International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2017; 3(3): 221-226

www.orthopaper.com
Received: 11-05-2017
Accepted: 12-06-2017

Dr. Parth Panchal
Assistant professor and
Head of orthopaedic dept
GMERS medical college Valsad,
Halar Road, Nanakwada,
Valsad, Gujarat, India

Dr. Chintan Patel
Assistant professor
GMERS medical college Valsad,
Halar Road, Nanakwada,
Valsad, Gujarat, India

Dr. Anish Rao
Senior resident
GMERS medical college Valsad,
Halar Road, Nanakwada,
Valsad, Gujarat, India

Correspondence
Dr. Parth Panchal
Assistant professor and
Head of orthopaedic dept
GMERS medical college Valsad,
Halar Road, Nanakwada,
Valsad, Gujarat, India

Study of early outcome of Austin Moore's prosthesis with bone cement in fracture neck femur in elderly

Dr. Parth Panchal, Dr. Chintan Patel and Dr. Anish Rao

DOI: http://dx.doi.org/http://dx.doi.org/10.22271/ortho.2017.v3.i3d.44

Abstract
Background: Femoral neck fractures, one of the most common injuries in the elderly and its prevalence has increased with improvement in life expectancy, increased incidence of osteoporosis, and changes in lifestyle leading to sedentary habits. In last four decades hip arthroplasty is evolved as the best treatment for intracapsular fracture neck of femur in elderly in terms of both short-term and long-term results. However, it is still not popular as a first treatment modality because of complications like dislocations and higher morbidity associated with the procedure and also cost.
Objectives: This study was design to gain a deeper understanding of the results and problems associated with this procedure and to evaluate if using bone cement with the Austin Moore's prosthesis offers any distinct advantages in reducing the complications of thigh pain, stem loosening and peri prosthetic fractures.
Results: Out of total 22 majority of patients (90.9%) had transcervical type of fracture. Commonest time of presentation of patients were after 72 hours and average delay in surgery after injury was 12 days. Early postoperative complications like shortening (2), superficial infection (2) deep vein thrombosis (1) was seen. However, no any late postoperative complications like loosening, dislocation, erosion, calcar resorption, protrusio acetabuli or periprosthetic fracture were found. Progressive improvement in Harris Hip Score seen at each follow up visit with average final score at one year was 84.53 with a maximum score of 93 and a minimum score of 65.8.
Conclusion: Hemiarthroplasty using cemented Austin Moore prosthesis for fractures of the femoral neck provides freedom from pain, better range of movement and more rapid return to unassisted activity with an acceptable complication rate.

Keywords: Fracture neck femur, Hemiarthroplasty, cemented Austin Moore prosthesis

Introduction
Femoral neck fractures, one of the most common injuries in the elderly, have always presented great challenges to orthopaedic surgeons. The prevalence of these fractures has increased with improvement in life expectancy, increased incidence of osteoporosis, poor vision, neuro-muscular in-coordination and changes in lifestyle leading to sedentary habits. The prevalence of the fracture also doubles for each decade of life after the fifth decade [1]. The burden of this fracture and its sequelae continues to be on the rise as geriatric population in our society is going to increase in next decades [2]. The goal of treatment of femoral neck fractures is restoration of pre-fracture function without associated morbidity [3].
The introduction of a single piece unipolar metal prosthesis by Thomson in 1954 and Austin Moore in 1957, to replace the femoral head ushered in the era of hemiarthroplasty of the hip as a treatment for these fractures. Experience of the last four decades has shown that hip arthroplasty is the best treatment for intracapsular fracture neck of femur in elderly in terms of both short-term and long-term results [4]. With the superiority of prosthetic replacement over internal fixation being well established, primary Total Hip Replacement (THR) is being offered at many centers as a treatment option for these fractures. However, hip arthroplasty is still not popular as a treatment modality for fracture neck of femur in our country because majority of the patients do well with hemiarthroplasty and also due to the high costs involved. It also has a higher incidence of dislocations and higher morbidity associated with the procedure [5].

This study was design to gain a deeper understanding of the results and problems associated with this procedure and to evaluate if using bone cement with the Austin Moore's prosthesis offers any distinct advantages in reducing the complications of thigh pain, stem loosening and peri prosthetic fractures.

Materials and Methods

A prospective study was carried out at City Hospital, Mangalore during the period of November 2012 to October 2013. Permission from Human Research Ethics Committee was taken before starting the study. Patients satisfying the inclusion criteria like Intra-capsular fracture of the neck of femur and aged above 60 years were included in the study. While patients with pathological fractures, arthritic changes involving the acetabulum, below 60 years of age, not willing for surgery and medically unfit for surgery were excluded from the study. All patients selected for the study were inquired and examined according to protocol and associated injuries, if any, were noted and investigations carried out in order to evaluate fitness for anesthesia.

Regular follow up of all cases was done at 6 weeks, 3 months, 6 months, 9 months and one year. At each follow up, patients were evaluated clinically using the Harris Hip Score and radiologically with appropriate X-rays.

The Harris Hip Score [6]

Maximum possible score is 100 points with four main domains to look for the calculation of score.

1. Pain relief (44 points), 2. Function which contains Gait & Activity (47 points), 3. Absence of deformity (4 points), 4. Range of motion (5 points)

1. Pain (total 44 points)

None or ignores it	44 points
Slight, occasional, no compromise in activities	40 points
Mild pains, no effect on average activities, rarely moderate pain with unusual activity, may take aspirin	30 points
Moderate pain, tolerable but makes concessions to pain some limitation of ordinary activity or work	20 points
Marked pain, serious limitation of activities	10 points
Totally disabled, crippled, pain in bed, bed ridden	0 points

2. Function (total 47 points)

A. Gait (total 33 points)		B. Activities (14 possible points)	
I) Limp (total 11 points)		I) Stairs (4 points maximum)	
None	11 points	Foot over foot without use of banister	4 points
Slight	8 points	Foot over foot using banister	2 points
Moderate	5 points	Stairs in any manner	1 point
Severe	0 points	Unable to do stairs	0 point
II) Support (total 11 points)		II) Shoes and socks (4 maximum)	
None	11 points	With ease	4 points
Cane for long walk	7 points	With difficulty	2 points
Cane for most of the time	5 points	Unable	0 points
One crutch	3 points	III) Sitting (total 5 points)	
Two canes	2 points	Comfortably in ordinary chair for one hour	5 points
Two crutches	0 point	On a high chair for half an hour	3 points
Not able to walk (specify reason)	0 point	Unable to sit comfortably in any chair	1 point
III) distance walked (total 11 points)		IV) Ability to enter public transportation (total 1 point)	
Unlimited	11 points		
About 1000 meters	8 points		
About 500 meters	5 points		
Indoors only	2 points		
Bed and chair	0 point		

3) Absence of deformity: Points (4) are given if the patient demonstrates.

a) Less than 30° fixed flexion contracture
b) Less than 10° fixed adduction
c) Less than 10° fixed internal rotation in extension
d) Limb length discrepancy less than 3.2 cm

4) Range of motion (5 points possible)

Tabulation to calculate the range of motion score

Hip movement	Range	Multiplying factor	Patient's range of movement	Score
Flexion	0-45	1		
	45-90	0.6		
	90-110	0.3		
Abduction	0-15	0.8		
	15-20	0.3		
Adduction	0-15	0.2		
ER in extension	0-15	0.4		
IR in extension	Any range	0		
Total Score				

Range of motion score = Total score × 0.05

Results for Harris Hip score are rated as:

Excellent: 90-100,
Good: 80-89,
Fair: 70-79 and
Poor: <70.

Though Harris Hip score is evaluated at every visit, the final Harris Hip Score calculated at one year is taken to determine the result of the procedure in the present study. Patients were also radiologically evaluated for extent of metaphyseal fill of the prosthesis, any intraoperative errors, loosening of the prosthesis, heterotopic ossification, sinking/subsidence of the prosthesis and protrusio acetabuli.

Result

During the study duration of total 12 months 22 patients were treated by hemiarthroplasty with Austin Moore prosthesis with bone cement for fracture neck of femur at the City Hospital, Mangalore.

Data was collected based on detailed patient evaluation with

respect to history, clinical examination and radiological examination. The postoperative evaluation was done both clinically and radiologically. Out of the 22 cases, all patients were available for follow up till one year which was taken as a basic pre-requisite for inclusion in the analysis of the data.

As seen in table 1 most of the patients (16 out of 22) were between 71 to 80 years of age with youngest was 68 years and oldest was 85 years of age. Female were predominant (64%). laterality pattern of all the study patients with left side being affected in 13 (59%) of the patients. 91 % of patients had fracture due to tripping or slipping while only 9% had because of road traffic accident (RTA). Table 2 shows the comorbidity in study patients. At the time of presentation 45.45% of patient were diabetic 36.27% patients had hypertension or other heart diseases. 13.63% of patients had ipsilateral knee osteoarthritis also.

As per the radiological evaluation it shows that majority of patients (90.9%) had transcervical type of fracture with only one patient each having a basicervical and subcapital fracture. (Figure 1) After injury presentation of patient to orthopedic department was varied and only 6 (27.27%) patient were presented within 24 hours. 7 patients (31.3%) presented after one week of the injury and fracture. (Table 1) However, all study patients were taken for surgical procedure between 3rd to 45th day following trauma and average delay in surgery was 12 days. Commonly used prosthesis size was 43mm followed by 45 mm. The mean prosthesis size was 45 mm, with a mean size of 43 mm in females and 49 mm in males. (Table 3)

Complications

Blood loss during surgical procedure was minimum with 19 (86.35%) patients had less than 750 ml. postoperative hypotension was seen in 3 (13.63%) patients. And one patient had periprosthetic fracture. Early postoperative complications shows that 2 patients had shortening, 2 had superficial infection and one had deep vein thrombosis. (Table 4) However, no any late postoperative complications like loosening, dislocation, erosion, calcar resorption, protrusio acetabuli or periprosthetic fracture were found. The minimum duration of hospital stay amongst the study patients was 16 days and maximum duration was 39 days with the average being 22 days.

Table 1: Demographic data of patients

Patient Distribution	No. of patients	Percentage
Age (years)		
60 – 70	3	13.6
71-80	16	72.7
>80	3	13.6
Gender		
Male	8	36
Female	14	64
Laterality of fracture		
Right	9	41
Left	13	59
Mode of Injury		
Slipping/Tripping	20	91
RTA	2	9
Time to presentation after injury		
<24 hrs	6	27.27
24 hrs – 72 hrs	6	27.27
72 hrs – 1 wk	3	13.63
> 1 week	7	31.8

Table 2: Systemic comorbidities in patients

Co-morbidities	No. of patients	Percentages
Heart Disease	2	9
Hypertension	6	27.27
Diabetes	10	45.45
COPD	1	4.5
Knee osteoarthritis	3	13.63

Table 3: size of prosthesis used

Size	No. of patients	Percentages
39 mm	2	9
41 mm	3	13.6
43 mm	5	22.72
45 mm	4	18.18
47 mm	3	13.6
49 mm	3	13.6
51 mm	1	4.5
53 mm	1	4.5

Table 4: Perioperative and early post-operative complication

Complications	No. of patients	Percentages
Perioperative		
Blood loss		
<500 ml	10	45.45%
500-750 ml	9	40.90%
>750 ml	3	13.63%
Post-operative hypotension	3	13.63%
Periprosthetic fracture	1	4.5%
Early post-operative		
Shortening	2	9.09%
Superficial infection	2	9.09%
Deep vein thrombosis	1	4.5%

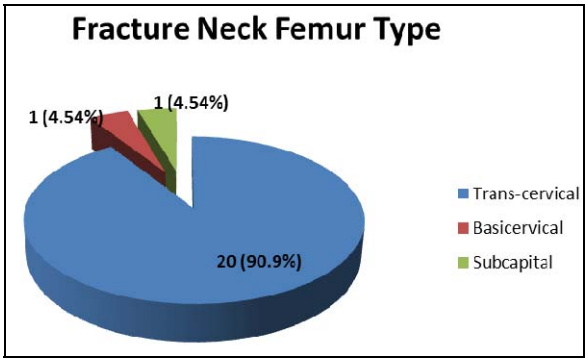

Fig 1: Radiological Type of Fracture Neck Femur

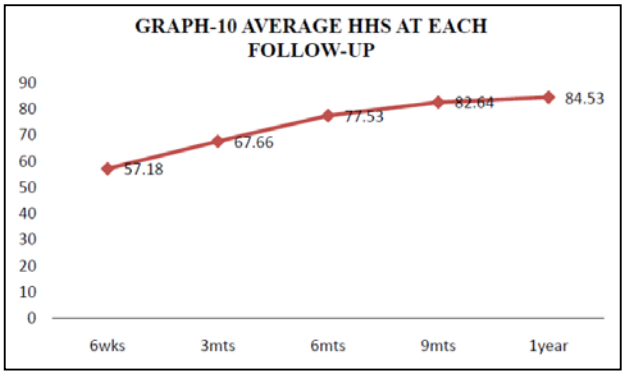

Fig 2: Average Harris Hip Score at each follow up visit

Analysis of the Harris Hip Score

1. **Pain:** At the final one year follow-up, 17 patients (77.3%) had slight, occasional, no compromise in

activities while 5 patients (22.7%) had mild pains with no effect on average activities. No patient had pain of such severity as to limit his/her activities.

2. **Gait Analysis:** 20 (90.9%) of the study patients had slight limp while 2 patients (9.09%) had a moderate limp. At the end of one year, 11 patients (54.54%) were found to be ambulating without the help of any support and the remaining 10 patients (45.45%) needed some support in the form of a cane or walker for long walks. 14 (63.63%) of the study patients could walk an unlimited distance at any given point of time while 6 patients (27.7%) could walk no more than 1000 meters at a time and 2 patients (9.09%) could only manage 500 meters at a time.
3. **Activity:** On evaluation of the patients ability to climb stairs it was found that 4 patients (18.18%) were able to climb stairs without the use of any support or railing while the remaining 18 patients (81.81%) were able to do so with the support of the railing. Since majority of the study patients did not have the habit of using shoes and socks, their ability to trim their toe nails was used as a parameter for evaluation. It was found that 16 patients (72.7%) were able to trim their toe nails without any difficulty while 6 patients (22.27%) found it difficult to do so. With regards to the ability to sit for a long duration it was found that 20 (90.90%) of the study patients were able to sit comfortably on a chair for up to one hour while 2 patients (9.09%) were not able to sit on a chair for more than half an hour at a stretch. All 22 of the study patients were able to enter and use public transport for commuting.
4. **Evaluation of deformities:** None of the 22 study patients had fixed deformities. Two (9.09%) of the study patients had post-operative limb shortening by 1 cm.
5. **Range of Movements:** The average range of movement score of the study patients was 4.8 with 5 patients (22.72%) having a score of 5 indicating attainment of maximum range of movements.

Progression of the Harris Hip Score

The average Harris Hip Score at 6 weeks after surgery was 57.18 with the highest score being 66.65 and the lowest being 43.83. The average Harris Hip Score at the second follow-up of 3 months was 67.66 with the maximum score being 83.88 and the minimum 51.06. At the third follow-up at 6 months the average Harris Hip Score was 77.53 with the highest being 88.8 and the lowest being 57.45. At nine months the average Harris Hip Score rose to 82.64 the maximum score being 92.9 and the minimum being 65.8. At the final one year follow-up the average Harris Hip Score was 84.53 with a maximum score of 93 and a minimum score of 65.8. Though a steady increase in the Harris Hip Score was seen in most patients between each follow-up there was not much change between the fourth (nine month) and fifth (one year) follow-up. (Figure 2)

Final Harris Hip Score and Clinical Result

The final Harris Hip Score as evaluated at one year follow-up averaged 84.53 with the maximum score being 93 and the minimum score being 65.8. (Figure 2) Overall, 4 patients (18%) achieved Excellent result, 13 patients (59%) achieved Good result, 3 patients (13.6%) achieved fair result and 2 patients (9.09%) achieved poor result. 77.27% of the patients achieved an excellent or good result.

Radiological Assessment

1. **Proximal femur morphology:** 6 patients had femur with Dorr type 2 morphology (27.27%), i.e. a wide metaphysic with large medullary canal but relatively good cortex whereas 16 patients (72.72%) had a Dorr type C femur i.e. wide metaphysis with wide medullary canal, loss of isthmus construction and loss of cortical bone stock.
2. **Implantation Error**: The type of implantation error in this study as assessed by method described by Sheriff and Parker. 2 (9.09%) patients had inadequate neck length, 2 (9.09%) had inadequate calcar setting and 1 (4.5%) had periprosthetic fracture.
3. **Metaphyseal Fill:** the relative fill of the stem of the prosthesis to medullary canal of femur at the level of tip of lesser trochanter was studied on antroposterior x-ray. 17 (77.27%) patients had < 70 % metaphyseal fill, whereas only 5 (22.72%) had ≥ 70% fill.

Discussion

The final goal in replacement surgery of fracture neck femur is early return to daily activities to pre fracture levels. This is particularly applicable to the elderly age group where complications related to prolonged immobilization need to be prevented.

The aim of assessing age is to estimate the patient's mean survival time and their ability to comply with rehabilitation protocol. The mean age of the patients in the present study was 74.77 years, which is lower to those reported in Western literature but higher than other Indian series. It might be because of lower life expectancy amongst the Indian population as compared with the Western Patients with hip fractures have an increased mortality rate during the first year after fracture but after one year the mortality rate is comparable to that of the general population. Gender wise distribution shows that female had slight higher fracture rate. This is due to the lower peak bone mass and postmenopausal bone loss in women [7]. Women have a skeleton that adapts less well to ageing by periosteal apposition. More women have bone size and volumetric BMD reduced to below a critical level at which the loads on the bone are near to, or greater than, the bone's structural ability to tolerate them. [8, 9]

Majority of our study patients (90.9%) sustained the injury due to a trivial trauma like tripping or slipping. Falls are a common event, particularly among the elderly. Modest changes in balance function have been described in fit older subjects as a result of normal aging. Subtle deficits in sensory systems, attention, and motor reaction time contribute to the risk, and environmental hazards abound. Epidemiologic studies have identified a number of risk factors for this like weakness, balance deficit, gait disorder, visual deficit, etc. [7]. Most of such injuries can be classified as "indirect" trauma. After injury, 31.8% presented for treatment after one week. It is a common scenario in developing country where patients present to a doctor much late given the seriousness of the condition or seek treatment from osteopaths and then come to an orthopaedician only after no relief in pain is obtained. Difficulty in post-operative rehabilitation was particularly noticed in the subset who presented after 1 week. All the study patients were taken up for the surgical procedure between the 3rd and 45th day after the trauma, the average delay to surgery being 12 days. Delay in taking up for surgery was usually for optimizing the medical condition of the patient and to achieve limb length in patients who presented late and had shortening of more than 2 cm. The shortening was corrected by high tibial skeletal traction using a

Denham's pin. All cases were performed on an elective basis and were scheduled as the first surgery in the morning.

Among all, 72.72% of the patients had at least one medical co-morbidity, which is lower than the 83.3% patients in the series by Noor *et al* [10] more than the 64.5% reported by Saxena *et al*. [11] Diabetes was found to be the most common co-morbidity seen in 45.45% of the study patients. It was observed that the postoperative rehabilitation of patients was significantly affected by the presence of the above co-morbidities. This also had an effect on the final functional result of the procedure.

In 5 patients 43 mm prostheses were used. This was followed in frequency by 45 mm (4 cases), 41 mm, 47 mm and 49 mm (3 cases each) prostheses. The commonly used sizes in the series by Jadhav *et al* was also 43 mm and 41 mm. [12] This is because of the preponderance of female patients and the small build of Indian patients. The rasps used for broadening the canal were part of the instrumentation that came with the prosthesis. The advantage was that the rasp corresponded to the exact length and width of the prosthesis which prevented any additional broadening of the canal and subsequent loose seating of the prosthesis or fractures of the femur.

In present study, most of the patient had blood loss below 500 ml. Only 13.6% had >750 ml of blood loss leading to hypotension requiring blood transfusion. Other complication like peri prosthetic fracture, Vancouver Type A_G [13] i.e. cortical perforation in the greater trochanteric area with stable prosthesis, seen in one patient. It was managed by passing a stainless steel wire loop of 20G besides cementing the prosthesis to secure the fixation. Weinrauch *et al* (2005)m [14] and Parker *et al* (2010) [15], have reported a statistically significant increased incidence of peri prosthetic fractures in uncemented Austin Moore prosthesis compared to cemented Thompson prosthesis. Superficial infection in the form of a wound dehiscence was seen in two patients (9.09%) one of who was a diabetic. There was no case of any cement related complication like hypotension, pulmonary embolism or cardiac arrest and also no late postoperative complications like loosening, dislocation, erosion, subsidence, protrusio acetabuli or periprosthetic fracture.

In present study, the final Harris Hip Score as evaluated at one year follow-up averaged 84.53 with the maximum score being 93 and the minimum score being 65.8. Overall, 4 patients (18%) achieved Excellent result, 13 patients (59%) achieved Good result, 3 patients (13.6%) achieved fair result and 2 patients (9.09%) achieved poor result. Overall, 77.27% of the patients achieved an excellent or good result. It is comparable with other standard studies of uncemented hemiarthroplasty with Austin Moore prosthesis like Dhar *et al* [16] and Moore *et al*. [17]. Results of present study suggest that cementing the stem of Austin Moore prosthesis gives a better functional, lesser pain and improved gait function outcome by providing better primary anchorage of the prosthesis. This is especially important in the osteoporotic femur with weak calcar. A good stable fit allows early mobilization of patients. Considering the advantages of using cement for stem fixation in unipolar hemiarthroplasty and the safety of cementing in patients without severe cardiopulmonary compromise, it would be prudent to cement all Austin Moore hemiarthroplasties.

Evaluation of satisfaction level of patients shows that, 8 patients (36.36%) were 'very satisfied', 10 (45.45%) were 'fairly satisfied' and 4 (18.18%) were 'not satisfied'. The level of satisfaction being a subjective assessment did not correlate well with the Harris Hip Score which was an objective assessment. Patient were also evaluated radiologically pre and post operatively for metaphyseal fill. Sixteen of patients (72.72%) had a Dorr [18] type C femur i.e. wide metaphysis with wide medullary canal, loss of isthmus construction and loss of cortical bone stock. Six patients had femur with Dorr type 2 morphology (27.27%), i.e. a wide metaphysic with large medullary canal, but relatively good cortex. The overwhelming majority of our patients had wide canals due to poor bone stock. This again justifies the need to cement the Moore's prosthesis to achieve a good primary anchorage in wide medullary canals, though this prosthesis has traditionally been used without cement.

The types of implantation errors in this study, as assessed by the methods described by Sharif and Parker [19] which included inadequate length of neck remnant (<12mm), inadequate calcar seating (>1 mm), difference in prosthetic head size compared to contra lateral head (up to 2 mm), intra operative periprosthetic fracture. 2 patients (9.09%) had inadequate neck length as did another 2 patients (9.09%) in whom calcar seating was found to be inadequate. There was one patient (4.5%) with peri prosthetic fracture. There was no error in selecting prosthesis of the correct head size.

In conclusion, Hemiarthroplasty using cemented Austin Moore prosthesis for fractures of the femoral neck provides freedom from pain, better range of movement and more rapid return to unassisted activity with an acceptable complication rate. However, in present study only one year follow up could be done. The long term results using cemented Austin Moore prosthesis needs further study for a longer period in a larger sample with a direct comparison between the cemented versus uncemented groups require to produce more reliable results.

References

1. Leighton R6K, Fractures of the Neck of the Femur. In: Rockwood and Green's fracture in Adults. Ed: Bucholz RW, Heckman JD, Court-Brown CM. 6th edn. Philadelphia, Lippincott Williams & Wilkins 2006, 1753-1791.
2. Swiontowski MF. Intracapsular fractures of the hip. J Bone Joint Surg Am 1994; 76:129-138.
3. Ioro R, Healy WL, Lemos DW, Appleby D, Lucchesi C, Saleh KJ, *et al.* Displaced femoral fractures in the elderly: outcomes and cost effectiveness. Clin Orthop. 2001; 383:229-242.
4. Bhandari M, Devereaux PJ, Swiontowski MF, Tornetta P, Obremskey W, Koval KJ, *et al.* Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. J Bone Joint Surg Am 2003; 85:1673-1681.
5. Maini PS, Talwar N, Nijhawan VK, Dhawan M. Results of cemented bipolar hemiarthroplasty for fracture of the femoral neck – 10 year study. Indian Journal of Orthopaedics 2006; 40(3):154-156.
6. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mould arthroplasty. An end result study using a new method of result evaluation. J Bone Joint Surg Am 1969; 51(4):737-755.
7. Osteoporosis Fauci, Braunwald, Kasper, Hauser, Longo, Jameson *et al.* (Editors). In: Harrison's Principles of Internal Medicine 17th edition, McGraw Hill.
8. Seeman Ego. Pathogenesis of bone fragility in women and men. The Lancet 2002; 359:1841-48.
9. Seeman Ego. Periosteal bone formation- a neglected determinant of bone strength. N Eng J Med 2003;

349(4):320-23.
10. Noor SS, Hussain N, Javed I. Outcome of Austin Moore hemiarthroplasty in elderly patients with fracture neck of femur. J of Pakistan Orthopaedic Association 2012; 22(1):14-9.
11. Saxena PS, Saraf JK. Moore prosthesis in fracture neck femur. Indian Journal of Ortho 1978; 12(2):138-46.
12. Jadhav AP, Kulkarni SS, Vaidya SV, Divekar MM, Suralkar SP. Results of Austin Moore replacement. J Postgrad Med 1996, 42:33.
13. Duncan CP, Masri BA. Fracture of the femur after hip replacement. Inst Course Lect 1995, 44:293.
14. Weinrauch P, Moore W, Shooter D, Wilkenson M, Bonarth E, *et al.* Early prosthetic complications after uncemented Austin Moore and cemented Thompson hemiarthroplasty. A multicenter review of 1118 patients. ANZ J Surg. 2006: 76(6):432-5.
15. Parker MJ, Pryor G, Gurusamy K. Cemented versus uncemented hemiarthroplasty for intracapsular hip fractures- a randomized controlled trial in 400 patients. J Bone Joint Surg (Br) 2010; 92, 116-22.
16. Dinesh Dhar. Early Results of Austin Moore Prosthesis in Elderly Patients with fracture neck femur. J.Orthopaedics 2007; 4(1)3.
17. Moore AT. The Self-Locking Metal Hip Prosthesis. J Bone Joint Surg Am. 1957; 39:811-827.
18. Dorr L, Faugere M, Mackel A *et al.* Structural and cellular assessment of bone quality of proximal femur. Bone, 1993; 14:231-42.
19. Sharif KM, Parker MJ. Austin Moore hemiarthroplasty: technical aspects and their effects on outcome in patients with fractures of the neck of femur. Injury 2002; 33:419-22.