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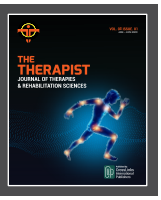

Original Article

Analyzing the Key Predictors of Implant Cut Out in DHS-Treated Intertrochanteric Fractures: A Comprehensive Investigation

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ABSTRACT

Intertrochanteric fractures are osteoporotic fractures in nature that mainly affect elderly people and lead to disability annually. This creates a burden on the healthcare system and results in significant resource usage, attention to medical needs, and rehabilitative care. **Objective:** To identify and analyze the key factors associated with intertrochanteric fractures. **Methods:** A cross-sectional study was conducted at Khawaja Muhammad Safdar Medical College (KMSMC) in Sialkot, Pakistan. This observational study enrolled 137 patients, with 63 males (46%) and 74 females (54%). **Results:** The average age of the selected group was 64.55±14.26 years. It was highlighted that most of the fractures (52%) were on the right side, this features a potential asymmetry in fracture development. Secondly, falls were recognized as the prime reason for intertrochanteric fractures, as it accounts for 65% of the cases. As per fracture classification taken into account, stable fractures (64%) were the most common type noticed. Furthermore, a large part of patients (76%) encountered a positive outcome in terms of union, mentioning a successful healing of the fractures. Besides, a notable percentage (52%) of the cases exhibit good reduction, demonstrating functional alignment of fractured bone segments in the course of the treatment procedure. **Conclusions:** The present study deduced that a remarkable number of fractures were observed on the right side, specifying a possible imbalance in fracture occurrence. Furthermore, falls were regarded as the primary cause of intertrochanteric fractures. Majority were stable in nature with positive union outcomes and showed a good reduction.

INTRODUCTION

Hip fractures are usually linked with poor bone quality, this underlines the crucial need for correct positioning of metalwork within the femoral head. It is also equally vital for implants to possess the strength and resilience needed to resist the development of cut-outs [1]. Intertrochanteric fractures, manifests higher death rates and complex impediments rendering them especially concerning [2]. They comprise hip fractures and which responsible for burdening the healthcare system as they cause millions of disabilities per Anum [3]. Inter-trochanteric fractures, are mostly seen in the geriatrics. So, this requires treatment aimed at restoring early mobility to lessen complications and return patients to their pre-operative state. Prompt surgical intervention is considered most important for

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elderly patients with intertrochanteric fractures [4]. The dynamic hip screw (DHS) is the prevailing gauge and standard for assessing outcomes, especially in stable intertrochanteric fractures. Over the past decades, the treatment of intertrochanteric fractures has noticed considerable improvements, with various fixation devices emerging and fading. But still, the choice of treatment relies on the fracture type and bone quality. The DHS has long been counted as the benchmark for fixing intertrochanteric fractures, particularly the stable fracture types [5]. The dynamic hip screw (DHS) is considered the ideal way out for intertrochanteric fracture fixation, earning its position as the gold standard implant [6]. For optimum post-surgical results, it is prudent to address a displaced joint by employing a recommended device in conjunction with DHS fixation. This method underlines the remarkable efficacy of DHS, yielding impressive outcomes and forming a foundation for further enhancing joint stabilization [7]. Implants must undergo a consequential number of loading cycles with sub-critical amplitudes, which can upshot in a failure mode often known as implant cut-out. Cut-out is the prime mechanical problem observed in trochanteric fractures. Various factors are responsible for this, such as age, osteoporosis, fracture type, reduction quality, and potential mispositioning of the lag screw. However, there is ongoing controversy and debate surrounding these factors [8]. Three crucial factors contributory to mechanical failures in the internal fixation of extracapsular proximal femoral fractures consist of male gender, non-anatomic reduction, and misalignment of the lag screw [9]. The widespread mechanical problem with the hip screw system is implant cut-out. Ensuring precise fracture reduction is vital to lessen cut-out risks [10]. Avoiding increased anterior hip screw placement is crucial [11]. It can also affect joint biomechanics and result in pain or limited range of motion. Precise positioning according to surgical guidelines is essential for optimal outcomes [12]. The DHS augments stress distribution in fractured bone, positioning it more closely with intact bone [13]. It also lessens the likelihood of post-operative problems in comparison to orthodox internal fixation methods [14]. Choosing for screw placement within lower half of femoral head has established to be a considerable deterrent compared to fixation collapse [15]. Alongside, the association between technical failures and the surgical method becomes noticeable. Fascinatingly, attaining exact alignment between the neck and shaft emerges as non-essential for completing a successful screw placement [16]. Furthermore, the employment of a guidewire showed satisfactory results, mostly when confronting complications in closed reduction scenarios [17]. This emphasizes the efficacy of employing a guidewire as a treasured asset in complicated cases. Ultimately, emphasizing the imperative of precise placement remains paramount prior to embarking on the insertion of the hip screw [18]. This study aims to not only bargain treasured insights into intertrochanteric fractures but also to pave the way for upcoming research endeavors. By shedding light on the main reasons related with these fractures, it will also offer a solid foundation for further inquiries in this field, driving progress and revolution in the understanding and handling of intertrochanteric fractures.

METHODS

An analytical cross-sectional study focusing on intertrochanteric fractures was steered at orthopedics department of Khawaja Muhammad Safdar Medical College (KMSMC) Sialkot, Pakistan from January 2016 to December 2019. A total of 137 members were included in the study, and their data were composed from patient records accessible in the department. The researchers employed a non-probability convenient sampling technique to select the participants based on their convenience and appropriateness. The study encompasses individuals of all ages and genders who had intertrochanteric fractures. Certain cases, such as medical board cases and those where intertrochanteric fractures were not diagnosed, were excluded from the study to ensure the reliability of the data. To analyze the data, frequencies, and percentages were calculated for different types of intertrochanteric fractures. These statistics were recorded in a separate Excel sheet. SPSS version 21.0 software was used for data analysis and interpretation. Before commencing the research, ethical approval was obtained from the Research Ethics Committee (REC) of KMSMC, Sialkot, under reference number 103/REC/KMSMC, dated 06-06-2023. This ensured that the study adhered to ethical guidelines and safeguarded the rights and well-being of the participants.

RESULTS

A study was conducted, enrolling a total of 137 patients, including 63 males (46%) and 74 females (54%). The patients' mean age was 64.55±14.26 years, with a minimum age of 37 years and a maximum age of 95 years. Details are given in Tables 1 and 2.

Table 1: Gender characteristics in frequency and percentages

Gender	Frequency (%)
Males	63 (45.99)
Females	74 (54.01)
Total	137 (100)

Table 2: Age characteristics in frequency and percentages

Age (years)	Minimum	Maximum	Median	Mean ± SD
Males	37	95	63	63.17±14.61

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Females	39	94	65.5	65.73±13.94
Total	37	95	64	64.55±14.26

The fracture details, including information on the side, etiology, type, outcome, and reduction, are presented in Tables 3 - 7. Gender is an important factor to consider when it comes to bones and fractures. As a result, in addition to overall fracture information for features such as side, etiology, kind, outcome, and reduction, gender comparison and M:F ratio are also stated as a subject of study. Examining fractures by side, it was found that 48% of the patients (M: F = 0.57:1) had left-sided fractures, while 52% (M: F = 1.22:1) had right-sided fractures (Table 3).

Table 3: Fracture Side by Left and Right

Fracture side	Left; n (%)	Right; n (%)
Males	24 (17.52)	39 (28.47)
Females	42 (30.66)	32 (23.35)
Total	66 (48.18)	71 (51.82)

The etiology of fractures revealed that falls were the predominant cause, accounting for 65% of cases (M: F = 0.68:1). Road traffic accidents (RTA) accounted for 33% of cases (M: F = 1.37:1), while physical assault accounted for 2% of cases (M: F = 0.5:1) (Table 4).

Table 4: Fracture etiology by fall, Physical assault, and RTA

Fracture etiology	Fall; n (%)	Physical assault; n (%)	RTA; n (%)
Males	36 (26.28)	1 (0.73)	26 (18.98)
Females	53 (38.68)	2 (1.46)	19 (13.87)
Total	89 (64.96)	3 (2.2)	45 (32.85)

The fractures were classified into two types: stable and unstable. The majority of cases were characterized as stable fractures, accounting for 64% of the total (with a male-to-female ratio of 0.87:1). Following stable fractures, unstable fractures comprised 36% of the cases (with a male-to-female ratio of 0.81:1) (refer to Table 5).

Table 5: Fracture Type by Stable and Unstable

Fracture side	Stable; n (%)	Unstable; n (%)
Males	41 (29.93)	22 (16.06)
Females	47 (34.30)	27 (19.71)
Total	88 (64.23)	49 (35.77)

The analysis of fracture outcomes based on union revealed that the majority of patients experienced successful union, accounting for 86% of the cases (with a male-to-female ratio of 0.97:1). The second most common outcome was follow-up-lost, which accounted for 7% of cases (with a male-to-female ratio of 0.29:1). Additionally, there were cases of cut-out, comprising 5% of the total (with a male-to-female ratio of 0.4:1), and a small proportion of patients who unfortunately expired, accounting for 2% of cases (with a male-to-female ratio of 0.5:1) (refer to Table 6).

Table 6: Fracture Outcome by Union, Cut-Out, Expired, and Follow-Up Lost

Fracture outcome	Union	Cut-out	Expired	Follow-up Lost
Males	58 (42.33)	2 (1.46)	1 (0.73)	2 (1.46)
Females	60 (43.80)	5 (3.65)	2 (1.46)	7 (5.11)
Total	118 (86.13)	7 (5.11)	3 (2.19)	9 (6.57)

The assessment of fracture reduction was done via radiological investigations. These indicated that the majority of fractures exhibited good reduction, accounting for 52% of cases (with a male-to-female ratio of 0.97:1). Following good reduction, a significant proportion of fractures were classified as acceptable, comprising 33% of the total (with a male-to-female ratio of 0.67:1). There were also cases of poor reduction, representing 15% of the fractures (with a male-to-female ratio of 0.91:1) (refer to Table 7).

Table 7: Fracture Reduction by Good, Acceptable, and Poor

Fracture reduction	Good	Acceptable	Poor
Males	35 (25.55)	18 (13.14)	10 (7.30)
Females	36 (26.27)	27 (19.71)	11 (8.03)
Total	71 (51.82)	45 (32.85)	21 (15.33)

DISCUSSION

Findings from a retrospective cohort study led in Italy shed light on an important observation: intertrochanteric fractures are more widespread among women than men [19]. This study also emphasizes this gender-specific discrepancy, indorsing that female practiced an advanced frequency of fractures compared to their male counterparts. Intertrochanteric fractures are categorized among the most commonly occurring fractures among elderly persons. In 2019 research was conducted in India to clarify on the main environmental factors that contribute to intertrochanteric fractures. According to the aforementioned study, the three noteworthy causes were falls from standing height, road traffic accidents, and slips on wet floors [20]. This study also underlines falls and road traffic accidents followed by as the main reasons for factors. In a prospective study, it was found that among men, common causes included sporting injuries and vehicle accidents. However, in the case of females, physical assaults and falls emerged as highlighted factors [21]. This study aligns with the aforementioned results for men but emphasizes falls as the primary cause of intertrochanteric fractures in females. A randomized controlled trial discloses that a large number of patients with intertrochanteric fractures demonstrate an unstable pattern [22]. However, this study points to the greater occurrence of stable intertrochanteric fracture cases among males and females. A retrospective study held at an academic medical center in New York discloses that most fractures lead to union. The study employed operative

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records and radiographs to detect appropriate candidates for investigation [23]. This research study also emphasizes that a meaningful proportion of fractures, exclusively 86%, achieved union. By assessing fracture reduction, a retrospective study held in Turkey showed that a majority of the fractures (77.5%) met the principles for appropriate reduction [24]. This research study focuses on the assessment of fracture reduction in intertrochanteric fractures, showing that a majority (52%) of the cases attained good reduction.

CONCLUSIONS

The present study highlights several valuable aspects of intertrochanteric fractures. Firstly, it was detected that many of these fractures appeared on the right side, accounting for 52% of the cases. This data can be useful for clinicians while assessing patients with suspected intertrochanteric fractures. Secondly, falls were categorized as the leading reason for intertrochanteric fractures, providing 65% of the cases. This focuses on the significance of fall restraint strategies and involvements to decrease the numbers of such fractures among susceptible populations, such as older people. The study also grouped the fractures into stable and unstable types, with stable fractures indicating the widely held at 64%. Recognizing the distribution and characteristics of several fracture classes is cardinal for suitable treatment scheduling and decision-making. Likewise, the study highlights the outcome of these fractures and found that a meaningful proportion (76%) rose in the union. This proposes that most patients faced successful healing and recovery. In terms of fracture reduction, 52% of cases attained good reduction. This specifies that the anatomical orientation of the fractured bones was well-restored, which is important for optimal functional consequences and long-term permanence. Largely this study specifies a comprehensive overview of intertrochanteric fractures, stress important factors such as fracture side, contributing factors, fracture classes, outcomes, and reduction quality.

Authors Contribution

Conceptualization: OFT, NMB
Methodology: MMA, NAB
Formal analysis: DM, WN
Writing-review and editing: TH, MAH, RA, OFT

Author have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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