Case report

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CENTRAL DURAL TENTING SUTURES IN A PATIENT WITH TRAUMATIC ACUTE EPIDURAL HEMATOMA: A CASE REPORT

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It is of paramount significance to diagnose epidural hematoma (EDH) as soon as possible and to evacuate EDH if necessary. Our aim was to show the importance of placing prophylactic central dural tenting sutures (DTS) for ensuring adequate hemostasis. We present a case of a 62-year-old male patient, who was diagnosed with an acute traumatic EDH and cerebral hemorrhagic contusion. The postoperative course was complicated by deterioration of the patient's consciousness and worsening of the left-sided hemiparesis, therefore we performed a head CT scan, which showed the formation of the new EDH at the operating site. Moreover, we reoperated the patient with the placement of multiple central DTS, while the control head CT scan showed a complete evacuation of the EDH. Consequently, the patient made a good recovery at discharge, with a remaining discrete left-sided hemiparesis. Prophylactic central DTS are important for maintaining an adequate hemostasis while operating on patients with EDH. *Acta Medica Medianae 2023;62(2): 83-87.*

Key words: *epidural hematoma, dural tenting suture*

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Introduction

Epidural hematoma (EDH) is an extra-axial collection of blood in the space between the outer sheet of the dura mater and the inner wall of the skull (1). It represents a life-threatening and urgent condition that requires rapid and adequate treatment. EDH occurs in 2.7–4% of cases of traumatic brain injury (TBI) and 9% of cases of severe TBI, with an estimated mortality of approximately 10% (1, 2). EDH can occur as a result of injury to the middle meningeal artery (90%), middle meningeal vein, diploic veins or venous sinuses and can be clinically manifested in different ways, ranging from comatose to fully conscious state (3). The decision for operative treatment is usually based on the evaluation of various clinical, systemic and radiological findings. Neurological examination includes assessment of Glasgow Coma Scale (GCS), pupillary findings and motor function (4). Furthermore, there is no clear consensus or guidelines on what occasion should central DTS be applied, while certain procedures in this operative technique are non-standardized.

Case report

The authors present a 62-year-old male patient, who underwent surgery for an EDH located below the right parietal bone, with the largest width up to 15 mm, as well as a cerebral hemorrhagic contusion (CHC) measuring 37x25 mm in the parietal lobe.

Moreover, he allegedly sustained the previously described injuries after a syncope, when he fell headfirst on the floor, injuring the right parietal side of his head. During the neurosurgical examination in the emergency room, on admission, the patient had a progressive alteration of the state of consciousness reaching soporous state (GCS score of 9), without gross lateralization of neurological deficits on the extremities or cranial nerves. Henceforth, the grand mal seizures were observed, although he did not suffer from any preexisting seizure

disorder. The diagnosis was initially confirmed by a head computerized tomography (CT), where, in addition to the above-mentioned EDH and CHC, two parallel and linear fractures of the right parieto-temporal bone and subarachnoid hemorrhage were demonstrated (Figure 1). After an adequate preoperative examination, the patient underwent an emergency surgery. During the operation, the patient was placed in the supine position under general anesthesia. The head was elevated above the level of the heart to promote venous outflow and reduce intracranial pressure. The patient's head was rotated to the left side (0°–15° from the horizontal plane). The roll was placed under the right shoulder to facilitate the head turning. Moreover, the head was supported with a Mayfield standard cranial stabilization system. The ipsilateral area of interest was shaved, adequately disinfected and draped. A trauma-flap (reversed question mark incision) approach was commenced, ending behind the hairline area. The temporalis musculocutaneous flap was elevated and craniotomy was performed with the five points of trepanation. The EDH was evacuated subsequently. The bleeding from the diploic veins and middle meningeal artery was identified and then coagulated and stopped by using hemostatic materials. The durotomy was performed in a semicircular fashion and the CHC was evacuated by using a gentle suction and irrigation. Hemostasis was managed with the use of regenerated oxidised cellulose (Surgicel®) and bipolar electrocautery. The subdural drainage was placed. The dura was watertight closed and DTS were placed on the surrounding post-craniotomy margins to prevent a re-accumulation of the hematoma. An epidural drain was placed while the bony lid was returned and fixated with non-dissolvable sutures.

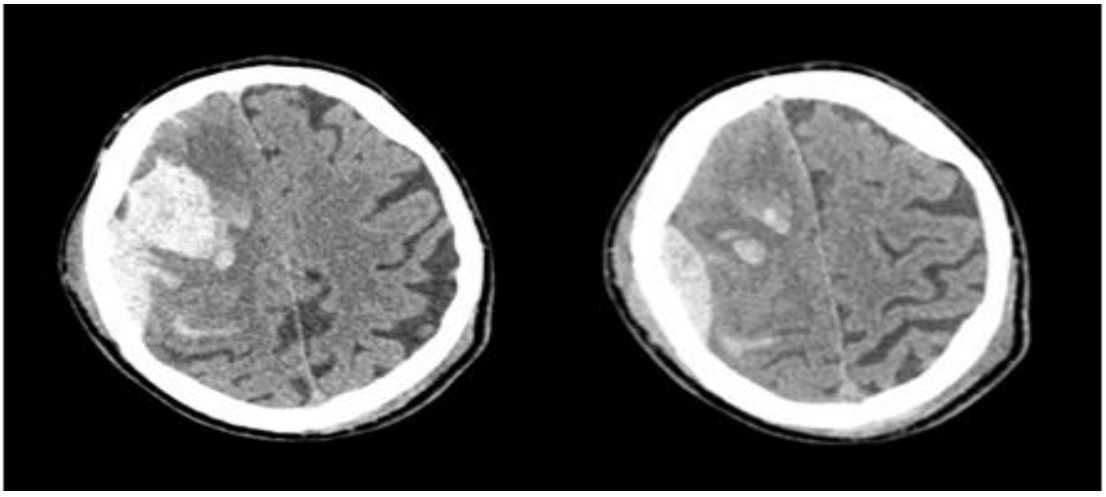

Figure 1. CT tomograms demonstrate a right parietal EDH with the greatest width up to 15 mm, CHC with dimensions of 37x25 mm in the right frontal and parietal lobe, as well as diffuse subarachnoid hemorrhage.

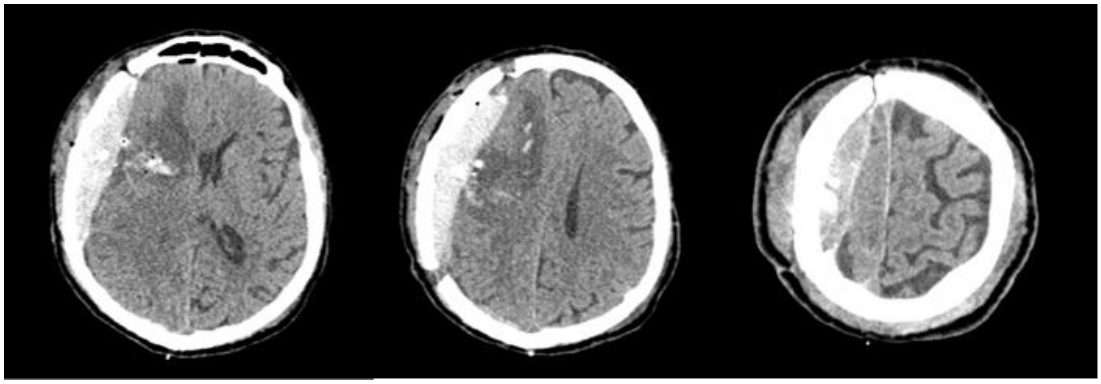

Figure 2. CT tomograms demonstrate the presence of expansive acute EDH with the largest width of 22 mm. Encephalomalacia in the region of the evacuated CHC and ischemic zone in the vascular territory of the MCA on the right are also evident.

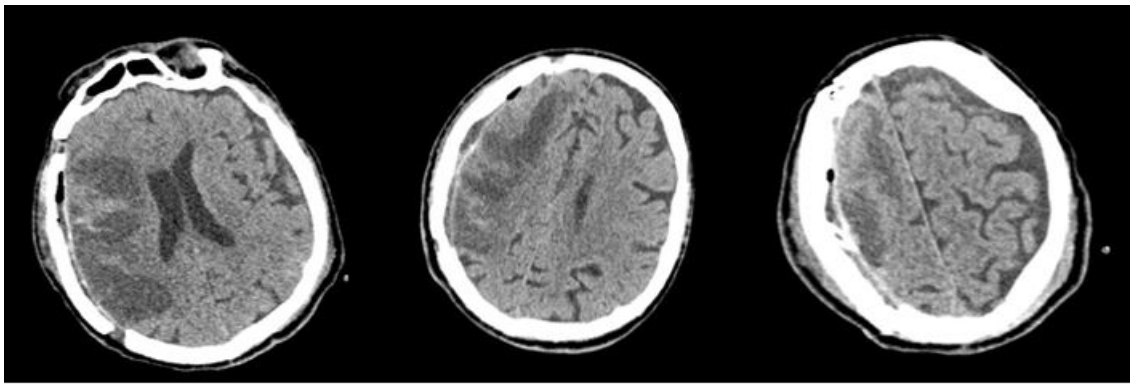

Figure 3. CT tomograms demonstrate a resolved EDH and an ischemic zone in the vascular territory of the right MCA.

Postoperatively, due to the development of flaccid left-sided hemiplegia, a control head CT was performed, which recorded the size progression of EDH in the region of the previous operation, with a maximum width of up to 22 mm, as well as ischemia in the vascular zone of the right middle cerebral artery (MCA) (Figure 2).

Upon receiving the results of the control head CT, we performed an urgent reoperation.

Moreover, the bleeding was originating from the Pachyoni's corpuscles, which was stopped with the use of bipolar electrocautery, while 5 central DTS were additionally placed.

The control head CT scan showed an evacuation of the EDH with a persistence of the ischemic zone in the area of the right MCA (Figure 3).

Consequently, the patient made a good recovery at discharge, with a remaining moderate spastic left-sided hemiparesis. Follow-up examinations were performed after 3 and 6 months, as well as after 1 year, while the patient reached a satisfying recovery. The patient was walking independently without the use of a cane or walker, and the gross motor activities of the left half of the body reached grade 4 on the Manual muscle test scale after physical and rehabilitation treatment.

Discussion

Traumatic delayed EDH accounts for 5.6% to 13.3% of all cases and represents EDH that is absent or of insignificant dimensions on initial brain CT and MRI, while subsequent imaging shows significant EDH (5). In rare cases, EDH may be overlooked because of its small size on initial head CT or because the density of the acute hemorrhage may be similar to that of the skull (6). On the contrary, our patient had a recurrence of EDH because epidural bleeding was shown during the initial radiological imaging and it had substantial dimensions.

In the early years of neurosurgical development, hemostasis was the dominant technical problem during surgical evacuation of EDH. Horsley's wax and Cushing's electrocautery were major contributions to neurosurgery, as well as Dandy's DTS. Moreover, DTS were used to attach the dura tightly to cranial bone and to prevent to some extent the recurrence of EDH, by reducing the volume of the potential epidural space and collapsing the dural blood vessels (7, 8).

Despite the large number of published research in the scientific literature on the application of DTS, there are still no official guidelines on indications, application time during the surgery and placement techniques of central DTS.

Vadanmbi et al. analyzed the necessity for DTS placement in 785 patients who underwent craniotomy and craniectomy, while obtaining the result that DTS do not statistically significantly affect the reduction of extradural postoperative bleeding requiring surgical reoperation compared to the group of patients in whom DTS was not placed (9). We believe that the limitations of their research were that they did not include the placement of central DTS, patient comorbidities, coagulation factor screening, the severity of the underlying disease that required craniotomy and craniectomy, as well as that there were huge differences in the age of the patients.

The use of DTS often leads to the appearance of certain complications, such as acute subdural hematoma, subdural hygroma, cerebrospinal fluid leakage, cortical tissue damage (1).

Placement of central DTS immediately before closing the dura or using a microscope significantly reduces the risk of complications related to DTS (1, 10). Nishiyama et al. reported a rare complication of pial arteriovenous fistula formation after DTS placement (11). A possible explanation for the occurrence of this complication could be that the authors of this study probably stimulated abnormal angiogenesis by cytokine releasement and vascular growth factors through mechanical injury of the MCA or Sylvian vein. Given that we had a clear visualization of the

cerebral cortex and bridging veins, as well as CHC after opening the dura, we believe that there was no need to use the operating microscope. The use of a microscope certainly increases the chance of successfully treating and visualizing traumatic brain injuries, while on the other hand it prolongs the duration of the operation, and in our patient, the time required for hematoma evacuation was of crucial importance.

Bearing in mind the hemostatic role and the complications that DTS can cause, possible alternatives for central DTS should be considered in the future. Additionally, a new technique of implanting self-drilling screws, after which dural sutures can be tied around the screw heads, thus serving as anchors has been proposed. This technique has shown satisfactory results in supraorbital keyhole craniotomy, sphenoid ridge keyhole craniotomy, pterional and subtemporal approaches (12). On the other hand, some authors suggest benefits of using a procedure called bone hole threader, which goes through the hole of the bony lid, with a wire tip that is elastic and thus prevents injury to the surrounding tissue. The potential benefits of this procedure could be that it reduces the average central DTS placement time by 24 seconds and allows the operator to place the central DTS without the assistance (13).

Specifically, in this case presentation, by opening the dura, a better visualization of the cortex and bridging veins was achieved, which minimized the risk of potential damage during central DTS placement. However, we believe that further research regarding this topic and operative technique is necessary, in order to establish a consensus and guidelines for the use of central DTS.

Conclusion

DTS placement has a hemostatic role and has been used in neurosurgery for decades. Central dural suspensions are of great importance after durotomy in cases of EDH, subdural and intracranial hemorrhages, in prevention of possible additional detachment of the dura and accompanying complications. However, there are very few studies on this issue, so we believe that additional research on the use of DTS, operative techniques and potential alternatives are necessary.

References

1. Khairat A, Waseem M. Epidural hematoma. StatPearls (serial online) 2021 Aug “cited 2022 Nov 30”. [PubMed]
2. Chicote AE, González CA, Ortiz LM, Jiménez AA, Escudero AP, Rodríguez BJC, et al. Epidemiology of traumatic brain injury in the elderly over a 25 year period. Rev Esp Anestesiol Reanim 2018; 65(10): 546-51. [CrossRef] [PubMed]
3. Bonow RH, Barber J, Temkin NR, Videtta W, Rondina C, Petroni G, et al. Global Neurotrauma Research Group. The Outcome of Severe Traumatic Brain Injury in Latin America. World Neurosurg 2018; 111: e82-e90. [CrossRef] [PubMed]
4. Bullock MR, Chesnut R, Ghajar J, Gordon D, Hartl R, Newell DW, et al. Surgical management of acute subdural hematomas. Neurosurgery 2006; 58(Suppl 3): S2-16. [CrossRef] [PubMed]
5. Kostić A, Veselinović A, Nikolov V, Stefanović I, Mitić R, Radisavljević M, et al. A combination of acute and delayed contralateral epidural hematoma. Srp Arh Celok Lek 2018; 146(3-4): 193-6. [CrossRef]
6. Slavko Živković, Jovan Ilić, Vesna Nikolov, Vesna Stokanović, Radisav Mitić, Marija Djordjević, et al. A case report on traumatic delayed epidural hematoma with atypical presentation. Acta Med Median 2022; 61(2): 60-71. [CrossRef]
7. Chivukula S, Weiner GM, Engh JA. The early days of hemostasis in neurosurgery. Neurosurg Focus 2014; 36(4): E5. [CrossRef] [PubMed]
8. Paulo D, Semonche A, Choudhry O, Al-Mufti F, Prestigiacomo CJ, Roychowdhury S, et al. History of hemostasis in neurosurgery. World Neurosurg 2019; 124: 237-50. [CrossRef] [PubMed]
9. Wadanamby S, Dharmapala HH, Ranaweera C, Packeer MS, Wadanamby SU. Is dural hitching necessary to prevent post-operative extradural haemorrhage in craniotomies and craniectomies. Sri Lanka J Surg 2016; 34(2): 7-11. [CrossRef]
10. Eroglu U, Zaimoğlu M, Sayacı EY, Ugur HC, Attar A, Kahilogullari G, et al. Is Placing Prophylactic Dural Tenting Sutures a Dogma? World Neurosurg 2021; 153: e403-7. [CrossRef] [PubMed]
11. Nishiyama Y, Kanemaru K, Yoshioka H, Hanihara M, Horikoshi T, Kniouchi H. Intracranial pial arteriovenous fistula caused by dural tenting: case report. Neurol Med Chir 2014; 54(3): 242-4. [CrossRef] [PubMed]
12. Park J. Self-drilling anchor screws for dural tenting sutures. Surg Neurol 2009; 72(2): 175-6. [CrossRef] [PubMed]
13. Katsuhara T, Otani N, Yamamuro S, Kajimoto R, Kobayashi M, Hirayama K, et al. Novel threading device for central dural tenting sutures. Interdiscip Neurosurg 2021; 25: 101199. [CrossRef]

Prikaz bolesnika

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ZNAČAJ CENTRALNIH DURALNIH SUSPENZIJA KOD BOLESNIKA SA AKUTNIM TRAUMATSKIM EPIDURALNIM HEMATOMOM: PRIKAZ SLUČAJA

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Traumatski epiduralni hematom (EDH) je potrebno dijagnostikovati što pre i, ukoliko je potrebno, razmotriti njegovo operativno uklanjanje. Cilj našeg rada bio je da ukažemo na važnost postavljanja profilaktičkih centralnih duralnih suspenzija (DS) u cilju obezbeđivanja adekvatne hemostaze. Predstavljamo slučaj šezdesetdvogodišnjeg bolesnika kod koga je postavljena dijagnoza akutnog traumatskog EDH i cerebralne hemoragične kontuzije (CHK). Bolesnik je hitno operisan – tada je učinjena evakuacija EDH i CHK, uz postavljanje perifernih DS. Postoperativni tok zakomplikovao se pogoršanjem stanja svesti bolesnika do nivoa sopora i pogoršanjem levostrane hemipareze, te je načinjen kontrolni CT mozga, koji je pokazao ponovni EDH na mestu prethodne operacije. Sledstveno, bolesnik je reoperisan uz postavljanje višestrukih centralnih DS, a kontrolnim postoperativnim CT-om mozga evidentirana je potpuna evakuacija EDH. Posledično, bolesnik je na otpustu dostigao zadovoljavajući oporavak, sa rezidualnom, diskretnom levostranom spastičnom hemiparezom. Profilaktičke centralne DS važne su za postizanje adekvatne hemostaze tokom operacije pacijenata sa EDH. *Acta Medica Medianae 2023;62(2):83-87.*

Ključne reči: *epiduralni hematom, duralna suspenzija*