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Letter to Editor

Instability, non-union, and subsequent failure of flexible nails: Takeaways from the complication

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Dear Editor,

We read with interest the recently published article entitled "Complications in operatively managed pediatric femoral shaft fractures," which highlights important implications following femoral shaft fracture management.[1] The majority of the cases in the study were managed with either flexible or rigid nailing. Non-union was also recorded as one of the major complications, despite the pediatric age, which is considered favorable for the natural union process.

As a corollary to the above article, we describe through a case snippet that instability, non-union, and ultimate implant failure is a continuum of progressive treatment failure. The instability due to poor fixation promotes excessive movement across the fracture site, thus interfering with the union process and leading to subsequent non-union.[2] Prolonged non-union places extraordinary stress on the implants leading to their failure in the form of loosening or breakage.

A 9-year-old patient (weight 30 kg) was managed elsewhere for his femoral shaft fracture with two titanium elastic nails. In this case, the nails were thinner, and the bend did not correspond to the fracture site, which led to instability of the construct [Figure 1a]. Besides that, the nail-ends were too protruding from the bone to irritate the skin. The subsequent hypertrophic non-union was evident on follow-up radiographs [Figure 1b]. The non-union ultimately led to implant failure in the form of breakage of both nails at the fracture site. One of the nails was removed in the process, as its distal end was irritating the medial skin [Figure 1c]. The revision surgery was done with removal by removing broken implants, opening the medullary canal, and autologous bone grafting and fixation with thicker nails of size 4.0 mm as compared to 3.0 mm used previously [Figure 1d]. A small amount of bone graft was taken from the iliac crest and mixed with nibbled bone from the fracture ends to increase the volume and placed across the fracture site. The grafting was done in the light of prolonged non-union and as an attempt not to leave anything to chance during the second surgery. Plating of the femur was an alternative option as the fracture site was already open, but nailing was chosen due to the fact that later plate removal requires re-exploration of the surgical wound, and there is a risk of cold-welding of screws. Flexible nails are always easier to remove in our experience. A deep tissue culture of the products of medullary reaming was sent even though pre-operative blood work, including

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Figure 1: (a) The radiograph shows the fracture managed by two titanium elastic nails. The nail-ends protrude out of the entry site (red arrow), and the bends of the nails do not correspond to the fracture site but is located in the distal fragment (yellow arrow). (b) The fracture shows no signs of healing in the 4th month, while the callus formation is evident. (c) The hypertrophic callus is noted at the fracture site, but the fracture gap and broken nails are still visible. The medial distal part of the broken nail was removed. (d) The persistent non-union led to re-operation to remove broken nails and fixation with thicker nails and bone grafting.

complete and differential counts, C-reactive protein, and erythrocyte sedimentation rate, did not suggest the presence of infection. The culture was negative for any bacterial or fungal growth. The fracture healed well in the next three months without complications, but the radiographs were lost during the process. The patient did not turn up for the nail removal at our center and may have consulted elsewhere.

The rare case snippet depicts all that can go wrong in a pediatric femoral shaft fracture managed with flexible nailing. The bending of the nail-ends results in skin irritation and bursa formation, and the medial skin irritation may impinge the vastus medialis muscle and interfere with knee movement. The decreased movement of muscles across fracture sites may then interfere with both union and range of motion. Non-adherence to the principles of flexible nailing provides a weaker construct and delays healing and even mechanical failure of nails, despite being a rare event. Common complications with flexible nails are entry site irritation, delayed healing, leg-length discrepancy, and axial malrotation.[3] Bending of nails has been commonly seen as an uncommon complication, but breakage of both nails is rare.[4] In this case, the breakage of both nails was noted as a continuum or the domino effect of one thing going wrong. Not bending the nails at the entry site or using end-caps may avoid skin irritation caused by protruding nail-ends.[5] Using nail size that, in combination, occupies 80% of the medullary cavity at the fracture site and pre-bending that results in bowing of the nails corresponding to the fracture sites are technical tips to avoid many of the above-mentioned complications. The described case may be of educational benefit to all practitioners.

AUTHORS' CONTRIBUTIONS

GSD conceptualised, did literature search, and wrote first and final draft. All authors have critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY FOR MANUSCRIPT PREPARATION

The author confirms that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

CONFLICTS OF INTEREST

There are no conflicting relationships or activities.

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