

# Treatment of Brodie's abscess: excellent results from curettage, bone grafting and antibiotics

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## ABSTRACT

**Introduction:** Brodie's abscess is not a common variant of subacute osteomyelitis; however, when it does occur, the presentation is atypical and usually late. This study aimed to describe the mode of presentation of Brodie's abscess and evaluate the results of surgical treatment in a resource-poor setting.

**Method:** Over a five-year period, we retrospectively reviewed 20 patients who presented to two tertiary health institutions in south western Nigeria with clinical and radiological features of Brodie's abscess.

**Results:** Brodie's abscess accounted for just 2 percent of all patients with osteomyelitis. Most patients were adults (mean age 21.5 +/- 7.8 years) and males (75 percent). In the series, the tibia was involved in 50 percent of the cases, the femur in 30 percent, and the radius and fibula each in 10 percent. The diaphyseal part of the long bones was affected in 65 percent of the patients and the metaphysis, in the remaining patients. The average size of the cavities was 3.0 +/- 0.8 cm. 65 percent of the isolates yielded *Staphylococcus aureus*. All patients were treated by curettage of the abscess cavities, cancellous bone grafting and antibiotics. All patients had satisfactory outcomes, with complete incorporation of the grafts and new bone formation in the cavities. No patient reported any recurrence.

**Conclusion:** Patients with Brodie's abscess respond well to surgical curettage of the abscess, cancellous bone grafting and antibiotic therapy.

**Keywords:** Brodie's abscess, developing countries, osteomyelitis, treatment

*Singapore Med J 2011;52(6):436-439*

## INTRODUCTION

Brodie first described a localised abscess of the tibia in an amputated limb that did not produce systemic signs and developed without prior febrile illness. Subsequently, the term 'Brodie's abscess' was applied to localised bone abscess that developed without prior systemic illness.<sup>(1)</sup> Due to its location in the bone, Brodie's abscess can mimic benign and malignant diseases. A recent study from a university hospital found that all 23 patients with a final diagnosis of subacute osteomyelitis were first referred to an orthopaedic oncology clinic.<sup>(2)</sup> Due to the diagnostic challenges of the condition, imaging modalities have been proposed to help confirm its diagnosis. This ranged from radiography of the affected area to magnetic resonance (MR) imaging. While osteomyelitis in its different forms may be rare in developed countries, it remains a relatively common problem in developing countries.<sup>(3)</sup>

Although the chronic variety of osteomyelitis is common, the subacute type (particularly Brodie's abscess) is rare, except in East Africa, where it is reportedly a common occurrence.<sup>(4)</sup> This may explain the paucity of reports on this variant. The disease has been described to follow an indolent course due to the interplay of host resistance combined with low virulence of the infecting organisms.<sup>(5)</sup> In his classification, Gledhill described four radiological types in the long bones,<sup>(6)</sup> and Roberts et al<sup>(7)</sup> expanded and modified the classification into six forms to include the spine, the lesion being classified as metaphyseal, diaphyseal, epiphyseal and vertebral. Their classification was based on anatomical location, morphology and similarity to various neoplasms. In this classification, Brodie's abscess was classified as type 1, where a localised radiolucent zone with sclerotic margin was seen on radiography.<sup>(7)</sup>

The treatment of Brodie's abscess varies. There are reports of successful treatment with antibiotics combined with immobilisation in children,<sup>(8)</sup> curettage with postoperative antibiotics,<sup>(9,10)</sup> and recently, the use of antibiotic-impregnated beads.<sup>(2)</sup> The curettage of abscess cavity with cancellous bone grafting has been reserved mainly for those with large cavity diameters > 3 cm.<sup>(10)</sup>

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**Table I. Patient characteristics and outcome.**

No.	Age	Gender	Duration (mths)	Site	Size (cm)	Side	Location	Symptoms	Culture
1	17	M	15	Tibia	4.0	R	Diaphyseal	Pain/swelling	<i>S. aureus</i>
2	35	M	9	Tibia	3.6	L	Metaphyseal	Pain/swelling	<i>S. aureus</i>
3	24	M	5	Tibia	2.0	L	Metaphyseal	Pain, heaviness in the bone, no fever	<i>S. aureus</i>
4	27	M	8	Tibia	3.0	R	Diaphyseal	Intermittent pain	No growth
5	20	M	4	Tibia	3.3	L	Diaphyseal	Pain/swelling	No growth
6	18	M	5	Tibia	2.6	R	Diaphyseal	Pain/swelling	<i>S. aureus</i>
7	23	F	4	Tibia	3.0	L	Metaphyseal	Pain/swelling, heaviness of heel	<i>S. aureus</i>
8	25	F	7	Tibia	2.9	L	Diaphyseal	Pain/swelling	MRSA
9	38	M	8	Tibia	2.7	R	Metaphyseal	Pain/swelling	<i>Klebsiella</i> spp.
10	18	F	5	Tibia	2.0	R	Diaphyseal	Pain/swelling	<i>S. aureus</i>
11	19	M	9	Tibia	3.2	L	Diaphyseal	Pain/swelling	<i>S. aureus</i>
12	15	M	4	Tibia	3.2	R	Diaphyseal	Pain/swelling	<i>S. aureus</i>
13	20	M	5	Femur	3.4	R	Metaphyseal	Pain/swelling	<i>S. aureus</i>
14	21	F	10	Femur	3.7	R	Metaphyseal	Boring pain	<i>S. aureus</i>
15	17	M	6	Femur	4.3	R	Metaphyseal	Pain	<i>S. aureus</i>
16	18	M	2	Femur	2.0	R	Diaphyseal	Pain/swelling	No growth
17	33	M	1.5	Femur	4.0	R	Metaphyseal	Pain/swelling	No growth
18	32	F	18	Femur	4.0	R	Metaphyseal	Pain/swelling	<i>P. aeruginosa</i>
19	14	M	7	Radius	2.0	L	Diaphyseal	Pain/swelling	<i>S. aureus</i>
20	16	M	6	Fibula	1.5	R	Diaphyseal	Pain/swelling	<i>S. aureus</i>

M: male; F: female; R: right; L: left; S.: *Staphylococcus*; MRSA: methicillin-resistant *Staphylococcus aureus*; P.: *Pseudomonas*

Laser Doppler flowmetry has been shown to accurately reflect bone perfusion, and is now used as an adjunct to surgery in recognising non-viable bone, thereby reducing the incidence of recurrence.<sup>(11)</sup> The duration of antibiotic treatment has also been a subject of controversy, but there seems to be a general consensus of 6–8 weeks. Due to the non-availability of more sophisticated means of diagnosis in our settings, most cases of Brodie's abscess are diagnosed based on clinical and plain radiological features alone. The common treatment of this condition in our environment is curettage of abscess cavity, cancellous bone grafting and antibiotics for six weeks. The purpose of this study was to evaluate the results of this modality of treatment.

## METHODS

From August 2002 to July 2006, all patients who had clinical and radiological features of Brodie's abscess from Federal Medical Centre, Owo and Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, which are two tertiary health institutions in south western Nigeria, were studied. The inclusion criteria were patients with a diagnosis of Brodie's abscess who had curettage and cancellous bone grafting and a follow-up period of more than two years. The exclusion

criteria were all patients with Brodie's abscess who were managed non-operatively or had incision and drainage with immobilisation, and whose follow-up period was less than two years.

A total of 1,037 patients with osteomyelitis were admitted in the two hospitals; 25 (2.4%) patients had Brodie's abscess, out of which 20 fulfilled the inclusion criteria. The surgical technique involved aggressive curettage with generous saline irrigation till fresh punctate bleeding was achieved from the floor of the abscess cavity. This was used to grossly identify viable bone. Cancellous bone was harvested from the anterior iliac crest using the technique previously described by Olasinde et al.<sup>(12)</sup> The amount of graft harvested was approximated to the volume of the residual cavity after curettage. The wound was closed in layers with primary skin closure without drainage and appropriate antibiotics prescribed postoperatively. The patient was subsequently advised on protected weight bearing with bilateral axillary crutches till resorption and creeping substitution of the graft occurred and new bone formation was evident on radiography. This was done to prevent pathological fracture in the area of the residual cavity.

The erythrocyte sedimentation rate (ESR) of all patients was measured preoperatively and at six weeks



**Fig. 1** Plain radiograph of the proximal tibia shows a typical type I Brodie's abscess with a localised radiolucent zone with sclerotic margin.



**Fig. 2** Postoperative plain radiograph of the same patient shows the lesion now healed.

post operation. Intraoperatively, samples of the abscesses were taken for histopathology as well as microscopy, culture and sensitivity testing. Postoperative antibiotics were prescribed accordingly. Serial radiograph was done in order to monitor the obliteration of the cavity. The patients' demographics, durations of symptoms before presentation, signs and symptoms, operative findings, duration of antibiotics, duration of follow-up and the bones involved were recorded. The outcome was rated as satisfactory if there was no recurrence at a minimum follow-up of two years and in cases of complete obliteration of abscess cavities with development of normal trabeculae bone pattern. The outcome was deemed unsatisfactory if there was recurrence and persistence of the abscess cavity. The results were expressed as mean and percentages.

## RESULTS

The details of clinical and histopathological findings are shown in Table I. The mean age of the patients was  $21.5 \pm 7.8$  (range 14.0–38.0) years. The male to female ratio was 3:1. The average duration of symptoms before presentation was  $7.3 \pm 4.2$  (range 6.0–72.0) weeks. All patients had symptoms of pain and localised swelling, but none had fever, localised tenderness or warmth. All radiographs showed localised radiolucent cavities within the bones with sclerosed margins. The mean size of the cavities was  $3.0 \pm 0.8$  (range 2.0–4.0) cm. The tibia (50%) was the most commonly affected bone, followed by the femur (30%), radius (10%) and fibula (10%). The diaphyseal part of the long bones was affected in 65% of the patients and the metaphysis, in the remaining patients. No patient had epiphyseal involvement. The right limb (65%) was the most commonly involved. The mean preoperative ESR was  $20 \pm 3.9$  mm/hr (Westergren Method) and  $36 \pm 31$  mm/hr in female and male patients, respectively. Postoperatively, the mean ESR was  $17.8 \pm 3.6$  mm/hr in female and  $15.8 \pm 6.6$  mm/hr in male patients. The intraoperative sample of the abscess yielded a growth of *Staphylococcus (S.) aureus* in 65%

of patients, *Klebsiella* spp. in 5%, methicillin-resistant *S. aureus* in 5%, *Pseudomonas aeruginosa* in 5% and no growth in 20% of patients. Histopathology showed inflammatory components with scattered lymphocytes, plasma cells and granulation tissue with no evidence of malignancy, which was reported as chronic nonspecific inflammation in all the patients. All patients in this study were prescribed parenteral antibiotics for two weeks and oral antibiotics for four weeks. Figs. 1 and 2 show the pre- and postoperative images of one of the patients. The average duration of follow-up was  $32.7 \pm 10.3$  (range 24–48) months. The outcome was rated satisfactory in all the patients.

## DISCUSSION

Brodie's abscess remains an uncommon variant of subacute osteomyelitis, and when it occurs, its symptoms linger before the patients seek medical attention. In East Africa, this form of osteomyelitis has been reported to be the most common.<sup>(4)</sup> This is contrary to our findings, in which Brodie's abscess represents only 2.4% of the total number of cases of osteomyelitis. The diaphyseal part of the bone was the most commonly affected, which contrasts with other reports, where metaphyseal involvement predominated.<sup>(4,5,7,8,13,14)</sup> This may be attributed to the greater number of adults than children in this study. Diaphyseal involvement has been reported to be more common in adults.<sup>(5,7,15)</sup> The tibia was the most frequently involved bone in the present study, which is similar to the findings of previous reports by Roberts et al<sup>(7)</sup> and Ross and Cole.<sup>(8)</sup> Trauma has been implicated as a predisposing factor to Brodie's abscess in some series;<sup>(16–18)</sup> this may account for why the tibia, which is subcutaneous in its anteromedial parts and consequently prone to trauma, is commonly involved.<sup>(16–18)</sup> Trauma and hypoxia, coupled with the hair loop arrangement of the vessels in the metaphyseal region, has been identified as a risk factor in the development of Brodie's abscess.<sup>(19)</sup>

In East Africa, where the subacute form of

osteomyelitis is very common, children frequently walk barefoot and foot infections are widespread, which causes a high resistance to *S. aureus* among its population. In our study, this organism, which grew in 60% of all samples, was the most common isolate from the intraoperative specimens taken from the abscesses. 80% of the cultures in this study yielded positive bacteria isolates. While this is similar to the 61% positive growth rate reported by Roberts et al,<sup>(7)</sup> it is much higher than the more commonly reported positive growth rate of < 30%.<sup>(20-22)</sup> We could identify no reasons for this relatively high positive yield, but the fact that the specimens were taken intraoperatively may be a factor.

Treatment of Brodie's abscess ranges from curettage, biopsy and culture, the use of impregnated antibiotic beads, cancellous bone grafting after curettage followed by immobilisation to antibiotic alone without surgery. It has previously been suggested that surgery should be reserved for aggressive lesions where ESR is > 40 mm/hr. It was also suggested that only patients whose abscess was > 3 cm should undergo surgery. In our environment, where most patients may not be able to afford more than one admission, coupled with the absence of adequate preoperative diagnostic investigations, all patients with Brodie's abscess underwent curettage of the abscess cavity, biopsy for histology and culture as well as cancellous bone grafting, with satisfactory results. This approach to treatment has been reported to yield satisfactory results in a similar African setting.<sup>(23)</sup> The main difference between our study and Kanoun et al's study was in the use of a cast in the latter; our patients were advised to practise protected weight-bearing but were not prescribed a cast.<sup>(23)</sup> Those with aggressive lesions were followed up more closely for up to a maximum period of four years without recurrence. Their ESR also returned to normal within six weeks post operation.

In conclusion, Brodie's abscess is an uncommon condition. The presence of radiolucent cavities with sclerotic margin in the diaphysis of long bones should elicit suspicion of the disease in adults. Our study showed that the observation of punctate bleeding from the floor of the residual cavity to denote viable bone can be used with satisfactory surgical results without recurrence. This would be useful in developing countries, where technologically advanced adjuncts to aid identification of non-viable bone tissue at surgery for Brodie's abscess may not always be available.

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