Routine pre-operative bone biopsy in non-union of long bones: analysis of 26 cases

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Citation

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Abstract

Background. Non-union of long bones is relatively rare, yet remains one of the most challenging complications to treat. The presence or absence of infection influences the adopted surgical strategy. Biological disturbances in aseptic non-union are also different from those encountered in cases of infected non-union. The purpose of this paper is to determine whether a pre-operative bone biopsy should be done in all cases of non-union of long bones.Methods. We reviewed the cases of 26 adults over a period of nineteen months. [It is departmental protocol to do a routine biopsy in all cases of non-union.] Patients were classified clinically into the following groups: Group I: aseptic or clean, Group II: suspicious of infection and Group III: clinically infected.Results. Positive cultures were found in groups I and II. Inflammatory markers did not differ significantly between the two groups. Group III could not be compared with the other groups because there was only one patient in this group.Conclusion. A pre-operative bone biopsy should be seriously considered in non-union of long bones.

INTRODUCTION

There are myriads of operative and non-operative treatment methods for fractures of long bones. The majority of long bones will unite when managed according to current orthopaedic practices. The rate of non-union varies greatly among studies[1] yet, over all, the rate of non-union is less than 1%.

Non-union is a formidable challenge to manage. Of course, the presence or absence of infection influences the treatment approach because the biological disturbances in aseptic cases are different from those where sepsis does occur.[2,3] A good mechanical environment can restore the disturbed biology, whereas in septic cases the disturbed biology is characterized by tissue necrosis and ischaemia.

The question whether a pre-operative bone biopsy should be done routinely in all cases of non-union of long bones, or not, is not clearly documented in the English literature on the subject. The purpose of this paper is to determine whether this should be the case.

MATERIALS AND METHODS

Setting: A secondary hospital affiliated with a tertiary institution.

Subjects: Twenty-six consecutive adult patients. The study was done over nineteen months (February 2007 - August 2008). The detailed information was extracted using a pro forma (see Table 1).

Figure 1

Table 1: Data for patients with non-union of long bones

1. Demographic data: Name, age and sex.
2. Index injury: Mechanism of injury, date and closed / open.
3. Initial management of index injury.
4. Subsequent management and complications.
5. Other injuries.
6. Radiological findings.
7. Pre-biopsy evaluation: Type of host and inflammatory markers.
8. Biopsy results.

Type of study: Retrospective. Approval by an ethics committee is not needed for retrospective studies. [Pre-operative biopsies are done per departmental protocol.]

Clinical classification: All patients were classified clinically according to Athanasou et al into the following categories: [4]

Group I = clean or aseptic

Group II = suspicious of infection

Group III = clinically infected

Prerequisites before the biopsy

Every patient must have been off antibiotic treatment for at least six weeks prior to the biopsy.

A full blood count, the Erythrocyte Sedimentation Rate (ESR) and C-reactive Protein (CRP) must be obtained just before the biopsy.

Technical considerations

Three tissue specimens must be taken from different areas of the fracture site.

Cultures must include anaerobes.

Measuring the outcome

For the result to be considered positive, cultures of at least two specimens must contain the same organism(s).

RESULTS

There were 21 males and 5 females in the test group. Their average age was 39 years (range: 20 - 65). Seven patients presented initially with closed fractures. The number of patients per group was as follows: Group I (n = 6), Group II (n = 19) and Group III (n = 1). Inflammatory markers were: CRP (average), Group I = 11.1 mg/l (range < 1 - 34.5), Group II = 14.1 mg/l (range <1 - 67.5) and Group III = 22 mg/l (one subject). ESR (average), Group I = 29.7 mm/hr (0-140), Group II = 27.0 (0-112) and Group III = 18 (only one subject). In some of the cases, some of the inflammatory markers were not recorded.

The positive culture results, recorded according to clinical groups, were as follows: Group I = 1, Group II = 2 and Group III = 0. The complete demographic data and results are recorded in Table 2.

Figure 2

Table 2: Culture results of patients with non-union

Open/Closed	Group	CRP (N. R. = 0-10mg/l)	ESR (N. R. = 0-31m m/hr)	Culture
Open	I	1.4	3	Negative
Closed	I	24.8	112	Negative
Open	I	13.6	15	Negative
Open	I	10.5	10	Negative
Open	I	5.9		Negative
Open	I	89	41	Negative
Closed	I	6.2	20	Negative
Open	I	3.5		Negative
Open	I	2.1	37	Negative
Open	I	3.6	79	Negative
Closed	I	3.1	12	Negative
Open	I	1.2	1	Negative
Open	I	4.4	1	Negative
Closed	I	13	140	Negative
Open	I	1.8		Negative
Open	I	67.5	46	Negative
Closed	I	9	6	Negative
Open	I			Negative
Open	I	2.9	20	Negative
Closed	I	<1	0	Negative
Open	I	<1	0	Negative
Closed	I	34.5	30	MRSA
Open	I	<1	23	Positive
Open	I	1.4	15	Positive
Open	I	1.6	2	Negative
Open	III	22	18	Negative

DISCUSSION

Our results suggest that a pre-operative biopsy should be seriously considered in cases of non-union. Positive cultures were found in groups I and II. These results changed our management strategies. The inflammatory markers did not differ significantly from one group to the other. Group III could not be directly compared to the other groups because there was only one patient in this group. Culture results could not be predicted on the basis of inflammatory markers. Patient 26 needs some special consideration because he presented to us with actively draining sinus from the tibia. Previous culture results from the abscess (done by another institution) cultured Methicillin-resistant Staphylococcus Aureus (MRSA). The patient showed us the results and sensitivity. Cultures obtained intra-operatively during bone and soft-tissue debridement cultured the same organism, rendering the sensitivity results exactly the same. This raises the possibility that there may be other explanations for our negative results, namely

The source of infection could be soft tissue.

The osteomyelitis could be patchy and therefore a “blind” bone biopsy could give false negative results.

Infection is a known cause of non-union and is of particular concern in patients with a history of open fractures or multiple surgical procedures.[5] Surgical intervention (open reduction and internal fixation) in septic non-union can lead to persistent infection in up to 66% of cases.[6] The role of a pre-operative biopsy is hardly discussed in detail in English

literature on the subject. DR Marsh et al did intra-operative biopsies in all 56 of their patients treated by open means.[7] This practice is also advocated by Bellabarba et al.[8] They gave no further details of their findings. KM Emara emphasized that infection should be excluded in all cases of non-union but gave no details of his results.[3]

The accuracy of a "blind" pre-operative bone biopsy can be significantly increased by pre-operative sequential scintigraphy using ^{99m}Tc-MDP (technetium – 99m methylene diphosphonate) / ^{111}Indium-white blood cells (^{111}In-WBC). This investigation is very useful in detecting osteitis at a fracture non-union site.[5] It can also distinguish between soft-tissue and bone infection. The other alternative is ^{111}In-WBC that has a 100% sensitivity, specificity and negative predictive value.[9] A Biopsy can then be done in an area of increased uptake. Magnetic resonance imaging (MRI) is also a very good modality that can distinguish between soft-tissue and bone infection.

The limitations of our study are its retrospective nature and the small number of patients reviewed. A larger and well-powered prospective study is required.

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