CASE REPORT

Endovascular Thrombectomy and Thrombolysis for Cerebral Venous Sinus Thrombosis Unresponsive to Heparin

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ABSTRACT
Cerebral venous sinus thrombosis is a rare, but potentially life-threatening, disease accounting for less than 1% of stroke. Most patients with dural sinus thrombosis improve after treatment with heparin, but a subgroup of patients has a poor prognosis with continued deterioration. Those patients may benefit from endovascular thrombolysis. We report on a young woman with dural sinus thrombosis, who was taking an oral contraceptive, and had continued deterioration despite heparin therapy. Subsequently, she was treated with endovascular thrombectomy and thrombolysis, and showed significant clinical improvement and radiological resolution in follow-up imaging. The literature on the efficacy and safety of thrombolysis in dural sinus thrombosis is reviewed.

Key Words: Heparin; Intracranial thrombosis; Sinus thrombosis, intracranial; Thrombectomy; Venous thrombosis

中文摘要
血管內血栓清除術和溶栓治療肝素無反應的腦內靜脈竇血栓病例

脳内静脈竇血栓形成是一種罕見但可致命的病，佔中風患者少於1%，大多數患者經肝素治療後腦硬膜竇血栓改善，但仍有一小部分患者經治療後情況繼續惡化預後很差，這些患者接受血管內溶栓治療可能有助改善病情。本文報告一名患有腦硬膜竇血栓的年青女性，她一向服食避孕丸，肝素治療對她無效。最終病人接受血管內血栓清除術和溶栓治療，病情顯著改善，影像掃瞄亦顯示血栓有消失的跡象。本文並回顧有關溶栓治療腦硬膜竇血栓的效用及安全性的文獻。

INTRODUCTION
This report is of a young woman who developed sudden loss of vision secondary to dural sinus thrombosis after taking an oral contraceptive pill. She was unresponsive to intravenous heparin and subsequently underwent endovascular thrombolysis by thrombectomy and urokinase infusion. The clinical and angiographical conditions both improved with good result after the procedure.

CASE REPORT
A 26-year-old woman with recurrent menorrhagia
after fibroid myomectomy started taking the oral contraceptive pill. She presented to Queen Mary Hospital, Hong Kong, in December 2006 with sudden onset of bilateral vision loss. Magnetic resonance imaging (MRI) of the brain showed dural sinus thrombosis involving the superior sagittal, left sigmoid, transverse, and straight sinuses. She was treated with intravenous heparin, but the vision loss did not improve. Endovascular therapy was then selected.

During the procedure, the Export XP Aspiration Catheter (Medtronic, Minneapolis, MN, USA) [Figure 1] was placed at the middle portion of the superior sagittal sinus, in which endovascular thrombectomy and thrombolysis (urokinase 1000 IU/hour for 24 hours) were performed. Follow-up digital subtracted angiogram done the next day showed improvement, with partial recanalisation of the thrombosed sinuses. The catheter was withdrawn 3 cm from the superior sagittal sinus, and urokinase 1500 IU/hour was infused for another three days before the catheter was removed. A second follow-up angiogram performed on day 4 showed patent dural sinuses and further resolution of the thrombus (Figure 2).

The patient regained her vision subsequently, and the overall clinical condition improved after the intervention. Eventually, she underwent uterine artery embolisation and, finally, hysterectomy due to protracted menorrhagia.

**DISCUSSION**

Cerebral venous sinus thrombosis is a rare form of stroke, accounting for less than 1%, and is potentially life-threatening. There are multiple contributory factors to the development of the condition, one of which is the oral contraceptive pill, as in this patient. Other causes include infection (mastoiditis, otitis, periodontal abscess), puerperium, hypercoagulable state, or low output state. The clinical symptoms are variable, including abnormal vision, headache, seizure, and symptoms related to cerebral, often haemorrhagic, infarct. The superior sagittal sinus is the most commonly affected in isolation or with other sinuses or deep cerebral vein involvement. MRI venography is the investigation of choice for diagnostic evaluation and follow-up of cerebral venous sinus thrombosis.

Anticoagulation is commonly used as the initial treatment for dural sinus thrombosis. An early randomised controlled trial by Einhäupl et al\(^1\) concluded that anticoagulation with dose-adjusted intravenous heparin is an effective treatment. Although there is potential risk of intracerebral haemorrhage associated with anticoagulation, it has been shown by the same group that the presence of intracerebral haemorrhage is not a contraindication to treatment.\(^1\) Recent guidelines by several organisations, including the European Federation of Neurological Societies\(^2\) and the American Heart Association/American Stroke Association\(^3,4\) have established heparin as the mainstay of treatment. According to one publication, subcutaneous low-molecular-weight heparin has a slight advantage over intravenous heparin due to its relatively reduced major bleeding complications.\(^2\)

In a small group of patients with venous sinus thrombosis, there is further clinical deterioration despite heparin therapy. Endovascular thrombolysis has therefore emerged as the potential treatment for those refractory to heparin therapy. The main rationale for endovascular thrombolysis is earlier recanalisation of the sinuses, and it has the advantage that the drug can be delivered where needed and downstream from the cerebral venous infarcts and haematoma.\(^2\) Endovascular thrombolysis is often combined with mechanical techniques such as thrombosuction, and this has been supported by prospective research.\(^6\)

Timing of the intervention remains unclear, but delayed treatment may be beneficial. In a case series by Sujith et al,\(^7\) local thrombolytic therapy with intravenous
Urokinase was given to three patients five days after they exhibited no response to heparin therapy and showed improvement with complete and partial recanalisation.

A search of the literature for the efficacy of endovascular thrombolysis shows promising results based on case series.7-11 A randomised clinical trial aimed at comparing the benefit of anticoagulation therapy versus endovascular thrombolysis (TO-ACT; Thrombolysis Or Anticoagulation for Cerebral venous Thrombosis) is currently under way and further information on its efficacy will be presented.

The potential complications of endovascular thrombolysis include cerebral haemorrhage. However, the significance of cerebral haemorrhage is uncertain based on the current literature.6,8 Careful patient selection is important, and those with large infarcts and

Figure 2. Pre-thrombolysis (a) anteroposterior and (b) lateral carotid angiograms at the late venous phase show poor visualisation of the sagittal, left transverse, and sigmoid sinuses (arrows) due to extensive thrombosis; post-thrombolysis (c) anteroposterior and (d) lateral carotid angiograms at the late venous phase performed four days after endovascular treatment show partial recanalisation of the sinuses.
impending herniation may not benefit. Recombinant tissue plasminogen activator may be associated with fewer bleeding complications when compared with urokinase due to its clot selectiveness and shorter half-life.

In conclusion, endovascular thrombolysis combined with thrombectomy has shown favourable results in patients with cerebral venous thrombosis who are unresponsive to heparin therapy. However, there are potential risks, including intracerebral haemorrhage, which the neuro-interventionist should be aware of. The ongoing randomised controlled study will be helpful to clarify the efficacy of thrombolysis compared with heparin therapy, and the appropriate criteria for patient selection.

REFERENCES