Spinal meningioma: the prognostic value of Magnetic resonance imaging in surgical outcome

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Objective

- To identify whether the geometrics of MRIs have any prognostic value in patients who have undergone surgical resection of a spinal meningioma

Introduction

- Spinal meningiomas account for 25-46% of all intradural spinal tumours with the highest incidence seen in the thoracic region of middle-aged women[1].
- Spinal meningiomas are slow growing and cause substantial compression of the spinal cord.
- They result in symptoms including pain, altered sensation, weakness and loss of bowel and bladder control.
- Surgical resection is the standard treatment and is now associated with a good postoperative outcome attributable to improvements in neuroimaging and surgical techniques.
- Previous research has identified predictive factors of outcome in patients with spinal meningiomas including length of symptoms prior to resection, severity of symptoms, tumour position in relation to the cord and tumour calcification[2, 3].

Scans

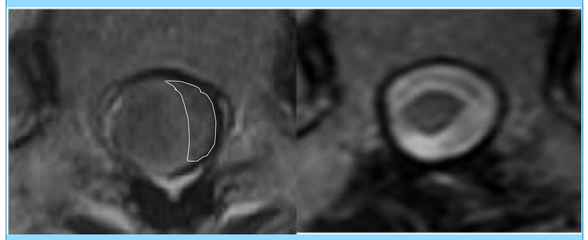

Figure 1. shows the preoperative (left) and postoperative (right) scans of the same patient. The preoperative scan shows the compressed spinal cord (highlighted). The postoperative demonstrates the expansion that is achieved from surgical decompression.

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Method

- We performed a retrospective study of 46 patients who underwent surgical resection of spinal meningioma between August 2005 and December 2012
- 31 patients had the appropriate preoperative scans and underwent preoperative analysis
- The 31 consisted of 4 male and 27 female patients with a mean age of 64 (range, 35 to 89).
- Scans were transferred from the 'Picture Archiving and Communications System' (PACS) to Photoshop CS3 for analysis.
- The measurements were performed using the 'magnetic lasso' and 'magic wand' .
- Once the desired area wass selected Photoshop produces a histogram from which pixel count and percentages can be read.
- The measurements we took were;

Area of cord as a percentage of estimated original

$$\left\{\frac{Area\ of\ cord\ at\ maximum\ compression}{(Area\ of\ cord\ above + Area\ of\ cord\ below)/2}\right\} \times 100$$

Tumour Occupancy

$$\left(\frac{Area\ of\ tumour\ at\ maximum\ compression}{Area\ of\ canal\ at\ maximum\ compression}\right) \times 100$$

Cord occupancy

$$\left(\frac{Area\ of\ cord\ at\ maximum\ compression}{Area\ of\ canal\ at\ maximum\ cord\ compression}\right) \times 100$$

- We then compared these results with the functional status of the patients before and after surgery using the Nurick Scale. We used the patients' notes for details of their function.

Grade	Description
1	Normal walk, possible clinical spinal irritation
2	Slight difficulty in walking with normal domestic and working life
3	Functional disability limiting normal work and domestic activities
4	Significant weakness making walking impossible without help
5	Bedridden or wheelchair bound

Table 1. Nurick Scale

Results

Preoperative

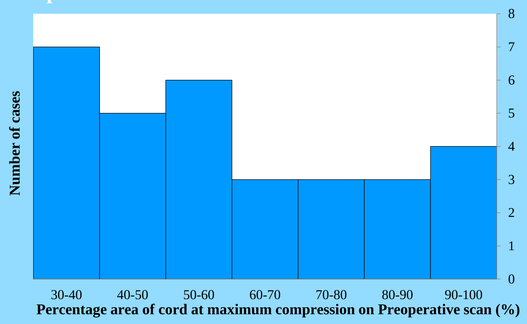

Figure 2. Cord compression was witnessed in all patients and the average cord cross-sectional area was 60.67% (ranging from 33.48-98.78%) of the estimated original value. When we compared all three preoperative measurements with outcome we found no significant correlation

Postoperative

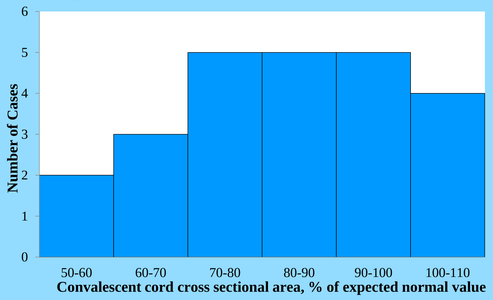

Figure 3. The average cord area was measured at the same level as the preoperative maximum compression, thus, demonstrating any cord wastage that remained. The areas ranged from 56.35-109.13% with an average cord area of 84.23%.

Table 2. The main presenting symptoms were motor deficits seen in 87.5% of patients and sensory changes seen in all patients. 89% of patients who had pre and postoperative assessment had improvements in their functional status. In 3 patients postoperative Nurick score worsened but no identifiable cause could be found.

*This number is lower because some patients had yet to have post-operative scans.

Grade	Preoperative scores	Postoperative scores
1	5	17
2	10	5
3	6	1
4	8	4
5	2	1
Total	31	28*

Table 2. Pre and postoperative Nurick score

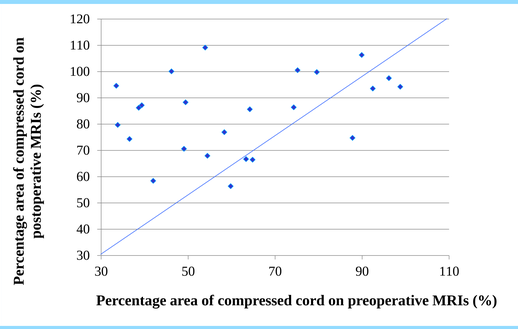

Figure 4. When we plotted preoperative spinal cord area at maximum compression against the same level post operatively we found that the spinal cord expanded back to an average area of 84.23% regardless of its preoperative compression.

In Fig 4. we see that the majority of the data falls above the blue line. This demonstrates that the extent of expansion, as shown by cord cross-sectional area, is not associated with degree of compression prior to surgery. Therefore the theory of cord wastage may be wrong or may not apply to this condition.

Conclusion

- We found that measurements on MRI scans have no obvious relationship with function before or after surgery.
- The patient therefore presents when neurological symptoms appear and not when a level of compression is reached.
- We found that degree of compression on the preoperative MRI cannot be used to assess functional recovery as the postoperative expansion of the cord does not seem to be jeopardized by this

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References

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