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Use of topically applied rt-PA in the evacuation of extensive acute spinal subdural haematoma

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Abstract Spontaneous spinal subdural haematoma is a rare cause of spinal cord compression, usually confined to a few vertebral levels. When the haematoma extends over several spinal segments, surgical decompression is a major undertaking. Recombinant tissue plasminogen activator (rt-PA) has previously been used in a number of surgical procedures, but not in the setting of acute spinal subdural haematoma. A minimally invasive technique of decompression, using topical rt-PA, is presented in two patients with extensive spinal intradural haematoma. Two patients receiving long-term anticoagulation therapy presented with acute-onset back pain progressing to paraparesis. Magnetic resonance imaging of the spine demonstrated spinal subdural haematomas extending over 15 vertebral levels in one patient and 12 in the other. An angiography catheter was introduced into the subdural space through a limited laminectomy. Thrombolysis

and evacuation of haematoma was then achieved by intermittent irrigation of the subdural space with rt-PA, followed by saline lavage. Postoperative imaging demonstrated satisfactory decompression in both patients. There was significant improvement of neurological function in one patient. Topical application of rt-PA for spinal subdural haematoma allows evacuation of the haematoma through a limited surgical exposure. Decompression of the subdural space by this minimally invasive technique may be advantageous over extensive surgery by minimising surgical exposure, reducing postoperative pain and risk of neuronal injury. This technique may be useful in patients presenting with compression extending over several vertebral levels or poor surgical candidates.

Keywords Spontaneous spinal subdural haematoma · Anticoagulant therapy · Topical rt-PA

Introduction

Spinal subdural haematoma is a rare cause of spinal cord compression. A review of the literature by Russell and Benoit [8], noted that 58 cases had been reported. In most cases the haemorrhage had been attributed to anticoagulant therapy [10], coagulopathy [3], lumbar puncture [3], epidural anaesthesia [6], spinal tumour, arteriovenous malformations [8] and secondary to trauma, although cases of

spontaneous subdural haematoma [1, 9] have also been reported. In the majority of cases, the presentation is acute with sudden-onset back pain sometimes associated with radicular pain. These symptoms progress over a variable course to sensori-motor neurological deficit, usually paraplegia, with sphincter disturbance. The importance of early diagnosis and prompt surgical decompression is well recognised, with better outcome seen in patients with incomplete neurological deficits at the time of surgery and in those in whom the rate of progression is slow [10].

Conventional surgical treatment consists of multiple laminectomies over the entire extent of the haematoma and direct evacuation of haematoma through a midline durotomy. In patients with compression extending over many levels, this represents a major undertaking with associated morbidity related to large areas of soft tissue and bony dissection. The use of fibrinolytic agents in the evacuation of compressive subdural haematoma has not been previously described. We describe a novel approach to the challenging problem of extensive acute spinal subdural haematoma, using a minimally invasive technique of evacuating the haematoma with topical recombinant tissue plasminogen activator (rt-PA) through a limited laminectomy.

Case reports

Case 1

A 66-year-old woman on anticoagulant prophylaxis (warfarin) for a prosthetic aortic valve presented with a 10-day history of acute low back pain with 3 days of progressive paraparesis, urinary incontinence and paraesthesia in the left leg. The INR (international normalised ratio) on admission was 5.5. On examination she had severe bilateral leg weakness (MRC grade 2). There was loss of sensation below L1. Magnetic resonance imaging (MRI) scans of the spine demonstrated a subdural haematoma extending from T3 to the sacrum, causing significant compression maximal at T9, T10

and T11 (Fig. 1). Evacuation of haematoma using intradural rt-PA was performed through a T9/T10 laminectomy.

Case 2

A 71-year-old woman on warfarin prophylaxis for atrial fibrillation presented with a 5-day history of acute-onset low back pain followed by progressive paraparesis and numbness in the legs. The INR on admission was 4.0. On examination, she was found to have a flaccid paralysis of the legs with loss of sensation to pinprick and fine touch below L2. An MRI scan of the entire spine showed a compressive subdural haematoma extending from T6 to the sacrum. Evacuation of haematoma using intradural rt-PA was performed through a T9 laminectomy.

Common features

In both cases, following laminectomy and dural incision, a firm organised subdural haematoma adherent to the spinal cord was seen. A fine angiographic catheter (5.0 French, nonbraided, straight, polyethylene) was introduced into the subdural space and passed both cranially and caudally along the haematoma. Five-millilitre boluses of rt-PA solution (1 mg/ml) were gently instilled through the catheter. Each bolus was left for 5 min, followed by lavage with normal saline to wash out the thrombolysed clot fragments. On average, this process was repeated eight to ten times until the effluent was clear of clots.

In both patients, postoperative MRI scans demonstrated a good evacuation of the subdural haematoma, with satisfactory spinal cord decompression (Fig. 2). The patient in case 1 developed a

Fig. 1 Sagittal T1-weighted magnetic resonance (MR) image of the dorsolumbar spine, showing areas of high signal in subdural space

Fig. 2 Sagittal T1-weighted MR image of the dorsolumbar spine following surgery and treatment with recombinant tissue plasminogen activator (rt-PA) in the same patient as Fig. 1, showing dissolution of the haematoma with a collection in the thecal sac

postoperative wound haematoma, which required evacuation. The haematoma manifested itself as local wound pain and swelling. Three weeks following surgery she was mobilising independently with the aid of a Zimmer frame. Five months later, the lower limb power had improved to normal on the right, and grade 4+/5 on the left. She was able to walk with a walking stick and had regained normal voluntary bladder control. The same patient also suffered haematemesis, which responded to a proton pump inhibitor. The patient in case 2 had failed to regain any motor or sensory function below T10 when reviewed at 10 months.

Discussion

Subdural haematoma in the spine is a rare entity. Early diagnosis and prompt treatment is associated with the best neurological outcome. In the majority of cases, the haematoma is restricted to within five levels. Multiple-level laminectomies with direct exposure and evacuation of the haematoma is the conventional treatment in these cases. However, some authors have opted for a conservative approach for management of these lesions [2, 5, 7].

In cases of acute subdural haematoma extending beyond five to six vertebral levels, an extensive surgical exposure and bony decompression not only represents a major operative undertaking but also may increase morbidity, risk of spinal instability and postoperative pain. A lengthy dural exposure may increase the risk of cerebrospinal fluid leak and the direct evacuation of coagulated adherent clot may also increase the risk of iatrogenic injury to the spinal cord. These considerations may result in a reluctance to proceed with major surgery, particularly in patients who are in a poor general medical condition.

Interval laminectomy has been described for the treatment of extensive haematoma, but adequate decompression of a solid clot through this approach may prove to be difficult. Decompression through interval laminectomies is, nonetheless, an alternative option in these patients. However, a solid clot that is adherent to the spinal cord is unlikely to be completely evacuated from areas between spaced laminectomies, and in patients with very extensive clots this procedure represents a considerable operative undertaking.

Laminoplasty is another option for evacuation of spinal subdural haematomas. However, this requires a lengthy dural exposure and carries a risk similar to multiple-level

laminectomies, except perhaps with regard to spinal instability [4].

Recombinant tissue-type plasminogen activator (rt-PA) is a fibrinolytic agent that acts by peripheral conversion of endogenous plasminogen to plasmin, thus promoting fibrin degradation and thrombus dissolution. The principle clinical applications of thrombolytic therapy include the treatment of sagittal sinus thrombosis, hyphaema, fibrous loculating pleural adhesions, intraventricular haemorrhage, spontaneous intracerebral haemorrhage and intravascular thrombi. The patient in case 1 suffered two haemorrhagic complications, i.e. wound haematoma and gastrointestinal haemorrhage. Whilst the wound haematoma could be attributed to the topical use of rt-PA, it is unlikely that the gastrointestinal haemorrhage was a related event, as thrombolytic agents have been previously applied topically within the central nervous system without systemic complications. This report illustrates that the topical use of thrombolytic therapy in patients with extensive spinal haemorrhage results in significant improvement in radiological appearances as well as improvement in neurological function in one case.

Conclusion

The technique of intermittent subtotal lavage of rt-PA described in this report is an effective method of evacuating extensive spinal subdural haematoma through a limited surgical exposure. This method represents a useful alternative to the conventional treatment of extensive surgical exposure and multiple laminectomies with associated morbidity. Moreover, this technique may be considered in patients who might otherwise be treated conservatively due to the very extensive nature of their lesions and their poor general health. Further work is required on a larger number of patients to assess the long-term benefits of this technique as compared with conventional surgical treatments. The rare nature of this condition is likely to prevent any individual centre from developing extensive experience, and further co-operation and case reporting will be necessary to further develop the treatment of choice in patients with extensive spinal subdural haematomas.

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