

# Amputation in the context of tumour or infection

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Initially fraught with complications including death from sepsis or haemorrhage, amputation has evolved from a procedure performed as rapidly as possible, to a definitive carefully planned and executed treatment option<sup>1</sup>. Despite advances in surgical and medical care, in the context of tumour or periprosthetic joint infection, amputation rates remain high. This review aims to discuss some of the considerations and philosophy behind the decision-making process, providing a guide to the management of such cases.

## Periprosthetic joint infection

Periprosthetic joint infections (PJIs) are a devastating consequence of arthroplasty, associated with significant morbidity and mortality. Infection is present in over 25% of revision cases; a figure that will increase with an ageing population with greater rates of diabetes, obesity and other comorbidities<sup>2</sup>. Access to joint arthroplasty continues to rise and it is predicted that the annual rate of PJI in the US could be between 38-270,000 by 2030<sup>3,4</sup>. Sadly amputation will remain an endpoint for some patients.

We advocate the concept introduced by McPherson *et al.* which considers local factors as well as the general medical status of the

patient<sup>5</sup>. Medically unwell patients are more likely to die or require an amputation, whilst healthier patients may undergo attempts at eradicating the infection. There is a strong correlation between poor, compromised

local tissues and the need for plastic surgical intervention with a flap and/or soft tissue transfer or recommendation of a primary amputation. In the context of life-threatening sepsis, an amputation may be the only option<sup>6</sup>. A more likely scenario however is the multiply revised,

chronically infected patient where further revision procedures are not indicated. In our experience the indication for an amputation includes massive bone loss, extensive soft tissue involvement, persistent and resistant infection despite attempts at control as well as patient factors. Multiply drug resistant >>

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and fungal species are particularly difficult to eradicate and long-term suppressive antibiotics (and their side effects) may not be suitable or acceptable to the patient. Previous studies have indicated an increased prevalence of above knee amputation (AKA) following an infected total knee replacement (TKR) in certain patient populations. These include male sex, black race, lower socioeconomic class, aged over 80 or younger than 50 and increasing numbers of comorbidities<sup>7</sup>. The associations were based on case series yet given the poor functional outcomes associated with AKA, it is essential to risk stratify patients before considering surgery so that they can be appropriately counselled regarding their risks<sup>7</sup>. This is particularly important given the higher energy expenditure necessary to mobilise following an AKA. In one series of 25 AKA patients (19 for failed PJI management), only 30% were walking regularly and 52% were wheelchair dependent<sup>8</sup>. If an amputation is considered the MDT approach allows the physical and psychological needs of the patient to be met and managed appropriately.

### Tumour and amputation

Primary bone and soft tissue tumours are rare and require specialist care. In the UK they are primarily managed in five specialist sarcoma units, with adjunctive treatments



Figure 2: 37 year old Male, Ewing's sarcoma of the distal fibula. Coronal (a) and sagittal (b) MRI scans highlight the extensive involvement, and AP radiograph (c) of the below knee amputation required to achieve a wide margin for the tumour resection.

(chemotherapy and radiotherapy) delivered at a local level. Primary malignant bone tumours comprise 0.2% of all cancers diagnosed in England annually, hence a GP may only see one such patient in their whole career<sup>9</sup>. Improved survival and less radical surgery are related to timely investigations and management yet delays in diagnosis are sadly still common<sup>10</sup>. Despite their rarity, 5% of childhood cancers in Europe are primary malignant bone tumours<sup>11</sup>. In adults primary malignancies are vastly outnumbered by metastatic disease and haemopoietic malignancies. Despite oncological

and surgical advances five-year survival rates for patients with primary bone sarcomas remain static around 53-55%<sup>9</sup>.

In comparison soft tissue sarcomas are more common, occurring at any age although most commonly in middle-older age groups. They comprise 7-10% of all childhood cancers and are an important cause of death in the 14-29 year old age group<sup>9,12,13</sup>. Of those with an intermediate or high grade tumour approximately 50% will develop metastatic disease and require systemic treatment<sup>14</sup>. Survival rates are similar to those of primary bone tumours (55% at five years)<sup>15</sup>.

If a primary bone or soft tissue malignancy is suspected, prompt referral to a specialist centre is advised. Surgery is the standard treatment for all patients with primary bone and soft tissue malignancies and should be performed by a surgeon with the appropriate training and experience in sarcoma management. The multidisciplinary team (MDT) will decide if the lesion is resectable taking into account factors which include tumour stage and grade, anatomical location, neurovascular involvement and co-morbidities. The principle aim is to excise the tumour with a margin of normal tissue outside the reactive zone. The size of this margin is debated but 1cm soft tissue envelope is commonly accepted. A functional limb is a secondary goal and may not always be possible due to anatomical constraints, poor response to treatment or the degree of resection necessary. In such cases, amputation may be a more appropriate procedure, (Figures 1 & 2).

In patients with a poor response to chemotherapy (>90% histological necrosis following chemotherapy represents a good treatment response) and 'close' bony margins there is currently insufficient evidence to support improved outcomes with amputation, as opposed to primary limb salvage with the possible increased rate of local recurrence<sup>9</sup>.

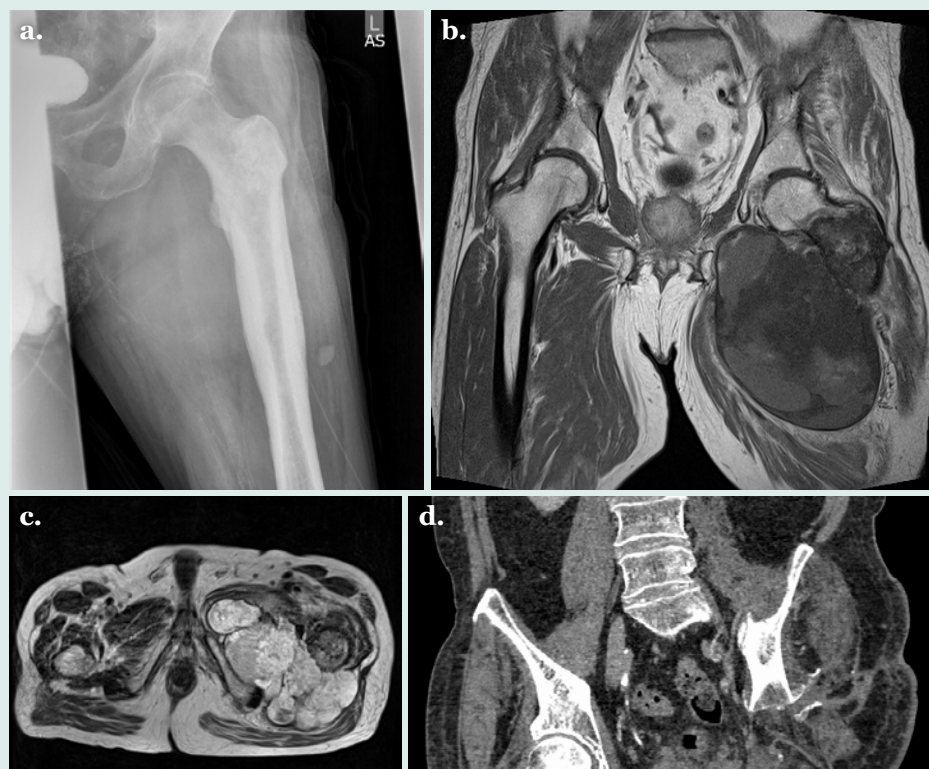


Figure 1: 74 year old male, dedifferentiated chondrosarcoma of proximal femur. AP radiograph (a), coronal (b) and sagittal (c) MRI scans highlight the large soft tissue mass and bone involvement, and the postop film (d) following a hindquarter amputation for tumour clearance.

With recurrence, all patients should be staged carefully since metastatic disease is common. Attempts should be made to regain local control through surgery and adjunctive treatment but for some this may mean an amputation based upon what function remains following repeated surgery, their performance status and of course their wishes, (Figure 3).

A more common scenario is metastatic disease from another tumour (estimated lifetime risk of being diagnosed with cancer is 1 in 2)<sup>16</sup>. Those presenting with impending or pathological fractures are not uncommon and decisions regarding treatment are often dependent on whether systemic therapy is an option. Important considerations include whether the disease is curable or not, the life expectancy of the patient and their degree of symptoms. Surgery is undertaken to improve quality of life, and an amputation in some circumstances is recommended as a palliative procedure if reconstructive options are not appropriate, or there is fungating disease.

Difficult decisions arise in the presence of a primary bone tumour with a pathological fracture. Due to the contamination of the surrounding soft tissues (as a result of the fracture) a primary amputation may be the recommended option in the absence of metastatic disease, particularly in high grade tumours that are not responsive to adjuvant treatment such as a chondrosarcoma.

### The multidisciplinary team approach

This is a vital part of the decision-making process in amputation, enabling an informed decision for both clinicians and patients. Each institution may not have access to all necessary resources, thus we would recommend referral to a regional MDT to help with management decisions.

With PJI or malignancy, with significant co-morbidities, amputation rather than revision or limb salvage may be recommended to minimise the risk to the patient. Similarly, due to the condition of the soft tissues, an amputation may be favoured. To our knowledge no study has evaluated MDT interventions in a randomised manner, however there is a wealth of literature in the infection setting supporting their role, with excellent results reflected in fewer operations, reduced length of stay and reduced antibiotic requirement<sup>17-20</sup>.

Early involvement of the rehabilitation team is essential when considering an amputation, and their care should be sought as early as possible. Psychological concerns for amputees include loss of confidence, the

distress of metastatic disease, fear of the unknown and loss of independence<sup>21</sup>. This can contribute to a risk of suicide in the post-operative period<sup>21</sup>.

### Philosophy of the amputation

When planning an amputation for infection or tumour there are a number of factors to consider

including the ideal stump length to enable prosthetic fitting, the ability to achieve a wide local excision and a satisfactory wound closure and weight bearing stump.

The concept of a wide local excision is common with malignant or aggressive benign tumours, with the aim to reduce local recurrence. The same thought process should apply with PJI's, with the amputation performed without entering the pseudocapsule of the joint or encountering pockets of infection. In some locations, such as a below knee amputation for an infection ankle prosthesis, this is readily achievable. With an infected stemmed knee replacement, the level of the bone transection should be above the implant or cement mantle to achieve clearance of infection. With an infected hip or proximal femoral replacement this is more challenging. Leaving an intact pelvic ring facilitates sitting, however in some instances a higher amputation may be required if the soft tissues are poor or the aggressiveness of the organism dictates this.

### Conclusion

Amputation is a safe and reliable treatment option for patients with malignancies or failed treatment of PJI's. The perioperative risks are low and adequate margins can be achieved. Support and management by the MDT are vital and the patient counselled throughout the process regarding their options. Important considerations include the primary goal of treatment, associated co-morbidities and the patient's wishes. ■

### References

References can be found online at [www.boa.ac.uk/publications/JTO](http://www.boa.ac.uk/publications/JTO).



Figure 3: Plain radiograph (a) and coronal MRI (b) showing metastatic angiosarcoma around the cemented femoral stem of a tumour prosthesis. A hip disarticulation was required.