

Original article:

Primary Hemiarthroplasty for treatment of Unstable Intertrochanteric Fractures in Elderly osteoporotic Patients; Comparative study with Dynamic Hip Screw Internal Fixation

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Abstract:

51 consecutive patients of Unstable Intertrochanteric fracture with DEXA Scan T score of -2.5 or less were selected for Internal Fixation with Dynamic Hip Screw or Bipolar Hemiarthroplasty. Complications related to recumbency or restricted weight bearing mobilisation were recorded. Stringent parameters were laid down to define Primary Technical Failure, Delayed Failure at 6 months and Shortening. Demographics of patient population, Operative time and Functional & Radiological outcome data was analysed for pros and cons of selection of either procedure. It was found that more female patients, patients with age >70 years were selected for hemiarthroplasty and male patients and patients with age less than 70 years were favoured for Internal fixation. Hemiarthroplasty permits early rehabilitation as well as better return to preinjury status with respect to mobility and social dependence and also has lower incidence of primary technical failure as well as lower incidence of delayed failure

Keywords: Unstable Intertrochanteric Fractures, Primary Hemiarthroplasty, Osteosynthesis

Introduction

The world number of hip fractures is rising rapidly with an expected incidence of 6.26 million by year 2050.^{1,2} Hedlund et al³ found that low energy trauma caused 53% of fractures in patients 50 years or older. In those above 75 years low energy trauma caused >80% of all fractures. An increase in these fractures is on the rise due to increase in life expectancy of the people and osteoporosis.^{1,2,3} The contribution of osteoporosis related fractures is more important than previously thought.

Over the years there has been many protocols developed to deal with osteoporotic comminuted fractures. Some advocated use of Stronger Implants e.g. strong nail to support the fracture, but often the Implant would survive but the fracture would displace around it. Augmenting fracture fixation with methylmethacrylate has also been advocated. Even following these various protocols post op activity, particularly weight bearing often needed to be restricted⁴.

Stability of Internal fixation is of paramount importance to attain the goal of return to Preinjury Status of activity as early as possible. Poor mechanical properties of weak bone in elderly osteoporotic patients do not usually provide a firm purchase for the screws⁵ Implant tends to force the proximal fragment in Varus and Axial

Collapse leading to cut-out of the fixed angle device^{6,7} through the head of femur or uncontrolled excessive^{8,9} collapse-backout of sliding screw device^{10,11} and finally perforation into head and neck including unacceptable shortening and external rotation deformity. Most surgeons have recommended that the hip be protected throughout the healing period particularly in patient with Intertrochanteric fracture with major comminution, osteoporosis or poor fixation of screws⁷.

Surgical technical factors like quality of reduction, choice of implant contribute to stability of internal fixation. Difficulty in maintaining anatomical reduction and preventing loss of stability is solved by impaction at fracture site, provided by sliding devices, that may theoretically lower the incidence of failure of fixation; may allow excessive collapse leading to perforation of head and neck, plate pull-out and breakage & therefore implant failure remains an unsolved problem¹² A failure rate as high as 35 % in unstable intertrochanteric fracture has been reported in literature with Nail plate¹³. Intramedullary devices have shown reduced tendency for cut-outs in osteoporotic bone^{14,15} and better results in unstable intertrochanteric fractures^{16,17} however intermedullary devices in unstable osteoporotic and severely comminuted fractures is still a part solution.

Endoprosthetic replacement has been offered to patient of severely comminuted trochanteric Fractures since 1974¹⁸, because of accelerated early mobilisation and rehabilitation of patients with good long term results.^{19,20} However Hemiarthroplasties face criticism from being technically more demanding (early Dislocations), leading to greater blood loss, Longer surgical Time, Infections etc. There is also some concerns about Long term problems such as loosening, protusio, stem failure, late infections and late dislocations.

Material & Methods

All patients of Age ≥ 55 years with Unstable Intertrochanteric fractures (Evans Type III & Type IV and AO/OTA Type 31-A2.2 & 2.3) undertaken for surgical treatment were the sample population. Patients were operated by one of the Four senior consultants, each with at least 15 years of Surgical Experience. Surgeon was allowed to select the procedure on the basis of all factors. Patient with psychiatric/neurological disorders, Non-ambulatory before injury, associated fracture in the same Limb that may significantly affect the final functional assessment were primarily excluded.

All operated patients were subjected to DEXA Scan within one month of the date of Injury and patients with Osteoporosis as per WHO criteria (contralateral hip or spine) were only included.

51 patients met the Inclusion Criteria. 30 patients were selected for Osteosynthesis with Dynamic Hip Screw (DePuy Synthes Make) and 21 for Primary Bipolar Hemiarthroplasty (Stryker Modular Bipolar). Data was collected for Demographics, Comorbidities, Primary Technical Failure, Delayed Failure, Functional Assessment.

Definition of Primary Technical Failure :For DHS Group – lack of continuity of cortex on apposing surfaces of the two main fragments¹⁴⁶, Varus of >10 degree, Tip Apex Distance (AP+ Lateral sum) <25 mm, Deep Infection persistent beyond 2 weeks.; For Bipolar Hemiarthroplasty-Varus or Valgus positioning >10 degree, Poor cementing in more than two Gruen Zones in either view, No weight bearing ambulation of the patient at two weeks, Dislocation with in two weeks, Deep infection persistent beyond two weeks

Definition of Delayed failure (at 6 months) : For DHS Group - Varus Angulation >10 degree, More than 20mm extrusion of the lag screw, perforation of femoral head/neck in any view, Implant Breakage or pull out, shortening > 2.5 cm, Reoperation: For Bipolar Group – patient becoming wheel chair bound after initial ambulation, Delayed Dislocation, Loosening or subsidence, Late Infection, Reoperation

Functional outcome was analysed by Harris Hip Score and Modified *Mobility & Aids Scoring Matrix*²² (Table 2)

Results

Age: Patients below 75 years of age were more often selected for DHS and Older patients got selected for Bipolar Hemiarthroplasty. Average Age for IF Group is 66±7.4 while for HA group is 72.8±9.5 (Fig. 1)

Sex: Greater percentage of Females were selected for HA and male were favoured for Internal Fixation (Fig 2)

Duration of Surgery: There was no significant difference if one included the time of setting up patient on fracture table & attaining anatomical reduction by biplane fluoroscopy (Table.1)

Choice of Procedure with respect to an associated Comorbidity: Associated comorbidity was not found to have any influence on selection of procedure by orthopaedic surgeons. (Fig. 3)

Complications: Complications included all adverse events including bed sore, atelectasis, DVT, pulmonary embolism as well as primary and delayed failures. 80% of DHS group had complications versus 43% of Hemiarthroplasty Group. (Fig 4)

Complications: Primary technical failure in Hemiarthroplasty group is much lower @ 4.76% compared to 33% in DHS Group. HA group scored better even on Delayed failures compared to DHS Group 38.1% versus 46.66%, though the advantage is not so marked. (Fig 5)

Complications: Shortening of >2.5cm shortening revealed that Bipolar hemiarthroplasty Group had shortening approaching 10% compared to 36.66% in Internal Fixation Group. Any amount of shortening was also found in much lesser number of patients in Arthroplasty Group 33% versus 70% (Fig 6)

Functional Outcome

Harris Hip Score: Harris Hip score of patients in two groups at 6 months were comparable except that a score higher than 90(excellent) was not attained by any patient in DHS Group (Fig 7)

Mobility and Aids Scoring Matrix (Table 2) : None of the patients in DHS group could attain Pre-Injury status wrt Mobility & Aids Score whereas as many as 47.6% patients attained same score in HA group. 76% of all patients in IF group had a fall in Mobility and Aids score by a value of more than 1 where as 28.56% had such fall in scores in DHS Group (Table 3 Figure 8) .

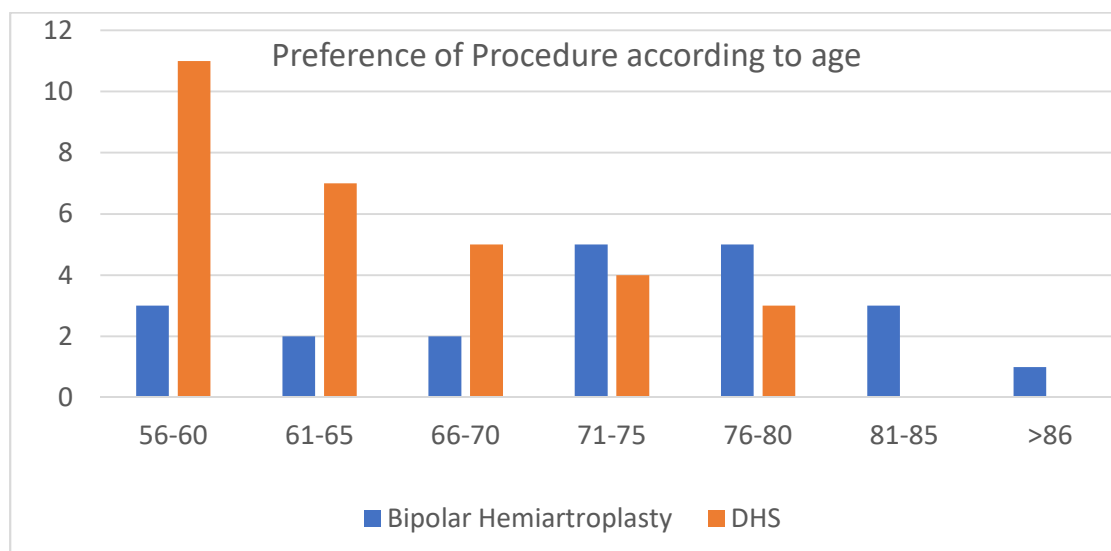


Fig. 1 – Selection of procedure according to age – Number of cases

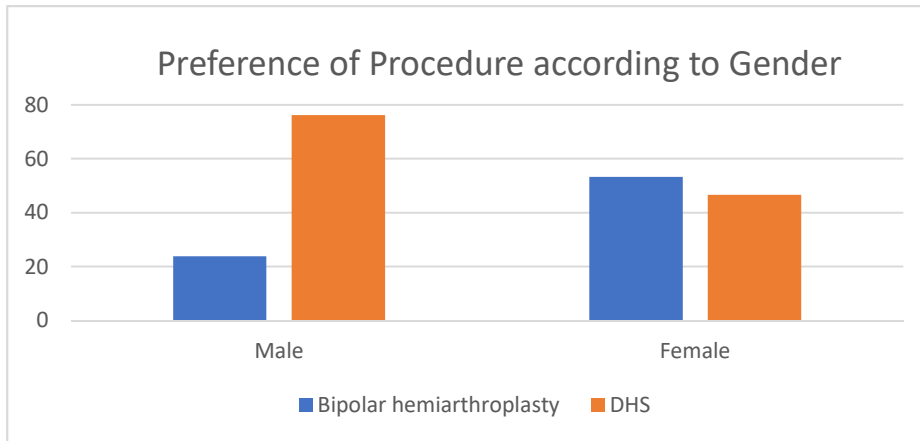


Fig. 2 – Selection of procedure according to Gender – Percentage

Duration of Surgery (Includes time of setting up patient on Fracture table & Reduction in IF Gp.)				
Choice of Procedure	Number of cases	Mean Time	Standard deviation	Statistical tests
Bipolar hemiarthroplasty	21	83.2857	26.1766	T = 0.9959 P<0.1621
DHS	30	91.1333	28.6966	

Table 1 – Duration of Surgery – Mean with standard deviation

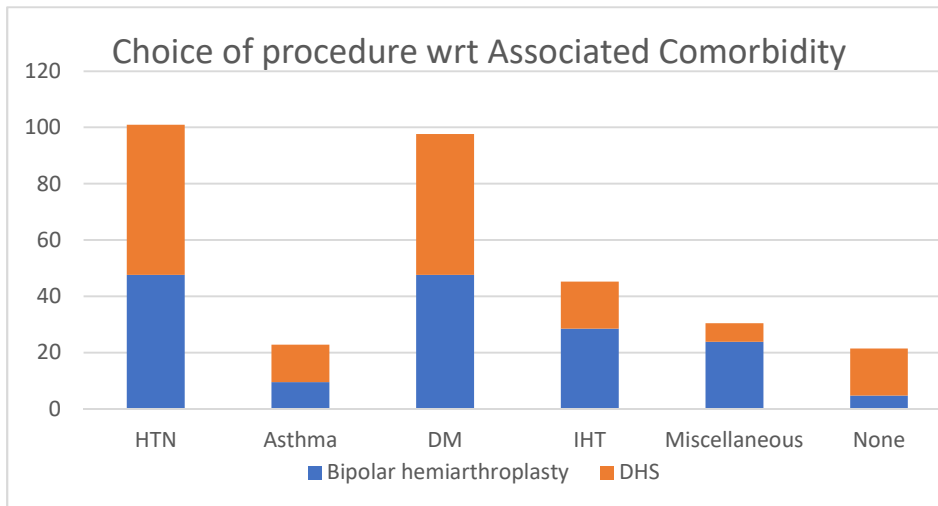


Fig. 3 – Selection of procedure according to Associated Comorbidity – Percentage

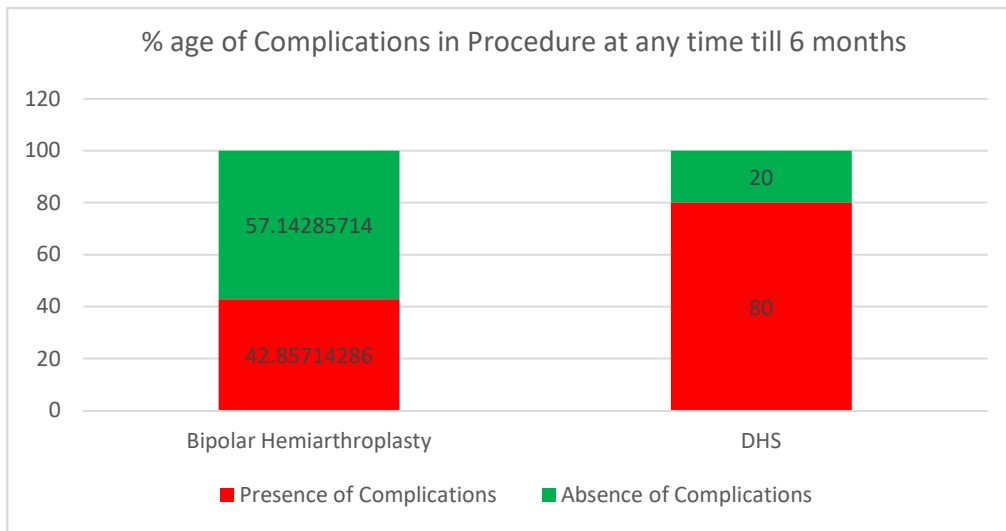


Fig. 4 – All complications (including complications of recumbency, Primary Technical Failure & Delayed Failure) procedure wise – Percentage

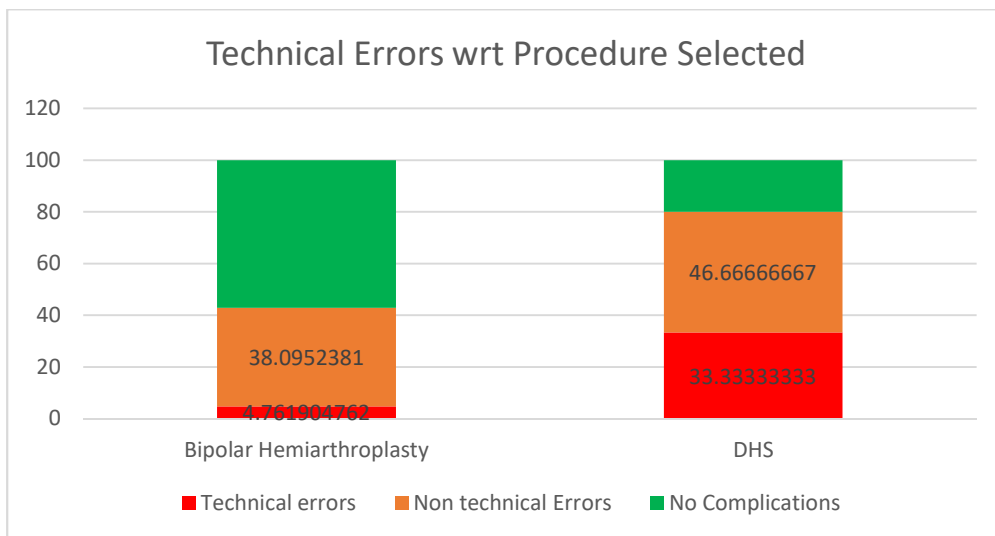


Fig. 5 – Complications excluding Complications of recumbency :Contribution of Primary Technical Failure & Delayed Failure procedure wise – Percentage

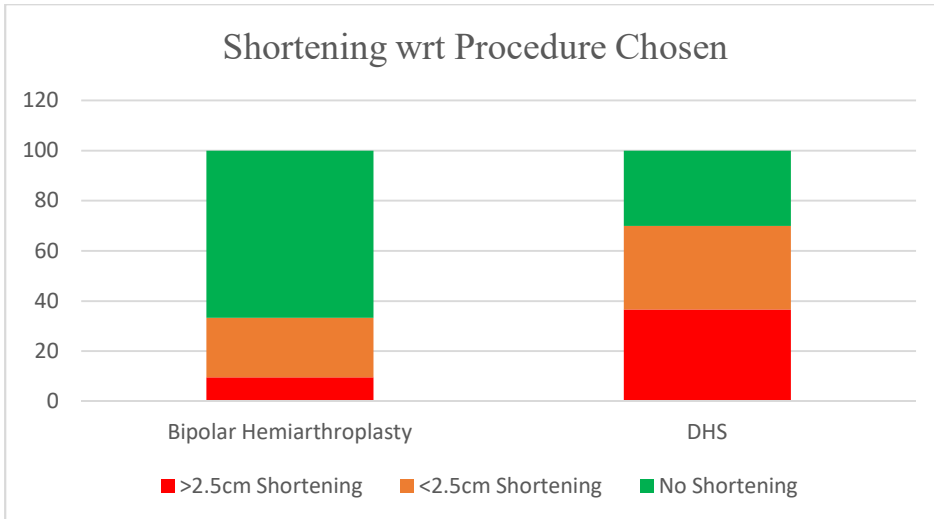


Fig. 6 – Complication of Shortening (at the end of 6 months) with selected procedure– Percentage

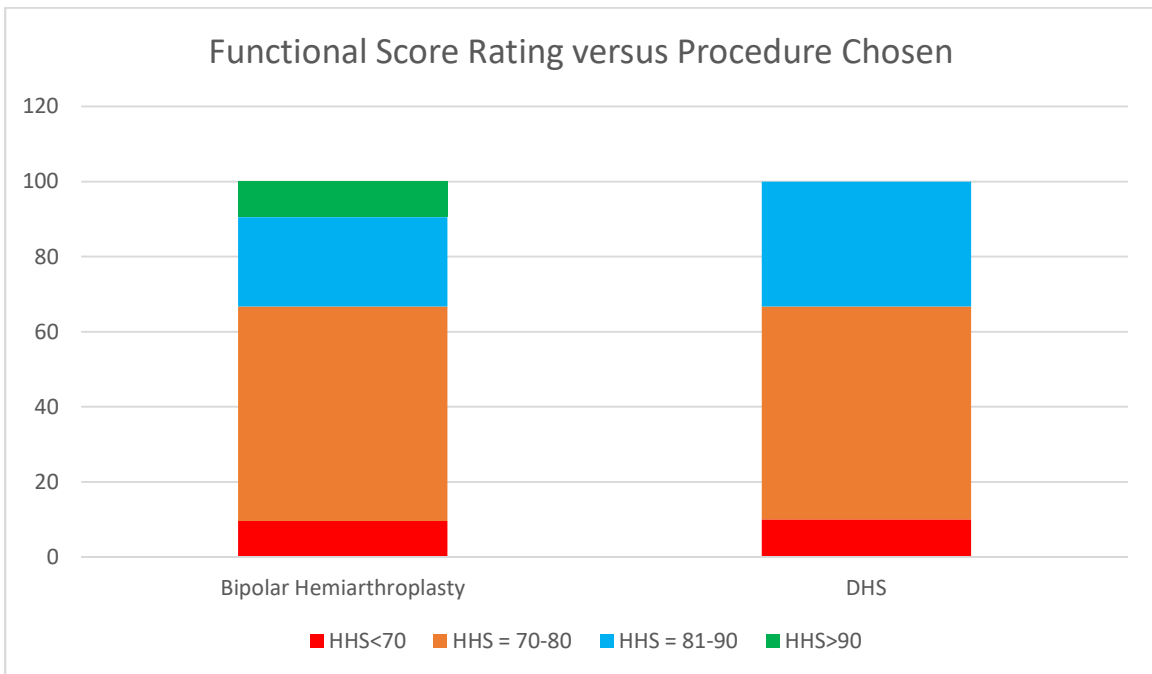


Fig. 7 – Harris Hip Score (at the end of 6 months) with selected procedure

Mobility & Aids Scoring Matrix	Able to walk without Aids(=3)	Requires Walking Stick Occassionally(=2)	Requires Walking Stick at All Times (=1)	Requires Use of Walker
Has regular Job, does work, exercises regularly (= 4)	7	6	5	4
Able to Go outdoors Independently, Does Shopping (=3)	6	5	4	3
Stays Indoor most of the time (=2)	5	4	3	2
Requires assistance of another person (=1)	4	3	2	1
Unable to walk: Wheel Chair bound	0	0	0	0

Table 2: Mobility & Aids Scoring matrix developed to assess post treatment functional status with Preinjury functional status

Mobility and Aid Score	Bipolar Hemiarthroplasty		DHS	
	Score Fall	No. of patients	Score Fall	No. of patients
Before Surgery Score of 7 Bipolar= 11 DHS = 10	Score Same	5	Score Same	0
	Score fall by -1	3	Score fall by -1	5
	Score fall by -2	2	Score fall by -2	1
	Score fall by -3	1	Score fall by -3	4
Before Surgery Score of 6 Bipolar= 4 DHS = 15	Score Same	3	Score Same	0
	Score fall by -1	1	Score fall by -1	1
	Score fall by -2	0	Score fall by -2	7
	Score fall by -3	0	Score fall by -3	7
Before Surgery Score of 5 Bipolar= 4 DHS = 5	Score Same	2	Score Same	0
	Score fall by -1	1	Score fall by -1	1
	Score fall by -2	0	Score fall by -2	1
	Score fall by -3	1	Score fall by -3	3
Before Surgery Score of 4 Bipolar= 1	Score Same	0		
	Score fall by -1	0		
	Score fall by -2	0		

DHS = 0	Score fall by -3	1		
Before Surgery	Score Same	0		
	Score fall by -1	0		
Bipolar= 1	Score fall by -2	1		
DHS = 0	Score fall by -3	0		

Table 3 – Fall in score as per Mobility and Aid Score – Fall in Score versus number of patients

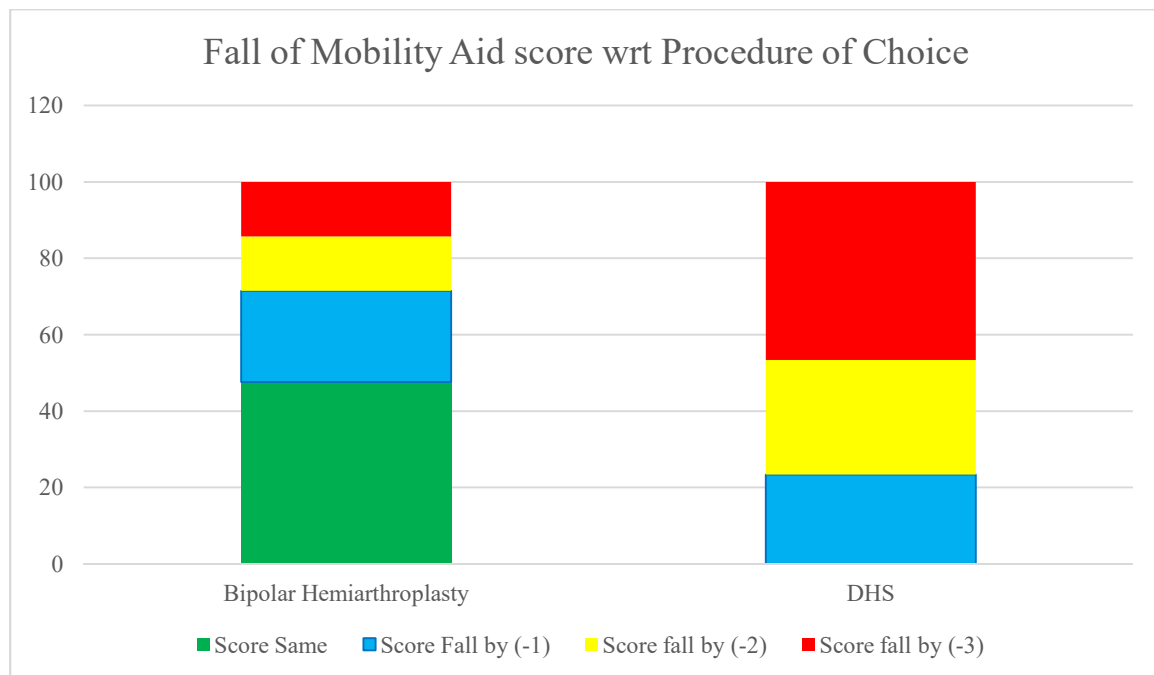


Fig. 8 – Fall in Mobility and Aid score according to procedure chosen



Fig 9. On the Right – Pre operative and Post surgery Radiographs of Internal Fixation & On the Left – Pre operative & Post Surgery Radiographs of Bipolar Hemiarthroplasty

Discussion

The selection of osteosynthesis, in Younger patients with Good Bone Stock is usually unanimous. However, an ideal treatment is still rather controversial in elderly patients because of poor quality of bone mass, co morbid disorders and difficulty in rehabilitation of these patients.²³ Both internal fixation²⁴ as well as Endoprosthesis replacement¹⁸ are being offered to these patients since 1975.

However, Cochrane database²⁵ systematic review 2006 reviewed various types of arthroplasties viz. unipolar, bipolar, hemi, total, cemented and uncemented for Proximal femoral fractures in adults. This review did not comment on merits of arthroplasties over Internal fixation for extracapsular fractures, particularly found no reference to specific suitability of Unstable Intertrochanteric fractures in elderly osteoporotic. This is probably because the two types of treatment are accepted as valid options for different profiles of patients, different fracture patterns at different ages. We nevertheless still believe that a comparison of technical difficulties with these two procedures, propensity for delayed failure of each procedure and ability of either to permit early rehabilitation is relevant for putting the selection of either procedure in proper perspective. Hence a design of the this study was selected which did not emphasise on either randomisation or matching of subjects and gave freedom to the surgeon to select any procedure according to their belief and experience and then we evaluated the results with respect to gains to the patient and occurrence of adverse events.

In our study, we found that the average time of the surgery in both the groups was same if one included the time taken for mounting the patient on fracture table and achieving reduction (Table 1). Average Blood transfusion was also comparable with 1.7 Units in Bipolar Group and 1.2 Units in Internal fixation Group. Broos etal⁴⁴ similarly concluded that the operative time, blood loss, and mortality rates were comparable between the two group.

Functional outcome is an important parameter for suitability of a treatment. When assessed by Harris Hip Score, the functional outcome results were comparable in both the groups (Figure 7) as noted by other authors as well¹⁹ However we believe that Harris Hip Score is an inappropriate tool for Functional assessment in Fracture cases because there had been no opportunity to assess their preinjury score. A standalone comparison of Harris Hip scores following two different procedure may result in Fallacious results. We therefore developed a matrix (Table 2) by simplifying Mobility Scale and Social Dependence Scale²² for comparing post treatment outcome with preinjury status. We understand that this scale helps us to estimate preinjury status of the patient on two important parameters of mobility and social dependence from history alone and helps us to assess the degree of improvement attained with selected intervention.

Using matrix we assessed the functional outcome as compared to preoperative status. We find that Bipolar Hemiarthroplasty group has substantially better functional outcomes compared to Internal fixation Group. 71% patients of Hemiarthroplasty group attained either the same status as before or had a fall in score by 1 (acceptable) whereas none attained preinjury status in Internal fixation group and Only 23% had a fall in score by acceptable 1 (Table 3 Fig. 8).

Proper execution of the any surgery assessed on the basis of known radiographic & clinical parameters is the first step in achieving an intended result and therefore stringent parameters were set for assessment of primary technical failure and delayed failure. To prevent bias from lack of experience, all cases were operated by Senior Consultants with at least 15 years of experience. It was observed that 33.33% of patients had one or more technical errors as on early postop X-rays against 4.76% in Bipolar hemiarthroplasty Group(Fig.5). Despite the perception of being simpler surgery, Internal Fixation appears tougher to get right compared to hemiarthroplasty.

Contribution of factors outside surgeon's control was assessed by Delayed failure. Delayed Failure were also higher in internal fixation group @46.67% versus 38.1%(Fig.5). Even with respect to shortening 9.5% in HA group and 36.67% in IF group had shortening of more than 2.5cm, 70% of patients in IF group had some shortening whereas 33% in Bipolar group had some shortening(Fig 6).

The goal of treatment of an intertrochanteric fracture must be restoration of the patient to his or her preinjury status as early as possible. Prolonged recumbency is particularly detrimental to elderly patients because of risk of complications like atelectasis, bed sore, pneumonia and DVT. Considering that up to 30 percent die with in First year if not rehabilitated quickly⁴ and, presence of associated comorbidities like Cardiac, Pulmonary or Renal Conditions further reduce expected remaining life span of elderly patients, there is a very strong case for choosing, a procedure that can restore elderly hip fracture patients to active ambulatory status quickly.

Main Difference between the two groups was that the patient who had arthroplasty were allowed to walk as tolerated without any restrictions from First day post op, to use limb as normally as possible and this helped overcome the fear of losing the balance much quicker. In contrast, Internal fixation patient, were not able to follow the advice of toe touch weight bearing/non weight bearing ambulation despite much explaining because of deranged sense of balance and lumbering fear of the recent fall event.

And when the bone stock, a necessary prerequisite for holding the fracture fragments long enough for osteosynthesis to succeed, is poor as in elderly osteoporotic patients, the case for selection of the Osteosynthesis as a viable option becomes that much more suspect. And delaying weight bearing as part of the protocol of post-operative rehabilitation inevitably forces additional recumbency in Osteosynthesis cases. Such patient either

continue to remain wheel chair bound and if they ambulate, their altered balance perception and inability to adhere properly to weight bearing instructions threatens increased chance of delayed failure.

Our study reveals, the surgeons chose no patient of age >80 years in Internal fixation group with a clear trend of more Bipolar Hemiarthroplasties at age more than 70 years and less and Less or no Internal fixations in patients above 70 years, with 71-75 years age block being the range where reversal of trend occurs (Fig. 1). Further Female sex also favours selection of Hemiarthroplasty as procedure of choice 53.33% females being selected for Hemiarthroplasty compared to 28.81 males (Fig. 2).

It is therefore safe to conclude from this study that Bipolar hemiarthroplasty is a procedure of choice in Osteoporotic females of age 70 or more and there exists sufficient evidence to favour this selection, there being less chances of complications of recumbency, lesser incidence of primary technical failure, Lesser chances of delayed complications and less chances of shortening and greater chances of return to preinjury level of Mobility and Aid dependence.

We understand the limitations of this study include failure to capture the impact of long-term complications of Arthroplasties viz. Loosening, protusio, late dislocations, and revisions or of Internal fixation viz. Non-union, Late Implant Failure, AVN, Implant related pain & Implant removal surgery, Stress shielding & Peri-implant fractures; and therefore ambiguity still remains in selection of arthroplasty, as to whether it would last the remaining life span of the patient, which internal fixation does if successful. But considering that, surgeons selected those patients who were already nearing end of their seventh decade and often had medical comorbidities, a choice based on predictable better good short-term results is understandable. It should however be noticed that surgeons selected more patients for internal fixation overall than for hemiarthroplasty, even though poorer results may be suggesting need for review of such selection policy.

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