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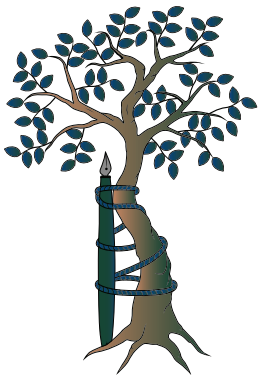

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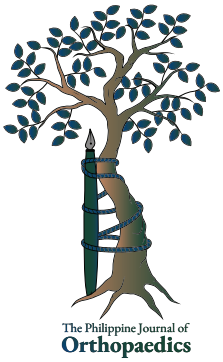
FEATURE ARTICLE

ORIGINAL ARTICLES

CASE SERIES



ABOUT THE LOGO: THE TREE OF ANDRY

Nicholas Andry coined the French term “orthopédie” which is derived from the Greek words “orthos” (correct or straight) and “paidion” (child). As implied in its etymology, “orthopédie” was first practiced treating childhood spinal and bone deformities.

The main elements of the logo are the tree of Andry; the Philippine Journal of Orthopaedics wordmark; and the fountain pen. The fountain pen, in replacement of the stake, represents how research has been the backbone of orthopaedic learning and practice.

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The **Philippine Journal of Orthopaedics,** the official journal of the **Philippine Orthopaedic Association, Inc.** is an open-access, English language, web-based, medical science journal published by the Association. The Journal is guided by the International Committee of Medical Journal Editors (ICMJE) **"Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals."**

The **Philippine Journal of Orthopaedics** shall advance the art and science of orthopaedics in the country by publishing high quality original clinical investigations, epidemiological studies, case reports, review articles, evaluations of diagnostic and surgical techniques, and the latest updates on management guidelines. The journal's target audience are local and international practitioners, clinicians, and other scientists, researchers. It shall accept manuscript submissions from consultants, fellows, residents, and other allied medical professions and specialties, not only from the Philippines but also from Asia and the rest of the world as long as these are within scope and relevant to the practice. Non-members of the Association may submit scientific manuscripts to the journal.

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CASE SERIES

Mabuhay! I am proud to present the third issue of the Philippine Journal of Orthopaedics for 2025. This edition showcases studies that reflect the strength of orthopaedic practice in the Philippines—from innovations in trauma and tumor care to insights that improve patient outcomes, even in a resource-limited setting.

I congratulate and thank the authors and the entire editorial team for their tireless scholarly work and for sharing their knowledge, expertise, and experiences with the orthopedic community.

May this issue inspire more of us to contribute to building a stronger and more relevant local orthopedic pool of knowledge.

Mabuhay ang Philippine Journal of Orthopaedics *at ang* Philippine Orthopaedic Association!

Justinian Aquilino IV Cyril LI. Pimentel, MD, FPOA
President, Philippine Orthopaedic Association and ASEAN Orthopaedic Association

The Philippine Journal of Orthopaedics

Expanding the Impact of the Philippine Journal of Orthopaedics

This issue marks a milestone for the Philippine Journal of Orthopaedics (PJO). We publish the first article submitted by international authors. While several authors from Asia and Europe have submitted articles in the past three years, Patel et al.'s paper on proximal femoral nailing compared to 95° plating is the first to make it to publication. While I personally do not know how our fledgling journal got onto the radar of our international authors, I have a sneaking suspicion that online accessibility and indexing played a part.

As any researcher knows, visibility and accessibility of scientific work are key when searching the literature. A search often begins with keywords in an indexing database. For researchers of the previous century, searching the Index Medicus using index cards was tedious, time-consuming, and inefficient. From the start of the 21st century, the World Wide Web has made searches more efficient and thorough, with medical databases such as PubMed, Scopus, Google Scholar, etc. Each database has strengths and weaknesses in terms of coverage, ancillary information, and efficiency of use.[1] Online publications have increased readership,[2] and become the main source of scientific information and the unequivocal goal of all publications, including this one.

Medical databases also inform the clinician in need of point-of-care answers. While most physicians still consult colleagues and websites, medical databases are an essential source of information.[3] Students and residents in training trawl these databases for articles that they can cite when they are asked the all-important questions "Why?" and "Says who?" This exercise in evidence-based decision-making hopefully instills a lifelong habit of looking for answers from credible sources.

For any scientific journal, being indexed confers a level of credibility and prestige. These databases have their own strict and discerning criteria before allowing any title to be included in their roster. The PJO has thus far been included in the Directory of Open Access Journals. Most databases require a publication history of at least three years. This issue of the PJO marks the 3rd year of our renaissance. It is the solemn promise of the editorial board to expand our reach and endeavor to be indexed in the most relevant databases.

Tammy L. Dela Rosa, MD, MMedSc
Editor-in-Chief

REFERENCES

1. Falagas ME, Pitsouni EI, Malietzis GA, Pappas G. Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. FASEB J. 2008;22(2):338–42. PMID: 17884971 DOI: 10.1096/fj.07-9492LSF
2. Tenopir C, King DW. Electronic journals and changes in scholarly article seeking and reading patterns. D-Lib Magazine. 2008;14(11/12). DOI: 10.1045/november2008-tenopir
3. Daei A, Soleymani MR, Ashrafi-Rizi H, Zargham-Boroujeni A, Kelishadi R. Clinical information seeking behavior of physicians: a systematic review. Int J Med Inform. 2020;139:104144. PMID: 32334400 DOI: 10.1016/j.ijmedinf.2020.104144

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The Philippine Journal of Orthopaedics

FEATURE ARTICLE

Bridging the Gap: The Seven Roles of a Sarcoma Nurse Navigator in a Resource-Limited Setting

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Department of Orthopaedics, University of the Philippines – Philippine General Hospital

ABSTRACT

Sarcomas are rare cancers that pose complex treatment and psychosocial challenges, particularly in resource-constrained settings like the Philippines. Navigation plays a vital role in bridging gaps in care delivery. This article aims to define and describe the roles of a Sarcoma Nurse Navigator in a Philippine tertiary referral hospital and evaluate how these roles align with existing global literature. Using personal narrative and experience-based reflection, the authors identified seven core roles performed by the Sarcoma Nurse Navigator. The identified roles include: (1) Advocacy and Assessment, (2) Bridge to the Multidisciplinary Team (MDT), (3) Care Coordination, (4) Data Management, (5) Emotional Support, (6) Follow-up Care, and (7) Guidance for Resource Mobilization and Access Support. These roles reflect the different challenges cancer patients face in the Philippine setting and may serve as a template for other navigation programs in the country.

Keywords. sarcoma, nurse navigator, patient navigation, cancer care, resource-limited setting, multidisciplinary care

INTRODUCTION

Sarcomas are rare types of cancer that start in the body's connective tissues, mainly nerves, muscles, fat, fibrous tissues, and bones. They can be difficult to identify and often require a complex combination of treatments such as surgery, chemotherapy and radiotherapy. As such, patients diagnosed and treated for sarcomas encounter significant challenges not just to their physical and mental wellbeing, but also to their family and interpersonal relationships.[1,2] In our country, these problems are further exacerbated due to the financial toxicity and inequity of healthcare that cancer patients experience.[3] Strategies to increase and sustain patients' access to effective diagnostics and treatment therefore become crucial to achieving good outcomes.

The concept of patient navigation was started in 1990 to improve cancer outcomes by eliminating barriers to timely diagnosis and treatment.[4] By serving as a bridge between the patient and their clinicians, navigators facilitate understanding of the disease, coordinate care, give emotional support and guide through the whole cancer journey.

Since then, multiple studies using navigation have shown improvements in cancer programs uptake and patient outcomes.[5-8] In some countries, cancer care systems are required to use patient navigation for accreditation (i.e., American College of Surgeons Commission on Cancer).[9]

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In the Philippines, the National Integrated Cancer Control Act of 2019 Sec.9 F lists cancer-focused patient navigation as one of the key activities to provide individualized support during the cancer journey, facilitating access to information and resources as needed, throughout the continuum of cancer care.[10]

With all these advantages, the roles of cancer patient navigators still need to be defined.[11] A one-size-fits-all strategy may not be appropriate for patients with sarcoma, as their ages and histopathologic diagnoses vary widely, requiring different treatment strategies. A significant number of sarcomas occur in adolescents and young adults (AYA), an age group with unique psychosocial concerns.[12]

This article aims to present the roles and responsibilities of a Sarcoma Nurse Navigator in a tertiary government referral hospital in the Philippines through personal narration [JMG] and compare these with the literature on patient navigation. The seven roles shown here may serve as templates for use by navigators in the Philippine cancer care setting.

SEVEN ROLES OF A SARCOMA NURSE NAVIGATOR

"Patient navigation is a more compassionate and structured way to help people deal with these problems [cancer]. The principle behind patient navigation is to ensure that no one should have to deal with cancer alone. It helps people and their families understand, access, and navigate through the healthcare system. This is where the sarcoma nurse navigator comes in. They are at the heart of the care team, assisting patients medically and emotionally through the uncertainties of diagnosis and the numerous phases of treatment and follow-up.

"The nurse navigator is not just a passive assistant; they change things for the better. They push for immediate care, collaborate with specialists, support families coping with psychological issues, and help them rise above financial or logistical problems. Most importantly, they are there for patients to ensure that no one falls through the gaps.

"Treatment abandonment continues to be a catastrophic consequence of an already overburdened healthcare system. The patient who may have been overwhelmed, scared, or unable to pay for the next step. Abandonment may be the difference between survival and disadvantage for people with sarcoma. Misinformation, emotional weariness, vast travel distances, and financial difficulties often cause people to quietly stop receiving medical treatment.

"Nurse navigators play an important role in preventing this. They notice when patients are missing appointments, they reach out when silence grows, and they intervene with empathy. They explain, support, and stand in the gap between the system and the patient. With the following strategies, the story doesn't have to end early..."

1. Advocacy and assessment

"The nurse navigator is often the first to welcome a patient into the cancer care journey. Through warm thorough assessments, they get to know the patient not just as a case, but as a person with fears, hopes, and a life interrupted by illness. They evaluate physical symptoms, emotional well-being, and social needs, and advocate for quick access to tests, specialists, or referrals. Persistent follow-up by a skilled nurse navigator can literally mean the difference between early and late-stage treatment."

Patient navigators are often the first point of contact upon hospital referral or visit for suspicion of cancer.[11,12] Navigators with relevant clinical experience, such as nurse specialists or nurse consultants, can help explain diagnosis and treatment as well as advocate for early consult for any concerns.[11,13,14]

2. Bridge to the Multidisciplinary Team (MDT)

"Sarcoma care demands the expertise of many specialists. The nurse navigator ensures that every voice on the care team is heard and that the patient's preferences are included. They help present cases at tumour board meetings and follow through on each recommendation. In systems where delays or gaps in communication are common, their presence brings alignment and focus to what can otherwise feel like a maze of appointments."

Sarcomas require multidisciplinary care from many clinical specialties which is coordinated through regular MDT meetings. Having navigators present in the MDT helps as they relay and explain findings to patients and their families and facilitate necessary diagnostic and treatment referrals.[11]

3. Care coordination

"Navigating cancer care is like crossing a bridge that keeps shifting, involving lab tests, surgeries, chemotherapy, radiation therapy, rehabilitation. Nurse navigators make sure each step happens in the right order and on time. They coordinate across departments, clarify instructions, and ensure that patients fully understand what's ahead. Their coordination prevents abandonment, reduces stress, and keeps hope alive when the process becomes too confusing or tiring."

A recent study at the Philippine General Hospital showed that incorporating a dedicated patient navigator reduces the rate of treatment abandonment in high-grade osteosarcoma patients, ranging from 50% before navigation to only 6% after it was implemented.[8] This real-world experience highlights the significant effect of navigation models in resource-constrained settings, as well as the critical role of navigators in keeping patients on track for curative therapy.

4. Data management

"Though often unseen, the data work of nurse navigators is just as important. In the Philippines, where cancer docu-

mentation is often lacking, navigators build records that help track a patient's journey and improve care over time. They log visits, update charts, and support research projects making sure every patient's experience contributes to better outcomes for others."

Some functions of hospital-based navigators, such as follow-up tracking and scheduling, are often passed to community-based navigators, although there can be considerable overlap.[15] In resource-limited settings, patient navigators may expand their scope of work as the need arises. Care should be taken that the additional work does not prevent them from their principal duty of guiding and supporting patients.[4]

5. Emotional support

"Cancer is not just a medical battle—it's an emotional one. Patients with sarcoma may face amputation, disability, or dramatic changes to their body image. Nurse navigators offer a steady presence. They listen, comfort, and connect patients to mental health resources, support groups, or simply a shoulder to lean on. Their support is especially critical for young patients, who often struggle with identity, fear, and uncertainty."

Effective listening and communication are crucial skills that cancer navigators need to fulfil their roles.[12,16] Cancer care can be very stressful for patients and their families. Navigators play an important role in accompanying them to finish the journey.[14]

6. Follow-up care

"Finishing treatment doesn't mean the end of the journey. Recurrence is a real possibility, and life after sarcoma can be filled with lingering side effects and anxiety. Navigators help schedule follow-ups, track test results, and stay in touch with patients to ensure they feel supported even after hospital visits grow less frequent. They help patients return to school or work and support caregivers during the long road of survivorship."

Using patient navigators have shown better follow-up rates and post-operative care following cancer treatment.[6,8]

7. Guidance for resource mobilization and access support

"In a country where many patients pay out-of-pocket for care, the cost of sarcoma treatment can be crushing. Nurse navigators help families find financial aid, transportation, housing, or even prostheses. They understand the barriers patients face and work tirelessly to help overcome them, turning a system that can seem indifferent into one that feels human and reachable."

Cancer navigators improve access to healthcare systems and treatment especially in low-resource settings.[5,7] Navigators can also guide patients towards funding aid agencies and appropriate clinical trials.[14,17]

SUMMARY

"My experience as a Sarcoma Nurse Navigator at the University of the Philippines Manila – Philippine General Hospital has shown how essential this role is in guiding patients through every stage of their cancer journey. From triaging patients at their first consultation to coordinating sarcoma rounds and supporting recovery after complex surgeries, navigation brings structure and compassion to a complex system. Nurse navigators do more than coordinate; they stand with patients through their most difficult moments. In overburdened systems, they enhance the human element of care."

As part of a multidisciplinary team, nurse navigators can reduce delays, strengthen communication, and build trust between patients, their families, and the clinical team. Especially in systems with limited resources, navigators can help patients complete their treatment and improve continuity of care. The different roles and responsibilities listed here reflect the unique challenges Philippine cancer patients face and can serve as a template for navigation programs in the country.

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STATEMENT OF AUTHORSHIP

All authors certified fulfilment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

JMG: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Writing – review and editing, Visualization, Project administration; **CLLG:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Data Curation, Writing - original draft preparation, Writing – review and editing, Supervision**; EHMW:** Conceptualization, Methodology, Resources, Writing - original draft preparation, Writing – review and editing, Supervision.

DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

Dr. Gaston is an Editorial Board member of the Philippine Journal of Orthopaedics (PJO). The other authors have no conflicts of interest to declare.

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REFERENCES

1. Franzoi IG, Granieri A, Sauta MD, et al. The psychological impact of sarcoma on affected patients. Psychooncology. 2023;32(12):1787-97. PMID: 37930090 DOI: 10.1002/pon.6240
2. Wang Q, Liu Q, Ho KY, et al. Experiences and needs of patients with sarcoma: a qualitative meta-synthesis. Eur J Oncol Nurs. 2025;76:102890. PMID: 40250283 DOI: 10.1016/j.ejon.2025.102890
3. Fernandez RAT, Ting FIL. Achieving health equity in cancer care in the Philippines. Ecancermedicalscience. 2023;17:1547. PMID: 37377687 PMCID: PMC10292855 DOI: 10.3332/ecancer.2023.1547
4. Freeman HP, Rodriguez RL. History and principles of patient navigation. Cancer. 2011;117(S15):3537–40. PMID: 21780088 PMCID: PMC4557777 DOI: 10.1002/cncr.26262
5. Gabram SG, Lund MJ, Gardner J, et al. Effects of an outreach and internal navigation program on breast cancer diagnosis in an urban cancer center with a large African-American population. Cancer. 2008;113(3):602-7. PMID: 18613035 DOI: 10.1002/cncr.23568
6. Krok-Schoen JL, Oliveri JM, Paskett ED. Cancer care delivery and women's health: the role of patient navigation. Front Oncol. 2016;6(2). PMID: 26858934 PMCID: PMC4729879 DOI: 10.3389/fonc.2016.00002
7. Koffi, K.G., Silué, D.A., Laurent, C. et al. AMAFRICA, a patient-navigator program for accompanying lymphoma patients during chemotherapy in Ivory Coast: a prospective randomized study. BMC Cancer. 2019;19:1247. PMID: 31870438 PMCID: PMC6929302 DOI: 10.1186/s12885-019-6478-3
8. Gaston CL, Taleon K, Barsales K, et al. The effect of a patient navigator on treatment abandonment and follow-up for high-grade osteosarcoma patients in the Philippine General Hospital. Asian Pac J Cancer Prev. 2021;22(9):2873–7. PMID: 34582656 PMCID: PMC8850873 DOI: 10.31557/APJCP.2021.22.9.2873
9. American College of Surgeons Commission on Cancer. Cancer program standards 2012: Ensuring patient-centered care. 2012. Accessed October 2025. https://apos-society.org/wp-content/uploads/2016/06/CoCStandards.pdf
10. Department of Health (DOH). Implementing rules and regulations of Republic Act No. 11215, otherwise known as the National Integrated Cancer Control Act. 2019. Accessed October 2025. https://careph.org/carephwp2/wp-content/uploads/2022/04/RA_11215_National_Integrated_Cancer_Control_Act_NICCA.pdf
11. Doerfler-Evans RE. Shifting paradigms continued-the emergence and the role of nurse navigator. J Thorac Dis. 2016 Jul;8(Suppl 6):S498-500. PMID: 27606079 PMCID: PMC4990669 DOI: 10.21037/jtd.2016.04.03
12. LaRosa KN, Stern M, Lynn C, et al. Provider perceptions' of a patient navigator for adolescents and young adults with cancer. Support Care Cancer. 2019;27(11):4091-8. PMID: 30778757 PMCID: PMC6698436 DOI: 10.1007/s00520-019-04687-3
13. LaRosa KN, Stern M, Bleck J, et al. Adolescent and young adult patients with cancer: perceptions of care. J Adolesc Young Adult Oncol. 2017;6(4):512-8. PMID: 28537818 PMCID: PMC5725627 DOI: 10.1089/jayao.2017.0012
14. Pautasso FF, Zelmanowicz AM, Flores CD, Caregnato RCA. Role of the nurse navigator: integrative review. Rev Gaucha Enferm. 2018; 39:e20170102. PMID: 30043944 DOI: 10.1590/1983-1447.2018.2017-0102
15. Domingo JB, Davis EL, Allison AL, Braun KL. Cancer patient navigation case studies in Hawai'i: the complimentary role of clinical and community navigators. Hawaii Med J. 2011;70(12):257-61. PMID: 22187512 PMCID: PMC3242420
16. Phillips S, Villalobos AVK, Crawbuck GSN, Pratt-Chapman ML. In their own words: patient navigator roles in culturally sensitive cancer care. Support Care Cancer. 2019;27(5):1655-662. PMID: 30109486 PMCID: PMC6449285 DOI: 10.1007/s00520-018-4407-7
17. Moffitt K, Brogan F, Brown C, et al. Statewide cancer clinical trial navigation service. J Oncol Pract. 2010;6(3):127-32. PMID: 20808555 PMCID: PMC2868637 DOI: 10.1200/JOP.200006

The Philippine Journal of Orthopaedics

ORIGINAL ARTICLE

Assessing the Accuracy of Visual Blood Loss Estimation in Open Reduction and Internal Fixation of the Femur in a Tertiary Hospital 2019-2022: A Retrospective Review

Khristian S. Camagay, MD and Jayson B. Montano, MD

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ABSTRACT

Background. Accurate estimation of intraoperative blood loss is crucial for effective treatment, particularly in orthopedic procedures such as open reduction and internal fixation (ORIF) with intramedullary nails for femoral fractures. Traditional methods rely on visual estimation, which is subjective and prone to inaccuracy.

Objective. This study aims to evaluate the accuracy of visual blood loss estimation by comparing it with laboratory-based calculations derived from hematocrit and hemoglobin levels.

Methodology. This retrospective cohort study reviewed the medical records of 115 patients who underwent ORIF with intramedullary nails at a tertiary hospital from January 10, 2019, to December 28, 2022. Blood loss was assessed using two approaches: visual estimates recorded by operating room personnel and calculations based on preoperative and postoperative hematocrit and hemoglobin values. Paired t-tests were used to compare these measurements and differences between the requested and actual number of blood bags used.

Results. Significant differences were observed between preoperative and postoperative hemoglobin (p <0.00001) and hematocrit levels (p <0.00001), indicating substantial blood loss. More blood bags were requested than used, with a mean difference of 0.95 (p <0.00001). Visual estimates of blood loss were lower than laboratory-based calculations, with a mean difference of 55 ml (p <0.00001) for hemoglobin-based EBL and 121 ml (p <0.00001) for hematocrit-based EBL.

Conclusion. Visual estimates of intraoperative blood loss differ significantly from laboratory-based methods, with surgeons underestimating blood loss, and overestimating transfusion needs. This study highlights the importance of adopting more precise, laboratory-based calculations for assessing blood loss in orthopedic surgeries.

Keywords. blood loss, orthopedic procedures, hematocrit, hemoglobin, visual estimation, intraoperative blood loss estimation

INTRODUCTION

Accurate estimation of intraoperative blood loss is crucial for effective treatment, particularly in orthopedic procedures such as open reduction and internal fixation (ORIF) with intramedullary nails for femoral fractures. Traditionally, blood loss estimation relied heavily on visual assessments made by operating room personnel. However, these visual estimates are often imprecise, leading to potential discrepancies in perioperative management and blood transfusion practices. Despite this, visual estimation remains widely used due to its simplicity, immediacy, and non-reliance on equipment or calculations.

To address this issue, this study aimed to evaluate the accuracy of visual blood loss estimation by comparing it with calculations using hematocrit and hemoglobin levels. We hypothesized that visual estimates would be less accurate

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than laboratory-derived measurements. Improving blood loss estimation methods could enhance clinical decision-making and optimize patient outcomes during orthopedic surgery.

In other institutions and published literature, blood loss was estimated using various objective methods such as gravimetric techniques (weighing sponges and suction canisters), photometric analysis (hemoglobin concentration in fluid), and laboratory-based calculations using hematocrit or hemoglobin values. These approaches were significantly more accurate than visual estimation.[1-3] Many centers are moving toward more standardized and quantitative blood loss estimation protocols, especially in surgical fields where transfusion decisions are critical.

METHODOLOGY

This study was a retrospective cohort study conducted at the surgery department of a single tertiary hospital to evaluate intraoperative blood loss in patients undergoing open reduction and internal fixation (ORIF) with an intramedullary nail for femoral fractures between January 10, 2019, and December 28, 2022. The study included 115 patients selected through convenience sampling. Eligible participants were aged 18–65 years and underwent ORIF with an intramedullary implant for closed femoral fractures. Exclusion criteria included patients with blood dyscrasias, patients receiving anticoagulants, immunocompromised patients, multiply injured patients, and those who received intraoperative transfusions. Given the retrospective nature of the study, withdrawal was not applicable.

Blood loss was assessed using two methods: visual estimation, which relied on the subjective judgment of operating room personnel, and laboratory-based calculation, determined using differences in preoperative and postoperative hematocrit and hemoglobin levels. Visual estimation was defined as the intraoperative assessment of blood loss based on the appearance of surgical sponges, suction contents, and the operative field, without objective measurement. No standard training or quantification protocol was used, consistent with common surgical practice.[1,3]

The laboratory-based estimated blood loss (EBL) was computed as:

$$\mathbf{EBL} = \mathbf{EBV} \times (\text{pre-op - post-op}) / \text{mean value}$$

Or

$$\mathbf{EBL_{Hct}} = EBV \times [(Hct_{pre} - Hct_{post}) / Hct_{mean}]$$
$$\mathbf{EBL_{Hgb}} = EBV \times [(Hgb_{pre} - Hgb_{post}) / Hgb_{mean}]$$

Where:

$$Hct_{mean} = (Hct_{pre} + Hct_{post}) / 2$$
$$Hgb_{mean} = (Hgb_{pre} + Hgb_{post}) / 2$$

using either hematocrit or hemoglobin values. Postoperative hemoglobin and hematocrit levels were collected as part of routine blood work, primarily on the first postoperative day. Analysis of collection timing showed a mean of 1.02 days (median: 1.0 days; mode: 1 day), confirming consistent timing across the patient cohort. Data were collected from patient records, including preoperative and postoperative blood counts, the number of blood bags requested, and the actual number used.

The primary outcome measured was quantified blood loss in milliliters (mL). Secondary outcomes included the difference between the requested and actual number of blood bags used. This discrepancy was studied to assess predictive accuracy and blood resource management. The number of bags requested per case was based on surgeon preference, patient factors, and institutional transfusion protocols. To ensure data confidentiality, each patient was assigned a unique code, and data were securely stored in the hospital's records facility, accessible only to the research team.

Descriptive statistics, including means, standard deviations, and ranges, were calculated for demographic variables and blood loss measurements. Paired t-tests were used to compare preoperative and postoperative hemoglobin and hematocrit levels, and differences between requested and actual blood bags. Statistical significance was set at $p < 0.05$, and data analysis was performed using SPSS version 26.

This study adhered to the Declaration of Helsinki and received approval from the Institutional Review Board (IRB) of our institution. Informed consent was waived due to the retrospective design, as permitted by IRB guidelines.

RESULT

The study included 115 patients who underwent open reduction and internal fixation (ORIF) of the femur at our institution between January 10, 2019, and December 28, 2022. The participants had a mean age of 31 years (range: 12–79), with 83% (95) being male and 17% (20) female. The mean body mass index (BMI) was 22.92 ± 3.55.

Preoperative and postoperative hematocrit and hemoglobin results showed a significant decrease in blood parameters, indicating substantial intraoperative blood loss. The mean preoperative hemoglobin was 122 g/L, which significantly dropped to 103 g/L postoperatively ($t = -10.13$, $p < 0.00001$). Similarly, the mean hematocrit value decreased from 38% preoperatively to 31% postoperatively ($t = -10.37$, $p < 0.00001$).

Blood bag utilization analysis revealed that the mean number of blood bags requested was 1.97, while the actual mean utilization was 1.03. This resulted in a mean difference of -0.95 ($t = -11.33$, $p < 0.00001$), highlighting a significant overestimation of blood needs.

Comparison between visual and laboratory-based blood loss estimation methods demonstrated a clear discrepancy. Visual estimation by operating room personnel averaged 578 ml,

Table 1. Demographics of participants (N=115)

	Range	Mean	SD
Age (years)	12-79	31	14.385
Height (meters)	1.48-1.97	1.63	0.07766
Weight (kilograms)	32-85	60.59	10.1655
BMI		22.92	3.55075
Sex	Male = 95 (83%) Female = 20 (17%)		
Date of operation	January 10, 2019 – December 28, 2022		

whereas laboratory-based calculation using hematocrit levels indicated a mean blood loss of 699 ml ($t = 7.14$, $p < 0.00001$), and hemoglobin-based calculations showed a mean of 633 ml ($t = 7.03$, $p < 0.00001$).

DISCUSSION

This study highlights the inaccuracy of visual blood loss estimation compared to laboratory-based methods using hematocrit and hemoglobin levels in patients undergoing ORIF with intramedullary nails. Visual estimation significantly underestimated actual blood loss, consistent with prior research findings.[1,3] These studies have collectively demonstrated that visual methods are prone to human error, often underestimating blood loss by 30% or more, particularly in surgeries with ongoing, concealed, or pooled bleeding.

The significant reductions in hemoglobin and hematocrit postoperatively confirm the occurrence of substantial intraoperative blood loss. These results echo the findings of previous studies,[4-6] which emphasized that even modest drops in these parameters may signal the need for transfusion or closer hemodynamic monitoring in orthopedic patients. Such laboratory-based estimates are thus not only more precise but also clinically actionable, guiding transfusion decisions and post-op care more effectively than visual estimates alone.

Other estimation methods, such as gravimetric, photometric, and computer-assisted tools, offer more objective assessments, and their adoption is expanding in well-resourced centers.[1] These methods reduced interobserver variability and helped in real-time intraoperative decisions. However, their implementation remains limited due to cost, availability, and the training required.

The observed difference between hemoglobin- and hematocrit-based blood loss estimates (mean difference of ~66 ml) can be attributed to physiological changes such as plasma volume shifts and hemodilution after surgery. Hematocrit can be influenced more by fluid shifts, while hemoglobin levels tend to reflect actual red cell mass more accurately in acute settings. One study argues that hemoglobin-based calculations may provide a more reliable estimate of acute blood loss, especially in the immediate postoperative period.[7]

Visual estimation has remained the default method for decades due to its convenience and speed, even though its inaccuracy is well-documented. One study emphasized its widespread use, which is perpetuated by the absence of training in more objective alternatives and the lack of standardized institutional protocols.[3] Despite its inaccuracy, visual estimation remains the dominant method in many institutions due to its simplicity, immediacy, and low cost. In high-volume centers and emergency scenarios, its utility lies in its speed—especially when no lab values are yet available. Without training or calibration protocols, visual estimation tends to devolve into a purely subjective guess, underscoring the need for training modules and standardized estimation frameworks.[8]

The consistent overestimation of blood bag requests—with nearly one unit per patient unused—reflects a misalignment between perceived and actual need. This has implications for resource allocation and cost-efficiency in transfusion services.[9] Some studies suggest refining predictive models

Table 2. Preoperative and postoperative hematocrit and hemoglobin results of patients based on laboratory results (N= 115)

	Preoperative (Mean)	Postoperative (Mean)	*t*-value	*p*-value	Interpretation
Hemoglobin (g/ L)	122	103	-10.134093	<0.00001	Significant
Hematocrit (%)	38	31	-10.366905	<0.00001	Significant

Table 3. Variations between requested and actual blood bag utilization during surgery (N= 115)

Requested blood bag (Mean)	Actual blood bag utilization during surgery (Mean)	Mean difference	*t*-value	*p*-value	Interpretation
1.97	1.03	-0.95	-11.333818	<0.00001	Significant

Table 4. Comparison between operating room personnel assessments and hematocrit-based calculations (N= 115)

Operating room personnel EBL in ml (Mean)	EBL by hematocrit-based calculations in ml (Mean)	*t*-value	*p*-value	Interpretation
578	699	7.13505	<0.00001	Significant

Table 5. Comparison between operating room personnel assessments and hemoglobin-based calculations (N= 115)

Operating Room Personnel EBL in ml (Mean)	EBL by Hemoglobin-Based Calculations in ml (Mean)	*t*-value	*p*-value	Interpretation
578	633	7.029	<0.00001	Significant

using laboratory data and preoperative risk scoring can optimize blood preparation practices, prevent wastage, and align with patient blood management (PBM) principles.[10,11]

CONCLUSION

This study demonstrates that visual estimation of intraoperative blood loss by operating room personnel significantly underestimates actual blood loss when compared to laboratory-based calculations using hematocrit and hemoglobin levels. The significant drops in hemoglobin and hematocrit confirm substantial blood loss during open reduction and internal fixation (ORIF) of femoral fractures. Additionally, the notable discrepancy between the number of blood bags requested and those utilized during surgery highlights the need for more accurate blood management protocols.

The findings strongly support the adoption of laboratory-based methods, specifically hematocrit and hemoglobin calculations, for estimating intraoperative blood loss. These objective approaches provide more accurate assessments than traditional visual estimation methods, reducing the risk of underestimating blood loss and ensuring appropriate blood transfusion management. Furthermore, the overestimation of blood bag requests underscores the importance of aligning predicted blood needs with actual clinical requirements.

The primary limitation of this study is its retrospective design, which may introduce selection bias. However, the large sample size and consistent findings enhance the reliability of the results. Other limitations include potential documentation bias and reliance on routine postoperative blood draws rather than serial intraoperative monitoring. Nevertheless, the findings add to a growing body of literature advocating for objective, quantitative methods in perioperative blood loss estimation and can inform local guidelines and training programs. Future research should explore the use of real-time monitoring technologies for blood loss estimation to further enhance accuracy and patient safety in orthopedic surgery.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

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DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

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REFERENCES

1. Kollberg SE, Häggström AE, Lingehall HC, Olofsson B. Accuracy of visually estimated blood loss in surgical sponges by members of the surgical team. AANA J. 2019;87(4):277-84. PMID: 31587711
2. Gerdessen L, Meybohm P, Choorapoikayil S, et al. Comparison of common perioperative blood loss estimation techniques: a systematic review and meta-analysis. J Clin Monit Comput. 2021; 35(2):245-58. PMID: 32815042 PMCID: PMC7943515 DOI: 10.1007/s10877-020-00579-8
3. Rothermel LD, Lipman JM. Estimation of blood loss is inaccurate and unreliable. Surgery. 2016;160(4):946-53. PMID: 27544540 DOI: 10.1016/j.surg.2016.06.006
4. Carson JL, Guyatt G, Heddle NM, et al. Clinical practice guidelines from the AABB: red blood cell transfusion thresholds and storage. JAMA. 2016;316(19):2025–35. PMID: 27732721 DOI: 10.1001/jama.2016.9185
5. Kozek-Langenecker SA, Ahmed AB, Afshari A, et al. Management of severe perioperative bleeding: guidelines from the European Society of Anaesthesiology: First update 2016. Eur J Anaesthesiol. 2017;34(6):332-95. PMID: 28459785 DOI: 10.1097/EJA.0000000000000630
6. McKibben NS, Lindsay SE, Friess DM, Zusman NL, Working ZM. Methods of quantifying intraoperative blood loss in orthopaedic trauma surgery: a systematic review. J Orthop Trauma. 2022;36(6):e215-26. PMID: 34799543 DOI: 10.1097/BOT.0000000000002313
7. Lopez-Picado A, Albinarrate A, Barrachina B. Determination of perioperative blood loss: accuracy or approximation? Anesth Analg. 2017;125(1):280-6. PMID: 28368940 DOI: 10.1213/ANE.0000000000001992
8. Athar MW, Abir G, Seay RC, Gui N, Butwick A, Carvalho B. Accuracy of visual estimation of blood loss in obstetrics: an observational simulation cohort study. Int J Obstet Anaesth. 2022;50:103539. PMID: 35397264 DOI: 10.1016/j.ijoa.2022.103539
9. Kersjes E, Smith LB. How should decision science inform scarce blood product allocation? AMA J Ethics. 2019;21(10):E852-7. PMID: 31651384 DOI: 10.1001/amajethics.2019.852
10. Frank SM, Savage WJ, Rothschild JA, et al. Variability in blood and blood component utilization as assessed by an anesthesia information management system. Anesthesiology. 2012;117(1): 99-106. PMID: 22531332 DOI: 10.1097/ALN.0b013e318255e550
11. Goodnough LT, Shander A. Patient blood management. Anesthesiology. 2012;116(6):1367-76. PMID: 22487863 DOI: 10.1097/ALN.0b013e318254d1a3

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ORIGINAL ARTICLE

Comparison between Face-to-Face and Telephone DASH Interviews in Hand Patients: A Prospective Comparative Study*

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ABSTRACT

Background. The Filipino version of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (FIL-DASH) is a patient-reported outcome measure validated for assessment during a face-to-face consult. When in-person consults are not feasible, such as during periods of lockdown or geographical limitations, patient outcomes should still be measured accurately.

Objective. To compare the Filipino Disabilities of the Arm, Shoulder, and Hand (FIL-DASH) scores of patients with hand disorders during face-to-face and telephone interviews.

Methodology. This was a pilot prospective comparative study. Patients aged 18 to 60 years with various chronic hand and upper extremity conditions seen at the Hand and Microvascular Surgery outpatient department of the Philippine General Hospital had face-to-face FIL-DASH interviews conducted by a trained interviewer. The same interviewer conducted a telephone FIL-DASH interview on these same patients after seven days. Survey information was collected and encoded using an electronic spreadsheet file. Descriptive statistics such as mean, median, frequency, and percentage were used to describe the clinical characteristics of the study participants. A paired t-test or Wilcoxon signed-rank test was used to compare the mean FIL-DASH scores between face-to-face and telephone modes. The Pearson correlation coefficient (r) was used to determine the relationship of the FIL-DASH scores obtained from face-to-face and telephone interviews.

Result. There were 79 respondents included in the study. The FIL-DASH scores from telephone interviews were significantly lower than the scores from face-to-face consults. Pearson's correlation coefficient was estimated to be 0.96, with a range of 0.94–0.98 (p <0.01). This showed a strong, positive relationship between FIL-DASH measured in both modes with a high correlation coefficient.

Conclusion. Despite FIL-dash scores from telephone interviews being lower, the study showed a strong correlation between the face-to-face and telephone FIL-DASH scores. This supports the use of the assessment of the FIL-DASH via telephone interview.

Keywords. patient reported outcome measures, telephone visits, interview, telehealth, quality improvement

INTRODUCTION

The goal of hand and upper extremity surgery is to restore hand function. The success of any such endeavor is determined by measuring the post-treatment functional status of the upper extremity.

One of the frequently used scoring methods is the DASH or Disabilities of the Arm, Shoulder, and Hand Questionnaire, which is a 30-item questionnaire concerning the upper extremity function of the patient during the preceding week.[1] A higher score indicates higher disability, with 0 being the minimum and 100 being the maximum score. This questionnaire has been translated and cross-culturally adapted into different languages, including Filipino (FIL-DASH).[2]

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The DASH is accomplished by an interviewer during a face-to-face consultation with a patient. Previously taken for granted, this limitation was highlighted during the COVID-19 pandemic, when physical clinic visits were restricted. In a tertiary public hospital like ours, patients may come from faraway provinces. Regular consults to monitor functional outcomes may become costly.

Although no prior studies have been done to compare face-to-face and telephone FIL-DASH scoring, other measurement tools have been studied.

Bossers et al. compared face-to-face and telephone scoring for patients with traumatic brain injury using the Extended Glasgow Outcome Scoring.[3] When they compared the scores obtained in face-to-face interviews done by a neurologist with those obtained from a telephone interview two weeks later, they concluded that telephone assessment was a valid alternative to the face-to-face interview when in-person contact is not feasible. Pettigrew et al. found good test-retest and interrater reliability for the structured interviews for the Glasgow Outcome Scale (GOS) using in-person and telephone contact.[4]

Hammarstedt et al. evaluated outcomes using five different tools in 456 patients two years after arthroscopic acetabular labral surgeries and found higher scores (indicating greater improvement) in telephone surveys compared to those obtained in-person or online.[5]

Based on the response of 432 patients in three specialty clinic practices in the University of California in San Francisco, telephone follow-up visits (TFVs) were seen to offer a cost and time-efficient alternative to in-person visits. And the survey done showed the TFVs to be acceptable to the patients.[6]

With today's widespread use of personal digital technology, tablets and smartphones have likewise been used to collect patient outcome information. Pang et al. found that 136 patients in a foot and ankle clinic who completed a patient-reported outcome tool on a tablet while in the clinic and on their own smartphones 24 hours later had consistent scores.[7]

Scwartzenberger et al. studied 969 patients who were asked to complete the long-term Boston Carpal Tunnel Questionnaire (BCTQ) at least one year after carpal tunnel release surgery. Patients asked to complete the BCTQ through telephone interview had a higher response rate and survey completeness as compared to those who answered the BCTQ through standard mail or web-based methods.[8] Wilkinson et al., showed that outcome measurement in patients more than one year after hand surgery was more reliable when taken over the telephone than the computer.[9]

This study sought to determine if the Filipino DASH Score (FIL-DASH) assessed through the telephone is as reliable as the FIL-DASH assessed in person.

METHODOLOGY

Over a period of two months, patients aged 18 to 60 years with chronic hand and upper extremity conditions (those who were symptomatic for at least three months before the interview) seen at the Hand and Microvascular Surgery Outpatient Department of the Philippine General Hospital, Manila, Philippines, were invited to participate in the study, and those who gave consent were included. Patients aged younger than 17 years and older than 61 years and patients immobilized in casts or splints were excluded. The intended sample size was 110 patients.

The face-to-face FIL-DASH interviews were conducted by a trained interviewer. No questionnaires were brought home by the patients. The same interviewer conducted a telephone FIL-DASH interview after seven days. Findings were recorded via the FIL-DASH form downloaded from the website of the Institute for Work and Health. The survey information was collected and encoded in an electronic spreadsheet.

Descriptive statistics such as mean, median, frequency, and percentage were used to describe the clinical characteristics of the study participants. The paired t-test was used to compare the face-to-face and telephone FIL-DASH ratings.

In this study, the consistency of the FIL-DASH Scores from face-to-face and telephone interviews were determined using the Pearson correlation coefficient,[10] where a score closer to one (1) indicates a direct correlation of the scores obtained using the two methods, a score closer to negative 1 (-1) indicates an inverse correlation, whereas a score closer to zero (0) indicates no relationship. For individual comparisons (not between groups), a score of .90 would be acceptable. The *p*-value was set at <0.01 to determine significance.

The study was approved by the institution's Ethical Review Board.

RESULT

The study included 79 patients (Table 1).

The face-to-face and telephone FIL-DASH scores of the 79 patients were plotted on a scatterplot (Figure 1). Most data points clustered near the line of equality, suggesting that telephone assessments reliably reflect in-person scores. A few outliers were noted, which may reflect individual variability or scoring discrepancies.

The mean FIL-DASH rating was significantly lower during telephone consults than during face-to-face consults (Table 2). Using the face-to-face and telephone FIL-DASH scores of the 79 patients included in the study, the Pearson's Correlation Coefficient was estimated to be 0.96, with a range of 0.94–0.98 (p <0.01). As it was greater than the recommended score of 0.90, this showed a strong, positive relationship between the scores measured in both modes.

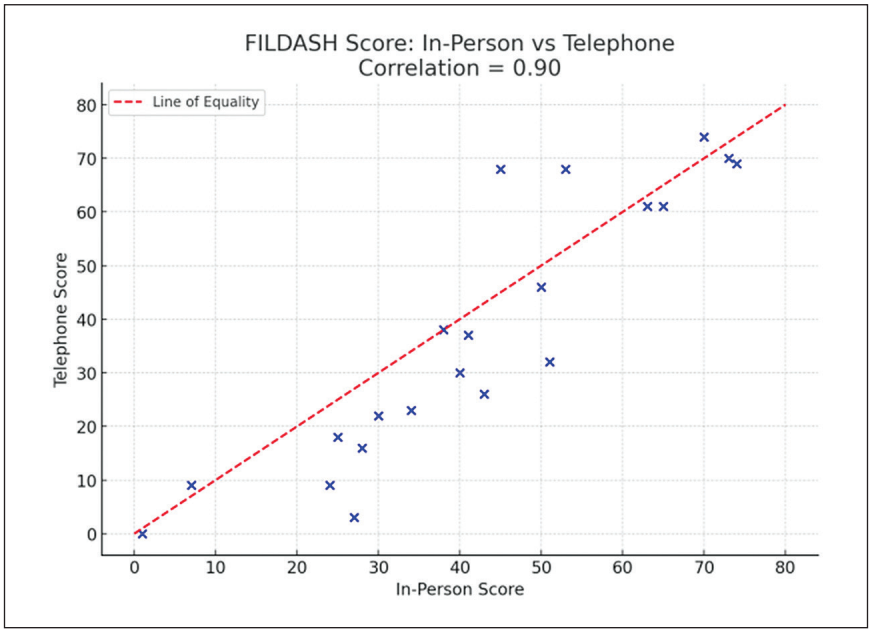

Figure 1. Scatterplot comparing FIL-DASH SCORES.

Table 1. Demographic profile of respondents

Demographic information	Summary measures
Age in years	41.32 ± 13.58
18 to 20	4 (5.06%)
21 to 40	34 (43.04%)
41 to 60	41 (51.9%)
Sex	
Male	38 (48.10%)
Female	41 (51.90%)
Diagnosis	
Acrodactyly	1 (1.27%)
Arthritis	7 (8.86%)
Brachial plexus injury	21 (26.58%)
Chronic regional pain syndrome	1 (1.27%)
Carpal tunnel syndrome	7 (8.86%)
Contractures	4 (5.06%)
Cyst or mass	12 (15.19%)
De Quervain tendosynovitis	3 (3.80%)
Chronic dislocation	3 (3.80%)
Malunion	3 (3.80%)
Nerve palsy	2 (2.53%)
Nonunion	2 (2.53%)
Chronic tendon transection	2 (2.53%)
Trigger finger	11 (13.92%)

Table 2. Distribution of Fil-DASH responses

Descriptive measures	Face-to-face	Telephone	*p*-value
Mean ± Std. deviation	36.76 ± 26.19	33.53 ± 26.52	<0.01*
Median (minimum, maximum) (25^{th}, 75^{th})	36 (0, 94) (14, 57)	30 (0, 91) (9, 58)	<0.01*

DISCUSSION

Telephone interviews are often used for patient assessments in healthcare, counseling, and customer service. It allows for convenient and accessible assessment without the need for face-to-face interaction.

DASH scores are typically evaluated in person. Nevertheless, the challenges posed by the COVID-19 pandemic made clinic visits difficult. Telephone DASH Score evaluation has become an attractive alternative.

We projected that 110 patients would be seen in the outpatient department over the two months that this study was conducted. However, only 79 patients were enrolled in the study. This was attributed to the low patient turnout during the study period because of the numerous non-working holidays during this period. This could have decreased the study's statistical power, increasing the possibility of a type II error. We chose to simplify the analysis by comparing the DASH scores obtained from the two methods. Doing this, the results were still shown to be statistically significant (p <0.01)

The FIL-DASH scores obtained during the telephone interview were significantly lower than those obtained during the in-person consult.

Like Hammarstedt's[5] and unlike Bosser's and Pettigrew's findings,[3,4] the FIL-DASH scores obtained during the telephone interview were significantly lower (indicating less disability) compared to those obtained during the in-person interview. Hammerstedt attributed this to confounding variables such as interview bias (non-verbal cues from the interviewer, which may alter the response). Time may have also played a role. Our telephone interviews were done seven days

after the face-to-face assessment, during which time patients' conditions may have improved.

Pearson's Correlation Coefficient showed a strong, positive relationship between the FIL-DASH scores measured in both modes, indicating a strong linear relationship. While FIL-DASH scores were, on average, lower over the phone than in person, patients with low scores were still likely to score low, and vice versa.

Interestingly, several patients reported higher disability via telephone than during in-person interviews. This pattern, also noted in other studies, may reflect the influence of social desirability bias—a psychological tendency where respondents give more favorable answers when not directly observed. In telephone interviews, reduced face-to-face interaction may lead individuals to underreport difficulties or overstate functional ability. Despite this, the overall findings indicate that telephone administration of the FIL-DASH is a valid alternative when in-person assessments are impractical, though slight positive bias should be considered in interpretation.

Although in-person and telephone interview FIL-DASH scoring might not be used interchangeably in the same patient during treatment and recovery, a patient's scores may be reliably monitored using one or the other method. The trend of the FIL-DASH scores obtained over the course of a patient's recovery can help determine whether a patient is returning to previous function. Likewise, telephone FIL-DASH scores may be used to compare the outcomes of different treatment modalities for conditions of the hand and upper extremity.

This is good news considering the benefits of foregoing clinic visits just to monitor subjective outcomes.[6] Although web-based scoring is already in use,[7] telephone interviews are still considered better.[8,9]

These findings must be interpreted with caution. The telephone format introduces unique limitations that may inadvertently affect outcomes. Distractions in the home environment, varying levels of privacy, auditory or technological issues, and reduced interpersonal engagement can all influence how patients understand and respond to questions. Unlike face-to-face interviews, where nonverbal cues and immediate clarification are available, telephone assessments rely heavily on verbal communication alone, which may compromise the depth or accuracy of responses in certain cases.

This study was conducted in a single institution and employed convenience sampling with no randomization. The face-to-face interview always came before the telephone interview. The study did not reach the target sample size of 110 due to multiple nonworking holidays and a relatively short duration. This may have also produced more variable results and potentially higher *p*-values, leading to weaker external validity. This potentially increases the variability of FIL-DASH scores of both face-to-face and phone consults, thereby decreasing the overall significance and reliability of the results.

We recommend future studies to include a longer duration of data collection, a larger sample size, and multiple data collection sites.

CONCLUSION

Despite FIL-DASH scores from telephone interviews being lower, the study showed a strong correlation between the face-to-face and telephone FIL-DASH scores. This supports the use of telephone interviews to assess FIL-DASH.

STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

ETT: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Writing – review and editing; **JMB:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Writing – review and editing, Visualization, Supervision, Project administration.

DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

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REFERENCES

1. Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: longitudinal construct validity and measuring self-rated health change after surgery. BMC Musculoskelet Disord. 2003;4:11. PMID: 12809562 PMCID: PMC165599 DOI: 10.1186/1471-2474-4-11
2. Estrella EP, Orillaza NS Jr, Castillo-Carandang NT, Cordero CP, Juban NR. The validity, reliability and internal consistency of the cross-cultural adaptation of the FIL-DASH (Filipino version of the disability of the arm, shoulder and hand) questionnaire in patients with traumatic brachial plexus injuries. J Hand Surg Asian Pac 2019;24(4):456-61. PMID: 31690189 DOI: 10.1142/S2424835519500590
3. Bossers SM, van der Naalt J, Jacobs B, Schwarte LA, Verheul R, Schober P. Face-to-face versus telephonic extended Glasgow outcome score testing after traumatic brain injury. J Head Trauma Rehabil. 2021;36(3):E134-8. PMID: 33201032 DOI: 10.1097/HTR.0000000000000622
4. Pettigrew LEL, Wilson JTL, Teasdale GM. Reliability of ratings on the Glasgow outcome scales from in-person and telephone structured interviews. J Head Trauma Rehabil 2003;18(3):252–8. PMID: 12802167 DOI: 10.1097/00001199-200305000-00003
5. Hammarstedt JE, Redmond JM, Gupta A, Dunne KF, Vemula SP, Domb BG. Survey mode influence on patient-reported outcome scores in orthopaedic surgery: telephone results may be positively biased. Knee Surg Sports Traumatol Arthrosc. 2017;25(1):50-4. PMID: 26499997 DOI: 10.1007/s00167-015-3802-6

6. Peng T, Gleason N, Gonzales R. A Comparison of patient-reported outcomes related to telephone follow-up visits and conventional office visits in medical specialty practices. Telemed J E Health. 2021;27(7):747-54. PMID: 33090078 DOI: 10.1089/tmj.2020.0147
7. Park SJ, Kim JJ, Kim BS. Validation of remote collection of patient-reported outcomes using patients' smartphones. Clin Orthop Surg. 2021;13(1):117-22. PMID: 33747388 PMCID: PMC7948045 DOI: 10.4055/cios20075
8. Scwartzenberger J, Presson A, Lyle A, O'Farell A, Tyler A. Remote collection of patient-reported outcomes following outpatient hand surgery: a randomized trial of telephone, mail, and e-mail. J Hand Surg Am. 2017;42(9):693-9. PMID: 28600107 DOI: 10.1016/j.jhsa.2017.05.002
9. Wilkinson JT, Clawson JW, Allen CM, Presson AP, Tyser AR, Kazmers NH. Reliability of telephone acquisition of the PROMIS upper extremity computer adaptive test. J Hand Surg Am. 2021;46(3):187-99. PMID: 33243590 PMCID: PMC7935760 DOI: 10.1016/j.jhsa.2020.09.014
10. Aziz MA, Kenford S. Comparability of telephone and face-to-face interviews in assessing patients with posttraumatic stress disorder. J Psychiatr Pract. 2004;10(5):307-13. PMID: 15361745 DOI: 10.1097/00131746-200409000-00004

SUPPLEMENTARY DATA

Face-to-face and telephone FIL-DASH scores of respondents

Patient no.	FIL-DASH score (face-to-face)	FIL-DASH score (telephone)
1	7	9
2	30	22
3	40	30
4	27	3
5	63	61
6	74	69
7	45	68
8	73	70
9	50	46
10	53	68
11	34	23
12	1	0
13	51	32
14	43	26
15	28	16
16	24	9
17	38	38
18	65	61
19	70	74
20	41	37
21	25	18
22	31	21
23	42	37
24	48	36
25	29	24
26	0	0
27	25	19
28	7	5
29	58	58
30	6	6
31	66	62
32	33	28
33	36	32
34	26	19
35	75	85
36	41	41
37	8	8
38	59	54
39	5	5
40	9	6

Patient no.	FIL-DASH score (face-to-face)	FIL-DASH score (telephone)
41	89	89
42	78	78
43	16	13
44	62	62
45	10	9
46	88	68
47	47	49
48	37	43
49	24	12
50	44	34
51	0	0
52	36	36
53	33	33
54	64	64
55	14	13
56	44	33
57	5	5
58	84	64
59	0	0
60	74	74
61	26	26
62	28	30
63	7	7
64	15	12
65	2	0
55	23	23
67	82	82
68	78	77
69	94	91
70	15	13
71	47	38
72	5	3
73	2	2
74	0	0
75	0	0
76	47	45
77	57	55
78	41	40
79	0	0

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ORIGINAL ARTICLE

Survival Analysis of Pathologic Fractures in Metastatic Bone Disease: A Retrospective Study on the Prognostic Role of Primary Tumor Site and Hematologic Markers in a Single Philippine Tertiary Center

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ABSTRACT

Background. Metastatic bone disease (MBD) poses a risk for skeletal-related events, including pathologic fractures and spinal cord compression, subsequently leading to higher mortality after definitive surgery. Estimation of survival is crucial in the treatment of metastatic pathologic fractures to help set realistic expectations for patients, their families, and physicians.

Objective. To determine the predictors of mortality in patients diagnosed with pathologic fracture secondary to metastatic bone disease in terms of hematologic and serologic markers such as preoperative hemoglobin, absolute lymphocyte count, and preoperative albumin.

Methodology. This retrospective cohort study involved 128 patients: 109 who were treated surgically and 19 who were treated non-surgically, from January 2010 to December 2020. Risk factors studied were age, preoperative serum albumin, absolute lymphocyte count (ALC), and hemoglobin, primary tumor site, whether surgery was done, presence of visceral metastases, presence of other bony lesions, and chemotherapy/radiotherapy use. Cox proportional-hazards regression was employed to determine the accuracy of each risk factor as a predictor of mortality.

Result. The patients' mean age was 60.05 years (SD = 11.10), and 56.25% were female. The most common site of primary tumor was the breast (32.02%), then the lung (25.00%). Among patients with low hemoglobin, 11.27% expired within the first six months from the time MBD was established, while 17.54% survived up to one year; however, this difference was not statistically significant (p = 0.310). Similarly, no significant difference in survival was observed among patients with low albumin, with 95.77% expiring within six months and 98.25% surviving up to one year (p = 0.511). In contrast, a statistically significant difference was found among those with low ALC, with 16.90% expiring within six months compared to 10.53% surviving up to one year (p = 0.002). Surgical treatment was performed on 85.16% of the study population. The proportion of surgical patients who survived within six months (82.46%) did not differ significantly from those who expired (87.32%, χ^2 = 0.59, p = 0.441).

Conclusion. The primary tumor site was an independent prognostic factor for survival in patients diagnosed with pathologic fractures from MBD, with primary lung malignancy having the poorest chance of survival. While preoperative serum albumin, hemoglobin, and ALC were not statistically significant predictors, they remain clinically useful as indicators of nutritional and physiologic status when assessing surgical risk. These findings are particularly relevant in local settings where access to timely diagnostic scans may be limited. In such contexts, readily available laboratory tests can play a valuable role in guiding risk stratification and shared decision-making in the management of MBD.

Keywords. bone neoplasms, pathological fractures, secondary, prognosis, retrospective studies, survival analysis

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INTRODUCTION

Metastatic bone disease (MBD) is the most common cause of malignancy in the bone, typically affecting patients in the terminal stage of their illness. This condition carries a high risk for skeletal-related events, including pathologic fractures and spinal cord compression in 10% of cases.[1–3] Pathologic fractures significantly increase mortality rates, with reports showing 60–83% mortality at one year and 70–94% at two years post-surgery.[4–6]

Surgical stabilization procedures, though invasive, are often necessary for palliation, pain relief, early mobilization, and reduced morbidity, especially since many patients are in the late stages of cancer.[6–9] However, surgery carries inherent risks that may worsen outcomes for critically ill patients. For those unfit for surgery, nonoperative management such as immobilization, non-weight bearing, and bracing can offer symptom relief.[10] Radiotherapy and chemotherapy have also demonstrated palliative benefits for patients with severe comorbidities or poor prognosis.[11] Overall, management should be tailored individually.

Estimating survival in patients with metastatic pathologic fractures is essential for setting realistic expectations for patients, families, and physicians.[3,12–14] Yet, prognostic assessments can be subjective. Several studies have developed scoring systems incorporating factors from spinal and extremity metastases to guide prognosis.[15–17] However, many omit hematologic or serologic parameters that may better reflect physiologic status.[14] Readily available serologic markers (e.g., serum albumin, hemoglobin, absolute lymphocyte count) correlate with nutrition, physiologic reserve, and survival, yet are underrepresented or inconsistently weighted in current tools, particularly for extremity disease.[14,18–22] In addition, some prognostic scores require detailed imaging that is not always available for extremity pathologic fractures, especially in resource-constrained settings, underscoring the value of simple laboratory-based indicators.[10,18] Known risk factors for mortality include the site of the primary tumor and preoperative functional status. Lung-origin tumors have the highest mortality (80%) when compared to breast (48%), kidney (79%), and prostate (40%) origins.[13,23] Functional status is commonly measured using the Eastern Cooperative Oncology Group (ECOG) Performance Status. Lower ECOG scores (0–1) correlate with reduced mortality, while higher scores (2–5) indicate poorer outcomes, although specific percentages are lacking in studies.[12,13,23,24]

Among hematologic and serologic parameters, hemoglobin, absolute lymphocyte count (ALC), and serum albumin have shown prognostic value.[12,13,18] Hemoglobin, assessed via complete blood count (CBC), is widely used in clinical settings. Preoperative anemia (<80–100 g/L) is a strong negative prognostic factor.[12,13,25] ALC, also obtained from the CBC, reflects immune function and wound healing but is not considered an independent predictor of survival in MBD.[12,13,19] Serum albumin is a marker of nutritional and visceral protein status; low levels are linked to poor surgical recovery and are significant in cancer survival prognosis.[13,14,19,20] These readily available laboratory values can assess physiological status and may help predict cancer survival outcomes.[18,21] Because CBC and serum albumin are inexpensive, routine, and easily extracted from clinical records, isolating them has practical value for risk stratification when advanced imaging is not immediately available.[10,20]

As of writing, local studies have not yet evaluated the prognostic significance of preoperative hemoglobin, ALC, and serum albumin levels in patients presenting with pathologic fractures secondary to metastatic bone disease. This study, therefore, aimed to identify key prognostic factors associated with diminished survival and to assess the validity of these factors in predicting outcomes among patients who underwent surgery for pathologic fractures secondary to metastatic bone disease of the axial or appendicular skeleton.

METHODOLOGY

Study design

This was a retrospective cohort, single-center study involving patients diagnosed with pathologic fractures of the axial or appendicular skeleton treated surgically and non-surgically from January 2010 to December 2020.

Study population

Adult patients aged more than 20 years with histologic proof of metastases and with available mortality data at six months and one year were included. Patients without information relating to the presence or absence of bone or visceral metastases, histopathology reports dated before the year 2010, patients diagnosed with carcinoma in situ, primary bone or soft tissue sarcoma, or hematologic malignancy were excluded from the study.

Data collection

Purposive data gathering was done by the primary author by scanning the daily patient census using the keywords "metastatic bone disease," "pathologic fracture," and related terms such as "metastatic" and "pathologic." Patients who appeared in the search were collected and filtered according to the inclusion and exclusion criteria. Patients' data and clinical information were then retrieved from electronic patient records (MDportal, HCQC, Digichart). Data included age at diagnosis, site of primary tumor, site of pathologic fracture, presence of visceral or other bony metastases, laboratory data including preoperative serum albumin, hemoglobin, and ALC values, surgical procedure performed (if any), course in the wards, and follow-up dates.

Preoperative hemoglobin (g/L) was taken at the time of admission or before any blood transfusion, and values less than 100.0 g/L were categorized as low, and those 100.0 g/L

and above were categorized as normal. ALC (cells/mcL) was computed from the complete blood count as WBC count x 1000 x percent lymphocyte (expressed as a decimal). ALC levels less than 500 cells/mcL were categorized as low, and those with greater than or equal to 500 cells/mcL were categorized as normal. Preoperative serum albumin (g/L) was also obtained at the time of admission or before any albumin correction, with values less than 35.0 g/L categorized as low and those 35.0 g/L and above categorized as normal.[13]

Oncologic diagnosis was classified into six groups: breast, lung, prostate, renal, thyroid (representing the top five primary carcinomas in our population), and other sites. The presence of visceral metastases was determined preoperatively based on imaging such as computed tomography (CT) scan of the chest and abdomen, and magnetic resonance imaging (MRI) of the brain. If the visceral metastases were discovered after surgery, this information was not utilized in the study because the authors aimed to determine survival rates with the information and parameters available during the time of decision-making, and this lowers the risk of overestimating the number of patients with visceral metastasis at the time of management. The same approach was used regarding the number of bone metastases, which was determined by nuclear bone scan imaging. The official results of all scans were reviewed by a consultant radiologist and the primary author.

Data analysis

Data were analyzed using STATA Statistical Software, Version 13. College Station, TX: StataCorp LP. A p-value of 0.05 was considered statistically significant. Descriptive statistics for continuous variables were summarized as means and standard deviations, while categorical variables were reported as frequencies and percentages. Comparative analyses of nominal variables (including primary tumor site, surgical status, chemotherapy and/or radiotherapy exposure, organ-specific visceral metastases, axial or appendicular involvement, and hematologic laboratory markers) according to mortality status (expired versus alive) was done using the Chi-Square Test of Homogeneity or Fisher's Exact Test, if the assumption of at least five expected frequencies per cell was not met. The Mann-Whitney U Test was used for ordinal or non-normally distributed continuous data, while the independent t-test was used for normally distributed continuous data.

We used survival analysis approaches in our inferential analyses to allow for differences in the time to mortality. Particularly, Kaplan-Meier survival curve analysis was utilized to determine the median time of mortality, with curves stratified by preoperative hemoglobin, ALC, and serum albumin (low vs normal) and by surgical status. Cox proportional-hazards regression with adjusted models for specific confounders was also employed to determine the hematologic and serologic predictors of mortality in patients who underwent surgery and in patients who did not.

Addressing bias

We limited our inclusion and exclusion criteria to information available at the time of presentation to reduce selection bias and confounding by indication. The index date was set at admission or the first confirmatory imaging of the fracture. Information bias was minimized by using official preoperative imaging reports, standardized laboratory definitions, and dual review of imaging classifications. Adjustments for key prognostic factors in multivariable Cox models were made during analysis. Residual confounding and selection bias inherent to retrospective designs may remain and are acknowledged.

Ethical clearance

This study was conducted in adherence to the ethical principles outlined in the Declaration of Helsinki (2013) and by the Guidelines of the International Conference on Harmonization - Good Clinical Practice (ICH-GCP), E6 (R2), and other applicable provisions of ICH-GCP 6 (as amended). Approval for the conduct of the study was obtained from the Institutional Review Board (IRB) and Institutional Ethics Review Committee (IERC) of St. Luke's Medical Center (Protocol Code: SL-21002).

RESULTS

One hundred and twenty-eight patients met the inclusion criteria, 109 of whom underwent surgical stabilization for pathologic or impending pathologic fracture and 19 of whom did not. All 128 were followed up for survival (Table 1).

Most participants were female (56.25%). The mean age of the respondents was 60.05 years (SD = 11.10). In particular, the age of those who survived up to one year was 56.26 years (SD = 10.52), while those who expired within six months had a mean age of 63.10 years (SD = 10.67). The mean age of the respondents who expired was significantly older (t = −3.62, p = 0.001).

The most common primary tumor site was the breast (32.02%), followed by the lung (25.00%), and the kidney (7.81%). Histological diagnosis of skeletal metastasis was obtained on the same day as surgical stabilization in the surgical group. Among those with primary lung cancer, the proportion of those who expired (32.39%) was significantly higher (χ^2 = 4.65, p = 0.031) compared to the other primary malignancies. Pathologic fractures were more common in the spine (64.06%) than in the appendicular skeleton (35.94%).

The mean preoperative hemoglobin, ALC, and serum albumin were 118.6 g/L (SD=1.79), 1,214.25 cells/mcL (SD = 736.97), and 25.0 g/L (SD=0.44), respectively (Table 1). We found that 14.06% of the participants had low hemoglobin, 14.06% had low ALC count, and 96.88% had low serum albumin. Of those with low hemoglobin, 11.27% expired within the first six months from the index date, while 17.54% survived up to one year; this difference shows no statistical significance

Table 1. Demographic and clinical profiles of the respondents according to mortality status (N = 128)

Characteristics	Mortality status			Test statistic	*p*-value (Two-tailed)
	Alive >6 mos to 1 year (n = 57)	Expired Within 6 mos (n = 71)	Total (N = 128)		
Age (Years; x̄, SD)	56.26 (10.52)	63.10 (10.67)	60.05 (11.10)	-3.62	0.001†
Sex (f, %)				0.01	0.982
Male	25 (43.86%)	31 (43.66%)	56 (43.75%)		
Female	32 (56.14%)	40 (56.34%)	72 (56.25%)		
Location of primary malignancy (f, %)					
Breast	20 (35.09%)	21 (29.58%)	41 (32.02%)	0.44	0.507
Lung	9 (15.79%)	23 (32.39%)	32 (25.00%)	4.65	0.031*
Thyroid	5 (8.77%)	3 (4.23%)	8 (6.25%)	1.12	0.465
Prostate	5 (8.77%)	5 (7.04%)	10 (7.81%)	0.13	0.751
Renal	7 (12.28%)	6 (8.45%)	13 (10.16%)	0.51	0.476
Others					
Colorectal	3 (5.26%)	2 (2.82%)	5 (3.91%)	0.71	0.479
Endometrial	0 (0.00%)	1 (1.41%)	1 (0.78%)	-0.90	0.368
Hepatocellular	1 (1.75%)	3 (4.23%)	4 (3.13%)	-0.80	0.423
Nasopharyngeal/Pharyngeal	1 (1.75%)	1 (1.41%)	2 (1.56%)	0.15	0.877
Neuroendocrine	0 (0.00%)	1 (1.41%)	1 (0.78%)	-0.90	0.368
Pancreatic	0 (0.00%)	2 (2.82%)	2 (1.56%)	-1.28	0.201
Parotid	1 (1.75%)	1 (1.41%)	2 (1.56%)	0.15	0.877
Round Cell	1 (1.75%)	0 (0.00%)	1 (0.78%)	1.12	0.263
Unknown	0 (0.00%)	1 (1.41%)	1 (0.78%)	-0.90	0.368
Urothelial	0 (0.00%)	1 (1.41%)	1 (0.78%)	-0.90	0.368
Vulvar	2 (3.51%)	0 (0.00%)	2 (1.56%)	1.59	0.112
Site of pathologic fracture (f, %)				1.67	0.197
Spine	40 (70.18%)	42 (59.15%)	82 (64.06%)		
Appendicular	17 (29.82%)	29 (40.85%)	46 (35.94%)		
Laboratory Findings					
Preoperative hemoglobin (x̄, SD)	11.75 (1.86)	11.95 (1.75)	11.86 (1.79)		
Low preoperative hemoglobin (<100.0g/L)	10 (17.54%)	8 (11.27%)	18 (14.06%)	-0.62	0.535
Normal preoperative hemoglobin (≥100.0g/L)	47 (82.46%)	63 (88.73%)	110 (85.94%)	1.03	0.310
Absolute lymphocyte count (x̄, SD)	1,440.21 (795.81)	1,032.84 (635.43)	1,214.25 (736.97)		
Low absolute lymphocyte count (<500 Cells/mcL)	6 (10.53%)	12 (16.90%)	18 (14.06%)	3.22	0.002†
Normal absolute lymphocyte count (≥500 Cells/mcL)	51 (89.47%)	59 (83.10%)	110 (85.94%)	1.06	0.302
Serum albumin (x̄, SD)	2.52 (0.41)	2.47 (0.46)	2.50 (0.44)		
Low serum albumin (<35.0/L)	56 (98.25%)	68 (95.77%)	124 (96.88%)	0.66	0.511
Normal serum albumin (≥35.0g/L)	1 (1.75%)	3 (4.23%)	4 (3.13%)	0.64	0.628
Chemotherapy or Radiation Therapy (f, %)					
For primary malignancy	27 (47.37%)	35 (49.30%)	62 (48.44%)	0.05	0.828
For metastasis	15 (26.32%)	13 (18.31%)	28 (21.88%)	1.19	0.276
Visceral metastasis (f, %)					
Brain	8 (14.04%)	13 (18.31%)	21 (16.41%)	0.42	0.516
Lung	10 (17.54%)	15 (21.13%)	25 (19.53%)	0.26	0.611
Liver	3 (5.26%)	10 (14.08%)	13 (10.16%)	2.70	0.101
Others: Adrenal	1 (1.75%)	1 (1.41%)	2 (1.56%)	0.02	1.000
Bony metastasis (f, %)				0.01	0.951
Axial	31 (54.39%)	39 (54.93%)	70 (54.69%)		
Appendicular	26 (45.61%)	32 (45.07%)	58 (45.31%)		
Surgery status				0.59	0.441
With surgery	47 (82.46%)	62 (87.32%)	109 (85.16%)		
Without surgery	10 (17.54%)	9 (12.68%)	19 (14.84%)		

Note: Comparative analyses were conducted using the Chi-Square Test of Homogeneity or Fisher's Exact Test (if expected frequencies were less than 5.00) and an independent t-test.

*Significant at 0.05; †Significant at 0.01

(p = 0.310). Similarly, no significant difference was observed in survival between patients with low albumin, with 95.77% expiring within six months and 98.25% surviving up to one year (p = 0.511). In contrast, a statistically significant difference was found in those with low ALC, with 16.90% of patients expiring within six months compared to 10.53% still alive up to one year (p = 0.002).

For patients with normal hemoglobin, normal ALC, and normal albumin, no statistically significant differences in values were observed between those alive up to one year and those who expired within the first six months. Only 1.75% of those who survived up to one year had normal albumin levels. This is because the study population's albumin levels were generally lower than normal. These findings suggest that despite low albumin levels, survival rates did not differ significantly.

Most (85.16%) respondents had surgery, and the proportion of these patients who survived up to six months (82.46%) was not significantly different (χ^2 = 0.59, p = 0.441) from those who expired (87.32%).

Almost half (48.44%) had received chemotherapy or radiation therapy for their primary malignancy, while 21.88% had these treatments for their metastases. The mortality rate in patients who underwent adjuvant chemotherapy or radiotherapy for the primary malignancy was 49.30% and was not a significant risk factor for mortality (p = 0.828). Similarly, those who received adjuvant chemotherapy or radiotherapy for metastasis had a mortality rate of 18.31% but this was also not significant (p = 0.276).

In terms of visceral metastases, 19.53% had lung metastasis (p = 0.611), 16.41% had brain metastasis (p = 0.516), and 10.16% had liver metastasis (p = 0.101). The most common sites of bony metastases were axial bones (54.69%, p = 0.951).

Table 2 shows that 40.63% of the respondents expired within six months, while 14.84% expired within six to 12 months. Results also showed that the median mortality time for patients with low preoperative hemoglobin, low ALC, and low serum albumin was within six months (95% CI = 6 to 6).

Table 3 depicts the Cox proportional hazards regression analyses of the predictors of mortality among the respondents according to the surgical status. Hazard ratios were adjusted for significant confounders, including age, primary lung malignancy, and primary renal malignancy. The adjusted hazard ratio of mortality among those without surgery was 25% higher than those with low preoperative hemoglobin (aHR = 1.26, p = 0.842) and low ALC (aHR = 1.26, p = 0.842) than those with normal hemoglobin and absolute lymphocyte count. In addition, low serum albumin was not associated with the hazard of mortality among those without surgery (aHR = 1.00, p = 1.000). On the other hand, the adjusted hazards for mortality among those with surgery with low preoperative hemoglobin (aHR = 1.26, p = 0.842), low absolute lymphocyte count (aHR = 1.20, p = 0.612), and low serum albumin (aHR = 1.45, p = 0.609) were 31%, 20%, and 45% higher, respectively, than those with normal serologic results. These results were not statistically significant ($p > 0.05$).

Figure 1 illustrates the Kaplan-Meier survival estimates according to the level of preoperative hemoglobin, level of absolute lymphocyte count, and level of serum albumin. The time interval from the index date to mortality was shorter among those with low preoperative hemoglobin, low ALC, low serum albumin, and without surgery, compared to those with high or normal preoperative hemoglobin, ALC, normal serum albumin, and with surgery.

Table 2. Frequency distribution of mortality according to the time of mortality among the respondents (N = 128)

Outcome	Time of mortality			
	6 months		12 months	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Mortality status (Expired)	52	40.63%	19	14.84%

Table 3. Univariate Cox proportional hazards regression analysis of the predictors of mortality among the respondents according to the surgical status (N=128)

Predictors	Mortality status (Expired)											
	Without surgery						With surgery					
	cHR	p-values (Two-tailed)	95% CI	aHR	p-values (Two-tailed)	95% CI	cHR	p-values (Two-tailed)	95% CI	aHR	p-values (Two-tailed)	95% CI
Low Pre-operative Hemoglobin (<100.0g/L)	1.14	0.901	0.14–9.29	1.25	0.842	0.14–11.18	1.20	0.656	0.54–2.64	1.31	0.507	0.59–2.92
Low absolute lymphocyte Count (<500 Cells/mcL)	1.14	0.901	0.14–9.29	1.25	0.842	0.14–11.18	1.02	0.948	0.53–1.96	1.20	0.612	0.60–2.39
Low serum albumin (<35.0g/L)	0.88	0.901	0.11–7.11	1.00	1.000	0.09–11.03	1.22	0.783	0.30–5.00	1.45	0.609	0.35–6.05

Note: cHR = Crude Hazard Ratio; aHR = Adjusted Hazard Ratio; Hazard ratios were adjusted for significant confounders: age, primary malignancy of lungs, primary malignancy of renal

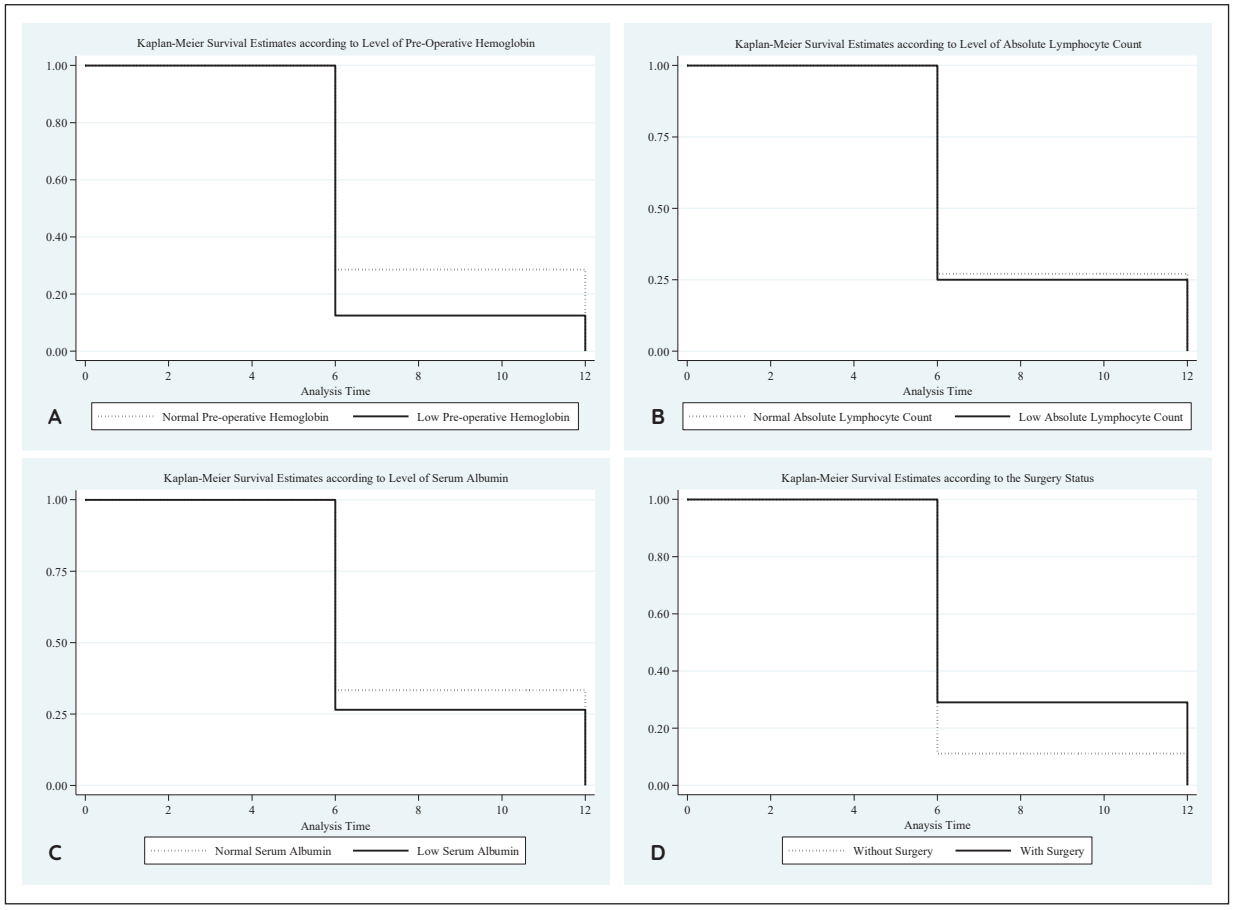

Figure 1. Kaplan-Meier survival estimates according to the level of preoperative hemoglobin **(A)**, level of absolute lymphocyte count **(B)**, level of serum albumin **(C)**, and surgery status **(D)**.

DISCUSSION

Pathologic fractures due to skeletal metastases from cancers of the breast, prostate, thyroid, lung, and kidney contribute significantly to patient morbidity and mortality.[3,13,18,23] We report a six-month mortality of 40.63% which is similar to previous reports (49.6%).[14] One-year mortality was 14.84%, lower than previously reported mortality rates of 60–83%.[6,12,13,18,23,25] The primary tumor site was an independent prognostic factor of survival in patients diagnosed with pathologic fracture from MBD, with primary lung malignancy having the poorest chance of survival. Preoperative serum albumin, hemoglobin, and ALC were not found to be significant in predicting survival in these patients.

The relationship between the primary site of malignancy and long-term survival in patients with pathologic fracture secondary to MBD has been well-established.[6,12,14,23,25] The most common primary malignancy was the breast, with lung coming in second, similar to our study's results (32.02% and 25.00%, respectively). Although more common overall, the prognoses of patients with MBD from breast cancer were significantly better than those with lung cancer.[3,12–14]

The spine was the most common location of MBD.[3,8,12,14] Pathological metastatic fractures of the spine and extremities may debilitate patients due to severe pain, prolonged recumbency, and possible weakness. We found that most pathological fractures were detected at the same time as the bony metastases. This suggests that both axial and appendicular metastasis may be primarily asymptomatic or tolerable in pain, therefore, difficult to detect during the early stage without regular surveillance.[8,18,25] The estimated life expectancy should guide management. Surgeons rely on careful assessment of various preoperative factors and scoring systems such as those by Bauer,[15] Tomita,[16] and Tokuhashi[17] to prognosticate and deduce which patients may benefit from surgical intervention. In our literature review, we found no prognostic scoring systems that used laboratory parameters to reflect the physiologic status of patients with MBD.

Multiple serologic parameters have been examined in studies in attempts to predict survival in patients diagnosed with MBD.[12,13,18,23,26] Serum albumin is readily available, evaluates nutritional status,[19] and prognosticates cancer survival.[12,27] Our study showed that patients who died within six months of being diagnosed with MBD more often had low preoperative serum albumin, ALC, and hemoglobin levels, whereas those who survived beyond one year were likely to have normal preoperative hemoglobin and ALC; however, these differences were not found to be statistically significant. Other reports have shown these three parameters

to have significant risks for mortality among patients with MBD in the spine, pelvis, or extremities.[12,13,18,25] Preoperative hemoglobin level was reported to be the only independent predictor of survival in early survival analyses.[12,25] Preoperative serum albumin has been reported in retrospective studies and a systematic review as an independent prognostic factor of survival in MBD from various malignancies[12,14,21,22] while ALC has been shown as an independent predictor for survival in MBD in the femur.[12] Further, low albumin levels were noted to be a general characteristic of the study population in our studies. All these findings may be because most of the patients diagnosed with MBD with concomitant pathologic fracture already represent the terminal stage of the disease.[12–14,18,23] These markers can be used for prognostication, but existing data should be corroborated by further research.

Our nonsurgical patients were either not medically fit to undergo any extensive procedure or were amenable only to systemic therapy. These conditions may have contributed to a higher mortality rate.[12,14] The surgical patients, on the other hand, were likely better candidates for surgery.[9,13,23] Despite these baseline differences, mortality did not differ between these two groups in our study. Again, these findings represent patients diagnosed with MBD as those already in the terminal stage of the disease, highlighting low survivability.

Several limitations are present in this study. The study population was selected based on search terms "metastatic bone disease," "pathologic fracture," and related keywords such as "metastatic" and "pathologic", which may have led to some cases being excluded in the process. There were also missing census files from the institute registry: six months from the year 2019, six months from the year 2018, 12 months from the year 2017, six months from the year 2016, and one month from the year 2015. Attempts made to retrieve these data were unsuccessful. These missing records contributed to the reduced sample size, which may have introduced residual confounding factors that can obscure modest but real effects. This study did not compare the mortality rates of patients with pathologic fractures to those with impending pathologic fractures. The presence of a pathologic fracture has been reported to be a negative predictor of survival.[18,25] Stratified analyses by anatomic distribution (isolated axial or appendicular involvement versus multiple skeletal disease) were not performed, which represents another limitation. This is also seen in other studies and may influence outcomes.[7,18,22] Aside from skeletal involvement, the pattern of metastatic spread influences prognosis. Visceral metastasis reaching the lungs is most common (59%), followed by the liver (15%).[4] A higher mortality rate is seen in these patients.[23] Brain metastasis is common in primary malignancies in the upper half of the body and carries a poor prognosis.[2] While bone and solid organ metastases often go hand-in-hand and indicate a poor prognosis, bone-only metastases reportedly have better outcomes.[2,4]

Other prognostic factors, such as hospital characteristics, patient comorbidities, specific surgical intervention, and surgical or medical complications, were not studied since this information was not available in our population. Patients may have had preexisting metastatic lesions identified by bone scan, without histologic confirmation. Most patients were confirmed to have MBD via biopsy on the day of surgical intervention. This occurs in up to 30% of patients with skeletal metastases.[28] Patients with an unknown primary tumor may have poorer outcomes due to delays in staging and treatment. Comorbidities, in addition to nutritional status, also contribute to the patient's surgical tolerance or postoperative complications.[28]

Treatment decisions were likely influenced by patients' overall picture as determined by the multi-disciplinary approach rather than immediate surgical indications. Patients in critical states were either not cleared up for surgery or chose to have palliative management instead. This selection bias is nearly unavoidable when comparing the mortality rates of surgical and non-surgical patients. In our center, numerous patients were worked up for MBD but did not undergo biopsy, further contributing to the low patient numbers in the non-operative group.

Peri-operative functional outcomes of patients were not considered in this study, but have been previously found to be significant risk factors for survival.[12,18,23] Furthermore, we grouped each cancer by primary location, without accounting for tumor stage, grade, and histologic subtype, all of which can influence prognosis.[12,13]

Studies involving a more homogenous population may improve the generalizability of findings. Expanding the case identification strategy, strengthening data management systems, and including patients with impending fractures may improve the representation of the sample and provide richer analysis. Collecting more detailed information on metastatic spread, tumor characteristics, comorbid conditions, complications, and perioperative functional outcomes could also allow for a more refined understanding of patient prognosis. Additionally, there may be value in exploring whether nutritional support could benefit patients with low preoperative albumin.

Conducting multicenter studies may help overcome limitations related to small sample size and single-institution bias and would allow for greater applicability of the findings across varied clinical settings. Taking these steps could lead to more accurate survival models and better support individualized care for patients with metastatic bone disease.

CONCLUSION

We found that the primary tumor site was an independent prognostic factor for survival in patients diagnosed with pathologic fractures from MBD, with primary lung malignancy having the poorest chance of survival. While preoperative serum albumin, hemoglobin, and ALC were not statistically significant predictors, they remain clinically useful as indicators

of nutritional and physiologic status when assessing surgical risk. These findings are particularly relevant in local settings where access to timely diagnostic scans may be limited. In such contexts, readily available laboratory tests can play a valuable role in guiding risk stratification and shared decision-making in the management of MBD.

A more standardized and comprehensive study design that addresses the current study's limitations may provide clearer guidance for future survival analyses in patients with pathologic fractures secondary to MBD. Conducting multicenter studies can help overcome limitations related to small sample size and single-institution bias, thereby improving the generalizability of the findings across varied clinical settings. Additional research is also needed to assess the potential benefits of nutritional supplementation in patients with low preoperative albumin levels.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

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REFERENCES

1. Adamsbaum C, Mascard E, Guinebretière JM, Kalifa G, Dubousset J. Intralesional Ethibloc injections in primary aneurysmal bone cysts: an efficient and safe treatment. Skeletal Radiol. 2003;32(10):559–66. PMID: 12856159 DOI: 10.1007/s00256-003-0653-x
2. Huang JF, Shen J, Li X, et al. Incidence of patients with bone metastases at diagnosis of solid tumors in adults: a large population-based study. Ann Transl Med. 2020;8(7):482. PMID: 32395526 PMCID: PMC7210217 DOI: 10.21037/atm.2020.03.55
3. Behnke NK, Baker DK, Xu S, et al. Risk factors for same-admission mortality after pathologic fracture secondary to metastatic cancer. Support Care Cancer. 2017;25(2):513–21. PMID: 27704262 DOI: 10.1007/s00520-016-3431-8
4. Narazaki DK, De Neto Alverga CC, Baptista AM, Caiero MT, de Camargo OP. Prognostic factors in pathologic fractures secondary to metastatic tumors. Clinics. 2006;61(4):313–20. PMID: 16924322 DOI: 10.1590/s1807-59322006000400007
5. Vincenzi B, Frezza AM, Schiavon G, et al. Bone metastases in soft tissue sarcoma: a survey of natural history, prognostic value and treatment options. Clin Sarcoma Res. 2013;3(1):6. PMID: 23594799 PMCID: PMC3637638 DOI: 10.1186/2045-3329-3-6
6. Forsberg JA, Wedin R, Boland PJ, Healey JH. Can we estimate short- and intermediate-term survival in patients undergoing surgery for metastatic bone disease? Clin Orthop Relat Res. 2017;475(4):1252–61.
7. Guzik G. Oncological and functional results after surgical treatment of bone metastases at the proximal femur. BMC Surg. 2018;18(1):5. PMID: 29370790 PMCID: PMC5784608 DOI: 10.1186/s12893-018-0336-0
8. Cho JH, Ha JK, Hwang CJ, Lee DH, Lee SL. Patterns of treatment for metastatic pathological fractures of the spine: The efficacy of each treatment modality. Clin Orthop Surg. 2015;7(4):476–82. PMID: 26640631 PMCID: PMC4667116 DOI: 10.4055/cios.2015.7.4.476
9. Willeumier JJ, Linden YM, van de Sande MAJ, Dijkstra PDS. Treatment of pathological fractures of the long bones. EFORT Open Rev. 2016;1(5):136–45. PMID: 28461940 PMCID: PMC5367617 DOI: 10.1302/2058-5241.1.000008
10. Damron TA, Mann KA. Fracture risk assessment and clinical decision making for patients with metastatic bone disease. J Orthop Res. 2020;38(6):1175–90. PMID: 32162711 PMCID: PMC7225068 DOI: 10.1002/jor.24660
11. Chow E, Zeng L, Salvo N, et al. Update on the systematic review of palliative radiotherapy trials for bone metastases. Clin Oncol (R Coll Radiol). 2012;24(2):112–24. PMID: 22130630 DOI: 10.1016/j.clon.2011.11.004
12. Nathan SS, Healey JH, Mellano D, et al. Survival in patients operated on for pathologic fracture: Implications for end-of-life orthopedic care. J Clin Oncol. 2005;23(25):6072–82. PMID: 16135474 DOI: 10.1200/JCO.2005.08.104
13. Nathan SS, Chan L, Tan WL, et al. The need for a system of prognostication in skeletal metastasis to decide best end-of-life care - A call to arms. Ann Acad Med Singapore. 2010;39(6):476–81. PMID: 20625625
14. Sim DS, Zainul-Abidin S, Sim EY, et al. Serum albumin level predicts survival after surgical treatment of metastatic femur fractures: A retrospective study. J Orthop Surg Res. 2020;15(1):128. PMID: 32245389 PMCID: PMC7118955 DOI: 10.1186/s13018-020-01632-7
15. Bauer HCF, Wedin R. Survival after surgery for spinal and extremity metastases: Prognostication in 241 patients. Acta Orthop. 1995;66(2):143–6. PMID: 7740944 DOI: 10.3109/17453679508995508
16. Tomita K, Kawahara N, Kobayashi T, Yoshida A, Murakami H, Akamaru T. Surgical strategy for spinal metastases. Spine (Phila Pa 1976). 2001;26(3):298–306. PMID: 11224867 DOI: 10.1097/00007632-200102010-00016
17. Tokuhashi Y, Matsuzaki H, Oda H, Oshima M, Ryu J. A revised scoring system for preoperative evaluation of metastatic spine tumor prognosis. Spine (Phila Pa 1976). 2005;30(19):2186–91. PMID: 16205345 DOI: 10.1097/01.brs.0000180401.06919.a5
18. Sørensen MS, Gerds TA, Hindsø K, et al. Prediction of survival after surgery due to skeletal metastases in the extremities. Bone Joint J. 2016;98-B(2):271–7. PMID: 26850435 DOI: 10.1302/0301-620X.98B2.36107
19. Rocha NP, Fortes RC. Total lymphocyte count and serum albumin as predictors of nutritional risk in surgical patients. Arq Bras Cir Dig. 2015;28(3):193–6. PMID: 26537145 PMCID: PMC4737361 DOI: 10.1590/S0102-67202015000300012

20. Cross MB, Yi PH, Thomas CF, Garcia J, Della Valle CJ. Evaluation of malnutrition in orthopaedic surgery. J Am Acad Orthop Surg. 2014;22(3):193–9. PMID: 24603829 DOI: 10.5435/JAAOS-22-03-193
21. Gupta D, Lis CG. Pretreatment serum albumin as a predictor of cancer survival: a systematic review of the epidemiological literature. Nutr J. 2010;9:69. PMID: 21176210 PMCID: PMC3019132 DOI: 10.1186/1475-2891-9-69
22. Kotian RN, Puvanesarajah V, Rao S, El Abiad JM, MOrris CD, Levin AS. Predictors of survival after intramedullary nail fixation of completed or impending pathologic femur fractures from metastatic disease. Surg Oncol. 2018;27(3):462–7. PMID: 30217303 DOI: 10.1016/j.suronc.2018.05.028
23. Hill T, D'Alessandro P, Murray K, Yates P. Prognostic factors following pathological fractures. ANZ J Surg. 2015;85(3):159–63. PMID: 25182567 DOI: 10.1111/ans.12830
24. Katagiri H, Takahashi M, Wakai K, Sugiura H, Kataoka T, Nakanishi K. Prognostic factors and a scoring system for patients with skeletal metastasis. J Bone Joint Surg Br. 2005;87(5):698–703. PMID: 15855375 DOI: 10.1302/0301-620X.87B5.15185
25. Hansen BH, Keller J, Laitinen M, et al. The Scandinavian Sarcoma Group skeletal metastasis register: Survival after surgery for bone metastases in the pelvis and extremities. Acta Orthop Scand Suppl. 2004;75(311):11–5. PMID: 15188660 DOI: 10.1080/00016470410001708270
26. Katagiri H, Okada R, Takagi T, et al. New prognostic factors and scoring system for patients with skeletal metastasis. Cancer Med. 2014;3(5):1359–67. PMID: 25044999 PMCID: PMC4302686 DOI: 10.1002/cam4.292
27. Karhade A V., Thio QCBS, Kuverji M, Ogink PT, Ferrone ML, Schwab JH. Prognostic value of serum alkaline phosphatase in spinal metastatic disease. Br J Cancer. 2019;120(6):640–6. PMID: 30792532 PMCID: PMC6461951 DOI: 10.1038/s41416-019-0407-8
28. Piccirillo JF, Tierney RM, Costas I, Grove L, Spitznagel EL Jr. Prognostic importance of comorbidity in a hospital-based cancer registry. J Am Med Assoc. 2004;291(20):2441–7. PMID: 15161894 DOI: 10.1001/jama.291.20.2441

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ORIGINAL ARTICLE

Proximal Femoral Nailing versus 95° Dynamic Condylar Screw Fixation in Subtrochanteric Femoral Fractures: A Comparative Study of 40 Cases

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ABSTRACT

Background. Subtrochanteric femoral fractures present treatment challenges due to complex anatomy and biomechanical stressors. While PFN is associated with shorter surgical time and improved early mobility, DCS may still be the preferred option in specific fracture morphologies or resource-constrained settings like those in India. The objective of this study was to evaluate and compare the clinical, functional, and radiological outcomes of Proximal Femoral Nailing (PFN) versus the 95° Dynamic Condylar Screw (DCS).

Methodology. This prospective study was carried out between July 2023 and March 2025 at a tertiary care centre in India. Forty patients aged more than 18 years with closed subtrochanteric fractures were enrolled and randomized into PFN and DCS groups. Perioperative metrics (operation time, blood loss), postoperative pain (VAS), time to mobilization, union rate, complications, and functional outcomes (Harris Hip Score) were assessed at 6, 12, 24 weeks, and 1 year.

Results. Operative time (PFN: 53 ± 12.6 min vs. DCS: 75.6 ± 12.3 min, p <0.001) and intraoperative blood loss (PFN: 150.2 ± 20.4 ml vs. DCS: 197.1 ± 45.5 ml, p <0.001) were significantly lower in PFN. Pain scores at 48 hours were also significantly better in PFN (p = 0.005). Hospital stay was shorter in PFN (3 vs. 5.6 days, p <0.001) compared to DCS. At 12 months, both groups achieved 95% radiological union and comparable functional recovery (mean HHS = 92.8, p >0.05). Complications occurred infrequently and did not differ significantly.

Conclusions. PFN offers perioperative advantages without compromising functional or radiological outcomes, making it preferable in settings that prioritize faster recovery.

Keywords. subtrochanteric fractures, proximal femoral nail, dynamic condylar screw, orthopaedic procedures, treatment outcome

INTRODUCTION

Subtrochanteric fractures are a complex subset of proximal femoral injuries that occur from the lesser trochanter to about 5 cm distally along the femoral shaft.[1] Representing 10–30% of proximal femoral fractures, they predominantly affect the elderly due to low-energy falls and younger individuals involved in high-energy trauma.[2] These fractures are challenging because of the area's complex anatomy and the significant biomechanical forces involved. High compressive, tensile, and shear forces, often combined with osteoporotic bone and comminution, contribute to instability, delayed healing, and other complications.[3]

Fixation must be stable to facilitate early mobilization and reduce the risks of non-union, malunion, and implant failure.[4] Traditional non-operative approaches like traction and casting have been replaced by operative fixation using intramedullary or extramedullary devices. Among these, Proximal Femoral

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Nailing (PFN) and 95° Dynamic Condylar Screw (DCS) plating are widely utilized techniques, each with specific indications, benefits, and drawbacks.[5]

PFN is an intramedullary technique favoured for its minimally invasive approach, biomechanical advantages, and suitability for osteoporotic bone. It aligns with the femur's mechanical axis and distributes stress more evenly, which is particularly useful in comminuted fractures. Its design reduces surgical trauma, blood loss, and infection risk, and allows early weight-bearing—an important factor for elderly patients.[6] However, PFN demands surgical precision and carries risks such as screw cut-out or migration when improperly placed.[7]

The 95° DCS is an extramedullary fixation method that provides rigid fixation and accurate anatomical reduction, making it suitable for fractures with metaphyseal comminution or diaphyseal extension.[8] It remains useful when intramedullary nailing is contraindicated, such as in fractures involving the piriformis fossa. The 95° dynamic condylar screw (DCS) is still commonly used for subtrochanteric fractures, even in cases without extension to the piriformis fossa. This practice is influenced by prevailing factors such as lower implant cost, greater availability in government institutions, and surgeon preference related to familiarity and experience with the technique. Yet, DCS requires extensive soft tissue dissection, increasing infection risk and potential for delayed healing, especially in osteoporotic bone. Its extramedullary position also exposes it to greater mechanical stresses.[9]

The decision between PFN and DCS is influenced by patient age, bone quality, fracture pattern, and surgeon experience. While PFN is associated with shorter surgical time and improved early mobility, DCS may still be the preferred option in specific fracture morphologies or resource-constrained settings.[10] This study aimed to comprehensively compare PFN and DCS in the treatment of subtrochanteric fractures, focusing on surgical outcomes, complications, and functional recovery.

METHODOLOGY

Study design and setting

This prospective observational analytical study was conducted at the Department of Orthopaedics, GMERS Medical College and General Hospital, Gotri, Vadodara, over a period extending from July 2023 to March 2025. The aim was to compare the outcomes of two surgical implants—Proximal Femoral Nail (PFN) and 95° Dynamic Condylar Screw (DCS)—in the management of subtrochanteric femur fractures.

Inclusion Criteria

- Age more than 18 years
- Closed subtrochanteric femoral fractures
- No other associated skeletal injuries
- Medically fit for surgery

Exclusion Criteria

- Pathological fractures
- Open fractures
- Medically unfit for anaesthesia or surgery
- Patients with a follow-up duration of less than six months

A consecutive sampling technique was used. Patients who fulfilled the eligibility criteria and consented to participate were randomized into either the PFN or DCS group through a computer-generated randomization sequence. This sequence was prepared in advance using random number tables, ensuring that the allocation process was objective and free from investigator influence. To maintain concealment, the randomization codes were sealed in opaque, serially numbered envelopes that were opened only after the patient was deemed fit for surgery and formally enrolled in the study. This approach prevented any prior knowledge of the treatment assignment and helped reduce allocation bias.

All patients underwent standard preoperative evaluation and preparation. All surgeries were done by the same team of surgeons, using spinal anaesthesia, a traction table, and image intensifier television (IITV) guidance.

For DCS fixation, a lateral incision was made, and the fracture was anatomically reduced. A guide pin was inserted and confirmed under IITV, followed by a Richards screw. The dynamic condylar plate was then fixed to the femoral shaft with cortical screws. Final fixation was verified under IITV, and the incision was closed in layers after saline wash and sterile dressing.

For PFN fixation, closed reduction was performed under fluoroscopy guidance following gentle traction. An approximately 2–3 cm incision was made near the greater trochanter. Entry into the medullary canal was started with an awl, followed by a guidewire and sequential reaming. The PFN was inserted, and fixation was completed using proximal lag screws, a de-rotation screw, and distal locking screws. Wound closure and dressing followed.

Intraoperative details, including operative time and estimated blood loss, were recorded. Postoperative management was standardized for both groups. Patients were monitored and followed up at 6, 12, 24 weeks, and 12 months post-surgery. Key outcome measures included union time, incidence of implant failure, postoperative pain assessed via Visual Analog Scale (VAS), and functional outcome assessed using the Harris Hip Score (HHS) at each follow-up point.

A sample size of 40 patients (20 in each group) was calculated based on a previous study by Ahmad et al.,[11] considering non-union rates with a 95% confidence level and 10% allowable error. Data were entered into Microsoft Excel and analysed using SPSS version 22. Descriptive statistics were used to summarize data. Continuous variables were expressed as mean and standard deviation, while categorical data were presented

as percentages and frequencies. Comparisons between groups were conducted using the chi-squared test for categorical variables, and a *p*-value less than 0.05 was considered statistically significant. Ethical approval was obtained from the institutional review board, and informed written consent was secured from all participants before their inclusion in the study.

Institutional Human Ethics Committee Number: IHEC/23/OUT/SRPG094

RESULTS

A total of 40 patients were included in the study, equally divided into two groups: 20 patients were treated with the 95° DCS (Figure 1), and 20 with the PFN (Figure 2). There were no significant differences in demographics between the two groups (Table 1).

Significant differences were observed in intraoperative parameters (Table 2). The mean operative time was significantly shorter in the PFN group (53 ± 12.6 minutes) compared

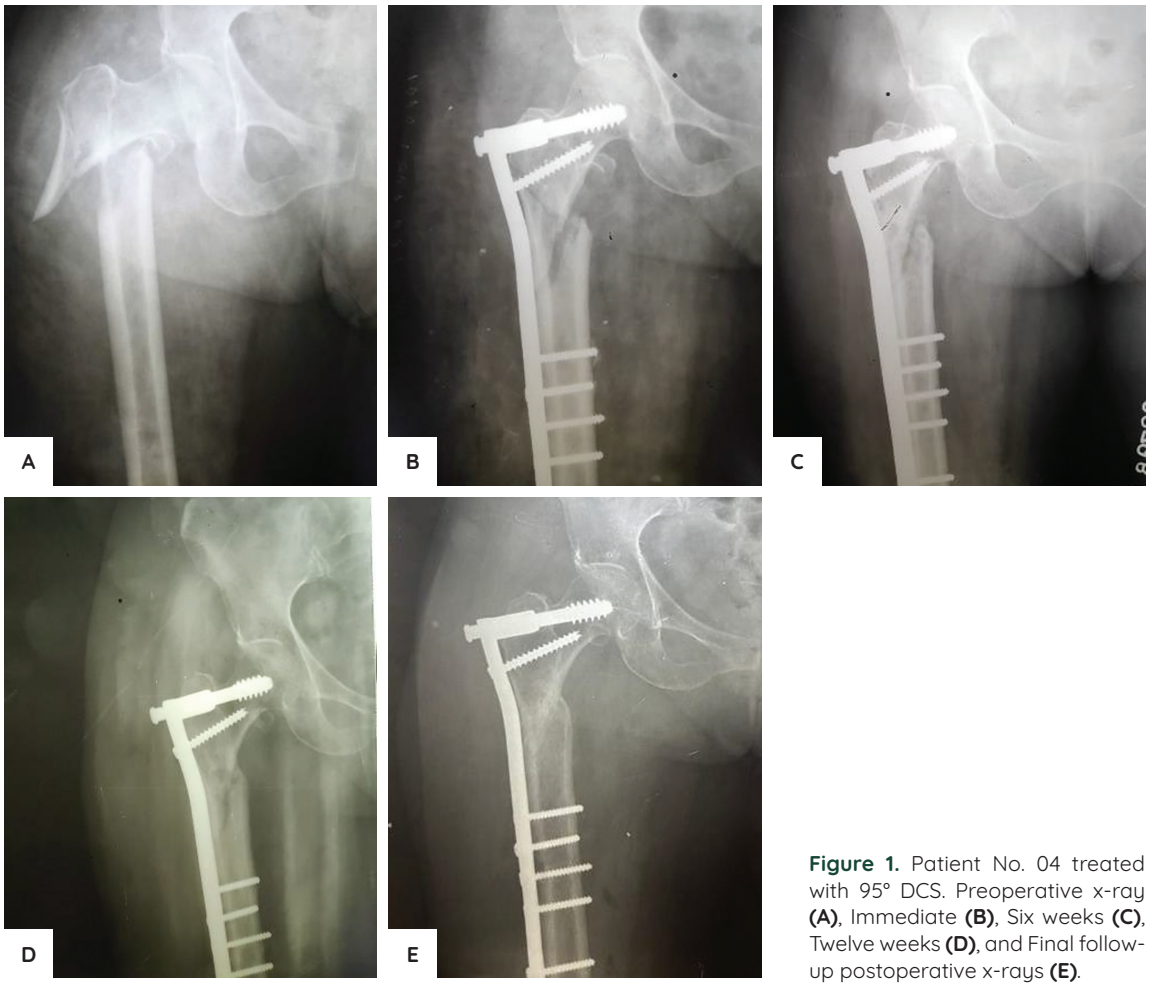

Figure 1. Patient No. 04 treated with 95° DCS. Preoperative x-ray **(A)**, Immediate **(B)**, Six weeks **(C)**, Twelve weeks **(D)**, and Final follow-up postoperative x-rays **(E)**.

Table 1. Socio-demographic and clinical characteristics (n = 40)

Parameters	95° DCS (n = 20)		PFN (n = 20)		*p*-value
	Mean/n	SD/%	Mean/n	SD/%	
Mean Age (years)	67.4	15.9	66.1	14.5	0.710
Male sex	10	50%	14	70%	0.197
Female sex	10	50%	07	30%	
Right sided injuries	13	65%	09	45%	0.204
Left sided injuries	07	35%	11	55%	
Müller classification A B C	 4 9 7	 20% 45% 35%	 8 10 2	 40% 50% 10%	0.125
History of hypertension	5	25%	5	25%	1.000
History of diabetes	7	35%	5	25%	0.490
Mean time from injury to presentation (days)	3.3	2.3	3.2	2.6	0.513

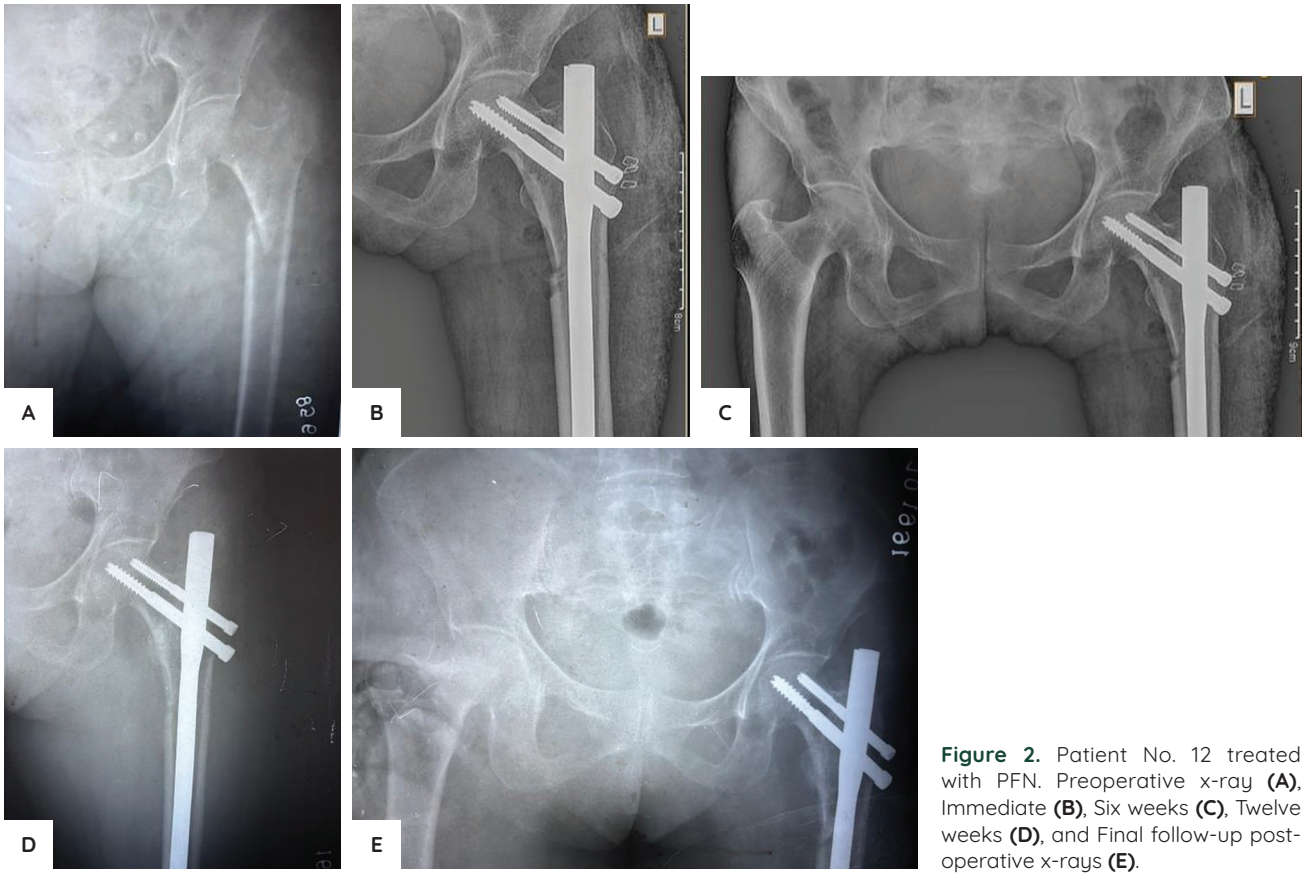

Figure 2. Patient No. 12 treated with PFN. Preoperative x-ray **(A)**, Immediate **(B)**, Six weeks **(C)**, Twelve weeks **(D)**, and Final follow-up post-operative x-rays **(E)**.

Table 2. Surgery-related characteristics (n = 40)

Parameters	95° DCS		PFN		*p*-value
	Mean/n	SD/%	Mean/n	SD/%	
Mean operation time (min)	75.6	12.3	53	12.6	<0.001*
Mean blood loss (ml)	197.1	45.5	150.2	20.4	<0.001*
Mean VAS at 0 hours postoperatively (cm)	3.7	1.5	3.8	1.3	0.639
Mean VAS at 24 hours postoperatively (cm)	3.6	1.2	3.9	1.1	0.305
Mean VAS at 48 hours postoperatively (cm)	1.6	0.6	1.1	0.8	0.005*
Mean time to mobilisation (days)	1.05	0.2	1.03	0.1	0.282
Mean hospital stay (days)	5.6	1.9	3	1.8	<0.001*
Mean time to partial weight bearing (days)	6.1	1.5	5.7	1.1	0.109
Mean time to complete weight bearing (days)	12.6	1.2	12.3	0.8	0.112
Final Harris Hip Score	92.9	1.8	92.7	2.2	0.749

*Statistically significant (p <0.001)

to the DCS group (75.6 ± 12.3 minutes), with a highly significant p-value (<0.001). Patients in the PFN group experienced less intraoperative blood loss (150.2 ± 20.4 ml) than those in the DCS group (197.1 ± 45.5 ml), and the difference was statistically significant (p <0.001).

Pain scores, assessed via the VAS at 48 hours, were significantly lower in the PFN group (1.1 ± 0.8) compared to the DCS group (1.6 ± 0.6), with a p-value of 0.005.

Total hospital stay was significantly shorter in the PFN group (3 ± 1.8 days) compared to the DCS group (5.6 ± 1.9 days), and this difference was statistically significant (p <0.001).

DISCUSSION

The study aimed to compare treatment outcomes of subtrochanteric femoral fractures managed using PFN and 95° DCS. Both groups were demographically comparable, with no significant differences in age, sex, or comorbidities, ensuring unbiased outcome assessment. These observations correspond with those of prior studies, such as those by Patel et al. and Sahito et al., who reported similar patient profiles in comparable cohorts.[8,12]

Operative parameters significantly favoured PFN. The PFN group had a shorter mean operative duration (53 minutes vs. 75.6 minutes for DCS) and less intraoperative blood loss

(150.2 ml vs. 197.1 ml). These results are consistent with studies by Sahin et al. and Kulkarni et al., who observed shorter operative durations and reduced blood loss with PFN.[13,14] The minimally invasive nature of PFN, requiring less soft tissue dissection, contributes to these advantages, particularly in elderly or comorbid patients.

While postoperative pain scores were initially comparable, they were significantly reduced in the PFN group at the 48-hour mark. This may be attributed to less periosteal stripping and muscle trauma, as supported by Sensoz et al., who reported better early pain control in PFN patients.[15] Reduced postoperative pain can facilitate earlier mobilization and rehabilitation, as reflected in our findings.

Although both groups showed early mobilization (~1 day), the PFN group had a significantly shorter hospital stay (3 days vs. 5.6 days). This mirrors findings from Ahmad et al. and D'Mello et al., who associated PFN with quicker postoperative recovery and discharge readiness.[11,16] Shorter hospitalization can reduce healthcare costs and minimize hospital-related complications, especially in older adults.

Functional outcomes, measured by the HHS, improved progressively in both groups and were statistically similar at all follow-up points (Figure 3). At 12 months, both groups had comparable scores, indicating that both fixation methods are effective in restoring hip function. These results are supported by D'Mello et al. and Singh et al., who found no long-term differences between PFN and DCS.[16,17]

Time required for partial and full weight bearing did not differ significantly between groups; however, earlier loading was more commonly observed in the PFN group. Studies like those by Kulkarni et al. and Patel et al. have highlighted PFN's biomechanical benefits, including load sharing and axial stability, which can support earlier mobilization.[12,14]

Radiological healing was excellent in both groups, with 95% callus formation by 12 months. This reinforces that both implants, when properly applied, can achieve union (Table 3). Complication rates were low and comparable. PFN had a higher rate of screw migration, while DCS had a slightly higher infection rate due to the more invasive surgical approach. These results are consistent with those of Ahmad et al., who reported similar outcomes.[15]

Although the 95° DCS is traditionally indicated for fractures with piriformis fossa involvement, metaphyseal comminution, or diaphyseal extension, in our series, it was used across all Müller types. This was because randomization in our study was not based on fracture pattern, and thus, implant allocation was independent of specific fracture morphology. The continued use of DCS across different fracture types reflects prevailing local practice patterns, where factors such as implant cost, limited access to proximal femoral nails,

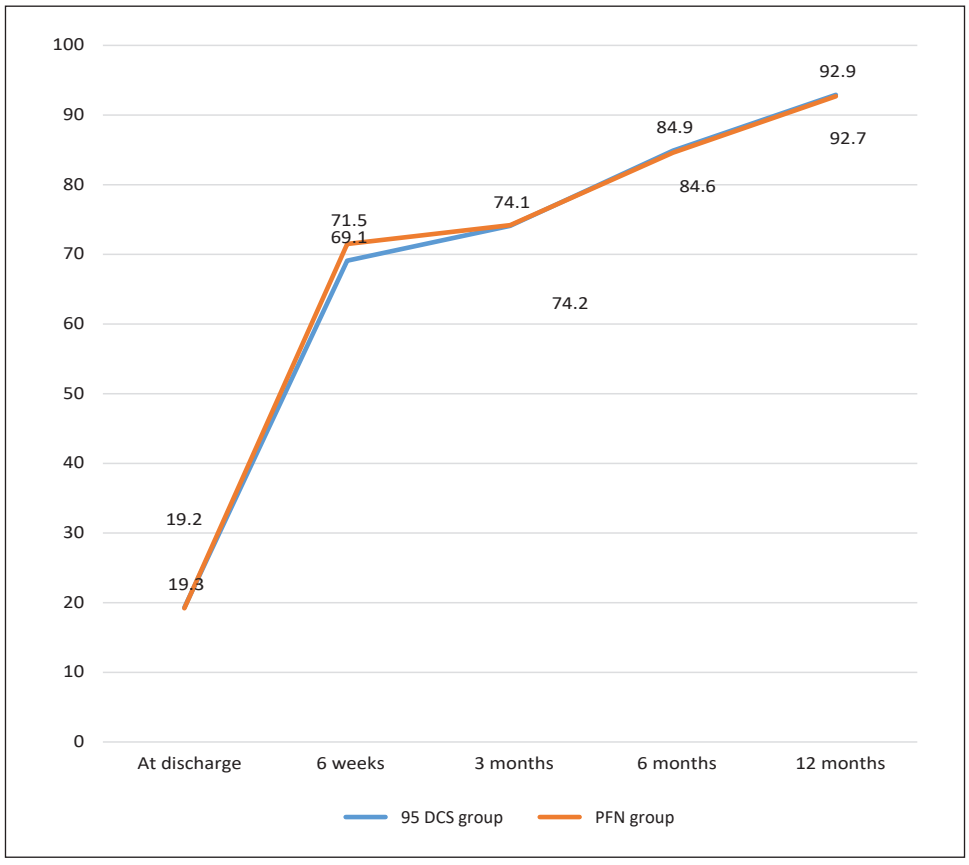

Figure 3. Distribution of study participants according to their mean Harris Hip Score (HHS) scores at discharge, 6 weeks, 3 months, 6 months, and 12 months postoperatively (n = 40).

Table 3. Postoperative recovery-related characteristics (n = 40)

Parameters	95° DCS		PFN		*p*-value
	Mean/n	SD/%	Mean/n	SD/%	
Callus formation at 12 months	19	95%	19	95%	1.000
Complications					
Wound dehiscence	0	0	0	0	-
Wound infection	3	15%	2	10%	0.633
Non-union	1	5%	1	5%	1.000
Cut-out	0	0	1	5%	0.311
Screw migration	0	0	3	15%	0.072
Implant breakage	1	5%	0	0	0.311
Nerve Palsy	0	0	0	0	-
Limb length discrepancy	1	5%	2	10%	0.548

occasional unavailability of a fracture table, and greater surgeon familiarity with plating techniques influence implant choice. These considerations were beyond the control of the study and are reported here to provide an unbiased representation of real-world practice.

CONCLUSION

This study compared the clinical, functional, and radiological outcomes of Proximal Femoral Nailing (PFN) and 95° Dynamic Condylar Screw (DCS) fixation in the management of subtrochanteric femoral fractures. Both techniques were effective in achieving fracture union and restoring hip function. However, PFN demonstrated significant perioperative advantages, including shorter operative time, reduced intraoperative blood loss, lower postoperative pain at 48 hours, and shorter hospital stay. Functional outcomes measured using the HHS, and radiological healing were comparable in both groups at the one-year follow-up. Although the complication profiles were not significantly different, PFN showed a trend toward fewer infections and quicker recovery, while DCS had a slightly higher incidence of wound complications. Based on these findings, PFN may be preferred, especially in elderly or high-risk patients requiring early mobilization.

Limitations

The study has several limitations, including its small sample size and single-center design. In addition, the short follow-up period of one year limits the ability to assess long-term outcomes, implant longevity and late complications. Future research involving larger, multicenter randomized trials with extended follow-up durations is recommended to validate and strengthen these findings.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

RV: Conceptualization, Software, Data Curation, Writing – original draft preparation; **PA:** Methodology, Visualization, Supervision; **SS:** Investigation, Resources; **MSD:** Methodology, Validation, Writing – original draft preparation; Writing – review and editing, Project administration; **MP:** Conceptualization, Software, Data curation, Writing – original draft preparation.

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AUTHOR DISCLOSURE

The authors declared no conflict of interest.

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REFERENCES

1. Joglekar SB, Lindvall EM, Martirosian A. Contemporary management of subtrochanteric fractures. Orthop Clin North Am. 2015;46(1):21–35. PMID: 25435032 DOI: 10.1016/j.ocl.2014.09.001
2. Panteli M, Mauffrey C, Giannoudis PV. Subtrochanteric fractures: issues and challenges. Injury. 2017;48(10):2023–6. PMID: 28992934 DOI: 10.1016/j.injury.2017.09.001

3. Inchaustegui ML, Ruiz K, Gonzalez MR, Pretell-Mazzini J. Surgical management of metastatic pathologic subtrochanteric fractures: treatment modalities and associated outcomes. JBJS Rev. 2023;11(5). PMID: 37141383 DOI: 10.2106/JBJS.RVW.22.00232
4. Yoon RS, Donegan DJ, Liporace FA. Reducing subtrochanteric femur fractures: tips and tricks, do's and don'ts. J Orthop Trauma. 2015;29(Suppl 4):S28–33. PMID: 25756824 DOI: 10.1097/BOT.0000000000000287
5. Garrison I, Domingue G, Honeycutt MW. Subtrochanteric femur fractures: current review of management. EFORT Open Rev. 2021; 6(2):145–51. PMID: 33828858 PMCID: PMC8022017 DOI: 10.1302/2058-5241.6.200048
6. Banan H, Al-Sabti A, Jimulia T, Hart AJ. The treatment of unstable, extracapsular hip fractures with the proximal femoral nail (PFN): our experience and outcome in 143 cases. Injury. 2002;33(5):401–5. PMID: 12095719 DOI: 10.1016/s0020-1383(02)00054-2
7. El-Mowafi HM, Eid TA, El-Sayed AS, Zalalo SH. Fixation of subtrochanteric fracture femur using a proximal femoral nail. Menoufia Med J. 2014;27:208–14.
8. Sahito B, Khaskheli JH, Kumar D, Lakho MT, Younis M, Ayub AK. Subtrochanteric fractures treated with dynamic condylar screw. Ann Abbasi Shaheed Hosp Karachi Med Dent Coll. 2022;27(1):10–5. DOI: 10.58397/ashkmdc.v27i1.247
9. Lotzien S, Rausch V, Schildhauer TA, Gessmann J. Revision of subtrochanteric femoral nonunions after intramedullary nailing with dynamic condylar screw. BMC Musculoskelet Disord. 2018;19(1): 448. PMID: 30577781 PMCID: PMC6303875 DOI: 10.1186/s12891-018-2372-4
10. Latheef MB. Comparative study between dynamic hip screw with locking side plate and proximal femoral nail in the management of trochanteric fractures of femur [Master's thesis]. Rajiv Gandhi University of Health Sciences (India); 2019.
11. Ahmad N, Ali W, Gul N, Tunio MZ. Comparison of proximal femoral nail versus dynamic condylar screw in treating reverse oblique intertrochanteric femoral fractures. Pak J Med Health Sci. 2023;17(6):177-9.
12. Patel I, Amin TK, Kachhad KH, et al. Results of proximal femoral nailing in subtrochanteric fracture of femur in adults. J Orthop Dis Traumatol. 2022;5(2):74–7. DOI: 10.53350/pjmhs2023176177
13. Sahin EK, Imerci A, Kınık H, Karapinar L, Canbek U, Savran A. Comparison of proximal femoral nail antirotation (PFNA) with AO dynamic condylar screws (DCS) for the treatment for unstable peritrochanteric femoral fractures. Eur J Orthop Surg Traumatol. 2014;24(3):347–52. PMID: 23443746 PMCID: PMC3958814 DOI: 10.1007/s00590-013-1195-0
14. Kulkarni SG, Sekhri A, Malve SP, et al. Intramedullary nailing versus dynamic condylar screw for subtrochanteric femur fractures. J Trauma. 2015;10(4):10–5.
15. Şensöz E, Ergun S, Kayaalp ME, Eceviz E. The comparison of dynamic condylar screw plate to proximal femoral nail in reverse oblique and transverse intertrochanteric fractures: a retrospective study on 61 patients. Cureus. 2023;15(3):e36397. PMID: 37090379 PMCID: PMC10115748 DOI: 10.7759/cureus.36397
16. D'Mello Z, Ambapkar L. Fixation of subtrochanteric fractures: comparative study of dynamic condylar screw versus proximal femoral nail. J Indian Med Assoc. 2018;116(7):10–3. https://onlinejima.com/journals_doc/download-journals/2018/july/july_2018_page_10_13_20.pdf
17. Singh AK, Narsaria N, Arun GR, Srivastava V. Treatment of unstable trochanteric femur fractures: proximal femur nail versus proximal femur locking compression plate. Am J Orthop (Belle Mead NJ). 2017;46(2):E116–23. PMID: 28437506

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ORIGINAL ARTICLE

Risk Factors for Amputation Among Patients with Diabetic Foot Disease in a Tertiary Hospital: A Retrospective Case-control Study

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ABSTRACT

Background. Amputation is commonly indicated to control infection in patients with diabetic foot disease. There were over 3.7 million diabetic adults in the Philippines in 2017. Around 4 of 1000 patients with diabetes underwent lower extremity amputations.

Objective. This study aimed to evaluate patients with diabetic foot disease who underwent lower extremity amputation at a tertiary hospital and analyze possible risk factors for their amputations.

Methodology. Records of patients treated for diabetic foot disease from 2017 to 2021 were reviewed. We identified risk factors such as sex, renal disease, arterial duplex scan, white blood cell count, HbA1c level, Wagner classification, and history of cigarette smoking, and correlated these with amputation.

Result. In 260 patients, older age, arterial occlusion (i.e., monophasic results on arterial duplex scan), poorer soft tissue status (i..e, higher Wagner classification), and higher WBC levels increased the likelihood of amputation. Renal disease, sex, smoking, and hemoglobin A1c (HbA1c) were not significantly related.

Conclusion. The factors associated with amputation in patients with diabetic foot disease were similar to those in literature, including age, soft tissue compromise, elevated white blood cell levels, and monophasic arterial duplex scans. Renal disease, sex, smoking, and HbA1c were not found to be statistically significant factors in this study.

Keywords. risk factors, type 2 diabetes, major amputation, diabetic foot, Wagner, renal disease, arterial duplex, smoking

INTRODUCTION

Amputation is commonly indicated as a means of controlling infection in patients with diabetic foot disease when debridement has failed or is not a viable option. Over 3.7 million cases of diabetes in adults were reported in the Philippines in 2017. Around 4 of 1000 patients with diabetes mellitus underwent lower extremity amputations.[1]

There are numerous risk factors associated with amputation like advanced age, smoking history, sex, peripheral neuropathy, renal impairment, peripheral arterial occlusive disease, soft tissue status, and glycemic control, among others.[2]

Clinical assessment and diagnostic procedures help determine whether amputation is necessary, and the appropriate level to ensure optimal healing and function. Peripheral pulses, hair growth, sensation, and skin color are examined.[3] Infection parameters, such as white blood cell (WBC) counts, C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), have predicted amputation in diabetic foot ulcer patients.[4]

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Arteriograms, by contrast, are rarely indicated unless revascularization is. Peripheral arterial occlusion is quantified using the ankle-brachial index (ABI) and color and pulsed-wave Doppler ultrasound.[5] ABI, however, may be falsely elevated in people with diabetes due to calcification of the tibial and peroneal arteries.

The primary aim of the study was to determine the risk factors for amputation among patients with diabetic foot disease treated at a tertiary hospital in the Philippines (Baguio General Hospital and Medical Center), specifically in terms of age, sex, arterial duplex scan results, soft tissue status, presence or absence of renal disease, Hba1c level, WBC level, and smoking history.

The researchers found several international articles, but few regional and local studies on the risk factors of amputation among diabetes mellitus patients. The study aimed to paint a picture of patients with diabetes and diabetic foot disease in the local setting.

METHODOLOGY

We conducted a retrospective case-control study, including all admitted patients with diabetic foot disease from January 2017 to December 2021. All patients with diabetic foot ulcers or infections were referred to the Orthopedics Department at the Baguio General Hospital and Medical Center. Excluded were patients with lost medical records, traumatic amputations, patients with gestational diabetes, diabetic infants born to diabetic mothers, and diabetic patients without foot wounds (Wagner 0). All available data sources were exhausted, including charts from hospital records, patient census, and electronic medical records. Age, sex, presence or absence of renal disease, results of arterial duplex scans, white blood cell count, HbA1c level, Wagner classification of soft tissue status, and smoking history were identified and correlated with the risk of amputation. The predictability of the risk factors were computed using Odds ratio, logistics regression analysis and Fisher exact test. Odds ratio is the odds of the event in the exposure group divided by the odds of the event in the control or non-exposure group. Logistics regression analysis is a statistical method used to predict the probability of a binary outcome (like yes/no, success/failure, or amputated/not amputated) based on one or more independent variables, while the Fisher exact test is used to determine whether there is a significant association between two categorical variables.

Wagner grading was done as follows: Grade 0: Pre-ulcerative lesion, healed ulcers, presence of bony deformity. Grade 1: Superficial ulcer without subcutaneous tissue involvement; Grade 2: Penetration through the subcutaneous tissue (exposed bone, tendon, ligament, or joint capsule); Grade 3: Osteitis, abscess, or osteomyelitis; Grade 4: Gangrene of the forefoot; Grade 5: Gangrene of the entire foot. Minor amputations were defined in this study as amputations distal to the tarsal joints, including ray amputations and disarticulations. Major amputations were defined at or proximal to the tarsal joints.

The sample size was determined by using the formula:

$$n = \frac{[(Z\alpha)/2 + Z\beta]^2 \times [P1(1-P1) + P2(1-P2)]}{(P1 - P2)^2}$$

Where:
$(Z\alpha)/2 = 1.96$ (for 95% confidence)
$Z\beta = 0.84$ (for 80% power)
P1 = proportion of exposure in cases (0.5 assumed value)
P2 = proportion of exposure in controls (0.3 assumed value)
505: mean population

Computation:

$$n = \frac{(1.96 + 0.84)^2 \times [(0.5 \times 0.5) + (0.3 \times 0.7)]}{(0.5 - 0.3)^2}$$

$$= \frac{(2.8)^2 \times [(0.25) + (0.21)]}{(0.2)^2}$$

$$= (7.84 \times 0.46) / 0.04$$
$$= 3.6064 / 0.04$$
$$= 90.16 \text{ (91 per group)}$$

The study was a retrospective case control study using the purposive sampling technique total enumeration to provide a full picture of the population while minimizing sampling error. Descriptive and inferential statistics were used. Frequencies and percentages were used to describe demographic data set while the Chi Square test was used to determine association between the risk factors and amputation. The level of significance was set at 0.05. Data were analyzed using IBM-SPSS ver.20.

RESULTS

A total of 260 patients with diabetic foot disease were included. All patients included had unilateral disease only. One hundred fifty-three patients underwent amputations, while 107 did not. Among the amputations performed, 97 were major and 56 were minor amputations.

The mean age for all patients was 62 years. Patients were analyzed per age group. Age groups 46–60, 61–75, and >75 were more likely than not to receive amputation (p <0.05) (Table 1).

Sex was not found to be a significant risk factor for amputation (Odds ratio = 1.00, Table 2). Most (n = 86) of the amputees were male, and 67 were female. Smoking history was associated with an odds ratio of 1.086 of amputation compared to non-smokers (p = 0.152, Table 3).

The presence of renal disease was associated with a 1.27 times higher likelihood of amputation, however, this association was not statistically significant (p = 0.152, Table 4). Of the 52 diabetics with concomitant renal disease, 33 underwent amputation.

Table 1. Age

Age (in years)	Amputated	Not amputated	Total	*P*-value	Odds ratio
1-15	0	1	**1**	insufficient data – cannot be computed	zero value (not computed)
16-30	1	2	**3**	0.52	Reference
31-45	6	17	**23**	0.066	0.71
46-60	62	44	**106**	<0.001*	2.82
61-75	68	38	**106**	<0.001*	3.58
>75	16	5	**21**	0.010*	6.40
Total	**153**	**107**	**260**		

*p <0.05, significant

Reference – this was used as a baseline for standard of comparison

The odds of amputation increased accordingly as one went up the Wagner Classification. None of the 11 Wagner I patients underwent amputation, while all 10 Wagner V patients underwent amputation. All Wagner grades from II to V showed statistically significant increases in the odds of amputation. Wagner V had the highest coefficient indicating the strongest effect (Table 5).

Arterial duplex scans were not available for all patients. Among the 125 patients that had data, Monophasic flow (indicating stenosis or occlusion) showed the strongest and most significant association with amputation (p <0.001) (Table 6).

High WBC values (10.01 x 10^9/L and higher) were associated with higher odds of amputation. WBC levels above 10 show statistically significant increase in amputation risk. WBC levels higher than 15.01 x 10^9/L had the most significant impact (Table 7).

Although patients with higher hemoglobin A1c levels had greater odds of amputation, this difference was not statistically significant (Table 8).

Table 2. Sex

Sex	Amputated	Not amputated	Total
Male	86	60	**146**
Female	67	47	**114**
Total	**153**	**107**	**260**

p = 0.152 (NS)

Odds Ratio: 1

Table 3. Smoking

Smoking	Amputated	Not amputated	Total
Smoker	44	29	**73**
Non-Smoker	109	78	**187**
Total	**153**	**107**	**260**

p = 0.441 (NS)

Odds Ratio: 1.086

Table 4. Renal disease

Renal disease	Amputated	Not amputated	Total
Present	33	19	**52**
Absent	120	88	**208**
Total	**153**	**107**	**260**

p = 0.276 (NS)

Odds Ratio: 1.27

DISCUSSION

Diabetic foot ulcers are frequent causes of hospitalization in diabetic patients. This condition represents a significant and preventable health issue among adults living with diabetes. These ulcers can lead to serious complications such as reduced mobility, infections, hospital admissions, lower limb amputations, and even death. Over a lifetime, the risk of developing a foot ulcer ranges from 19% to 34%, and this figure continues to grow due to increased life expectancy and the rising medical complexity of individuals with diabetes.[6]

Diabetic foot ulcers develop from a combination of peripheral vascular dysfunction, peripheral neuropathy, and infection. Several risk factors for major amputation in diabetic patients have been identified, including age, sex, ulcer size, hypertension, neuropathy, nephropathy, inadequate glycemic control, white blood cell count, and abnormal lipid levels.[7-13] There are various causes of diabetic foot ulceration, but micro- and macrovascular diseases greatly influence severity.

We investigated different risk factors and their association with odds of amputation in patients with diabetic foot ulcers. In this study, increasing age was found to be a significant risk factor, aligning with previous studies. A retrospective study by Farine et al., revealed a significant negative correlation between older age at the time of initial surgical amputation and three-year survival post-amputation.[14] Older age is also accompanied by more pathologies of the bone and joint associated with diabetes mellitus.[15] Diabetic foot ulcers were more prevalent in the 50- to 59-year-old age group, as reported by Yao et al.[16]

Ulcer severity often dictates treatment. Conservative treatment of foot ulcers can be demanding, requiring daily foot hygiene, effective offloading, and glycemic control. Infection is common, being a common cause of hospitalization. Most (60 to 80%) of diabetic foot ulcers will heal, but 10 to 15% will not, and up to 24% will require amputation.[17]

Patients with higher Wagner grades were more likely to need amputation and multimodal management, as seen in our study and in the literature.[18]

In a prospective study by Musa et al., older age and elevated WBC were associated with amputation, consistent with this study.[19] Elevated neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio were markers of systemic inflammation, indicating ongoing tissue damage, microangiopathy, and microvascular complications among diabetic patients. Increased neutrophils may lead to endothelial damage. Lymphocytes dwindle in number due to apoptosis of these cells during a heightened inflammatory process.[20]

Popliteal artery stenosis or occlusion, indicated by a monophasic arterial duplex scan was a statistically significant risk factor for amputation in our study and in the literature.[21] This monophasic Doppler waveform is typically seen in multilevel obstructive arterial disease.[22]

The researchers did not find either sex to be at higher risk for amputations. However, in a meta-analysis and systematic review by Fan et al., the male sex was mildly more predictive of an amputation following a diabetic foot ulcer.[23]

Table 5. Wagner

Wagner	Amputated	Not Amputated	Total	*P*-Value	Odds Ratio
I	0	11	**11**	Cannot be computed	Zero value (not computed)
II	10	62	**72**	0.026	*Reference*
III	53	29	**82**	<0.001	*11.33*
IV	80	5	**85**	<0.001	99.2
V	10	0	**10**	<0.001	*Undefined***
Total	**153**	**107**	**260**		

**p* <0.05, significant

Reference – this was used as a baseline for standard of comparison

**Undefined or infinite Odds ratio suggests perfect association

Table 6. Arterial duplex scan

Arterial duplex	Amputated	Not amputated	Total	*P*-value	Odds ratio
No record	55	70	**125**		0.30
Monophasic	25	3	**28**	<0.001	*6.77*
Biphasic	15	5	**20**	0.016	*2.22*
Triphasic	58	29	**87**	0.049	*1.64*
Total	**153**	**107**	**260**		

**p* <0.05, significant

Table 7. WBC

WBC Level x 10^9/L	Amputated	Not amputated	Total	*P*-value	Odds ratio
0 to 5	1	4	**5**	Reference	0.25
5.01 to 10	20	30	**50**	0.298	0.67
10.01 to 15	45	38	**83**	0.049	1.18
15.01 to 20	33	18	**51**	0.013	1.83
20.01 to 25	21	7	**28**	0.005	3
25.01 to 30	21	7	**28**	0.005	3
30.01 above	12	3	**15**	0.010	4
Total	**153**	**107**	**260**		

**p* <0.05, significant

Reference – this was used as a baseline for standard of comparison

Table 8. HbA1c

Hemoglobin A1c	Amputated	Not amputated	Total	*P*-value	Odds ratio
0 to 6	27	22	**49**	Reference	1.23
6.1 to 12	92	63	**155**	0.204	1.46
12.1 to 18	33	22	**55**	0.121	1.50
18.1 to 24	1	0	**1**	Cannot be computed	Undefined**
Total	**Z**	**107**	**260**		

**p* <0.05, significant

**Undefined or infinite Odds ratio suggests perfect association

Reference – this was used as a baseline for standard of comparison

Despite the widely acknowledged link between poorly controlled diabetes and various microvascular and macrovascular complications, we found that elevated HbA1c levels, often considered a primary marker of glycemic control, did not directly correlate with an increased risk of lower extremity amputation. Previous studies have found that HBA1c ≥6.5% was strongly associated with major and minor amputations.[24] Zhou et al., concluded in their meta-analysis that a high level of HbA1c was a significant risk factor for lower extremity amputation in patients with diabetes. The odds ratio for a lower extremity amputation was 1.229 for every 1% increase in HbA1c.[25] However, HbA1c level has limited utility as a sole predictor.[26] While poor glycemic control is generally associated with microvascular and macrovascular complications, evidence has not consistently shown a linear relationship between HbA1c and risk of amputation.[27] Despite this lack of evidence, glucose level control is still recommended to reduce the risk of amputation in patients with diabetes.[25]

A holistic approach to risk assessment and prevention may be more critical than solely focusing on HbA1c levels.[28,29] HbA1c acts more as an indicator of systemic diabetic burden and metabolic dysregulation rather than a singular predictive variable for limb loss.[30,31] Ulceration, rather than chronic hyperglycemia alone, is a major precursor to amputation.[32] Specifically, the pathogenesis of lower extremity amputation in diabetic patients is multifactorial, primarily driven by microvascular and macrovascular complications, coupled with neurological deficits that lead to impaired sensation and structural deformities.[33] Focusing solely on HbA1c as a risk factor might distract from the critical interventions targeting vascular health, neurological integrity and aggressive wound care in diabetic foot management.[34]

Our study did not find an association between renal impairment and risk of amputation, in contrast with other studies.[35] Renal disease reflects vascular health in diabetic patients. In a retrospective study, lower glomerular filtration rate (GFR) and end-stage kidney disease were identified as risk factors for major amputations.[36]

This paper did not find smoking history as a statistically significant risk factor for amputation, unlike a retrospective study by Anderson et al., which showed that amputation was more likely to occur in diabetic patients who smoked. There were also more proximal amputations among smokers.[37]

In the local setting, where healthcare resources are limited, identified risk factors can guide appropriate screenings, educational programs, and preventive measures. This study, however, was limited by incomplete charts and the absence of EMR records during earlier years and may not be applicable to the larger population. We also had a decrease in cases from 2020 to 2021 due to the COVID-19 pandemic.

Based on the recognized risk factors in this and other studies, we recommend the following for clinical practice. Since the decision for amputation is mainly based on soft tissue status (i.e., Wagner classification), routine foot examinations help identify those at high risk. Physicians must emphasize patient education, instructing patients on proper foot care, daily inspection, selecting suitable footwear, avoiding injuries, and seeking early consultation when necessary.

We recommend further study of risk factors, and methods to reduce the incidence of diabetic foot amputations, particularly in local settings.

CONCLUSION

Age, soft tissue status (i.e., Wagner classification), elevated WBC levels, and arterial occlusion (i.e., arterial duplex scan) were found to be statistically significantly associated with amputation in patients with diabetic foot disease. On the other hand, sex, Hba1c levels, smoking, and the presence of renal disease were not statistically significant risk factors. With multiple risk factors present in diabetic patients undergoing amputation, clinical examination and available ancillary procedures should be exhausted.

Future studies should use stronger study designs for stronger evidence regarding risk factors for lower extremity amputations in patients with diabetes mellitus.

STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

ACDR: Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Visualization, Funding acquisition; **FPMS:** Validation, Investigation, Data Curation, Funding acquisition; **IEG:** Conceptualization, Methodology, Writing – review and editing, Supervision, Project administration.

DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

The authors declared no conflict of interest.

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REFERENCES

1. Felipe RR, Plata-Que MT. Predictors of outcomes of foot ulcers among individuals with type 2 diabetes mellitus in an outpatient foot clinic. J ASEAN Fed Endocr Soc. 2021;36(2):189-95. PMID: 34966204 PMCID: PMC8666495 DOI: 10.15605/jafes.036.02.14
2. Tresierra-Ayala MÁ, Rojas AG. Association between peripheral arterial disease and diabetic foot ulcers in patients with diabetes mellitus type 2. Medicina Universitaria. 2017;19(76):123-6. DOI: 10.1016/j.rmu.2017.07.002

3. Hiremath R, Gowda G, Ibrahim J, et al. Comparison of the severity of lower extremity arterial disease in smokers and patients with diabetes using a novel duplex Doppler scoring system. Ultrasonography. 2017;36(3):270-7. PMID: 28273696 PMCID: PMC5494865 DOI: 10.14366/usg.16049
4. Islam SN, Deka N, Hussain Z. Role of doppler ultrasound in assessing the severity of peripheral arterial diseases of the lower limb. J Med Ultrasound. 2021;29(4):277-80. PMID: 35127408 PMCID: PMC8772481 DOI: 10.4103/JMU.JMU_137_20
5. Keven A, Durmaz MS. The importance of community screening of asymptomatic elderly for peripheral arterial disease by doppler ultrasound and ankle-brachial index. J Ultrason. 2017;17(71): 235-40. PMID: 29375897 PMCID: PMC5769662 DOI: 10.15557/JoU.2017.0034
6. McDermott K, Fang M, Boulton AJM, Selvin E, Hicks CW. Etiology, epidemiology, and disparities in the burden of diabetic foot ulcers. Diabetes Care. 2023;46(1):209-21. PMID: 36548709 PMCID: PMC9797649 DOI: 10.2337/dci22-0043
7. Zhong A, Li G, Wang D, Sun Y, Zou X, Li B. The risks and external effects of diabetic foot ulcer on diabetic patients: a hospital-based survey in Wuhan area, China. Wound Repair Regen. 2017;25(5): 858-63. PMID: 29052949 DOI: 10.1111/wrr.12589
8. Sadriwala QS, Gedam BS, Akhtar MA. Risk factors of amputation in diabetic foot infections. Int J Surg. 2018;5(4):1399-402. DOI: 10.18203/2349-2902.isj20181118
9. Lin C, Liu J, Sun H. Risk factors for lower extremity amputation in patients with diabetic foot ulcers: a meta-analysis. PLoS One. 2020;15(9):e0239236. PMID: 32936828 PMCID: PMC7494323 DOI: 10.1371/journal.pone.0239236
10. Sen P, Demirdal T, Emir B. Meta-analysis of risk factors for amputation in diabetic foot infections. Diabetes Metab Res Rev. 2019;35(7):e3165. PMID: 30953392 DOI: 10.1002/dmrr.3165
11. Guo Z, Yue C, Qian Q, He H, Mo Z. Factors associated with lower-extremity amputation in patients with diabetic foot ulcers in a Chinese tertiary care hospital. Int Wound J. 2019;16(6):1304-13. PMID: 31448507 PMCID: PMC7949440 DOI: 10.1111/iwj.13190
12. Rodrigues BT, Vangaveti VN, Urkude R, Biros E, Malabu UH. Prevalence and risk factors of lower limb amputations in patients with diabetic foot ulcers: a systematic review and meta-analysis. Diabetes Metab Syndr. 2022;16(2):102397. PMID: 35085918 DOI: 10.1016/j.dsx.2022.102397
13. Zubair M. Prevalence and interrelationships of foot ulcer, risk-factors and antibiotic resistance in foot ulcers in diabetic populations: a systematic review and meta-analysis. World J Diabetes. 2020 Mar 15;11(3):78.
14. Farine F, Rapisarda AM, Roani C, et al. Predictive factors of amputation in diabetic foot. biomedicines. 2024;12(12):2775. PMID: 39767688 PMCID: PMC11673742 DOI: 10.3390/biomedicines12122775
15. Crispin JC, Alcocer-Varela J. Rheumatologic manifestations of diabetes mellitus. Am J Med. 2003;114(9):753-7. PMID: 12829202 DOI: 10.1016/s0002-9343(03)00140-2
16. Yao Y, Chen L, Qian Y. Age characteristics of patients with type 2 diabetic foot ulcers and predictive risk factors for lower limb amputation: a population-based retrospective study. J Diabetes Res. 2024;2024:2380337. PMID: 39735416 PMCID: PMC11671627 DOI: 10.1155/jdr/2380337
17. Pemayun TG, Naibaho RM, Novitasari D, Amin N, Minuljo TT. Risk factors for lower extremity amputation in patients with diabetic foot ulcers: a hospital-based case-control study. Diabet Foot Ankle. 2015;6:29629. PMID: 26651032 PMCID: PMC4673055 DOI: 10.3402/dfa.v6.29629
18. Shah P, Inturi R, Anne D, et al. Wagner's classification as a tool for treating diabetic foot ulcers: our observations at a suburban teaching hospital. Cureus. 2022;14(1):e21501. PMID: 35223277 PMCID: PMC8861474 DOI: 10.7759/cureus.21501
19. Musa IR, Ahmed MON, Sabir EI, et al. Factors associated with amputation among patients with diabetic foot ulcers in a Saudi population. BMC Res Notes. 2018;11(1):260. Published 2018 Apr 27. PMID: 29703224 PMCID: PMC5921536 DOI: 10.1186/s13104-018-3372-z
20. Sales JP, Tablante E. Pre-operative neutrophil-lymphocyte and platelet-lymphocyte ratios as predictors of morbidity and mortality in diabetic foot infection amputation patients. Philipp J Orthop. 2025;40(1):7–15. doi.org/10.69472/poai.2025.06
21. Kasbekar PU, Goel P, Jadhav SP. A decision tree analysis of diabetic foot amputation risk in Indian patients. Front Endocrinol (Lausanne). 2017;8:25. PMID: 28261156 PMCID: PMC5313600 DOI: 10.3389/fendo.2017.00025
22. Zubair A, Lotfollahzadeh S. Peripheral arterial duplex assessment, protocols, and interpretation. [In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK576430/
23. Fan L, Wu XJ. Sex difference for the risk of amputation in diabetic patients:a systematic review and meta-analysis. PLoS One. 2021;16(3):e0243797. Published 2021 Mar 11. PMID: 33705430 PMCID: PMC7951841 DOI: 10.1371/journal.pone.0243797
24. Tarricone A, Gee A, Boulton AJ, Rogers L, Lavery LA. Uncontrolled diabetes is a strong predictor of amputation in end stage renal disease patients on hemodialysis. Ann Vasc Surg. 2025;114:313-9. PMID: 39736381 DOI: 10.1016/j.avsg.2024.12.057
25. Zhou ZY, Liu YK, Chen HL et al. HbA1c and lower extremity amputation risk in patients with diabetes: a meta-analysis. Int J Low Extrem Wounds. 2015;14(2):168-77. DOI: 10.1177/1534734615593190
26. Yin K, Qiao T, Zhang Y, et al. Unraveling shared risk factors for diabetic foot ulcer: a comprehensive Mendelian randomization analysis. BMJ Open Diabetes Res Care. 2023;11(6):e003523. PMID: 37989345 PMCID: PMC10660165 DOI: 10.1136/bmjdrc-2023-003523
27. Mohan A, Ravura S, Srinivasan K. Predictive risk factors for lower limb amputations in patients with diabetic foot ulcer in correlation with Wagner's grading. Int Surg J. 2021;8(12):3576. DOI: 10.18203/2349-2902.isj20214748
28. Reiber GE, Ledoux WR. Epidemiology of diabetic foot ulcers and amputations: evidence for prevention. In: Williams WH, Kinmonth AL, Wareham NJ, eds. The evidence base for diabetes care. Chichester, UK: Wiley; 2002:641. DOI: 10.1002/0470846585.ch28
29. Thewjitcharoen Y, Krittiyawong S, Porramatikul S, et al. Outcomes of hospitalized diabetic foot patients in a multi-disciplinary team setting: Thailand's experience. J Clin Transl Endocrinol. 2014;1(4): 187-91. PMID: 29159100 PMCID: PMC5685051 DOI: 10.1016/j.jcte.2014.10.002
30. Yachmaneni A Jr, Jajoo S, Mahakalkar C, Kshirsagar S, Dhole S. A comprehensive review of the vascular consequences of diabetes in the lower extremities: current approaches to management and evaluation of clinical outcomes. Cureus. 2023;15(10):e47525. PMID: 38022307 PMCID: PMC10664734 DOI: 10.7759/cureus.47525
31. Tanasescu D, Sabau D, Moisin A, et al. Risk assessment of amputation in patients with diabetic foot. Exp Ther Med. 2022;25(1):12. PMID: 36561621 PMCID: PMC9748709 DOI: 10.3892/etm.2022.11711
32. Price P, Harding K. The impact of foot complications on health-related quality of life in patients with diabetes. J Cutan Med Surg. 2000;4(1):45-50. PMID: 10689228 DOI: 10.1177/120347540000400112
33. Casadei G, Filippini M, Brognara L. Glycated hemoglobin (HbA1c) as a biomarker for diabetic foot peripheral neuropathy. Diseases. 2021;9(1):16. PMID: 33671807 PMCID: PMC8006047 DOI: 10.3390/diseases9010016
34. Akyüz S, Bahçecioğlu Mutlu AB, Guven HE, Başak AM, Yilmaz KB. Elevated HbA1c level associated with disease severity and surgical extension in diabetic foot patients. Ulus Travma Acil Cerrahi Derg. 2023;29(9):1013-8. PMID: 37681727 PMCID: PMC10560815 DOI: 10.14744/tjtes.2023.08939
35. Wolf G, Müller N, Busch M, et al. Diabetic foot syndrome and renal function in type 1 and 2 diabetes mellitus show close association. Nephrol Dial Transplant. 2009;24(6):1896-901. PMID: 19131351 DOI: 10.1093/ndt/gfn724
36. Lee JH, Yoon JS, Lee HW, et al. Risk factors affecting amputation in diabetic foot. Yeungnam Univ J Med. 2020;37(4):314-20. PMID: 32370489 PMCID: PMC7606965 DOI: 10.12701/yujm.2020.00129
37. Anderson JJ, Boone J, Hansen M, Spencer L, Fowler Z. A comparison of diabetic smokers and non-smokers who undergo lower extremity amputation: a retrospective review of 112 patients. Diabet Foot Ankle. 2012;3:10.3402/dfa.v3i0.19178. PMID: 23082237 PMCID: PMC3474996 DOI: 10.3402/dfa.v3i0.19178

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ORIGINAL ARTICLE

Activity Levels among Filipino Sarcoma Patients: A Philippine Musculoskeletal Tumor Society (PMTS) Collaborative Study*

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ABSTRACT

Objectives. Osteosarcoma and soft tissue sarcomas are the most common sarcomas in the Philippines, often resulting in disability and decreased productivity. We sought to answer the following question: Are Filipino sarcoma survivors able to return to baseline and/or sports activities after treatment?

Methodology. Post-treatment patients with sarcomas of the extremities with a follow-up period of at least one year were included in this retrospective, multi-center study. Outcome measures included the modified Musculoskeletal Tumor Society (MSTS, 1993) score and the University of California, Los Angeles (UCLA) activity score.

Results. Fifty-eight patients with extremity sarcomas were followed for an average of 4.5 years. Osteosarcoma was the most common diagnosis, with most at Enneking Stage IIB. MSTS scores among limb salvage surgery patients (LSS) were significantly higher compared to amputees (79% ± 9 vs. 51% ± 9, $p = 0.000057$). Baseline activity post-LSS was higher (7.1 ± 1.3) compared to amputees (5.8 ± 0.9). At one year post-surgery, overall activity for both groups decreased (4.0 ± 0.65 for LSS, 4.1 ± 0.6 for amputees), then increased at their latest follow-up (6.9 ± 1.4 for LSS, 4.9 ± 0.86 for amputees). Analysis of UCLA scores showed no interaction with the type of surgery performed ($p = 0.7$).

Conclusion. This is the first report comparing physical activity levels among Filipino sarcoma patients. Returning to baseline and high-impact activities is possible after sarcoma treatment, which may improve quality of life.

Keywords. extremity sarcoma, MSTS score, physical activity, return to sports, sports, UCLA score

INTRODUCTION

Sarcomas comprise a heterogeneous group of malignant tumors arising from mesenchymal cells. These tumors can occur at any age, affecting various anatomic sites, and account for approximately 1% of all newly diagnosed cancers. Bone and soft tissue sarcomas represent the two major subgroups, with over 50 distinct histological subtypes.[1-3]

In the Philippines, osteosarcoma and soft tissue sarcomas are the most common sarcomas in clinical practice. While considered rare, the burden of disease is significant for patients with sarcoma of the extremities, many of whom are diagnosed in the second to sixth decades of life, often resulting in disability and decreased productivity. In our socio-cultural context, where a second family member is tasked with caregiving, this additional loss in productivity contributes to the hidden costs of sarcoma care.[4-10]

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Advancements in chemotherapy, radiation therapy, and surgical techniques over the last four decades have made limb-sparing surgery (LSS) the current standard of care for resectable extremity sarcomas. A significant number of patients still require amputation, however, particularly in low-resource settings.[11-13]

Cancer patients often experience chronic physical and psycho-emotional changes that impact their quality of life (QoL) long after treatment is completed. Among long-term survivors, physical activity can improve overall function, mental health, social engagement, and outlook on daily life. While authors have studied factors affecting the quality of life for Filipino carcinoma patients, none have thus far focused on sarcoma survivors, their return to physical activity, and the effect on their physiologic and psycho-emotional well-being.[4-10,14-16]

In relation to this, the authors sought to evaluate post-treatment function and recreational activities among patients with extremity sarcomas, to determine the following:

- The effect of surgical intervention on post-treatment physical activity level
- Changes in physical activity level pre- and post-treatment
- The effect of surgical and/or oncologic complications on physical activity level

METHODOLOGY

Patients with biopsy-proven extremity bone or soft tissue sarcoma who completed surgical and/or systemic treatment where applicable, with a follow-up period of at least one year, and who were able to respond to physician-administered functional and activity scoring tools were included in this retrospective, multi-institutional study. Demographic information and various disease- and treatment-related variables were recorded in a single electronic database with access restricted to authors. The main outcome measures were the modified Musculoskeletal Tumor Society (MSTS) score and the University of California, Los Angeles (UCLA) activity score.

The modified 1993 version of the Musculoskeletal Tumor Society (MSTS) score (Appendix A) is a widely recognized, physician-administered tool that emphasizes limb-specific outcomes and considers the use of assistive devices. Scores of 23 or higher are considered Excellent, 15 to 22 are deemed Good, 8-14 are considered Fair, and less than 8 are considered Poor. Scores are expressed as a percentage of the maximum to facilitate statistical analysis. This tool was validated and adopted by the MSS and the International Society of Limb Salvage in 1993 to facilitate studies comparing outcomes of musculoskeletal tumor surgeries, using a standard set of questions with low interobserver variability.[17]

There is currently no gold standard for assessing physical activity levels among cancer patients. The UCLA activity score (Appendix B) was used to collect information about general activity level as it is license-free and minimizes confusion for both patients and doctors. It categorizes the intensity and frequency of physical activity, ranging from a score of 10 (the highest) to 1 (the lowest), for those dependent on caregivers. It has also been shown to have excellent reliability and a strong correlation with other activity scales, such as the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) and IPAQ (International Physical Activity Questionnaire), among patients who have undergone joint replacement surgery.[18,19]

Frequency of participation was based on physical activity recommendations for cancer patients set by the American College of Sports Medicine (ACSM), with 15 minutes a day, three times a week considered as the minimum level of acceptable physical activity.[20]

Surgical outcomes, complications, and pre- and post-treatment physical activity levels were recorded. MSTS scores were compared using a T-test, while two-way ANOVA was used to determine differences between UCLA activity scores at three time points: one year post-treatment,[14] three years post-treatment, and on the latest long-term follow-up.

Ethical consideration

Approval to conduct the records review was granted by the Ethics Review Board of the Philippine Orthopedic Center (Certificate No. POCERB-2022-04-007).

RESULTS

Fifty-eight patients diagnosed with extremity bone or soft tissue sarcomas who had completed treatment and a minimum follow-up time were included. All sarcomas were located on the lower extremities (Table 1).

The group consisted of 34 males and 24 females, with a mean age of 24 years and an average follow-up period of 4.5 years. Osteosarcoma was the most common histologic diagnosis for both groups, and the most common diagnosis for which chemotherapy was received. Patients were most often diagnosed at Enneking St. IIB. Thirty-nine patients underwent amputation, while 19 underwent limb salvage surgery (LSS). Infection was the most common complication among the patients undergoing ablative surgery. Of 19 patients who underwent LSS, one patient developed a surgical site infection, one underwent revision due to implant failure, and one underwent metastasectomy for solitary lung metastases. Endoprosthetic reconstruction (EPR) and rotationplasty were the two most frequently performed reconstructions, with four EPRs performed for osteosarcomas of the distal femur and two for the proximal tibia. All six rotationplasties were done for distal femur osteosarcomas. The most common ablative procedures were above-knee amputation (AKA), followed by hip disarticulation. Debridement for surgical site infection was the most frequently performed additional procedure in this group.

Table 1. Patient demographics

	Total	Lower extremity		Chemotherapy
Number of patients	58	Limb Salvage: 19 (33%)	Amputation: 39 (67%)	40 (69%)
Gender (M[1]/ F[2])	34/24	9/10	25/14	24/16
Mean age at surgery (range)	24 years (6-70 yo)	21 years (7-56 yo)	25 years (6-70 yo)	16 years (6-35 yo)
Enneking stage	IIA IIB III	2 16 1	3 26 10	- 32 8
Mean years of follow-up	4.5 years (1-21)	3.5 years (1-17)	6 years (1-21)	5 years (1-19)
Histologic diagnosis Osteosarcoma Chondrosarcoma Ewing's sarcoma UPS[3] Synovial sarcoma Other STS[4]		 15 1 - - - 3	 30 - 1 3 2 3	 38 - 1 - - 1
Type of surgery		EPR[5] (6) Fusion (2) Rotationplasty (6) Excision (5)	Hemipelvectomy (2) Hip disarticulation (16) AKA[6] (18) BKA[7] (2) Syme (1)	
Additional intervention for complications		3 Debridement (1) Implant revision (1) Metastasectomy (1)	5 Debridement (4) Metastasectomy (1)	

[1] Male; [2] Female; [3] Undifferentiated Pleomorphic Sarcoma; [4] Soft Tissue Sarcoma; [5] Endoprosthetic reconstruction; [6] Above-knee amputation; [7] Below-knee amputation

Table 2. Tabulated Modified Musculoskeletal Tumor Society (MSTS) scores

MSTS Rating	Limb Salvage	Amputation
Excellent (≤23)	14	11
Good (15-22)	3	9
Fair (8-14)	2	12
Poor (<8)	-	7

Table 3. Overall MSTS Scores

Type of surgery	Modified MSTS score (expressed as percent of total score)
Limb salvage (n = 19)	79% ± SD 9
Amputation (n = 39)	51% ± SD 7

Table 4. Sports activity levels (UCLA score) for sarcomas of the lower extremity according to the type of surgery (limb salvage vs amputation)

Type of surgery	Time	UCLA activity score
Limb salvage (n = 19)	Prior to surgery 1 year post-op Latest follow-up	7.1 ± SD 1.3 4 ± SD 0.65 6.9 ± SD 1.4
Amputation (n = 39)	Prior to surgery 1 year post-op Latest follow-up	5.8 ± SD 0.9 4.1 ± SD 0.6 4.9375 ±0.858

Regarding outcome measures, the raw MSTS scores appeared to be better for the LSS group compared to the amputation group. While none of the limb salvage patients scored poorly in the MSTS, seven amputees (18% of the amputation group) did (Table 2). Statistical analysis confirmed higher overall MSTS scores among LSS patients at 79% ± 9, significantly better compared to amputees' 51% ± 9, ($p = 0.000057$) (Table 3).

Analysis of UCLA scores was conducted within each group at three time points: before treatment to establish baseline activity, at one year post-treatment, and at the latest follow-up (Table 4). Mean activity before treatment was found to be higher for LSS patients (7.1 ± 1.3) compared to amputees (5.8 ± 0.9). Further assessment showed that 26% of LSS patients ($n = 10$ out of 19) were regularly engaged in high-impact activities before treatment, compared to 21% in the amputation group ($n = 8$ out of 39). At one year post-treatment, overall activity for both groups decreased (4.0 ± 0.65 for LSS patients and 4.1 ± 0.6 for amputees), but this was subsequently followed by an increase across the board on the latest follow-up (6.9 ± 1.4 for the LSS group and 4.9 ± 0.86 for the amputation group). Two of five LSS patients and two of eight amputees who had already been engaging in high-impact activities were able to return to their baseline, pre-diagnosis level.

There was no evidence of interaction between the type of surgery and UCLA scores at any point ($p = 0.7$). However, mean scores were significantly lower for LSS patients who developed complications requiring additional surgery ($n = 3$) compared to those who did not ($n = 16$, $p = 0.02$). This contrasts with the amputation group, where no significant difference was noted between those with complications ($n = 5$) versus those without ($n = 34$, $p = 0.41$). These findings can account for the statistically significant results comparing UCLA scores across the three time points ($p = 0.02$).

DISCUSSION

The American College of Sports Medicine (ACSM) defines sufficient physical activity as "150 minutes of moderate intensity exercise per week.[20]" Approximately 25% of patients in the study regularly participated in high-impact activities

before surgery. This baseline is lower than reports from two similar Western studies despite a comparable mean age.[14,16]

Looking through the activities of our Filipino patients, a key difference lies in the options available to patients on a day-to-day basis. Among the sports reported in these Western studies were skiing, snowboarding, squash, tennis, inline skating, and more. As a corollary, a paper published by Reyes et al. in 2016 on sociodemographic indicators of health among Filipinos found that it is more common for our patients to use their "free time" to make extra income, to make ends meet.[21] With over 26.14 million Filipinos living below the poverty line in 2021, this constitutes a significant barrier and avenue for development.[8,21-23] In contrast, patients from affluent countries tend to have sufficient minimum wage, a well-functioning healthcare system, and more leisure time, allowing better access to more diverse forms of recreation. This high-lights the sociocultural and geopolitical role that society plays in improving the overall fitness of its citizens.

At one year, a general decrease in overall UCLA scores was observed, consistent with the early course of recovery from surgery and adjuvant chemotherapy. Interestingly, six patients who underwent amputation reported improved scores at one year post-surgery. These included three teenagers who had undergone above-knee amputation, and three who had undergone hip disarticulation. Upon further investigation, the patients attributed their increased levels of activity to physiotherapy after surgery, the regular use of assistive devices, being assigned household chores, and finding online support groups that encouraged them to be more active. While 37% of our patients were regularly participating in moderate to high-impact activities on the latest follow-up, this is lower compared to 91% at three years for Hobusch et al., and 89% at five years for Lang et al.[14,16] Aside from the longer follow-up period, there are several reasons that may account for this. In the 2019 study by Hobusch, all 32 patients with extremity soft tissue sarcomas underwent limb salvage regardless of tumor size and location.[14] In the 2015 study by Lang, all 27 patients with lower extremity osteosarcoma underwent endoprosthetic replacement, but had very high baseline levels of activity, and this was subsequently found to be predictive of higher UCLA scores.[16] Quarantine mobility restrictions and slow vaccine rollout were also cited by several of our patients as factors that made an impact on their previous lifestyles. These are key points for further research and reference when monitoring our post-operative patients.

In terms of the effect of surgery on postoperative activity levels, our analysis showed that the mean UCLA scores were not significantly different across all time points between the two groups. At first, this may seem counterintuitive: in principle, limb and joint salvage procedures are considered functionally superior to all forms of ablative surgery, especially when using physician-rated outcome measures like the MSTS. Our study population exhibited this same trend. Several authors have pointed out, however, that when using more objective outcome measures, particularly for tumors around the knee, the theoretical advantage of limb-sparing procedures over ablative procedures may not be as distinct as expected.[24-27] The perception of joint salvage's superiority may be related not to physiologic function, but rather to biologic tolerability, or the capacity of patients to adapt to their post-surgical limitations.[24,27,28] Finally, we looked at the possible effect of complications on activity levels. Mean UCLA scores between limb salvage patients with complications versus those without were significantly different, probably due to the need for revision surgery for endoprosthetic failure in one LSS patient. Mean UCLA scores were not significantly different within the ablative surgery group regardless of complications, consistent with previous reports.

Study limitations include a small and relatively heterogenous sample size, selection bias, and recall bias regarding activities before diagnosis. Sarcomas themselves are heterogenous and rare, both inherent non-modifiable features that add to the difficulty of recruiting more patients. Nevertheless, the incidence of osteosarcomas and soft tissue sarcomas continues to increase among Filipinos. The lack of published literature focused on sarcoma survivors' return to physical activity after treatment partly mitigates the small sample size. The authors also recommend better representation from other regions of the Philippines, which may significantly increase the sample size and its homogeneity.

CONCLUSION

This study is the first local attempt to compare activity levels among sarcoma survivors who have undergone different surgical interventions, including amputation. Cancer patients have long been encouraged to engage in regular physical activity because of proven positive effects on quality of life, but few studies have focused on sarcoma survivors. Return to baseline activities and regular high-impact sports is possible after sarcoma treatment. By demonstrating the benefits of physical activity on sarcoma survivors, we may better educate our colleagues and patients about small but impactful changes they can make to improve overall health and quality of life. A larger sample size with a longer follow-up is recommended to determine whether complications and the type of surgery affect long-term function.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

ART: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Visualization, Project administration; **EHMW:** Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – review and editing, Supervision, Project administration; **CLLG:** Conceptualization, Validation, Investigation, Resources, Writing – review and editing, Project administration; **CACV:** Validation, Investigation, Resources, Writing – review and editing; **MSR:** Validation, Writing – review and editing.

DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

Dr. Gaston is an Editorial Board member of the Philippine Journal of Orthopaedics (PJO). The other authors have no conflicts of interest to declare.

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REFERENCES

1. Pingping B, Yuhong Z, Weiqi L et al. Incidence and mortality of sarcomas in Shanghai, China, during 2002-2014. Front Oncol. 2019;9:662. PMID: 31380289 PMCID: PMC6653066 DOI: 10.3389/fonc.2019.00662
2. American Cancer Society. Cancer facts and figures. Atlanta, GA: American Cancer Society; 2023. https://www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/2023-cancer-facts-figures.htm
3. Burningham Z, Hashibe M, Spector L, Schiffman JD. The epidemiology of sarcoma. Clin Sarcoma Res. 2012;2(1):14. PMID: 23036164 PMCID: PMC3564705 DOI: 10.1186/2045-3329-2-14
4. Mojica JAP, Feliciano KBS. Profile of cancer patient referrals to the Department of Rehabilitation Medicine, Philippine General Hospital. Acta Med Philipp. 1993;29:51–5.
5. Gallas-Martir MA, EG Aniceto. Effect of the cancer support program on the quality of life of lung cancer patients at the Lung Center of the Philippines. Scient Proc. 1997;5(1):34–40.
6. Manalo MOU, Ngelangel CA. correlation between demographic, socio-economic, and cancer-specific factors with quality of life scores among newly-diagnosed cancer patients of the medical oncology clinics of the Philippine General Hospital Cancer Institute. Acta Med Philipp. 2021; 49(2).
7. Ngelangel CA, Lam HY, Rivera AS, et al. Quality of life changes in Filipino cancer patients from baseline to one year after diagnosis: a country-specific analysis of the ACTION study. Phil J Health Res Dev. 2017; 21(1):1–10
8. Ngelangel CA, Lam HY, Rivera AS, et al. Philippine costs in oncology (PESO): describing the economic impact of cancer on Filipino cancer patients using the ASEAN costs in oncology study dataset. Acta Medica Philipp. 2018; 52(2):125–33. DOI: 10.47895/amp.v52i2.418
9. Ramiro LS, Ngelangel CA, Amarillo ML, et al. The UP DOH QoL scale measures of quality of life of Filipino cancer patients. Philipp J InternMed. 1997;35:179–88. https://drive.google.com/file/d/1CuS4LSCRgMl6qpDIPvkOBR0fcPgJ6p3a/view
10. Sabal EB, Baltazar EA, Delos Santos N, et al. Prospective study on the impact of surgery and adjuvant chemotherapy quality of life of breast cancer patients. Philipp J Surg Spec. 2006; 61(1):6–12.
11. Agarwal MA, Puri A, Anchan C et al. Rotationplasty for bone tumors - is there still a role? Clin Orthop Relat Res. 2007;459:76-81. PMID: 17414168 DOI: 10.1097/BLO.0b013e31805470f0
12. Asavamongkolkul A, Eamsobhana P, Waikakul S, Phimolsarnti R. The outcomes of treatment of giant cell tumor of bone around the knee. J Med Assoc Thai. 2012;95(9):S122–8. PMID: 23326994
13. Wang, EHM. Bone allografts in limb salvage surgery: Philippine experience. Transplant Proc. 1998; 30(7):3774. PMID: 9838653 DOI: 10.1016/s0041-1345(98)01230-5
14. Hobusch GM, Cernakova M, Puchner SE, et al. Sports activity after soft tissue sarcoma of the lower extremity. Disabil Rehabil. 2020;42(1):14–9. PMID: 30620226 DOI: 10.1080/09638288.2018.1520929
15. Liska TM, Kolen AM. The role of physical activity in cancer survivors' quality of life. Health Qual Life Outcomes. 2020;18(1):197. PMID: 32571351 PMCID: PMC7310034 DOI: 10.1186/s12955-020-01448-3
16. Lang NW, Hobusch GM, Funovics PT, Windhager R, Hofstaetter JG. What sports activity levels are achieved in patients with modular tumor endoprostheses of osteosarcoma about the knee? Clin Orthop Relat Res. 2015;473(3):847–54. PMID: 25062703 PMCID: PMC4317435 DOI: 10.1007/s11999-014-3788-2
17. Enneking WF, Dunham W, Gebhardt MC, Malawar M, Protchard DJ. A system for the functional evaluation of reconstructive procedures after surgical treatment of tumors of the musculoskeletal system. Clin Orthop Relat Res. 1993;(286):241–6. PMID: 8425352
18. International Physical Activity Questionnaire Group. International physical activity questionnaire; 2023.
19. Naal FD, Impellizzeri FM, Leunig M. Which is the best activity rating scale for patients undergoing total joint arthroplasty? Clin Orthop Relat Res. 2009;467(4):958–65. PMID: 18587624 PMCID: PMC2650053 DOI: 10.1007/s11999-008-0358-5
20. American College of Sports Medicine. Guidelines for exercise and cancer; 2019.
21. Reyes JAL. Exploring leisure time activities and sociodemographic indicators of subjective happiness and self-perceived health among Filipinos. J Southeast Asian Stud. 2016;9(2):269–88. DOI: 10.14764/10.ASEAS-2016.2-6
22. Lewin J, Puri A, Quek R, et al. Management of sarcoma in the Asia-Pacific region: resource-stratified guidelines. Lancet Oncol. 2013;14(12):e562–70. PMID: 24176574 DOI: 10.1016/S1470-2045(13)70475-3
23. Asian Development Bank. Poverty data: Philippines. 2023.: https://www.adb.org/where-we-work/philippines/poverty
24. Nathan SS, Hua TL, Yoke MC, Ong TM, Pereira BP. Outcome satisfaction in long-term survivors of oncologic limb salvage procedures. Eur J Cancer Care (Engl). 2021;30(2):e13377. PMID: 33289196 DOI: 10.1111/ecc.13377
25. Puri A, Gulia A. Management of extremity soft tissue sarcomas. Indian J Orthop. 2011;45(4):301–6. PMID: 21772621 PMCID: PMC3134013 DOI: 10.4103/0019-5413.82332
26. Cirstoiu C, Cretu B, Serban B et al. Current review of surgical management options for extremity bone sarcomas. EFORT Open Rev 2019;4(5):174–82. PMID: 31191985 PMCID: PMC6540945 DOI: 10.1302/2058-5241.4.180048
27. Davis AM, Devlin M, Griffin AM, et al. Functional outcome in amputation versus limb sparing of patients with lower extremity sarcoma: a matched case-control study. Arch Phys Med Rehabil. 1999;80(6):615–8. PMID: 10378484 DOI: 10.1016/s0003-9993(99)90161-2
28. Stevenson J, Tsagkozis P, Grimer R. Functional and quality of life outcomes in bone sarcoma following amputation, rotationplasty or limb-salvage. Exp Rev Qual Life In Canc Care 2016;1(4): 303–12. DOI: 10.1080/23809000.2016.1203725

APPENDICES

Appendix A. Modified MSTS 1993 Scoring Tool adapted for the paper, Sports and Activities After Sarcoma Treatment Among Filipinos

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Philippine Musculoskeletal Tumor Society Research Committee (PMTS-R)

Institution :
Date of survey :
Representative PMTS Member :
Hospital number :

Lower Extremity

Pain	Function	Emotional Acceptance	Supports	Walking Ability	Gait	Total score
5: No pain	5: No restriction	Enthused, would recommend to others	5: None	5: Unlimited	5: Normal	
			4: Occasional use of brace			
3: Modest	3: Recreational restriction	Satisfied	3: Mostly brace	3: Limited (<1000 steps)	3: Minor cosmetic	
1: Moderate	1: Partial disability	Accepts	1: One cane or crutch	1: Inside only (<200 steps)	1: Major cosmetic, minor handicap/ functional deficit	
0: Severe	0: total disability	Dislikes	0: Two canes or crutches	0: Unable unaided	0: Major handicap/ functional deficit	

Scores with indeterminate definition or value such as "intermediate" corresponding to scores of 4 and 2 under "Pain" and "Function" have been removed to avoid confusion, as part of the 1993 modifications[17]

Appendix B. University of California, Los Angeles (UCLA) activity score.

UCLA Activity Score

Hip ID:
Study Hip: ☐ Left ☐ Right
Examination Date (MM/DD/YY): / /
Subject Initials: |____|____|____|
Medical Record Number:

Interval: _____

Check one box that best describes current activity level.

☐ 1: Wholly Inactive, dependent on others, and can not leave residence

☐ 2: Mostly Inactive or restricted to minimum activities of daily living

☐ 3: Sometimes participates in mild activities, such as walking, limited housework and limited shopping

☐ 4: Regularly Participates in mild activities

☐ 5: Sometimes participates in moderate activities such as swimming or could do unlimited housework or shopping

☐ 6: Regularly participates in moderate activities

☐ 7: Regularly participates in active events such as bicycling

☐ 8: Regularly participates in active events, such as golf or bowling

☐ 9: Sometimes participates in impact sports such as jogging, tennis, skiing, acrobatics, ballet, heavy labor or backpacking

☐ 10: Regularly participates in impact sports

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ORIGINAL ARTICLE

Early Discharge after Hip Fracture Surgery is Safe and Maintains Quality of Life in Elderly Patients: Experience from a Low-Resource Setting

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ABSTRACT

Background. While many studies compare early intervention versus delayed surgery in fragility hip fractures, there are few studies regarding the postoperative course of these patients. It is worth looking at the other side of the surgery to determine if an early discharge after hip fracture surgery is favorable.

Methodology. This was a retrospective cohort study on elderly hip fracture patients. Subjects were classified into those discharged one to two days post-op (early discharge) and three to six days post-op (routine discharge). World Health Organization Quality of Life Brief version (WHOQOL-BREF) in Tagalog scores were taken at two weeks, six weeks, and twelve weeks post-operation. Complications or readmission related to the index surgery, patient satisfaction, and cost difference were also analyzed.

Result. Sixty-two subjects were included in this study. WHOQOL-BREF scores of all subjects significantly increased up to 12 weeks of follow-up. Physical domain score in the WHOQOL-BREF was better in the early discharge group in the first six weeks only. Hospitalization costs for the two groups were not significantly different. No participant was readmitted due to complications of their index surgery. Most (73%) said they were *Very Satisfied* with their course of hospital stay, while 27% were *Satisfied*.

Conclusion. This study shows that even in a low-resource setting, elderly hip fracture patients have good outcomes in terms of quality of life, have a high satisfaction rate, and no increased risk of post-op complications if discharged early.

Keywords. fragility hip fracture, early discharge, quality of life, developing countries

INTRODUCTION

The incidence of hip fractures in the elderly is steadily rising as life expectancies get longer, thanks to medical advances and changing health habits. Although exact nationwide statistics are unavailable, records from the author's institution confirm this increasing trend. There are various procedures to address these elderly hip fractures: plating, nailing, and joint replacement. Technique and implant advancements have hastened recovery compared to the previous decade. Shortening the length of post-op stay has been investigated with the advent of enhanced recovery after surgery (ERAS).

Peter Salmon et al. compared patients' evaluation of care at a center with rapid discharge to two comparison sites with longer durations of stay. They found that a short period of three days was not detrimental to the patients.[1] A large study involving 330,000 patients concluded that same-day discharge and accelerated discharge were safe for patients undergoing total joint replacement.[2] Alley et al. found that early discharge among total hip arthroplasty patients was safe

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in safety net hospitals,[3] and a delay in the discharge increased the risk of complications and readmission.[4]

While early discharge has been proven effective in developed countries, applying this process in a low-resource setting such as the Philippines has yet to be studied since most surgeons still favor delayed discharge. In an informal survey among Orthopedic Surgeons in the northern Philippines, more than 92% of the 24 respondents discharge their elderly hip fracture patients more than three days after surgery. There were multiple reasons: awaiting inpatient rehabilitation, which usually starts one or two days after surgery; prolonged IV antibiotics; wound monitoring; drain output monitoring; assurance to the healthcare provider that the patient can sit and mobilize through physical therapy; and superstitions that a more extended stay can avoid developing complications in the future. Advanced age and poor fitness for anesthesia (higher ASA) have been associated with longer extended hospital stays.[5]

While many studies compare early intervention versus delayed surgery in fragility hip fractures, there are few studies regarding the postoperative course of these patients. It is worth looking at the other side of the surgery and asking if an early discharge protocol is applicable.

In a low-resource set-up, maximizing resources and minimizing hospital stay can avoid wastage, reduce expenses, and allocate resources to others in need.

Study location: Tertiary government hospital in the Philippines

This research study was conducted at a government tertiary hospital in the Philippines. Our population had limited access to postoperative care and rehabilitation services. The institution lacks postoperative protocols. Since there was no down-referral network system (e.g., home for the elderly, rehabilitation facility), all patients were discharged directly to their homes. Patients relied on various caregivers, including immediate family members, friends, and neighbors.

Objectives

This study aimed to determine whether, among patients who underwent surgery for fragility fractures of the hip (fixation or replacement), early discharge (one to two days post-op) compared to a routine discharge (3 to six days post-op) results in differences in the following outcomes: WHOQOL-BREF questionnaire in Tagalog at two weeks, six weeks, and twelve weeks post-operation; complication or readmission related to the index surgery; patient satisfaction; and cost difference.

METHODOLOGY

This was a retrospective cohort study from January 2019 to September 2022 in a tertiary government hospital in the Philippines. The principal investigator operated on all patients.

Inclusion criteria were as follows: 1) willing and able to provide informed consent; 2) patients at least 60 years old who received fixation or replacement surgery for fragility hip fractures; and 3) patients with an uncomplicated course of hospitalization. Exclusion criteria were as follows: 1) patients who were discharged more than six days after the index surgery; 2) patients with pathologic or multiple fractures; and 3) patients who requested to stay longer in the hospital for recovery.

The type of surgical procedure was decided by the primary investigator. Patients with femoral neck fractures who were community ambulators premorbid underwent total hip replacement (THR) (Microport, TN, USA). Those limited to home ambulation underwent partial hip replacement (PHR) (Chunli, China). Those with intertrochanteric fractures who received full government subsidy underwent cemented modular bipolar partial hip replacement (Chun li, China). At the same time, patients with intertrochanteric fractures who were able to pay out-of-pocket underwent proximal femoral nailing (PFN) (Canwell, China) or proximal femoral plating (PFLP) (Auxein, India). During the study, trauma implants such as the PFN and PFLP were not yet consigned by the hospital; thus, some intertrochanteric fractures were treated with PHR.

Discharge criteria were arbitrary; if the patient was stable, afebrile, and able to sit and stand with or without assistance. Postoperative rehabilitation and wound care were taught through instructional videos.

Personal data

All information was coded and de-identified. Personal data collected in paper copies (i.e., consent forms) were stored by the institution's Department of Orthopaedics research team under a lock and key cabinet where the primary investigator can access the data. The primary investigator digitally stored electronic data collected for this study using a password-protected dedicated Excel sheet; only the investigator and his supervisor were authorized to open the file. Personal data will be stored for a period of 10 years as prescribed by the institution's Health Information Management System.

Through chart review, demographic data, presence of hypertension or diabetes, pre-operative diagnosis, laterality, the procedure done and implant used, type of anesthesia, pre-operative hemoglobin, blood loss, blood transfusion/s (if any), and duration of each patient's stay in the hospital from admission to surgery to discharge. Patients were grouped into those discharged one to two days post-op (early discharge) and three to six days post-op (routine discharge).

WHOQOL-BREF

The abbreviated WHOQOL-BREF in Tagalog scores were routinely taken at two, six, and twelve weeks after surgery. No WHOQOL-BREF was taken before their injury. The WHOQOL in Tagalog is available online and can be

downloaded for free. The WHOQOL-BREF is a 26-item questionnaire developed by the World Health Organization that measures quality of life in four domains: physical health (seven items), psychological health (six items), social relationships (three items), and environment (eight items). The first two items in the questionnaire measure the participants' overall QOL and general health. Each item is rated using a 5-point Likert scale, where 1 represents "disagree" or "not at all" and five means "completely agree" or "extremely." The abbreviated tool has a high correlation with the expanded version, WHOQOL-100, and provides a rapid means of assessing the above domains of interest. It has been translated, field-tested, and culturally validated across different languages, including Filipino.[6,7]

While this is a generic questionnaire, it has been studied in hip surgery. Kumar et al. assessed the reliability of the WHO QOL-BREF questionnaire in total hip replacement patients. They found that the questionnaire was a potent tool in determining the quality of life in patients undergoing total hip replacement—simple, reproducible, and reliable.[8] While there are more disease-specific questionnaires for the hip—Harris Hip score (HHS), Oxford Hip score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Modified Harris hip Score—these have not been studied cross-culturally. These, if given to patients with a poor understanding of the English language, might give unreliable results.

Yao et al. added items to the generic WHOQOL-BREF to make it more sensitive in describing quality of life in patients with hip fractures. They compared the quality of life scores of hip fracture patients using both the WHOQOL-BREF and the QOL-HF. Four hip-specific items were added to the WHO-BREF to develop the QOL-HF: N1) How much difficulty do you have sitting for a long time? N2) How much difficulty do you have walking a long distance? N3) How much dependency do you have on your walking aid? N4) Are you able to put on your shoes and socks by yourself? However, the addition of these specific items failed to improve the validity and reliability of the standard questionnaire. The WHOQOL-BREF was competent alone and did not need additional items to be more specific.[9]

Patient satisfaction

Patients were contacted remotely or in-person (at the outpatient department) to determine readmissions or complications relating to the index surgery, and level of patient satisfaction (very satisfied, satisfied, not satisfied) (Figure 1).

Hospitalization costs

Costs primarily included laboratory tests, medications, operating room use, equipment consignment, and miscellaneous hospital fees. Implant costs and professional fees were excluded since the cohort comprised both private and subsidized (service) patients. Hospitalization cost was based on the Statement of Account from the hospital.

SPSS software (version 20; SPSS Inc., Chicago, IL, USA) was used for analysis. A repeated ANOVA measure was used to compare the WHOQOL scores between the two groups. A p-value of less than 0.05 was considered statistically significant. The reliability of the score was evaluated using the Cronbach alpha test. T-test and Chi-square were used for continuous and nominal data, respectively.

RESULT

Patient demographics

A total of 62 subjects gave consent and were included in this study, 33 of whom were discharged early, while 29 were routinely discharged. The mean age of the patients was 79.61 years (SD = 8.64), with no significant difference between the groups (Table 1). Diagnosis and total length of stay were significantly different between the two groups.

Over time, for all patients, the mean WHOQOL-BREF scores and domain scores increased significantly at two, six, and 12 weeks [Physical: $F(2, 122) = 380.211$, $p = 0.001$; Psychological: $F(2, 122) = 114.11$, $p = 0.001$; Social: $F(2, 122) = 53.43$, $p = 0.001$; and Environmental: $F(2, 122) = 104.31$, $p = 0.001$].

The two groups' scores differed from each other only in terms of the physical domain at two and six weeks ($p = 0.03$), and the environment domain at six weeks ($p = 0.03$) (Figures 1 and 2). There were no other significant differences with other domains at other time points.

Cost analysis

Hospitalization costs for the two groups were not significantly different (Table 2).

Complication / readmission / satisfaction

There were no subjects readmitted due to complications of the index surgery during the time of this study. Most (73%) said they were *Very Satisfied* with their course of hospital stay, while 27% were *Satisfied.* There were no deaths recorded during the duration of the study.

DISCUSSION

This study was approved by the Regional Health Research and Development Consortium – Ethics Review Committee and the technical review committee of the institution.

All 62 patients were able to follow up in the clinic and were mostly independently mobile. Seven patients started using wheelchairs because of frailty and fear of falling again. Hypertension, diabetes mellitus, and laterality of the fracture did not significantly affect outcomes. There were significantly more intertrochanteric fractures than femoral neck fractures in this study.

Table 1. Patient demographics

	Early discharge (n = 33)	Routine discharge (n = 29)	*p*-value
Age in years, (SD)	79.85 (8.53)	79.34 (8.90)	0.821
Male:Female	4:29	6:23	
	33	29	0.493
With HTN	21	15	0.245
With DM	8	4	0.238
Diagnosis, IT:NOF	18:15	23:6	0.040*
Laterality, left:right	19:14	15:14	0.644
Procedure THR PHR CR-PFNA CR-Plate	 4 19 8 2	 4 13 10 2	0.801
Duration of surgery in minutes (SD)	78.7 (37.3)	85.7 (35.8)	0.453
Days from admission to surgery, (SD)	4.4 (2.9)	4.2 (3.3)	0.847
Days from surgery to discharge, (SD)	1.7 (0.5)	3.6 (1)	<0.001‡
Length of stay in days, (SD)	6.1 (2.9)	7.9 (4)	0.048‡
Anesthesia, General:Regional	8:25	5:24	0.614
Pre-op Hgb in mg/dL (SD)	113.9 (10.2)	114.9 (15.5)	0.766
Blood loss in mL, (SD)	256.1 (156.5)	238.1 (130.6)	0.467
Transfusion, Yes:No	10:23	9:20	1.000

* Chi-square; ‡ t-test; (SD) Standard deviation; GA = General Anesthesia; Hgb = Hemoglobin; IT = Intertrochanteric fracture; NOF = Neck of femur fracture; THR = Total hip replacement; CR = Closed reduction; PFNA = Proximal femur nail antirotation

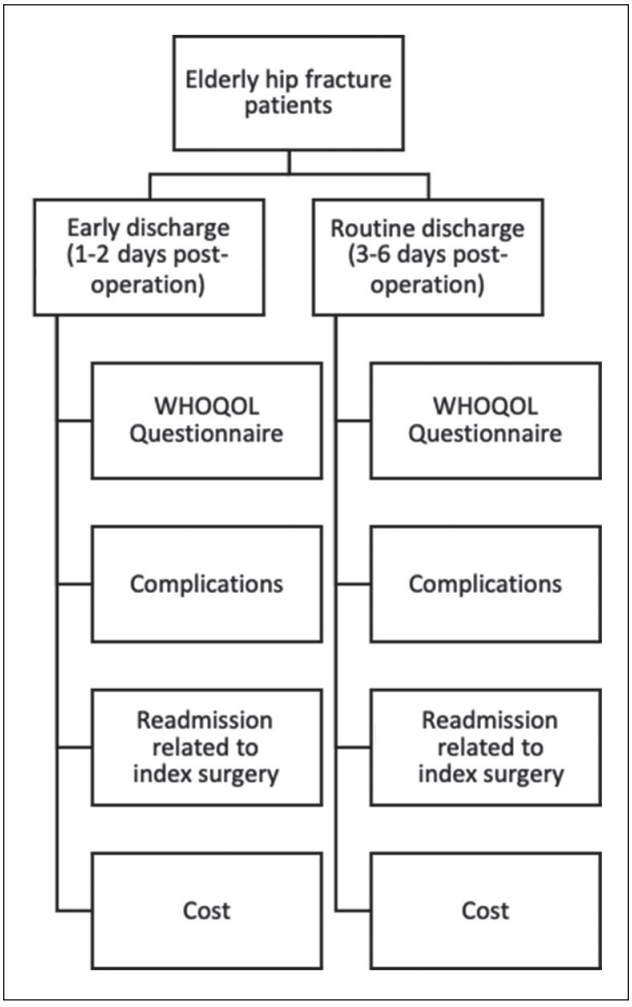

Figure 1. Study flow.

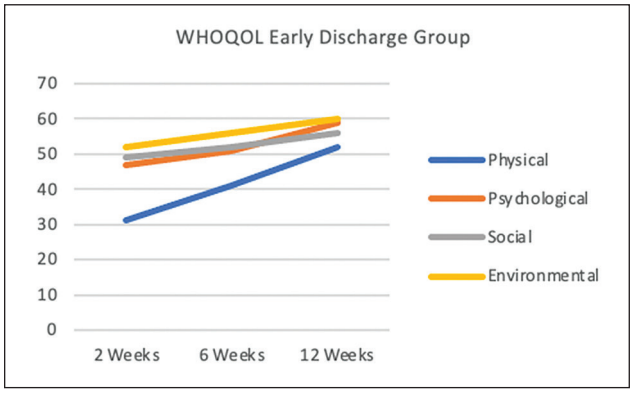

Figure 2. WHOQOL of early discharge group.

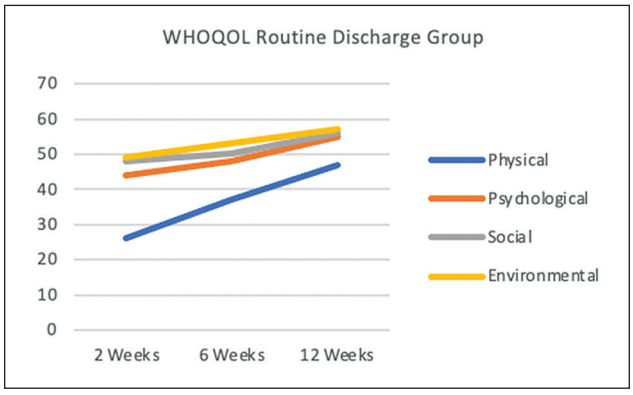

Figure 3. WHOQOL of routine discharge group.

Table 2. Cost of hospitalization

	Early	Routine	*p*-value
Cost of hospitalization	PhP 69,392	PhP 89,127	0.849 α

p-value not significantly different

The primary investigator had operated on all the subjects, assisted by a scrub nurse and an implant technician. There was no significant difference between the two groups in terms of operative duration. The average waiting time from admission to surgery was four days for both groups. Of note, some of these patients' incidents of falls or fractures had occurred a few days to weeks from admission. One patient had a femoral neck fracture three months before admission, and one had their fracture two years before. The author tried to operate on these patients at the soonest possible time once the internist gave a cardiac and pulmonary risk assessment. A study by Tud and Claudio in the Philippines among elderly Filipinos with fragility fractures of the hip showed a significantly lower incidence of in-hospital complications among patients who underwent surgery within 72 hours from admission.[10] Moran et al. found, similarly, that a delay of more than four days significantly increased the mortality among these patients.[11]

The length of stay was significantly different for the two groups, since they were grouped into early and routine discharges. The anesthesiologists favored regional anesthesia over general anesthesia in this study, and all had indwelling catheters removed after 24 hours. The preoperative hemoglobin, blood loss, and transfusion did not differ between the groups.

The WHOQOL-BREF analysis in this study revealed an increasing trend of quality of life scores among all subjects. An in-depth analysis of the domains per week between groups showed that patients who were discharged earlier had better quality-of-life scores in the first six weeks in the physical domain and at six weeks in the environment domain. Both groups had no significant difference in their scores at the 12-week follow-up. Of note, all patients had the physical domain as their lowest score since mobilization was really a challenge.

Our patients scored higher on social, psychological, and environmental domains than on the physical domain, which reflects the sociocultural norm in the Philippines. Every patient has their own caregiver in the hospital and at home. These caregivers may be their immediate relatives, neighbors, or friends. Close family ties and willingness to sacrifice reflect the importance of family in Filipino culture.

While there was no recorded readmission to the hospital secondary to complications from the hip fracture surgery, one subject developed a periprosthetic infection one year after the index surgery (PHR done for an intertrochanteric fracture in 2020). It presented as a pustule appearing on the surgical wound. Surgery was advised to address the infection, but the patient refused. At the time of writing, she is currently undergoing antibiotic suppression and can still ambulate with a walker. However, this patient's quality of life remains at par with others.

This study also examined the hospitalization costs between early and routine discharge groups. However, it did not account for the payer source—whether expenses were paid directly by the patient or family, covered by the Philippine Health Insurance Corporation, or subsidized through the Medical Assistance Indigency Fund. This distinction is important in a low-resource setting such as the Philippines, where 68% of healthcare spending comes from the private sector and 52% is paid out-of-pocket.[12] While van Balen et al. found that early discharge did not substantially reduce total cost, a more comprehensive cost-effectiveness analysis demonstrated a 40% gain with early discharge or shorter hospital stay.[13,14] The early discharge group incurred an average cost of PhP 69,392 (USD 1,245.66) compared with PhP 89,127 (USD 1,599.92) for the routine discharge group. Although the difference was not statistically significant, the PhP 19,735 (USD 354.26) reduction is financially meaningful in a low-resource context, as such savings could be redirected to other indigent patients. Future research should incorporate payer stratification to better capture the socioeconomic implications and true cost-effectiveness of early discharge.

Patient satisfaction with their discharge course was recorded through three scores: Very Satisfied, Satisfied, and Not Satisfied. Forty-five patients reported "Very Satisfied," while seventeen reported "Satisfied." None said, "Not Satisfied." This was a crude way of recording the satisfaction rate of the process since there were no validated questionnaires to use, as far as the primary investigator was aware.

Early discharge of patients after hip fracture surgery was advantageous both for the patient and the hospital. The Enhanced Recovery After Surgery (ERAS) is an evidence-based and multidisciplinary perioperative care pathway to promote patient mobilization, reduce complication rates, decrease hospital length of stay, and reduce cost. It possesses a clear advantage for patients and potential savings for the health care system.[13] While it started initially with Dr. Henrik Kehlt, a Danish colorectal surgeon, this approach is also applied widely in orthopedics. In the United Kingdom, Germany, and Denmark, total hip and total knee arthroplasty had an average length of stay of about six to 12 days. However, during the last decade, they have adapted optimal multimodal perioperative care to enhance recovery (the fast-track methodology). With this protocol, they shortened the length of stay of their joint replacement patients to one to three days after the procedure. They used six well-defined criteria (ability to get dressed independently, ability to get in and out of bed, ability to sit and rise from a chair/toilet, independence in personal care, mobilization with a walker, and ability to walk >70 meters with crutches) for them to assess if the patient was fit to be discharged early.[14] Some studies have also shown that rehabilitation at home, compared to a skilled nursing facility, makes no difference. A local study by Peña et al. found no difference in hip scores and quality of life among hip fracture patients who received complete or incomplete rehabilitation.[15]

This study has several limitations. It was conducted in a single institution, and all operations were performed by a single surgeon. Although this may limit generalizability to other hospitals with varying protocols and practices, it also ensured uniformity in surgical technique and postoperative care,

thereby enhancing internal consistency. The study primarily involved a chart review complemented by interviews and data from the hospital's health information system. Interpretation of the results should consider the heterogeneity of the subjects, as the analysis did not distinguish between intertrochanteric and femoral neck fractures. A more detailed subgroup analysis of these fracture types is recommended in future research. Developing standardized discharge criteria for hip fracture patients would also strengthen future studies. Lastly, patient follow-up was challenging due to the advanced age of participants and limited contact accessibility, highlighting the need for improved patient tracking and long-term communication systems.

CONCLUSION

This study showed that early discharge was not inferior to routine discharge. Orthopedic surgeons, researchers, and even policymakers can use this to formulate strategies regarding discharge plans for hip fracture patients and develop policies to improve patient care and outcomes even in a low-resource setting.

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STATEMENT OF AUTHORSHIP

The author fulfills ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

MSAS: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Writing – review and editing, Visualization, Supervision, Project administration.

DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

The author declared no conflict of interest.

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REFERENCES

1. Salmon P, Hunt GR, Murthy BV, et al. Patient evaluation of early discharge after hip arthroplasty: development of a measure and comparison of three centres with differing durations of stay. Clin Rehabil. 2013;27(9):854-63. PMID: 23543343 DOI: 10.1177/0269215513481686
2. Mundi R, Axelrod DE, Najafabadi BT, Chamas B, Chaudhry H, Bhandari M. Early discharge after total hip and knee arthroplasty-an observational cohort study evaluating safety in 330,000 patients. J Arthroplasty. 2020;35(12):3482-7.e3. PMID: 32768260 DOI: 10.1016/j.arth.2020.06.092
3. Alley MC, Shewmaker GS, Vaickus MH, Niu R, Freccero D, Smith EL. Early discharge after total hip arthroplasty at an urban tertiary care safety net hospital: a 2-year retrospective cohort study. J Am Acad Orthop Surg. 2021;29(20):894-9. PMID: 34232930 DOI: 10.5435/JAAOS-D-20-01006
4. Morcos MW, Nowak L, Schemitsch E. Delayed discharge after total hip arthroplasty is associated with an increased risk of complications. Can J Surg. 2022;65(5):E593-8. PMID: 36302127 PMCID: PMC9467463 DOI: 10.1503/cjs.021219
5. Foote J, Panchoo K, Blair P, Bannister G. Length of stay following primary total hip replacement. Ann R Coll Surg Engl. 2009;91(6):500-4. PMID: 19558767 PMCID: PMC2966203 DOI: 10.1308/003588409X432356
6. Altman AD, Helpman L, McGee J, et al; Society of Gynecologic Oncology of Canada's Communities of Practice in ERAS and Venous Thromboembolism. Enhanced recovery after surgery: implementing a new standard of surgical care. CMAJ. 2019;191(17):E469-75. PMID: 31036609 PMCID: PMC6488471 DOI: 10.1503/cmaj.180635
7. Husted H, Lunn TH, Troelsen A, Gaarn-Larsen L, Kristensen BB. Why still in hospital after fast-track hip and knee arthroplasty?. Acta Orthop. 2011;82(6):679-84. PMID: 22066560 PMCID: PMC3247885 DOI: 10.3109/17453674.2011.636682
8. Kumar P, Sen RK, Aggarwal S, Jindal K, Rajnish RK. Assessment and reliability of the World Health Organisation quality of life (WHO QOL-BREF) questionnaire in total hip replacement patients. J Clin Orthop Trauma. 2020;11(Suppl 5):S756-9. PMID: 32837104 PMCID: PMC7386303 DOI: 10.1016/j.jcot.2020.07.020
9. Yao KP, Lee HY, Tsauo JY. Are hip-specific items useful in a quality of life questionnaire for patients with hip fractures? Int J Rehabil Res. 2009;32(3):245-50. PMID: 19407660 DOI: 10.1097/MRR.0b013e32832bb10c
10. Tud AR, Claudio RS. A Comparison of complication rates between early and delayed surgery among filipino patients with fragility fractures of the hip. Acta Med Philipp. 2024;58(3):34-9. PMID: 38966840 PMCID: PMC11219548 DOI: 10.47895/amp.vi0.6799
11. Moran CG, Wenn RT, Sikand M, Taylor AM. Early mortality after hip fracture: is delay before surgery important?. J Bone Joint Surg Am. 2005;87(3):483-9. PMID: 15741611 DOI: 10.2106/JBJS.D.01796
12. Obermann K, Jowett M, Kwon S. The role of national health insurance for achieving UHC in the Philippines: a mixed methods analysis. Glob Health Action. 2018;11(1):1483638. PMID: 29914319 PMCID: PMC6008596 DOI: 10.1080/16549716.2018.1483638
13. van Balen R, Steyerberg EW, Cools HJ, Polder JJ, Habbema JDF. Early discharge of hip fracture patients from hospital: transfer of costs from hospital to nursing home. Acta Orthop Scand. 2002;73(5):491-5. PMID: 12440489 DOI: 10.1080/000164702321022749
14. Sigurdsson E, Siggeirsdottir K, Jonsson H Jr, Gudnason V, Matthiasson T, Jonsson BY. Early discharge and home intervention reduces unit costs after total hip replacement: results of a cost analysis in a randomized study. Int J Health Care Finance Econ. 2008;8(3):181-92. PMID: 18566886 DOI: 10.1007/s10754-008-9036-0
15. Peña MARG, Tabu IA, Ching Bing-Agsaoay DD. Functional outcomes among geriatric fragility hip fracture patients in a developing country: a comparative study between complete and incomplete post-operative rehabilitation. Acta Med Philipp. 2022;56(6). DOI: 10.47895/amp.v56i6.3436

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ORIGINAL ARTICLE

Evaluating Fracture Hematoma Reintroduction vs. Non-Reintroduction in Femoral Shaft Fractures: A Single-Blinded Randomized Controlled Trial

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ABSTRACT

Background. Fracture hematoma plays a critical role in bone healing by supplying essential growth factors. However, the original hematoma is often discarded during surgery. The potential benefits of reintroducing fracture hematoma remain unclear.

Objective. This study aimed to evaluate the efficacy of fracture hematoma reintroduction in promoting bone union, reducing pain, and improving functional outcomes in patients with closed femoral shaft fractures treated with open reduction and intramedullary nailing.

Methodology. A single-blinded randomized controlled trial was conducted, enrolling 18 adult patients with closed femoral shaft fractures. Patients were randomized into two groups: hematoma reintroduction (n = 9) and non-reintroduction (n = 9). The primary outcome was time to bone union, measured using the Radiographic Union Scale in Tibial fractures (RUST). Secondary outcomes included pain (assessed using the Visual Analog Scale) and functional outcomes (evaluated with the Lower Extremity Functional Scale) at six, 12, and 24 weeks postoperatively. Statistical analysis included ANOVA and multivariable regression.

Result. At six weeks, the hematoma reintroduction group showed a significantly higher mean RUST score compared to the non-reintroduction group (p = 0.022). However, by 12 weeks (p = 0.108) and 24 weeks (p = 0.241), the difference between the groups was no longer statistically significant. Both groups demonstrated similar improvements in pain and functional outcomes over time. No complications were reported in either group.

Conclusion. While hematoma reintroduction may enhance early bone healing, the long-term outcomes in terms of bone union, pain, and function are comparable between the two treatment approaches. Hematoma reintroduction is a well-tolerated intervention, with no observed complications.

Keywords. fracture hematoma, femoral shaft fractures, intramedullary nailing, bone healing, randomized controlled trial

INTRODUCTION

Femoral shaft fractures are among the most common long bone injuries, often resulting from high-energy trauma such as motor vehicle accidents or falls from height. These fractures typically require surgical stabilization, with intramedullary nailing being the current gold standard due to its biomechanical stability and favorable outcomes in fracture healing and functional recovery.[1]

In ideal settings, minimally invasive osteosynthesis (MIO) is preferred for long bone fractures, as it preserves the soft tissue envelope and the local biologic environment. However, in many rural or resource-limited hospitals where intra-operative fluoroscopy (C-Arm) is unavailable, MIO becomes impractical. In such cases, surgeons often resort to open

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reduction techniques, which inherently disrupt the fracture hematoma—a key component of the early healing cascade.

Fracture hematoma is rich in mesenchymal stem cells, inflammatory cytokines, and angiogenic growth factors such as VEGF and BMPs, all of which play critical roles in initiating neovascularization and endochondral ossification.[2-4] The hematoma microenvironment supports cellular recruitment, vascular invasion, and soft-callus formation, thereby accelerating bone repair.[3,5] Despite this biologic plausibility, a hematoma is often removed during open surgery because of traditional surgical practice, infection concerns, or the absence of clinical evidence supporting its reintegration.

Although animal and preclinical studies have demonstrated the benefits of preserving or reintroducing fracture hematoma, few clinical trials have evaluated these effects in humans.[2,4,6] This highlights a gap in translational research, particularly in low-resource settings where biologic preservation strategies could help compensate for limited imaging and specialized surgical tools.

This study aims to address that gap by evaluating the effect of fracture hematoma reintroduction during open reduction and intramedullary nailing of femoral shaft fractures. We hypothesized that reinfusing the native hematoma after fixation would promote early bone healing, replicating the biologic advantages of minimally invasive approaches without requiring specialized equipment.

To objectively assess radiographic healing, we used the Radiographic Union Score for Tibia (RUST). Although originally developed for tibial fractures, RUST has been validated as a reliable and reproducible tool for assessing union in long bones, including the femur.[7] This scoring system provides a consistent framework for evaluating healing across defined postoperative time points.

By comparing outcomes between hematoma reintroduction and standard non-reintroduction protocols, this single-blinded randomized controlled trial explores the feasibility, safety, and potential clinical value of this biologic adjunct—particularly in rural and underserved health-care environments.

METHODOLOGY

Patient enrollment, inclusion/exclusion criteria, randomization and blinding

This single-blinded randomized controlled trial was conducted at Region 1 Medical Center from January 2021 to December 2023. Adult patients presenting with closed femoral shaft fractures were screened for eligibility (Figure 1).

Inclusion criteria were adults aged 18–60 years with closed, isolated, unilateral femoral shaft fractures (AO type 32A or 32B), fit for surgery, and who presented within 21 days of injury.

Exclusion criteria included: open fractures, pathologic fractures, polytrauma, prior surgery on the same limb, significant comorbidities (e.g., uncontrolled diabetes mellitus, end-stage renal disease), and refusal to provide informed consent.

After confirming eligibility and obtaining consent, patients were randomized into two groups (hematoma reintroduction or non-reintroduction) using a block randomization method. A computer-generated sequence from the Research Randomizer tool (www.randomizer.org) was used. Allocation was concealed in sealed opaque envelopes, which were opened just before surgery. Surgeons were informed of the group assignment immediately before the procedure. The study was not registered at ClinicalTrials.gov.

To minimize potential biases, blinding was maintained throughout the evaluation. The operating surgeon was not

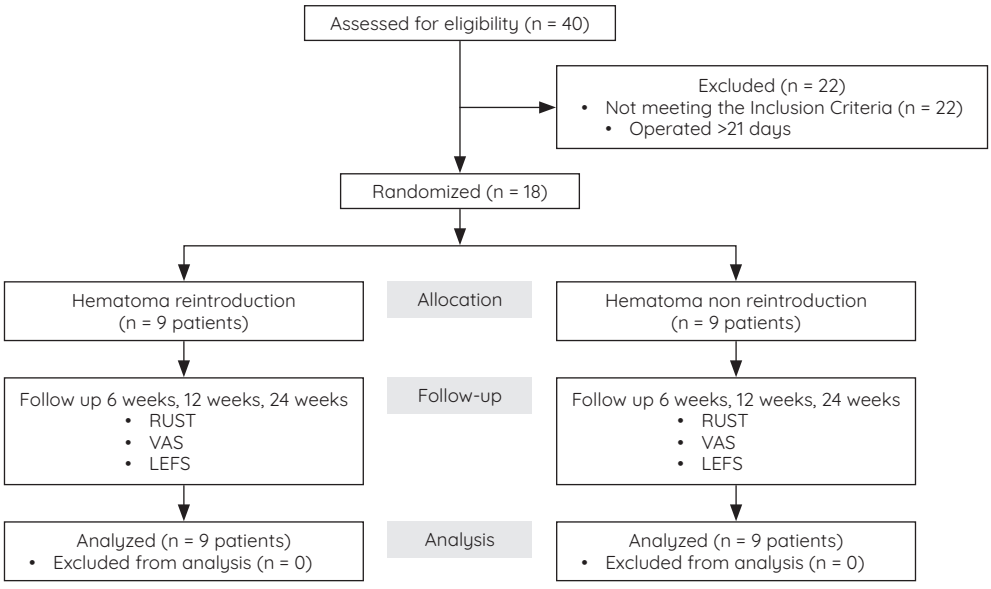

Figure 1. Flowchart of patient inclusion, randomization and follow up.

involved in postoperative outcome assessment. A separate research assistant—uninvolved in the clinical care or surgical procedure—collected follow-up data. Radiographic scoring was performed by an independent observer blinded to treatment allocation.

Surgical technique and hematoma reintroduction

All patients underwent open reduction and antegrade intramedullary nailing via a lateral approach. A standard stainless-steel femoral nail system was used in all cases, with distal and proximal locking screws. Although implant length and diameter were adjusted based on intraoperative measurements, the implant type and manufacturer were consistent across all patients.

In the hematoma reintroduction group, a target volume of 10 mL of fracture hematoma was aspirated using a sterile 14-gauge needle and 20-mL syringe immediately after fracture exposure and before irrigation. The aspirate was collected into a sterile container and reintroduced into the fracture site after definitive fixation and before wound closure. If less than 10 mL of liquid hematoma was available, visible clotted hematoma was carefully collected using sterile forceps, placed into the same 20-mL syringe, and reinjected to reach the 10 mL target volume. In the control (non-reintroduction) group, the hematoma was completely evacuated and discarded during standard irrigation, with no reinfusion (Figure 2).

Hematoma reintroduction

For patients assigned to the hematoma reintroduction group, the hematoma collected from the fracture site was kept in a sterile environment. Once the fracture was stabilized and the implants were positioned, the preserved hematoma was reintroduced into the fracture site.

Postoperative care and follow-up

All patients received the same standardized postoperative care, including antibiotics, thromboprophylaxis, and pain management. Radiographs (anteroposterior and lateral views) were taken at six, 12, and 24 weeks postoperatively. Clinical follow-up was done concurrently.

Figure 2. Sample of aspirated hematoma (10 ml) prior to reintroduction into the fracture site.

Outcome measures

The primary outcome was radiographic evidence of fracture healing, assessed using the Radiographic Union Scale in Tibial fractures (RUST). This score evaluates bridging callus on four cortices, with higher scores indicating greater union. A score of ≥9 was considered indicative of union.

Secondary outcomes included pain (measured by the Visual Analog Scale, VAS) and function (measured by the Lower Extremity Functional Scale, LEFS), both assessed at six, 12, and 24 weeks.

Sample size and statistical analysis

The study initially screened 40 patients, of whom only 18 met all inclusion criteria. This sample size was not determined by power analysis due to the exploratory nature of the trial and logistical limitations. The goal was to generate preliminary clinical data to guide future studies on fracture hematoma reintroduction.

Data were analyzed using SPSS version 25 (IBM Corp., Armonk, NY, USA). Descriptive statistics summarized baseline characteristics. One-way ANOVA was used to compare RUST, VAS, and LEFS scores between groups at each time point. Multiple linear regression was used to control for covariates such as age, fracture type, and sex. Statistical significance was set at $p < 0.05$.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Review Board of Region 1 Medical Center (IRB Protocol No. 2019-012). Written informed consent was obtained from all participants before enrollment. Patient data were anonymized and stored in encrypted, password-protected files accessible only to authorized members of the research team. The study was conducted in accordance with the Declaration of Helsinki (2013 revision). The authors declare no conflicts of interest.

RESULT

A total of 18 patients were included in the study, with 9 in the hematoma reintroduction group and 9 in the non-reintroduction group. The mean age was 30.0 ± 12.18 years in the hematoma reintroduction group and 27.78 ± 6.57 years in the non-reintroduction group. Most participants were male (14 out of 18), with all four female patients belonging to the non-reintroduction group. None of the patients were smokers (Table 1).

Fracture classification and baseline characteristics

An imbalance was noted in AO fracture types between the two groups: the hematoma reintroduction group had more AO 32A fractures (8 out of 9), while the non-reintroduction group had more AO 32B fractures (5 out of 9). AO 32A fractures are generally considered to have a more favorable prognosis than 32B wedge-type fractures, which may influence healing rates despite randomization (Table 1).

Primary outcome: fracture healing (RUST Scores)

All patients completed the 24-week follow-up and achieved radiographic union, defined as RUST ≥9. No cases of delayed union or nonunion were observed (Table 2).

At six weeks, the hematoma reintroduction group demonstrated a significantly higher mean RUST score compared to the non-reintroduction group (6.44 ± 1.24 vs. 4.89 ± 1.36; $p = 0.022$), indicating an early radiographic healing benefit (Figures 3 and 4). However, by 12 and 24 weeks, the difference between groups diminished and was no longer statistically significant, suggesting that the initial advantage did not translate into superior long-term healing outcomes (Tables 2 and 3).

Secondary outcomes: pain and functional recovery

Pain scores, assessed using the VAS, improved steadily in both groups across all time points. The hematoma reintroduction group showed slightly lower scores, though differences were not statistically significant (Table 4).

Functional outcomes, as measured by the LEFS, improved progressively over time in both groups. Scores were slightly higher in the reintroduction group at all time points (Table 4).

Complications

No complications or adverse events were reported in either group. There were no instances of implant failure throughout the study period.

Table 1. Baseline Characteristics of Participants

Baseline Characteristics	Hematoma Reintroduction (n = 9)	Hematoma Non-reintroduction (n = 9)	Total (n = 18)
Age (mean ± SD)	30.0 ± 12.18	27.78 ± 6.57	28.89 ± 9.68
Gender, n (%)			
Male	9 (64.3%)	5 (35.7%)	14
Female	0 (0%)	4 (100%)	4
Smoking status, n (%)			
Smoker	0	0	0
Non-smoker	9 (100%)	9 (100%)	18
Fracture type, n (%)			
Type 1 (AO 32A)	8 (66.7%)	4 (33.3%)	12
Type 2 (AO 32B)	1 (16.7%)	5 (83.3%)	6

Table 2. Primary Outcome—Radiographic Evidence of Bone Union Over Time

Time (Weeks)	Hematoma Reintroduction (Mean ± SD)	Hematoma Non-reintroduction (Mean ± SD)	*p*-value
6	6.44 ± 1.24	4.89 ± 1.36	0.022
12	8.86 ± 0.90	7.63 ± 1.69	0.108
24	10.60 ± 1.52	9.38 ± 1.85	0.241

Table 3. ANOVA Results for RUST Scores

Time (Weeks)	Sum of Squares	df	Mean Square	F	*p*-value
6 weeks					
Between Groups	10.889	1	10.889	6.426	0.022
Within Groups	27.111	16	1.694		
Total	38.000	17			
12 weeks					
Between Groups	5.668	1	5.668	2.979	0.108
Within Groups	24.732	13	1.902		
Total	30.400	14			
24 weeks					
Between Groups	4.617	1	4.617	1.536	0.241
Within Groups	33.075	11	3.007		
Total	37.692	12			

Table 4. Secondary Outcomes—Pain and Functional Outcomes over Time

Time (Weeks)	Pain level (VAS score)	Functional Outcomes (LEFS score)
6	5.67 ± 1.00	37.11 ± 6.88
	6.00 ± 0.50	36.22 ± 2.33
12	3.29 ± 0.49	55.57 ± 3.78
	3.88 ± 0.64	53.75 ± 2.92
24	1.40 ± 0.55	74.20 ± 3.90
	1.88 ± 0.64	72.75 ± 2.65

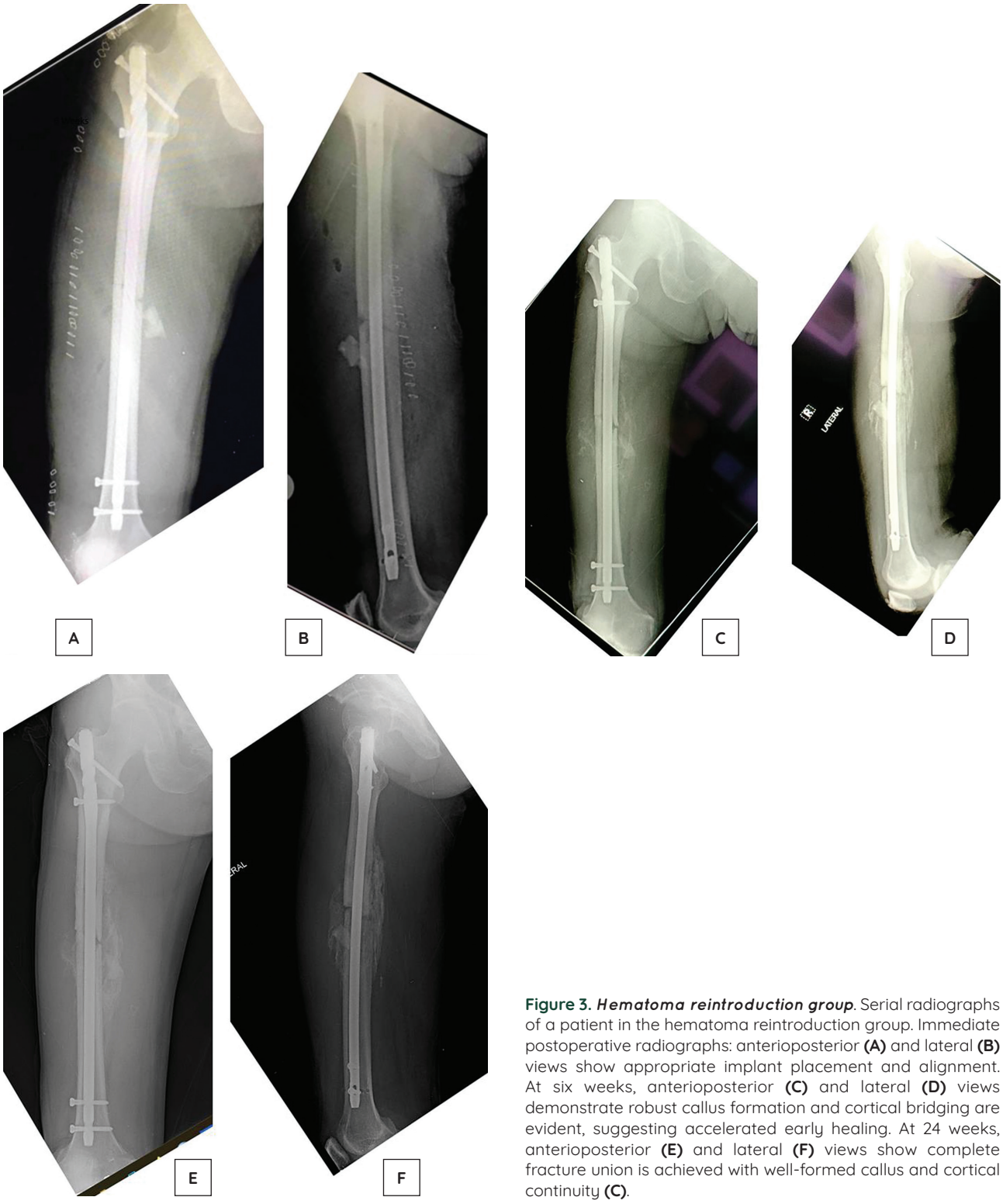

Figure 3. ***Hematoma reintroduction group***. Serial radiographs of a patient in the hematoma reintroduction group. Immediate postoperative radiographs: anterioposterior **(A)** and lateral **(B)** views show appropriate implant placement and alignment. At six weeks, anterioposterior **(C)** and lateral **(D)** views demonstrate robust callus formation and cortical bridging are evident, suggesting accelerated early healing. At 24 weeks, anterioposterior **(E)** and lateral **(F)** views show complete fracture union is achieved with well-formed callus and cortical continuity **(C)**.

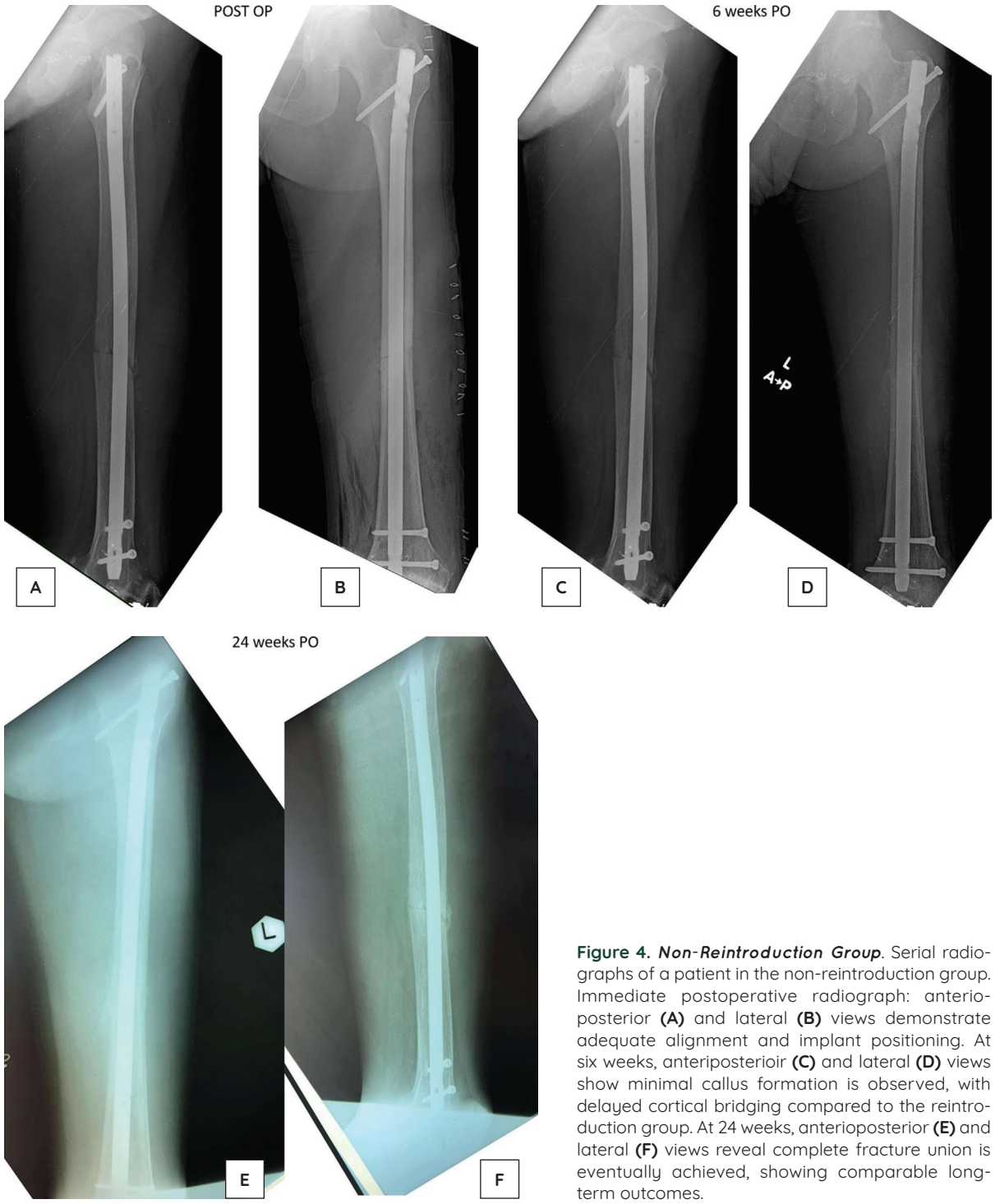

Figure 4. ***Non-Reintroduction Group***. Serial radiographs of a patient in the non-reintroduction group. Immediate postoperative radiograph: anterioposterior **(A)** and lateral **(B)** views demonstrate adequate alignment and implant positioning. At six weeks, anteriposterioir **(C)** and lateral **(D)** views show minimal callus formation is observed, with delayed cortical bridging compared to the reintroduction group. At 24 weeks, anterioposterior **(E)** and lateral **(F)** views reveal complete fracture union is eventually achieved, showing comparable long-term outcomes.

DISCUSSION

This study evaluated the effects of fracture hematoma reintroduction on the healing of closed femoral shaft fractures treated with open reduction and intramedullary nailing. The primary outcome, as measured by RUST scores, showed a statistically significant advantage in the hematoma reintroduction group at six weeks. This supports the hypothesis that fracture hematoma, when reinfused into the fracture site, contributes to early bone healing. However, the difference diminished over time and became statistically insignificant at 12 and 24 weeks, suggesting that while early callus formation may be enhanced, long-term union is ultimately comparable between treatment groups.

Secondary outcomes, including pain (VAS) and functional recovery (LEFS), followed similar trajectories. Both groups showed progressive improvement in pain and mobility, with no significant difference at any time point. These findings suggest that while hematoma reintroduction may accelerate early radiographic healing, it does not appear to provide sustained advantages in long-term patient-reported outcomes.

The Radiographic Union Score for Tibia (RUST), although originally developed for tibial fractures, has been validated in long bone healing, including femoral shaft fractures. Litrenta et al demonstrated high interobserver reliability of RUST and modified RUST when applied to metadiaphyseal femoral fractures, supporting its use in this study.[3]

The biological rationale for hematoma preservation lies in its composition of mesenchymal stem cells, cytokines, and osteoinductive growth factors such as VEGF and BMPs.[2,4,6] These elements are central to initiating angiogenesis, inflammation, and osteogenesis—the first steps of fracture healing. Marsell and Einhorn described the hematoma as a "biologic burst" that stimulates vascular invasion, soft callus formation, and cortical bridging.[2] Preserving or reintroducing this biologic material has been shown to enhance bone regeneration in preclinical models,[4,8] and our findings suggest this benefit may translate clinically during the early healing phase.

This study also carries relevance for surgical decision-making in resource-limited environments. In many rural hospitals where intraoperative fluoroscopy is unavailable, minimally invasive osteosynthesis (MIO) is impractical, compelling surgeons to perform open reduction. This approach disrupts the biological environment of the fracture site. Hematoma reintroduction offers a low-cost, biologically sound adjunct to mitigate this disruption without extending operative time or requiring specialized equipment.[1,9,10] Furthermore, in health systems where financial hardship often delays orthopedic care,[9] cost-effective interventions that improve early healing can help reduce the burden on both patients and hospitals.

No complications or adverse events were recorded in either group, demonstrating that hematoma reintroduction is a safe adjunct to internal fixation. This finding helps address concerns about possible contamination or immunologic reaction associated with reinfusion of biologic material.[5,7]

Despite these promising results, this study has several limitations. The small sample size limits the power to detect subtle differences and increases the risk of type II error. As a pilot trial, the aim was to generate preliminary data for future large-scale studies. Additionally, an imbalance in fracture patterns between groups (more AO 32A fractures in the hematoma group and more 32B in the control group) may have influenced early results despite randomization. Multivariable regression was used to control for this, but residual confounding remains possible.

In summary, fracture hematoma reintroduction appears to be a safe, biologically rational, and cost-effective technique that promotes earlier radiographic healing. While long-term outcomes were similar, the early healing benefit may have practical implications in patients requiring early mobilization and in low-resource environments where delayed union has significant functional and economic consequences. Larger, stratified studies are warranted to confirm these findings.

CONCLUSION

This randomized controlled trial is among the first to clinically evaluate the effect of fracture hematoma reintroduction on femoral shaft fracture healing in humans. Our findings indicate that reinfusing the native fracture hematoma during open reduction and intramedullary nailing may promote faster radiographic healing in the early postoperative period. However, this early benefit was not sustained at later time points, with comparable outcomes in bone union, pain reduction, and functional recovery observed between the hematoma and non-reintroduction groups by 12 and 24 weeks.

In rural or resource-limited hospitals where fluoroscopy is unavailable and MIO is impractical, open reduction remains necessary. Hematoma reintroduction may help restore the biologic potential lost during surgical exposure, offering a biologically sound, low-cost adjunct without requiring additional instruments or time.[1,9,10]

This technique was found to be safe, with no adverse events or implant failures. It may offer added value in enhancing early healing, reducing the risk of delayed union, and decreasing long-term patient costs—particularly relevant in low-resource settings where economic hardship limits access to prolonged postoperative care.[9] Further large-scale studies are warranted to validate these findings and identify patient groups that may benefit most from this biologically augmented approach to fracture management.

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STATEMENT OF AUTHORSHIP

All authors certified fulfillment of ICMJE authorship criteria.

CREDIT AUTHOR STATEMENT

NKPP: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing – original draft preparation, Writing – review and editing, Visualization, Project administration, Funding acquisition; **JDJS:** Conceptualization, Methodology, Validation, Formal analysis, Writing – review and editing, Supervision, Project administration.

DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

The authors declared no conflict of interest.

FUNDING SOURCE

None.

REFERENCES

1. Rockwood CA Jr, Green DP, Bucholz RW, Heckman JD, Court-Brown CM, Tornetta P III. Rockwood and Green's Fractures in Adults, 8th ed. Philadelphia, PA: Wolters Kluwer Health; 2015.
2. Marsell R, Einhorn TA. The biology of fracture healing. Injury. 2011;42(6):551-5. PMID: 21489527 PMCID: PMC3105171 DOI: 10.1016/j.injury.2011.03.031
3. Litrenta J, Tornetta P 3rd, Mehta S, et al. Determination of radiographic healing: an assessment of consistency using RUST and Modified RUST in metadiaphyseal fractures. J Orthop Trauma. 2015;29(11):516-20. PMID: 26165265 DOI: 10.1097/BOT.0000000000000390
4. Dimitriou R, Tsiridis E, Giannoudis PV. Current concepts of molecular aspects of bone healing. Injury. 2005;36(12):1392-404. PMID: 16102764 DOI: 10.1016/j.injury.2005.07.019
5. Giannoudis PV, Einhorn TA, Marsh D. Fracture healing: the diamond concept. Injury. 2007;38(Suppl 4):S3-6. PMID: 18224731 DOI: 10.1016/s0020-1383(08)70003-2
6. Street J, Bao M, deGuzman L, et al. Vascular endothelial growth factor stimulates bone repair by promoting angiogenesis and bone turnover. Proc Natl Acad Sci U S A. 2002;99(15):9656-61. PMID: 12118119 PMCID: PMC124965 DOI: 10.1073/pnas.152324099
7. Einhorn TA, Gerstenfeld LC. Fracture healing: mechanisms and interventions. Nat Rev Rheumatol. 2015;11(1):45-54. PMID: 25266456 PMCID: PMC4464690 DOI: 10.1038/nrrheum.2014.164
8. Gerstenfeld LC, Cullinane DM, Barnes GL, Graves DT, Einhorn TA. Fracture healing as a post-natal developmental process: molecular, spatial, and temporal aspects of its regulation. J Cell Biochem. 2003;88(5):873-84. PMID: 12616527 DOI: 10.1002/jcb.10435
9. Obayemi JE, Card EB, Shirima O, Premkumar A, Massawe H, Sheth NP. Hospitalized for poverty: orthopaedic discharge delays due to financial hardship in a tertiary hospital in Northern Tanzania. Glob Health Res Policy. 2022;7(1):31. PMID: 36050802 PMCID: PMC9438232 DOI: 10.1186/s41256-022-00265-z
10. Claes L, Recknagel S, Ignatius A. Fracture healing under healthy and inflammatory conditions. Nat Rev Rheumatol. 2012;8(3):133-43. PMID: 22293759 DOI: 10.1038/nrrheum.2012.1

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CASE SERIES

Outcomes of Proximal Interphalangeal Joint Fracture-Dislocations Treated with Hemi-hamate Arthroplasty

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ABSTRACT

Background. Proximal phalangeal joint (PIPJ) dorsal fracture-dislocations (DFD) of the proximal interphalangeal joint are complex injuries that are challenging to treat. Hemi-hamate arthroplasty (HHA) is an excellent option in cases when the volar fragment is large and severely comminuted.

Objective. The objective of this study was to present the clinical outcome of patients with PIPJ-DFD treated with HHA.

Methodology. This case series was a retrospective chart review of all adult patients with PIPJ-DFD treated with HHA between 2015 and 2024. Inclusion criteria included patients with PIPJ-DFD treated with HHA. Patients with multiple digit injuries, open injuries, and associated soft tissue damage were excluded. Primary outcomes measured were the PIPJ arc of motion and the presence of flexion or extension deficits. Secondary outcomes observed include graft healing and post-operative complications.

Results. A total of five patients were included in the study. All were male with a mean age of 33.8 years. Four patients had middle finger injuries, and one patient had a ring finger injury. The mean delay to surgery was 2.8 months (range, one week to six months), and the median follow-up was 32 months (range, two to 72 months). The mean volar lip involvement/fragmentation was 50% (range, 40 to 60%). All grafts healed, with a mean PIPJ extension deficit of 25.8° and a mean flexion deficit of 94°. The mean PIPJ arc of motion was 68°. No sensory deficits or pain were reported during use. One case developed radial collateral ligament insufficiency with ulnar subluxation.

Conclusion. This case series confirms that HHA is an effective treatment for PIPJ-DFD, yielding satisfactory functional outcomes and reliable graft healing.

Keywords. hemi-hamate arthroplasty, proximal-interphalangeal joint fracture dislocations

INTRODUCTION

Dorsal fracture-dislocations (DFD) of the proximal interphalangeal joint (PIPJ) are complex injuries and are challenging to treat. Depending on the fracture severity, patients may experience early onset of painful post-traumatic arthritics, deformity, and instability, all leading to increased stiffness and decreased range of motion.[1] Treatment mainly depends on the size of the volar lip fragment, which affects reducibility and stability. A fragment larger than 40 to 50% of the base of the middle phalanx that requires 30° or more of flexion to maintain PIPJ reduction renders the injury unstable and requires surgery.[2-5]

In 1999, Hastings first described a technique called hemi-hamate arthroplasty (HHA) to treat unstable PIPJ fracture dislocations involving more than 50% of the volar lip

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(presented at the 54th Annual Meeting of the American Society for Surgery of the Hand, September 2–4, 1999).[6] The technique was technically challenging. Stability depended not only on the reconstructed bony buttress but also on the surrounding soft tissues around the PIPJ, including the volar plate and collateral ligaments. The hemi-hamate autograft provided articular congruity by reconstituting the concavity of the middle phalangeal base, affording a volar buttress that prevents dorsal dislocation.[7,8]

The outcomes of HHA have been reported in several systematic reviews, achieving post-operative PIPJ motion arcs of 74.3 to 79.8°. Thus, HHA is a good treatment alternative for fracture-dislocations of the PIPJ that cannot be fixed due to severe comminution or large volar bone loss (>40%).[9-12]

The objective of this paper was to report the outcomes of HHA in the treatment of PIPJ-DFD.

METHODOLOGY

A retrospective chart review was done on patients with fracture-dislocations of the PIPJ treated with HHA from January 1, 2015, to January 1, 2024. Included were all adult patients with fracture-dislocations of the PIPJ treated with HHA. Excluded were patients with multiple digit injuries on the same hand, open injuries, and associated tendon, collateral ligament, or neurovascular injuries. Collateral ligament injuries were diagnosed based on static radiographs (varus or valgus angulation of more than 30°) or direct visualization during surgery.

Surgical technique

The surgery for HHA reconstruction for dorsal fracture-dislocations of the PIPJ has been well described in the literature.[4] A variation of the technique was done with a trapezoidal incision (Figures 1 A-D) with isolation of the flexor sheath between the A2 and A4 pulley for later re-attachment between the joint and flexor tendons. After exposing the PIPJ through a shotgun approach, the volar buttress defect was measured to approximate the size of the graft to be harvested. Through fluoroscopic guidance, the hamate was identified at the base of the 4th and 5th metacarpals. Using small osteotomes and pushing the 4th and 5th metacarpal volarly, a graft slightly larger by 1 mm on all dimensions was harvested from the distal dorsal intra-articular cortex of the hamate. The graft was then trimmed to size using a small rongeur or small bone rasp. Two 1.5 mm cortical screws were used to secure the graft to the intra-articular proximal volar articular cortex of the middle phalanx (1.1 or 1.2 mm screws were not available). The volar buttress was re-created with the graft. Even if radiographs showed step-off of the articular surface, direct visualization showed no step-off (Figures 2 A-F). This difference was due to the thicker cartilage of the hamate graft compared to the phalanx.

Post-operative protocol

Post-operatively, the hand was immobilized in a dorsal blocking splint with the PIPJ flexed at 30°. Post-op radiographs were taken one week post-surgery and then at three weeks. The patient was allowed to do ROM of the PIPJ within the confines of the dorsal blocking splint within one week. Formal therapy was started between three to four weeks post-op. The PIPJ angle was gradually extended, and the splint was discontinued at five to six weeks post-op. Buddy taping was done, and passive range of motion (ROM) exercises were initiated, until the patient achieved an extension deficit of less than 10°. Night splinting using gradual extension splints was done for those with extension deficits of more than 20°. Unlimited activity was permitted at 12 weeks postop.

Bone graft union was evaluated using post-operative radiographs. The absence of the fracture line and the presence of crossing trabeculations between the graft and phalanx

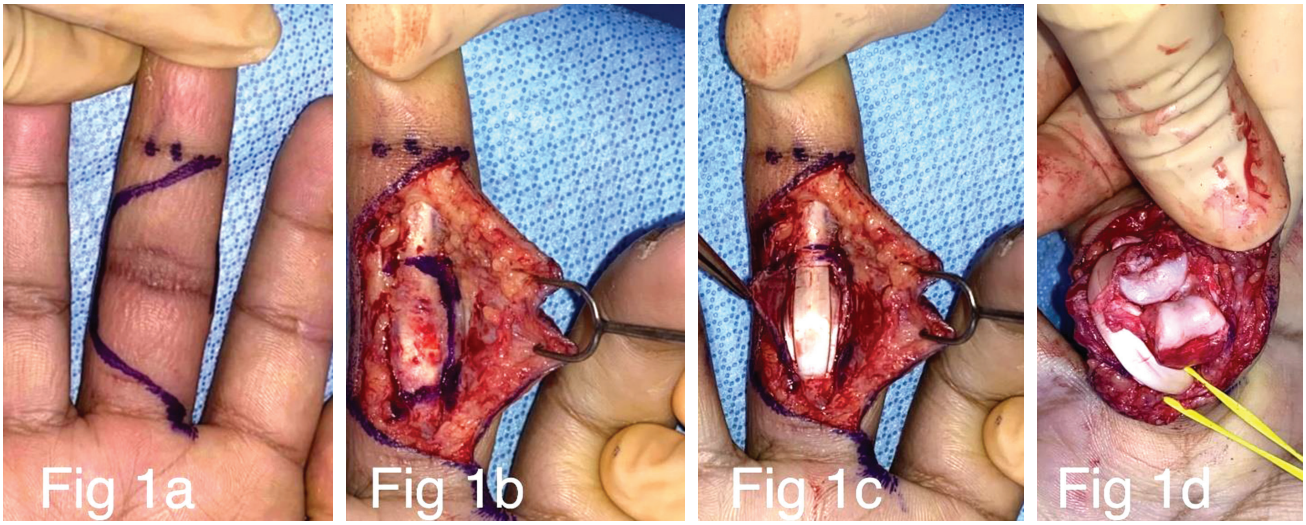

Figure 1. Trapezoidal incision over the volar PIPJ **(A)**. Flap was raised and another flap on the tendon sheath was created between A2 and A4 pulleys **(B)**. The flexor tendons were exposed and the volar plate was released from the accessory collateral ligaments and base of the middle phalanx **(C)**. "Shotgun" exposure of the PIPJ **(D)**.

indicated a united graft. We did not wait for the graft to unite on radiography; full ROM was encouraged, and the splint was discontinued at five to six weeks post-surgery, as long as there was no indication of screw loosening.

On follow-up, PIPJ extension lag, range of motion, graft union, and complications were documented. ROM was measured using a finger goniometer.

RESULTS

A total of five patients were identified (all males) with a mean age of 33.8 years (range, 29-42). The middle finger was involved in four cases, and the ring finger in one. Mean delay to surgery was 2.8 months (range, 7 days to 6 months), mean articular surface involvement was 50% (range, 40 to 60%), and the median follow-up for the five patients was 32 months (range, 2 to 72 months) (Table 1). Two patients received acute reconstructions (<3 weeks from injury). Two had reconstructions at six months, one at one month, and one at two months. Those patients with delayed treatment reported using their hands as tolerated, with no splint. Persistence of limitation of motion and pain prompted their present consult. The reasons were mostly that patients did not want to undergo the surgery at the time of injury.

Table 1. Patient demographic data (n = 5)

	N	Mean, SD*/Range
Age, years (mean, SD)		33.8, 6.8
Sex (all males)	5	
Finger Involved		
Middle finger	4	
Ring finger	1	
Delay to surgery (months, range)		2.8 (range, 0.25 – 6)
Volar lip involvement/fragmentation (%, range)		50 (range, 40-60%)

*SD – Standard deviation

In the five patients, on final follow-up, the mean PIPJ extension deficit was 25.8° and the mean flexion was 94° (range, 80 to 107°, median 96°) (Table 2). There were no sensory deficits

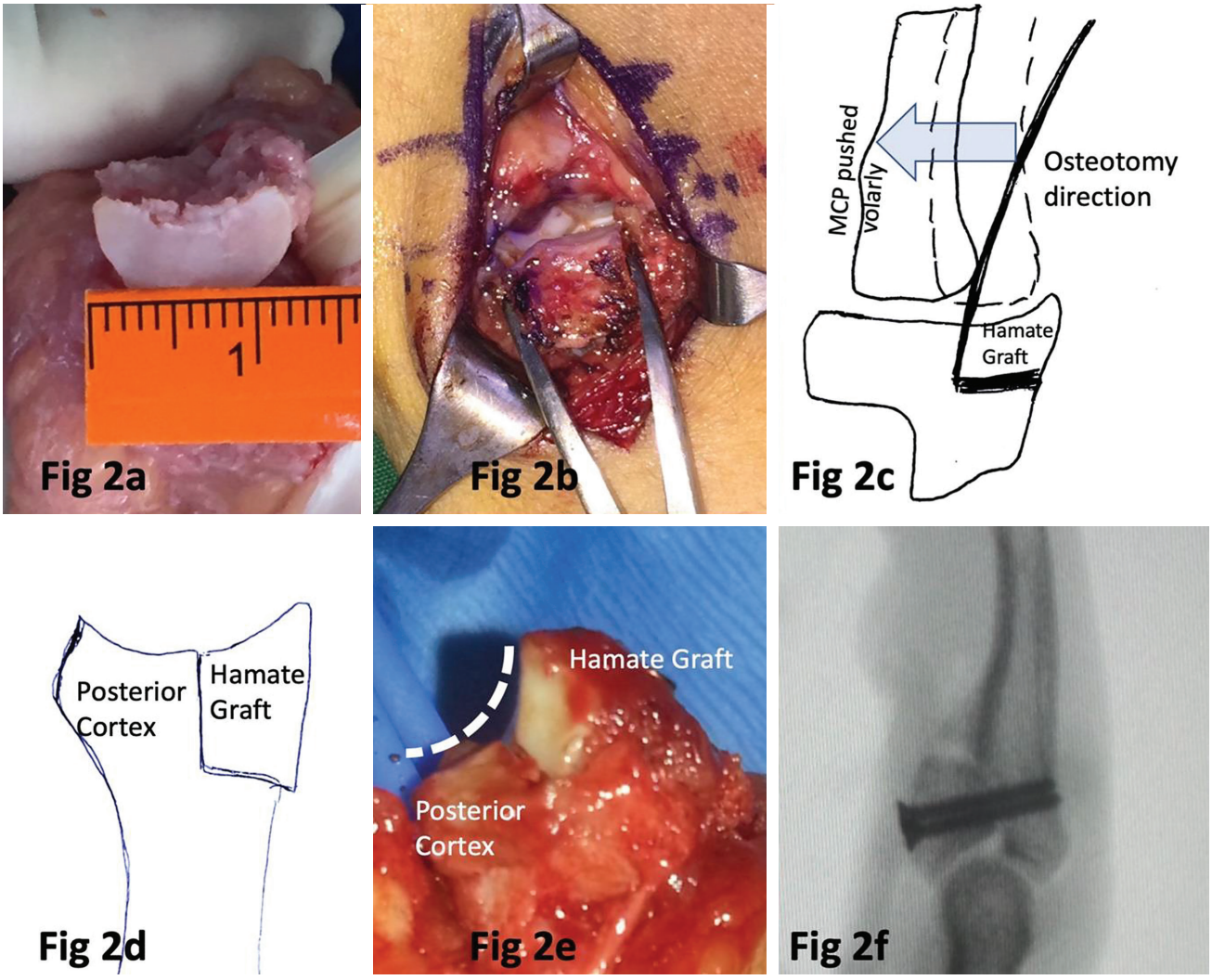

Figure 2. Volar lip defect prepared and measured **(A)**. The measurements were drawn on the hamate, adding 1 mm on all dimensions **(B)**. Osteotomy was done. Intra-articular osteotomy was done by pushing the 4th and 5th metacarpal bases volarly, with a slightly angulated position to achieve a convex surface **(C)**. After harvest, the volar lip was reconstructed, creating a concavity of the middle phalangeal base with no cartilage step-off **(D and E)**. Radiographs may show step-off since the cartilage of the hamate is thicker than that of the base of the middle phalanx **(F)**.

Table 2. Patient outcomes (n = 5)

Patient no.	Delay (months)	Volar lip (%)	Extension deficits	PIPJ* flexion	PIPJ ROM**	Other outcomes	Follow up (months)
1	0.25	50	30°	96°	66°	Healed	2
2	6	50	24°	85°	61°	Healed	72
3	1	50	35°	80°	45°	Healed, RCL insufficiency	53
4	0.5	40	10°	100°	90°	Healed	32
5	6	60	30°	107°	77°	Healed	11
Mean	2.75	50	25.8°	93.6°	68°		34

*PIPJ – Proximal interphalangeal joint; **ROM – range of motion

reported, and no pain was reported during use of the hand. Radiographic union was evident by the 4th to 5th week post-surgery. There was no screw loosening among the five patients. The grafts in all cases were large; however, no intra-operative dislocation occurred after graft fixation. All six patients were satisfied with the outcome.

We had one complication in a 36-year-old male with a four-week history of PIPJ dorsal fracture-dislocation of the right middle finger. The patient at 48 months post-op showed radial collateral ligament insufficiency with subluxation of the PIPJ (Figure 3). The patient had a history of being lost to follow-up for more than a year, and also claimed to have not done physiotherapy. Although the fixation was healed, there was ulnar deviation of the PIPJ. We believe that this was caused by the inadequate repair of the volar plate to the collateral ligament on the radial side. The ROM was 35 to 80°, but there was no pain on ROM both at work and at rest (Figure 4). Patient claimed he was able to use his hand and opted for observation. There were no complications concerning the hamate donor site.

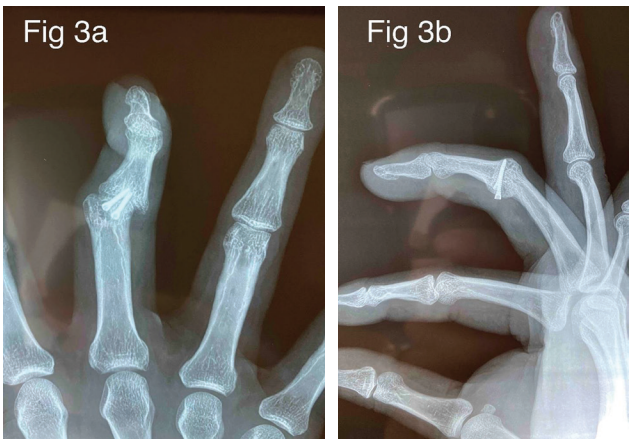

Figure 3. Radiographs showed ulnar deviation of the PIPJ flattening of the head of the proximal phalanx at the ulnar side **(A)**. Lateral radiograph showed stable graft healing **(B)**.

CASE

A 25-year-old male consulted our clinic with a two-week history of left middle finger injury from playing basketball. Radiograph showed a 40% articular involvement. An HHA arthroplasty was suggested if the fragment is not fixable. Intra-operatively, there was fragmentation of the volar fragment, hence an HHA was done. Two 1.5mm cortical screws were used to fix the graft (Figure 5). At 36 months post-surgery, extension deficit was 10° with PIPJ flexion of 100°, and ROM arc of 90°. FIL-DASH (Filipino Version of the Disability of the Arm, Shoulder, and Hand) score was 1 with no pain, and grip was 100% compared to the contralateral side (Figure 6). The patient was able to return to unlimited sports activities, including basketball. There was some remodeling of the graft with stable union (Figure 7).

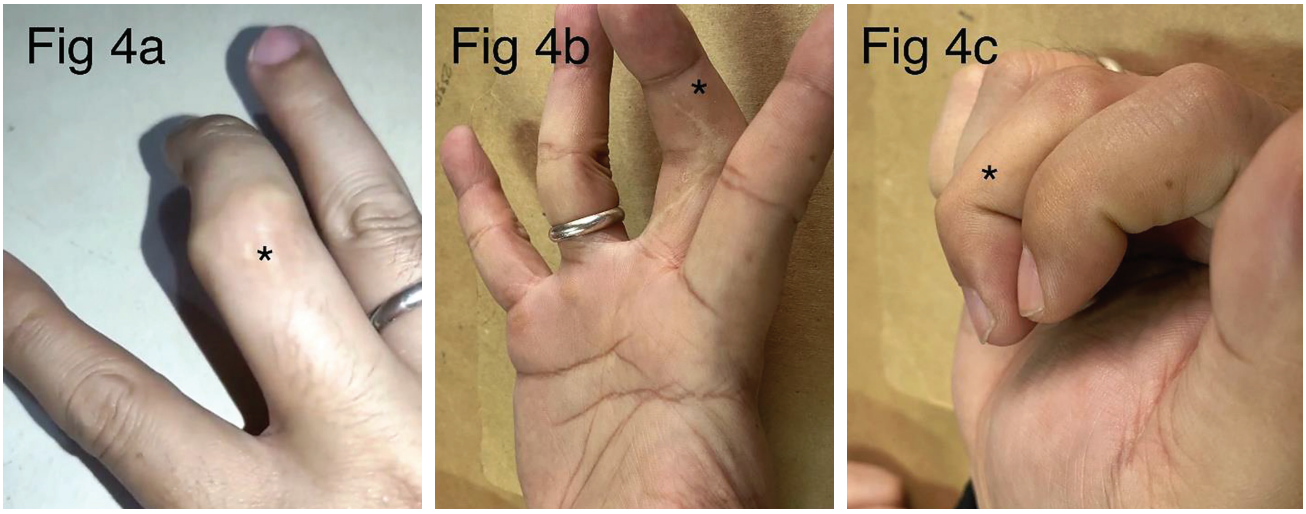

Figure 4. The clinical picture shows ulnar deviation of the middle phalanx **(A)**. There was a flexion contracture of 45° **(B)**. PIPJ flexion was good at 80°. *Middle finger **(C)**.

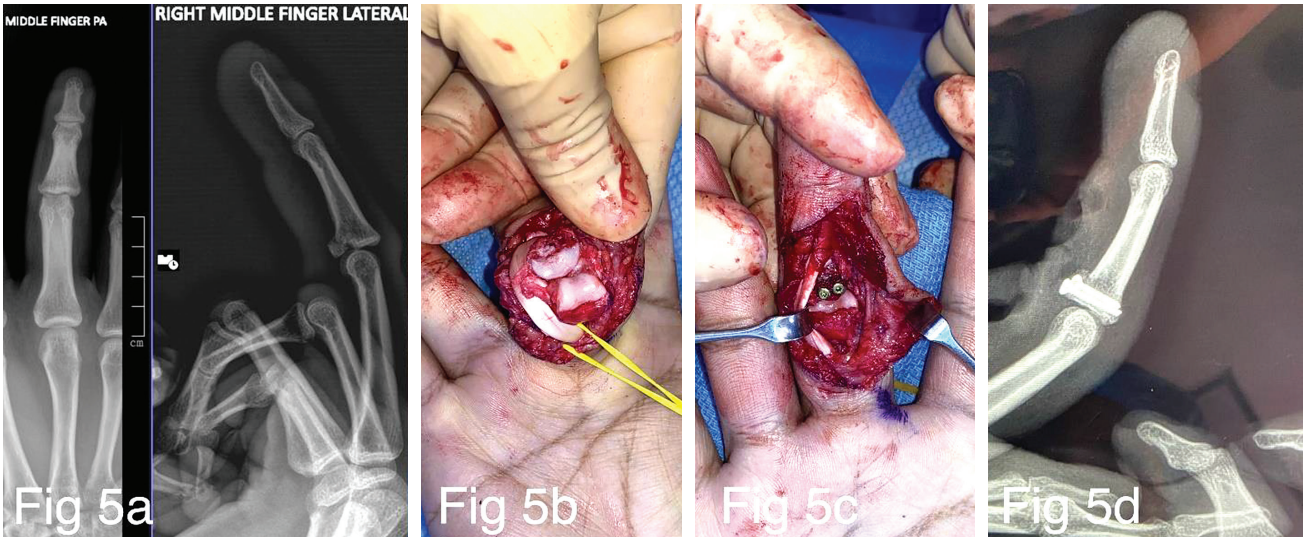

Figure 5. The injury film shows a PIPJ-DFD of the middle finger with approximately 40% volar lip involvement **(A)**. The "shotgun" image of the PIPJ **(B)**. The PIPJ was reduced, and the graft fixation was stable with two 1.5 mm screws **(C)**. Radiograph showing a concentric reduction of the PIPJ and stable fixation **(D)**.

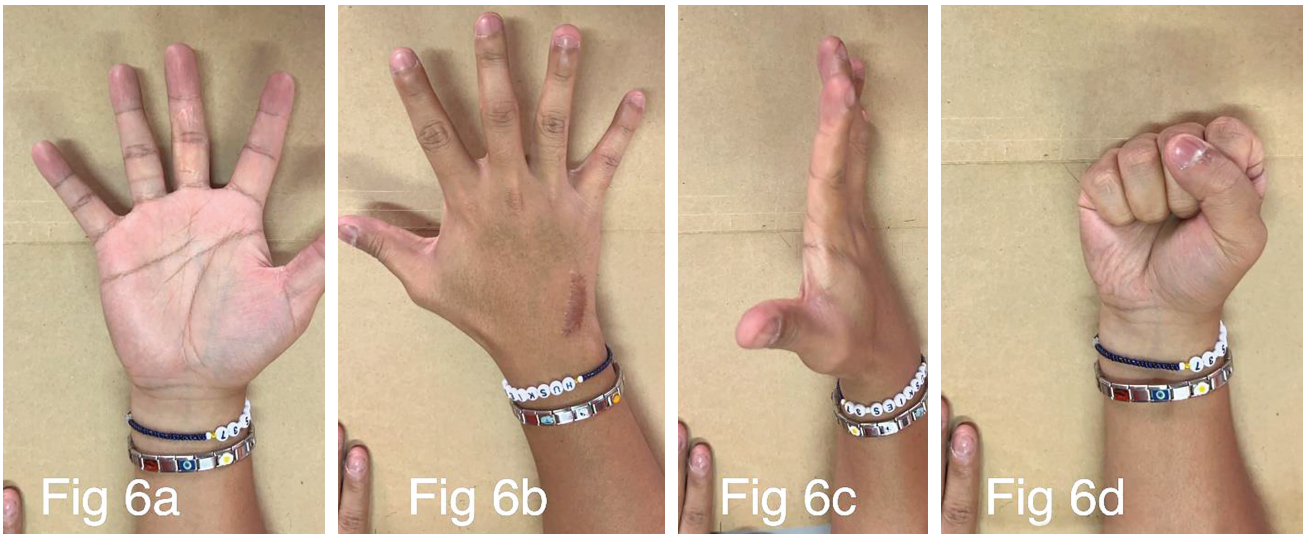

Figure 6. At 36 months follow-up, the middle finger had excellent extension **(A and B)**, with a 10° extension deficit **(C)** and excellent flexion at 100° at the PIPJ **(D)**.

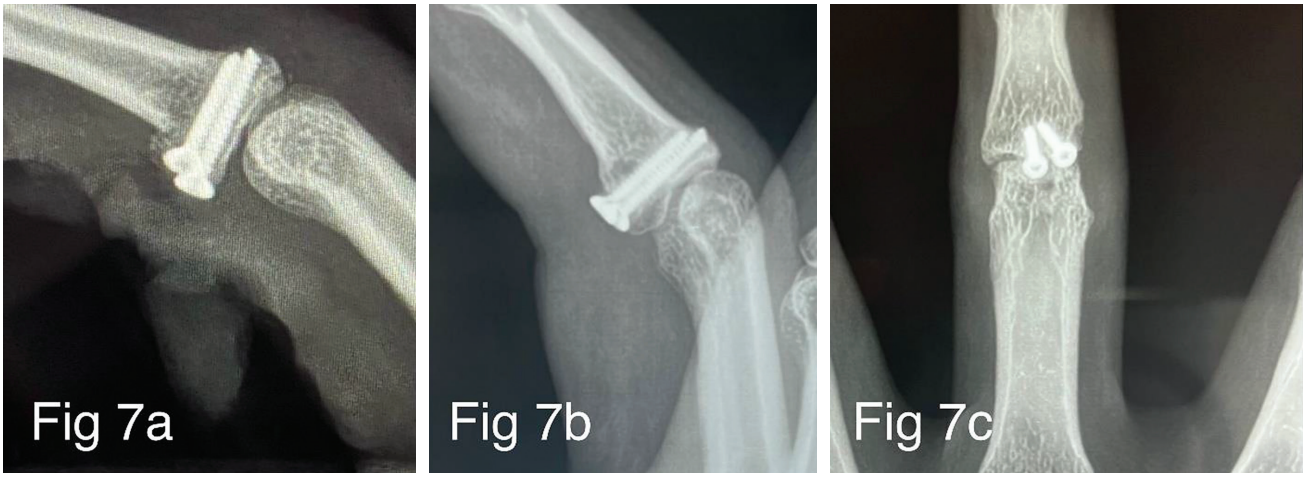

Figure 7. Radiograph immediately post-op **(A)** showed stable reduction. Concavity was a little flat. Radiographs at 36 months follow-up: Lateral and AP views showed signs of remodeling with improvement in the concavity of the graft, which appeared more "flushed" **(B and C)**.

DISCUSSION

This case series demonstrates that hemi-hamate arthroplasty is an effective treatment for PIPJ dorsal fracture-dislocations with substantial articular surface involvement. Our results showed that this technique can achieve satisfactory functional outcomes with reliable graft healing and an acceptable range of motion, even when performed in a delayed fashion. Two systematic reviews analyzed a variety of options in treating these injuries. These included volar plate arthroplasty, ORIF (open reduction, internal fixation), extension block pinning, dynamic external fixation, and percutaneous reduction with K-wire fixation.[9,10] While no treatment option has been accepted as the gold standard, several patient factors were considered for the treatment that will result in the best outcome. Usually, the size and degree of comminution are considered. If the involved segment is smaller than 50% the width of the middle phalanx, percutaneous fixation with K-wires yields the best results in terms of ROM and the least number of complications in two systematic reviews.[10,11] In cases where the volar lip fragment was severely fragmented and could not be fixed by either pin or screws, then volar plate arthroplasty could be used as an option.[10] In addition, due to the technical skill required to perform these surgical procedures, the surgeon's preference should be taken into consideration.

Comparing the results in this small case series with published literature, our results for PIPJ arc of motion (68°, range 45 to 90°) compared favorably, though less reported in four systematic reviews (74.3 to 79.8°).[8-12] The mean PIPJ flexion in this study was 94° (range, 80 to 107), but the mean extension deficit/flexion contracture was 25.8° (range, 10 to 30°). This extension deficit was high compared to studies by Williams (9°), Linderblatt (6.5°), Calfee (19°), Afrendas (10°), and Korambayil (0°).[4,5,8,13,14] This small case series included both acute reconstructions (performed within three weeks) and delayed procedures (up to six months post-injury). The mean delay to surgery of 2.8 months reflects the clinical reality that many of these injuries were either managed conservatively, presented late to hand surgeons, or were missed entirely. This case series suggests that delayed reconstruction does not necessarily compromise outcomes, as all grafts healed successfully regardless of timing. This finding is clinically relevant as it provides surgeons with flexibility in treatment planning and suggests that patients who present late can still benefit from reconstruction.

In our small case series, we noted that the hamate graft was large (Figure 2c). We believe that this may be the reason for the extension deficit/contracture present in our cases, thereby affecting the ROMs of the PIPJ. The large hamate graft is an advantage and provides a stable volar buttress to prevent dorsal subluxation and provide a gliding flexion movement of the PIPJ at the expense of a flexion contracture. This was also noted by Brennan et al.,[15] in their case series of 13 patients. Those with a 'flushed' graft had a higher mean arc of motion (85°) compared to those with a cortical step-off (62°).

A single complication observed in this series highlights an important technical consideration in PIPJ reconstruction. Radial collateral ligament insufficiency and joint subluxation at 48 months post-operatively highlight the relevance of comprehensive soft tissue repair during the primary procedure. This complication likely resulted from inadequate or failed repair of the volar plate to the collateral ligament complex.

In addition, the patient's history of non-compliance with follow-up and physiotherapy may have contributed to this complication, as timely rehabilitation is crucial for maintaining joint stability and preventing contractures.

Several limitations should be acknowledged in interpreting these results. The small sample size of five patients limits the generalizability of our findings and prevents robust statistical analysis. The variable follow-up period makes it difficult to assess long-term outcomes consistently across all patients. Additionally, the study lacks a control group or comparison with alternative treatment methods, which would strengthen the evidence for hemi-hamate arthroplasty.

CONCLUSION

The hemi-hamate arthroplasty can achieve satisfactory functional outcomes with reliable graft healing for PIPJ dorsal fracture-dislocations with substantial articular involvement. While extension deficits are common, patients typically achieve pain-free function with adequate flexion for daily activities. Careful attention to soft tissue repair, particularly the collateral ligament complex, is crucial for preventing long-term instability. The technique appears suitable for both acute and delayed reconstruction, providing surgeons with flexibility in treatment planning.

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DATA AVAILABILITY STATEMENT

Datasets generated and analyzed are included in the published article.

AUTHOR DISCLOSURE

Dr. Estrella is an Associate Editor of the Philippine Journal of Orthopaedics. Dr. Ngui declared no conflict of interest.

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None.

REFERENCES

1. Elfar J, Mann T. Fracture-dislocations of the proximal interphalangeal joint. J Am Acad Orthop Surg. 2013;21(2):88-98. PMID: 23378372 PMCID: PMC5823287 DOI: 10.5435/JAAOS-21-02-88
2. Kiefhaber TR, Stern PJ. Fracture dislocations of the proximal interphalangeal joint. J Hand Surg Am. 1998;23(3):368-80. PMID: 9620177 DOI: 10.1016/S0363-5023(05)80454-X
3. Haase SC, Chung KC. Current concepts in treatment of fracture-dislocations of the proximal interphalangeal joint. Plast Reconstr Surg. 2014134(6):1246-57. PMID: 25415092 PMCID: PMC4241553 DOI: 10.1097/PRS.0000000000000854
4. Williams RMM, Kiefhaber TR, Sommerkamp TG, Stern PJ. Treatment of unstable dorsal proximal interphalangeal fracture/dislocations using a hemi-hamate autograft. J Hand Surg Am. 2003;28(5):856-65. PMID: 14507519 DOI: 10.1016/s0363-5023(03)00304-6
5. Lindenblatt N, Biraima A, Tami I, Giovanoli P, Calcagni M. Hemi-hamate autograft arthroplasty for acute and chronic PIP joint fracture dislocations. Handchir Mikrochir Plast Chir. 2013;45(1):13-9. PMID: 23519711 DOI: 10.1055/s-0033-1337917
6. Hastings H, Capo J, Steinberg B et al. Hemicondylar hamate replacement arthroplasty for proximal interphalangeal joint fracture/dislocations. Presented at 54th Annual Meeting of the American Society for Surgery of the Hand; 1999; Boston, MA.
7. McAuliffe JA. Hemi-hamate autograft for the treatment of unstable dorsal fracture dislocation of the proximal interphalangeal joint. J Hand Surg Am. 2009;34(10):1890-4. PMID: 19969196 DOI: 10.1016/j.jhsa.2009.08.017
8. Calfee RP, Kiefhaber TR, Sommerkamp TG, Stern PJ. Hemi-hamate arthroplasty provides functional reconstruction of acute and chronic proximal interphalangeal fracture-dislocations. J Hand Surg Am. 2009;34(7):1232-41. PMID: 19700071 DOI: 10.1016/j.jhsa.2009.04.027
9. Faulkner H, Graham DJ, Hile M, Lawson RD, Sivakumar BS. Hemi-hamate arthroplasty for base of middle phalanx fracture: a systematic review. Hand (N Y). 2023;18(2):300-6. PMID: 34098748 PMCID: PMC10035091 DOI: 10.1177/15589447211014623
10. Gianakos A, Yingling J, Athens CM, Barra AE, Capo JT. Treatment for acute proximal interphalangeal joint fractures and fracture-dislocations: a systematic review of the literature. J Hand Microsurg. 2020;12(Suppl 1):S9-S15. PMID: 33335365 PMCID: PMC7735550 DOI: 10.1055/s-0040-1713323
11. Demino C, Yates M, Fowler JR. Surgical management of proximal interphalangeal joint fracture-dislocations: a review of outcomes. Hand (N Y). 2021;16(4):453-60. PMID: 31517516 PMCID: PMC8283102 DOI: 10.1177/1558944719873152
12. Frueh FS, Calcagni M, Lindenblatt N. The hemi-hamate autograft arthroplasty in proximal interphalangeal joint reconstruction: a systematic review. J Hand Surg Eur. 2015;40(1):24-32. PMID: 25342651 DOI: 10.1177/1753193414554356
13. Afendras G, Abramo A, Mrkonjic A, Geijer M, Kopylov P, Tägil M. Hemi-hamate osteochondral transplantation in proximal interphalangeal dorsal fracture dislocations: a minimum 4 year follow-up in eight patients. J Hand Surg Eur Vol. 2010;35(8):627-31. PMID: 20511322 DOI: 10.1177/1753193410373311
14. Korambayil PM, Francis A. Hemi-hamate arthroplasty for pilon fractures of finger. Indian J Plast Surg. 2011;44(3):458-66. PMID: 22279280 PMCID: PMC3263275 DOI: 10.4103/0970-0358.90822
15. Brennan C, Dargan D, Haeney J. Hemi-hamate arthroplasty outcomes: a single-centre experience. J Hand Surg Eur. 2024;49(5):637-8. PMID: 37987654 DOI: 10.1177/17531934231212395

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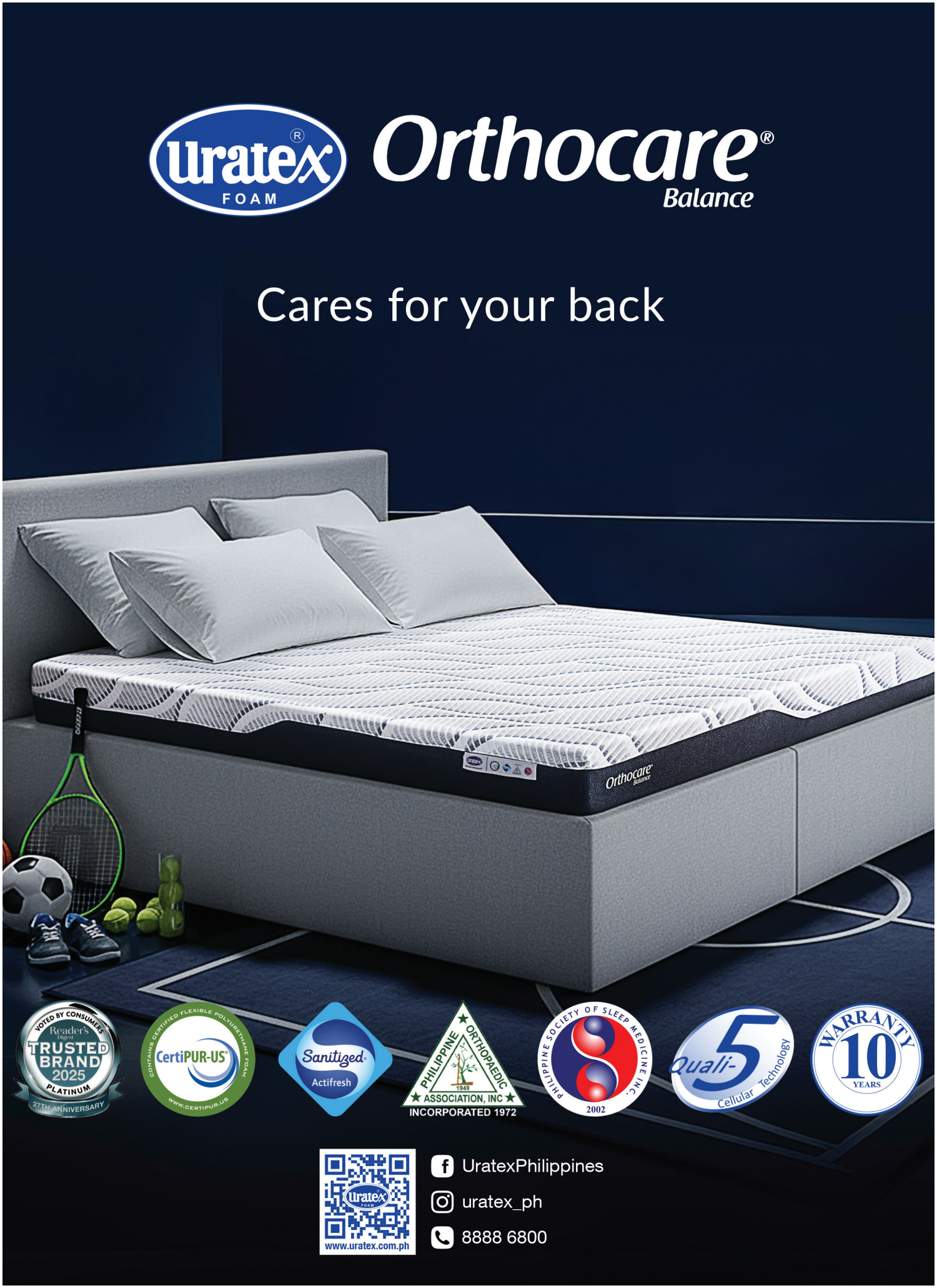

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