



# Minimally Invasive Surgical Approach for Treatment of Chronic Subdural Hematoma, Outcome in 1079 Patients

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## ABSTRACT

**AIM:** To present the authors' experience in treatment of chronic subdural hematoma (CSDH) by a minimally surgical percutaneous approach.

**MATERIAL and METHODS:** We relate our experience of mini-invasive evacuation of chronic subdural hematoma. Between May 2006 and December 2017, 1079 patients have been operated for percutaneous evacuation of chronic subdural hematoma. Prior to operation, the volume of hematoma was measured quantitatively by using a software for CT scan.

**RESULTS:** From May 2006 to December 2017, 1079 patients underwent mini-invasive percutaneous evacuation (MIPE). Of the 1079 patients, 994 (92.12%) became asymptomatic or improved clinically. Six weeks later, the scan revealed the hematoma had wholly disappeared in 699 (64.78%) of the cases. We had one postoperative abscess.

**CONCLUSION:** Treatment of CSDH using our MIPE technique is a safe method with satisfactory outcome and a good therapeutic alternative to the craniostomy.

**KEYWORDS:** Chronic subdural hematoma, Minimally invasive neurosurgery, Percutaneous evacuation

## INTRODUCTION

Chronic subdural hematoma (CSDH) is a commonly confronted entity in neurosurgery. It has a tendency to arise with an upper frequency in elderly patients. It is usually the result of a rupture in the cortical veins and usually related to benign or minimal head trauma that often goes unnoticed. It is more likely to appear in patients suffering from cerebral atrophy, alcoholism or those taking anticoagulants. The appraised incidence of CSDH is between 1.72 to 20.6 per 100.000 inhabitants according to various studies (1,2,3,10,22,30). It is more frequently observed in males than females (2,17,22,35). CSDH can manifest by a broad spectrum of signs and symptoms. These may range from a simple headache to gait disturbance, weakness and hemiparesis, memory disturbances, hemiparesis, impairment of memory, confusion, mental impairment, dizziness, epilepsy, even dementia-related deterioration, coma. Hence, we call it "the great imitator".

There is a large variance in treating CSDH which is approached in different ways by the various clinics and surgeons ranging from a simple burr hole to a large craniotomy (12-14,18,19, 21,23,27,28,32-34,36-39,41-43,48). In the last two decades, Twist-drill craniostomy (TDC) has been a minimally-invasive management addition to the treatment armamentarium for CSDH. Majority of currently published papers study a small group of patients (4-7,9,11,16,20,24-26,29,33,44-46,49).

The purpose of this paper is to present our experience in treatment of CSDH by a minimally surgical percutaneous approach.

## MATERIAL and METHODS

The study has been carried out retrospectively. Patients have been operated for percutaneous evacuation of chronic subdural hematoma over a period of 130 months, from

May 2006 until December 2017. We selected 1079 patients displaying signs and symptoms of CSDH operated using our minimally invasive technique. The signs and symptoms included headache, hemiparesis, gait disturbances, loss of balance, impaired memory, recurrent falls, confusion, drowsiness, mental disorder, weakness, dizziness, worsening of the general state, seizure (Table III). All patients had a CT scan. The Criterion for inclusion was; symptomatic patients, with chronic subdural hematoma diagnosed on CT scan images, exerting a mass effect on midline structures. Hematoma's chronicity was defined as being in crescent-moon shape appearance, hypodense fluid (Hounsfield Index between zero and 40) calculated by the machine during the initial CT exam. Patients with heterogeneous hematoma were excluded from the study. Of the 1079 patients, 410 were females and 669 were males with an average age of 74,89 (Table I, Figure 1). History of mild head trauma was obtained in the majority of cases. Other etiologies included anticoagulant therapy, abuse of alcohol, Von Willebrand's disease and liver failure.

### Surgical Procedure and Patients' Management

We quantified the volume of hematoma preoperatively through the Advanced Workstation software installed on the CT scan. All patients were operated using a percutaneous treatment technique under local anaesthesia. They were placed in supine position with raised shoulder on the side of the haematoma and the head turned towards the contralateral side. After the skin preparation, a skin incision was made only through the skin and subcutaneous tissue. This scar never exceeded 10 mm. Incision point was ensured to be in the middle of the hematoma (at its thickest point of hematoma) by calculating its extent of the hematoma on the CT scan. We preferred a 2 mm twist drill for perforating the skull.

For passing dura, we used a needle (Trocart) of 1.1 mm in diameter and 30 mm in length. Once we pierced dura, we slowly evacuated small amount of hematoma with a 20 ml syringe. We preferred evacuating hematoma in several steps to avoid causing an abrupt change in the intracranial pressure. To escape potential damage to the brain, we stopped the evacuation a few milliliters less than the amount of hematoma that the software calculated preoperatively. After 30 minutes of observation period in the recovery room, patients returned to their room. The postoperative observation is summarised as follow: Glasgow coma scale evaluation, neurological exam and monitoring of vital signs was done immediately after the surgery and thereafter, every four hours for 12 hours. Patients had a control CT scan the day after surgery. Discharge from hospital was on average two days after surgery. Patients were seen a week and six weeks after surgery with a check-up CT scan. Postoperative treatment was limited to simple analgesics. Patients were summoned to drink at least one litre a day. They received 2 litres I.V. infusion on the day of the surgery. Some received corticosteroid therapy for 2 or 3 days.

### Ethical Disclosure

This study was performed From May 2006 to December 2017 before the current regulation known as Jardé law that went into effect in November 18th 2016 (decree n° 2016-1537). According to the past Huriet law on biomedical research, and the law n°2004-806, non-interventional studies did not require prior submission or approval to/from an IRB, and they did not require written consent.

### RESULTS

Among the selected patients, 106 patients (9.82%) had bilateral subdural hematoma. A total of 994 patients (92.12%)

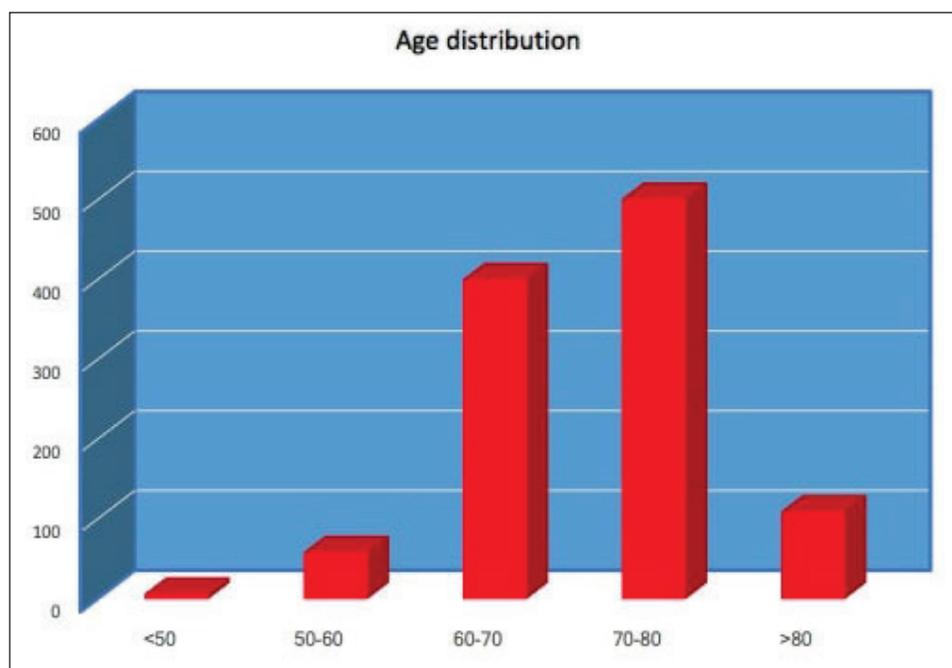


Figure 1: Age distribution.

became asymptomatic or were clinically improved. In 85 (8.88%) cases, no significant improvement was seen. No clinical worsening was recognized postoperatively. In 699 patients (64.78%) hematoma totally disappeared. Residual subdural hematoma less than five mm with no mass effect and no brain asymmetry was observed in 271 (25.12%) patients six weeks following surgery. 41 (3.74%) patients presented hematoma recurrence. Among them, 32 have been operated successfully for the second time by the same method. Nine were operated using trephine hole. In five patients (0.45%), postoperative pneumocephalus exerting significant masse effect was observed, requiring the second surgery.

In 269 patients, pneumocephalus was present on first day control CT scan without mass effect. Six weeks' control CT scan showed disappearance of pneumocephalus in 258 patients. Among the 1079 patients, the history of disease revealed a benign previous head trauma in 875 patients (81.07%).

Three patients died between the post-operative period and the date of the 6-week control visit. However, no direct link could be established between the deaths and CSDH.

Among the selected patients, 311 patients (28.82%) had anticoagulant treatment, 334 (30.95%) had a history of alcoholism and 22 (2.04%) were diagnosed with liver diseases or bleeding disorders (Table II, Figure 2).

Symptoms and signs are shown in Table III and Figure 3.

**DISCUSSION**

The treatment of chronic subdural hematoma is still controversial. There is still no general consensus on the issue in medical literature. The main treatment remains surgery. A wide spectrum of surgical techniques notably craniotomy, Trephine hole and Trepan puncture are used in order to simplify the procedure, and decrease the risk of complications in elderly patients with generally very high risk factors, we prefer using our techniques previously described (5-7,9,11-14,26,33,37-39,42,45,46,49). The main criterion for using our technique is CSDH with subdural hypodense lesion close to water density. Patients with recent re-bleeding component and asymptomatic patients were excluded and treated differently. Our results demonstrate that headache and gait disturbance as the more common clinical manifestations. A total of 875 patients (81.07%) had a history of previous trauma within the past two months. Forty one (3.74%) patients presented with hematoma recurrence, and 32 have been operated successfully for the second time by the same method. However, 9 were operated using trephine hole. Our surgical method is easily implemented in minimal time. The procedure does not exceed generally more than half an hour. It is performed under local anaesthesia and a mild sedation can be given if necessary. Three ml subcutaneous injection of lidocaine was performed in 456 patients. The size of incision is 10 mm. No subcutaneous bleeding was seen in patients. The length of hospital stay has declined (on average two versus five days). The same holds true for postoperative scar-related headache (on average two versus five for other surgical procedures). At six weeks'

**Table I:** Patients' Characteristics

	Male	Female	Total
	n (%)	n (%)	n (%)
Number of patients	669 (62.01)	410 (37.99)	1079 (100)
Mean age (years)	74.56	75.42	74.89

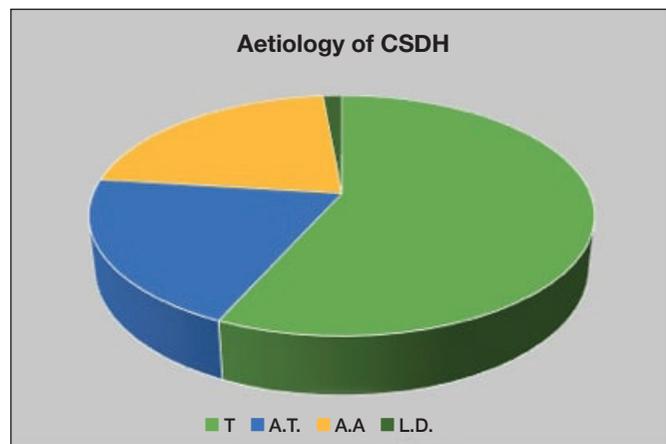
**Table II:** Aetiology of Patients with CSDH

Aetiology	n (%)
Trauma	875 (81.07)
Anticoagulant therapy	311 (28.82)
Alcohol abuse	334 (30.95)
Liver and bleeding disorders	22 (2.040)

*CSDH: Chronic subdural hematoma.*

**Table III:** Clinical Manifestations in Patients with CSDH

Symptoms	No. of patients (%)
<b>Single symptoms</b>	
Headache	665 (61.63)
Gait disturbance	551 (51.06)
Weakness + hemiparesis	350 (35.22)
Memory disturbances	342 (31.70)
Confusion	303 (28.08)
Dizziness	238 (22.01)
Consciousness disturbance	113 (10.47)
Psychic disturbance	87 (8.06)
Convulsion	29 (2.69)
Language impairment	21 (1.95)



**Figure 2:** Etiology of CSDH.

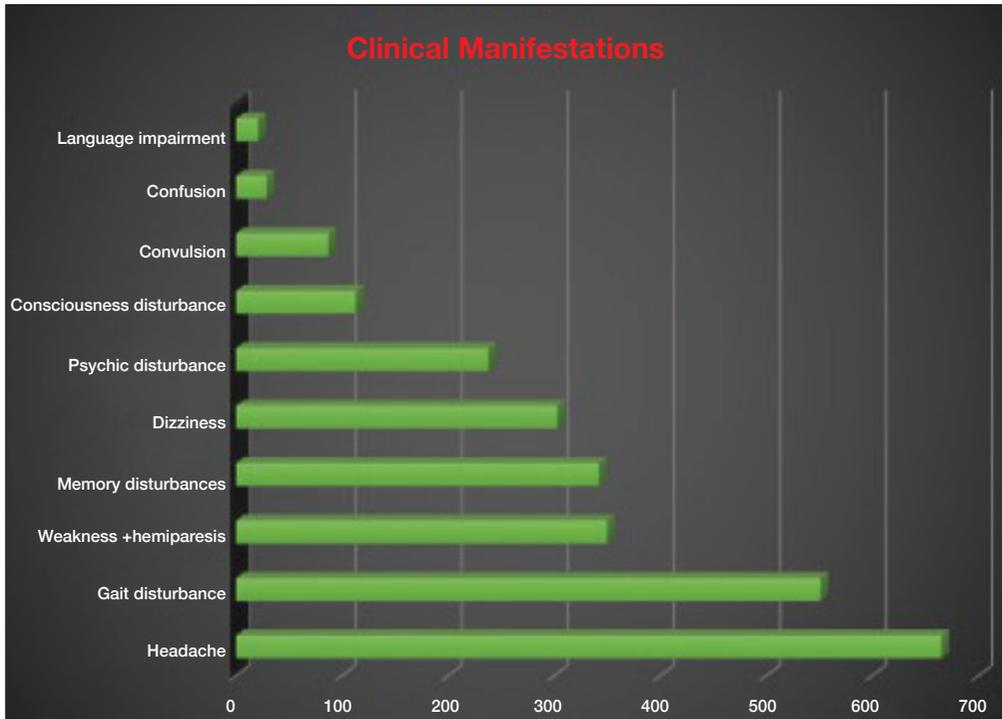


Figure 3: Clinical manifestations.

follow-up visit, 939 patients (87.03%) were clinically improved. Among them, 712 (65.99%) became totally asymptomatic. Although twist-drill craniostomy has been used for several years to treat CSDH, to the best of our knowledge, our paper

**Table IV:** Comparison Of Outcomes of BHC, TDC and Craniotomy from Four Systematic Reviews and Meta-Analyses with the Results of Our Method (VAE)

Authors & Year	Surgical Method	Cure Rate (%)	Recurrence (%)
Weigel et al., 2003 (47)	TDC	88.1	33
	BHC	79.1	12.1
	Craniotomy	67.8	10.8
Ducruet et al., 2012 (8)	TDC	93.5	28.1
	BHC	84.9	11.7
	Craniotomy	74.4	19.4
Chari et al., 2014 (7)	SEPS/hollow screw	77.6	22.4
Ivamoto et al., 2016 (15)	TDC	81.5	6.8
	BHC	82.5	10.9
Present Study	TDC + VAE	92.12	3.74

**BHC:** Burr hole craniostomy, **TDC:** Twist drill craniostomy, **VAE:** Volume adjusted evacuation

is the only study that provides the technique of quantifying the volume of hematoma before the surgery. We presented this technique for the first time in 2011, and used in 28 patients (33). Concerning recurrence rate for TDC, our study shows values below the average of the literature. Recurrence rate is 3.74% in our study. TDC series reported systematic reviews of Weigel et al. (33%), Ducruet et al. (28.1%), Chari et al. (22.4%) and comprehensive systematic reviews of Ivamoto et al. (6.8%) (7,8-15). The average duration of hospital stay (two days) in our study was lower than Smely et al. with 4.9 days for TDC and 9.6 days for BHC and also lower than Balsler et al. with 9.3 days for TDC, and 13.4 days for BHC (49,50). A comparison of outcomes of our method of TDC with volume adjusted evacuation (VAE) with the summarized data on the corresponding treatment groups from four systematic reviews and meta-analyses is summarized in Table IV.

**CONCLUSION**

TDC and volume adjusted gradual staged evacuation of CSDH up to a few milliliters less than preoperative calculated volume without supplementary procedures of irrigation and drainage is an effective and safe method for treatment of selected patient groups with hypodense chronic subdural hematoma.

The average duration of hospital stay, morbidity and mortality of our method was lower than other conventional surgical modalities.

It is conceivable that the volume adjusted evacuation reduces the rate of postoperative residual hematoma.

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