Bilateral proximal tibia stress fracture following bilateral distal femoral hemiepiphysiodesis - A rare complication

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ABSTRACT

Correction of lower limb deformities by hemiepiphysiodesis with 8-plates is gaining popularity among deformity surgeons. Complications including metal failure, recurrence of deformity have been reported but stress fracture has not been reported. We have encountered bilateral proximal metaphyseal tibia stress fractures following correction of valgus deformity of both knees by hemiepiphysiodesis of distal femur following inadvertent overcorrection to a varus deformity following loss of follow up. The varus deformity has been reversed by guided growth of distal femoral physis resulting in fracture union and normal gait pattern.

We herewith emphasize the importance of timely follow up with removal of 8 plates for hemiepiphysiodesis in deformity correction to prevent unexpected complication. We are reporting a rare complication of proximal tibial stress fractures following distal femur hemiepiphysiodesis done for valgus deformity with 8-plates.

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1. Introduction

Physiological genu valgum corrects after the age of 6. Pathological valgus deformity persisting in later years of life adversely affects joint morphology resulting in early degenerative changes in lateral compartments, medial collateral ligament laxity. Pathological valgus deformity is associated with lateral femoral condyle hypoplasia and patellofemoral instability with shallow trochlea and patella tilt. Abnormal gait pattern is a common cause of clinical attendance.

Guided growth in form of temporary hemiepiphysiodesis has been accepted as a safe and efficient method of treatment for deformity correction. Tension band 8-plate has gained increasing popularity over the last decade due to simplicity of surgical technique and physis sparing characteristic.^{1–3} Its reported complications are overcorrection, rebound deformity, hardware migration and failure (screw breakage)^{4–6} but not a stress fracture. Apart from end of growth due to closed physis there is no definite contraindications for 8-plate. It has successfully been used in angular and longitudinal growth modification on healthy and disease altered growth plates. Overcorrection of the deformity is a

disadvantage if the timely removal of 8 plates has not been performed. Though this might require further intervention, stress fractures of the associated skeleton are not a known complication.

Stress fractures typically occur in adults in tibia, second metatarsal. It is common in military recruits, marathon training when unaccustomed sudden cyclical stress is applied to the bone. By definition stress fractures occur in a normal bone due to fatigue failure and in weakened bone by cyclical suboptimal stress. We are not aware of any case report of stress fractures as a complication following deformity correction by hemiepiphysiodesis. The purpose of the case report is for the deformity correcting surgeons to be aware of stress fracture being a potential complication following inadvertent deformity overcorrection.

2. Case report

9 year old boy with valgus deformity of both legs presented to our clinic with complaints of deformity, pain in and abnormal gait pattern. Past medical history included ichthyosis vulgaris, severe asthma, filagrin gene mutation, adrenal suppression and hypertension related to previous corticosteroid toxicity. His regular medications included medication for asthma and topical ointments for skin. Patient was not on steroids.

Patient had history of fracture of distal radius and ankle following appropriate energy trauma. Bone densitometry was normal. Patient was short and overweight for age with weight

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Fig. 1. Preoperative long leg alignment view radiographs showing mild valgus deformity but clinically intermalleolar distance was 17 cm.

Fig. 2. Postoperative radiographs at 18 months showing stress fractures bilateral proximal medial tibia. Patient had sustained right distal tibia following road traffic accident in the interim period and was treated non operatively and had healed right side distal tibia fracture.

above 98 percentiles and height between 9 and 25 percentile with BMI of 28.75. His lower limb length appeared equal with significant valgus deformity, particularly on the right and flat feet. The intermalleolar distance was 17 cm on clinical measurement at the time of consultation though the long leg films did not show the severity of the deformity (Fig. 1).

Distal femoral hemiepiphysiodesis was performed for correction of deformity on both knees. Immediate post-operative period was uneventful. Patient was involved in road traffic accident and had sustained distal tibia fracture which was treated in plaster cast in a different hospital. Patient had not injured proximal tibia during this event. Patient had not attended follow up appointment in spite of multiple appointments were provided though some of them were erroneously made due to human error. Patient was finally reviewed at 18 months following surgery when attended the appointment. It was noted that the patient had significant over correction of the valgus deformity resulting in varus deformity and bilateral proximal medial tibial stress fracture due to varus overcorrection (Figs. 2 & 3).

Patient was under the care of multidisciplinary team including bone metabolic team and pediatricians and was investigated for any other cause to explain the stress fracture. Bone density scan did not show any osteoporosis or osteopenic features with DEXA height corrected score of 0.2. Calcium, phosphates serum and urine level, vitamin D levels were within normal range. Patient was mobilized with crutches and weight bearing as pain allows. Lateral distal hemiepiphysiodesis was performed to correct the varus deformity within few weeks after the fractures were discovered and satisfactory corrections were achieved with healing of the fractures (Figs. 4 and 5).

3. Discussion

Metal failure in the form of the screw fracture has been a known complication following tension band 8 plates in hemiepiphysiodesis.^{4,5} The risk is higher with increased BMI.^{4,5} In cases of Blount's disease with varus deformity treated with hemiepiphysiodesis, screw breakage rate has been higher but stress fractures have not been reported.⁵ Stress fracture following deformity correction with 8 plates has not been reported before. We feel that this is a rare complication and has to be bear in mind if correction is not closely monitored. Common causes of unaccustomed vigorous exercise, cyclical load are not present in this patient nor are other causes like metabolic bone disorder, neoplastic foci or genetically acquired growth anomaly noted. Though this patient has filaggrin gene mutation affecting the skin, we feel there is no direct correlation to the fracture. The patient has not been on steroid therapy. The fractures occurred in the limb segments separate from the implants, thus are not related to the presence of metalwork or surgical technique. There is no screw breakage or implant

Fig. 3. Stress fractures at proximal tibia at 18 months post surgery – closer image.

Fig. 4. Postoperative radiograph following surgery to correct varus deformity.

Fig. 5. Satisfactory alignment of lower limbs 15 months after distal femoral hemiepiphysiodesis and 3 months after removal of 8 plates.

failure. We feel that one of the possible explanations is translation of the mechanical axis resulting in overload of medial proximal tibia on weight bearing and is consistent with the morphology of fractures. Furthermore, prompt union after restoring normal axis and no recurrence of fractures later on support the diagnosis. The authors acknowledge the possibility that the fractures of the proximal tibia cannot be entirely attributed to the overcorrection given the background problems. At the time of presentation with the proximal tibia fractures, the investigation has not shown any severe bone and metabolic anomalies. The fact that the fractures has healed following the correction of deformity is suggestive of the overcorrection being the dominant factor among all. We emphasize the importance of timely follow up with removal of 8 plates in the distal femur when used for deformity correction and to avoid varus overcorrection. As far as we are aware, stress fractures of proximal tibia following hemiepiphysiodesis with 8-plates of distal femur has not been reported as a potential complication of overcorrection. We want the surgeons performing deformity correction to be aware of this rare complication when correcting deformities around knee as 8 plates have gained popularity in the modern era of deformity correction (Fig. 5).^{1–3,6}

Conflict of interest

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article. No ethical review was required as this is a case report.

References

- Cooper GA, Southern T, Eastwood DM, Bache CE. Lower extremity deformity management in MPS IVA, Morquio-Brailsford syndrome: preliminary report of hemiepiphysiodesis correction of genu valgum. *J Pediatr Orthop.* 2016;36(4):376–381.
- Kumar A, Gaba S, Sud A, Mandlecha P, Goel L, Nayak M. Comparative study between staples and eight plate in the management of coronal plane deformities of the knee in skeletally immature children. *J Child Orthop.* 2016;10(5):429–437.
- Yilmaz G, Oto M, Thabet AM, et al. Correction of lower extremity angular deformities in skeletal dysplasia with hemiepiphysiodesis: a preliminary report. *J Pediatr Orthop.* 2014;34(3):336–345.
- Burghardt RD, Specht SC, Herzenberg JE. Mechanical failures of eight-plate guided growth system for temporary hemiepiphysiodesis. *J Pediatr Orthop.* 2010;30(6):594–597.
- Schroerlucke S, Bertrand S, Clapp J, Bundy J, Gregg FO. Failure of orthofix eight-plate for the treatment of Blount disease. *J Pediatr Orthop.* 2009;29(1):57–60.
- Shin YW, Trehan SK, Uppstrom TJ, Widmann RF, Green DW. Radiographic results and complications of 3 guided growth implants. *J Pediatr Orthop.* 2016;10.1097/BPO.0000000000000825.