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Case reports

Intraspinal oxidised cellulose (Surgicel®) causing delayed paraplegia after thoracotomy – a report of three cases

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Oxidised regenerated cellulose (Surgicel®) is a commonly used haemostatic agent in neurosurgery, thoracic surgery, and orthopaedics. We present three cases of paraplegia after thoracic surgery during which oxidised cellulose had been used during thoracotomy for haemorrhage control, and was later found to have passed through the intervertebral foramen causing spinal cord compression. In all intraspinal and perispinal procedures, the over-liberal use of Surgicel® should be avoided, and attempts made to remove all excess Surgicel® once adequate haemostasis is obtained.

Key words: Spinal cord compression – Oxidised cellulose – Surgicel® – Spinal haematoma – Thoracic surgery complication – Haemostasis

Case 1

A 15-month-old boy was referred to the neurosurgical unit with a 2-day history of progressive paraparesis following cardiac surgery. He had had a right modified Blalock Taussig shunt using 5 mm Gortex between the subclavian and 'true' pulmonary arteries and ligation of 2 large collateral arteries for congenital pulmonary artery stenosis and a ventriculoseptal defect.

Postoperatively, he initially moved his legs normally. By day 2, he had developed a flaccid paraparesis with urinary retention. Myelography and CT showed a complete block at T5/T6 by an extradural mass (Fig. 1).

A T4–T6 laminectomy was performed and a large mass of necrotic fat, blood, and Surgicel® was removed from the extradural space. A good decompression was obtained. Further enquiry concerning his original surgery revealed that intra-operative haemostasis had been difficult and part of the posterior thoracotomy wound had been packed with Surgicel®.

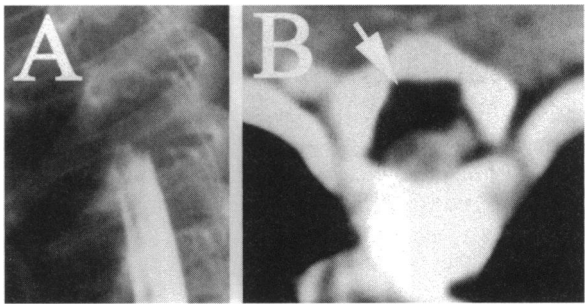

Figure 1 CT myelogram of Surgicel® compression (case 1) (A) Myelography shows a complete extradural block to contrast flow. (B) The axial CT indicates the significant size of the intraspinal mass (arrow).

Seven years later, he is able to walk short distances and stand with callipers. He self-catheterises, but has full control of bowel function.

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Case 2

A 37-year-old woman presented with a 12 h history of progressive paraparesis after thoracic surgery. The surgery consisted of a thoracotomy and partial lower lobectomy for metastatic sarcoma. A thoracic epidural catheter had been inserted for pain relief to the T5/T6 level and subcutaneous heparin had been started for thrombo-embolic prophylaxis. Four years earlier, local surgery and radiotherapy had controlled a thigh sarcoma until bilateral lung metastases had presented at routine follow-up. The first metastasis had been resected uneventfully 3 months previously.

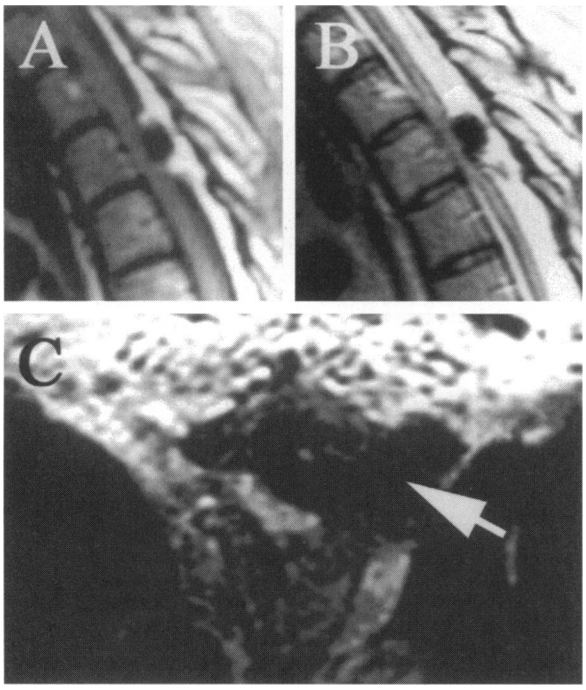

Figure 2 MRI of Surgicel® compression (case 2). (A) T1- and (B) T2-weighted MR images show a hypo-intense intraspinal extradural mass. (C) The axial T1-weighted MR image shown indicates the mass of Surgicel® not only within the canal but also extending along the foramen (arrow).

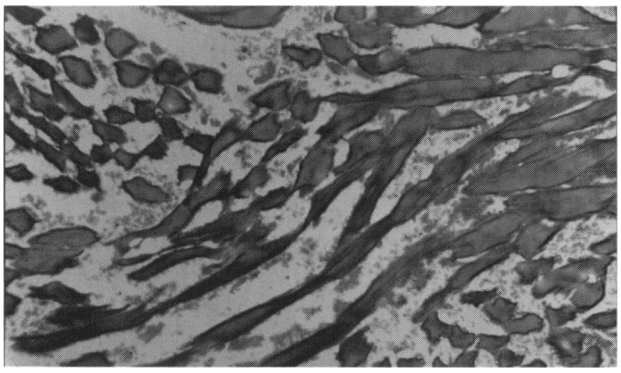

Figure 3 Histology of intraspinal mass. In case 2, swollen fibres predominate with few red cells, suggesting the majority of compression is due to Surgicel®, and not a swollen haematoma.

Postoperatively, she described numbness in both legs. Over the next 8 h she became progressively paraparetic. She was referred for neurosurgical assessment. The subcutaneous heparin was stopped and the epidural catheter removed. On examination, she had a flaccid paraparesis (MRC grade l–2/5) with a sensory level at T6, sacral sparing, and preserved bladder function. Magnetic resonance imaging (MRI) revealed an extradural compressive localised mass at T5 extending out with the intervertebral foramen (Fig. 2). As she improved neurologically, a conservative approach was taken. The presumed diagnosis was a spinal extradural haematoma, a possible consequence of the epidural analgesia. The patient was treated with dexamethasone.

One day after admission, the patient deteriorated and became paraplegic. An urgent laminectomy was performed and a large mass of Surgicel® and blood clot was found at the T4/T5 level which was removed from the extradural space (Fig. 3). A good decompression was obtained.

Further enquiry regarding the thoracotomy revealed a problem with bleeding requiring packing at the T4/T5 intervertebral foramen with Surgicel®. Some improvement in limb function ensued, but unfortunately the patient suffered a fatal pulmonary embolus 6 days later. Postmortem examination revealed the intervertebral foramen through which the Surgicel® had passed (Fig. 4).

Case 3

A 50-year-old male presented with a 12 h history of right leg monoplegia 3 days after thoracic surgery. A crush injury had produced right 1st, 5th and 6th rib fractures, a clavicular fracture and a haemothorax, which required operative haemorrhage control. A bleeding azygous vein was found and controlled. Surgicel® was required at the apex of the rib separation to aid haemostasis. An epidural catheter was inserted for pain relief.

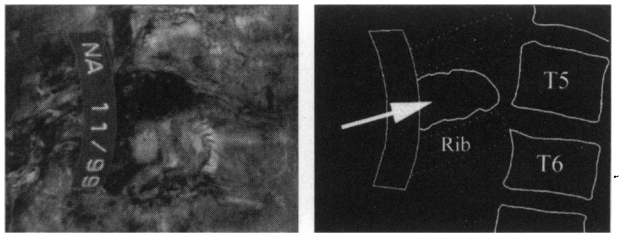

Figure 4 Posterior thoracic wall defect (case 2). A postmortem photograph and explanatory line drawing identifies the point at the apex of the thoracotomy where the defect was found (arrow). The spinal canal and cord are only millimetres away. There is also no evidence that the foramen is enlarged from direct malignant infiltration and destruction.

Three days post-thoracotomy, the patient complained of progressive weakness and numbness in his right leg. There was no bladder disturbance. On examination, he had a right limb flaccid monoplegia with loss of deep tendon reflexes, an up-going planter response and crossed temperature loss. MRI showed an extradural compressive lesion at the level of the epidural catheter. An urgent hemilaminectomy found a mass of Surgicel® in the lateral recess pressing the cord to the left. This was removed and the cord decompressed. Two months postoperatively, he walks with a stick.

Discussion

Oxidised regenerated cellulose is a commonly used haemostatic agent. Once saturated with blood, it swells into a gelatinous mass which aids in the formation of a clot. As such, Surgicel® can cause local compression and data sheet recommendations suggest removal following haemostasis.

Post-thoracotomy paraplegia is a rare and devastating complication. Causes include cord infarction, spinal epidural haematoma, and local effects due to any associated malignant disease process. There have been 8 previously published cases of post-thoracotomy paraplegia due to the compressive effects of intraspinal Surgicel®.[1–5] In all cases, difficult bleeding was encountered on the posterior thoracic wall and diathermy was unable to secure haemostasis. Surgicel® was used, left *in situ*, and later found within the spinal canal at exploration. On postmortem examination of our second case, there was evidence of diathermy use in and around the intervertebral foramen possibly facilitating passage of foreign material.

The spinal canal is only a few millimetres from the intrathoracic opening of the intervertebral foramen.[6] Previous reports suggested the Surgicel® migrated into the spinal canal through the foramen due to relative pressure differences.[3,5] The usual site of troublesome bleeding requiring Surgicel® application is the posterior end of the rib adjacent to the gaping thoracostomy. Closure of the thoracostomy with rib approximation could produce a compressive force on the Surgicel® forcing it into the adjacent foramen. The established negative pressure of the intravertebral subdural space could potentially enhance this pressure gradient and aid medial Surgicel® herniation.

Conversely, postmortem examination of patient two suggests minimal pressure would be required whilst placing the Surgicel® to advance a portion into the spinal canal through the intervertebral foramen.

Deterioration has been reported to occur up to 50 h after surgery. This delay has also been noted in a patient developing Surgicel®-induced paraplegia following disc surgery.[7] This suggests that the Surgicel® may continue to swell some time after application.

In case 2, 24 h after thoracotomy, MRI revealed a localised area of hypo-intensity on T1- and T2-weighted images with evidence of communication through the intervertebral foramen. The T2 characteristics agree best with previous descriptions of Surgicel®.[8] This contrasts with epidural haematomas, which are described as hyperintense on T2-weighted images in the acute phase and later develop into a similar intensity to CSF.[9] The T2-weighted image is the most useful for differentiating haematoma and Surgicel®.

Although spinal epidural haematomas can be treated conservatively with good clinical results,[10,11] the progressive swelling associated with Surgicel® mandates urgent decompression if cord function is to be preserved.

Awareness of the possible threat to the immediately adjacent spinal canal should merit in the more judicious use of Surgicel® in the pleural cavity and in all intraspinal and perispinal procedures. Where possible, an attempt should be made to remove all Surgicel® after haemostasis has been achieved.

References

1. Iwabuchi S, Koike K, Okabe T, Tago S, Murakami T. Iatrogenic paraplegia caused by Surgicel used for hemostasis during a thoracotomy: report of a case. *Surg Today* 1997; **27**: 969–70.
2. Lovstad RZ, Steen PA, Forsman M. Paraplegia after thoracotomy – not caused by the epidural catheter. *Acta Anaesthesiol Scand* 1999; **43**: 230–2.
3. Short HD. Paraplegia associated with the use of oxidized cellulose in posterolateral thoracotomy incisions. *Ann Thorac Surg* 1990; **50**: 288–90.
4. Sugar O. Oxidized cellulose hemostat (Surgicel). *Surg Neurol* 1984; **21**: 521.
5. Wada E, Yonenobu K, Ebara S, Kuwahara O, Ono K. Epidural migration of hemostatic agents as a cause of postthoracotomy paraplegia. Report of two cases. *J Neurosurg* 1993; **78**: 658–60.
6. Walker WE. Paraplegia associated with thoracotomy. *Ann Thorac Surg* 1990; **50**: 178.
7. Banerjee T, Goldschmidt K. 'Surgiceloma' manifested as cauda equina syndrome. *South Med J* 1998; **91**: 481–3.
8. Oto A, Remer EM, O'Malley CM, Tkach JA, Gill IS. MR characteristics of oxidized cellulose (Surgicel). *Am J Roentgenol* 1999; **172**: 1481–4.
9. Lovblad KO, Baumgartner RW, Zambaz BD, Remonda L, Ozdoba C, Schroth G. Nontraumatic spinal epidural hematomas. MR features. *Acta Radiol* 1997; **38**: 8–13.
10. Kumar R, Gerber C. Resolution of extensive spinal epidural haematoma with conservative treatment. *J Neurol Neurosurg Psychiatry* 1998; **65**: 949–50.
11. Pahapill PA, Lownie SP. Conservative treatment of acute spontaneous spinal epidural hematoma. *Can J Neurol Sci* 1998; **25**: 159–63.