



CASE REPORT

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Epiphysiodesis Screw Thread Damage and Migration

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ABSTRACT

Percutaneous femoral distal epiphysiodesis using transphyseal cannulated screws is commonly used for correcting anisomelia and angular deformity in adolescent patients.

Method: We report a case of previously unreported complication using cannulated screws: The thread being damaged, the screw failed to block growth in the physis showed by the releasing of a metal filament in the bone marrow after the screw's removal.

Results: The patient showed a limb length discrepancy necessitating a surgical correction.

The screw thread was damaged by the other device releasing a metal filament lodged in the bone marrow.

The metal filament was released during the first operative gesture for Patient A, whereas it occurred on the removal of the hardware on the other example.

Images:

Conclusion: This report illustrates an uncommon complication using transphyseal screws inherent to the Métaizeau surgical technique.

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Introduction

Epiphysiodesis remains a classic technique for the treatment of leg length discrepancy and angular deformity. For the leg length discrepancy (LLD), this technique is recommended for inequalities of 2 to 5 cm [1]. For the greater LLD, a combination of short leg lengthening and epiphysiodesis can be proposed. In angular deformity like genu varum or valgum, a hemi-epiphysiodesis is usually recommended. This procedure is mostly performed in the distal femur, proximal tibia or both.

Different surgical techniques can be performed with their pros and cons. In 1933 Phemister was the first to describe an open procedure epiphysiodesis [2]. We are prone to use the percutaneous epiphysiodesis with transphyseal screws (PETS) developed by Métaizeau using a fluoroscopic guided technique that consists in crossing two screws in X by percutaneously placing them in the physis. Other surgical techniques exist with staples, plates, or screws [3, 4].

Epiphysiodesis is normally well tolerated and complications are rare but wide. With 0% to 49% of complications reported in the literature, including: post-operative hemarthrosis, superficial or deep infection, wound hematoma, transient or permanent neuropathy, under- or over-correction and incomplete epiphysiodesis [3, 5-8].

Despite all of the different complications for this procedure, we describe in this article a new one occurring in two patients.

Cases presentation

Patient A

A 12-years-old sportive patient with a LLD after a femoral shortening associated with a Salter osteotomy.

The patient presented a congenital hip dysplasia, which was treated during her first year of life in Spain with conservative treatment. Unfortunately, her right hip presented a re-dislocation. Spanish doctors proposed a surgical treatment when she would turn 9 years old; but at 8, she moved into Belgium. HUDERF's Orthopedic pediatric team proposed at first a femoral shortening osteotomy associated with a Salter osteotomy in July 2017. One year after this procedure, the right leg was 45 mm shorter than the left. A percutaneous epiphysiodesis with two screws crossing in X was performed in October 2018 (Figure 1). Per-operative X-ray showed two screws in the right position. After two months, on the left knee appeared a genu varum associated with walking difficulty. A new cliché was performed showing that the lateral screw didn't cross the physis anymore (Figure 2). We also see a white spot corresponding with the lateral screw thread. When we drilled the lateral screw, we scraped on the medial screw, blunt its screw thread, and its binding capacity. Because of the

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symptomatic ineffectiveness of the screw, surgical revision was performed in two stages. First, the screws were removed and the distal lateral femoral hemiepiphysiodesis screw was replaced under fluoroscopic assessment (Figure 3.). After 6 months, when the varus was corrected, epiphysiodesis of the distal femur and proximal tibia was realized (Figure 4.)



Figure 1: Left knee X-ray face and profile (October 2018): screws are in place across the physis, note the metal filament released during the placement of the material



Figure 2: Left knee X-ray face and profile (January 2020): one screw no longer cross the lateral physis, note the metal filament in the bone marrow.



Figure 3: Left knee X-ray face and profile (February 2020): the removal of the two initial epiphysiodesis screws, correction of the varus by the placement of a screw for lateral hemi-epiphysiodesis. Note the metal filament leftover in the bone marrow.

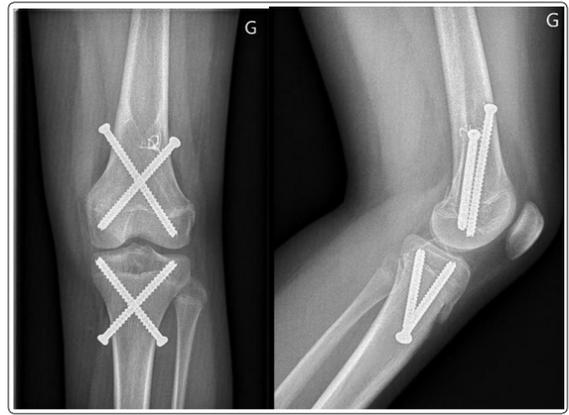


Figure 4: Left knee X-ray face and profile (August 2020): Last surgery after 6 months, when the varus was corrected, epiphysiodesis of the distal femur and proximal tibia was realized

Example of other occurency

On the other hand, here is an example of a metallic image on the X-ray without any clinical consequence. To reduce the leg length difference, a temporary epiphysiodesis was performed in this patient. A year after the screws were removed, leaving a metal filament in the bone marrow, as shown on picture below.



Figure 5: EOS (Right and left knee): Epiphysiodesis in the left knee



Figure 6: EOS (right and left knee): removal of the material in the left knee, leaving a metal filament in the bone marrow.

Discussion

Epiphysiodesis is a common surgical procedure to treat LLD in growing children. Hemi-epiphysiodesis can be proposed for angular deformity (such as genu varum/valgum).

The complication rate of this technique is 0 to 49% depending on the study. This interval is explained by the subjective definition of “complication” and the difference between the duration of follow up.

Compared to the open procedure, the percutaneous technique has many advantages regarding the cosmetic scars, the safeness, the infection rates, and the effectiveness on the LLD but it subsists some inevitable per-operative issue.

The complication rate remains debated in the literature as explained in the introduction, this method however seems to be preferred by most surgeons.

Makarov and Al reported a 7.0% rate on a cohort of 863 children using any method combined. According to them, the main complication is the angular deformity noticed especially in valgus without clear etiology but highlighting risk factors (young patient, congenital etiology, and significant difference in length) [9]. A recurrence of the valgus on removal of the screw with overcompensation of the physis is possible.

Depending on the literature, this complication has an incidence of 0 to 49%. It's corrected with growth in 2.3% of children [9]. In our first case, the complication observed is an angular deformation but in varus with a clear etiology. The thread being damaged, the screw failed to block growth in the physis. Regarding the etiology and the symptomatic nature, the growth could not have corrected this deformity, a surgical revision was therefore necessary.

The main issue is that the fluoroscopic technique involves a 2-dimension working that could lead to blind spots.

The open technique, therefore, has the advantage on the one hand of having a better visualization of the structures, and on the other hand does not require crossing screws, which limits the risk of damaging. Nevertheless, it presents another type of complication such as the peroneal nerve injuring noted for the first time by Green and Anderson [10, 11]. During our case report, the fluoroscopic side view during the operation misleads the surgeon, which is the difficulty of this procedure. During the operation in case of doubt during the positioning of the screw, or an abnormal resistance that occurs, if a radiopaque filament is visualized at the level of the crossing of the screws, it seems to be a sign of premature wear of the screw, which cannot then play its role on the growth of the physis. A screw change is a reasonable solution despite the costs incurred for the hospital. On the other hand, if the filament is not visualized as in the second case, the thread was certainly a little worn during its installation, but the screw is still competent.

We suggest that component testing and biomechanical resistance of the screws should be conducted.

We want to emphasize, that the metal filament in the other patient was an accidental discovery event; the patient never complained and never showed any clinical sign.

Nevertheless, we believe that this metal filament in bone marrow is harmless, representing no more risk of infection than the initial implant itself and very few risks of migration.

We haven't found any other article relating to this event suggesting that the true incidence rate is for now unknown. Since no other case was reported, it could be a common complication as the epiphysiodesis screw bending [12].

Conclusion

Epiphysiodesis is a common procedure that is well tolerated by patients in the treatment of limb length differences and angular deformities. The complication rate fluctuates between 0 and 49%

and brings together a great diversity. Currently, no study proves a superior efficacy between the open or percutaneous methods.

This report illustrates an uncommon complication using transphyseal screws inherent to the Metaizeau surgical technique.

The damaging of the thread during screwing is a newly reported complication. The presence of the metal filament on the x-ray at the level of the crossing of the screws seems to be a sign of too much wear on the thread to ensure proper functioning. However, the leftovers released by the damaging seem harmless.

The percutaneous method brings many advantages, provided that the two peroperative views are of good quality and that the potential complications are taken into account.

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