Arterial embolization in the management of connective tissue tumours

Oisin JF Keenan[1] • Buchir Arumilli[2] • Finn Farquharson[3] • Nicholas Chalmers[3] • Ashok Paul[2]

[1]School of Medicine, University of Manchester, Manchester, M13 9PT, UK; [2]Department of Orthopaedics, Manchester Royal Infirmary, Central Manchester University Hospitals NHS Foundation Trust, Manchester, M13 9WL, UK; [3]Department of Radiology, Manchester Royal Infirmary, Central Manchester University Hospitals NHS Foundation Trust, Manchester, M13 9WL UK

Correspondence to: Ashok Paul. Email: ashok.paul@cmft.nhs.uk

DECLARATIONS

Competing interests

None declared

Funding

Publication costs were funded by the Department of Orthopaedics, Manchester Royal Infirmary, Manchester, UK. No other funding was obtained for this study

Ethical approval

Written informed consent for publication was obtained from the patient

Guarantor

AP

Contributorship

AP and OK had the idea for the paper. All authors assisted in data collection and analysis. OK wrote the paper. All authors helped

Arterial embolization may be used effectively for connective tissue tumours: to reduce bleeding during surgical excision, or for palliative treatment.

Case one

A 59-year-old woman (see Table 1) presented with a very large mass in the right gluteal region which had grown rapidly over the past five months. The mass was painful and overlying skin was tightly stretched with areas of bruising; see Table 1 for imaging and histological details. The tumour was considered surgically inoperable owing to size, risk of bleeding and likelihood of recurrence.

The patient therefore underwent selective arterial catheterization and embolization (SACE) via a left femoral approach. Pre-embolization angiography revealed the mass was supplied by branches of the posterior division of the internal iliac and lateral circumflex femoral (LCF) arteries. The superior gluteal artery and its branches were embolized using polyvinyl alcohol (PVA) particles until a pruned tree appearance was obtained; two metallic coils were also deployed. Ascending branches of the LCF artery were then catheterized and embolized using PVA particles and metallic coils. Owing to multiple feeding vessels, embolization of all vessels at a single procedure was considered impossible. However, successful palliation of symptoms was achieved, and the patient died later of disease progression.

Case two

A 31-year-old man with multiple skeletal metastases from phaeochromocytoma presented with painful pathological fractures of the right humerus and tibia. Radiographic findings are given in Figure 1.

The patient underwent pre-operative SACE (via a left femoral approach) in order to reduce the risk of bleeding at surgery. Pre-embolization angiography revealed highly vascular tumours. Embolization of the humeral tumour was carried out using coils, PVA particles and Gelfoam, leading to immediate reduction in vascular filling of around 30% (Figure 2A,B). Similarly, embolization of the tibial tumour by Embozene spheres and coils immediately reduced vascular filling by around 60%.

SACE enabled subsequent uncomplicated open reduction and internal fixation (ORIF) of the humeral fracture (Figure 3), followed by radical excision of the tibial tumour together with bone grafts and ORIF (Figure 4). The patient subsequently underwent radiotherapy to both tumours. Hence, SACE facilitated surgery with reduced risk of peri- or post-operative haemorrhage, and SACE itself was uncomplicated. The patient remains alive with good local tumour control at follow up of 10 months.

Case three

A 61-year-old man presented with a painful hypervascular metastatic renal tumour in the left

revise the paper and approved the final version

Provenance

This article was submitted by the authors and peer reviewed by James Skipworth

Table 1.
Summary of clinical details for patients undergoing selective arterial catheterization and embolization.

Case	*Sex*	*Age*	*Tumour*	*Indication for embolization*	*Angiographic outcome*	*Functional outcome*	*Complications*
1	Female	59	High-grade sarcoma of right gluteus ($25 \times 20 \times 18$ cm) with six pulmonary metastases	Palliation	Multiple feeding vessels	Reduced tumour size	None
2	Male	31	Metastatic phaeochromocytoma of right distal humerus and right proximal tibia	Facilitation of surgery	Significantly reduced tumour vascularity	Uncomplicated surgery	None
3	Male	61	Metastatic renal tumour of left distal femur	Facilitation of surgery	Angiographic stasis	Uncomplicated surgery	None

Figure 1. Radiograph showing metastatic tumour of the right distal humerus with an undisplaced pathological fracture through the large lytic area, and further lytic areas both proximal and distal to the lesion. In addition, a metastatic tumour was present at the right proximal tibia, with a pathological tibial plateau fracture of the right knee.

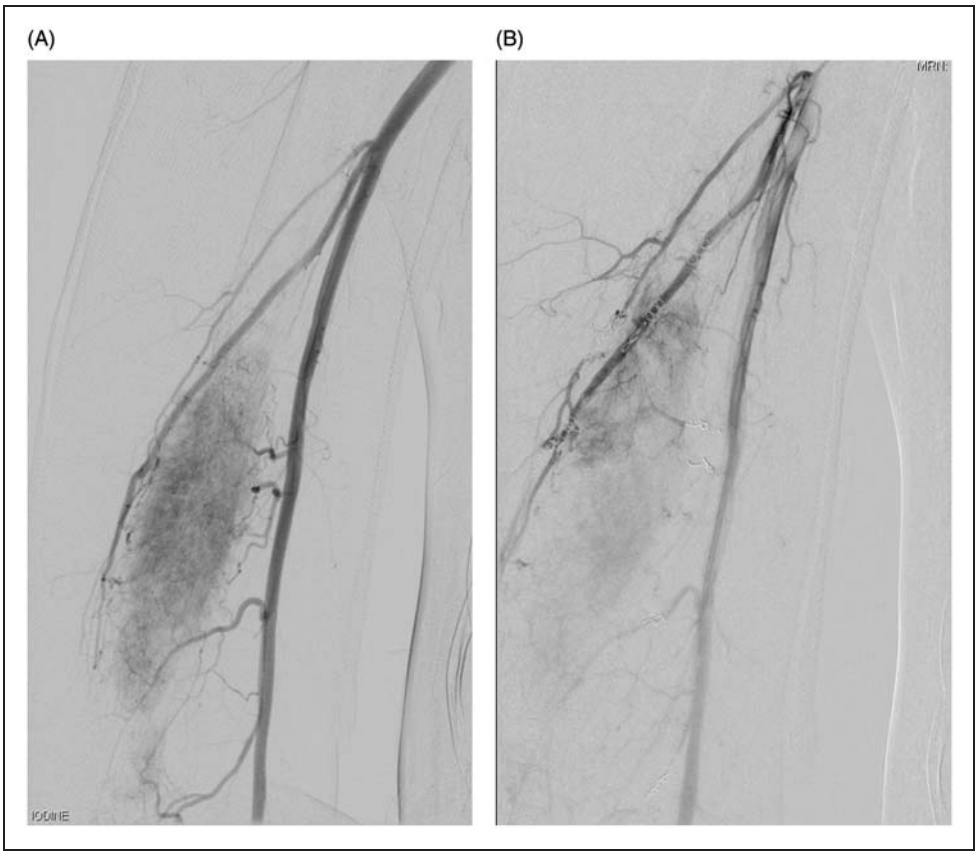

Figure 2. Hypervascular metastatic tumour of the right distal humerus with pathological fracture. (A) Angiographic image immediately before embolization. (B) Angiographic image following embolization with coils, PVA particles and Gelfoam, with immediate reduction in vascular filling.

femur, with extensive bony erosion and risk of imminent fracture. SACE was performed, using PVA particles to branches of the superficial and deep femoral arteries, to reduce the risk of bleeding during surgery. This produced immediate angiographic stasis, and enabled uncomplicated intramedullary nail insertion. The patient recovered well from surgery with normal use of the left lower limb, but died 18 months later of disease progression.

Discussion

Arterial embolization has been reported in oncological practice for several purposes: to decrease tumour size before excisional surgery, to permit surgery by reducing peri-operative haemorrhage, to manage acute haemorrhage, and for palliative care and tumour reduction.[1,2] However, experience with arterial embolization in the management of tumours is still early,[1] and few reports exist in the literature for its use in the management of connective tissue tumours.[1,3–5]

For sarcomas, as for other connective tissue tumours, substantial improvements have been made in reducing mortality and morbidity; this has been achieved through a multi-disciplinary approach combining treatment modalities and ensuring local control and effective chemotherapy.[6,7] Local tumour control refers to the 'physical elimination of all malignant clones and/or tumour stem cells' within the primary tumour and identified metastases.[3] For sarcomas in particular, the preferred method of achieving local control involves early surgery.[8] However, various factors may mean that surgery is not feasible, including the presence of multiple disease sites or the morbidity associated with the operation.[3]

Figure 3. Radiograph following open reduction and internal fixation of the right humeral fracture.

Figure 4. Radiograph following radical excision of the right tibial tumour, bone graft insertion with open reduction and internal fixation.

Arterial embolization is an important adjunctive treatment to facilitate surgery in certain situations. As demonstrated in this case series, pre-operative embolization may reduce the risk and severity of peri-operative and post-operative haemorrhage and therefore may reduce the threshold of safe surgical intervention. In patients where surgery is completely precluded, embolization may still provide useful clinical improvement and palliation, particularly for tumour reduction and cessation of bleeding or discharge.

In this case series, immediate angiographic stasis was achieved by one procedure in one case, using PVA particles administered to branches of the gluteal or femoral arteries. In another case, tumour vascularity was significantly reduced by embolization using a combination of PVA particles, gelatine microspheres, Gelfoam and metallic coils. Angiographic success was associated with functional improvements in these two patients. In the final case, the presence of multiple feeding vessels meant that embolization of all vessels was not possible with a single procedure. There were no complications of embolization or surgery.

Conclusion

Arterial embolization may be used effectively in the management of both primary and metastatic tumours involving connective tissue. It has a definite role in palliative tumour reduction where surgery is inappropriate, and should also be considered before surgical excision to reduce the risk of severe bleeding in vascularized tumours (e.g. renal metastases, phaeochromocytomas and certain sarcomas).

References

1. Krauel L, Albert A, Mora J, *et al*. Use of angioembolization as an effective technique for the management of pediatric solid tumors. *J Pediatr Surg* 2009;44:1848–955
2. Hansen ME, Kadir S. Elective and emergency embolotherapy in children and adolescents. Efficacy and safety. *Radiologe* 1990;30:331–6

3. Anderson PM, Pearson M. Novel therapeutic approaches in pediatric and young adult sarcomas. *Curr Oncol Rep* 2006;8:310–5
4. Balke M, Streitbuerger A, Budny T, *et al*. Treatment and outcome of giant cell tumors of the pelvis. *Acta Orthop* 2009;80:590–6
5. Puma F, Cardini CL, Passalacqua G, Ragusa M. Preoperative embolization in surgical management of giant thoracic sarcomas. *Eur J Cardiothorac Surg* 2008;33:127–9
6. Federman N, Bernthal N, Eilber FC, Tap WD. The multidisciplinary management of osteosarcoma. *Curr Treat Options Oncol* 2009;10:82–93
7. Sugarbaker P. Management of abdominopelvic sarcoma [Chapter 7]. In: *Musculoskeletal Cancer Surgery Treatment of Sarcomas and Allied Diseases*. Dordrecht, The Netherlands: Kluwer Academic Publishers, 2001
8. Anderson P. Osteosarcoma relapse: expect the worst, but hope for the best. *Pediatr Blood Cancer* 2005;47: 231