



AN OSTEOSYNTHESIS PROJECT IN THE NEGLECTED FRACTURE NECK OF THE FEMUR USING NONVASCULAR FIBULA GRAFTS

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ABSTRACT

Femur neck fractures are difficult to treat if left untreated. A young patient's head of femur should be preserved. There are several bone graft options, including osteosynthesis, osteotomy with or without vascular or non-vascular grafts. It was determined that osteosynthesis with nonvascularized fibula grafting can be effective when treating neglected fracture necks of the femur in young adults. The participants in this study were 15-60-year-old with traumatic fracture necks of the femur that were delayed over 3 weeks. In 81.25% of our patients, the HHS was 70 or higher. 6.25% of patients did not union and 12.5% had AVN. For young patients suffering from neglected fracture necks of femur, nonvascular fibula grafting appears to be a viable treatment option. In comparison with other more complicated procedures, it is technically less demanding

Key words:- Osteosynthesis, Non-Union, Fibular Graft, Fracture Neck of Femur

Access this article online

Home page:

<http://www.mcmed.us/journal/ajomr>

Quick Response code



Received:16.04.2017

Revised:05.05.2017

Accepted:28.05.2017

INTRODUCTION

In the past, fracture necks of femurs were referred to as "unsolved fractures." [1] However, recent studies have shown that these fractures are now less likely to develop avascular necrosis (AVN) and nonunions. [2,3] Several explanations may explain this, including selecting patients properly for osteosynthesis. Treatment of neglected fracture necks of femurs remains challenging. A revision surgery is required in approximately 30% of cases treated surgically for fracture necks of femur. [4] These failures typically require arthroplasty replacements. Because of our culture of sitting cross-legged and squatting, arthroplasty would not be an appropriate option for our country. It would prevent repeated surgeries and improve outcomes if patients with neglected fracture neck of femur

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were managed with a total hip evidence-based approach even in affluent nations. According to Barnes et al. [6], complication rates significantly increase after more than a week of treatment delay. The femoral head should therefore be salvaged by some additional procedure. Osteotomies and bone grafting procedures are available for this purpose. Since there is no consensus on the best treatment among these options, today we are faced with a dilemma.

It has been shown in this study that neglected fracture necks of the femur in young patients can be avoided due to early loosening of the prosthetic components. [5] As a result, an evidence-based approach to femur fracture necks would prevent repeated surgeries and result in better outcomes in patients with neglected fracture necks.

Barnes et al. [6] found that delayed treatment significantly increases the risk of complications. The

femoral head may therefore need to be salvaged through some additional procedure. Many options are available for bone grafting and osteotomies. Since there is no clear consensus on the ideal treatment, we are faced with a dilemma today. The purpose of this study was to analyze a prospective case series of young adults who had neglected femoral neck fractures, initially treated with osteosynthesis using cannulated hip screws with additional vascularized fibula grafting. In addition to evaluating the results, we aimed to identify at-risk patients and improve the method in order to avoid failure.

PATIENTS AND METHODS

Based on Meyer's et al.'s definition, it is unclear what constitutes neglected fracture neck of the femur. [7] are referring to a 1-month evaluation period, whereas Nagi et al. [8] have used a 3-week evaluation period, beyond which the fracture is considered neglected. [8] and Sandhu et al. [9] have used the same criteria. In our study, we included young adults 15-60 years of age with traumatic fracture necks of the femur that were delayed 30 days or more.

The institute has treated 22 cases of neglected intracapsular fractures of the neck of the femur between September 2015 and December 2016. In total, 18 males (82%) and 4 females with an average age of 42 years (15-60) were enrolled. Six of the patients had a history of falls. Sixteen patients had been injured in road traffic accidents (73%).

In addition, patients with pathological fractures, osteonecrosis of the femoral head, collapse of the acetabulum, and patients with any other pathologies in the hip, e.g., rheumatoid arthritis, were excluded from the study. Approximately 17 weeks are the average time it takes for a patient to present, ranging from 3 to 55 weeks. All fractures were recorded according to the side, any associated injuries, comorbidities, level, and Pauwel's and Garden type. [Table 1]

It was not necessary to investigate the vascular status of the femoral head in any special way. We performed a computed tomography scan for two patients with femoral head density changes without flattening or collapse in their preoperative radiographs suggesting AVN (cases 1 and 14), who were then referred for surgery.

A preoperative skin traction was given above the knee after all routine investigations had been completed. Case 12 involved an upper tibial skeletal traction for a patient with significant proximal migration of the femur. This study also included three cases with the same principles treated by three different surgeons, with the author performing the majority of the procedures.

A fresh fracture neck of the femur was treated using the same operative principles. All patients have been satisfactorily reduced by closed reduction with the exception of two patients (cases 11 and 14) who had an

open reduction by Watson's Jones method. The fracture was fixed by one surgical team, while the fibular graft was harvested by another. We did not split or drill the graft.

Periosteum was, however, preserved with special care. On 11 patients, triangular guide wires were used, on 10 patients, inverted triangular guides were used, and on 1 patient, all guides were given at the same angle. Initially, the cancellous cannulated screws were placed over either of the two guide wires, and then the third guide wire was left to place the fibula graft. No particular location was selected for the screws, as they were placed based on the convenience of placing the fibula graft. By using the 8 mm section of the triple reamer, the neck was then reamed over the third guide wire. Following this, the third guide wire was hammered into place over the fibula strut graft.

A third postoperative day was chosen for mobilization based on the patient's pain tolerance. A six-week exercise program was initiated after hip surgery to strengthen the hip joint. It was recommended that all patients remain non-weight bearing for the first six weeks. A crutch was used to mobilize the patient, with weight bearing at the toes. After 12 weeks of surgery, the patient was permitted to bear full weight as tolerated.

A follow-up of six weeks, three months, and six months was conducted on all patients following surgery, as well as every six months thereafter. We calculated the modified Harris Hip Score (HHS) at each follow-up following a thorough clinical examination. Complications were examined at both surgical sites.

Every follow-up included a radiograph of the anterior-posterior and lateral views of the hip. Union was considered to occur when bones bridged over the fracture site. We noted when union first occurred during the follow-up period. There were changes in bone density, isolated patches of sclerosis, discrete rarefactions, and subchondral cortical depressions that were observed in people who had AVN. An evaluation was done on the fibula graft for any fracture and back out was performed. A sign of revascularization is the incorporation of fibula grafts (partial or complete) plus the presence of trabecular continuity.

RESULTS

The study excluded patients with a follow-up period of more than one year. Thus, two patients who underwent surgery within a year were excluded. One patient died within one month of surgery, and three patients went unfollowed. The results of 16 patients could therefore be evaluated. He and his team evaluated, staged, and scored the manuscript.

Following up on sixteen cases took an average of 6 months (5-7.5 months), with fifteen of the cases marrying on average after a follow-up period of 34.4 months (14-50 months). HHS averaged 82.06 within a 53-100 range at the final follow-up. There were six cases

where excellent results were achieved, four cases where good results were achieved, and three cases where fair results were achieved. There were three patients who had poor results with HHS <70 [Table 2].

A significant gap appeared on the postoperative radiograph in two patients, but both completed union at seven and six months after surgery (cases 12 and 14), respectively. Unlike the second patient, the first patient's graft was incorporated.

The segmental collapse of one patient occurred 1.5 years after surgery (case 11). Implant penetration has occurred in the joint. As for case 7, a patient without preoperative radiological signs of AVN developed Ficat-stage II osteonecrosis.

The procedure resulted in the development of AVN in 2 out of 16 patients (12.5%). The study has a very short follow-up, so we cannot comment on AVN incidences after 3 years, as AVN can occur even after a surgical procedure. [10] In another patient (case 3), there was implant penetration in the joint after 18 months. Ten of the 16 patients showed evidence of revascularization,

however, as Nagi et al. [8] noted, the fibula was not selectively incorporated in the neck.

A 60-year-old female patient died within a month of surgery (case 9). Her cognitive function was significantly impaired. After being discharged, she remained bedridden for four weeks before succumbing to her illness.

In one patient, the neck was completely reabsorbed, resulting in a significant shortening of 3 cm (case 4). The same side of his injury has lymphedema (filariasis) in his feet and legs.

After 19 months of surgery, one patient with an excellent outcome had a fixed flexion deformity of 10° (case 8). Five months after surgery, the fibula graft was partially incorporated into the joint.

Neither neurovascular injury nor compartment syndrome nor weakness of extensor hallucis nor ankle instability were observed at the graft site. However, one patient (case 7) complained of tingling sensations in the foot and leg, and the other developed superficial surgical site infections that resolved with oral antibiotics. (case 17).

TABLE 1: PATIENTS AND METHODS

CASE NUMBER	AGE/SEX	DELAY (WEEKS)	ASSOCIATED INJURY/COMORBIDITY	SIDE/LEVEL OF FRACTURE	GARDEN TYPE/PAUWEL'S TYPE	CONFIGURATION USED	POSITION OF FG
1	30/female	26	-/spondylolisthesis	Left/SC	IV/II	IT	I/C
2	35/male	3	Scrotal injury/-	Right/BC	II/III	T	S/C
3	37/male	7	—	Left/SC	IV/III	IT	I/C
4	56/male	4	-/elephantiasis of left leg and foot	Left/TC	IV/III	IT	I/C
5	52/female	15	—	Left/SC	IV/II	T	A/I
6	43/male	14	—	Left/TC	III/II	T	A/I
7	62/male	12	Distal radius#/-	Right/TC	III/III	IT	I/C
8	45/male	4	—	Right/TC	III/II	T	A/I
9	56/female	7	-/cognitive imbalance	Left/SC	IV/II	T	P/I
10	42/male	6	Head injury/-	Right/SC	IV/III	T	S/C
11	40/male	5	—	Left/SC	III/II	IT	I/C
12	17/female	53	—	Left/SC	III/III	IT	I/C
13	43/male	34	—	Left/SC	IV/II	IT	I/C
14	52/male	57	—	Right/TC	IV/II	IT	I/C
15	29/male	6	Chest injury/-	Left/TC	IV/III	T	S/C
16	35/male	15	—	Right/SC	IV/II	T	P/I
17	47/male	12	—	Left/SC	III/II	T	P/I
18	33/male	4	—	Left/SC	IV/III	T	P/I
19	36/male	16	—	Left/TC	IV/III	IT	I/C
20	42/male	14	—	Left/TC	IV/III	P	C/C
21	40/male	18	-/DM	Left/SC	IV/III	T	S/C
22	24/male	24	-/coxa valga, corrected CTEV	Right/SC	IV/I	IT	I/C

TABLE 2: RESULTS

CASE NUMBER	TIME SINCE SURGERY (MONTHS)	HHS	UNION (MONTHS)	EVIDENCE OF AVN/FICAT	GRAFT STATUS	COMMENT
1	47	93	4	Absence	I	Had preoperative AVN
2	52	95	5.5	Absence	I	—
3	43	70	6	Absence	NI	Implant penetration in the joint
4	35	52	5	Absence	I	Shortening, C/L fibula used
5	Lost to follow-up					
6	41	74	7	Absence	NI	
7	40	60	7.5	Stage II	NI	Tingling sensation over foot and leg
8	42	90	4	Absence	I	10° FFD
9	Patient died					
10	41	80	6.5	Absence	I	
11	40	65	NU	LSC	NI	ORIF
12	37	90	7	Absence	I	Postoperative gap at number site
13	35	86	5.5	Absence	I	
14	27	83	8	Absence	NI	Had preoperative AVN and gap at number site, ORIF
15	Lost to follow-up					
16	Lost to follow-up					
17	17	72	7	Absence	NI	Had postoperative infection at graft site
18	22	100	7	Absence	I	
19	16	96	5	Absence	I	
20	14	85	7.5	Absence	I	
21	12				Patient	excluded

DISCUSSION

There was a belief in the early 20th century that a fractured neck of the femur would permanently disable a person. [11] But now, almost normal function is expected following the fracture. Fractures of the neck of the femur are not uncommon in patients who have neglected their medical care for weeks to months. We are taken back to the same age of confusion and controversy because of their negligence in seeking treatment. These fractures have been neglected for a long time and proper guidelines have yet to be developed for their management.

Nonunion rates for nonvascular fibular grafting in neglected fracture necks have been reported between 0-17% by Roshan and Ram [12] and AVN rates between 0-33% by other authors. Different studies have used different criteria for evaluating the functional status of patients, making it difficult to compare functional outcomes. During a mean follow-up of over six years, Roshan and Ram [13] found that patients treated by this method had an average HHS of 87.1. Nonunion of femoral neck fractures after fixation is most commonly

associated with poor reduction and fracture displacement. A closed method is not usually able to reduce femur neck fractures that are neglected. [14] Repetitive attempts can further compromise femoral head blood supply. There are some authors who recommend going for open reductions in this situation. [8]

Nevertheless, open reductions don't only increase surgical time, blood loss, and morbidity, but also damage the arcade of blood vessels at the base of the femoral neck, which increases this injury to the femoral head. [15,16] A late segmental collapse occurred in one of two patients in our series who had an open reduction. The immediate postoperative radiographs of two patients showed a significant gap at the fracture site, but both patients achieved union, and both had excellent and good functional outcomes. Therefore, we should try to achieve a closed reduction if possible, even if the reduction isn't accurate. It is well known that the aging process leads to healing complications [6]. Although we have achieved an average HHS of 82.06, the average HHS for patients over 50 years old is only 57.5. Regarding the osteosynthesis and fibula grafting of older

patients over 55 years of age, Sandhu [17] has not recommended it. The results of our study support the same

CONCLUSION

It has been reported that male patients have about half the complications related to fractured necks of femur compared to female patients. [18] However, in our series, female patients had a better outcome than male patients. Regardless of the level of the fracture, Gardens and Pauwel's type of fracture, no particular pattern of outcome was observed. Most studies have shown similar outcomes for fractures of the type III and IV of the gardens system, and recent studies suggest that the outcome doesn't depend on the level of the fracture [19] [6].

A recent meta-analysis [20] by Jain et al. The treatment guidelines for neglected fracture necks of the femur have been proposed on the basis of the length of delay, and osteosynthesis has been recommended only for patients with neglect for more than six months with vascular heads and Sandhu stage II or lower. In our series, two patients with neglect over 6 months had an excellent outcome with 100% union, and two patients had a good functional outcome with 100% union. Our results show that fibula grafting can enhance fracture biology regardless of the length of delay irrespective of the vascular status of the head and Sandhu type.

When placing screws in the fracture neck of the femur, most authors recommend an inverted triangular configuration rather than a triangular configuration. Biomechanical studies support this conclusion. The triangular configuration was associated with nonunion in a recent study by Yang et al [14]. In patients with an inverted triangle configuration, we have achieved a good functional outcome, and in patients with a triangular configuration, we have achieved a fair functional outcome. Nonunion and AVN were also more prevalent in the triangular group. In this case, it is possible that inverted triangles are more ideal for fixing femoral neck fractures, even in neglected cases.

Those with a good functional outcome had fair functional outcomes from inferior central fibula grafts. Our series included two patients with implant penetration in the joint who had the screw placed superior to the graft. According to LeCroy et al. [5,] the results are similar. Because of this, it is not recommended to place the fibula graft above the implant.

There is a difficulty in treating patients with osteonecrosis in a precollapse stage. Nagi[8] and Inclin[21] both report revascularization of avascular heads. Only the first patient in our series had graft incorporation; the second patient did not show signs of revascularization until final follow-up; both patients achieved union with preoperative AVN.

Besides providing mechanical strength, the fibula also stimulates the union and is incorporated into the bone. In addition to stabilizing the fracture, the triffin shape of the fibula prevents rotation. Thus, the nail can be regarded as a biological Smith-Petersen nail. [10] A tibial graft of the Plemister type is another nonvascular cortical graft option. In spite of this, donor sites are more likely to suffer fractures due to this procedure. In addition to allografts, other sources of cortical bone grafts have been described. [21] The major concern about the use of allografts is the transmission of disease. [5,7,23,25-28]. A typical orthopaedic surgeon is not competent to perform this procedure due to the microsurgical facilities and the expertise required. In radiation exposure patients, Duffy et al. [22] studied vascularized pedicle bone grafting to see if it can offer some benefit. However, we have no experience with the procedure altogether.

When compared to other treatments, muscle pedicle bone grafting does not have the same success rate. In 32 patients with posterior quadratus femoris muscle pedicle bone grafts, Meyers et al. [7] reported a 28% failure rate. Only 75% of patients who received quadratus femoris or gluteus medius muscle pedicle bone grafts reported satisfactory union, according to Baksi [23].

For neglected fracture necks of the femur, valgus osteotomy is a common procedure. Especially recommended for fractures with a varus alignment. Kainth et al. [24] suggested this procedure for patients who had a sing's index over 3 and had a healthy bone structure. According to the literature, a good functional outcome is reported in 35-80% of patients, and nonunions range from 0% to 45%, along with AVNs occurring in 6% to 42% of patients. [14] A common side effect of this procedure is a reduction in range of motion, shortening, and a limp. It is possible to develop degenerative diseases and osteonecrosis over the femoral head if there is an increased load placed over it. Additionally, valgus osteotomies are complicated by the lack of an ideal implant to fix the osteotomy, valgus strain, and overexertion of the knee, and the possibility of a difficult and expensive total hip replacement (THR) after the procedure fails.

Eighty-two percent of our patients achieved a satisfactory HHS of 70 or higher. In this study, nonunion rates were 6.25% and AVN rates were 12.5%. The results are comparable with those of other employees treated similarly or differently. It may be recommended over other forms of treatment because of its simplicity and lack of major complications. It is important to note that, despite being a small study, the following conclusions can be drawn; nonvascular fibula grafts act as biodegradable implants for fracture necks of femurs, and improve the biology of neglect, with good results regardless of how long it is delayed.

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Cite this article:

Dr. Ashok Reddy P. An Osteosynthesis Project In The Neglected Fracture Neck Of The Femur Using Nonvascular Fibula Grafts. *American Journal of Oral Medicine and Radiology*, 2017, 4(2), 82-88.



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