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# DECIDING FACTORS: SELECTING AN IMPLANT IN AN INTERTROCHANTERIC FRACTURE.

**Orthopaedics**

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## ABSTRACT

**Introduction:** Intertrochanteric fractures are a global concern, with 1.6 million annually occurring. The study aimed to find the optimal implant using Evans and AO classifications, addressing issues like inadequate understanding, incorrect implant selection, and surgeon incompetence. **Materials and methods:** The study identified patients with proximal femur intertrochanteric fractures in a hospital from 2016 to 2019, categorized them into stable and unstable fractures using the Orthopaedics Trauma Association categorization system and kappa statistic. **Result:** The study involved 104 patients who underwent surgery, with four dying during follow-up. The stable group had an average age of 50, while the unstable group had an average age of 57. Both groups used different postoperative regimens, with intramedullary implants preferred. The unstable group faced more issues due to osteoporosis and instability. **Conclusion:** The choice between an intramedullary device and a surface implant for treating intertrochanteric fractures is influenced by fracture stability, despite a great deal of uncertainty in the best implant choice.

## KEYWORDS

Intertrochanteric Fractures, Stable Fracture, Unstable Fracture, Nail, Plate

### INTRODUCTION:-

In the US, there are thought to be 250,000 instances of intertrochanteric fractures annually, and by 2040[1], that number is predicted to have doubled. An estimated 1.6 million of these fractures occur annually globally, according to the International Osteoporosis Foundation, and that number might increase to six million by the year 2050[2]. The world's population is living longer, which causes lower bone density with age, and young individuals are more susceptible to high-velocity injuries. Since significant osteopenia, related comorbidities, and fracture complications with high instability make managing these fractures in older adults more difficult. Even with a strong union rate, the majority of patients never return to their preoperative degree of mobility[3]. The reasons for the poor outcome of these fracture surgeries include inadequate comprehension of the fracture pattern, incorrect implant selection, incompetence of the surgeon, and the conservative character of the option. Even after several trials have concluded, complications like nonunion and shortening continue to be seen. Choosing the right categorization is crucial for treatment planning and result prediction. A perfect categorization would be accurate and repeatable, suitable for clinical settings, audits, and research. The two most often used systems are the Evans classification, which Jensen and Michaelsen improved, and the AO classification. Finding the optimal implant for an intertrochanteric fracture in support of the most widely used fracture classification system was the study's goal.

### MATERIALS AND METHODS: -

The time frame for the study was May 2018–December 2021. All patients admitted to our hospital with a proximal femur intertrochanteric fracture are included. Children with open epiphysis, severe concomitant patients, femur neck fractures, fractures less than 5 cm distal to the lower trochanter, pathological fractures, proximal femur dysplasia, nonunion after prior surgery, and infections were excluded. Patients who met the inclusion criteria had to be clinically stable, have a valid CT scan, and have anteroposterior and lateral views on their radiographs. We received approval from our institutional review board to conduct this study. Using an appropriate aseptic approach and either a surface or intramedullary implant, we performed 104 spine anesthetic operations on patients. The optimal categorization should be chosen in order to choose the implant of choice. Reliability and reproducibility between observers as well as between observers on various occasions are essential components of a perfect categorization. Furthermore, the categorization needs to imply a course of action and a result. With the computation adjusted for random matches, the kappa statistic offers a way to assess the diagnostic accuracy of a categorization. We have chosen to use the Orthopedics Trauma Association categorization system (AO classification; see fig. 1 of the system[4]). Our patient was categorized into two groups based on the AO classification system: stable fracture (as defined by AO systems 31-A1.1 to 31-A2.1 for typical stable) and unstable fracture (as defined by AO systems 31-A2.2 to 31-A3.3). This made the classification process straightforward and easy to use.

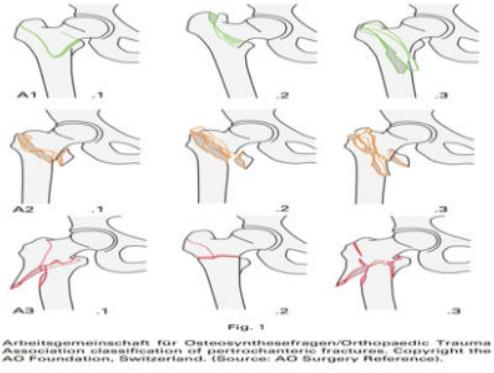



Fig. 1

Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association classification of pertrochanteric fractures. Copyright the AO Foundation, Switzerland. (Source: AO Surgery Reference).

**Figure 1:- classification of fracture**

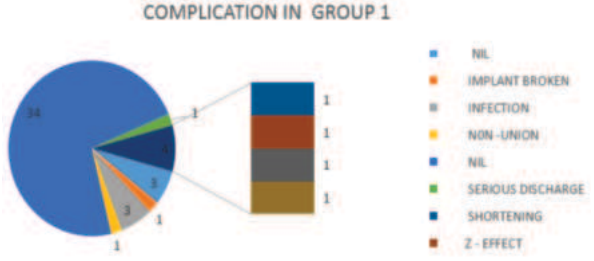
A stable fracture is one that has no post-fixation displacement following anatomic reduction and fixation, as per the definition of fracture stability in intertrochanteric fracture (fig. 2.1). On the other hand, even after proper reduction and fixation [5,6], an unstable fracture (fig. 2.2, 2.3) is described as having a tendency to collapse with axial stress. fracture comminution, or more than two fragments with loss of posteromedial cortical buttress, reverse oblique pattern, loss of lateral wall buttress under the vastus ridge, osteoporosis, and size of lesser trochanter (in a two-part fracture) are factors that contribute to instability. Another significant variable that may be changed in the treatment of these fractures is the quality of reduction (intra-operatively), independent of the fracture's pattern[7]. Restoration of cortical continuity in stable fractures resists fracture collapse; however, in unstable fractures, this is restricted by fracture orientation or comminution, leading to greater stress at the bone implant interface. To prevent loss of reduction due to collapse, the implant utilized to treat an unstable fracture must consequently be able to handle additional strain. One method of limiting collapse and leg length

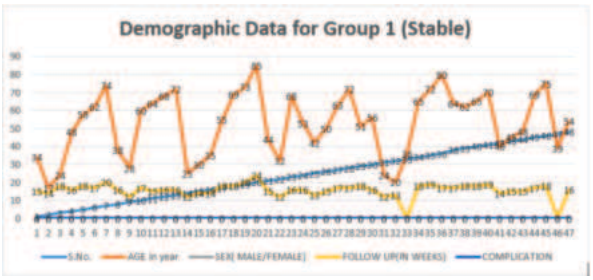
disparity, as well as boosting inter-fragmentary compression and reducing bone-implant strains, is a valgus reduction. On the other hand, a Varus malreduction results in a higher implant load and less fracture stability. The two most popular methods for fixing an intertrochanteric fracture are an intramedullary sliding nail and hip screw (IMN-SHS) or a sliding hip screw and side plate (SHS-P). 1. Multiple types of intertrochanteric fractures have been demonstrated to be treated by the SHS-P construct; however, new research indicates that the IMN-SHS build performs better in unstable fractures, reducing fracture collapse and related complications.[8–13] Following spinal anesthesia, the patient was placed on a fracture table, a closed reduction was carried out, and a k-wire preliminary fix was made. An effort was made at open reduction if closed reduction was not feasible. The SHS-P System (fig. 3.1) was the implant of choice for a stable fracture in a young patient; however, the IMN-SHS system (short PFN-A1/A2; fig. 3.2) was the implant of choice for an elderly osteoporotic patient. The IMN-SHS system was the implant of choice for unstable fractures in both young and elderly patients (long PFN-A1/A2 fig. 3.3). The IMN-SHS-System or dynamic condylar screw were the options when an intraoperatively stable fracture changed to an unstable one, i.e., either multi fregmentation or fracture of the lateral wall. Trochanteric buttress plates are not accessible in our institute, so we are not feminized while using them. Following surgery, knee bending began on day one for both stable and unstable fractures, and toe-touch weight bearing began on day two for stable fractures but was postponed for three weeks for unstable fractures.

**RESULT**: -

Of the 104 people who underwent surgery in our research, four passed away during follow-up. Between 17 and 85 years old, 48 patients in the stable group had an average age of 50 years, while 56 patients in the unstable group had an average age of 57 years, ranging from 28 to 84 years. $P < 0.01$, which indicates statistical significance, was the difference. Thirty-eight percent of the group in the unstable group and twenty percent of the group in the stable group were male ($P = 0.70$). According to $P = 0.33$, there was no discernible change in the patients' Singh index. While the unstable group had an average follow-up period of 23 weeks, the stable group had one of 15.5 weeks on average. At intervals of two weeks, six weeks, twelve weeks, and twenty-four weeks, both groups were monitored. Every follow-up saw the acquisition of x-rays. In both groups, different postoperative regimens were used. Stable group mobilization, which involved sitting and knee-bending, started the next day. After changing the dressing and touching the toes, weight bearing started the next day and will last for three weeks. Restricted weight bearing started after three to six weeks. At 12 weeks, full weight bearing started. On the second day following surgery, the unstable group started to be mobilised by knee bending and sitting. Three to six weeks after the loss of lateral wall integrity (fracture in 24 out of 56 patients), toe contact weight bearing started. Between six and twelve weeks, partial weight bearing started. Three to six weeks after the loss of lateral wall integrity (fracture in 24 out of 56 patients), toe contact weight bearing started. Six to twelve weeks into the trial, partial weight bearing began. Union cannot be visible before full weight bearing is permitted (Figs. 4.1, 4.2).

Antibiotics chosen based on culture and sensitivity were used to treat infections that caused complications in three stable patients and four unstable patients. One patient from each group experienced a severe discharge that was treated with intravenous albumin (level < 2.5 mg/dl). Z-effect was seen in 4 patients (1 in the stable group and 3 in the unstable group) requiring revision and implant replacement due to loss of reduction (DCS). Bone grafts and bone marrow infiltration were used to treat the non-union that was observed in three patients—two stable and one unstable. Two patients (one from each group) required an implant replacement due to an implant breakage below the screw level (choice not altered). Malunoin and shortening are present in six cases. The preferred implant in both groups was intramedullary (maximum), however the unstable group experienced greater problems than the stable group because of osteoporosis and other issues (instability).



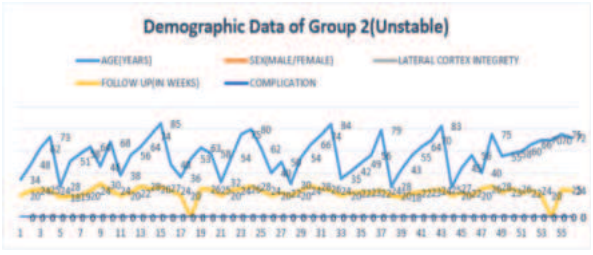




**Figure:-2 Clinical photographof patient**

**Figure 3:- Clinical photograph of patient**

**DISCUSSION**

It is still challenging to choose an implant for an intertrochanteric fracture. The surgeon is always forced to give it some consideration.

We have provided a step-by-step method here to address this question. The first step is to choose a classification scheme with high kappa values, greater reproducibility, and increased reliability. We used the AO categorization system for our investigation. In their study of the AO classification system, Schipper et al[14]. (2014) found that the AO classification with subgroups had a mean intra-observer kappa value of 0.48 and a mean inter-observer kappa value of 0.33 and 0.34. The mean kappa values for the AO system without a subgroup were 0.78 for intra-observers and 0.67 and 0.63 for inter-observers. Evan's kappa value is 0.22 and 0.44, Kyle's is 0.32 and 0.37, and Boyd's is 0.29 and 0.37 in terms of inter- and intra-observer comparisons, respectively. According to the research, the AO system with groups has a higher classification accuracy for intertrochanteric fractures than Evans, Boyd, and Kyle. Nonetheless, the AO categorization system's subgroup reliability is unsatisfactory. The next stage is to label the fracture, determining if it belongs to the reverse oblique unstable fracture pattern (A3), the unstable group (A2.2–A2.3), or the stable group (A1–A2.1). There is insufficient data to support the superiority of one implant over another for stable intertrochanteric fractures; therefore, options should be open to the user. The intraoperative quality of reduction is still crucial in this group. A precise reduction should be followed by post-fixation retention of the reduction, with direct cortical contact between the proximal and distal pieces at the posterio-medial location. With the exception of patients with severe osteoporosis, for whom an intramedullary implant is the preferable option, our institute favors the SHS system for both younger and older patients. There is strong evidence to support the use of intramedullary fixation in reverse oblique unstable intertrochanteric fractures (A3) because the biomechanics of these fractures make SHS system fixation inappropriate because the lateral cortical buttress cannot resist collapse and the line of collapse is not perpendicular to the fracture line. Conversely, the intramedullary system provides internal buttress by resisting collapse through both its intramedullary location and an expanded proximal end. Additionally, because the procedure is minimally invasive, the vastus soft tissue envelope is preserved, maintaining stability and vascularity. Although trochanteric buttress plates (TSPs) provide more resistance to collapse, IM systems are more dependable when fixed in conjunction with SHS systems. Therefore, intramedullary implants are the superior option for these fractures since they provide better functional results and union [15, 16–21]. Due to many fragments, loss of lateral cortical wall, difficulty reducing the fracture and maintaining the reduction post-fixation, and the fact that older individuals with osteoporosis are more susceptible to these fractures than others, unstable intertrochanteric fractures (A2.2 to A2.3) are the most challenging to treat. The use of an intramedullary implant is advised by current guidelines. TSP may be able to stop excessive collapse if the SHS system is in use. We don't use TSP at our institute. There were no long-term differences in the outcome at 3 and 12-month follow-up in a randomised prospective study comparing fixation using a SHS system (343 patients) or an intramedullary system (341 patients) for all intertrochanteric or sub-trochanteric fractures. However, the intramedullary group had improved early pain on mobilisation scores [22]. In the SHS/TSP group, medialization of the femoral shaft was observed more frequently and was linked to higher levels of discomfort following surgery. The research suggests that an intramedullary device provides more overall benefits than a SHS with TSP. Knowledge of a particular implant by the surgeon may have a quantifiable impact on the length of the procedure, the use of fluoroscopy, intraoperative blood loss, the requirement for transfusion, complications, However, a comprehensive analysis of the data revealed notable variations in the released information, and as a result, no evidence of an implant-related impact has been demonstrated [23,24,25]. The cost of SHSS, short nails, and long nails, respectively, is rising [26,27]. Surface implants are less costly than intramedullary implants. The less costly implant should be chosen when both are suitable for fixation. Meta-analyses have not demonstrated a difference in functional results between intramedullary and extramedullary devices, despite the vast number of random controlled trials. In an RCT comparing extra vs. intramedullary fixation in 210 patients with A1 and A2 fractures, Utrilla et al. [28] reported that while there was no difference in the functional result for stable fractures, unstable fractures showed improved mobility a year after the implantation of an intramedullary device.

## CONCLUSION:

Although there is a great deal of uncertainty regarding the best implant to use for treating an intertrochanteric fracture, we are able to select between an intramedullary or surface implant by using the appropriate classification (AO in our study) to assess fracture stability. Although there is contradictory information about the best implant for treating an intertrochanteric hip fracture, one may select between utilising an intramedullary device or a SHS by determining how stable the fracture is.

## Conflict of interest:

This article's topic has not received, nor will it receive, any direct or indirect profit of any kind from a commercial party.

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