Simple Bone Cyst as a Sequel of Forearm Plate Osteosynthesis

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Received: 24 October 2010 / Accepted: 2 December 2010 / Published online: 11 February 2011
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Abstract This report presents the long-term effect of plate osteosynthesis to repair a right forearm fracture in an 11-year old patient, who 6 years later requested removal of her plates because of the pain she was experiencing in the area. The 17 year-old female had developed simple bone cysts around the implanted plates for her radius and ulnar fracture. Circulatory disturbances might have a role in the development of the simple bone cysts in this case.

Keywords Simple bone cyst · Forearm plating · Complication · Osteosynthesis · Implant removal

Introduction

Osteosynthesis is a surgical procedure that utilizes mechanical devices such as pins, metal plates, wires or screws for internal fixation of a fracture. Labosky et al suggested that leaving forearm plates in a child for the rest of her life is not a benign decision. The plate may cause mechanical problems and can lead to loss of bone strength due to a stress shielding effect. Implanted metal devices undergo corrosion by a variety of pathways that releases metallic substances into the patient's system and set up the potential for pathological effects such as bacteriological, metabolic, immunological, and oncological conditions [1, 2]

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Simple bone cyst is mostly a solitary lesion which is most common seen in the humerus, then the femur. Simple bone cysts of the radius or ulna are rare [3]. The chance for developing simple bone cyst as a long-term potential complication from the implanted plates is not mentioned in the English literature.

This report presents the long-term effect of plate osteosynthesis to repair a right forearm fracture in an 11-year old patient, who 6 years later developed simple bone cysts around the implanted plates for her radius and ulnar fracture.

Case Report

The patient, a 17 year-old female, asked for the removal of her right forearm plates because of pain and local tenderness over the ulnar plate developed a few months before (Fig. 1). Six years before she had a bone fracture of her right forearm after accidentally falling down while playing at school. There was not any pathological process to predispose her forearm fracture. She was treated by closed reduction and casting. The immobilization period was about 6 weeks. Ten days after removal of the cast she had a fracture in the same place of her right forearm after falling down accidentally a second time. This injury was treated by plate osteosynthesis for her forearm bones. The radial plate was a 5-hole 3.5 mm one third tubular and the ulnar plate was a 6-hole 3.5 mm one third tubular. She had an uneventful post operative course. The initial X-rays were not available. After the surgery the patient and her family were told that the removal of the plates is not necessary.

During the 6 years after the surgery, she had no symptoms related to her forearm and therefore there was no control X-ray of her forearm. There was not any sign of

Fig. 1 Antro-posterior X-ray of the right forearm demonstrates a large simple bone cyst of the ulnar bone beneath the plate. The lesion is seen through the unscrewed hole of the plate. A cyst is also seen around the distal screw of the radial plate

Fig. 2 Histopathologic sections shows bone trabeculae, connective tissue with vascularization, hyalinized connective tissue, rare osteoclast like giant cells hemorrhage and hemosiderin deposition. (Hematoxyline-eosin stain X100)

infection (edema, erythema, and discharge) at the time she asked for removal of her plates. The erythrocyte sedimentation rate was normal and the neurovascular was intact. X-ray of the right forearm demonstrated a large osteolytic lesion of the ulnar bone beneath the plate. A cyst is also noted around the distal screw of the radial plate (Fig. 1).

After removal of the ulnar plate, the cortex under the plate was very thin and large bone cysts filled with serosanguineous fluid appeared. In some areas the thickness of the cortical bone was as thin as an egg shell. After the removal of the distal screw of the radial plate a serosanguineous fluid was drained. There was no tissue of any kind inside the cystic lesions. Cultures of the fluids from the lesions were negative for micro-organisms. The cavities fluids were not analyzed. Samples were taken from the wall of both ulnar and the radial lesions for histopathological studies. Histopathologic sections showed bone trabeculae, connective tissue with vascularization, hyalinized connective tissue, rare osteoclast like giant cells hemorrhage and hemosiderin deposition. There was not any tumoral process. Histopathological findings were compatible with simple bone cysts (Fig. 2). There was not any metallic debris on gross or histological examination. At operation a thin layer of bone had covered the ulnar plate. It was used as autogenous bone graft to fill the ulnar cyst (Fig. 3). I thought that simple decompression of the radial cyst through the screw hole might be enough treatment. The forearm was protected by cast for 6 weeks. Healing of the ulnar bone lesion with complete disappearance of the cyst cavities were observed within 6 months (Fig. 4). After 1 year the radial cyst did not heal. Figure 5 shows the radial lesion at surgery which was filled with autogenous bone graft harvested from the iliac crest. The radial lesion healed within 6 months (Fig. 6).

Discussion

The etiology of simple bone cysts is unclear. Multiple theories exist to explain their presence but none has been confirmed. Literature substantiates the theory of a disturbance in or occlusion of the intramedullary venous circulation [3–7].

Concurrent development of simple bone cysts in the radius and ulna is rare [3].

Rumball and Finnegan noted changes in bone vascularity secondary to plate application that may represent the underlying cause for loss of cortical integrity [8]. Olerud and Danckwardt-Lillistorm in an experimental osteotomy fixed by compression plating found avascular cortical regions of varying extent in the immediate vicinity of the fracture zone and beneath the plate [9]. Jacobs et al studied the effect of semitubular and dynamic compression plates on

Fig. 3 The ulnar cyst was filled with autogenous bone graft

Fig. 4 Healing of the ulnar bone lesion with complete disappearance of the cyst cavities were observed within 6 months. The radial lesion did not heal

cortical bone perfusion. They found that plating altered the cortical circulation. There was evidence of an increase in the depth and area of ischemic tissue. With high force and sufficient force the cortical circulation could be obstructed [10].

A fracture always causes some circulatory disturbance in the adjacent cortex [9, 11]. In this case, refracture, subsequent surgical intervention, subperiosteal dissection, and the type of the plate used for osteosynthesis might have aggravated the circulatory disturbance around the plates.

Fig. 5 Radial lesion at surgery

Fig. 6 The radial lesion healed within 6 months

Circulatory disturbance might have a role in the development of the simple bone cysts in this case.

Aneurysmal bone cyst was the leading differential diagnosis for the lesions of this case. There are reports for the development of the aneurysmal bone cyst following trauma and fracture [12]. But there was not any histopathological finding to support the diagnosis of aneurysmal bone cyst in the lesions.

A flaw in this report is that the post injuries and immediate post-operative radiographs were not available. But the patient and her family remember that they were not told about any pathologic process involving the right forearm bones any time. The patient only had plate osteosynthesis for her radius and ulna fracture and no other special treatment was added to the treatment of her forearm fracture.

Conclusion

Development of a simple bone cyst as a complication around plate osteosynthesis has not been described previously. Circulatory disturbances might have a role in the development of the simple bone cysts in this case.

Conflict of interest statement I am the sole author of this manuscript and there is not conflict of interest of any kind in preparing this manuscript.

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