



E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(2): 459-463
© 2020 IJOS
www.orthopaper.com
Received: 15-01-2020
Accepted: 19-02-2020

Dr. Lakhwinder Singh
Associate Professor, Department
of Orthopedics, Adesh Medical
College, Mohri, Haryana, India

Dr. Nilesh kachnerkar
MS Orthopaedics, Associate
Professor, Department of
Orthopaedics, Government
Medical College, Jalgaon,
Maharashtra, India

Comparative result of cannulated versus non-cannulated cancellous screw fixation in fracture neck of femur

Dr. Lakhwinder Singh and Dr. Nilesh kachnerkar

DOI: <https://doi.org/10.22271/ortho.2020.v6.i2g.2081>

Abstract

Background: Cancellous screw fixation is treatment of choice for the management of fracture neck of femur in adults. Many types of screws are available including cannulated and non-cannulated. Both have their advantages and disadvantages. Hence we conducted the study to compare result of cannulated versus non-cannulated screw fixation in terms of intra-operative surgical advantage and post-operative results.

Objectives

1. To compare result of cannulated versus non-cannulated cancellous screw fixation in fracture neck of femur in adults.
2. To study intra-operative surgical advantage of cannulated over non-cannulated cancellous screw fixation.

Patients and Methods: 50 consecutive adult patients ranging from 20-50 years of age those suffering from fracture neck of femur were treated by cannulated and non-cannulated cancellous screw fixation. The study was carried out to compare results of cannulated and non-cannulated cancellous screw fixation for intracapsular fracture neck of femur in young adults.

Results: Study conducted on 50 patients of both sex and age between 20 yrs and 50 yrs within the period of 2 years those suffering from fracture neck of femur. Alternate consecutive patients were treated by cannulated and non-cannulated cancellous screw fixation. Data regarding operative time, radiation exposure and average blood loss was collected. Follow up was done at 6 weeks, 3 months, 6 months and 9 months and Modified Harris Hip Scoring (MHHS) and complications were noted. Data was tabulated and statistically analysed.

Conclusions: Our study showed that cannulated screw fixation has intra-operative advantage over non-cannulated cancellous screw fixation in terms of operative timing, radiation exposure and average blood loss but there was no advantage in terms of complications and post-operative results.

Keywords: Fracture neck of femur, cannulated cancellous screw, non-cannulated cancellous screw, modified harris hip scoring (MHHS)

1. Introduction

Hip fractures are devastating injuries that most commonly affects the elderly and have a tremendous impact on both the health care system and society in general. Despite marked improvement in implant design, surgical technique and patient care, hip fractures consume a significant proportion of our health care resources. Various methods of treatment have been employed since ages. But the problem remains an enigma which is unsolved till today.

The first description of hip fractures was given by French surgeon Ambroise Pare in 1564 ^[1]. However Sir Astley Cooper gave a clear description of fracture neck of femur and other fractures and dislocation about the hip ^[2]. In 1866, Hamilton and Stimson explained the preferential treatment of internal fixation for fracture neck of femur, quoting surgeries performed by John Ray Burton in Philadelphia during 1834 ^[3]. In 1883 Nicholas Senn advocated close reduction and impaction of fragments which would cause union of fracture ^[4]. In 1838, internal trabecular pattern of femoral head was described by Ward ^[5]. Vascular anatomy of head was described by Crock ^[6]. Whiteman ^[7, 8] and Leadbetter ^[9] methods of closed reduction were important contribution to conservative management.

Corresponding Author:
Dr. Nilesh kachnerkar
MS Orthopaedics, Associate
Professor, Department of
Orthopaedics, Government
Medical College, Jalgaon,
Maharashtra, India

This however produced a few satisfactory unions, but extremely high morbidity and mortality. In 1908, Davis reported use of ordinary wood screws for the fixation of femoral neck fractures ^[10]. Similar screws were used by Decosta in 1907 ^[10], Delbet in 1909 and Martin and Knight in 1920.

The first effective method of internal fixation was introduced in 1931 by Smith Peterson and associates ^[11]. S-P nail technique was simplified by the introduction of cannulated nail by Johansson in 1932 ^[12] and Westcott in 1934 ^[13]. In 1945, Virgin and Mac Ausland introduced dynamic compression hip screw (DHS). Several other types of threaded pins like Knowels pins, Gouffon pins (non-cannulated), Hagie pins have been designed and used for internal fixation of femoral neck fractures ^[14]. Knowels (1936) advocated threaded pins should be placed as far apart as possible in the head in an effort to obtain "absolute fixation".

A cancellous lag screw is currently the most commonly used implant for stabilization of femoral neck fractures. Different types of designs have been used including Von Bahr, Uppasala, Garden Asins and the AO/ASIF screws ^[15].

Both cannulated and non-cannulated screws have their own advantages and disadvantages. Cannulated screws which are hollow have strength compromised due to hollowness but offering the advantage of shortening operative time and decrease fluoroscopy exposure as they are placed over guide wires. At the same time non-cannulated screws require pre-drilling blindly which may not be at the suitable place, so may require repeated placement attempts, loss of track may occur while inserting final screws. But they have advantage of more strength compared to cannulated screw.

The treatment algorithm in elderly consist of either hemiarthroplasty or total hip replacement but in adults the treatment algorithm falls in watershed zone due to two main risks, non-union and avascular necrosis followed by late segmental collapse later on and needing another surgery. Non-union is reported to be rare after undisplaced fracture, but occurs in 20-30% of displaced fractures. Avascular necrosis is one of the two important complications of femoral neck fractures. Aseptic necrosis is the actual death of bone secondary to ischemia, an early phenomenon after fracture neck of femur and is a microscopic event ^[16, 17].

Late segmental collapse is the collapse of the subchondral bone and articular cartilage that overlies the infarcted bone. Incidence of late segmental collapse varies from 7% to 27%. Garden had reported increased frequency in women than men ^[18]. Moore demonstrated that in a poor reduction the surface area for blood vessels to grow up the remaining neck is decreased so that the incidence of aseptic necrosis and late segmental collapse is increased when the fracture is poorly reduced ^[19]. Other reported complications are related to the internal fixation itself such as fractures around the implant, loss of fixation by backing out of the screws with collapse of the fracture, and breakage of the screws.

A retrospective study of 84 patients was done by st. Pellet *et al.* (2003) at department of traumatology, university hospital, Lauranne, Switzerland who were operated by cancellous screw for intracapsular fracture neck of femur. The study showed mean age of 63.6 years. The numbers of patients with various Garden grades were as followed: - grade I – 56%, grade II – 19%, grade III – 19% and grade IV- 6%. The patients were followed for a mean time of 2 years. Follow-up showed complication in 15 patients with AVN being the most

common-11 patients (13.4%), followed by non-union in patients (4.8%) ^[20].

KBL Lee *et al* (2004) in there study evaluated the efficacy and safety of cancellous screw fixation in intracapsular fracture neck of femur in 116 patients. The study showed the median age of study was 71 years and two-third was females. There were 104(90%) cases of undisplaced (Grade I and II) fractures and 12(10%) cases of displaced (Grade III and IV) fractures. At 2 year follow-up, 85% returned to the pre-morbid level of ambulation and 90% reported good pain relief. The complication rate was 15% (11 cases) - 11 showed non-union (9%) and in 6 showed AVN (5%) ^[21].

A study of 64 consecutive cases of intracapsular fracture neck of femur was carried out by Lo Irene *et al* (2011) in young adults (age<65 years) treated with reduction and screw fixation between 2000-07. The study showed the mean age was 53.5 years (32-65 years). The mean follow-up period was 36.8 months (6-100 months). The study showed AVN in 9 cases (14.1%). There were 2 cases (3.1%) of non-union ^[22].

The study included the problems faced in placement of screws, intra-operative reduction achieved. Post-operative results were radiologically assessed for breakage, migration into acetabulum, loss of reduction with the screws in place and final results were evaluated functionally using Modified Harris Hip Scoring (MHHS) system as the tool of evaluation.

2. Aims and Objectives

1. To compare result of cannulated versus non-cannulated cancellous screw fixation in fracture neck of femur in adults.
2. To study intra-operative surgical advantage of cannulated over non-cannulated cancellous screw fixation.

3. Material and Methods

A study was conducted in 50 consecutive cases of intracapsular fracture neck of femur in patient between the age of 20-50 years which are admitted in the department of orthopaedics treated by cannulated or non-cannulated cancellous screw fixation irrespective of sex and socio-economic status. The study was carried out to evaluate the immediate and early results of cancellous screw fixation for intracapsular fracture neck of femur in young adults.

Inclusion criteria included: -

1. Age between 20-50 years
2. Traumatic femoral neck fracture presenting within 1 week of injury.
3. Patients who are medically fit for surgery.

ASA 1 and 2

1. Patients with pathological femoral neck fracture.
2. Ipsilateral or contralateral major limb injury affecting treatment and rehabilitation.

3.1 Grouping

Alternate consecutive patients were operated with cannulated and non-cannulated screws.

3.2 Procedure: Patients were admitted to the ward. In all patients buck's traction with 5 pound weight was applied to the fracture limb and patients were given oral or parenteral NSAIDs to relieve the pain. Antero-posterior radiograph of the pelvis with both hips were taken for all the patients, keeping the fractured limb in 15° internal rotation to bring the neck parallel to X-ray film.

All surgeries were performed on an elective basis using standard aseptic precautions. Surgeries were performed under spinal or general anaesthesia on a fracture table where the pelvis was rested on the perineal support and the affected limb was placed in abduction to facilitate C-arm examination (fluoroscopic image intensifier).

Reduction was done by closed method using either Whitman or Leadbetter method whichever succeeds in accurate reduction. The accuracy of reduction was evaluated clinically by the "heel-palm" test and radiographically by Garden's alignment index. In heel-palm test, the heel is placed in the palm of an outstretched hand. If the reduction is complete, the leg will not rotate spontaneously externally. Reduction was confirmed with AP and lateral view under C-arm exposure on monitor screen.

The affected limb was scrubbed from abdomen to ankle joint, then painted with betadine solution and drape applied exposing ASIS and proximal end of lateral part of thigh for the intended procedure.

3.3 Surgical Technique [23]: As per standard technique a lateral longitudinal incision in line with the greater trochanter measuring about 4-6 cm starting at the base of the greater trochanter and extending distally was made. The superficial fascia, tensor fascia lata and vastus lateralis were then split in the line of skin incision. The origin of vastus lateralis were elevated subperiosteally at the base of greater trochanter.

Determination of anteversion of the femoral neck was done by placing a threaded guide wire on anterior aspect of femoral neck and confirming its position with image intensifier.

3.3.1 For Cannulated Screw Fixation: Using a power drill, a positioning guide wire was placed. Confirming the position of wire with C-arm, wire was placed accurately in the proximal femur, calcar and head parallel to the anteversion wire in antero-posterior and lateral views. This wire stabilises the head and prevents displacement or rotation of head during insertion of other guide wires. Second guide wire was placed in the postero-superior part. Third guide wire was placed in the antero-superior part.

The screws were placed as far as possible close to the cortical bone. The anteversion guide was removed. The position of guide wires was confirmed in C-arm image intensifier in both AP and lateral views. All the guide wires were threaded into the subchondral bone upto 5-10mm of the femoral head margin.

Using the direct measuring device, the insertion depth of three guide wires was determined. The drilling depth was calculated by subtracting 10mm from this reading. This is to prevent penetration of the joint. The screw length was calculated by adding 5mm to the drilling depth as the screw head remains outside the near cortex.

4.0 mm cannulated drill bit with drill sleeve was inserted over the guide wire. Drilling was done to the depth determined as above and confirmed with image intensifier. Care was taken not to change the direction of drill bit but rather to let it follow the guide wire. Cannulated tap was passed over the guide wire to tap the near cortex.

A screw was selected so that the threaded portion crosses the fracture line and engages the proximal fragment. The screws were used with washers in some cases to prevent screw head penetration into the bone. Using the cannulated hexagonal screw driver, the cannulated screws were inserted over the guide wire till 5-10mm of screw was outside the lateral cortex. All the screws were tightened simultaneously for final

purchase into the subchondral femoral head. The position of screw was confirmed in C-arm image intensifier in both AP and lateral views.

3.3.2 For Non-Cannulated Screw Fixation [24]: freehand technique was used. A hole is drilled in the inferior cortex using a solid 4.0 mm drill bit and position was confirmed on image intensifier. Then a non-cannulated screw was inserted without tapping. Similarly other two screws were inserted in the superior cortex. Traction released and final tightening done.

The wound closed in layers. Sterile compression dressing was done, traction removed and patient shifted to recovery.

After each operative procedure number of radiation exposures (films taken), duration of surgery and weight of sponge for blood loss was noted. Weight of each sponge was noted pre-operatively and post-operatively and each gram of weight was considered equal to one gram of blood loss.

3.4 Post-Operative Management: In case of spinal anaesthesia, foot end elevation was given depending on the patients post-operative blood pressure. Every 6hrly blood pressure, pulse rate, temperature, respiratory rate monitored for the first 24 hrs. Intramuscular analgesics were given as per patient's compliant, intravenous antibiotics were continued for 3 days [25].

Patients were made to sit up on the first day after surgery. Quadriceps and knee bending started on 2nd day. Check radiograph was taken after 48 hours to note the adequacy of reduction. First dressing was done on 5th post-operative day to observe for any discharge, presence of infection, gaping and condition of stitch line. Suture removal was done on 11th post-operative day. The patients were mobilised using a walker as soon as possible but weight bearing on affected limb was not allowed before discharge from hospital.

Patients who had infection and bed sores were treated accordingly before discharging them from the hospital. After suture removal, the patients were discharged with instructions not to bear weight on the affected limb till further instruction. Sitting cross-legged, squatting and straight leg rising were not allowed. Patients were told to continue static quadriceps and knee bending exercises and to do the toe and ankle movement.

At the time of discharge the patients were asked to come for follow up after 6 weeks and for further follow up at 3 months, 6 months and 9 months. The patients who turned for follow up or whose details could be collected were finally taken up for assessment for functional results. At each follow up patients were evaluated clinically by Modified Harris Hip Scoring system and clinical examination was done regarding the pain, tenderness, active range of movements of hip and limb length discrepancy and all the details were recorded in the follow up chart. The radiograph of operated hip was taken at each follow up and looked for progressive signs of union, and accordingly patients were allowed partial to full weight bearing walking.

At 9 months patients were evaluated clinically and final MHHS was noted and radiologically union and complications like non-union, AVN (evident by area of increased density in subchondral area), any loosening of threads or shaft of screws, breakage of screws, migration into acetabulum, neck length absorption as evident by prominence or backing out of screw heads, loss of reduction with screw in place were noted.

4. Results

Study conducted on 50 patients of both sex and age between 20 yrs and 50 yrs, treated by internal fixation by cannulated and non-cannulated cancellous screw were subjected for this study and patients were followed at the interval of 6 weeks, 3 months, 6 months and 9 month at follow up. Data was tabulated and statistically analysed.

Table 1: Showing age distribution

	Age
Mean	36.6
S.D.	9.08

Table 2: Showing sex distribution

Sex	Males		Females	
	Frequency	%	Frequency	%
	39	78.00	11	22.00

Table 3: Showing side involvement

Side	Right		Left	
	Frequency	%	Frequency	%
	23	46.00	27	54.00

Table 4: Showing duration of surgery

Type of screw fixation	No. of patients	Average duration of surgery (in minutes)	Standard deviation
Non-cannulated	25	52.8	6.79
cannulated	25	44.4	7.53
p		<0.05	

Table 5: Showing radiation exposure

Type of screw fixation	No. of patients	Average number of x-ray shots taken	Standard deviation
Non-cannulated	25	84.16	9.91
cannulated	25	70.76	11.59
p		<0.05	

Table 5: Showing average blood loss

Type of screw fixation	No. of patients	Average duration of surgery (in minutes)	Standard deviation
Non-cannulated	25	52.0	12.65
cannulated	25	38.4	11.20
p		<0.05	

Table 6: Showing complications

Complications	Group		No. of cases	Percentage (%)
	Non-cannulated	Cannulated		
Infection	0	1	1	2
Non-union	4	1	5	10
AVN	2	2	4	8
Broken screw	0	1	1	2
X2				0.116
P				>0.5

Table 6: Showing results –According to Modified Harris Hip Score

Results	Group		Total	Percentage (%)
	Non-cannulated	Cannulated		
Excellent	20	18	38	76
Good	4	5	9	18
Fair	0	1	1	2
Poor	1	1	2	4
X2				0.354
P				>0.5

5. Conclusion

The femoral neck fracture continues to be unsolved fracture and the guidelines for management are still evolving. The treatment of intracapsular fracture neck of femur with anatomical reduction, early and stable fracture fixation with 6.5mm cancellous screw was found to give a high percentage of excellent and good results.

The management has evolved significantly. It started with close reduction and immobilisation in POP hip spica in abduction and internal rotation (Whiteman abduction plaster) in the early part of 20th century. High incidences of AVN, non-union, bed sores and respiratory complications led to exploration of methods of internal fixation. Further improvement in implant designs brought in newer devices like SP nail plate and McLaughlin nail plate; these also did not stand the test of time. The modern concept of fixation under compression led to the use of partially threaded cancellous screws and placement over preliminary wires led to the development of cannulated variety of screws, which are now the standard of care in adults.

The presentation at different ages poses different problems related to the management. The issues are fixation failure in osteoporotic bone of elderly, marked displacement of fragments, posterior comminution and disruption of blood supply in adults, and a higher incidence of non-union and AVN in adults. Hence accurate reduction and internal fixation are mandatory requirements to expect fracture healing.

In the present study it was found that mean age was 36.66 years with male predominance (78%) and regarding site of injury left to right ratio was 1.17:1.

Our study showed that cannulated screw fixation has the advantage of shortened operative time and decreased fluoroscopy exposure as they are placed over guide wire. Also there is decrease blood loss due to shortened operative time. But in terms of functional results and complications there was no difference between the two groups. There is single case of broken screw which occurred in cannulated group, this may be due to decreased strength of cannulated screws due to hollowness.

6. Discussion

Many studies were carried out to find out the results of fixation in femoral neck fracture like studies by M.F. Swiontkowski *et al* (1984), St. Pellet *et al* (2003) [20], G.J. Haidukewych *et al* (2004) [26], KBL *et al* (2004) [24], Sibaji chaudhari (2008) [27] and Lo Irene *et al* (2011) [22], and all favours the treatment with cancellous screws for fixation of femoral neck fracture.

Preservation of femoral head with internal fixation is desirable in younger and more active patients with femoral neck fracture. A healed femoral neck fracture, without the development of osteonecrosis, leads to good functional outcome. In adults, femoral neck should be preserved and fixed with cancellous screws as this gives high percentage of excellent and good results. Cannulated screw fixation definitely has intra-operative advantage but there is no significant difference in terms of complications and results. Hence cannulated screws is best for fixation of intracapsular fracture neck of femur, and this is going to stay for a long period in orthopaedic practice.

The limitations of current study were that study group is small; follow up was of medium duration to comment on true incidence of AVN. So further follow up is required to comment on true incidence of AVN.

7. Reference

1. Cooper A. A treatise of dislocation and on fractures of the joints. London, Longman, Rees, 1822.
2. Cooper A. Fractures of the upper part of the thigh bone. A treatise of dislocation and on fractures of the joints, 3rd edition London, Longman, Rees, 1824.
3. Carnesale PG, Anderson LD. Primary prosthetic replacement for femoral neck fractures. Arch. Surg. 1975; 110:27-29.
4. Senn N. The treatment of fractures of the neck of femur by immediate reduction and percutaneous fixation. JAMA. 1889; 13:150.
5. Ward FO. Human anatomy. London; Renshaw, 1838.
6. Crock HV. An atlas of the arterial supply of the head and neck of the femur in man. Clin Orthop. 1980; 152:17-27.
7. Whitman R. A new method of treatment for fractures of the neck of the femur, together with remarks on coxa vara. Ann Surg. 1902; 36:746-761.
8. Whitman R. The abduction method considered as the standard routine in the treatment of fractures of the neck of the femur. J Orthop Surg. 1920; 2:547-553.
9. Leadbetter GW. Closed reduction of fractures of the neck of femur. J Bone Joint Surg. 1938; 20:108-113.
10. Wilym G. Davis G. The operative treatment of intracapsular fracture of the neck of the femur. J Bone Joint Surg Am. 1909; s2-6:481-483.
11. Smith-Peterson MN, Cave EF, Van Gorder GW. Intracapsular fractures of the neck of the femur: treatment by internal fixation. Arch Surg. 1931; 23:715-759.
12. Johansson S. The operative treatment of medial fractures of femoral neck. Acta Orthop Scand. 1932; 3:362-385.
13. Westcott HH. A method for the internal fixation of transcervical fractures of the femur. J Bone Joint Surg. 1934; 16:372-378.
14. Kenneth J Kovel, Zukerman JD. Femoral neck fractures. In: Hip fractures – A practical guide to management. New Delhi. 2006, 1-127.
15. Crawford EJ, Emery RJ, Hansell DM. *et al.* Capsular tension and intracapsular pressure in subcapital fracture of the femur. J Bone Joint Surg. 1988; 70B:195.
16. Catto M. A histological study of avascular necrosis of the femoral head after transcervical fracture, J Bone Joint Surg Br. 1965; 47:749-776.
17. Catto M. A histological study of avascular necrosis of the femoral head after transcervical fracture, J Bone Joint Surg Br. 1965; 47:777-791.
18. Garden RS. Malreduction and avascular necrosis in subcapital fractures of the femur. J Bone Joint Surg Br. 1971; 53:183-196.
19. Moore AT. Hip joint fracture (a mechanical problem). Instr Course Lect 1953; 10:35-49.
20. St. Petel *et al.* Sub or inter-trochantric fractures following screw fixation. Swiss Surg. 2003; 9:82-86.
21. KBL Lee *et al.* Cancellous screw fixation for femoral neck fractures: one hundred and sixteen patients. Ann Acad Med Singapore. 2004; 33:248-251.
22. Lo Irene *et al.* Journal of orthopaedics trauma and rehabilitation, 2011, 1-4.
23. Terry S, James H Beaty. Campbell's operative orthopaedics: 11th edition; 3, 3277-3278.
24. Kenneth J Kovel, Zukerman JD. Femoral neck fractures. In: Hip fractures – A practical guide to management. New Delhi. Springer, 2006, 65-67.
25. Terry S, James H, Beaty. Campbell's operative orthopaedics: 11th edition, 3, 3276.
26. George Haidukewych J, Walter Rothwell S, David Jacofisky J, Micheal Torchiaand E, Daniel Berry J. Operative treatment of femoral neck fractures in patients between the age of fifteen and fifty years. J Bone Joint Surg Am. 2004; 86:1711-1716.
27. Sibaji Choudhari. Closed reduction, internal fixation with quadratus femoris muscle pedicle bone grafting in displaced femoral neck fractures: Indian J Orthop. 2008; 42(1):33-38.