Case report

Bridging the gap: A technique to avoid limb length discrepancy in arthroplasty for femoral neck fracture – a case report

Aakash Mugalur

Narayani Hospital and Research Centre, Sripuram, Vellore, Tamil Nadu, India

ARTICLE INFO

Article history:

Received 25 September 2017

Received in revised form 15 October 2017

Accepted 13 November 2017

Available online 15 November 2017

Keywords:

Arthroplasty

Femoral neck fractures

Replacement

Hip

Limb length discrepancy

ABSTRACT

Equalizing limb length is of paramount importance for optimal outcome in patients undergoing hip arthroplasty(HA). Numerous techniques have been described for avoiding limb length discrepancy (LLD) in patients undergoing HA. However their applicability in patients undergoing HA for neck of femur(NOF) fractures remains questionable due to dissociation between the femur and the head. I hereby describe a novel yet simple technique for better utilization of already established techniques to avoid LLD in NOF fractures undergoing HA. After exposure of hip, the proximal head and neck fragment is extracted taking care not to damage bone at fracture site. Proximal fragment is provisionally fixed to distal fragment in a retrograde manner using 6.5 mm cannulated screws after predrilling over guide wires. Horizontal and vertical offsets are measured. The hip joint is reduced and a mark is made on greater trochanter (GT) utilizing the co-axial stitch method. The joint is dislocated & screws removed. THR is done in a routine manner taking care to establish and recreate native anatomy of hip. Limb length is ascertained utilizing the previous mark on GT. Recreation of proximal femoral anatomy helps in better utilization of already established techniques to avoid LLD and helps us to re-create the native anatomy in HA. It is simple, less time consuming and doesn't require extensive armamentarium or image guidance for its applicability. However it needs to be validated and its advantages might be undermined in old NOF fractures with resorption of the neck or in severely comminuted fractures.

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Introduction

Total hip arthroplasty (THA) and hemi-arthroplasty improve the quality of life in elderly patients with displaced neck of femur fractures. THA has better long term survival rate and better functionality.^{1–3} Equalizing the limb length in relation to the contralateral uninvolved side after the surgery is quintessential for better patient outcomes. Limb length discrepancy (LLD) leads to patient dissatisfaction and masks the excellent functional outcome of the surgery and is one of the most common reasons for litigation against orthopaedic surgeons.^{4,5} Absolute equalization of limb lengths in THA is difficult.⁶ However, numerous pre-operative and intraoperative methods have been described to avoid limb length discrepancy in THA.⁴ Literature suggests that preoperative templating alone is unreliable to avoid LLD.^{7,8} Though the intra-operative techniques are valuable in a routine THA, they are less applicable in a patient with neck of femur fracture. The fracture in the neck and the relative greater mobility of the femur with respect to the acetabulum in comparison to other cases may lead to

suboptimal utilization of these techniques. I hereby describe a novel technique for better utilization of already established techniques to equalize limb length in neck of femur fractures undergoing THA.

Methodology: A 65 year old gentleman presented with a post traumatic transcervical fracture of the right femur. (Fig. 1) Considering the age and the pre-trauma ambulatory status, a decision was taken to proceed with uncemented THA for the right hip. Prior templating was done on the radiographs. An absolute shortening of 1.5 centimetres was noted clinically in supine position. After prior anesthesia clearance the patient was posted for right THA. The surgery was done under spinal anesthesia. Left lateral decubitus position was used. Posterolateral approach for the hip joint was utilized.

The technique: The provisional neck cut of the femur was not taken at this point of the surgery. (Fig. 2a) The femoral head was extracted taking care not to damage the bone at the fracture site. (Fig. 2b) The fractured proximal head & neck segment was aligned with the distal femoral neck and was fixed with “proximal to distal” guide wires along the axis of the femoral neck. (Fig. 2c) Cannulated drill bit for the 6.5 mm cannulated screws system was used and the femoral head was drilled from proximal to distal

E-mail address: orthoakash@gmail.com (A. Mugalur).

Fig. 1. Pre-operative radiograph of the pelvis showing a fracture of the neck of right femur.

Fig. 2. The intra-operative steps.

- a) Photograph showing the neck fracture.
- b) Photograph showing the extracted femoral head.
- c) Photograph showing the provisional fixation of the proximal fragment to the distal fragment with guide wires.
- d) Photograph showing proximal to distal drilling using a cannulated drill bit for the 6.5 screw system.
- e) Photograph showing the 6.5 mm cannulated screws being inserted after drilling.
- f) Photograph depicting the screw heads buried on par with the femoral head cartilage.
- g) Intra-operative radiograph showing the reduced hip joint with the screws in situ.
- h) Photograph showing the marking on the greater trochanter after reduction of the hip joint using the coaxial stitch technique.
- i) Photograph showing the final prosthesis in situ.
- j) Photograph showing the re-confirmation of length with the co-axial stitch technique.

taking care not to drill the lateral femoral cortex. (Fig. 2d) The screw length was measured and two 6.5 mm cannulated screws of appropriate length were inserted from “proximal to distal” along

the pre-drilled tract over the guide wires. (Fig. 2e) A countersink was used to bury the screw heads on par with the articular cartilage. (Fig. 2f) The horizontal and vertical offsets were

measured and documented. The hip joint was reduced. (Fig. 2g) I routinely use co-axial stitch method as an intraoperative tool to equalize limb length in hip replacement surgery.

The hip was positioned at 45° flexion and the knees were positioned at 90°. The axis of the femur was marked proximal and distal to the incision with a long ruler and a sterile marker pen. A co-axial stitch was taken from the skin proximal to the hip incision. A mark was made on the greater tuberosity (GT) using a straight hemostat at the distal end of the co-axial stitch using the electrocautery. (Fig. 2h) After this marking on the GT, the hip was dislocated posteriorly and the screws were extracted. The proximal head & neck fragment was extracted. A provisional neck cut was taken using the 'neck cut guide'. Sequential reaming of the acetabular socket was done and a 52 mm OD 'Reflection' acetabular shell was inserted and a 6.5 mm × 25 mm acetabular screw was used to secure the acetabular shell. Size E XLPE liner was inserted into the acetabular shell. The femoral broaching was done sequentially. With the trial prosthesis the horizontal and vertical offsets were restored. The joint was reduced and leg length was measured by co-axial stitch method using the previous electrocautery mark on the GT with the right lower limb in the identical position at the time of the initial measurement. The final prosthetic components were implanted (Fig. 2i) after removal of the trial components. Polarstem (Size1) and a 28 mm(-3) stainless steel head was inserted after prior trial. (Smith & Nephew) The length was confirmed yet again using the same co-axial stitch with the final prosthesis in situ. (Fig. 2j) The posterolateral capsule and the external rotators were re-inserted to the GT using non absorbable suture. Wound was closed in layers. The post operative alignment is depicted in Fig. 3.

Discussion: Though absolute equalization of limb length is ideal, it is relatively difficult in the clinical scenario to replicate the

absolute native length in patients undergoing THA.⁶ Preoperative planning is an integral and necessary part of the THA, but relying only on preoperative templating leads to suboptimal outcome.⁸ Numerous intra-operative techniques have been described in literature utilizing various calipers, fixed pelvic reference pins, infra-cotyloid pins, umbilical tapes, rulers, skin sutures, fixed suture lengths.⁴ Most of the techniques use a fixed pelvic reference along with a variable femoral reference.⁴ However with each of these techniques, exact replication of the femur position during pre and post insertion of the trial prosthesis holds paramount importance.⁹ Navigation though accurate is cumbersome, expensive and yet surgeon dependent.^{4,10} The operative surgeon has the freedom to choose from the well defined techniques to equalize limb length.

I use the co-axial suture technique for my hip surgeries.¹¹ This technique entails the use of a fixed point in the skin proximal to the hip incision along the line of the greater trochanter. Though the skin is not considered to be a fixed reference point, sufficiently anchoring the suture proximally gives enough fixation and decreases the variability. The hip is positioned in 45° of flexion and knees in 90° of flexion. Using a sterile marking pen, an axis connecting the skin anchorage point, the GT and the femur in a straight line is drawn using a straight long ruler. A straight hemostat is attached to the distal end of the suture and a mark is made on the GT using the electrocautery before dislocation of the hip. This serves as a reference for the limb length evaluation after the completion of the procedure. During the procedure with the hip reduced, with trial implants in situ the limb length is measured using the GT mark as a reference. The already marked axis ensures that the limb replicates the exact pre-dislocation position in the sagittal plane. Care must be taken to ensure that the position of the limb is replicated in the coronal plane as well. If the tip of the

Fig. 3. Post operative radiograph showing the hip prosthesis in situ.

hemostat at the mark on the GT suggests pre-dislocation length is maintained. The tip of the hemostat proximal or distal to the earlier electrocautery mark on the GT suggests lengthening and shortening respectively. The same can be utilized to restore the limb length in comparison to the opposite side if a pre-operative discrepancy exists.

However all these techniques require a continuity of the proximal femoral anatomy for measurement. In femoral neck fractures the distal femur is mobile and assumes a position not conforming with the actual position of the femur anatomically. Even with the abundance of intra-operative techniques available to achieve limb length, the discontinuity in the neck prevents the optimum utilization of these techniques.

Provisional retrograde fixation of the proximal fragment to the distal fragment reconstructs the anatomical geometry in neck of femur fractures. Reconstruction of proximal femoral anatomy helps us in better understanding of the native limb length, the vertical and horizontal offsets. Maintaining the integrity of the lateral femoral cortex does not weaken the proximal femur avoiding the possibility of stress raisers for iatrogenic fractures. There is no requirement for extensive armamentarium. It is simple and doesn't even require the use of intra-operative image guidance as the proximal femoral geometry is completely visible. Despite the minimal increase in operative time, considering the simplicity and the relative benefits its worthwhile utilizing this technique. Once the proximal femoral anatomy is stabilized, the surgeon can use any intra-operative method as per his preference and convenience. The same technique can also be applied for the hemi-replacement arthroplasty of the hip joint.

These are the potential drawbacks of the technique. Its applicability in old neck of femur fractures (from the date of trauma to presentation) is undermined by resorption of the femoral neck. Its use in significantly comminuted neck of femur fractures might be suboptimal. Though minimal, there is an increase in the operative time due to the inclusion of extra steps. This is a description of the technique in a single patient. It needs to be validated. In conclusion, provisional intra-operative retrograde fixation of the neck of femur fractures can lead to better utilization of already established techniques to avoid LLD in THA and hemi-

arthroplasty. It helps recreate native femoral anatomy during the surgery.

Conflicts of interest

Nil.

Funding

Nil.

Acknowledgement

Nil.

References

1. Avery P, Rooker G, Walton Gargan MM, et al. Long term outcome of total hip arthroplasty versus hemiarthroplasty in mobile, independent elderly patients with a displaced intracapsular fracture of the femoral neck. *Orthop Proc.* 2012;94–B(12):9.
2. Mani KKC, Raj DRC, Acharya P, et al. Total hip arthroplasty for displaced femoral neck fractures in elderly patients. *Orthop Muscular Syst.* 2015;4:204.
3. Ossendorf C, Scheyerer MJ, Wanner GA, et al. Treatment of femoral neck fractures in elderly patients over 60 years of age – which is the ideal modality of primary joint replacement? *Patient Saf Surg.* 2010;4:1610.1186/1754-9493-4-16.
4. Desai AS, Dramis A, Board TN. Leg length discrepancy after total hip arthroplasty: a review of literature. *Curr Rev Musculoskelet Med.* 2013;6:336–341.
5. Hofmann AA, Skrzynski MC. Leg length inequality and nerve palsy in 6 a total hip arthroplasty: a lawyer awaits!. *Orthopaedics.* 2000;23:943–944.
6. Rubash HE, Parvataneni HK. The pants too short, the leg too long: leg length inequality after total hip arthroplasty. *Orthopaedics.* 2007;30:764–765.
7. Woolson ST, James MH, Sawyer A. Results of leg length equalization for patients undergoing primary total hip replacement. *J Arthroplast.* 1999;14:159–164.
8. Knight JL, Atwater RD. Preoperative planning for total hip arthroplasty: quantitating its utility and precision. *J Arthroplast.* 1992;7:403–409.
9. Bose WJ. Accurate limb length equalization during total hip arthroplasty. *Orthopaedics.* 2000;23:433–436.
10. Maloney WJ, Keeney JA. Leg length discrepancy after total hip arthroplasty. *J Arthroplast.* 2004;19:108–110.
11. Hossain M, Sinha A. A technique to avoid leg-length discrepancy in total hip arthroplasty. *Ann R Coll Surg Engl.* 2007;89(3):314–315.