

## Vignette 6: Answer

Making the diagnosis is the first step in this case because not all distal femoral fractures are the same in children. To nail down the diagnosis and corresponding recommended treatment options, one must first classify this fracture. The most common system for distal femoral epiphyseal fractures is the classic Salter-Harris scheme. In a type I fracture, there is a separation through the growth plate; in type II (most common), the fracture crosses the physis and exits obliquely across one of the corners of the metaphysis; in type III, the fracture line extends through the growth plate and exits through the epiphysis into the joint; in type IV, a vertical fracture crosses the epiphysis, physis, and metaphysis; and type V are crush fractures of the growth plate.<sup>20</sup> Based on the x-ray, the patient sustained a displaced Salter-Harris II fracture of his distal femur. Because this fracture is displaced, the likelihood of growth arrest and formation of a physeal bar are quite high, thus necessitating anatomic alignment of the fracture. This is typically accomplished via an open reduction (if adequate closed reduction cannot be achieved) and pinning of the fracture.

Often, type II fractures reduce with longitudinal traction, and smooth transphyseal pins can be placed when the metaphyseal piece is small. In cases with a large metaphyseal fragment, K-wires or cannulated screws can be used to fix the fracture without violating the growth plate. Unlike Salter-Harris II fractures elsewhere in the body, in the distal femur, even with anatomic alignment, there is a high chance of growth arrest. This physis maintains an undulating shape and is more susceptible to shearing and compressive forces.<sup>20</sup>

Surveillance follow-up is recommended, with an evaluation around 6 months after the injury for early detection of a potential growth disturbance. It is even suggested that follow-up should continue until skeletal maturity because both growth acceleration and arrest have been seen with distal femur physeal fractures. If a bony bar is identified, indications for excision are when less than 50% of the bar is affecting the physis and more than 2 years of growth remain (as in our case).<sup>20</sup> An MRI is the best modality to determine the extent of a physeal bar formation. In older children, it is commonly viewed that girls stop growing at 13 years of age and boys stop at 16 years of age. Typically, projected leg-length discrepancies of less than 2 cm can be managed nonsurgically, between 2 and 5 cm can be treated with a contralateral epiphysiodesis, and greater than 5 cm may need a limb-lengthening procedure.

If the bar is excised, it is usually filled with a substance that will prevent the bar from reoccurring (fat is commonly used). If Harris growth arrest lines are present, you will see them starting at the bar and extending outward. (A Harris growth arrest line is a linear increased density seen above the growth plate on x-rays. It represents temporary slowing or cessation of growth due to insult from the fracture.) Once the bar is excised and the growth resumes, the Harris growth arrest lines will become more horizontal, indicating that the bar is no longer acting as a tether. An osteotomy may be performed depending on the child's age and extent of deformity. Some believe that by merely removing the physeal bar, the limb will continue to grow and the deformity will improve. Others believe that if the deformity is clinically unacceptable, then an osteotomy should be performed. In patients approaching skeletal maturity, an osteotomy and/or a hemiepiphysiodesis may be the better treatment option.

**Why Might This Be Tested?** Question writers typically focus on pediatric fractures that may lead to secondary deformities and complications. It is important to be aware of which distal femur fractures have a higher likelihood of future issues (growth arrest and deformity) and to know which ones need to be followed closely and what to do if the issues arise.

### Here's the Point!

**If you inherit a patient with a distal femoral physeal fracture, you have bought that patient until skeletal maturity because growth acceleration or deceleration are common. Anatomic reduction and secure fixation is a must. Physeal bars should be resected when less than 50% of the growth plate and more than 2 more years of growth are left.**