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Short communication

Bone healing is achievable despite extensive wound dehiscence and wide plate and screws exposure in children

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ABSTRACT

Background: Extensive wound dehiscence and wide plate and screw exposure in the early weeks following orthopaedic surgery in children is usually managed either by extensive debridement, lavage and secondary closure or hardware removal and external fixation.
Patients: Three children with LCP plate and screws exposure were managed by simple repetitive debridement and local wound care without any IV antibiotics, nor secondary closure or hardware removal. All three cases occurred in the tibia, one following tibial osteotomy in lateral hemimelia with a long history of previous surgeries, one following wide excision of a tibial Ewing sarcoma with chemo- and radiotherapy, and the third following wide excision of a 12 cm necrotic tibial segment due to chronic osteomyelitis. Bone healing was uneventful in 2 cases and was in progress in the case with the Ewing sarcoma. Plate and screws were removed in all cases, following an obvious bone healing in 2 cases, and forced by the need for chemotherapy due to the presence of lung metastases in the third case. Spontaneous soft tissue healing occurred thereafter.
Conclusion: A stable fixation may lead to a good bone healing despite an extensive wound dehiscence and a wide plate and screws exposure with just a proper local wound care and without any major additional surgery.
Level of evidence: Level IV.

1. Introduction

Surgical wound dehiscence and postoperative plate and screws exposure are possible complications both in the adult and the pediatric population, and are known to increase the risk of surgical site infection [1]. Bone stability has been shown to reduce the incidence of some infections [2].

The goal of treatment of infection associated with internal fixation devices is to achieve bone healing, without progression to chronic osteomyelitis. Complete eradication of infection is not necessary since the fixation device is temporary [3]. In case of acute infection, implant removal is usually not an option, since bone healing has not occurred yet. Implant retaining surgeries were advocated, in association with long term antibiotics in patients with a stable implant, no sinus tract, a good quality of tissue surrounding the implant, and the presence of a known microorganism [4,5]. In case of necrotic tissue and purulence, repeated debridement is advocated. In the presence of a chronic osteomyelitis, extensive surgical treatment is necessary, sometimes requiring either direct exchange of the internal fixation device or removal of the hardware and external fixation [3].

Several authors reported satisfactory results following repeated debridement and prolonged antibiotics despite plate and screw retention for cases with early wound dehiscence and plate exposure [6,7], in contrast with some others' experience [8]. However, all published studies report the use of flaps or any other soft tissue procedures to insure plate coverage [7,8]. We found no articles in the literature dealing exclusively with the management of acute post-operative infection or plate exposure in the pediatric population.

We report herein three children with extensive wound dehiscence and wide plate and screws exposure who were managed by hardware retention without soft tissue coverage with a satisfactory outcome.

2. Patients

The first patient (Fig. 1) is an 8-year-old boy with lateral hemimelia, and a long history of previous surgeries (total 12) the last of which being fixation with a locking plate and screws and

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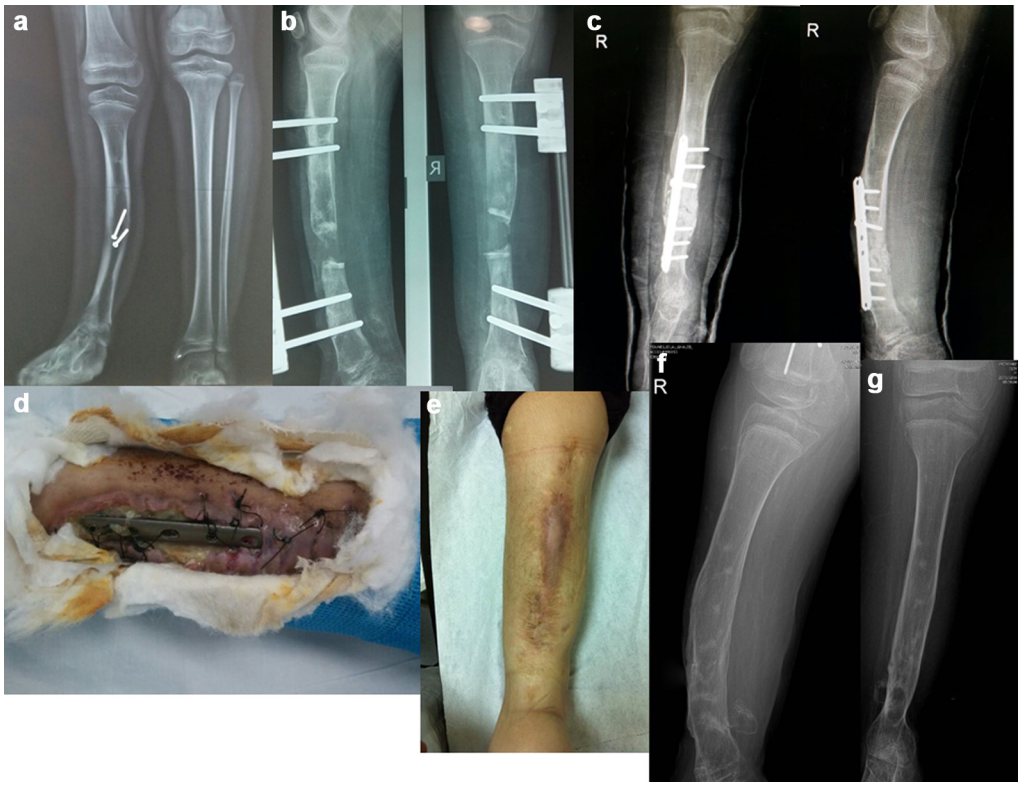

Fig. 1. First case; a, b: axial alignment correction and gradual lengthening using an Orthofix® unilateral external fixator that failed to heal 10 months later; c: regenerate bone grafting and plating using locked screws; d: wound dehiscence; e: skin condition after removal of plate; f, g: good bone union at end of treatment.

bone grafting following nonunion of an osteotomy. He developed progressive wound dehiscence and 5 cm plate exposure during the third postoperative week with a pseudomonas surgical site infection. Debridement and lavage were undertaken twice and oral antibiotics given for 6 weeks along with daily scrupulous wound care by the parents with direct control by a staff member once a week. Six months later, the wound was clean without any clinical or biological signs of infection and the bone healed uneventfully despite persistent plate exposure. The plate was removed and the wound was left to heal secondarily over 3 weeks. Eighteen months later, the patient was asymptomatic with no sequelae.

The second patient (Fig. 2) is a 12 year-old boy who presented with a severe right tibial diffuse osteomyelitis. On presentation, he had a 13 cm long sequestrum that required surgical excision and reconstruction in two stages according to Masquelet's method with internal fixation using a locking plate. Six weeks after the second stage, he presented with a 1 cm distal wound dehiscence and plate exposure with no clinical nor biological signs of infection. He was managed in the same manner as the first case and progressed to uneventful healing despite worsening of plate exposure to 7 cm at complete bone healing and plate removal one year later.

The third patient (Fig. 3) is a 7-year-old boy, with a history of right tibial Ewing sarcoma, with a history of multiple operations, the last being an open reduction and internal fixation of the tibia following hardware failure using a long locking plate. Six weeks postoperatively, he developed wide and progressive wound dehiscence and Enterobacter Cloacae infection and plate exposure which was managed in the same manner as for the first 2 cases. One year later, the wound was clean with no signs of infection despite entire plate exposure, and the skin showed areas of healing underneath the plate; radiographs showed signs of progressive but slow bone healing. He was then diagnosed with lung metastases and since chemotherapy was planned we decided to remove the plate in order to avoid increased risk of local infection. The wound healed uneventfully but the child passed away.

3. Discussion

Although the reported cases in this paper are rather atypical and rare, bone healing seems to be achievable despite extensive wound dehiscence and wide plate and screws exposure in children.

The safest reported management of early post-operative infection or wound dehiscence and plate and screws exposure is hardware removal, extensive debridement and external fixation. The rationale behind using external fixators is to reduce the contact surface between bone and hardware while insuring a stable fixation, the latter being previously demonstrated as a factor that decreases the infection risk [2]. This may not be possible in some cases due to the lack of good bone stock proximally and distally, or to some psychosocial and economic issues. The three cases reported herein fit perfectly well in this patient category. All three could not withstand enduring an external fixator and more operations.

The Locking Compression Plate (LCP) was initially described as an "internal external fixator", since the plate is not pressed against the bone, thus reducing the bone/metal interface. When LCP becomes exposed, secondary to infection or wound dehiscence, the "internal external fixator" becomes an "external fixator". Eijer et al. showed that the LCP predecessor, the PC-Fix had much lower infection rates than Dynamic Compression Plates [9]. This probably explains the favorable outcome in our 3 cases despite extensive plate exposure. In our third patient, the skin even grew between the bone and the plate transforming it into a real external fixator but in close contact with the skin.

Berkes et al. reviewed 123 patients with early post-operative infection (< 6 weeks). Treatment with debridement, hardware retention and antibiotics was successful in 71% of cases [6]. Similar

Fig. 2. Second case; a, b, c: radiographs and skin condition 6 weeks postop; d, e, f: radiographs and skin condition 1 year postop; g, h, i: radiographs and skin condition on removal of plate and screws; j: skin condition a year after removal of the plate.

Fig. 3. Third case; a–e: progression of plate exposure with no purulence or signs of cellulitis; f, g: skin growth underneath the plate, confirming that an exposed LCP plate acts as an external fixator; h, i: evolution of skin condition after removal of the plate.

encouraging results were reported by other authors with the same strategy [7]. Charalampos et al., on the other hand, reported a bad experience in 26 adults [8]. None of the cited authors report retaining exposed hardware. The last two papers explicitly reported performing procedures to ensure adequate soft tissue coverage. None of our 3 cases required soft tissue coverage and all of them progressed to bone healing despite extensive plate and screws exposure. Scrupulous daily-supervised wound care is mandatory. Our 3 patients' young age may have been a positive factor for healing.

4. Conclusion

Plate and screws retention, despite extensive wound dehiscence and hardware exposure, is inevitable in some cases but seems to be compatible with bone healing and satisfactory outcome in children provided locking plates are used. A scrupulous supervised daily wound care is mandatory. The wound should remain clean even if it requires repeated surgical debridements and oral antibiotics. In case of local or systemic septic deterioration or construct instability, a rapid shift towards more conventional and safer methods such a hardware removal, debridement, IV antibiotics and external fixation should be undertaken.

Disclosure of interest

The authors declare that they have no competing interest.

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