



# Chronic subdural hematoma under local anesthesia with manual burr hole

Nathan Beucler<sup>1,2</sup> · Aurore Sellier<sup>1</sup> · Cédric Bernard<sup>1</sup> · Arnaud Dagain<sup>1,3</sup>

Received: 11 January 2021 / Accepted: 16 March 2021

© The Author(s), under exclusive licence to Springer-Verlag GmbH Austria, part of Springer Nature 2021

## Abstract

**Context** Burr hole evacuation (BHE) of symptomatic chronic subdural hematoma (CSH) carries significant morbidity and mortality in the elderly because they are a fragile population. As military neurosurgeons, we perform a simplified technique under local anesthesia using a manual craniotome.

**Methods** We present the case of an 85-year-old woman suffering from a right-sided CSH causing confusion and severe left-sided hemiparesis.

**Conclusion** After the procedure, the patient presented immediate neurological improvement. Performing manual BHE of symptomatic CSH under local anesthesia is safe, and it is of great interest for very old patients or in case of strained resources, thus we think that this technique should be taught to every young neurosurgery resident.

**Keywords** Symptomatic chronic subdural hematoma · Local anesthesia · Manual burr hole · Burr hole evacuation

## Introduction

Symptomatic chronic subdural hematoma (SCSH) is a frequent disease in the elderly. The trephination craniotomy, then the burr-hole, and finally the twist drill have been introduced as possible surgical treatments for SCSH [3, 4, 8]. BHE is usually performed under general anesthesia with a pneumatic or motor cranial drill [7, 9]. Nevertheless, some patients suffering from symptomatic CSH can be very old with multiple comorbidities and thus deemed too fragile to undergo general anesthesia. Furthermore, neurosurgeons working in strained resource facilities may have limited access to a motor craniotome and even to a Jackson-Pratt drain [5]. Hence, we present a simplified and reproducible BHE technique using a

manual craniotome under local anesthesia that is routinely performed at our institution.

## Description of the technique

### Relevant surgical anatomy (Fig. 1)

The surgeon carefully identifies important bony landmarks. In the extension of the frontal process of the zygomatic bone, the linea temporalis constitutes the inferior limit of the incision, far from the bridging veins of the midline. The coronal suture is palpated under the skin 3 to 4 cm ahead of the projection of the central sulcus: this suture is the landmark for the incision site. The median line is clearly marked and indicates the superior sagittal sinus.

### Patient positioning (Fig. 1)

The patient is placed in a slight semi-sitting position. A pad is placed under the shoulder ipsilateral to the hematoma. The head is rotated 90° on the opposite side and inclined 30° laterally to place the skull convexity in a horizontal plane to avoid postoperative pneumocephalus, [6] then it is held against the operating table with the use of adhesive tape placed just above the ear. An adjustable belt is placed at the level of the patient's elbows, and

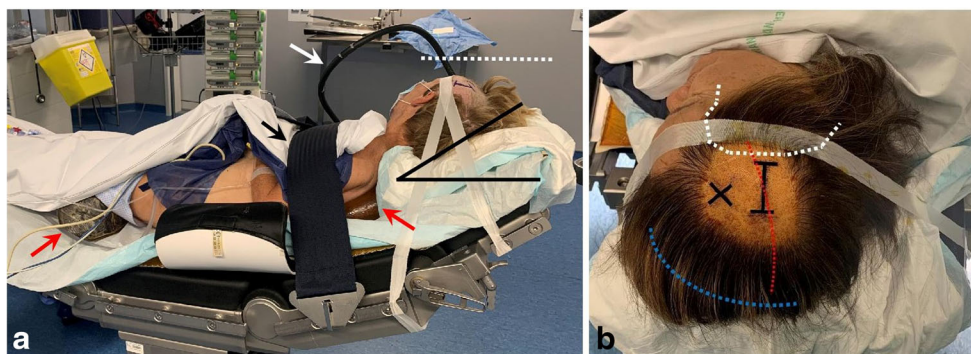
This article is part of the Topical Collection on *Brain trauma*

✉ Nathan Beucler  
nathan.beucler@neurochirurgie.fr

<sup>1</sup> Neurosurgery Department, Sainte-Anne Military Teaching Hospital, 2 boulevard Sainte-Anne, 83800 Toulon Cedex 9, France

<sup>2</sup> Ecole du Val-de-Grâce, French Military Health Service Academy, 1 place Alphonse Laveran, 75230 Paris Cedex 5, France

<sup>3</sup> Val-de-Grâce Military Academy, 1 place Alphonse Laveran, 75230 Paris Cedex 5, France



**Fig. 1** **a** Patient positioned in a reverse-Trendelenburg semi-seated position, a pad under the shoulder ipsilateral to the hematoma (red arrow) and under the knees. An adjustable belt (black arrow) secures the patient and an arch is placed near the head to ease breathing under the fields (white arrow). The head is rotated 90° to the opposite side and

tilted 30° (black angle) so that the incision is in a horizontal plane (white dotted line). **b** The incision (black line) is made just above the linea temporalis (white dotted line), along the coronal suture (red dotted line) which is felt under the skin. The median line is clearly located (blue dotted line)

an arch is positioned near the patient's head to give unobstructed view under the surgical drapes.

## Operating team

The anesthetist must be aware of the ongoing procedure but his physical presence is not necessary. The presence of an anesthesiology nurse is preferable for intraoperative management of hypertension. A soft anxiolytic therapy like hydroxyzine can be given shortly before the procedure. Preoperative anti-epileptic therapy (levetiracetam) can be used at the discretion of the neurosurgeon. A scrub nurse is not necessary, but a circulating nurse is mandatory to provide any supplemental material that the surgeon might need (Fig. 2) and to reassure regularly the patient under the surgical drapes.

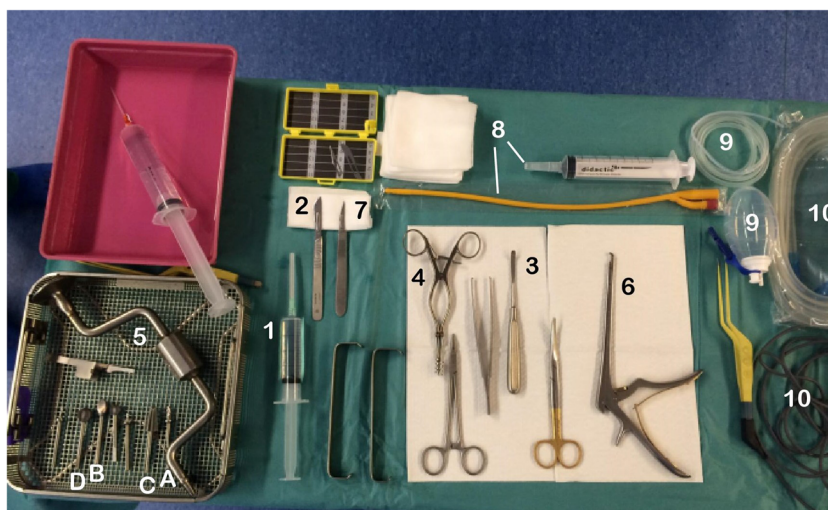
## Procedure (Fig. 3, video)

Local anesthesia of the scalp and pericranium using lidocaine plus 1% adrenaline is performed. Skin incision begins just

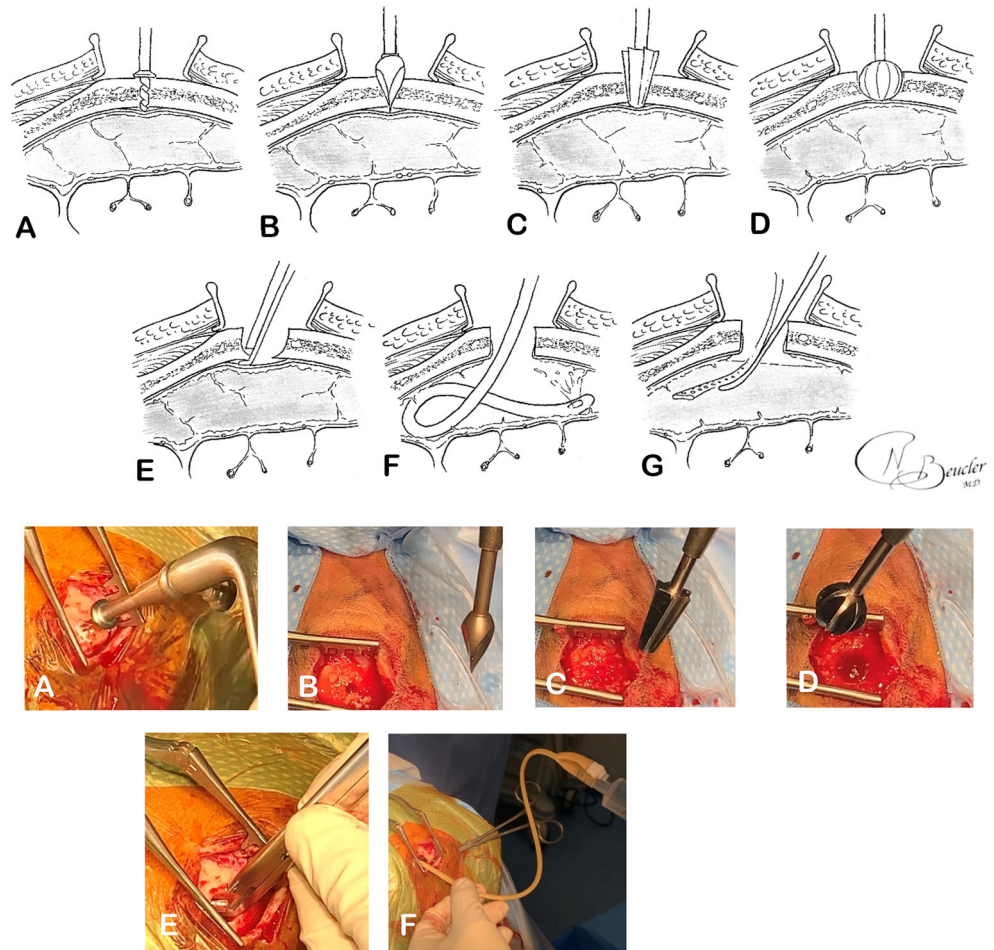
above the linea temporalis and runs vertically along the coronal suture for 3 to 4 cm, down to the bone. Specific attention is given to control scalp bleeding, then the pericranium is detached from the skull. The manual drilling of the skull begins with a metal tip until the inner cortical surface of the skull is breached. The craniotomy is continued with progressively larger drills (warhead-shape, then umbrella, and finally sphere). A Kerrison rongeur is used to enlarge the burr hole up to 1.5-cm diameter. Horsley's wax can be used for bone hemostasis.

The dura mater is coagulated and opened along with the outer membrane of the hematoma, which leads to spontaneous evacuation of the hematoma. Dura mater aggression is painful for the patient. At this moment, the surgeon's attention is of paramount importance as some patients might not react well to the sudden release of intracranial hypertension. This point should be discussed before the procedure with the circulating nurse whose role is to reassure the patient. A urinary catheter (diameter 16 Fr, 5.3 mm) connected to a 50-mL syringe is used for the thorough washing (1500 mL) of the subdural

**Fig. 2** Operating table: keep it simple! (1) Local anesthesia (lidocaine plus 1% adrenaline); (2) scalpel number 21; (3) Cobb periosteal elevator; (4) small Beckmann retractor; (5) manual craniotome with progressively larger drills [(A) metal tip, (B) warhead, (C) umbrella, (D) large sphere]; (6) Kerrison rongeur; (7) scalpel number 11; (8) urinary catheter (diameter 16 Fr, 5.3 mm) with 50-mL syringe; (9) Jackson-Pratt subdural drain (diameter 4 mm or 7 mm) with its bulb; and (10) suction and bipolar. A Halstead clamp may help for tunneling



**Fig. 3** Pencil drawings and corresponding intraoperative photographs. Manual burr hole is performed using progressively larger drills: **a** metal tip, **b** warhead, **c** umbrella, and **d** large sphere. **e** Then it is enlarged using a Kerrison rongeur. **f** Thorough washing of the subdural space is performed using a urinary catheter. **g** The Jackson-Pratt drain is inserted with the help of a Cobb elevator



space using warm saline solution until the flushing liquid appears clear [12]. This kind of catheter is long and smooth enough to perform atraumatic washing of the whole subdural space without compromising any bridging vein [1].

A Jackson-Pratt flat silicone drain is smoothly inserted rearwards. Making the drain slide against a thin Cobb elevator is sometimes helpful to find the appropriate angle of insertion [1, 2]. The drain is then tunneled using a Halstead clamp. If a Jackson-Pratt drain is not available, a urinary catheter can be used as well. Subcutaneous tissue is closed with absorbable individual stitches. Water is injected directly through the subdural drain before closing the last subcutaneous suture: this manoeuvre helps to reduce postoperative pneumocephalus (Fig. 4) [6]. The skin is closed with staples. The drain is secured to the skin and a purse string suture is added in anticipation of the drain removal; then it is connected to a bulb put on a gentle vacuum.

### Postoperative course

The patient remains 1 h in the monitoring room looking for an acute subdural hematoma or seizures. She resumes walking at day 1 with the help of the physiotherapist. The subdural drain

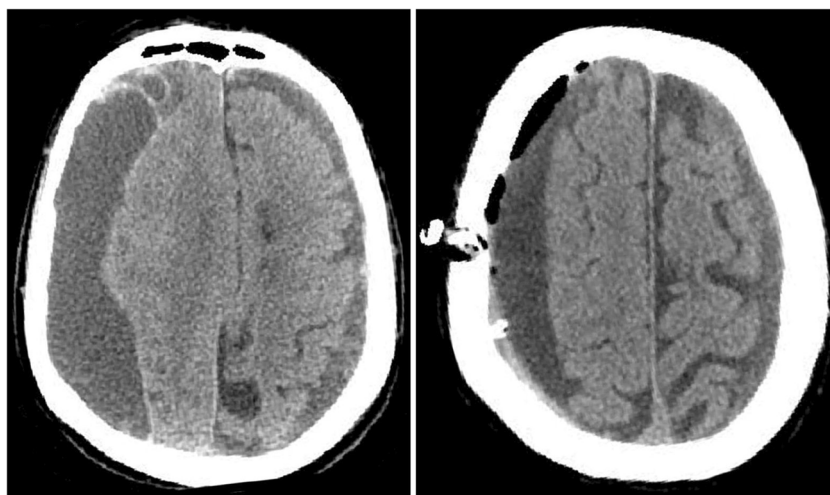
is removed 48 h after the procedure [10]. Deep venous thrombosis prophylaxis is not required unless the patient remains bedridden after the surgery; in such case, it is introduced after the removal of the drain [12]. We do not routinely perform a postoperative computed tomography (CT) scan of the head unless the patient's neurological status worsens [11]. We schedule a follow-up at 1 month. At that time, a CT scan is mandatory only if there is a need to resume any antiplatelet or anticoagulant therapy.

### Advantages of the technique

It usually takes much longer for older patients to recover from general anesthesia than for younger ones. With this in mind, BHE of symptomatic CSH could sometimes be performed under local anesthesia to ease the morbidity of the whole procedure.

Naturally, performing manual BHE of symptomatic CSH under local anesthesia is more demanding for the neurosurgeon and the surrounding team. For the neurosurgery resident, it is the occasion to learn to communicate with the team of the operating theater, to trust simple anatomical landmarks, and to simplify the procedure because of the transient effect of local anesthesia.

**Fig. 4** (Left) Preoperative CT scan of the brain displaying right chronic subdural hematoma. (Right) Postoperative CT scan of the brain shows a residual subdural collection with minimal pneumocephalus



As military neurosurgeons, we are trained to perform decompressive craniectomy with a manual cranial drill, a Gigli saw, and a rongeur on forward surgical teams. BHE of CSH using a manual craniotome constitutes the first step of this learning curve.

With regards to the facility's interests, the operative time of BHE under local anesthesia is no longer than "classic" BHE using a pneumatic or motor cranial drill. What is more, local anesthesia shortens the occupancy time of the operating room and enables immediate neurological improvement of the patient.

The surgical procedure exposed here is a modern revitalization of the original description of BHE by Horrax et al. in 1937 [2].

## Relative contraindications

BHE of CSH under local anesthesia presents inherent limits that may be deterrent in case of:

- anxiety of undergoing a fully awoken neurosurgical procedure;
- uncontrollable agitation;
- impaired consciousness with the necessity of securing the airways;
- a CSH encysted low at the level of the temporal muscle, because the surgical approach would be too painful;
- the need of performing a real craniotomy for wider exposure in case of CSH with multiples pseudomembranes or recurrent subdural hematoma; and
- bilateral subdural hematoma.

## Conclusion

BHE of symptomatic CSH under local anesthesia is a simple and reliable procedure. It is more easily supported by very old

patients. It is sometimes the only way to perform CSH evacuation in strained resource facilities. It is of great pedagogic interest for young residents. For military neurosurgeons, it is the first step toward the practical learning of manual decompressive craniectomy. For the abovementioned reasons, we think that this procedure should be taught to every young neurosurgery resident.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s00701-021-04818-y>.

### Take home messages

1. Manual burr hole evacuation under local anesthesia is useful in very old patients and strained resource facilities
2. Open discussion with the patient, the anesthesiology team, and the circulating nurse before the procedure is essential
3. Identify carefully the incision landmarks (linea temporalis, coronal suture)
4. A thorough local anesthesia is very important
5. Try not to waste time during manual cranial drilling
6. Dura mater coagulation and incision is painful
7. Be attentive to the patient's reaction after the sudden release of intracranial pressure
8. Fill the subdural space with water before closing the wound
9. Anticipate drain removal with a purse string suture
10. Talk to your patient during the whole procedure

**Authors' contribution** NB and AD conceptualized the article.

NN, AS, CB, and AD participated to the clinical care of the patient.

NN, AS, CB, and AD participated to the drafting of the manuscript.

NN, AS, CB, and AD participated to the literature review.

NN, AS, CB, and AD participated to the critical revision of the manuscript.

NB and AD participated to the final revision of the manuscript.

The pencil drawings were performed by N. Beucler.

## Declarations

**Patient informed consent** The patients who appear in the photographs and surgical video have been given the possibility to read the manuscript and have consented to the publication of this work.

This work has been conducted in accordance with the Declaration of Helsinki 1964 and its further amendment in 2013.

**Competing interests** The authors declare no competing interests.

## References

1. Beucler N, Sellier A, Joubert C, Desse N, Dagain A (2020) Early insertion of the subdural drain during chronic subdural hematoma surgery: in response to “Drain type and technique for subdural insertion after burr hole evacuation of chronic subdural hematoma” by TSR Jensen et al., *Acta Neurochirurgica* (Wien), 25 June 2020. *Acta Neurochir* 162(11):2711–2712. <https://doi.org/10.1007/s00701-020-04577-2>
2. Fichtner J, Beck J, Raabe A, Stieglitz L (2015) The Nelaton catheter guard for safe and effective placement of subdural drain for two-burr-hole trephination in chronic subdural hematoma: a technical note. *J Neurol Surg A Cent Eur Neurosurg* 76(05):415–417. <https://doi.org/10.1055/s-0034-1396435>
3. Horrax G, Poppen J (1937) The frequency, recognition and treatment of chronic subdural hematomas. *N Engl J Med*. <https://doi.org/10.1056/NEJM193703042160904>
4. Hulke (1883) Severe blow on the right temple, followed by right hemiplegia and coma, and then by spastic rigidity of the left arm; trephining; evacuation of inflammatory fluid by incision through dura mater; quick disappearance of cerebral symptoms; complete recovery. *Lancet*. 122(3141):814–815. [https://doi.org/10.1016/S0140-6736\(02\)23988-4](https://doi.org/10.1016/S0140-6736(02)23988-4)
5. Mahmood SD, Waqas M, Baig MZ, Darbar A (2017) Mini-craniotomy under local anesthesia for chronic subdural hematoma: an effective choice for elderly patients and for patients in a resource-strained environment. *World Neurosurg* 106:676–679. <https://doi.org/10.1016/j.wneu.2017.07.057>
6. Nakaguchi H, Tanishima T, Yoshimasu N (2000) Relationship between drainage catheter location and postoperative recurrence of chronic subdural hematoma after burr-hole irrigation and closed-system drainage. *J Neurosurg* 93(5):791–795
7. Raghavan A, Smith G, Onyewadume L et al (2020) Morbidity and mortality after burr hole craniostomy versus craniotomy for chronic subdural hematoma evacuation: a single-center experience. *World Neurosurg* 134:e196–e203. <https://doi.org/10.1016/j.wneu.2019.10.023>
8. Rand BO, Ward AA, White LE (1966) The use of the twist drill to evaluate head trauma. *J Neurosurg* 25(4):410–415. <https://doi.org/10.3171/jns.1966.25.4.0410>
9. Regan JM, Worley E, Shelburne C, Pullarkat R, Watson JC (2015) Burr hole washout versus craniotomy for chronic subdural hematoma: patient outcome and cost analysis. *PLoS One* 10(1):e0115085. <https://doi.org/10.1371/journal.pone.0115085>
10. Santarius T, Kirkpatrick PJ, Ganesan D et al (2009) Use of drains versus no drains after burr-hole evacuation of chronic subdural haematoma: a randomised controlled trial. *Lancet* 374(9695):1067–1073. [https://doi.org/10.1016/S0140-6736\(09\)61115-6](https://doi.org/10.1016/S0140-6736(09)61115-6)
11. Schucht P, Fischer U, Fung C et al (2019) Follow-up computed tomography after evacuation of chronic subdural hematoma. *N Engl J Med* 380(12):1186–1187. <https://doi.org/10.1056/NEJMc1812507>
12. Tahsim-Oglou Y, Beseoglu K, Hänggi D, Stummer W, Steiger H-J (2012) Factors predicting recurrence of chronic subdural haematoma: the influence of intraoperative irrigation and low-molecular-weight heparin thromboprophylaxis. *Acta Neurochir* 154(6):1063–1068. <https://doi.org/10.1007/s00701-012-1334-0>

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.