Functional Outcome And Mortality Assessment Following Proximal Femoral Nailing In Inter Trochanteric Fracture

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ABSTRACT
Intertrochanteric fractures constitute one of the most typical fractures of the hip. The incidence of fractures in the trochanteric area has risen with an increase in numbers of the older person with osteoporosis. Mortality, morbidity ratios are increasing in patients with inter-trochanteric fractures. Advanced age and associated co-morbidities are two primary added source for high mortality in trochanteric fracture patients. We conducted this study to assess the mortality rate and the functional outcome in inter-trochanteric fractures after proximal femoral nailing. This is a prospective study, in which 60 Intertrochanteric fractures of femur patients who came to our hospital EMS. Inclusion and Exclusion criteria were included in this study and were done from a period from January 2014 to July 2017. They were evaluated on each follow-up clinically using Harris Hip score and radiologically using RUST score. The overall mortality rate at the end of the 3-year follow-up in our study is 13.3%. The factor which significantly influenced the mortality rate was Coronary artery disease. Four patients had implant-related complications. One patient developed non-union, which was later revised with Bipolar Hemiarthroplasty. One patient developed screw back out, and two patients developed screw breakage. Results of our study concluded that elderly patients of age group 75-89 years of age were at higher risk for intertrochanteric fractures. Associated comorbid condition plays a significant role in the mortality of this fractures. In our study, coronary artery disease had a significant influence on the mortality rate for intertrochanteric fractures with a 4.63 fold rise in the mortality rate for these patients.

INTRODUCTION
Intertrochanteric fractures constitute one of the commonest fractures of the hip. The incidence of fractures in the trochanteric area has risen with an increase in numbers of elderly person with osteoporosis (Gullberg et al., 1993). The imperative goals of treatment are early mobilisation using stable fixation using them as minimally invasive procedure as possible. Nowadays, there is an increasing interest in intramedullary nailing, especially for unstable inter-trochanteric fractures (Baumgaertner et al., 1998). Mortality, morbidity ratios are increasing in patients with inter-trochanteric fractures. Advanced age and associated co-morbidities...
are two primary added source for high mortality in trochanteric fracture patients. Individuals suffering from intertrochanteric fractures should be mobilised as early as possible because there is a high incidence of thromboembolic insult, urinary tract infection and pneumonia. One of the main problem in the outcome of this type of fragility fracture in patients low level of interest in returning to daily activities. Although most of the authors in literature recommend no delay in surgery and early mobilisation to prevent mortality and morbidity, still this topic is controversial. Factors related to senility, such as the presence of other diseases, physical weakness, poly-pharmacy adversely affect the treatment outcome. This study aims to assess the mortality rate and the functional outcome in inter-trochanteric fractures after proximal femoral nailing.

Figure 1: Pre-operative X-rays

Figure 2: Immediate post-operative X-rays

Figure 3: 6 months post-operative x-rays

Statement of informed consent
Written informed consent was obtained from the patient and Ethics Committee for the publication of

Figure 4: Clinical Outcome showing excellent results

Figure 5: Clinical Outcome showing excellent results

Figure 6: Clinical Outcome showing excellent results

Figure 7: Pre-operative x-rays
Table 1: Age distribution

| Age     | 30-44 | 45-59 | 60-74 | 75-89 | >90 |
|---------|-------|-------|-------|-------|-----|
| No. of patients | 4    | 14    | 16    | 24    | 2   |
| Percentage  | 6.6%  | 23.3% | 26.6% | 40%   | 3.3% |

Table 2: Gender distribution

| Gender  | Frequency | Percentage |
|---------|-----------|------------|
| Male    | 43        | 72         |
| Female  | 17        | 28         |
| Total   | 60        | 100        |

Table 3: Mode of injury

| Mode of injury      | Frequency | Percentage |
|---------------------|-----------|------------|
| Fall                | 46        | 77         |
| Road traffic accident | 14       | 23         |

Table 4: Distribution of classification

| Boyd and Griffin Grade | Frequency | Percentage |
|------------------------|-----------|------------|
| I                      | 0         | 0          |
| II                     | 35        | 58.3       |
| III                    | 4         | 7          |
| IV                     | 21        | 34         |

Table 5: Distribution by ASA

| American Society of Anaesthesiologists Score | Frequency | Percentage |
|----------------------------------------------|-----------|------------|
| I                                            | 23        | 38.33      |
| II                                           | 20        | 33.33      |
| III                                          | 8         | 13.33      |
| IV                                           | 9         | 15         |

Figure 8: Immediate post-operative x-rays

Figure 9: 6 months post-operative x-rays

this case series and accompanying any images.

Methodology

This is a prospective study done from January 2014 to July 2017. Patients included in this study were skeletally matured patients. Patients excluded from this study are patients with pathological fractures, ipsilateral limb fractures, open fractures, neurological impairment and poly-trauma. The total number of patients included in this study were sixty patients.
Table 6: Functional outcome at Sixth month follow-up

| Harris Hip Score at 6th month follow-up | n  | %   |
|----------------------------------------|----|-----|
| Poor                                   | 10 | 16.6|
| Fair                                   | 5  | 8.3 |
| Good                                   | 35 | 58.3|
| Excellent                              | 10 | 16.6|
| Radiological Union                     |   |     |
| No                                     | 1  | 3.3 |
| Yes                                    | 59 | 98.3|
| Implant Related Complication           |   |     |
| No                                     | 56 | 93.3|
| Yes                                    | 4  | 6.6 |
| Wound Related Complication             |   |     |
| No                                     | 60 | 100.0|
| Yes                                    | 0  | 0.0 |
| Mortality                              |   |     |
| No                                     | 60 | 100.0|
| Yes                                    | 0  | 0.0 |

Table 7: Functional outcome at the end of 2nd year follow-up

| Harris Hip score at the end of 2nd year follow-up | n  | %   |
|--------------------------------------------------|----|-----|
| Poor                                             | 9  | 15  |
| Fair                                             | 6  | 10  |
| Good                                             | 16 | 26.67|
| Excellent                                        | 24 | 40  |
| Radiological Union                               |   |     |
| No                                               | 0  | 0.0 |
| Yes                                              | 55 | 91.66|
| Implant Related Complication                      |   |     |
| No                                               | 55 | 91.66|
| Yes                                              | 0  | 0.0 |
| Wound Related Complication                        |   |     |
| No                                               | 55 | 91.6 |
| Yes                                              | 5  | 8.3 |
| Mortality                                        |   |     |
| No                                               | 55 | 91.6 |
| Yes                                              | 5  | 8.3 |
### Table 8: Functional outcome at the end of 3rd year follow-up

| Harris Hip score at the end of 3rd year follow-up | n%     |
|--------------------------------------------------|--------|
| Poor                                             | 3(5)   |
| Fair                                             | 3(5)   |
| Good                                             | 9(15)  |
| Excellent                                        | 37(61.6)|
| Radiological Union                               |        |
| No                                               | 0(0.0) |
| Yes                                              | 52(86.6)|
| Wound Related Complication                       |        |
| No                                               | 52(86.6)|
| Yes                                              | 0(0.0) |
| Mortality                                        |        |
| No                                               | 52(86.6)|
| Yes                                              | 8(13.3) |

### Table 9: Association of ASA with Mortality

| ASA Score | Frequency | Mortality | p-value |
|-----------|-----------|-----------|---------|
| I         | 23        | 1         | 0.013   |
| II        | 20        |           |         |
| III       | 8         | 3         |         |
| IV        | 9         | 4         |         |

### Table 10: Hazard Ratio for CAD

| Hazard Ratio | P value     |
|--------------|-------------|
| At 2 years   | 1.159 (0.743-1.108) | 0.363 |
| At 3 years   | 4.636 (0.802-26.804) | 0.001 |

### Table 11: Hazard Ratio for Diabetes Mellitus

| Hazard Ratio | P value |
|--------------|---------|
| At 2 years   | 1.077 (0.907-1.280) | 0.388 |
| At 3 years   | 1.063 (0.857-1.318) | 0.704 |

### Table 12: Hazard Ratio for Hypertension

| Hazard Ratio | P value |
|--------------|---------|
| At 2 years   | 1.035 (0.868-1.236) | 0.648 |
| At 3 years   | 1.257 (0.949-1.668) | 0.095 |

Figure 12: Clinical outcome

Figure 13: Pre-operative x-rays
Figure 14: Immediate post-operative x-rays showing varus collapse

Figure 15: Back out of lag screw

Figure 16: Bipolar hemi-arthroplasty done after removal of PFN and fracture mobility was checked under fluoroscopic which showed non union

Figure 17: Pre-operative x-rays

Figure 18: Immediate post-operative x-rays

Figure 19: X-rays showing Break of de-rotation screw tip

Figure 20: Pre-operative x-rays

Figure 21: Immediate post-operative x-rays

Figure 22: X-rays showing back out of both the de-rotation and lag screws
Patients were evaluated preoperatively and underwent closed reduction and proximal femoral nailing. Patients were mobilised immediately following surgery with full weight-bearing with walker support. Patients were assessed post-operatively with Harris Hip score to assess the functional outcome and hazard ratio to evaluate the mortality rate.

Pre-Operative Planning

Patients planned for closed reduction and internal fixation with proximal femoral nailing were initially put on skin traction. After obtaining anaesthesia fitness, patients underwent the planned procedure.

Operative Technique

Closed Reduction And Internal Fixation With Proximal Femoral Nailing.

Postoperative Care

All the patients were given appropriate analgesics. Only three doses of antibiotics were administered post operatively. Patients were started on full weight bearing on the first postoperative day with walker support. Physiotherapy such as knee bending exercise, ankle pump exercise and quadriceps strengthening exercises were taught to the patient on day two post-operatively. The wound was inspected on a postoperative day two and day 5. Sutures were removed on postoperative day 12. Patients were followed up clinically using Harris Hip score and radio-logically using RUST score at six months, and the mortality rate was followed up at 2nd year and 3rd year.

Statistics Used

The data was first entered into excel files and then exported into SPSS 20.0 version. Thus by using SPSS software, the present study results were analysed. Missing data, outliers and logical checks were performed at the first level. Using SPSS, frequencies were evaluated in each demographical variables of subjects. Mortality assessment was done by contacting the patients for follow-up with the use of postoperative proforma.

RESULTS AND DISCUSSION

A total number of 60 patients underwent closed reduction and proximal femur nailing in our study. These patients were selected based on pre-defined inclusion and exclusion criteria after informed consent. All patients were recruited through the EMS department of MGMC & RI.

Distribution of Age

In our study, 18 patients (30%) belonged to less than 60 years, and 42 patients (70%) belonged to the age group for more than 60 years.

Distribution of Gender

In our study, 43 patients (72%) were male, and 17 patients (28%) were female.

Distribution by Mode of Injury

In our study, 77 percentage (46 patients) had the injury due to fall and 23 percentage (14 patients) had an injury due to road traffic accident (RTA).

Distribution of Boyd and Griffin classification

When compared with the type of fracture according to Boyd and Griffin classification, 35 patients (58.3%) had type II fracture, 4 patients (7%) had type III fracture, and 21 patients (35%) had type IV fracture.

Distribution by ASA
In our study, 23 patients were categorised as ASA I, 20 patients as ASA II, 8 patients as ASA III and 9 patients as ASA IV.

**Assessment of Functional Outcome**

Harris Hip Score at the end of the 6th month follow up showed poor in 10 patients, fair in 5 patients, good in 35 patients and excellent in 10 patients. When the radiological union was assessed, the union was seen in 59(98.3%) patients. When implant-related complications were assessed, 56(93.3%) patients didn’t have any implant-related complication. In contrast, one patient showed non-union of Intertrochanteric fracture, which was then treated with bipolar hemi-arthroplasty [Figure 16]. Two patient had de-rotation screw tip breakage, and 1 patient had back out of both screws.

All the patients were contacted for follow up. Out of 10 patients who had low Harris hip score, 2 patients developed dementia. There was no mortality at the end of 6 months during the follow-up.

During the 2nd year end follow-up, there was a significant result in the excellent group of Harris hip score in 40%. Out of 60 patients, only 55 patients were followed up. Five patients were informed to be dead. Nine patients had low Harris hip score. Out of 5 informed dead patients two patients died due to Myocardial Infarction, one patient died due to Carcinoma of Prostate, one patient died due to age-related complication, and one patient died due to road traffic accident. The mortality rate at the end of 2 years is 8.3%.

During the third year-end follow-up, there was an excellent result in the Harris hip score in 61.6%. Out of 60 patients, only 52 patients were followed up, and two patients additionally experienced mortality due to Myocardial Infarction, and one patient died due to Hepatic encephalopathy. The mortality rate at the end of 3 years is 8.3%.

**Association of ASA with Mortality**

In our study, one patient less than 60 years died due to RTA who had an ASA score I.

**Hazard Ratio**

Hazard ratio was calculated for Coronary Artery Disease, Diabetes mellitus and Hypertension using SPSS SOFTWARE (VERSION 20).

**CAD**

CAD had a significant influence on the mortality rate with a p-value of 0.001 at the end of 3 years.

**Diabetes Mellitus**

Influence of Diabetes Mellitus on mortality rate was not significant (P-value > 0.05) at the end of 2 years and the end of 3 years.

**Hypertension**

Influence of Hypertension on mortality rate was not significant (P-value > 0.05 ) at the end of 2 years and the end of 3 years.

In this study majority of the patients were men 43 patients (72%) with a high mean age of (>60 years)[Tables 1 and 2]. The most common type of fracture, according to Boyd and Griffin classification was type II (58.3%) and the majority of the patients were operated with a proximal femoral nail within 48 hours of the injury [Figures 2, 8, 14, 18, 21 and 24].

In our study, 23 patients were categorised as ASA I, 20 patients as ASA II, 8 patients as ASA III and 9 patients as ASA IV. [Table 5]

Studies reported that the incidence of fractures in the trochanteric area has risen with the increasing numbers of elderly persons with osteoporosis (Zelenka et al., 2018). The distribution of sex differences is unclear since most of the studies show a higher incidence of Intertrochanteric fractures in women above 60 years of age (Kannus et al., 1996). However, men tend to have more significant impairments in activities of daily living and mobility compared to women.

Further, majority of the participants in this study reported that injury occurs due to falling 46 patients (77%) and only less number of them were involved in Road Traffic Accident 14 patients (23%) [Table 3]. In line with this, the study by Huang et al. observed the majority of the injuries occurred due to fall and not RTA (Huang et al., 2015). Concerning side of the injury, most of the injury reported that they had left side. In line with our study result, the study of Chukuezi and Nwosu et al. showed similar results (Chukuezi and Nwosu, 2012).

Further, the study also observed that Type-2 injury was reported higher in comparison with other types like Type 3 and 4 [Table 4]. Similar to this, the study of Benzol and Connoly et al., observed type 2 injury is more complicated than other types (Benzol and Connolly, 2012). To attain the below objective, the present study carried out complication tests in different months.

Most of the fractures were unstable intertrochanteric fracture of type II and type IV [Figures 1, 7, 13, 17, 20 and 23]. The result of the present study is supported by Adams et al., where they have proved that unstable intertrochanteric fractures can be treated with intramedullary nailing (Adams et al., 2001). In this study, all patients were mobilised on the first postoperative day...
which was very much supported by a study done by Mohamed et al which proved the improvement in morbidity status of the patient and also gave an excellent clinical [Figures 4, 5, 6, 10, 11 and 12] and radiological [Figures 3 and 9] outcome at regular follow-ups when assessed with Harris hip score (Ali, 2010).

During the sixth-month follow-ups two cases had de-rotation screw tip breakage [Figures 19 and 25], this may be related to the less strength and rigid properties of implants (Harris, 1969). When shortening was evaluated at the sixth-month follow-up, we found that patients who had varus collapse showed more shortening and backed out of the Lag screw [Figure 15]. One patient showed back out of both de-rotation and Lag screw at 6 months follow up period [Figure 12].

Because of mortality, in our study, the overall mortality rate was 13.3% at the end of 3 years follow up, which is significantly higher, considering the number of patients included in this study. Daniachi D et al., in his study “Epidemiology of fractures of the proximal third of the femur in elderly patients” showed that the intra-hospital mortality rate was 7.1 %. In contrast, our study showed no incidence of intra-hospital mortalities (Daniachi et al., 2015). However, the present study showed an intertrochanteric fracture rate higher in the age group more than 60, which is in line with the study conducted by Guilherme (Ricci et al., 2012).

In our study most of the deaths were reported in age group more than 70, which is in line with other studies where they also reported the same age group as vulnerable to death post surgeries (Haleem et al., 2008), advancing age, co-morbidities, associated pathologies were having high influence in an increase in mortality rates, this was also reported by a study (Hommel et al., 2008).

In our study, no mortalities were reported at 6 months follow up [Table 6]. 5 patients died at the end of 2 years follow up period, and all 5 were above the age of 90 years [Table 7]. Out of which, 2 patients died due to Myocardial infarction (3.33%), 1 due to Carcinoma of Prostate (1.66%), 1 due to age-related complications (1.66%) and 1 due to RTA (1.66%). The overall mortality rate at the end of 2 years follow up was 8.3%. Most of the deaths reported at 2 years follow up were associated with co-morbidities and higher ASA grade, which is in line with other studies (Hommel et al., 2008) [Table 9].

Young E-L et al., in his study “Risk Factors and Trends Associated with Mortality Among Adults with Hip Fracture in Singapore” followed 36082 patients for 18 years after hip fractures and concluded that Malay ethnicity, older age, male sex, pre-fracture co-morbidity, and trochanteric fractures were independently associated with increased risk of death, identifying population groups that could be targeted for intervention strategies (Yong et al., 2020). These results are in line with our study in which 8 deaths reported at the end of 3 years follow up were associated with higher age (>70 years), male sex, pre-fracture co-morbidities and higher ASA grades [Table 8].

In our study, it was found that patients with CAD had 4.63 times higher risk of mortality at the end of 3 years follow up period (with a p-value of 0.001) compared to the patients not having CAD [Table 10]. The mortality statistics were in line with the study conducted by Katsoulis M. et al., showing hip fracture was associated with excess short- and long-term all-cause mortality in both sexes (Katsoulis et al., 2017). In our study, the influence of Diabetes Mellitus and Hypertension on mortality rate was not significant (P-value > 0.05) at the end of 2 years and 3 years follow up period [Tables 11 and 12].

CONCLUSIONS

Functionally 76.6% of our patients had excellent and excellent Harris Hip score at the end of 3 years follow up period. Implants acted excellently concerning union and achieved union in all the cases except one. In our study, we did not encounter a single case of surgical site infection. Early full weight-bearing mobilization with walker support helped in achieving a good outcome. Management of Inter Trochanteric fracture must be multidisciplinary and multifaceted with an increase in age-related pathologies and osteoporosis. There is always a high rate of proximal femur fractures in the elderly. Patients associated comorbid conditions especially coronary artery disease, has a significant influence on the outcome of mortality for these fractures. These patients were found to have 4.63 times higher risk of mortality compared to the patients without having coronary artery disease in our study.

Limitations And Recommendations For The Future

Short duration and less number of subjects is also a limitation of our study.

The study focuses exclusively on mortality, and morbidity could have been done.

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Conflict of Interest
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