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Case Report

Fracture arising of Steinmann pin cortical defect 3 years after insertion: A case report and review of literature

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ARTICLE INFO

Article history:

Received 3 June 2013

Accepted 11 July 2013

Available online 30 July 2013

Keywords:

Steinmann pin

Complications

Cortical defect

Fracture

ABSTRACT

A plethora of complications have been reported after insertion of a Steinmann pin amongst which the commonest ones are infection and pin loosening. We present a literature review on pathological fractures arising out of cortical defects left behind by pin insertion and report a unique case where a Steinmann pin insertion in proximal tibia has given rise to a fracture as late as 3 years after insertion.

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1. Introduction

Steinman pin insertion remains the most commonly performed procedure in orthopaedic practice. Although its use for definitive fracture treatment has steadily declined due to advent of newer implants and devices, it still finds application in treatment in fractures suffered by medically unfit and paediatric patients and for providing interim traction in almost all lower limb injuries as well as hip and knee pathologies.

Upper tibial Steinman pin insertion is required for most fractures around the hip joint and the femur. The insertion of a Steinman pin is a relatively safe procedure if the basic

principles of insertion are adhered to. Complications like infection and pin loosening¹ are quite common especially if the pins are retained for longer duration, which is rarely the scenario these days. Besides other complications like damage to ligaments & growth plate, pin cut through, major complications do occur like deep peroneal nerve palsy² leading to foot drop, growth plate damage in children³ and pseudoaneurysm of anterior tibial artery.⁴

We report a case of upper tibial fracture resulting from a stress riser due to cortical defect as a result of previous Steinman pin insertion 3 years before, which to the best of our knowledge and search of literature has not been previously reported in English language literature other than

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<http://dx.doi.org/10.1016/j.jcot.2013.07.002>

Evans et al⁵ in 1984 reporting 2 cases, within 6 months of the insertion.

2. Case report

A 33-year-old male presented to us with pain in right upper leg after trivial fall. Past history revealed that the patient had sustained open fracture femur 3 years back and was treated initially with debridement and skeletal traction for 2 weeks after that intramedullary fixation done elsewhere, and uneventful healing of fracture thereafter.

Patient was asymptomatic before the present incident of fall. Examination revealed healed scar on the medial and lateral aspect of the upper leg suggestive of previous skeletal traction, scar of old open fracture femur of about 4 cm on lateral aspect of mid-thigh, swelling, tenderness and abnormal mobility at upper leg and no distal neurovascular deficit. Radiological examination revealed oblique fracture of upper tibia, fracture line running through the previous pin insertion site, which is visualized as focal osteolysis and surrounded by sclerosis (Figs. 1 and 2).

After complete examination, the fracture was treated with open reduction and internal fixation with lateral plating. Wound healed uneventfully and the fracture united at around 4 months with good functional range of motion.

3. Discussion

The upper tibial Steinman pin skeletal traction is one of the most commonly performed procedure in orthopaedic practice for conditions affecting pelvis, hip and thigh. However such a simple procedure is also fraught with complications, sometimes grave like vascular or neural injury.

The case reported above is first of its kind in English literature where the resulting cortical defect has given rise to fracture as late as 3 years after the insertion of the pin. Till

Fig. 1 – Lateral radiograph showing oblique fracture pattern through the cortical defect; note the anterior pin placement.

Fig. 2 – Anteroposterior radiograph depicting the fracture.

now only report is 2 cases of fracture occurring within 6 months after Steinman pin insertion in upper tibia.⁵ The fate of bony defect arising as a result of implant removal is unclear in literature. Most of the available literature pertains to refracture after plate removal. Anderson et al⁶ reported that the out of 244 patients with forearm bones fracture, 7 had a refracture out of which 5 had a fracture at the previous site and 2 at screw holes. The causative factor in latter was stated to be severe trauma. However no fracture occurred in their series after 6–8 weeks of protection after implant removal. Similarly Deluca et al⁷ reported no refracture after 4 months of implant removal. Although the deductions from forearm bones can't be generalized to all the long bones; such reports offer some valuable insights into healing of cortical defects in long bones - Fracture through screw or pinhole requires considerable force and is virtually nonexistent after 4–6 months. Recently few cases (Table 1) of stress fracture of femur and tibia after placement of tracker pin during navigated TKR have been reported,^{8–14} longest interval reported for tracker pin induced stress fracture is 12 months.⁹ Beldame et al¹⁴ reported the incidence of stress fractures to be 1.3% in their series of 385 computer assisted total knee arthroplasties. They found a preliminary period of thigh pain before the actual fracture occurred and suggested bicortical pin fixation rather than transcortical one to avoid this complication. However paper by Evans and Thomas⁵ remains the only till date to report such a complication occurring as a result of Steinman pin insertion.

Pin or implant diameter is crucial in determining the risk of stress fracture in a bone. It has been estimated that a screw hole greater than 30% of the diameter of the bone results in a 45% reduction in the torsional strength of that bone.¹⁵ In adult bone, a pin diameter of 6 mm is the maximum that can be used to achieve a stable implant without suffering the consequences of stress fracture through the pinhole itself.¹⁵

Such a complication is not entirely unpreventable. Choosing a proper sized pin is foremost. Larger diameter pins do well after pre-drilling the bone. The added advantage is minimizing thermal necrosis and subsequent loosening. If the pin diameter is a constraint and the traction required is heavy

Table 1 – Overview of fractures occurring at pin placement sites reported in literature.

Year reported	Author	Number of cases reported	Bone involved	Causative pin	Primary procedure	Time duration from pin insertion to fracture	Management of fracture
2011	Hoke et al	3	Tibia in all	Tibial tracker pin	TKA	3 months, 8 weeks, 6 weeks	Conservative in all
2011	Jung et al	1	Femur	Tracker pin	TKA	1 year	Operative
2010	Massai et al	1	Tibia	Tracker pin	TKA	3 weeks	Conservative
2010	Beldame et al	5	Femur	Tracker pin	TKA 5/385	Average 12.6 weeks	Operative
2008	Bonutti et al	2	Femur	Tracker pin	TKA	9 weeks, 12 weeks	Operative
2008	Li et al	1	Supracondylar femur	Tracker pin	TKA	1 month	Operative
2008	Wysocki et al	2	Femur	Tracker pin	TKA	10 weeks, 9 weeks	Operative
1984	Evans et al	2	Tibia	Steinman pin	Fracture femur, posterior dislocation hip	6 months, 4 months	Not mentioned
2013	Present report	1	Tibia	Steinman pin	Femur fracture	After 3 years	Operative

as is common in paediatric population, it is advisable to pre-tension the pin or wire. Small diameter wires which are pre-tensioned are more resistant to pin tract infection as well.¹⁶

The recommended site for insertion of upper tibial skeletal traction is point 2 cm distal and posterior to the tibial tuberosity from lateral to medial side. Insertion begun on the medial surface may injure the common peroneal nerve if the point of insertion is too far posterior or there is posterior deviation of the pin.² Pin placement should be in the middle, neither too anterior nor posterior. Excessive superficial (anterior) insertion of the pin increases the chances of the pin cutting through the anterior cortex of the tibia; there is vulnerability of the anterior tibial artery to become injured by an excessive posterior pin insertion in the proximal tibia.⁴

If local wound or other skin conditions does not permit insertion of pin at fore mentioned site, one needs to shift the insertion site distally then, and it is advisable to use smaller wire and apply traction after pre tensioning.

After the definitive fixation of the fracture, one needs to keep in mind the presence of the cortical defect during the rehabilitation process, which is usually not the case. We recommend regular radiographs through the pin tract as well especially keeping a watch for sclerosis and increasing osteolysis. If osteomyelitis with ring sequestrum is suspected, prompt curettage should be undertaken. Attention for a longer period of time needs to be paid in patients with defective bone healing like in smokers. Although there are no markers to predict fractures through the cortical defect at a later date, procedures like supplementary bone grafting seem too far-fetched considering the very low frequency of such events. However they can be very well considered in cases where the defect is persistently visualised even after 6 months and is relatively anteriorly placed. Further studies are however needed to understand the time frame in the healing of cortical defects and factors affecting it.

To conclude the present case signifies the possibility of a major complication resulting from frequently used so called minor procedure in orthopaedic practice. To avoid such complications basic technique should be practiced which includes choosing the right diameter and correct insertion site

(mid way between anterior and posterior cortices). If options are available, one should go for smaller diameter pins with tensioning, especially when using site other than the standard one. If one needs to put a large diameter pin, predrilling is recommended.

Ethical aspects

The patients gave an informed consent for the publication of this report.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES

- Althausen PL, Hak DJ. Lower extremity traction pins: indications, technique, and complications. *Am J Orthop*. 2002;31(1):43–47.
- Levi N. Is preoperative tibial traction responsible for peroneal nerve palsy in patients with a fractured hip? *Acta Orthop Belg*. 1998;64(3):273–276.
- Bjerkreim I, Benum P. Genu recurvatum: a late complication of tibial wire traction in fractures of the femur in children. *Acta Orthop Scand*. 1975;46(6):1012–1019.
- Suri T, Dabas V, Sural S, Dhal A. Pseudoaneurysm of the anterior tibial artery: a rare complication of proximal tibial Steinman pin insertion. *Indian J Orthop*. 2011;45(2):178–180.
- Evans PE, Thomas WG. Tibial fracture through a traction-pin site. A report of two cases. *J Bone Joint Surg Am*. 1984;66(9):1475–1476.
- Anderson LD, Sisk TD, Tooms RE, Park WI. Compression-plate fixation in acute diaphyseal fractures of the radius and ulna. *J Bone Joint Surg Am*. 1975;57-A:287–297.

7. Deluca PA, Lindsey RW, Ruwe PA. Refracture of bones of the forearm after the removal of compression plates. *J Bone Joint Surg Am.* 1988;70:1372–1376.
8. Hoke D, Jafari SM, Orozco F, Ong A. Tibial shaft stress fractures resulting from placement of navigation tracker pins. *J Arthroplasty.* 2011;26(3):504.
9. Jung HJ, Jung YB, Song KS, et al. Fractures associated with computer navigated total knee arthroplasty. *J Bone Joint Surg Am.* 2007;89:2280.
10. Bonutti P, Dethmers D, Stiehl JB. Case report: femoral shaft fracture resulting from femoral tracker placement in navigated TKA. *Clin Orthop Relat Res.* 2008;466:1499.
11. Li CH, Chen TH, Su YP, et al. Periprosthetic supracondylar femoral fracture after total knee arthroplasty with navigation. *J Arthroplasty.* 2008;23:304.
12. Wysocki RW, Sheinkop MB, Virkus WW, et al. Femoral fracture through a previous pin site after computer-assisted total knee arthroplasty. *J Arthroplasty.* 2008;23:462.
13. Massai F, Contedua F, Vadala A, Iorio R, Basiglini L, Ferretti A. Tibial stress fracture after computer-navigated total knee arthroplasty. *J Orthop Trauma.* 2010;11:123–127.
14. Beldame J, Boisrenoult P, Beaufils P. Pin track induced fractures around computer-assisted TKA. *Orthop Traumatol Surg Res.* 2010;96(3):249–255.
15. Seligson D, Donald GD, Stanwyck TS, et al. Consideration of pin diameter and insertion technique for external fixation in diaphyseal bone. *Acta Orthop Belg.* 1984;50(4):441–450.
16. Antoci V, Voor MJ, Antoci Jr V, Roberts CS. Effect of wire tension on stiffness of tensioned fine wires in external fixation: a mechanical study. *Am J Orthop.* 2007;36(9):473–476.