Management of septic non union and discrepancy of humerus in a child: A case report

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ABSTRACT

INTRODUCTION: The management of large bone defect in the upper limb is fraught with difficulties and problems. It’s is a long course treatment which include many components: infection, osseous loosening and shortening.

CASE PRESENTATION: We present our experience of an 12-years-old boy with septic non union of the proximal left humerus with length discrepancy of 6 cm treated with ilizarov fixator(IL) followed by vascularized fibula graft (VFG) with a good clinical result without complications.

DISCUSSION: The bone loss may be treated with allografts, bone transfer and bone substitute. Consideration of the quality of bed tissue and the size of the bone defect are condition to ensure a good result.

CONCLUSION: Ilizarov fixator is an attractive and the most used technique for solving the problem of discrepancy and stabilizing in the upper limb.

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1. Introduction

Septic non union of the humerus is a rare complication caused by multiple etiologies: osteoarthritis, osteomyelitis and fracture’s infection which result of shortening and disability for upper limb. It’s is a long course treatment which include many components: infection, osseous loosening and shortening especially in children whose growth cartilage is still fertile. Some authors describe the usefulness of the ilizarov technique in the management of the infection and the lengthening of the humerus [1]. The bone loss may be treated with allografts, bone transfer and bone substitute.

We present our experience of an 12-years-old boy with septic non union of the proximal left humerus with length discrepancy of 6 cm treated with Ilizarov fixator(IL) followed by vascularized fibula graft (VFG) with a good clinical result without complications.

This work has been reported in line with the SCARE criteria 2018 [2].

2. Presentation of case

An 12-years-old boy was admitted to our department with a diagnosis of left bifocal humerus osteomyelitis without any drug history or family genetic history. He was operated and put on antibiotic with initially a good clinical and biological evolution. Four months after surgery the boy had a pathological fracture of the proximal humerus caused by benign traumatism. For which he was received an orthopaedic treatment. However, the evolution was marked by the non-union of the humerus until 6 months later. On clinical assessment he had a painful and limited range of motion of the shoulder and no clinical or biological inflammatory signs. He has a shortening of 6 cm in the left arm. X-Ray shows pseudarthrosis with destruction of the proximal growth plate (Fig. 1). The prevision of length discrepancy was estimated to 9 cm. After discussion, the medical staff decided to use the induced membrane by experienced operator. The parent’s patient agree with this technique. The first step of the management was to treat both septic non-union and shortening with Ilizarov fixator(IF) without opening the pseudarthrosis site (Fig. 2): We decided to sacrifice the proximal growth plate. The slow distraction is enabled spontaneously from non union site without needing any osteotomy. The stabilization is constructed with three half 4 mm pins into the humeral head avoiding axillary nerve. The distal humerus was fixed by one wire from medial to lateral through the epicondyle and one half 4 mm pins avoiding the radial and ulnar nerve. Then we fixe the pins to a half ring in the proximal and in the distal 4/5 ring. The

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half ring opens medially to accommodate the shoulder and the 4/5 ring opens anteriorly to accommodate the flexion of the elbow. The two rings were connected with three rigid rods to allow positioning of humerus and distraction of the non-union. A good stability of the mounting was achieved. Lengthening was performed using the technique of Ilizarov [3] and Cattaneo [4] and the distraction begin about 10 days after the operation and proceed at rate of 0,25 mm, four times a day. The parents are instructed how to handle the fixator to continue the lengthening at home. Clinical control and X-Ray were taken regularly until the end of hyper lengthening which evaluated about 9 cm overall. The operative follow-ups remain simple. The second step of the management was to treat the bone defect. The pseudarthrosis was exposed and cleared of granulation tissue back to healthy bone and the medullar canal was opened. The segmental bony defect was bridged by 10 cm vascularized fibula graft (VFG) (Fig. 3). The procedure undertaken with the IF in place. Skeletal fixation was obtained by one screw placed distally. The Ilizarov frame was kept in-situ for 2 additional months. The shoulder had 70° of forward flexion, 80° of abduction and the patient is painfree. At the last follow-up of 7 years the fibula hypertrophied and consolidated to the humerus and no signs of recurrent infection or fracture (Fig. 4).

3. Discussion

The management of large bone defect in the upper limb is fraught with difficulties and problems [5]. It’s important to set out a preoperative strategy because the surgeon would face simultane-
ously multiple problems: bone defect and sometimes associated with infection and limb discrepancy. It’s is accepted that in a healthy tissue bed a bone defect of up 6 cm can be performed by a non-vascularised bone graft [6]. By contrast, a bone defect up to 6 cm in a poor soft tissue bed such as infection and osteomyelitis, a vascularised bone graft is indicated [6]. In deed the vascularised bone graft whose VFG has many advantages which is bringing his own vascularity to the poor soft tissue and heals as a segmental fracture in contrast to a non-vascularised bone graft [6]. In addition to that, the concept of induced membrane has also been reported to treat bone defect and expand the indication of non vascularized bone graft even in poor soft tissue bed [6]. Indeed the membrane prevents resorption of the cancellous bone and promotes the vascularization by delivering osteoinductive factors [7].

The first step of the strategy should enhance on eradicating any active infection. For this matter Illarov Fixator(IF) has been described as a potent and promising technique [1,4] to treat at the same time non union and lengthening of the humerus. Indeed, the IF stabilizes the pseudarthrosis site which is an essential condition to allow successful healing of infection. Some authors use callus distraction following the osteotomy for compression non union, the procedure will treat at the same time the shortening and the pseudarthrosis. Based on this clinical findings Liu [1] reported a good outcome in septic non union of the humerus undertaken by IF with callus distraction: 10 patients successfully treated from total of 11 patients. Other authors, start distraction in closed non union site and will perform lengthening firstly and this is the case of Jupiter [5] which he reported an excellent result with this procedure in a 19-year-old male patient. Alammar [8] in a recent study of 60 patients, demonstrated that IF is an effective method for closed arthrodesis in infected ankle comparing to open methods. In our case we used the method of Jupiter [5] and that Alammar [8] combined, indeed we perform the distraction of the non union without opening the pseudarthrosis site. Cattaneo [4] described a humeral lengthening using IF in 43 cases varied from 5 cm to 16 cm with different etiology of defect bones included achondroplasia, congenital shortening, bone infection and fracture with an excellent outcome in most patients. Van Loon [9] described a correction of deformity and realignment of the humerus using IF in 3 dimension plans in a 13-year-girl with Ollier disease. The girl has better function of upper limb and is satisfied with the cosmetic result. We believe
that IF is a promising technique with an excellent result in treating the pseudarthrosis in the humerus with lengthening, although it’s complex, high rate of complications and need a tight cooperation between patients and their family.

The second step of the strategy is filling the bone defect and the successful is conditioned by the control of the infection. Transfer of vascularized fibular graft (VFG) is the first choice for reconstruction of large bone defect with a poor bed tissue [6,10]. VFG has been described frequently in the literature to reconstruct bone defect in humeral tumor [10], osteomyelitis [5] and glenohumeral arthrodesis with good result. Onoda [10] reported 4 patients who underwent a VFG to reconstruct humerus in tumor disease with total outcome of 75 percent according to Musculoskeletal Tumor Society scores. In our institution, our policy lean on the VFG as first choice treatment when the defected bone extend 5–6 cm especially in poor bed tissue. VFG has proven its effectiveness to reduce the risk of fracture and provide more rapid healing by the simultaneous supply of bone and its sufficient blood flow [10]. Based on this clinical findings Jupiter [5] published an excellent review of the usefulness of VFG to reconstruct bone defect in humerus associated with massive contracture and scarring soft tissue envelope due to osteomyelitis. The overall result was satisfactory with good range of motion of the shoulder (120° abduction; 80° forward flexion; 40° extension) and no complications associated. On the other hands Heitmann [11] reported a high rate of late fracture up to 40 % in his serie of 15 VFG in humerus.

The limitation of our study that is a single case presentation and it is early to conclude the real efficiency of this method. We have some critics about our management, we think that the decision to start the treatment of the orthopaedic treatment of pathological fracture is not the best. We are ahead of bone infection associated with fracture then the evolution towards non union is inevitable, thus the surgical treatment is necessary. May be the decision of orthopaedic treatment is argued on using progressively the therapeutic arsenal against a difficult disease in children whose growth cartilage is still fertile.

4. Conclusion

The treatment of the bone defect in the upper limb has evolved in last 4 decades with the availability of many therapeutic options with high effective outcome: vascular and non vascular bone graft. Consideration of the quality of bed tissue and the size of the bone defect are condition to ensure a good result. Ilizarov fixator is still even since attractive and the most used technique for solving the problem of discrepancy and stabilizing in the upper limb.

Declaration of Competing Interest

The authors report no declarations of interest.

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Consent

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