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## Post traumatic dural sinus thrombosis following epidural hematoma: Literature review and case report

Lorenzo Pescatori, Maria Pia Tropeano, Cristina Mancarella, Emiliano Prizio, Giorgio Santoro, Maurizio Domenicucci

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### Abstract

Dural sinus thrombosis following a head trauma is a rare condition, described in literature along with the lack of consensus regarding diagnosis and management. We present a case of a fifty-year-old man with a head injury and combined supratentorial-subtentorial epidural hematoma who was treated conservatively through the administration of low molecular weight heparin. The diagnosis and management of this condition are discussed based on a literature review. The early diagnosis may prevent potentially treatable poor outcomes.

**Key words:** Dural sinus thrombosis; Epidural hematoma; Low molecular weight heparin

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**Core tip:** Dural sinus thrombosis (DST) is a rare although serious clinicopathological entity that causes approximately 0.5% of all stroke cases. Head trauma may be identified as a possible cause of DST. The lack of consensus regarding the most appropriate therapeutic strategy prompted us to describe this unusual case of transverse sinus thrombosis caused by a combined supra-subtentorial haematoma. The absence of symptoms of the patient convinced us to assume a conservative behaviour which consisted in the administration of low molecular weight heparin after the computed tomography scan had



documented the stability of the extradural collection. Our strategy leads to the recanalization of the sinus.

Pescatori L, Tropeano MP, Mancarella C, Prizio E, Santoro G, Domenicucci M. Post traumatic dural sinus thrombosis following epidural hematoma: Literature review and case report. *World J Clin Cases* 2017; 5(7): 292-298 Available from: URL: <http://www.wjgnet.com/2307-8960/full/v5/i7/292.htm> DOI: <http://dx.doi.org/10.12998/wjcc.v5.i7.292>

## INTRODUCTION

Dural sinus thrombosis (DST) is a rare although serious clinicopathological entity that causes approximately 0.5% of all stroke cases<sup>[1]</sup>. Superior sagittal sinus as well as transverse sinus are more affected than other dural sinuses<sup>[1]</sup>. Head trauma may be identified as a possible cause of DST. In particular, depressed skull fractures occurring at the site of the dural sinuses as well as epidural or subdural hematoma have been found to be associated with DST<sup>[2-6]</sup>. Here we describe the case of a man who reported the occlusion of the transverse sinus as the consequence of the development of a combined supratentorial-subtentorial epidural hematoma. The patient was treated conservatively through the administration of low molecular weight heparin (LMWH). We discuss the physiopathological hypothesis, the clinic-radiological aspects as well as the management options reviewing the literature.

## CASE REPORT

This is the case of a fifty-year-old man who was hospitalized after being involved in a car accident in which he reported a concussive head trauma. Except for the trauma he did not have a significant history of illness. The patient was subjected to a brain computed tomography (CT) scan which showed the presence of a combined right supra-subtentorial hematoma (Figure 1). Clinical evaluation of the patient did not reveal any neurological signs except for a mild headache. Because of the site of the hematoma, an involvement of the transverse sinus was suspected. As a consequence a brain magnetic resonance imaging (MRI) with arterial and venous reconstruction was performed. The MRI confirmed the presence of the hematoma involving the supratentorial and the subtentorial compartment. Furthermore the venous study did not show any appreciable signal of blood flow within the right transverse sinus. This radiological finding was likely to be due to the occlusion of the sinus (Figures 2 and 3). Because of the absence of neurological signs as well as the patency of the contralateral dural sinuses system, a conservative management was adopted. A CT scan performed 48 h after the accident showed a slight increase in the

size of the hematoma (Figure 4). As a consequence, administration of LMWH was delayed. By the 10<sup>th</sup> post-traumatic day two more brain CT scan had been performed which had shown the progressive decrease in the size of the hematoma (Figure 5). This reduction encouraged us to begin the administration of LMWH. On 15<sup>th</sup> post-traumatic day the patient was discharged at home. During the subsequent 23 d the patient did not experience any symptoms related to the trauma. On 24<sup>th</sup> post-traumatic day, he began to complain of mild headache, vertigo and nausea. Since the symptoms were not responsive to oral analgesics and antiemetic drugs, the patient came back to the Emergency Department of our Hospital. A new brain CT scan was performed. It showed a further reduction of the size of both hematomas. Given the clinical history, a new brain MRIs can with venous angiographic reconstruction was performed. The new MRI confirmed the further decrease in the size of the epidural hematomas. Angiographic reconstructions of the dural sinuses showed that, although characterized by a less intensity in comparison with the contralateral sinus, the blood flow signal within the previously occluded transverse sinus was now visible. These radiological findings were likely to be due to the partial recanalization of the sinus (Figure 6). Symptoms progressively disappeared and after a brief period of hospitalization the patient was discharged at home.

## DISCUSSION

DST is a rare although serious clinicopathological entity that causes approximately 0.5% of all stroke cases. The signs and symptoms are extremely varied and non specific. Cerebral sinus thrombus formation due to head injury has been postulated to be caused by a sinus endothelial injury, thrombus extension from scalp abrasions, or damage to the emissary veins<sup>[7]</sup>. Sinus thrombosis can often occur with thrombosis of the cerebral veins, leading to cytotoxic and vasogenic edema<sup>[8]</sup>. The sinus thrombi lead directly to the decreased absorption of cerebrospinal fluid because of the increased sinus venous pressure, resulting in intracranial hypertension. Patients with cerebral sinus thrombosis most often present with severe headache that can be gradual or acute in nature. Patients can also have symptoms of increased intracranial pressure, including nausea and vomiting. Some patients have seizures. In 1946, Ecker described the first case of head injury associated with DST. Since then, other trauma-induced DSTs have been reported in cases of head injuries<sup>[5,9,10]</sup>. Ochagavia announced that the incidence of DST was 4% after penetrating head trauma<sup>[10]</sup>. However, Stiefel *et al.*<sup>[11]</sup> reported that he found DST with an incidence of 6.8% in the pediatric age group. There are two series on post traumatic DST in children but sporadic case reports in adults and in

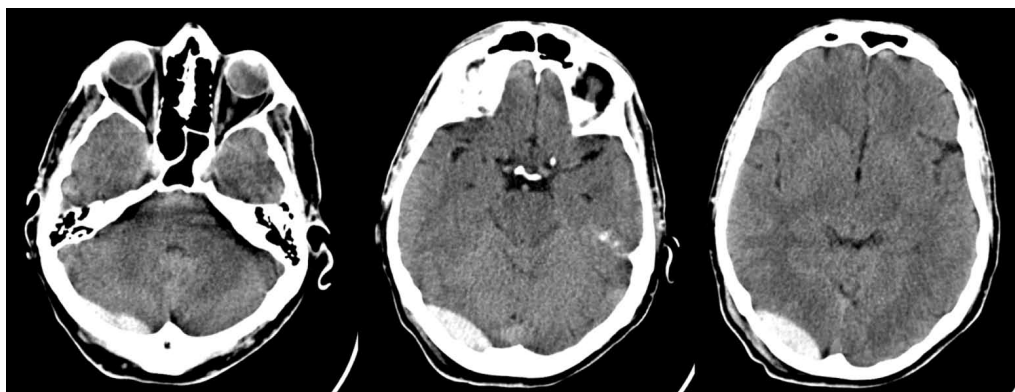


Figure 1 First computed tomography scan performed after the trauma. It shows the presence of a combined supra-subtentorial epidural hematoma.

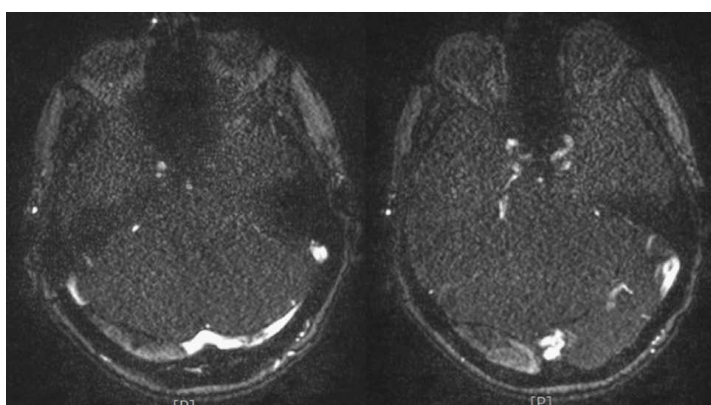


Figure 2 Angio-magnetic resonance imaging documenting the absence of the blood signal within the sinus as well as the epidural hematoma compressing the cerebellum and the sinus wall.

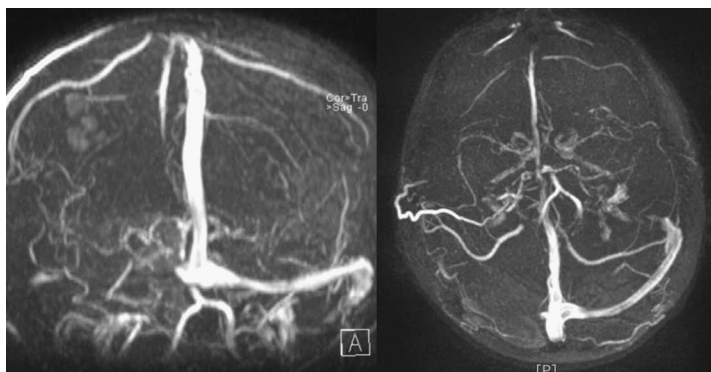


Figure 3 Angio-magnetic resonance imaging three dimensional reconstruction of the dural sinus system. It is not possible to appreciate any signal within the right transverse sinus as it happens for dural sinus occlusion. Notice the patency of the contralateral dural sinus complex.

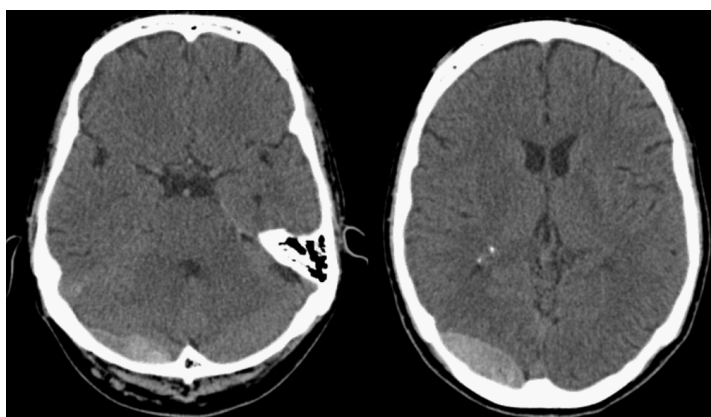


Figure 4 Computed tomography scan performed 48 h after the trauma. An increase of the size of the ematoma was identified by the radiologist. As a consequence we decided to postpone the administration of low molecular weight heparin.



Figure 5 By the 10<sup>th</sup> post-traumatic day two more brain computed tomography scan had been performed showing the partial reabsorption of the hematoma. From this moment the administration of low molecular weight heparin began.

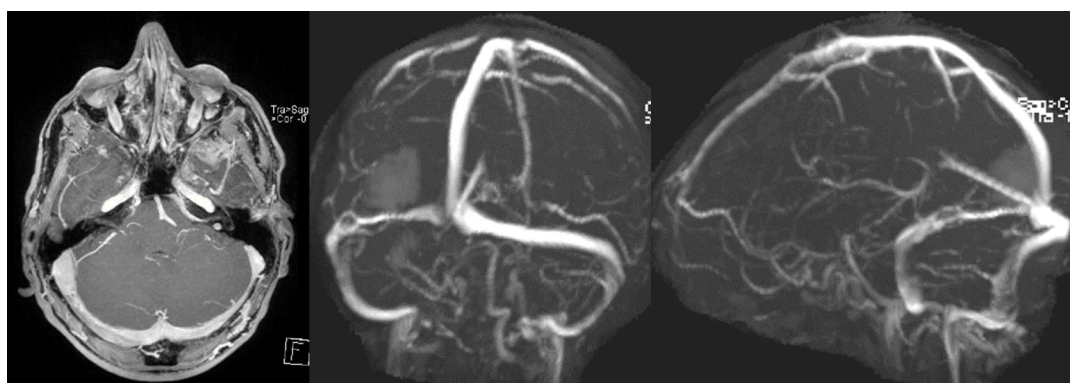


Figure 6 Brain magnetic resonance imaging with angiographic reconstruction of the venous system performed on 24<sup>th</sup> post-traumatic day after the onset of posterior cranial fossa symptoms. Magnetic resonance imaging shows the partial recanalization of the right transverse sinus as well as the almost complete reabsorption of the epidural hematoma.

Table 1 Summary of reported cases with cerebral sinus thrombosis due to head injury in the last 30 years

Ref.	Age, sex	Symptom	Skull fracture	Intracranial lesion	Treatment	Follow-up
Hesselbrock <i>et al</i> <sup>[8]</sup>	44, M	IICPS, seizure	?	Contusion	Supportive	Unknown
Taha <i>et al</i> <sup>[22]</sup>	5 (3M/2F) children	Various	3 cases	Contusion	Supportive	4 RC 1 no RC dead
Ochagavia <i>et al</i> <sup>[10]</sup>	27, M	Herniation due to IICPS	-	Edema	-	Unknown
Ferrera <i>et al</i> <sup>[17]</sup>	24, M	IICPS	+	Venous infarct	Surgery	6 RC
Stiefel <i>et al</i> <sup>[11]</sup>	8 (5F/3M) children	IICPS	All cases	-	-	1 no RC 1 dead
Meena <i>et al</i> <sup>[9]</sup>	40, M	IICPS, seizure, hemiparesi	-	-	AC	Unknown
Satoh <i>et al</i> <sup>[21]</sup>	2, F	IICPS	-	-	Supportive	RC
Brors <i>et al</i> <sup>[13]</sup>	32, M	Cranial nerve palsy	+	Contusion	AC	RC
Erdogan <i>et al</i> <sup>[16]</sup>	1, M	IICPS	-	Venous infarct, SH	Supportive	Unknown
Owler <i>et al</i> <sup>[4]</sup>	18, M	IICPS, hemiparesi	-	Venous infarct	Supportive, surgery	Unknown
Sousa <i>et al</i> <sup>[19]</sup>	7, F	IICPS	-	-	supportive	Unknown
Muthukumar <i>et al</i> <sup>[25]</sup>	7, F	IICPS	+	-	AC	Unknown
Saad <i>et al</i> <sup>[20]</sup>	10, F	IICPS	-	-	AC	Unknown
Yuen <i>et al</i> <sup>[23]</sup>	4, F	IICPS	+	-	Supportive	RC
Dalgıç <i>et al</i> <sup>[15]</sup>	35, M	IICPS	-	-	AC	RC
	25, M	Facial palsy	+	EH	AC	No RC
Caplan <i>et al</i> <sup>[14]</sup>	27, M	IICPS, paraesthesias	+	Contusion	AC	Unknown
Bakar <i>et al</i> <sup>[12]</sup>	18, M	IICPS	+	Edema	Surgery	Unknown
Beer-Furlan <i>et al</i> <sup>[26]</sup>	3, M	IICPS	+	EH	Surgery	Dead
Lebowitz <i>et al</i> <sup>[18]</sup>	6, M	IICPS	-	SH	AC	No RC
Yun <i>et al</i> <sup>[24]</sup>	10, M	IICPS	+	EH	Supportive	RC
Our case	50, M	IICPS	-	EH	Supportive, AC	RC

M: Male; F: Female; IICPS: Increased intracranial pressure; EH: Epidural hematoma; RC: Recanalization; SH: Subdural hematoma; AC: Anticoagulation.



children have been published<sup>[4,6,12-25]</sup>. Overall, there are 32 cases including 22 children and 10 adults (Table 1). The higher number of children can be explained by the fact that the venous collateral system is not completely mature in their cerebrum. In only 3 cases (1 adult and 2 children) there was an epidural hematoma (EH). It was always associated with skull fracture. Our case is the first case reported, to our knowledge, in which the epidural hematoma was not associated to skull fracture and had a supra and subtentorial localization. In our case, although it is difficult to establish if the occlusion of the sinus was owed to the extrinsic compression of the hematoma on the sinus wall or to the development of a thrombus within the sinus, it is possible that both the phenomenon contributed to the occlusion through a cause-effect process. The extrinsic compression of the hematoma probably caused a deceleration of the blood flow within the sinus. As a consequence, according to the principles of blood stasis, modifications of the vascular wall and blood rheology enunciated by Virchow, it is likely that a thrombus within the transverse sinus developed. The initial imaging study in the evaluation of patients with possible DST is usually a brain CT scan. Magnetic resonance imaging, as well as MR angiography and venography, provide us with the most sensitive tools for detecting DST. The combination of these imaging modalities constitutes the study of choice in the diagnosis of DST. In fact the images shown by our MRI are compatible with an occlusion of the transverse sinus. There is no consensus on the overall treatment concerning surgical, radiosurgical, endovascular or conservative treatment. Identification and treatment of the underlying causes should represent the first step in the treatment of dural sinus occlusion. In case of extrinsic compression such as depressed skull fractures as well as epidural or subdural hematoma surgical removal of the identified source of compression has been advocated by several authors<sup>[12,14]</sup>, even if only 1 case of post-traumatic DST related to EH, reported in literature, was underwent to surgical treatment<sup>[26]</sup>. In our case, despite the presence of the epidural hematoma without mass effect as well as the occlusion of the sinus, the complete absence of neurological symptoms encouraged us to adopt a conservative behaviour. Despite the role of antithrombotic therapy has been widely examined and several studies have been published in this sense, its use in post-traumatic DST still remain controversial, because of increased risk for venous hemorrhagic infarction<sup>[26]</sup>. A meta-analysis conducted by Coutinho *et al*<sup>[27]</sup> which included 2 randomized controlled studies investigating the role of unfractionated heparin as well as LMWH, concluded that the anticoagulant treatment can be considered safe and is associated with a better overall outcome in patients affected with DST. The EFNS guideline on the treatment of cerebral venous and sinus thrombosis in adult patients conducted by Einhäupl *et al*<sup>[28]</sup> in 2010 concludes that patients with cerebral sinus thrombosis

without contraindications for anticoagulant should be treated either with body weight-adjusted subcutaneous LMWH or with dose adjusted intravenous heparin. In addition the study concluded that the use of LMWH should be considered safe despite the presence of intracranial haemorrhage. Although conscious of current literature, we decided to postpone the administration of subcutaneous LMWH because of the growth of the epidural hematoma that had been shown by a control CT scan performed 48 h after trauma. Once serial CT scan demonstrated the progressive reduction in the size of the hematoma subcutaneous LMWH heparin was administered and continued after discharge. LMWH pharmacologically doesn't possess thrombolytic action; given this the main purpose of their administration is to prevent recurrent thrombosis and appositional thrombus growth. Data collected from different studies confirm that DST patients display a high spontaneous and intrinsic thrombolytic potential, with recanalization rates of 60% during the first 20 d as happened in our case. Thereafter, recanalization rates increase insignificantly<sup>[26]</sup>. The second MRI with angiographic and venous reconstruction performed during the second hospitalization showed that the blood flow within the transverse sinus had reappeared. The administration of LMWH as well as the progressive reabsorption of the epidural hematoma are related to the recanalization of the transverse sinus. The consequent reorganization of the venous blood flow within the dural sinus system may explain the physiopathology of the posterior cranial fossa symptoms characterized by vertigo and headache.

DST is a rare although serious condition described in literature along with a lack of consensus regarding diagnosis and management. Most reports show good outcome and recovery, but DST might be related to a poor recovery and even lead to death. DST may be caused by post-traumatic depressed skull fractures or intracerebral hematomas compressing the sinus wall and altering the blood flow within the sinus until thrombosis, so additional diagnostic investigations should be performed in terms of DST in head trauma cases that have other risk factors. The administration of anticoagulant therapy still remains controversial but in association with the progressive reabsorption of the hematoma it could allow the recanalization of the dural sinus.

## COMMENTS

### Case characteristics

A fifty-year-old man was hospitalized after being involved in a car accident in which he reported a concussive head trauma.

### Clinical diagnosis

Except for a mild headache, the patient didn't show neurological signs.

### Differential diagnosis

Haemorrhage, concussion injury, cerebral contusion.



## Laboratory diagnosis

All labs were within normal limits.

## Imaging diagnosis

Computed tomography (CT) scan showed the presence of a combined right supra-subtentorial hematoma, while the magnetic resonance imaging scan showed the occlusion of the transverse sinus.

## Treatment

Once serial CT scan demonstrated the progressive reduction in the size of the hematoma subcutaneous heparin or low molecular weight heparin was administered and continued after discharge.

## Related reports

Dural sinus thrombosis (DST) following a head trauma is a rare condition, described in literature along with the lack of consensus regarding diagnosis and management.

## Term explanation

Dural venous sinus thrombosis is a subset of cerebral venous thrombosis. It is the presence of a blood clot in the dural venous sinuses that causes approximately 0.5% of all stroke cases. The symptoms depend mainly on which sinus is involved.

## Experience and lessons

In case of head trauma the DST should always be considered. This entity is often underestimated. Recognizing this condition can prevent misdiagnosis and suggest the best treatment option. The administration of anticoagulant therapy could allow the recanalization of the dural sinus.

## Peer-review

This is a rare and interesting case, which could highlight a differential diagnosis for clinical doctors.

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