



Case report

Pseudarthrosis of distal radial growth plate treated with Blount clip: A case report

S. Shaibi^{*}, Y. Sbihi, A. Soudi, M.A. Choukri, Y. EL Andaloussi, M. Fadili

Orthopedic Traumatology Department of IBN ROCHD University Hospital, Casablanca, Morocco

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A B S T R A C T

Introduction and importance: Epiphyseal detachment of distal radius are frequent, the richness of the vascular supply at this level favors rapid consolidation, but with the possibility of long-term complications which vary according to the classification of Salter and Harris. In the literature they are dominated by the epiphysiodesis, however, Pseudarthrosis of the growth plate is exceptional. Through this case presentation, we will explain contributing factors of its occurrence and its care management.

Case presentation: We report a case of a pseudarthrosis of distal radial growth plate (GP) due to an epiphyseal detachment type I of Salter and Harris in a 16-years-old patient who presented with a right wrist trauma at the age of 8, treated by a traditional immobilization (Moroccan Jbira) and who kept a painful deformity of the right wrist in hand ulnar boot. Face and profile radiography of the right wrist found a pseudarthrosis of distal radial growth plate, the patient had surgery to attach pseudarthrosis spot using a Blount clip, and at the same time, creating a partial epiphysiodesis in the lateral side, resulting in the correction of the wrist malalignment. After 5 years, we had a consolidation of the pseudarthrosis spot, without modification of angular deviation.

Clinical discussion: GP's traumas care management is based on an urgent and anatomical reduction because it is a very fragile area and is more affected by mechanical stress, however in our context Patients consult usually after late complications such as deformations and functional abnormalities.

Blount clip was our surgical team choice because it is the best way of osteosynthesis in our case, it allows a solid fixation thanks to its biomechanical characteristics.

Pseudarthrosis of distal radial growth plate is exceptional in the literature that's why we cannot compare our results.

Conclusion: This complication would have been prevented with initial adequate care management, prevention about avoiding traditional traitements.

1. Introduction

Epiphyseal detachments of distal radius account for approximately 20% of growth plate injuries [1,8]. The richness of the vascular supply at this level favors rapid consolidation, but with the possibility of long-term complications. The importance of these complications varies according to the classification of Salter and Harris [9].

In the literature, the complications are dominated by epiphysiodesis that generates arm length inequality [9]. However, Pseudarthrosis of the growth plate is exceptional. There are no guidelines for surgical management of this type of pseudarthrosis in the literature. Authors report a case of a pseudarthrosis of distal radial growth plate due to an epiphyseal separation type I of Salter and Harris in a 16-years-old patient in the

IBN ROCHD University Hospital of Casablanca. Through this rare case presentation in the literature, we will explain contributing factors of its occurrence and its care management.

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

This work has been reported in line with the SCARE criteria [11].

2. Case presentation

This is a 16-year-old adolescent who presented with a closed trauma of the right wrist at the age of 8, following a fall from a height of 2 m,

^{*} Corresponding author.

E-mail address: saidhouse7@gmail.com (S. Shaibi).

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treated by traditional immobilization (Jbira). and without any other past medical or surgical history or Drug History and Allergies. The patient consulted us for pain and deformity of the right wrist with, on clinical examination, an ulnar boot hand, limitation of pronosupination movements and persistence of mobility of the fracture site. On radiological examination (Fig. 1): the radiography of the right wrist, face and profile, showed non union of the growth plate on an epiphyseal detachment of the distal radius, Salter and Harris type I, with osteocondensation of the edges of the physal bone and persistence of a clear epiphyseal-metaphyseal space, associated with an angular deviation of the distal end of the radius with a medial sinus of 45° and retroversion of the radial glenoid by 15° . The distal end of the ulna was the site of a valgus callus with shortening.

The diagnosis of pseudarthrosis of distal radial growth plate was retained. Those type of lesion may evolve to permanent clinical deformity of the wrist, chronic pain and disability. After 5 years from the initial trauma, the patient had surgery to attach pseudarthrosis spot using a Blount clip, and at the same time, creating a partial epiphyseodesis in the lateral side, resulting in the correction of the wrist malalignment. This intervention was undergone under general anesthesia, using a tourniquet and antibiotics prophylaxis, by a fellow resident with 4 years of experience in trauma at an orthopedic surgery at the adult trauma and orthopedic service. (Fig. 2).

After 5 years, the patient presented with a painless ulnar boot hand with no flexion-extension limitation but a slight pronation limitation (Fig. 3), he began to do manual work without restriction of mobility. The radiological assessment (Fig. 4) showed consolidation of the pseudarthrosis focus without any change in angular deviation in either the frontal or sagittal planes. CT scan confirmed total epiphyseodesis (Fig. 5). The patient was taken back for corrective osteotomy.

The patient was reoperated for correction of his deformation with a radial osteotomy (Fig. 6). 2 years later, overall, the deformation is partially corrected. From a functional point of view, the patient has a



Fig. 1. X-ray of the wrist showing the pseudarthrosis of inferior radial growth plate due to type 1 of Salter and Harris fracture of distal radial epiphysis.



Fig. 2. Post-op X-ray of the right wrist after placement of a Blount clip.

good flexion-extension of the wrist, but a limited pronosupination movement with a 80 degrees of pronation and 45 degrees of supination.

3. Discussion

This case is representative of our context where patients' fractures are frequently mistreated by traditional ways. Patients consult usually after late complications such as deformations and functional abnormalities. Our approach is to have a maximal correction of those complications and have quiet overall satisfying results without aiming for perfection.

The growth plate (GP) is composed, successively from the epiphysis to the metaphysis, of four cellular layers with different functions, immersed in a fundamental substance, the intercellular matrix, and whose purpose is an endochondral ossification process. Its mechanical stabilization is provided by the perichondral shell and the Lacroix fibrous ring [2]. It receives its vascularization from three systems: the epiphyseal arteries, the centromedullary metaphyseal arteries and the arteries of the perichondral shell [2], which gives this region a high potential for consolidation in the event of fracture.

This GP is a low-strength zone and will yield to stresses more quickly than the ligaments that are inserted into it. This is why joint sprains and dislocations are rare in children [3]. Salter [4] has shown that the intercellular matrix ensures the solidity of the growth plate; in fact, the more the cells hypertrophy, the less space there is for the matrix and the more fragile the zone is, which makes the hypertrophic zone more vulnerable to epiphyseal detachment (Salter and Harris type I), thus sparing the reserve cells, which guarantees a good growth prognosis.

On the other hand, Ogden [10] in his classification divides Salter and Harris type 1 into 3 subtypes according to the orientation of the shock wave in relation to the different histological layers, so that the trauma rarely passes purely parallel to the hypertrophic layer (type 1a) and is generally found undulating, either in the maturation layer (type 1b), or in the serrated and reserve layer (type 1c). Consequently, any trauma passing through this layer may lead to the development of fibrosis, which is a source of pseudoarthrosis, especially in the presence of favorable biomechanical conditions, which casts doubt on the prognosis given by Salter and Harris for this type of detachment.

Hefti et al. [5] showed in his study that the GP will react in several ways after having suffered a trauma. These situations are classified into four types: Type I is hypergrowth, probably by vascular flow necessary for consolidation. Type II corresponds to a stop or a major slowdown in the functioning of the physal when the reserve chondrocytes have been affected. This may explain the non-healing of the cartilage and the subsequent pseudoarthrosis in our case. Type III is asymmetric



Fig. 3. Clinical aspect after 5 years of the intervention showing a hand cubital boot deformity.



Fig. 4. X-ray showing complete epiphysiodesis of distal radial growth plate without modification of the misalignment.

stimulation of the physeal, resulting in axial deviation. Finally, type IV is the formation of an intraphyseal bone bridge (epiphysiodesis), resulting in axial deformity if it is peripheral, articular deformity if it is central, and shortening if it occupies a major part of the physeal. This corresponds to the valgus deformity of the distal ulna in our patient.

The management of GP trauma requires urgent reduction as anatomically correct as possible and as little harm as possible, avoiding any untimely or violent maneuver, followed by restraint [3]. According to Peterson [3] [6], 93% of CC fractures are treated orthopedically because most physical lesions are not displaced and are treated with temporary immobilization and displaced lesions are reduced by manual traction followed by immobilization. Our patient was treated in the traditional way (manipulation and immobilization by jbirra); this method does not respect any biological or biomechanical rules of fracture immobilization, which resulted in instability and installation of the pseudarthrosis focus.

Blount clip was our surgical team choice because it is the best way of osteosynthesis in our case, it allows a solid fixation thanks to its biomechanical characteristics allowing good osteonal consolidation, by promoting beneficial compression forces and limiting harmful shearing forces. This was demonstrated by Catherine [7] in her experimental study on induced deformities of the distal radius of the lamb,

concluding that the staple was superior to pins and external fixators in provoking epiphysiodesis.

3.1. Patient perspective

Patient was satisfied of the overall surgical results considering that it was at first the family decision to not seek for adequate medical care when the trauma first occurred.

4. Conclusion

Growth plate pseudarthrosis is a rare entity in children. It is a preventable complication if there is an initial treatment and rigorous monitoring of each epiphysal separation. In our case, the blount staple allowed epiphysiodesis of the growth cartilage, but the absence of a similar case in the literature made it difficult to compare our results with those of other studies.

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Ethical approval

This study is exempt from ethical approval in our institution.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Guarantor

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M.Fadili

Provenance and peer review

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CRediT authorship contribution statement

S.Shaibi: study concept, writer
Y.Sbihi: data analysis

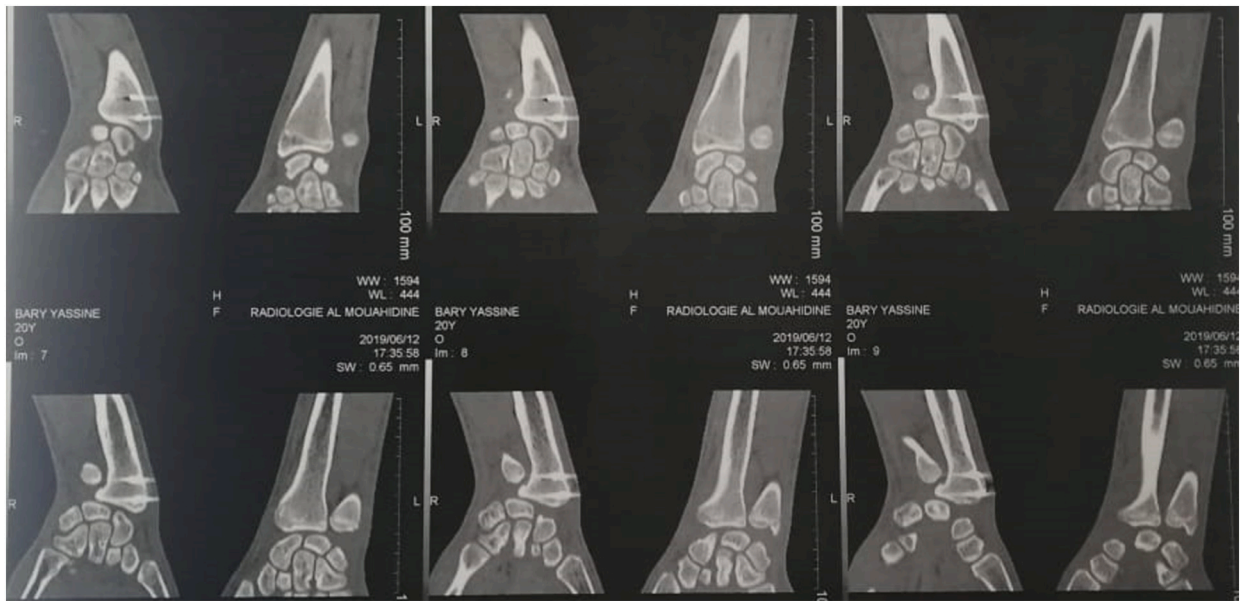


Fig. 5. CT scan of the right wrist confirming complete epiphyseal fusion of distal radial growth plate.

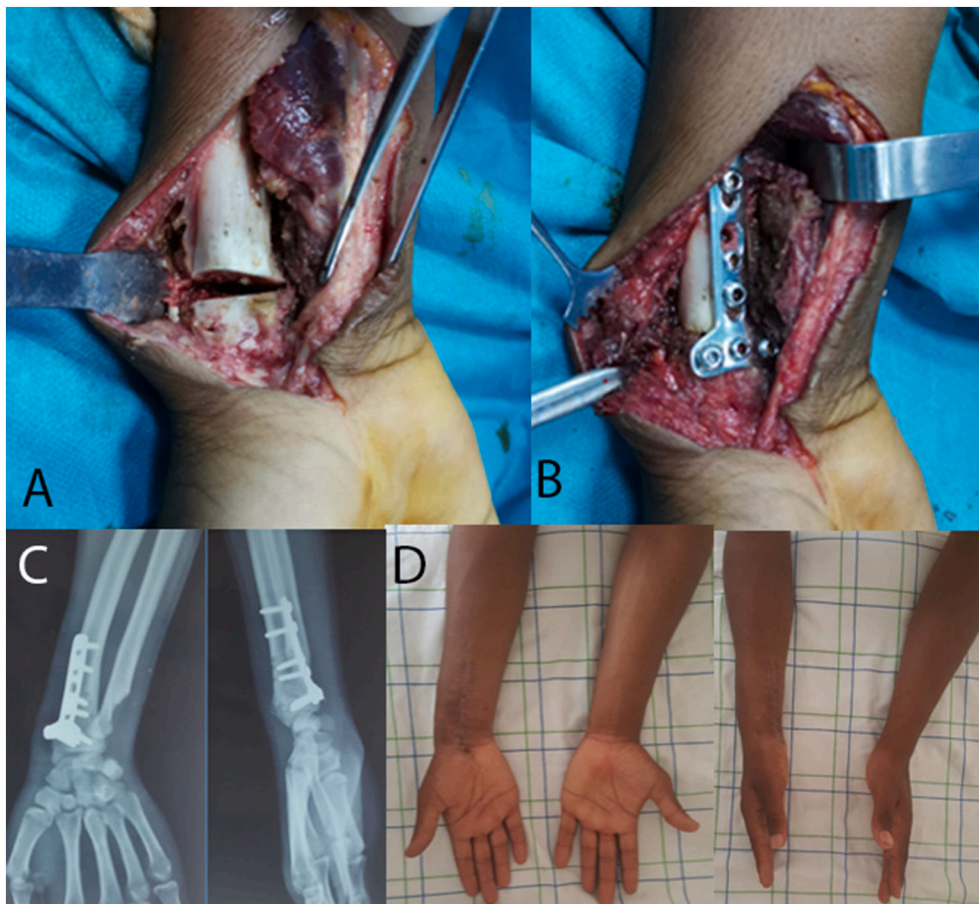


Fig. 6. A- Radial subperiosteal osteotomy. B-Resection of the radius and fixation by locking plate. C-X-ray showing a partial correction of the deformity. D- Satisfactory functional result with good flexion-extension and limitation of the supination to 45°.

A.Sdoudi: interpretation
 M.A.Choukri: data collection
 Y.EL Andaloussi: consultant
 M.Fadili: study concept, head of orthopedic trauma service

Declaration of competing interest

There is no conflict of interest.

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