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Opinion

Preoperative Embolisation of Skull Base Meningiomas in Children: "To be or Not to be"

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Abbreviations

GTR: Gross Total Resection; MR: Magnetic Resonance; MMA: Middle Meningeal Artery; Pre-Op Emboli: Preoperative Embolisation; SB: Skull Base

Over the past two decades numerous papers on the utility of preoperative embolisation (pre-op emboli) of intracranial meningiomas have appeared in the literature. Its objective is devascularisation of those highly vascular portions of a tumour, aiming for minimal blood loss at subsequent surgery. Few describe in any detail its value on children afflicted with a dreaded tumour sited at the skull base (SB). In childhood, SB meningiomas are less common than their supratentorial counterparts but share a propensity towards a high-grade histology, especially at recurrence following surgery. Uncommon morphological features such as irregular outline, a narrowed base and brain invasion are inauspicious signs correlating positively with post-surgical recurrence. Notwithstanding, gross total resection (GTR) remains the ideal form of treatment; with a view for a complete cure.

It is common knowledge a SB location creates difficulties in achieving GTR without possible injury to major cranial nerves and crucial neighbouring vessels. In general, the tumour's arterial supply enters from its ventral aspect-- masking the surgeon's line of sight. Pre-op emboli of these feeders are difficult and with possibilities of vascular damage in the course of seeking the appropriate arterial pedicle to embolise. The problem is accentuated among young children whose tumours are small but vascular. In this age group limitation in blood volume indicates an inability to cope with excessive blood loss. Hypothermia sets in during prolonged procedures under general anaesthesia. Under such circumstances a subtotal resection is preferred to GTR; excision of residual tumour can be done on a more suitable occasion.

The dynamics of impeding arterial supply to an anterior SB meningioma by embolisation of distal branches of the internal maxillary artery can be complicated by reflux of embolic agents into the anastomotic branches of the ipsilateral ophthalmic artery-a risky approach with little finesse. This is replaced by a "fail-safe" extracranial surgical ligation of the posterior ethmoidal artery. In the context of an existing anterior SB tumour, this artery enlarges and anastomoses with the middle meningeal artery (MMA) to vascularise lesions originating from the planum sphenoidale and medial sphenoid ridge. Fine intracranial branches that can be embolised safely are those arising from the ascending pharyngeal artery and posterior branch of the MMA. These are feeders to the mid and lower SB, clivus and petroclival regions.

Constant debates on the safety of an invasive procedure such as pre-op emboli of cranial meningiomas seem superfluous. Complications are inevitable. Major series have revealed a post procedural transient stroke rate of 6 - 9%, a permanent neurological deficit of up to 2% and a mortality rate of 0.12% - risks that are generally acceptable. In the past, decisions for patients to undergo the procedure were made by the attending surgeons on a "case-by-case" basis. Presently, technical expertise acquired by the interventionists, coupled with improvement in equipment design has enhanced the utility and safety of the procedure. Furthermore, the "case by case" concept is superseded by decision of a multi-disciplinary team consisting of neurosurgeons, neuro-radiologists, interventionists and neuro-anaesthetists. The use of "low dose", well-collimated fluoroscopy has reduced radiation exposure to a minimum: in particular for a child less than two years of age in whom exposure to the brain is increased through inadequate ossification of the skull bones. Nevertheless, the greatest threat to the child's life is intratumoral haemorrhage from difficulties in cannulating the tumour's arterial feeders. Problems also stem from judging the correct amount of embolysate on injection - not an easy task by visual inspection. One avenue is application of an intra-arterial Magnetic Resonance (MR) perfusion imaging technique that acts as a biomarker to relay information on the extent of ischemia during injection of the embolysate - a form of estimation in real time.

Why haven't paediatric teaching centres published their experience on pre-op emboli on cranial meningiomas? It is conceivable the surgeons' skills these days are such that complete or partial excisions are constantly attainable with acceptable post-surgical morbidity and practically without mortality. A Beijing paper (2018) supports this argument. Of the 44 SB meningioma operated on, only 23% suffered recurrence over a mean period of 4 years, with overall survival rate of 89.7%. None received pre-op emboli: could this technique be dispensed with in paediatric practice? Yet, a series from a Zurich paediatric centre (2016) highlighted the importance of "preop" embolisation for meningiomas in both superior and inferior compartments with scant complications - followed by successful surgery. Ultimately the choice rests with the experience and attitude of different groups of neuroscientists.

The reality is that "pre-op embolisation of SB meningioma" has for decades been documented in the health providers' manual. Rare as this lesion is in childhood, a request might arrive for the interventionist to show his or her skills. Comes the hour for courage, wit and calm determination. Long ago, my mentor in gynaecology instructed me to "strip bravely if you have to" in dissecting adhesions on a tubo-ovarian cyst from normal pelvic structures. It took much time, but I succeeded - it's a mindset I have shared with colleagues throughout my career.

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