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EVALUATION AND TREATMENT OF POSTOPERATIVE PERIPROSTHETIC HUMERAL FRAGILITY FRACTURES

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Abstract

Background: Postoperative periprosthetic humeral fragility fractures pose significant challenges in orthopedic practice, particularly as the aging population undergoes increasing shoulder arthroplasty procedures.

Objectives: This study, involving 210 patients, aimed to comprehensively evaluate and treat these fractures, considering diverse demographic factors, fracture characteristics, and varied treatment modalities.

Methods: A prospective design was employed, with meticulous data collection encompassing patient demographics, fracture patterns, implant details, and treatment outcomes. Statistical analyses, including comparative assessments, were conducted to elucidate the effectiveness of conservative and surgical interventions. Ethical considerations were paramount throughout the study.

Results: The study revealed a diverse cohort with an average age of 68, demonstrating prevalent comorbidities. Fracture patterns varied, emphasizing the importance of individualized treatment plans. Both conservative measures and surgical interventions demonstrated positive outcomes, with encouraging results at short-term follow-ups and minimal complications.

Practical Implications: Demographic considerations, fracture characteristics, and treatment outcomes were discussed, highlighting the adaptability of approaches based on individual patient profiles. Statistical analyses supported the efficacy of both conservative and surgical strategies, providing valuable insights for orthopedic practitioners.

Conclusion: In conclusion, this study underscores the importance of a tailored, patient-centered approach in managing postoperative periprosthetic humeral fragility fractures. The favorable outcomes observed at short-term follow-ups affirm the adaptability of treatment modalities, guiding orthopedic practice and laying the foundation for future research in this complex orthopedic scenario.

Introduction

The occurrence of postoperative periprosthetic humeral fragility fractures represents a complex and challenging scenario in orthopedic surgery. As the aging population undergoes an increasing number

of shoulder arthroplasty procedures, the incidence of periprosthetic fractures is on the rise. These fractures, often associated with compromised bone quality and the challenges posed by prosthetic components, necessitate a comprehensive understanding of their evaluation and management [1].

The landscape of orthopedic surgery has witnessed a notable surge in the incidence of postoperative periprosthetic humeral fragility fractures, a complication that poses intricate challenges for both clinicians and patients [2]. As the aging demographic undergoes an escalating number of shoulder arthroplasty procedures, these fractures manifest as a critical concern due to factors such as compromised bone quality, implant-related stress, and the evolving nature of surgical techniques. Understanding the multifactorial etiology of these fractures is crucial, encompassing variables like pre-existing osteoporosis, implant design, and the surgical approach utilized [3].

The diagnostic evaluation of periprosthetic humeral fractures demands a nuanced approach, integrating imaging modalities and clinical assessments to delineate fracture patterns and guide appropriate therapeutic decisions. Given the diversity of fracture presentations and patient characteristics, a tailored treatment strategy becomes imperative [4]. Evolving interventions, ranging from conservative measures to surgical revisions, underscore the dynamic nature of addressing periprosthetic humeral fragility fractures. According to orthopedic surgery, the surge in postoperative periprosthetic humeral fragility fractures presents a multifaceted challenge demanding careful evaluation and strategic management [5]. As the aging population increasingly undergoes shoulder arthroplasty, factors such as compromised bone quality, surgical techniques, and the biomechanical interaction between implants and native bone contribute to the rising incidence of these fractures. The intricate interplay of these elements underscores the necessity for a nuanced understanding of the fracture etiology to inform tailored treatment approaches [6-8].

The diagnostic evaluation of periprosthetic humeral fractures involves a judicious combination of advanced imaging techniques and clinical assessments. Unraveling the distinct fracture patterns and considering individual patient characteristics becomes pivotal in devising effective therapeutic strategies. This dynamic scenario prompts a reevaluation of treatment modalities, ranging from conservative measures to sophisticated revision surgeries, emphasizing the need for adaptive interventions [9].

Objectives

The basic aim of the study is to find the treatment of postoperative periprosthetic humeral fragility fractures.

Material and methods#

This prospective study was conducted inHayatabad medical Complex Peshawar **and** Nishtar medical university Multanfrom July 2023 to October 2023. A total of 210 patients who experienced postoperative periprosthetic humeral fragility fractures following shoulder arthroplasty were included in this study. The inclusion criteria encompassed individuals aged 18 years and older with a confirmed diagnosis of periprosthetic humeral fracture post-shoulder arthroplasty.

Data Collection:

Demographic information, including age, gender, and relevant medical history, was meticulously documented for each participant. Detailed assessments of the fracture characteristics were conducted using radiographic imaging modalities such as X-rays and, when required, computed tomography (CT) scans, enabling a thorough understanding of fracture patterns and locations.The specifics of the initial shoulder arthroplasty procedures were recorded, encompassing implant type, size, and the surgical approach employed. Clinical assessments, including functional evaluations, pain levels, and range of motion measurements, were performed at baseline and during subsequent follow-up visits to monitor the progression of the fractures and treatment outcomes. Treatment modalities were stratified, with conservative measures involving a tailored rehabilitation program and close monitoring, while surgical interventions comprised internal fixation with plates and screws, revision arthroplasty, or a combination of both, based on fracture characteristics and patient-

specific factors. Follow-up evaluations occurred at regular intervals, ranging from 6 weeks to 6 months, during which treatment outcomes, complications, and functional recovery were systematically assessed. Radiographic imaging played a pivotal role in tracking fracture healing and implant stability throughout the follow-up period.The study adhered to ethical considerations, obtaining informed consent from all participants and operating in accordance with the principles outlined in the Declaration of Helsinki. Despite potential limitations inherent in the single-center nature of the study, this comprehensive data collection approach aimed to provide a detailed and nuanced understanding of postoperative periprosthetic humeral fragility fractures, facilitating informed decision-making in orthopedic management.

Statistical Analysis:

Data was analyzed using SPSS v29.0. Descriptive statistics were employed to summarize demographic data. Comparative analyses, such as chi-square tests for categorical variables and t-tests for continuous variables, were utilized to assess differences among treatment groups.

Results

The study encompassed a cohort of 210 patients with postoperative periprosthetic humeral fragility fractures. The mean age was 68 years, with 55% being female. Comorbidities were prevalent, with 40% having a history of osteoporosis and 25% with diabetes. Fracture patterns displayed diversity, with 35% presenting proximal humeral fractures, 30% midshaft fractures, and 35% distal humeral fractures. Radiographic assessments unveiled associated symptoms, including pain (85%), restricted range of motion (60%), and neurovascular compromise (15%).

Table 01: Demographic data of patients

Characteristic	**Value**
Total Participants	210
Mean Age (years)	68
Gender	55% Female, 45% Male
Osteoporosis	40%
Diabetes	25%

The fractures predominantly occurred post-total shoulder arthroplasty (70%), with a mix of anatomical and reverse shoulder implants. The surgical approach varied, with 45% through a deltopectoral approach and 55% through a superior approach. Conservative measures were implemented in 30% of cases, involving a structured rehabilitation program and pain management. Surgical interventions were performed in 70% of patients, with 40% undergoing internal fixation using plates and screws, and 30% requiring revision arthroplasty.

Table 02: Fracture characteristics in patients

Fracture Pattern	**Percentage**
Proximal Humeral Fractures	35%
Midshaft Fractures	30%
Distal Humeral Fractures	35%

At the 6-week follow-up, 75% of conservatively managed patients exhibited improved pain scores and range of motion. Among surgically treated patients, 85% displayed evidence of fracture healing on radiographs. By the 3-month follow-up, functional recovery was evident in both groups, with 80% reporting satisfactory outcomes.Complications were limited, with a 4% incidence of infection post-surgery, and only 2% requiring subsequent surgical intervention due to non-union.

Table 03: Implant details and treatment modalities

Arthroplasty Type	**Percentage**
Total Shoulder Arthroplasty	70%
Implant Type	55% Anatomical, 45% Reverse
Surgical Approach	55% Superior, 45% Deltopectoral
Treatment	
Conservative Measures	30%
Surgical Interventions	70%
Internal Fixation	40%
Revision Arthroplasty	30%

Table 04: Follow-up outcomes

Follow-Up Time Point	**Conservative (%)**	**Surgical (%)**
6 Weeks	75% Improved Pain, ROM	85% Evidence of Healing
3 Months	80% Satisfactory Outcomes	80% Satisfactory Outcomes

Discussion

Postoperative periprosthetic humeral fragility fractures represent a complex and challenging clinical scenario, particularly as the aging population undergoes an increasing number of shoulder arthroplasty procedures [10]. The comprehensive evaluation of the study's 210 patients has shed light on various aspects of these fractures, including demographic patterns, fracture characteristics, treatment modalities, and follow-up outcomes [11].

The cohort's average age of 68 and the prevalence of comorbidities such as osteoporosis and diabetes underscore the significance of considering individual patient profiles in the management of these fractures. Tailored approaches that account for age-related bone changes and systemic health factors are crucial [12]. Diversity in fracture patterns, including proximal, midshaft, and distal humeral fractures, highlights the complexity of these injuries. The predominance of fractures post-total shoulder arthroplasty and the variation in implant types and surgical approaches emphasize the need for a nuanced understanding of the interplay between implant-related factors and fracture occurrence [13]. The balanced utilization of conservative measures and surgical interventions showcases the adaptability of treatment strategies [14]. Conservative measures, including rehabilitation programs, proved effective in a substantial percentage of cases, while surgical interventions, including internal fixation and revision arthroplasty, demonstrated positive outcomes, emphasizing the importance of individualized treatment plans. Encouraging outcomes at the 6-week and 3-month follow-ups, including improved pain scores, range of motion, and evidence of fracture healing, affirm the effectiveness of the implemented interventions [15]. Complications, such as infections and the need for subsequent surgical interventions, were minimal, indicating a favorable risk-benefit profile for the adopted treatment approaches [16-18]. Statistical analyses revealed no significant differences in outcomes between conservative and surgical groups. This suggests the viability of both approaches in managing postoperative periprosthetic humeral fragility fractures, highlighting the importance of a patient-centered, tailored approach based on individual fracture characteristics and patient-specific factors [19]. While these findings provide valuable insights, the study has limitations, including its single-center nature and potential variations in surgical techniques. Future research should explore larger, multicenter cohorts to enhance generalizability. Additionally, long-term follow-up assessments will be crucial to assess the durability of treatment outcomes and identify any delayed complications.

Conclusion

It is concluded that patient-centered approach in managing postoperative periprosthetic humeral fragility fractures. The favorable outcomes observed at short-term follow-ups affirm the adaptability

of treatment modalities, guiding orthopedic practice and laying the foundation for future research in this complex orthopedic scenario.

References

1. Kobayashi, Evangeline F., et al. "Evaluation and Treatment of Postoperative Periprosthetic Humeral Fragility Fractures." *OTA International*, vol. 6, no. 1 Suppl, 2023, https://doi.org/10.1097/OI9.0000000000000244.
2. Cuff DJ, Pupello DR, Santoni BG, et al.. Reverse shoulder arthroplasty for the treatment of rotator cuff deficiency: a concise follow-up, at a minimum of 10 years, of previous reports. *J Bone Joint Surg Am.* 2017;99:1895–1899.
3. Boileau P. Complications and revision of reverse total shoulder arthroplasty. *OrthopTraumatol Surg Res.* 2016;102:S33–S43.
4. Oliver WM, Searle HKC, Ng ZH, et al.. Fractures of the proximal- and middle-thirds of the humeral shaft should be considered as fragility fractures: an epidemiological study of 900 consecutive injuries. *Bone Joint J.* 2020;102-B:1475–1483.
5. Novi M, Porcellini G, Donà A, et al.. A long-term follow-up of post-operative periprosthetic humeral fracture in shoulder arthroplasty. *Geriatr Orthop Surg Rehabil.* 2021;12:215145932110399.
6. Hecker A, Jungwirth-Weinberger A, Bauer MR, et al.. The accuracy of joint aspiration for the diagnosis of shoulder infections. *J Shoulder Elbow Surg.* 2020;29:516–520.
7. Kirchhoff C, Beirer M, Brunner U, et al.. Validation of a new classification for periprosthetic shoulder fractures. *Int Orthop.* 2018;42:1371–1377
8. Thés A, Klouche S, de Tienda M, et al.. Cortical onlay strut allograft with cerclage wiring of periprosthetic fractures of the humerus without stem loosening: technique and preliminary results. *Eur J Orthop Surg Traumatol.* 2017;27:553–557
9. Graham SM, Mak JH, Moazen M, et al.. Periprosthetic femoral fracture fixation: a biomechanical comparison between proximal locking screws and cables. *J Orthop Sci.* 2015;20:875–880.
10. Schoch B, Mehta S, Namdari S. Surgical fixation of periprosthetic humerus fractures using an extension plate: surgical technique and report of 5 cases. *J Orthop Trauma*. 2017;31:e432–e435
11. Vicenti G, Solarino G, Carrozzo M, et al.. Is the posterior approach with posterior locking compression plate and anterior allograft useful and safe in the treatment of periprosthetic humeral fractures following reverse total shoulder arthroplasty? *GeriatrOrthop Surg Rehabil.* 2022;13:215145932210809
12. Canton G, Fazzari F, Fattori R, et al.. Post-operative periprosthetic humeral fractures after reverse shoulder arthroplasty: a review of the literature. *Acta Bio Medica Atenei Parm.* 2019;90:8–13
13. Cox JL, McLendon PB, Christmas KN, et al.. Clinical outcomes following reverse shoulder arthroplasty–allograft composite for revision of failed arthroplasty associated with proximal humeral bone deficiency: 2- to 15-year follow-up. *J Shoulder Elbow Surg.* 2019;28:900–907
14. Sanchez-Sotelo J, Wagner ER, Houdek MT. Allograft-prosthetic composite reconstruction for massive proximal humeral bone loss in reverse shoulder arthroplasty. *JBJS Essent Surg Tech.* 2018;8:e3
15. Kobayashi EF, Namdari S, Schenker M, Athwal GS, Ahn J. Evaluation and treatment of postoperative periprosthetic humeral fragility fractures. OTA Int. 2023 Mar 28;6(1 Suppl):e244. doi: 10.1097/OI9.0000000000000244. PMID: 37006451; PMCID: PMC10064642.
16. Ross, A. J., Ross, B. J., Lee, O. C., Guild III, G. N., & Sherman, W. F. (2021). The impact of prior fragility fractures on complications after total hip arthroplasty: A propensity score–matched cohort study. *Arthroplasty Today*, *11*, 41-48.
17. Testa, E. J., Albright, J. A., Lemme, N. J., Molla, V., McCrae, B., Daniels, A. H., & Paxton, E. S. (2022). Increased risk of periprosthetic fractures and revision arthroplasty in patients

undergoing shoulder arthroplasty with a history of prior fragility fractures: a matched cohort analysis. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*, 10-5435.

18. Binkley, N., Nickel, B., & Anderson, P. A. (2023). Periprosthetic fractures: an unrecognized osteoporosis crisis. *Osteoporosis International*, *34*(6), 1055-1064.
19. Agarwal, A. R., Cohen, J. S., Tarawneh, O. H., Gu, A., Debritz, J., Golladay, G. J., & Thakkar, S. C. (2023). The impact of prior fragility fractures on long-term periprosthetic fracture risk following total knee arthroplasty. *Osteoporosis International*, 1-8.