

## Value of Selective Arterial Embolization of Lower Thoracic and Lumbosacral-Pelvic Tumours in Children, Adolescents and Young Adults

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**Received:** August 14, 2023; **Published:** August 18, 2023

Tumours originating from the lower thoracic, lumbosacral spine and pelvis are hard to manage due primarily to the multiplicities of their arterial supply. Moreover, lesions in the sacrum and pelvic cavity are not easily accessible and their feeding arteries and accompanying nerve fibres are tightly bunched. Surgical excision of tumour in such a tight space may lead to inevitable intra operative blood loss.

One avenue of preventing excessive blood loss is the use of preoperative selective arterial embolisation PAEm. It is a semi-invasive intravascular technique that centres on manoeuvring the tip a radio-opaque catheter into the origin of an artery through a femoral artery puncture. The fact it has been routinely used over the past forty years speaks of its reliability. And in keeping with current development of hi-tech interventional radiology equipment, finer angiography catheters and sophisticated heparin-coated guide wires, PAEm is regarded a safe procedure in the hands of an experienced intravascular interventionist.

Significantly, should a child at ten years of age or less is undergoing an invasive procedure, being performed under general anaesthesia is a necessity. One known factor among children is their small volume of circulating blood compared to adults. Therefore, intra-operative blood loss in young children must be kept to a minimum. They are also prone to hypothermia that may contribute to hypotensive episodes. Arterial catheterisation using a femoral artery approach can lead to arterial spasm, manifested by loss of distal femoral arterial pulse. On the rare occasions where the use of corticosteroids are necessary the child may develop transient arterial hypertension on waking. These should pose little danger with constant neuro-vascular monitoring by the paediatric anaesthetist, the key member of a multiple-disciplinary team.

An important part of an interventional radiologist's education is a sound knowledge of the vascular anatomy of the spinal cord. Basically, it provides a vascular road map for the surgeons using the traditional catheter-based arteriogram or the currently favoured Computed Tomography (CT) or the MRI (Magnetic Resonance Imaging) contrast enhanced angiograms. For the surgeon or intravascular interventionist having to deal with disc prolapse, epidural nerve root injection or preoperative embolisation of tumours of the thoracic-lumbar spine, knowledge of arterial supply to spinal cord is imperative.

Significantly, it relates to the Artery of Adamkiewicz (AAkz) that arises from the abdominal aorta on the left (80%) and anastomosing with the anterior spinal artery of the spinal cord. AAkz passes through an intervertebral foramen at about T8/T9 on the left and ascends to the 6<sup>th</sup> thoracic level before taking an acute hair-pin bend and runs caudally, ending at the conus medullaris. At surgery, temporary ligation

of its major side branch supplying the anterior spinal cord may result in the fearsome spinal cord ischemia syndrome. It is characterised by sudden back pain, shock and partial loss of strength and sensation in the lower limbs. An equally malign complication is rectal ampulla dysfunction accompanied by urinary incontinence.

One of the most challenging procedures is PREm of sacrococcygeal chordomas in children. There is a general lack of experience since this sacral malignancy is singularly rare compared to its counterpart sited at the skull base. Thus, over a period of a dozen years the Toronto Hospital for Sick Children reported ten cases of chordoma originating at the skull base and cervical spine but none from the sacrococcygeal regions.

Sacral chordomas are famously indolent, its growth and spread are silent to the extent that the child might not recognise common symptoms of back pain and neuralgia of the lower extremities. As the tumour spreads down the pelvic cavity, there is erosion of the sacrum and tumour encasements and adhesions of the median sacral artery and its side branches. Its corresponding sensory and motor sacral nerve roots are similarly involved. Postero-laterally, the lesion can invade the pelvic floor muscles such as the piriformis, while the sacroiliac joint may be involved. It is nigh impossible to radically remove this tumour; and poses difficulties at selective preoperative embolisation with potentials of destroying the neighbouring collateral arteries that supply normal tissues.

When it comes to dealing with the benign Aneurysmal Bone Cyst (ABC), the task seems easier unless it originates from the posterior lumbar spine where the feeding arteries are branches the distal abdominal aorta. It is a scenario for super selective embolisation of the feeders along both sides of the diseased vertebra consisting of instilling fine particles (150 to 400  $\mu\text{m}$ ) of PVA (Polyvinyl Alcohol) and Gelfoam to deprive the tumour's blood supply. Embolic materials are placed via a microcatheter coaxially sited through a conventional angiographic catheter. Additionally, a flow control method using a natural preferential flow of embolic particles into the tumour's feeders is usually successful.

An ABC situated within the sacro-pelvic region is uncommon even among children. Although its gross/imaging features of multiple fluid-filled cysts of differing sizes with occasional haemorrhagic foci and eggshell like cystic walls are strongly suggestive, one cannot be certain such gross findings are not that of a malignant telangiectatic osteosarcoma (TOS). Characteristic septal enhancement on post contrast MRI is noted in both lesions. Septations within an ABC reflects the presence of columns of functioning osteoid tissues whereas the almost identical septations within a TOS are histologically lines of active tumour tissues in a sarcoma. Their management differs in that complete surgical excision and postsurgical radiation therapy after histopathological confirmation can be curative. Similarly, for the truly benign ABC a course of (4 to 5) injections of fine embolic particles via PAEm shall lead to reossification of its contents and gradual thickening of its bony walls.

In conclusion, the use of PAEm therapeutically or to reduce intraoperative blood loss is virtually indispensable: albeit done under the "dreaded" general anaesthesia. Yet, clinical practices do differ. A famed Paediatric Centre in the North American east coast has virtually dispensed with PAEm prior to surgery. It speaks highly of the experience and resilience of their multi-disciplinary team.

**Volume 12 Issue 9 September 2023**

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