Case report

Non-union fracture neck femur in a toddler: Reconstructed by valgus osteotomy – A minimally invasive approach

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ABSTRACT

Background: Non-union is one of the devastating complications of fracture neck of femur. Though a very rarely encountered entity in a toddler (1–3 years paediatric age group), non-united femoral neck fractures are reported in developing countries because of mismanagement by quacks and delay in referrals. For operative treatment, many different procedures have been described, including close/open reduction and internal fixation using K-wires, cannulated screws, fibula or nails. There is no evidence in the literature that one or other implant influences the rate of postoperative complications, such as avascular femoral head necrosis or coxa vara. But, still the choice of fixation implant is debatable.

Case report: We present a case of 3-year-old child of non-union femoral neck fracture treated with valgus osteotomy. Choice of implant was kept to bare minimum to reduce the cost of implant and magnitude of surgery, which made the surgery minimally invasive, which is not the case in other studies. Two solid cancellous screws and a Kirschner wire (K-wire) were used to achieve fixation. Implant was removed after one year. The patient was followed up for 2 years and was found to be asymptomatic clinically with restoration of neck shaft angle and no signs of AVN.

Conclusion: Our method of intertrochanteric valgus osteotomy and internal fixation stabilized using K-wire and screws is a technically simple yet effective method of treating difficult fracture neck femur. Although a larger series and multicentric trials are needed, yet we would safely recommend extension of this technique to unstable fractures, to minimize the incidence of complications, cost and magnitude of surgery.

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1. Introduction

Fractures of the femoral neck in children and adolescents are very rare. They account for less than 1% of all the paediatric fractures.¹ However, complications accompanying these fractures are devastating, specifically avascular necrosis (AVN) and non-union and early closure of the proximal physis of the femur—resulting in decrease of growth and coxa vara. In past, the incidence of non-union varies from 7% to 10%, depending on the location of the fracture in the neck of femur. Significant reduction occurred in non-union incidence due to early anatomical reduction and rigid internal fixation. Though very rare but still, non-united femoral neck fractures are reported in developing countries because of mismanagement by quacks and delay in referrals.

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2. Which surgery to opt and which implant to choose? Not yet well defined

Nowadays, many authors are having interest on research on valgus Intertrochanteric osteotomy fixed with dynamic hip screw (DHS), due to the excellent results proven in recent years. But, still the choice of fixation implant is debatable because DHS is a bulkier implant which increases the magnitude of primary surgery and secondary surgery for implant, removal especially if the child is too young. Aim of surgery in non-union fracture neck of femur in toddler is not only to achieve union without complication but also to reduce the magnitude of surgery for implant removal. More so, in a developing nation, the other aim is to reduce the cost of implant. Here, we present a case of a 3-year-old child of non-union femoral neck fracture treated with valgus osteotomy. Two solid cancellous screws and a Kirschner wire (K-wire) were used as fixation implant to reduce the magnitude of surgery by using less bulkier implant. Implant was removed after one year and the patient was asymptomatic at 2-year follow-up with restoration of neck shaft angle and no signs of AVN. This implant turned out to be a simple

option fulfilling all the aims of treating non-union fracture neck femur in a toddler.

3. Case report

A 3-year-old female child admitted in our hospital with complaints of pain in left hip and difficulty in walking for 4 months preceded by an incidence of a fall from 8 ft height. The patient also reported h/o massage from quack. Systemic examination was unremarkable. On local examination, the patient had a short limb

and trendelenburg gait with no hip joint tenderness. Active Straight leg raising (SLR) was present bilaterally. Apparent and true shortening of 1 cm was present corroborating with supratrochanteric shortening. On radiological examination, there was an evidence of fracture neck of femur Delbet type III (Fig. 1). Fracture line was sclerosed with smoothed out margins suggestive of non-union. Intertrochanteric valgus osteotomy was performed, which was stabilized using a K-wire, and two solid cancellous screws were used to fix the non-union fracture neck femur (Fig. 2). We used this minimally invasive approach keeping the use of

Fig. 1. X-ray showing fracture neck of femur non-union in AP and lateral view (arrow pointing the fracture).

Fig. 2. (a, b) Immediate postoperative X-ray AP and lateral view (arrow pointing the valgus osteotomy). (c, d) 1 year postoperative X-ray AP and lateral view showing union of fracture and osteotomy site.

Fig. 3. (a) Diagrammatic representation of the surgical steps illustrating the importance of valgus osteotomy in reducing the shearing forces at fracture site. (b) Postoperative X-ray AP and lateral view after removal of implant showing difference in neck shaft angle of sound and affected site.

implant to bare minimum to reduce the magnitude of surgery both primary and secondary (to remove the implant) and to keep the cost of surgery low. Contrary to conventional thinking, a stable fixation was achieved even with a K-wire; yet postoperatively, the child was kept on hip spica to prevent weight bearing. Spica was removed after 10 weeks and the patient was mobilized. The patient remained asymptomatic with no restriction of activities for about 1 year postoperatively after which the implant was removed (Fig. 3). Surgery done for implant removal was minimally invasive; the fact was substantiated by small size incision and less than 30 min of total surgical time. A hip spica was again applied for

6 wks to prevent any stress fracture. After spica removal, the patient was gradually mobilized and allowed full weight bearing within the next 4 weeks. The patient was followed up for 2 years and was found to be asymptomatic clinically with no limp, no shortening, with radiological evidence of union, restoration of neck shaft angle (corroborating with the neck shaft angle of given age group) and there was no evidence of AVN (Fig. 4).

4. Discussion

The usual causes of non-union in femoral neck fracture are poor reduction, improper immobilization, non-operative treatment in undeserving fractures, infection and implant failure.² For operative treatment many different procedures have been described, including close/open reduction and internal fixation using K-wires, cannulated screws, fibula or nails.³ There is no evidence in the literature that one or other implant influences the rate of postoperative complications, such as avascular femoral head necrosis or coxa vara. Canale and Bourland³ reported a decrease in complications in all, undisplaced or displaced, type II fractures, after reduction and internal fixation by pins or screws. Heiser² stated that if it is necessary to bridge the physis, and it is preferable to do so with smooth K-wires to prevent premature closure of the physis.

For neglected cases, internal fixation alone is likely to have high failure rate. Treatment of femoral neck non-union in children by fibular grafting was also tried.⁴ The fibula was used alone or with screw fixation. This technique had a high success rate but could not deal in cases with coxa vara or limb shortening except if accompanied with intertrochanteric valgus osteotomy. In a series of nine cases done by Pedro et al., they have achieved 100% union rate of their cases done by intertrochanteric valgus osteotomy and plate fixation; they reported only one case of delayed union but it eventually healed.⁵

In our case, we have used a K-wire and two non-cannulated cancellous screws. Non-cannulated screws were intentionally used because they are economical and probably exert more compression at the fracture site than a cannulated one. The valgus osteotomy decreases the shearing forces, thereby increasing chances of union. The major advantage of using K-wire and screws for stabilizing the osteotomy is to avoid the use of bulkier implants and the need for a second major operation for plate removal in children.

Fig. 4. 2-year follow-up postoperative X-ray AP and lateral view showing restoration of neck shaft angle and no evidence of AVN.

5. Conclusion

Our method of intertrochanteric valgus osteotomy and internal fixation using K-wire and screws is a technically simple yet effective method of treating difficult fracture neck femur. Although a larger series and multicentric trials are needed, we would safely recommend extension of this technique to unstable fractures, to minimize the incidence of complications.

Ethical standard

The patient gave the informed consent to the publication of this case study.

Funding

None.

Conflicts of interest

The authors have none to declare.

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