ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 12 | December - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PREDICTOR OF SCREW CUT-OUT AFTER CEPHALOMEDULLARY NAIL FIXATION OF INTERTROCHANTERIC FRACTURES: A PROSPECTIVE OBSERVATIONAL STUDY

Orthopaedics

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ABSTRACT

Introduction: Screw cut-out is one of the most dreaded complication of cephalomedullary nailing of femur. There are various radiological parameters to predict this complication. The aim of this study is to use Parker's ratio as a predictor of screw cut-out, and to test its reliability in predicting screw cut-out. **Method:** The study was conducted on 52 patients of 60-85 years of age undergoing cephalomedullary femoral nailing for intertrochanteric femur fractures (AO/OTA 31A1, 31A2 and 31A3). Parker's ratio was calculated using post-operative radiograph. Patient was followed up 14 days, 30 days, 3 months, 8 months and 1 year after surgery to check for screw cut-out. **Results:** A total of 6 patients suffered from screw cut-out post-operatively out of 52 (11.53%). 5 out the 6 patients with AP Parker's ratio (PR) >66 i.e. superiorly placed lag screw, experienced cut-out, in contrast to 1 out 45 with PR between 33-66 and zero in patients with PR <33 (p=0.00). Similarly, 3 out of 7 patients with lateral PR >66, i.e. anteriorly placed screw, suffered from this complication, as compared to 3 out of 43 with PR between 33-66 and zero pateints with PR <33 (p=0.0001). **Conclusion:** Our work concludes that Parker's ratio is a significant predictor of screw cut-out, with a ratio of between 33-66 in both AP and lateral predicting good outcome post-operatively.

KEYWORDS

Intertrochanteric fractures, Cephalomedullary nails, Parker's Ratio, Cut-out

INTRODUCTION

With increasing average life expectancy, there is a parallel increase in the elderly population and this has also been shown to have increased the incidence of geriatric fractures.[1] Proximal femoral fractures are one of the most common types of fracture in the elderly population worldwide with a global incidence of over 182.5 per 100,000 person-years. Due to an aging population and increased life expectancy worldwide, the burden of these fractures on health care systems is increasing.[2]

Hospital-based studies suggest that hip fractures are common in India too. A recent study from North India shows an annual incidence rate of 163 and 121 per 100,000 per year in women and men, respectively, above the age of 55 years. Additionally, it has been suggested that hip fractures occur at an earlier age in Indians in comparison with western counterparts with the peak age for hip fractures in Indians occurring in their 60s.[3]

About half of proximal femoral fractures are intertrochanteric fractures (AO type 31-A1, A2, or A3).[2] Intertrochanteric fracture is a major cause of mortality, morbidity and loss of functional autonomy in the elderly.[4] Intertrochanteric fractures are defined as extracapsular fractures of the proximal femur that occur between the greater and lesser trochanter.[5]

Screw cut-out or back-out is the most common mechanical complication of the osteosynthesis of intertrochanteric fractures. This complication determines a significant increase in morbidity in elderly patient.[6] Surgical treatment of cut-out might lead to further complications, longer rehabilitation, increased social burden and healthcare system costs[6]. The aim of the study is to use Parker's ratio as a radiological predictor of cut-out to prevent its occurrence in elderly patients, who most often suffer from such fractures.[6]

MATERIALS AND METHOD

Study Design/Study Type:

Prospective observational study.

Source Of Data:

Intertrochanteric fractures treated with cephalomedullary femoral nailing (CMN) done at Department of Orthopaedics, Peoples Hospital, Bhanpur, associated with Peoples College of Medical Sciences and Research Centre (tertiary medical centre), after approval by institutional ethical committee and written informed consent from the patients, operated over a period of November 2022 to January 2024.

Study Participants:

The study included 52 elderly patients.

Inclusion criteria consisted of close intertrochanteric fractures (AO 31A1, 31A2 and 31A3), and patients within the age group of 60-85 years.

Exclusion criteria included patients below 60 years and above 85 years, open fractures, and pathological fractures.

Operative Procedure:

After obtaining ethical clearance from institutional ethical committee and informed written consent, patients were registered and operated by a minimally invasive approach for intramedullary nail insertion.

The CMN used in the study had the following specifications: the short CMN was 25 cm in length, while the long CMN was available in lengths of 36, 38, 40, and 42 cm, all with a proximal diameter of 15mm and a proximal nail angulation of 6 degrees. The distal diameter options were 9, 10, 11, and 12mm, with a lag screw diameter of 8mm and a de-rotation screw diameter of 6.2mm. The distal locking bolt measured 4.9mm in diameter.

Tip-apex distance (TAD) of the lag screw, i.e. sum of distances from tip of lag screw to apex of femoral head on AP and lateral views on fluoroscopy, was kept as <25mm.

Post-Operative Assessment:

Patients were assessed post operatively using pelvis bilateral hip (PBH) radiographs- anteroposterior (AP) and lateral views- and Parker's ratio AP and lateral are calculated using that radiograph.

Parker's ratio involves recording the superior, inferior, anterior and posterior borders of the femoral head (figure). A is considered to be a point on the inferior (in the AP view) and posterior (in the lateral view) border of the femoral head. B is the mid-point of the lag screw. C is considered to be a point on the superior (in the AP view) and anterior (in the lateral view) border of the femur. The distances AB and AC are measured and the position of the centre of the lag screw in relation to the femoral head is calculated by the ratio of AB and AC multiplied by 100. The ratio is calculated in both the AP and lateral views to give a value within a range of 0 to 100 for each view. In the AP view, 0 is considered to be the most inferior screw placement and 100 is considered to be the most superior pin placement. In the lateral view, 0 is considered to be the most posterior screw placement and 100 is

considered to be the most anterior pin placement.[7]

Patient were then followed up at 14 days, 30 days, 3 months, 8 months and 1 year after surgery and PBH AP and lateral radiographs were done at each follow-up to check for screw cut out. Cut-out was defined as projection of the lag screw from the femoral head by more than 1 mm.[8]

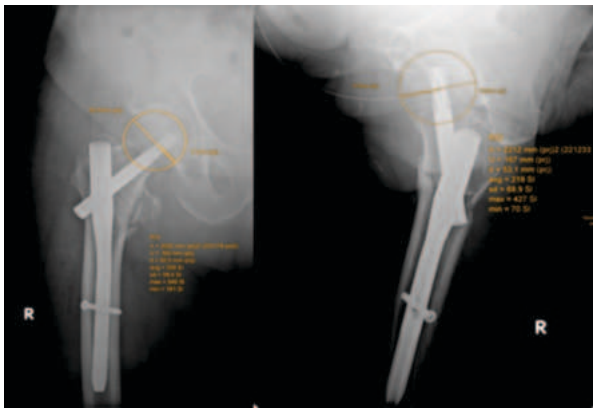

Figure 1: Assessment of the Parker's ratio anterior–posterior view and lateral view.

Statistical Analysis:
Data was compiled using Microsoft Excel and analysis was done with the help of IBM SPSS software version 20. p value < 0.05 was taken as significant.

RESULTS

A total of 52 patients participated in the study. The summarized details of the participants baseline characteristics are presented in Table 1.

Table 1. Baseline patient characteristics

Patient Variables	Number of patients
Age (in years)	
60-70	31 (59.6%)
71-80	16 (30.7%)
81-85	5 (9.6%)
Gender	
Female	30 (57.6%)
Male	22 (42.3%)
Side of Injury	
Left	21 (40.3%)
Right	31 (59.6%)
Mode of Injury	
Fall	35 (67.3%)
Road Traffic Accident	17 (32.6%)
AO/OTA Classification	
AO 31A1	7 (13.4%)
AO 31A2	29 (55.7%)
AO 31A3	16 (30.7%)
Type of CMN	
Long CMN	27 (51.9%)
Short CMN	25 (48.07%)

A total of 6 patients suffered from screw cut-out post-operatively out of 52 (11.53%).

5 out the 6 patients with AP Parker's ratio (PR) >66 i.e. superiorly placed lag screw, experienced cut-out, in contrast to 1 out 45 with PR between 33-66 and zero in patients with PR <33 (p=0.00).

Similarly, 3 out of 7 patients with lateral PR >66, i.e. anteriorly placed screw, suffered from this complication, as compared to 3 out of 43 with PR between 33-66 and zero pateints with PR <33 (p=0.0001). Summarised details of the same are in Table 2.

Table 2. Correlation of Parker's ratio with incidence of screw cut-out

Parker's Ratio	Number of patients	Screw Cut-out	Percentage
Parker's Ratio AP			
<33	1	0	0
33-66	45	1	2.22
>66	6	5	83.33
		p-value	0.00
Parker's Ratio Lateral			
<33	2	0	0
33-66	43	3	6.97
>66	7	3	42.85
		p-value	0.0001

DISCUSSION

The study included a total of 52 subjects, with 27 patients operated with long CMN and 25 with short CMN. The distribution of study subjects was based on age categories. Majority of the patients in present study were aged between 60 to 70 years. Similar results were obtained by various authors. **Temiz A et al**[9] in their study found that most of the patients were aged 65 to 81. In **Berger-Groch J et al**[10] study, mean age of 81.2 ± 9.2 years. **Nherera L et al**[11] found that mean age in their study was 77 years. As per **Pfeilschifter J et al**[12], the density of bones gradually decreases as a person gets older, leading to a higher likelihood of developing osteoporosis. This explains the fact that as age increases, prevalence of fracture increases.

A few studies have investigated predictors of cut-out based on samples that were purely treated with intramedullary devices. The earliest of these studies, by **Geller et al**[13], showed that a Tip-Apex Distance (TAD) > 25 mm was predictive of cut-out. A subsequent study by **Lobo-Escolar et al**[14] found that higher TAD and suboptimal osteosynthesis were predictive. **Kashigar et al**[15] reported that a higher calcar referenced tip-apex distance (CalTAD), a novel measurement index of implant position first described in a biomechanical study by **Kuzyk et al**[16], was predictive. **Ibrahim et al**[17] in his study concluded that Parker's ratio (PR) was not a reliable predictor of screw cut-out post-operatively.

In contrast to that, we found in our study that Parker's ratio in the range of 33-66 i.e. a centrally placed lag screw, led to very low incidence of screw cutout. However, superiorly placed screws (PR >66) led to drastic increase in screw cut out frequencies, so does anteriorly placed screws (PR >66 in lateral view). Our study, is more in concordance with **Murena et al**[6], who to found out that PR is indeed a reliable predictor of lag screw cut-out.

CONCLUSION

Screw cut-out is a dreaded complication of cephalomedullary nailing that should be avoided at all costs. Though our study concludes that Parker's ratio is a reliable predictor of screw cut-out, there are other parameters as well that should be taken care of while using CMNs, like keeping TAD and CalTAD <25mm and ensuring proper reduction of fracture and using adequately sized lag screw. Parker's ratio tells us about the centricity of screw placement, which is highly desirable to reduce the incidence of screw cut-out.

In the end, the treatment should be customized to the patient and the surgeon's competence to carry out the procedure safely. Further research, including prospective studies with larger sample sizes, is necessary to fully assess the impact of radiological parameters like Parker's ratio on postoperative outcome.

Funding
No dedicated funding secured for this study.

Conflicts Of Interest
No conflicts of interest to declare.

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