Audit

Analysis of the referral pattern to a supraregional bone and soft tissue tumour service

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Aim: To investigate the sources of delay in diagnosis and determine if there was a similar diagnostic error rate as found by the Musculoskeletal Tumour Society, which subsequently altered patients' management and affected outcome.

Patients and Methods: A prospective review of 100 consecutive patients referred to our institution analysed causes for delay in referral and whether prior investigations or procedures had complicated further management.

Results: Patients were symptomatic for 14.8 months (range, 0–26 months) prior to consultation with their GP. A further 13.5 months (range, 0.5–120 months) elapsed before referral by the local hospital (94) or GP (6) to the bone and soft tissue service. A significant delay in referral of more than a month occurred in 72 patients. Those patients with malignant disease were symptomatic for 7.6 months (range, 0.5–11 months) prior to seeking medical advice with a further 7.5 months (range, 0–13 months) elapsing prior to onward referral at their local hospital. From the study group, 63 patients were subjected to complex imaging studies (bone scan, CT, MRI) prior to referral; 34 biopsies or surgery were performed in 34 cases by referring teams, 16 of which complicated subsequent management.

Conclusions: If a high suspicion of a soft tissue or bone tumour is suspected from the history, examination and plain radiograph, then early referral to a specialist centre is recommended where relevant, high-quality investigations can be arranged in a short time leading to a planned biopsy, confirmation of diagnosis and definitive treatment at an earlier stage.

Key words: Bone tumour – Referral – Delay

A bone or soft tissue neoplasm is likely to present to an individual orthopaedic or general surgeon only once in a working life-time. A high degree of clinical suspicion is necessary for early diagnosis. A previous study by the Musculoskeletal Tumour Society presented by Mankin and colleagues in 1982 showed that 60% of referred patients to their centre had a major error in diagnosis and that 18% had sub-optimal treatment secondary to problems related

to the biopsy.¹ Improper biopsy technique often eliminates the opportunity for subsequent limb salvage.^{2–5} In 1992, the same group re-evaluated the same patient group with 25 surgeons from 21 institutions submitting 597 patients.⁶ The results were essentially the same as those presented in 1982 with a fifth of patients requiring more complex operations or adjunctive irradiation or chemotherapy due to errors in diagnosis and technique. The Society has re-iterated its

series of recommendations about the technical aspects of biopsy and that the procedure, whenever possible, should be carried out in the treatment centre.^{1,6}

Delays in referral, the requirement for repetition of imaging studies and a significant proportion of patients who had undergone previous biopsy and surgery appeared to complicate the management of patients seen at the London Bone and Soft Tissue Tumour Service and nationally.⁷ The aim of this study was to investigate the sources of delay in diagnosis and determine if there was a similar diagnostic error rate as found by the Musculo-skeletal Tumour Society, which subsequently altered patients' management and affected their outcome.

Patients and Methods

Data were collected prospectively on a proforma completed by the consultant in clinic regarding events prior to referral for 100 consecutive patients between October 1997 and December 1998. The patient's definitive diagnosis and treatment were subsequently recorded and 20 months following referral the patient's response to treatment was analysed.

There were 56 men and 44 women with an average age of 36.3 years referred by four main routes. The major source of patients came from 58 different orthopaedic teams referring 76 patients. There were 12 referrals by other specialities including general surgery and gynaecology. Finally, 6 patients were sent direct by local general practitioners (GPs) and there were 6 'in-house' referrals within the hospital.

Results

Patient delay in seeking medical advice

Overall patients noted symptoms for 14.8 months (range, 0–26 months) prior to seeing a doctor. The majority (63) had described a form of discomfort in the affected area, with a painless mass (28) forming the second commonest presenting symptom. Nine patients were discovered incidentally to have a bone or soft tissue lesion. The 47 patients who subsequently were diagnosed with malignant disease had symptoms for a shorter time (Fig. 1), but this still averaged 7.6 months (range, 0.5–11 months).

Local delay in seeking expert advice

Referral to the supraregional centre from the patient's GP or local hospital took an average of 13.5 months (range, 0–32 months). The process tended to be quicker for conditions perceived to be malignant (Fig. 2); however, this still took on average 7.5 months (range, 0–13 months).

Figure 1 Length of symptoms prior to seeing a local doctor for each tumour category.

Figure 2 The delay in onward referral to the Bone Tumour Unit for each tumour category.

Imaging prior to referral

Almost all patients (96) had a plain radiograph prior to being referred to our centre. Complex imaging studies were available for 63 patients (Fig. 3), but the majority (56) of these had to be repeated because they did not provide appropriate information for tumour staging or planning treatment. For example, scanning of the entire limb was almost never performed. Acquisition of these scans was often time consuming and contributed to the delay in the patient's onward referral. More than one complex imaging technique was ordered in 18 patients.

Diagnosis and surgical interventions

Prior to referral, the majority of referring teams were correct in their suspicion of which lesions were malignant or metastatic based on clinical assessment and imaging (Fig. 4) only. Malignant lesions (47) accounted for slightly more referrals than benign conditions (41). Osteoid osteomas form a large number of the benign lesions (Table 1) as a minimally invasive treatment service was provided

Figure 3 The different imaging modalities obtained prior to referral, the number repeated and the overall number required before definitive treatment.

Table 1 Final diagnoses in each tumour category

Benign	Osteoid osteoma	9
	Exostosis	5
	Fibrous dysplasia	4
	Infection	6
	Soft tissue benign	17
Malignant	Soft tissue sarcoma	23
	Osteosarcoma	14
	Chondrosarcoma	4
	Ewings	3
	Malignant fibrous histiocytoma	3
Metastatic	Breast	7
	Renal	2
	Melanoma	2
	Carcinoid	1

at the supraregional centre. Soft tissue sarcomas (23) accounted for a relatively high proportion of malignant tumours and it was in this group that the highest number of surgical procedures (16) had been undertaken.

The commonest sites involved (Table 2) were around the knee and excision of the lesion only (Table 3). Two stress fractures were treated by stabilisation with internal fixation and one patient with radiation necrosis following treatment for a dermatological condition required prosthetic replacement for restoration of function. Thirty patients with malignant disease had surgery. Biological reconstruction (8) or prosthetic replacement (11) was achieved for most cases with skeletal involvement. Although primary amputation had to be undertaken in two cases, one followed a pathological fracture through the deposit. Stabilisation was required for 5 cases with metastatic disease.

Nine patients were referred following recurrence after inadequate initial excision of a soft tissue lesion and in seven cases seeding of tumour cells was risked by poorly positioned

Figure 4 The proportion of patients in each tumour category on suspected diagnosis prior to referral with definitive diagnosis.

Table 2 Distribution of the different categories of tumour throughout the body

Site	Benign	Malignant	Metastatic
Foot	3		
Ankle/calf	3	5	
Knee	12	13	
Hip	8	17	6
Back			4
Chest	3	2	
Shoulder	8	9	2
Elbow	1		
Forearm	3	1	

Table 3 Surgical treatments used for different categories of tumour

Benign	Observe	14
	Excision	24
	Stabilisation	2
	Prosthesis	1
Malignant	Excision with:	
	Adjuvant	15
	Reconstruction	8
	Prosthesis	11
	Amputation	2
Metastasis	No further surgery	11
	Radiotherapy	7
	Stabilisation	5

needle (5) and open biopsies (2) that contaminated intra-articular compartments.

Discussion

Curettage, resection and amputation formed the traditional method of managing skeletal neoplasms. The advent of advanced imaging techniques has improved our under-

standing of the biological behaviour of sarcomas and effective adjuvant therapy has led to wide-spread acceptance of limb-sparing techniques.¹⁻⁵ The potential for curative surgery associated with lower morbidity is more likely with early presentation and there is good evidence that prognosis is related to tumour size.^{8,9} Ideally, a rapid referral to a specialist centre is required following history, examination and a plain radiograph in order to prevent unnecessary delays to treatment which may alter outcome. Delay in diagnosis may allow the tumour size to increase – a factor associated with poor outcome.^{8,9} Our patients with malignant disease were symptomatic for 7.6 months (range, 0.5–11 months) prior to seeking treatment locally with practically the same period of time, 7.5 months (range, 0–13 months), elapsing prior to onward referral to the tumour unit.

If the clinical examination and plain radiographs suggest an aggressive or malignant tumour, staging studies should be performed prior to biopsy. Any surgical manipulation of the lesion will influence interpretation of the radiographic studies. Bone scan, computerised tomography (CT) and magnetic resonance imaging (MRI) are usually required to delineate local tumour extent and systemic involvement.¹⁰ The protocols used in tumour staging with these imaging modalities differ from those required in other musculoskeletal disorders. In particular, imaging the whole limb segment by MRI often detects strikingly apparent skip metastases on sagittal imaging.¹¹ Complex imaging studies were organised for 63 patients at their local hospital, but had to be repeated in 56 patients in order to achieve more accurate staging.

The Musculoskeletal Tumour Society^{1,6} has adopted the policy that biopsies should be performed by the surgeon who will ultimately perform the tumour resection. It is crucial that the location of the biopsy be in line with the anticipated incision for the definitive procedure. The biopsy tract should not contaminate surrounding tissue planes or compromise flaps. Mistakes are particularly common around the knee where the biopsy tract often strays into the suprapatellar bursa contaminating the joint. A biopsy is an intralesional procedure which breeches the tumour pseudocapsule – this risks seeding tumour deposits along the biopsy tract. Seven (15%) patients out of 47 with malignant disease had poorly executed biopsies, a very similar number to that found by Mankin and colleagues on two occasions, 10 years apart. Problems with the biopsy lead to a different or more complex operation or adjunctive irradiation or chemotherapy. This may affect patient outcome in terms of disability, loss of function, local recurrence or death.^{1,6} Needle or core biopsy of sarcomas often provides an adequate specimen for diagnosis, reduces patient morbidity and the risk of contamination. This technique has been shown to be as accurate and more cost-

effective than open biopsies.¹²

Proper techniques for open biopsies are necessary to minimise contamination. Transverse incisions, seen in one patient in our series, are to be avoided at all costs. If a soft tissue component is present, there is no need to biopsy the underlying bone.¹³ Regardless of the technique used, tumour cells will contaminate all tissue planes and compartments traversed. Nine (39%) of 23 patients with soft tissue sarcomas underwent inadequate excision biopsies at their local hospital. All had residual tumour necessitating further surgery through scarred tissue planes. Previous studies, including that by Noria and co-workers, have shown residual disease in unplanned excisions of soft tissue sarcomas.¹⁴

Metastatic bone tumour is the most common destructive lesion of the skeleton in a patient over the age of 40 years.¹⁵ The majority of these present in a patient with multiple deposits at the end stage of a patient's lifespan and are managed appropriately in most orthopaedic units throughout the country. Solitary deposits for some metastatic tumours, such as renal cell carcinoma, may be managed as a primary lesion of bone if resection of the primary tumour can be achieved.^{15,16}

Conclusions

This study highlights the problems that still exist in recognising sarcomas prior to embarking on surgery. Tumours superficial to fascia that are more than 5 cm in diameter and any lesion deep to fascia should be considered a sarcoma until proven otherwise.^{3,6} Solitary bone lesions seen on plain radiographs where a biopsy is being considered^{3,6} should be discussed with a specialist unit to ensure that the appropriate management plan is implemented.

Recommendations

After a plain radiograph, we recommend that patients are referred by telephone or E-mail to the sarcoma co-ordinator early on clinical grounds. Further imaging studies can then be obtained expeditiously using protocols designed for the diagnosis and management of bone and soft tissue tumours. Tissue diagnosis can then be acquired via an approach designed not to complicate further surgical management.

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