COMMENTARY

Salter-Harris I and II fractures of the distal tibia: Does mechanism of injury relate to premature physeal closure?
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J Pediatr Orthop. 2006; 26(3):322-328.

The authors present their second article on premature physeal closure in Salter-Harris (S-H) fractures of the distal tibia. Previously they looked at 92 patients with distal tibial physeal fractures and reported that residual physeal gap greater than 3 mm after reduction is associated with increased risk of physeal arrest in S-H I and II fractures specifically (Baramada et al). Similar results are reported in the current study, utilizing a larger sample size.

As these authors mention, many variables can play a role in determining which physeal injuries will result in arrest. Phieffer et al evaluated the effect of interposed periosteum in the fracture site using a rat model. Comparing proximal medial tibial physeal fracture, fracture with interposed periosteum, and physeal defect with interposed periosteum (control), the authors reported a small but significant (statistically but not clinically) leg length discrepancy (2% versus 0.5% of the contralateral leg) in the fracture with interposed periosteum compared to the fracture-only group. Review of the histology revealed that small physeal bars did not guarantee a limb length inequality or angular deformity, as they could be found in both experimental groups. The authors concluded that the cause of growth disturbance must be multifactorial and the exact effect of interposed periosteum is still undefined.

In a follow-up study, Gruber et al further evaluated the fate of interposed periosteum and its effect on physeal fracture healing. Histologic evaluation revealed no evidence of osteogenic potential by the periosteum. Instead the physis reacted to the periosteum as if it were a foreign body, either degrading it or pushing it away (towards the metaphysis). The physis could repair itself even with interposed periosteum. Histological formation of a bar was similar in animals with fracture alone or fracture plus interposed periosteum. Vertical septa occurring at the time of fracture allow migration of marrow elements from the epiphysis and metaphysis; osteoclasts and chondroclasts enter and are followed by osteoblasts laying down bone, thus forming the bar. More severe damage (physeal ablation) revealed trabecular networks along these vertical septa routinely, and therefore these tibias healed via primary ossification with bar formation.

Rohmiller et al also proposed that injury mechanism (Lauge-Hansen classification) would impact the outcomes. The impaction of the growth plate in an abduction injury was associated with almost 50% rate of physeal closure despite anatomic reduction. Perhaps the abduction force causes more damage to the physis than does rotational force.

References:

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Phieffer L, Meyer R, Gruber H, Easley M, Wattenbarger J. Effect of interposed periosteum in an animal physeal fracture model. *Clin Orthop Relat Res*. 2000;376:15-25.