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HOW TO CHOOSE CHOICE OF IMPLANT IN INTERTROCHANTERIC FRACTURE: DECIDING FACTORS.

Orthopaedics

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KEYWORDS

INTRODUCTION:-

The incidence of Intertrochanteric fracture is estimated to be 250,000 cases per year in the United states and is expected to be double by the year 2040[1].The International Osteoporosis Foundation estimates that approximately 1.6 million such fracture occur per year worldwide, a figure which may rises up to six million by 2050[2]. Main reasons for these are increased longevity of the world population, decreased bone density with age, high velocity trauma in young people. Management of thesefracture in older people is more challenging due to associated comorbidity, severe osteopenia, and fracture comminution with high instability. Despite having good union rate, most people do not regain their preoperative level of mobility[3]. Reason for poor result these fracture surgery are poor understanding of fracture pattern, wrong choice of implant, surgeon incompetency, choice of conservative nature. Complication like shortening, nonunion, is still seen after so many studies had been over. Selection of appropriate classification is uttermost for planning the treatment and predicting the outcome.An ideal classification should be appropriate for clinical practices, for audit, for research and should be reliable and reproducible. Most frequently used systems are AO classification and Evans classification which modified by Jensen and Michaelsen. The **aim** of this study was to determine the implant of choice in intertrochanteric fracture on the behalf of most currently used fracture classification system.

MATERIALS AND METHODS

This study was conducted between May 2018 to December 2020.We include all patient admitted with intertrochanteric fracture of proximal femur in Govt. medical college kota.

Exclusion Criteria: - were children with open epiphysis, severe comorbid patient, fracture neck of femur, fracture below 5 cm distal to lesser trochanter, pathological fracture, proximal femur dysplasia, previously operated nonunion or infection.

Inclusion Criteria:-were patient with proper radiograph (anterior-posterior and lateral views) and CT scan, clinically stable patient .Approval for this study was obtained from our institutional review board. We operated 104 patients under spinal anesthesia with proper aseptic technique with either surface or intramedullary implant. For the purpose to select the choice of implant, ideal classification should be select. An ideal classification should be reliable, should be reproducible among different observer as well as by different observer on separate occasion. In addition the classification should suggest treatment and outcome. The kappa statistic provide a method of determining the diagnosis accuracy of a classification with the calculation adjusting for random matches. In our study we select AO classification (Orthopedics Trauma Association classification system[4] fig.1). On the basis of AO classification we grouped our patient into two group i.e. is stable fracture (as per AO system 31-A1.1 to 31-A2.1 typical stable) or unstablefracture (as per AO system 31-A2.2 to 31-A3.3) to make it simple and easy to apply.

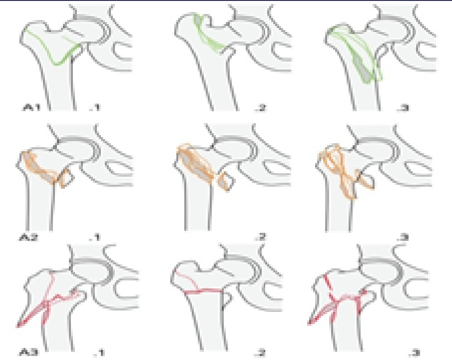

Fig. 1

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

Fig.1

According to the concept of fracture stability in intertrochanteric fracture ,**Stable fracture** has been defined as one that has no post fixation displacement after anatomic reduction and fixation(fig2.1) .By contrast, an **unstable fracture**(fig2.2,2.3) has been defined as tending to collapse with axial loading even after appropriate reduction and fixation[5,6].Factor contributing instability are fracture comminution i.e more than two fragment with loss of posteromedial cortical buttress, reverse oblique pattern, loss of lateral wall buttress beneath the vastus ridge, osteoporosis, size of lesser trochanter (in two part fracture). The quality of reduction(intra-operatively), regardless of the pattern of the fracture,is another important modifiable factor in management of these fracture[7].In stable fracture restoration of cortical continuity resist fracture collapse where as in unstable fracture this is limited either by comminution or fracture orientation, resulting the bone implant interface will be subject to increased stress. Implant used to fix unstable fracture must, therefore be, capable of bearing more-load,in order to avoid loss of reduction through collapse. A valgus reduction is one way of increasing inter-fragmentary compression and of reducing bone-implant stresses, as well as minimizing collapse and leg length discrepancy. Whereas varus mal –reduction leading to increased implant load and decreasing fracture stability. Fixation of intertrochanteric fracture is commonly performed with either a sliding hip screw and side plate (SHS-P) or intramedullary sliding nail and hip screw (IMN-SHS)[1]. SHS-P construct were shown to be capable of treating multiple type of intertrochanteric fracture but recent studies report IMN-SHS construct is better in unstable fracture preventing fracture collapse and its complication[8-13].

Operative Technique: - After spinal anesthesia patient mounted on fracture table, closed reduction performed and preliminary fix with k-wire. If closed reduction not possible the open reduction attempted. For stable fracture in young patient choice of implant was SHS –P System (fig.3.1) but in old osteoporotic patient implant was IMN-SHS

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system (short PFN-A1/A2 fig.3.2).For unstable fracture in young or old patient choice of implant was IMN-SHS system (long PFN-A_1/A_2 fig.3.3) Sometimes Intra-operatively stable fracture converted to unstable one i.e. either multifregmantetion or fracture of lateral wall then choice was IMN-SHS system or dynamic condylar screw. We are not familiar with the use of trochanteric buttress plate,not available in our institute.Post –operatively, on day one knee bending started(for stable and unstable) and toe-touch weight bearing started on day two for stable fracture but in unstable weight bearing delayed for 3 week.

RESULT

Total 104 patients were operated in our study, out of which 4 patient were lost during follow up. In stable group there were 48 patients with mean age was 50 years ranges from17-85years and in unstable group there were 56 patients with mean age was 57 years ranges from28-84 years .The difference was statistically significant (P= 0.01). There were 20 females and 28 males in stable group and 21 were female and 35 were male in unstable group (P=0.70). Singh index of the patients was not significantly difference (P=0.33).Theaverage follow up period in stable group was 15.5 weeks and in unstable group was 23 weeks. The both group were followed at interval of 2weeks, 6weeks, and 12 weeks and at 24 weeks. At each follow-up x-rays were taken .Post -operative protocol were different in both groups. In stable group mobilization started next day i.e is knee bending and sitting. On the next day with change of dressing and toe touch weight bearing started till 3 weeks .From 3 to 6 weeks partial weight bearing started. Full weight bearing started after 12 weeks. In unstable group mobilization was started on second day of surgery with knee bending and sitting. Toe touch weight bearing started delayed on 3 weeks till 6 weeks due to loss of lateral wall integrity (fracture in 24 patients out of 56 patients). Partial weight bearing started on 6 weeks to 12 week. Full weight bearing not allowed till union seen (fig 4.1, 4.2). Complication like infection (3 patients in stable and 4patients in unstable) were seen and manage with appropriate antibiotics selected by culture and sensitivity. Two patients had serious discharge (one in each group) managed by i.v albumin (level below 2.5 mg/dl). Z-effect seen in 4 patients (1 in stable group and 3 in unstable group) with Loss of reduction requires revision and change of implant (DCS). Non- union seen in 3 patients (1 in stable and 2 in unstable) manage by bone-grafting and bone marrow infiltration. 2 patients had implant broken (one in each group) at below screw level need implant change (choice remains same).6 patient shows shortening and malunoin. In both groups implant of choice was intramedullary (maximum) but due to comminuaition (instability) and osteoporosis unstable group having more complications than stable group.

Demographic Data For Group 1 (Stable)

S.No.	AGE in year	SEX(MALE/ FEMALE)	FOLLOW UP(IN WEEKS)	COMPLICATIO N
1	34	M	15	NIL
2	17	M	14	NIL
3	24	M	18	NIL
4	48	F	16	NIL
5	58	F	18	NIL
6	62	F	17	INFECTION
7	74	M	20	NIL
8	38	M	16	NIL
9	28	M	12	NIL
10	60	F	17	SHORTENING, MALUNINO
11	64	F	15	NIL
12	68	M	16	N0N -UNION
13	72	M	16	NIL
14	25	M	12	NIL
15	30	M	14	NIL
16	35	M	14	NIL
17	55	M	18	NIL
18	69	F	18	NIL
19	73	F	20	SHORTENING, MALUNION
20	85	F	24	SERIOUS DISCHARGE
21	44	M	15	NIL
22	32	M	12	NIL
23	68	F	16	NIL
24	53	M	16	NIL
25	42	M	13	NIL
26	50	M	15	NIL
27	63	F	17	NIL
28	72	F	17	IMPLANT BROKEN
29	51	M	18	NIL
30	56	M	16	NIL
31	24	M	12	NIL
32	20	M	13	NIL
33	36	F	LOST	NIL
34	65	F	18	NIL
35	72	F	19	INFECTION
36	80	F	17	NIL
38	64	M	17	NIL
39	62	M	18	NIL
40	65	F	18	NIL
41	70	F	19	INFECTION
42	40	M	14	NIL
43	45	M	15	NIL
44	48	M	15	NIL
45	69	F	17	SHORTENING
46	75	F	18	NIL
47	39	M	LOST	NIL
48	54	M	16	Z - EFFECT

Demographic Data For Group 2 (Unstable)

S.N o.	AGE(YEAR S)	SEX(M ALE/FE MALE)	LATERAL CORTEX INTEGRETY	FOLLO W UP(IN WEEKS)	COMPLICATI ON
1	34	M	FRACTURE	20	NIL
2	48	M	INTACT	24	NIL
3	62	F	INTACT	25	NIL
4	73	F	FRACTURE	24	INFECTION
5	28	M	INTACT	18	NIL
6	51	M	FRACTURE	19	NIL
7	58	F	FRACTURE	20	Z-EFFECT
8	64	M	INTACT	24	NIL
9	46	M	FRACTURE	30	NON-UNION
10	68	F	INTACT	24	NIL
11	38	M	INTACT	20	NIL
12	56	M	INTACT	22	NIL
13	64	F	INTACT	28	Z-EFFECT
14	74	F	FRACTURE	26	SERIOUS-DISCHARGE
15	85	M	FRACTURE	27	SHORTENING
16	48	M	INTACT	24	NIL
17	36	M	INTACT	20	NIL
18	53	F	INTACT	LOST	NIL
19	63	M	INTACT	26	NIL
20	58	M	FRACTURE	25	INFECTION
21	32	M	FRACTURE	20	NIL
22	54	M	INTACT	24	NIL
23	75	F	INTACT	26	NIL
24	80	F	INTACT	28	NIL
25	62	M	INTACT	24	NIL
26	40	M	FRACTURE	20	NIL
27	50	M	INTACT	22	NIL
28	30	M	FRACTURE	20	NIL
29	54	M	FRACTURE	24	SHORTENING ,MALUION
30	66	F	INTACT	28	N0N-UNINO
31	74	F	INTACT	26	NIL
32	84	F	FRACTURE	24	INFECTION
33	35	M	FRACTURE	20	NIL
34	42	M	INTACT	22	NIL
35	49	M	INTACT	23	NIL
36	56	F	INTACT	22	NIL
37	79	F	INTACT	24	INFECTION
38	28	M	INTACT	20	NIL
39	43	M	INTACT	18	NIL
40	55	F	INTACT	22	NIL
41	64	F	FRACTURE	23	NIL

42	70	M	FRACTURE	24	IMPLANT-BREAK
43	83	M	INTACT	25	NIL
44	27	M	FRACTURE	20	NIL
45	45	M	FRACTURE	22	NIL
46	56	F	INTACT	20	NIL
47	40	M	INTACT	26	NIL
48	75	M	INTACT	28	NIL
49	55	M	FRACTURE	23	NIL
50	58	M	FRACTURE	26	NIL
51	60	M	FRACURE	22	SHORTENING ,MALUNION
52	66	F	INTACT	24	NIL
53	70	F	INTACT	20	NIL
54	70	M	INTACT	LOST	NIL
55	75	F	INTACT	25	Z- EFFECT
56	72	F	INTACT	24	NIL

DISCUSSION

To decide choice of implant in intertrochanteric fracture remains difficult question .It always forces the surgeon to think about it. To solve this question we proposed a stepwise plan here. Firstly select a classification system which is more reliable, reproducible and having high kappa values. In our study we choose AO classification system. chipper et al[14] studied AO classification system , they reported a mean intra-observer kappa value is 0.48 and mean inter-observer kappa value is 0.33 and 0.34 for the AO classification with sub group.For the AO system without sub group the mean kappa value were 0.78 for intra-observer and 0.67 and 0.63 for inter- observer. The kappa value for Evan is 0.22 and 0.44, for Kyle is 0.32and 0.37 and for Boyd is 0.29 and 0.37 in inter-observer and intra-observerrespectively .So the studies suggest that the AO system with group can be used to classify the intertrochanteric fracture more reliably than Evans, Boyd, Kyle. However the reliability of the AO classification system with subgroup is not satisfactory. Next step is to label the fracture either it is in stable group (A_1-$A_{2.1}$) or in unstable group ($A_{2.2}$-$A_{2.3}$) or it is reverse oblique unstable fracture pattern(A_3).For stable intertrochanteric fracture there is little evidence of the superiority of one implant over another, so choice should be optional. In this group quality of reduction (intra-operatively) remains paramount . There should be direct cortical contact at posterio-medially between proximal and distal fragments following accurate reduction and reduction should be remains post fixation. In our institute we preferred SHS system in both young and elder patient except in severe osteoporotic patient where choice is intramedullary implant. In reverse oblique unstable intertrochanteric fracture(A_3) there is strong evidence to support the use of intramedullary fixation because the biomechanics of these fracture are such that fixation with SHS system is inappropriate , as the line of collapse is not perpendicular to the fracture line and lateral cortical buttress cannot resist collapse. Where as in intramedullary system resist collapse both by their intramedullary position and by an enlarged proximal end, offering internal buttress. With additional advantage of minimal invasive nature of surgery there by preserving the vastus soft tissue envelope which maintain vascularity and stability. The use of a trochanteric buttress plate (TSP) offers increased resistance to collapse but combined fixation with SHS system is less reliable than IM system .So in these fracture choice of implant should be intramedullary which offers better functional outcome and union[15,16-21].

Unstable intertrochanteric fracture ($A_{2.2}$ to $A_{2.3}$) group are most difficult fracture to manage, due to multiple fragments, loss of lateral cortical wall, difficulty in reducing the fracture and maintain the reduction post-fixation, particularly elder people with osteoporosis. Current guide lines recommend the use of an intramedullary implant as choice .If SHS system is usingthen TSP may prevent excessive collapse.In our institute we are not using TSP.In a randomized prospective study comparing fixation using a SHS system (343 patients) or intramedullary system (341 patients) for all intertrochanteric or sub-trochanteric fractures showed no long- term differences in outcome at 3 and 12 months follow-up, with improved early pain on mobilization scores in the intramedullary group[22].Medialisation of the femoral shaft was seen more frequently in the SHS/TSP group and was associated with increased post-operative pain. Overall intramedullary device appears from the evidence to offer more benefit than an SHS with TSP. A surgeon familiarity with a specific implant may have a measurable effect on the operating time, the use of fluoroscopy, intraoperative blood loss, and need of transfusion, complication, But a systemic review of the evidence reported significant heterogeneity in published data and an implant- associated effect has not therefore been shown[23,24,25].There is increasing cost associated with SHS_S ,short nails and long nails respectively[26,27].Intramedullary implant are more expensive than surface implants. When both implants are appropriate for fixation then less expensive implant should be the choice. Despite the large number of random controlled trial, meta-analyses have not shown difference in functional outcome between intramedullary and extra-medullary devices. According to Utrilla et al[28] in RCT of extra versus intra-medullary fixation in 210 patient in A1 and A2 fractures,he found no difference in functional outcome in stable fractures but in unstable fracture better mobility at one year following intramedullary device.

CONCLUSION:

Yes, there is a lots of confusion about the right choice of implant in the treatment of intertrochanteric fracture but with the help of appropriate classification (AO in our study) assessment of fracture stability allows us to choose the right implant for fixation between eitherintramedullary or surface implant.

Conflict Of Interest:

There is no benefit in any form have been received or will be received from a commercial party directly or indirectly to the subject of this article.

CONCLUSION

There is conflicting evidence about the choice of implant in the treatment of intertrochanteric fracture of the hip, but assessing the stability of the fracture allows one to choose between using a SHS or an intramedullary device.

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