

# A MODIFIED TECHNIQUE TO TREAT CHRONIC AND SUBACUTE SUBDURAL HEMATOMA: TECHNICAL NOTE

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## BACKGROUND

We present a patient on warfarin in whom a drainage port system was attached to the skull, successfully draining a subacute subdural hematoma.

## CASE DESCRIPTION

An elderly male presented to our institution with right hemiparesis a week following a motor vehicle accident. He was on warfarin for recurrent pulmonary emboli and suffered from severe coronary artery disease. Physical examination demonstrated a grade 3/5 hemiparesis and a computerized tomography (CT) scan confirmed the diagnosis of subacute subdural hematoma. He underwent twist drill craniostomy and attachment of the subdural evacuating port system. Recovery in this patient was dramatic.

## CONCLUSION

The subdural evacuating port system (SEPS) permits the neurosurgeon to drain subacute or chronic hematomas by a method that is minimally invasive, simple, and safe. The SEPS appears to promote brain expansion without the potential biohazards of other standard techniques. © 2003 Elsevier Inc. All rights reserved.

## KEY WORDS

*Subdural hematoma, true closed system drainage, twist drill craniostomy.*

There exist numerous methods for the surgical treatment of chronic and subacute subdural hematomas [1,2,6,7,9,10]. These include burr hole irrigation with or without subdural catheter placement, twist drill catheter insertion, and craniotomy.

Steroids are occasionally used. All are acceptable; their use is a matter of personal preference. The variety of surgical strategies, however, is testimony to their frequent failure and potential for complications. Burr hole irrigation often allows entrainment of air into the subdural space. Pneumocephalus, even in the absence of tension, increases morbidity and headache. A variety of catheters have been inserted into the subdural space, either through burr holes or twist drill holes. These may impale brain parenchyma or injure tenuous bridging veins. Application of suction to a catheter in the subdural space may result in brain or meninges plugging its perforations. Larger catheters may provoke seizures when abutting cortex. They may act as bacterial conduits, increasing the risk of subdural empyema. In our method, a hollow screw (port) is threaded to the skull through a twist drill opening, not entering the subdural space. The port is then connected to a Jackson-Pratt-type suction reservoir, thereby establishing a true closed drainage system that is established to evacuate the subacute and chronic subdural hematomas. Although this is similar to an existing system, there are significant design differences [4]. Our system introduces a mild, uniform, negative pressure throughout the subdural space, thus promoting slow drainage of the fluid collection and the gradual decompression, re-expansion, and recovery of the brain.

## DEVICE DESCRIPTION AND INSERTION TECHNIQUE

The subdural evacuating port system (SEPS) consists of a stainless steel evacuating port (Figure 1), stainless steel drill bit with safety stop collar, set screw and Allen wrench, silicone tubing, a silicone suction reservoir bulb, and flexible ruler. The evac-

Disclosure: The SEPS was developed with the assistance of Medical Designs, LLC, Brandon, South Dakota. Dr Asfora has a licensing agreement with Medical Designs, LLC, for the device described in this paper. US Design Patent Number D435,291 covers the Subdural Evacuating Port device.

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**1** Subdural evacuating port.

uating port is a 6 mm outside diameter tube, 4.5 cm in length with a pair of wings extending from the exterior surface to facilitate manual insertion. The evacuating port has self-tapping threads on the proximal end and a series of annular barbs on the distal end. The 5.8 mm drill bit is used to create a twist drill hole through the outer and inner tables of the patient's skull. After opening the dura with an electrocoagulator, the evacuating port is threaded into the opening of the skull with a clockwise twisting motion. One end of the silicone tubing is attached to the suction reservoir bulb. A low negative pressure ( $\leq 2.5$  cm Hg) is applied by gently squeezing the reservoir bulb, and this, in turn, allows for external drainage of subdural fluid and the gradual decompression, re-expansion, and recovery of the brain.

## CASE REPORT

A 69-year-old male was referred to our facility with a history of progressive weakness and a decreasing level of consciousness. He had been involved in a motor vehicle accident approximately one week prior. He was taking warfarin, 10 mg daily, for recurrent pulmonary emboli and suffered from chronic coronary artery disease. Physical examina-

tion revealed drowsiness, inability to obey commands, and global dysphasia. Cranial nerve function was normal and there was grade 3/5 hemiparesis of the right arm and leg. Laboratory tests confirmed coagulopathy and two units of fresh frozen plasma were administered. The CT scan showed a large, subacute subdural on the left with 18 mm of shift. (Figure 2A). The patient was taken to the operating room that day and had a left frontal twist drill craniostomy performed under local anesthesia. The dura was opened, the port screwed into the skull, and the closed suction drainage system established. Surgical time was rapid, approximately 5 minutes. Postprocedure the patient's level of consciousness and hemiparesis improved rapidly. The port system was removed within 48 hours from initial procedure with the wound being closed with a single stitch. Follow-up examination and CT scan 2 months later were within normal limits (Figure 2B).

## DISCUSSION

Unlike other comparable devices [8,9], the SEPS does not enter the intracranial space. The proximal tip of the evacuating port remains within the bone, similar to the Camino bolt (Integra NeuroCare, San

**A****B**

**2** (A) Preoperative CT of patient with subacute subdural hematoma. (B) Postoperative CT of same patient. Diego, CA) used for intracranial pressure monitoring. The inner diameter of our port is 5 mm, in contrast with the 2.3 mm of the screw described by

Emonds et al [4]. They report this to be a disadvantage and do not recommend its use for large blood clots. Drainage catheter-type devices that are in direct contact with the brain or well-vascularized outer membranes may be associated with more subdural rebleeding than devices that are not in direct contact with the brain, bridging veins, or subdural membranes, particularly if negative pressure is applied. Adhesions can also form between these catheters and the subdural membranes if left in place for prolonged periods. Our SEPS technique also differs from other drainage procedures in that the subdural space is not irrigated during or after the procedure, which significantly reduces operating room time. Irrigation has not been shown to improve outcomes [8]. There are no leaks around the subdural port or its bulb and tubing. This reduces the risk for infection and maintains a fairly constant negative pressure in the closed drainage system. The fluid drainage may be continuous or intermittent and is gradual and independent of gravity. It is therefore not necessary to keep patients flat in bed for extended periods of time. Patients are allowed to increase activity as tolerated, typically beginning on the first day following the SEPS surgery. Additionally, to maximize effectiveness, the port should be positioned over the point at which the subdural collection is at its greatest thickness; otherwise loculation may occur. If on preoperative CT or magnetic resonance imaging (MRI) the hematoma is noted to be loculated, the use of additional ports may be considered. The SEPS should remain in place until the hematoma stops draining, generally 24 to 48 hours. If the patient has not improved neurologically and the initial postoperative CT scan shows significant mass effect, alternative treatments (craniotomy, burr hole, etc.) should be considered if the patient has stabilized medically.

To date we have treated 32 patients who presented with chronic, subacute, and acute-on-chronic subdural hematoma by means of one or multiple subdural evacuating ports. Follow-up has ranged from one to 24 months. In 26 patients (81.2%) the postoperative course was uneventful with complete evacuation of the hematomas, resolution of symptoms, and no adverse sequelae reported by either the patient or his/her referring physicians. A follow-up CT carried out the day following the procedure revealed significant residual subdural hematoma with mass effect in three patients. Needle aspiration of residual hematoma through the SEPS to unplug the port was successfully carried out in two of these patients without further recurrence of the hematoma. The third pa-

tient was taken to surgery for a craniotomy that revealed multiple layers of subdural membranes; the SEPS was patent. In another three patients (9.4%), recurrence of the hematoma was noted within 1 to 2 months. Of these three patients (9.4%), one was treated by percutaneous aspiration of the recurrent hematoma through the previous twist drill hole site, while the other two patients, in view of an acute subdural hematoma component, were treated by standard craniotomy.

In our experience, we feel that the SEPS is a viable alternative in treating patients with chronic, subacute, and acute-on-chronic subdural hematoma, especially if they are fully anticoagulated, or in whom general anesthesia is contraindicated because of an unstable medical situation. It has also worked as a temporary measure in a more acute setting in an attempt to decrease intracranial pressure until the patient can undergo standard craniotomy.

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## COMMENTARY

The authors have presented a modified extracranial bolt method for drainage of chronic subdural hematomas. This technique appears to have benefits over conventional burr hole drainage with or without irrigation in patients at increased risk for bleeding or pneumocephalus.

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**A**n honest man is not the worse because a dog barks at him.

—DANISH PROVERB