Fibular graft for reconstruction of proximal femoral aneurysmal bone cysts

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Received 22 November 2016
Accepted 18 December 2016

The Egyptian Orthopaedic Journal
2016, 51:143–146

Background
The treatment options of aneurysmal bone cyst might change according to patient's age, location, and type of lesion. Curettage and insertion of bone graft or polymethyl methacrylate are the principal techniques used.
Patients and methods
Eight patients (five male and three female; aged 8–14 years, with a mean age of 11 years) were treated with fibular autograft and iliac graft for the treatment of aneurysmal bone cyst in the proximal femur. Plain radiography and clinical assessment were performed through the whole follow-up period between 20 and 48 months (with a mean of 36 months). The musculoskeletal tumor society scoring system for limb salvage for the lower limb was used for clinical evaluation.
Results
Clinically, seven out of eight patients had excellent results according to the musculoskeletal tumor society scoring system for limb salvage for the lower limb. One case had postoperative pathological fracture after beginning weight bearing. Fibular grafts were fully incorporated into the recipient site within 12–16 months, with a mean incorporation time of 13 months. The graft donor site showed some minor problems such as leg discomfort and heel pain.
Conclusion
Curettage and an autogenous nonvascularized fibular graft is a good technique to treat benign cystic lesions of the proximal femur in relatively young patients. It is recommended to externally protect the limb with plaster of Paris. Hydrogen peroxide lavage was used to control local recurrence.

Keywords:
aneurysmal, cyst, fibula, graft

Egypt Orthop J 51:143–146

1110-1148

Introduction

Despite attempts of investigators to establish a relationship of the aneurysmal bone cyst (ABC) with other entities, the term remains purely descriptive. ABC is a rare benign lesion, characterized with blood-filled cavity within an expanded region of the bone. Although ABC can be seen in whole skeleton, usually long bones (65%) are affected. A total of 80% of the patients are below the age of 20 years and are rarely detected after the age of 30 years. The cells that line the cyst wall show fibrous components, macrophages, giant cells, and islands of bone. Options of ABC treatment might change according to its location and type, and age of the patient. Previous reports suggested that the aneurysmal cyst appears to be the result of hemorrhagic degradative events such as giant cell tumor, hemangioma, nonossifying fibroma, eosinophilic granuloma, and other tumors [1–3].

The other possibility is that the aneurysmal cyst is a partially necrotic and extremely vascular (telangiectatic) osteosarcoma, which has a high rate of metastasis. Regardless of the techniques reported, there remains a recurrence rate that ranges from 5% to greater than 40%.The appearance of the lesions supports the word blowout and shows marked thinning of the cortex over the site, with only minimal bone formation, all of which are sometimes best seen on a computed tomography or a MRI scan [4–6].

The treatment options of ABC might change according to patient's age, location, and type of the lesion. Curettage and insertion of bone graft or polymethyl methacrylate are the principal techniques used. In other trials, sclerosing substances, bone substitutes, and other agents seemed to be less effective than conventional curettage [7]. In this study, eight patients were treated for ABC in the proximal femoral metaphysis using the technique of cortical collapsing

 DOI: 10.4103/1110-1148.203148

of fibular autograft supplemented by cancellous bone graft.

Patients and methods

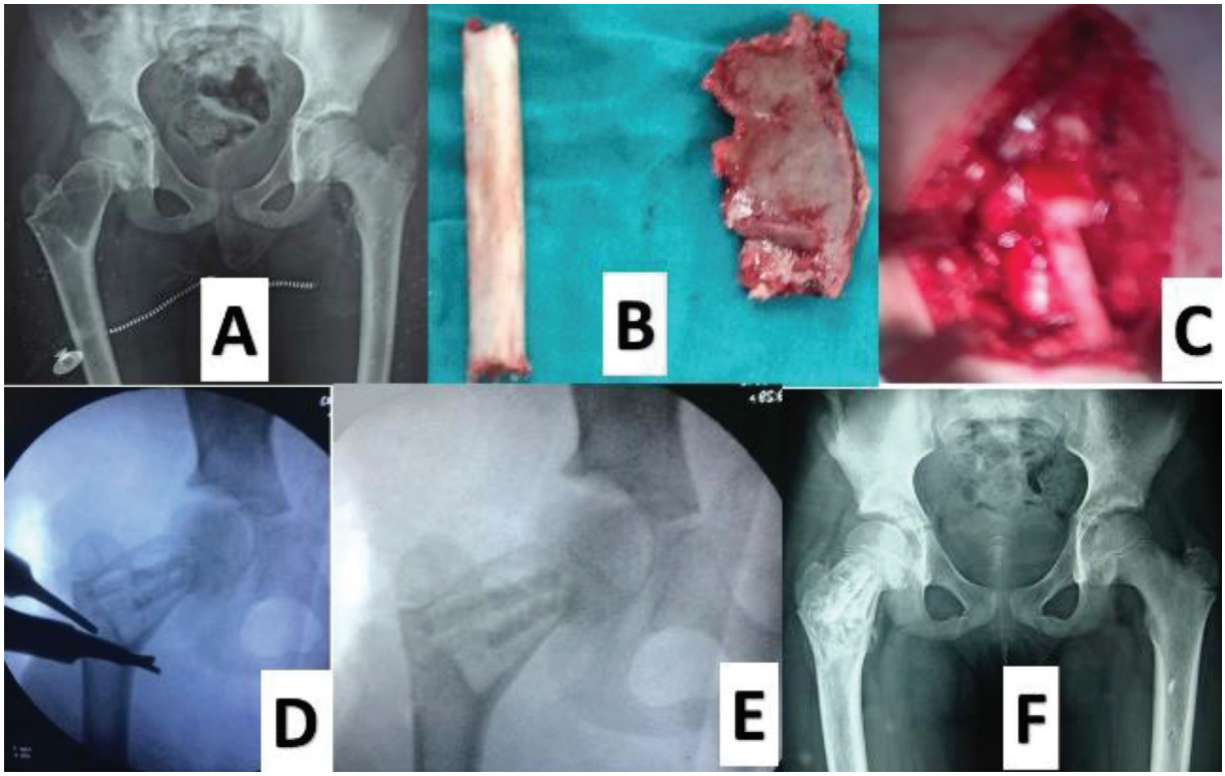
From August 2006 to march 2010, eight patients (five male and three female; aged 8–14 years, with a mean age of 11 years) were treated with fibular autograft for the treatment of ABC in the proximal femur. This prospective study was conducted at Zagazig University Hospitals, after approval of our ethical com-mittee for research in accordance with the ethical standards laid down in the 1964 declaration of Helsinki and its later amendments.

All cases were classified according to localization and activity. All the patients had type II and active tumors according to criteria of Campanacci *et al.* [8], respectively. In the follow-up period, recovery of the patients was evaluated according to classification modified by Capanna *et al.* [9] – (i) full recovery: all spaces caused by cyst filled with new bone formation; (ii) partial recovery: new bone formation filled the gaps, but in some zones osteolytic areas were present; (iii) recurrence: osteolytic lesions appeared after new bone formation and cortical thinning (iv), and there was no response to treatment. In all cases, clinically and radiologically diagnosed ABCs were confirmed histopathologically.

Operative technique

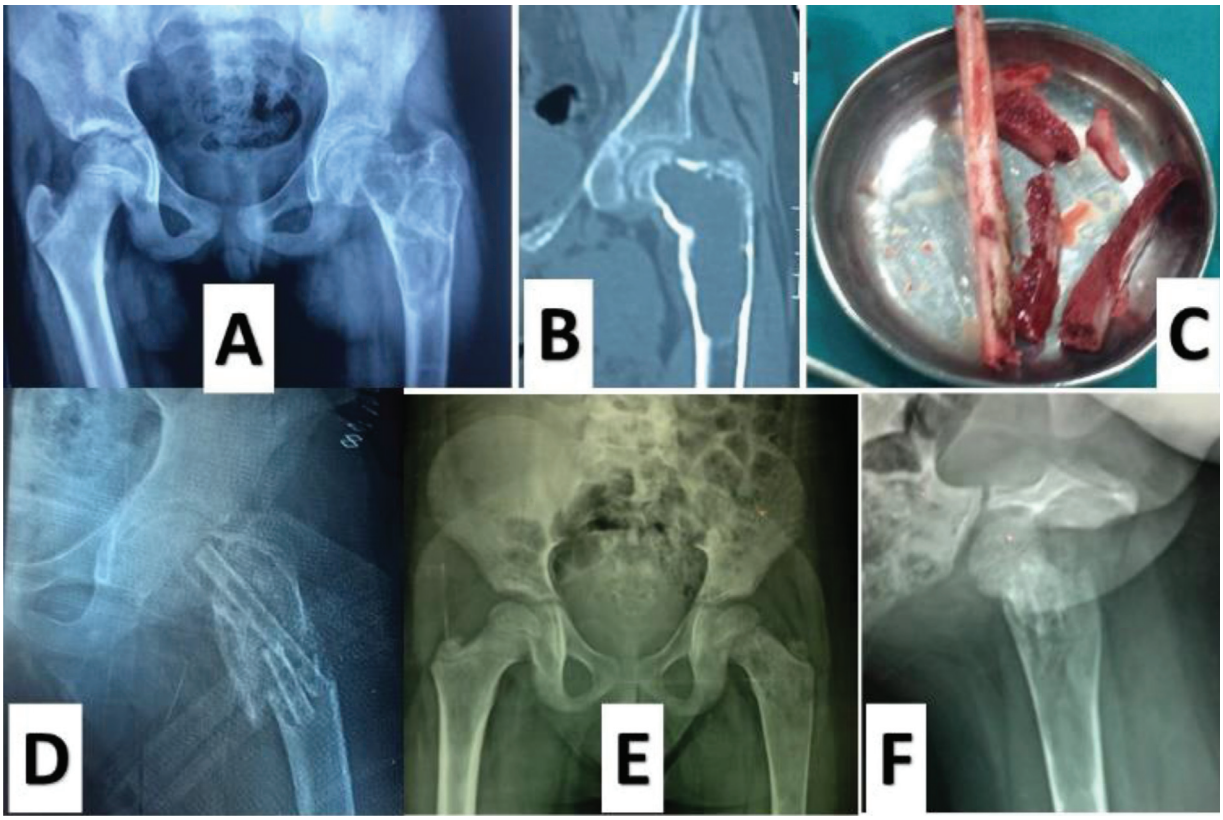
In supine position, surgery began with harvesting of the fibula from the ipsilateral leg through lateral incision from the middle segment of the fibula after dissecting the segment subperiosteally after leaving more than 6 cm distal segment to guard against ankle joint stability, and care was taken not to injure the sural nerve. After closure of leg wound, a thorough curettage was performed to the proximal femoral lesion through a lateral femoral approach. This was followed by hydrogen peroxide lavage in cases in which local recurrence was a risk. Last, impaction of the fibular graft inside the cyst was done, either one segment or more, without internal fixation (Fig. 1). Drain was left around the lesion and incision was closed anatomically. A spica cast was done for all patients. After 8–12 weeks, the spica cast was removed and weight bearing was started thereafter according to cyst healing and graft incorporation. Plain radiography and clinical assessment were performed through the whole follow-up period between 20 and 48 months (with a mean of 36 months). The follow-up intervals were every 3 months for the first year, every 6 months for the second year, and once a year later.

Figure 1



Male patient 8 years old; with aneurysmal bone cyst: A) preoperative x-ray with left aneurysmal bone cyst of proximal femur; B) CT scan of proximal femur; C) intraoperative photo showing fibular bone graft; D) postoperative x-ray with cortical break in the Spica; E&F) X-Ray after 15 months of operation with graft consolidation.

Figure 2



Female patient 11 years old; A) Plain x-ray showing aneurysmal bone cyst of proximal femur; B&C) Intraoperative photos with graft ; D&E) Intraoperative radiology showing graft insertion in good position; F) Plain x-ray of patient 13 months after grafting with bone graft consolidation.

Results

Follow-up period ranged from 24 to 42 months, with a mean follow-up of 30 months.

Time to weight bearing ranged from 3 to 6 months, with a mean of 4.5 months.

Clinically, seven out of eight patients had excellent results according to the musculoskeletal tumor society scoring system for limb salvage for the lower limb [10]. One case had postoperative pathological fracture after beginning weight bearing. Spica cast was done for a longer period of 2 months and finally achieved union with residual pain in the hip region.

Factors such as age, sex, and size of the cyst had no statistically significant effect on the final functional outcome. Fibular grafts were fully incorporated into the recipient site within 12–16 months, with a mean incorporation time of 13 months (Fig. 2). The graft donor site showed some minor problems such as leg discomfort and heel pain. Complications of the main operative site were encountered, such as pathological fracture in one case and limb-length discrepancy because of coxa vara deformity after healing of the cyst without an impact on the overall functional result. The pattern of cyst healing ranged from complete cyst consolidation, which means 100% radio-opacity of the cyst in 50% of patients within a mean time of 13 months. Some lesions remained incompletely consolidated with residual cavities until the last follow-up without affecting the functional outcome.

Discussion

The proximal femur is one of the common anatomical sites of benign bony lesions. In planning for the management of such lesions, three important points should be considered: first, to prevent deformity and pathological fracture; second, control the biological behavior of the disease to prevent local recurrence in the long term; and third, postmanagement protection of the proximal femur either externally by a spica cast or internally by osteosynthesis, which protects against pathological fracture [11,12]. An autologous cancellous bone graft easily incorporates, revascularizes, and has no immunogenicity. Bone graft substitutes such as bone cement and biocompatible materials provide an alternative for filling bone defects, but these materials do not provide structural support, with difficult incorporation, and thus they have not gained complete acceptance [5,13,14]. Autogenic nonvascularized cortical grafts provide good structural support at the recipient

site. The proximal femur especially in young patients has a rich blood supply that aids vascularization of the grafts [15].

Ozaki *et al*. [6] reported 17% recurrence rates with curettage and cement application. In the same study, the results were compared with cryotherapy, and lower complication rates were determined in the cement group. The advantages of this technique are that it is easy to perform and there is structural support of the cement in the cavity. However, it has limitations; in this technique, neurovascular structures and growth plate should protect from the heat effect.

Although good results were reported with Ethibloc injection, 30% local and systemic complications such as infection, fistule formation, and pulmonary thromboembolism were reported. Good results were reported between 82 and 96% with cryotheraphy. However, progression of fractures, local infection, fusion, or nerve damage with associated fractures and growth plate destruction are potential complications [5,13].

In the study of Haluk *et al*. [16], they performed cortical collapsing and massive fibular autografting developed for ABC centrally located in the proximal humeral metaphysis, leading to widespread destruction. These cases had important technical problems both for en-bloc resection, because lesions were too close to the physis, and curettage and grafting with widespread destructions.

In this study, fibular nonvascularized graft was augmented with cancellous bone graft in eight patients. Fibular grafts were fully incorporated into the recipient site within 12–16 months, with a mean incorporation time of 13 months. The graft donor site showed some minor problems such as leg discomfort and heel pain. Pathological fracture was found in one case and limb-length discrepancy because of coxa vara deformity after healing of the cyst without an impact on the overall functional result.

Conclusion

Curettage and an autogenous nonvascularized fibular graft is a good technique to treat benign cystic lesions of the proximal femur in relatively young patients. It is recommended to externally protect the limb with plaster of Paris. Hydrogen peroxide lavage was used to control local recurrence.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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