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Research Article

TECHNIQUE FOR CLOSED REDUCTION OF FEMORAL SHAFT DISPLACED FRACTURE USING INTRAMEDULLARY NAIL WITH STEINMANN PIN SUPPORT: CASE STUDY

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ABSTRACT

Purpose: To present simple method for displaced femoral shaft fractures, using Steinmann pin support to gain better control over fracture segmented facilitate the placement of a guide wire into the femoral medullary cavity.

Methods: From January 2010 to January 2014, 11 males and 5 females were enrolled in this study. Under epidural or general anesthesia, traction of the fracture segment was achieved using standard fluoroscopic image. During the operation fracture segment was aligned by 2 Steinmann pins, which facilitated the insertion of the IM nail into the femoral medullary cavity. The operative time and blood loss was recorded. Follow-up was conducted to assess the fracture union and functional recovery of the affected limbs.

Results: Steinmann pin support was taken intra-operatively to insert the guide wire into the femoral medullary cavity through the fracture segment successfully in all 16 cases, with close reduction technique. The average reduction time was 21 minutes, the average blood loss was 130ml. All fractures healed well without neurovascular injury and postoperative wound infection. At the follow ups no significant shortening deformity was seen and no rotational deformity was found.

Conclusion: The Steinmann pin support can facilitate the insertion of a guide wire into the femoral medullary cavity through the fracture segment in closed and controllable manner, and subsequently makes easy IM nail placement.

Keywords: femoral shaft displaced fracture, Closed reduction, Intramedullary nail, Steinmann pin support.

INTRODUCTION

Femoral shaft fractures result in high energy trauma, which is generally seen inyoung population. Closed reduction and intramedullary nail fixation is the gold standard method of choice for the treatment of most diaphysis femur fractures with high union rates and functional outcomes, in comparison with other treatment strategies. The union rate is 99.1% with low percentage of complication[1]. It is not always an easy procedure due to the tension of muscles attached to the thigh, shifts the position of the fracture fragments, especially for shaft segmental fractures, which prolong the operating time in closed reduction surgery[2]. Prolonged operation results more exposure to radiation for both patients and surgeons and even accelerate the degeneration of joints[3]. At the same time there are reports that clear radiation can cause a variety of tumors, such as: leukemia, thyroid cancer, lung cancer[4]. Thus, we introduced a new reduction technique using steinmann pin support to gain better control over fracture segment, easy fracture reduction, maintaining proper bone alignment, easy guide wire placement, and nail insertion with less effort and in minimal time. It reduced the radiation exposed to the patient and the surgical team. We obtained a significant result from16 cases of femoral shaft displaced fracture from January 2010 to January 2014, the results of this technique are presented in this report.

MATERIALS AND METHODS

General data:

Between 2010 to 2014 (January), 11 males and 5 females, aged 19 to 53 years, mean 36.3 years old were treated in our department with steinmann pin support. The types of injury were categorized in two: 10 cases of traffic injuries and 4 cases of fall injury which were open fractures and two heavily injured cases of closed fractures in which 12 cases were left sided and 4 cases were right sided MüllerAO classification type 32-C2.Also, it comprised of 4 cases of cerebral contusion, 3 cases of public branch facture, 2 cases of tibia and fibula fracture, 3 cases of rib fracture and cases of injury to surgery time (6-18) days, average 8days.

Surgical methods:

Preoperative traction on tibial tubercle was given under local anesthesia in our orthopedic ward on the day of fracture. Under General or Epidural anaesthesia, patient was placed supine on the traction table with slight adduction of affected limb with the unaffected leg parallel and in a close proximity. Both sides of anterior superior iliac spine were maintained on the same level, which was conformed under anteroposterior fluoroscope view where large horizontal rotor tip was marked, the lateral femoral canal was cleared, and center position was maintained. Traction is applied to the affected limb until fracture segment achieve proper alignment. After routine sterilization was done, the tip of the greater trochanter was selected as the entry point of the IM nail, and the skin was incised about 3-4cm to expose the entry point. After exposing greater trochanter, tip was felt with index finger, entry point is located, and the guide pin was inserted into femoral medullary cavity under the C-arm X-ray machine. Intramedullary reaming was done along the guide pin up to lesser trochanter. Using two 3.5mm diameter of Steinmann pin into the middle of the cross-section of femoral fracture segment; first,from lateral to medial, and second, anterior to posterior at the level of at least 3 cm away from the fracture line. Figure (B,C) With the help of two Steinmann pins ,intermediate angular displacement adjustment was done by rotating the fracture segment, and osseous anatomy was maintained under C-arm fluroscopy. Guide wire was inserted into the femoral medullary canal through fracture segment up to distal end. Both ends of the segment fracture was observed under C-arm fluoroscopy and IM reaming is done up to distal end of femoral canal. The nail size was measured, and IM nail with proper length was inserted along the guide wire to fix the displaced femoral shaft fracture. Finally, functional reduction of the fracture and bone alignment of femur is confirmed under C-arm fluoroscopy. After confirming the position of fracture segment and bone alignment was satisfactory, first distal then proximal screws was inserted to lock the nail. Drain was placed conventionally. The operative time ,blood loss, and fluroscopy time were recorded.

Postoperative treatment and management:

Antibiotic was utilized in all patients for 24-48 hours. The drain was pulled out 48–72 hours after surgery. The patients were encouraged to start physiotherapy as early as pain could be tolerated. Isometric quadriceps strengthening exercise was suggested to start on the first postoperative day then crutch-assisted walking on the second day. Partial weight-bearing started after six weeks of the operation. Full weight-bearing is allowed with radiographic evidence of fracture healing process, mostly after three months of the operation. Follow-up visits were managed at one, three and six months post-operatively and every half year thereafter. Clinical and radiological assessment were performed at each follow-up visit. The lengths of both lower limbs of each patient were measured, and the functional recovery of the affected limb was assessed.

RESULTS

Evaluation of treatment effectiveness:

Closed reduction was achieved in all 16 patients. The reduction time was 11-38minutes. The mean reduction time was 21 minutes. The blood loss was 80-320ml, an average of 130ml, without blood transfusion. There were no iatrogenic fractures and neurovascular injury, postoperative wound infection did not appear as well as fat embolism and deep vein thrombosis did not occur. After measuring both lower extremities, no significant shortening deformity was seen. Also, no rotational deformity was found. The postoperative hospital stay was (4-9) days with an average of 6days. All 16 patients were followed up for 6 months to 3 years, an average of 18 months. Evaluation according to the HSS knee score (Hospital for special surgery) showed excellent result in 5 cases, good result in 8 cases, moderate result in 2 cases, and poor result in 1case. A typical image is shown in figure (F).

DISCUSSION

Femoral shaft fracture is one of the most common fracture of our body, mostly seen in males from 15 to 24 years old. In this age group, people have destructive in nature, and are mainly involved in violence which results in very serious and complex type fractures[3].Different technique can be used to treat femoral shaft fractures, which depends on the position of the fracture, extent of fragmentation, age of the patient, social and economic demands of the patient, and other. Orthopedic surgeons should be aware of the advantages, disadvantages, and restriction of these various methods .Since the late 1930s, closed intramedullary nailing technique is the gold standard treatment of choice for adult femoral shaft fractures, with high rate of union and usually an early return to function[6]. Especially the emergence of interlocking intramedullary nail more expanded for femoral shaft fractures, due to the anti-rotation and anti-shortening advantages which is useful in the treatment of intertrochanteric fractures, femur fractures and segmental femoral condyle fracture.

In support of multi-segmental femoral shaft fractures, various devices has been introduced to assist for closed reduction technique which include invasive and non-invasive means. Our technique of Steinmann pin support provides an effective solution for the difficulties by easy fracture reduction, maintaining proper bone alignment, guide wire insertion through fracture segments, and finally nail insertion with less effort and minimal time. There is a technique introduced for closed reduction of femoral shaft fracture using external support device[7]. But this technique is only for simple femoral shaft fractures. In case of multi-segmental femoral shaft fractures, fracture displacement is complex, difficult to maintain bone alignment and guide wire placement in close procedure. If closed reduction method is unconventional, steinmann pin is inserted through a small stab incision to control fracture segment and bone alignment. Technically, it makes it very easy to insert interamedullary guide wire and easy to perform with less operative time and fluorscopic exposure to medical staff and patient injury[8].

Placement of guide wire through the fracture segment is one of the difficult parts of surgical procedure. Additionally ,postoperative rotational deformity control is another big challenge for the orthopedic surgeon, especially in multi segmental femoral shaft fractures[9].Femoral rotational deformity after locked IMN is the most common form of malunion in lower limbs, it accelerates the degeneration of joints, and increase the incidence of degenerative diseases[10].Rotational malalignment of the femur of $\geq 10°$ was symptomatic for the patient and the hip, knee, and parello femoral joints were affected. In the femoral shaft fractures with closed reduction, surgeons need to pay more attention on rotational deformity, and prevent fractures segment from the fixed deformity[11]. Intraoperatively, we used Steinmann pin to rotate the proximal femur fracture segment, by observing the corresponding relationship between the femoral head and the greater trochanter, which determined the neutral position of the nail.For controlling rotational deformity, We put Steinmann pin unicortically in the center of fracture segment to avoid bone rotation and interference with nailing process, similar as introduced schanz pin techenique [12,8]. Outcome measures of femoral shaft fracture and rotational deformities determined through the variation of cortical bone thickness[13].

It has also been reported that navigated estimation of femoral anteversion provides a useful tool during closed intramedullary nail fixation[14]. However, navigation devices are expensive and not prominent. For easy achievement and maintain bone alignment, We used Steinmann pin as supplementary to correct femoral shaft fracture segment, which was more time effective for surgeons and cost reducing for patients.

CONCLUSION

Steinmann pin can be used to treat displaced femoral shaft fractures. Compared with the other prevalent techniques which were more costly for patients, our technique is safer and gained better control over fracture segment. It can be used for both simple and complex fractures to facilitate the placement of a guide wire into the femoral medullary cavity in a closed and controllable manner with less effort and minimal time.

Figure 1: Radiograph anteroposterior view (1a) and lateral view (1b) of high energy segmental femur shaft fracture in a 26 years old male patient with history of fall from 10 meters height.

Figure 2: Intra operative image of Steinmann pin and guide pin usage to prevent mal reduction of the fracture segment.

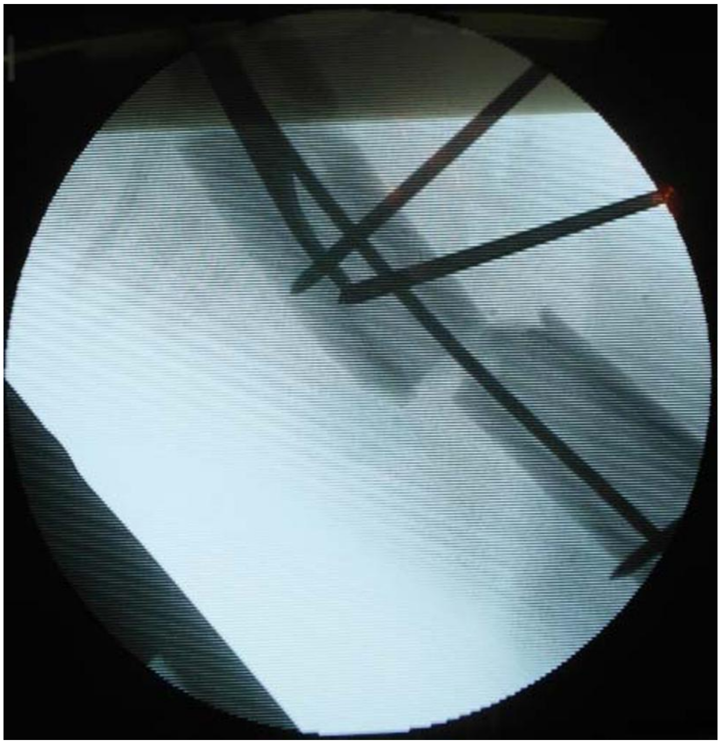

Figure 3: Fluoroscopic image of segmental fracture of femoral shaft, Steinmann pin used to facilitate guide wire passage to avoid the need for open reduction strategies.

Figure 4: Postoperative radiographs [anteroposterior view (4a) and lateral view (4b)] of the right femoral shaft segmental fracture show that nearly anatomical reduction and intramedullary nail fixation was achieved.

Figure 5: Incision area on fourth Postoperative day.

REFERENCES

1. Winquist RA, Hansen ST, Jr., Clawson DK (2001) Closed intramedullary nailing of femoral fractures. A report of five hundred and twenty cases. 1984. J Bone Joint Surg Am 83-A (12):1912.
2. Ricci WM, Gallagher B, Haidukewych GJ (2009) Intramedullary nailing of femoral shaft fractures: current concepts. J Am Acad Orthop Surg 17 (5):296-305.
3. Jaarsma RL, Pakvis DF, Verdonschot N, Biert J, van Kampen A (2004) Rotational malalignment after intramedullary nailing of femoral fractures. J Orthop Trauma 18 (7):403-409.
4. Berrington de Gonzalez A, Darby S (2004) Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries. Lancet 363 (9406):345-351
5. Whittle AP, Wood GW II (2003) Shaft of femur. In: Canalle ST (ed) 's Operative Orthopaedics. Int.edn. Mosby, Philadelphia, Pennsylvania, pp 2825–2859
6. Wolinsky PR, McCarty E, Shyr Y, Johnson K (1999) Reamed intramedullary nailing of the femur: 551 cases. J Trauma 46 (3):392-399
7. Shezar A, Rosenberg N, Soudry M (2005) Technique for closed reduction of femoral shaft fracture using an external support device. Injury 36 (3):450-453
8. Georgiadis GM, Burgar AM (2001) Percutaneous skeletal joysticks for closed reduction of femoral shaft fractures during intramedullary nailing. J Orthop Trauma 15 (8):570-571
9. Karaman O, Ayhan E, Kesmezacar H, Seker A, Unlu MC, Aydingoz O (2014) Rotational malalignment after closed intramedullary nailing of femoral shaft fractures and its influence on daily life. Eur J Orthop Surg Traumatol 24 (7):1243-1247
10. Cordier W, Katthagen BD (2000) [Femoral torsional deformities]. Orthopade 29 (9):795-801
11. Ettinger M, Maslaris A, Kenawey M, Petri M, Krettek C, Jagodzinski M, Liodakis E (2012) A preliminary clinical evaluation of the "greater trochanter-head contact point" method for the intraoperative torsional control of femoral fractures. J Orthop Sci 17 (6):717-721
12. Farrar MJ, Binns MS (1996) Percutaneous reduction for closed nailing of femoral shaft fractures. J R Coll Surg Edinb 41 (4):267-268
13. Langer JS, Gardner MJ, Ricci WM (2010) The cortical step sign as a tool for assessing and correcting rotational deformity in femoral shaft fractures. J Orthop Trauma 24 (2):82-88
14. Citak M, Gardner MJ, Krettek C, Hufner T, Kendoff D (2008) Navigated femoral anteversion measurements: a new intraoperative technique. Injury 39 (4):467-471