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Single-Center Comparison of Chronic Subdural Hematoma Evacuation Outcomes Under

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BACKGROUND: Chronic subdural hematoma (CSDH) is a neurosurgical pathology of an aged populace. Pathogenetic risk factors include traumatic brain injury, prolonged use of antiplatelet drugs, hypertension, and some inflammatory processes. The incidence increases as patients age. Burrhole evacuation is the most common approach in management of symptomatic cases. We compared evacuation of chronic subdural hematomas with general or local anesthesia (GA and LA, respectively) and evaluated the safety, economic benefits, effects of comorbidity, benefits, and shortcomings of both techniques.

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• METHODS: We conducted a retrospective study of 67 consecutive patients who had 74 procedures for CSDH in a single neurosurgical center, the Regional Clinic, Centre of Neurosurgery and Neurology, over a 3-year period. They were grouped into the GA group (n = 44) and LA group (n = 23). Mean duration of procedure, length of hospital stay, complications, and preoperative and postoperative neurologic statuses were compared. The distribution of nominal variables between groups was compared using the Fisher exact test. The average duration of operation and length of hospital stay were compared using the Mann-Whitney U-test due to violation of the normality assumption.

RESULTS: LA proved to be as effective as GA in CSDH evacuation. Seventy-four surgical procedures were performed on 67 patients due to recurrence in less than 30 days in 7 patients. Fifteen patients had tension pneumocephalus managed with fluid therapy to full recovery. LA was economical and required shorter hospital stays and surgical time.

CONCLUSIONS: In our studies, LA proved to be noninferior to GA, time conserving, and less prone to some of the adverse effects of GA on elderly patients with comorbidity, although some patients who are hyperactive or contraindicated to LA will require GA.

### INTRODUCTION

hronic subdural hematoma (CSDH) is a collection of broken-down blood products between the arachnoid and dura mater. It becomes chronic within 10 days from the first hemorrhage.<sup>1,5,7,9,10,16-18,36</sup> The incidence of CSDH is 2–20 per 100,000 people, with a 3:1 male-to-female ratio. CSDH is common in those aged older than 60 years as incidence increases with aging and is most often associated with multiple comorbidities.<sup>1,3,7,9,10,16-19,31</sup> Pathogenesis is associated with head trauma, long-term use of anticoagulants or antiplatelets, hemophilia disorder, uncontrolled hypertension in the elderly, and breakage caused by subclinical brain bridging-vein injury.<sup>2,4,5,7-10,16,17,31,36,41</sup> As the hematoma expands, it causes mass effect, producing variable clinical pictures including headache, nausea, vomiting, reduced consciousness, mental status change, aphasia, general weakness, sensory disturbance,

		103	
Key words	LA: Local anesthesia		
Blood thinners		105	
Comorbidity	From the <sup>1</sup> Medical Faculty, Uzhhorod National University, Uzhhorod, Ukraine; and <sup>2</sup> Municipal	107	
Complication	Non-Profit Enterprise "Regional Clinic, Center of Neurosurgery and Neurology" Transcarnathian Regional Council, Uzbhorod, Ukraine	108	
Elderly	Ta when correspondence about the addressed: Okara Emperual Urama, M.D.		
Tomography	[E-mail: druzomokoro@yahoo.com]	110	
Trauma	Citation: World Neurosurg. (2024).	III	
Abbreviations and Acronyms	https://doi.org/10.1016/j.wneu.2023.12.116	112	
CSDH: Chronic subdural hematoma	Journal homepage: www.journals.elsevier.com/world-neurosurgery	113	
CT: Computed tomography	Available online: www.sciencedirect.com	114	
GA: General anesthesia GCS: Glasgow Coma Scale	1878-8750/\$ - see front matter © 2023 Elsevier Inc. All rights reserved.	115 116	

gait disturbance, and seizures.<sup>5,6,10,11,13,16,17,30,32</sup> These symptoms in combination with any of the pathogenesis in an elderly patient are an indication for head computed tomography (CT), which is the gold standard for diagnosing CSDH. Accurate patient history taking is vital in the diagnosis, management, and prognostics of CSDH.<sup>5,7,8,18,20,25,30,36</sup> All symptomatic CSDH is surgically evacuated through 2 burr holes or 1 burr hole, with or without drains, and general anesthesia (GA) or local anesthesia (LA).<sup>13,5,10,13,15,17-19,24,28-30,35,40</sup>

Surgical evacuation of CSDH, a familiar procedure to neurosurgeons, is indicated by neurologic symptoms such as focal deficits, CT head scan image with a midline shift >5 mm, or significant blood volume with diameter >15mm.<sup>4,8,10,13,14,18,19,22,25,6,39</sup>

Risk factors of CSDH are subclinical head trauma in the elderly, prolonged use of antiplatelets or anticoagulants due to comorbidities like ischemic heart disease, atrial fibrillation, atherosclerosis, and brain atrophy.<sup>1,4,10,16,30,31,33,41</sup> Although CSDH is a common pathology, there is still no consensus on a management plan; different authors advocate for pharmacotherapeutic versus surgical treatment, I burr hole versus 2 burr holes, with a drain versus without a drain, and GA versus LA.<sup>1-4,6,8,10,13,15,18-21,28,29,37,40</sup>

Due to comorbidities associated with most aged patients and CSDH, the proper choice of anesthesia is crucial for individual patients.<sup>1,3,4,9,1,8,19</sup> In this retrospective study, we compared 2 groups of patients operated on with 1 or 2 burr holes for CSDH using GA or LA. We considered associated comorbidities, brain

reexpansion, postoperative tension pneumocephalus, length of hospital stay, time to rehabilitation, and preoperative and postoperative Glasgow Coma Scale scores.

### **MATERIALS AND METHODS**

From January 2020 to December 2022, a total of 67 consecutive patients with CSDHs underwent surgical treatment, with the exclusion of patients who were managed conservatively or those with acute subdural hematoma. Due to recurrence within 30 days, the total number of procedures conducted was 74. All patients included in the study had unilateral or bilateral CSDH. Patients were divided into 2 groups: a general anesthesia (GA) group (n =44) and a local anesthesia (LA) group (n = 23). Patients in the GA group were administered propofol, fentanyl, and atracurium, while those in the LA group were given anxiolytics (diazepam), and the area of incision was locally infiltrated with 2% lidocaine (6-10 mL). The surgical site was sterilized and draped, and an incision and burr hole were placed in the appropriate location. The dura was fenestrated, and the hematoma was evacuated. A passive drain (part of a disposable infusion set) was inserted subdurally, draining into the dressing gauze, and the scalp was sutured. Brain CT scan was performed on most patients within 24 hours postoperatively, and the clinical picture served as criteria for drain removal. We compared time of surgery, length of hospital stay, preoperative and postoperative Glasgow Coma Scale (GCS) scores, preoperative and postoperative neurologic statuses, and

Table 1. Demographic, Morbid	ity, and Risk Fact	ors			
Assessment Criteria	Group GA (n = 4		o GA (n = 44)		Group LA (n $=$ 23)
Age (mean $\pm$ standard deviation)		5	8.6 ± 16.1		63.7 ± 16.1
Age range		13	3-83 Years		22-88 Years
Gender fraction		27% (12) Female 73% (32) Male		17% (4) Female 83% (19) Male	
Comorbidity	Group GA	( <i>n</i> = 44)	(	Group LA ( <i>n</i> = 23)	Total ( <i>n</i> = 67)
Cardiovascular	93.1%	(41)		95.6% (22)	94% (63)
Hepatic	0%	(0)		8.7% (2)	3% (2)
Diabetes mellitus	6.8%	(3)		13% (3)	9% (6)
Psychiatric	4.5%	(2)		4.3% (1)	4.4% (3)
Respiratory	2.2%	(1)		8.7% (2)	4.4% (3)
Multitrauma	4.5%	(2)		0% (0)	3% (2)
Oncology	2.2%	(1)		0% (0)	1.5% (1)
Risk factors in anamnesis		Group GA (n	= 44)	Group LA ( $n = 23$ )	Total ( <i>n</i> = 67)
Head trauma		32% (14)		18% (4)	27% (18)
Prolonged use of anticoagulant/antipla	atelets	9% (4)		30% (7)	16% (11)
Head trauma, anticoagulant and antip	latelet use	59% (26)		52% (12)	57% (38)

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postoperative complications (recurrence and tension pneumocephalus) in the LA group versus the GA group.

### RESULTS

Sixty-seven patients with CT-confirmed CSDH were operated on in our single center over a 3-year period. The patients were in 2 groups: GA patients (n = 44) and LA patients (n = 23). Seven patients were reoperated on due to recollection of hematoma in less than 30 days; 5 patients had CSDH recurrence in >30 days; and 10 patients had bilateral CSDH. Seven were in the GA group, Q3Q4 and 3 were in the LA group (Table 3). Mean age was GA = 59 (70) years and LA = 64 (66), and age range was GA = 13-83 years and LA = 22-88 years. Gender was as follows: GA = 27% (12) female, 73% (32) male, LA = 17% (4) female, 83% (19) male (see Table 1).

The mean duration of operation was higher in the GA group  $(73.4 \pm 48.1 \text{ vs. } 53.8 \pm 18.9 \text{ min})$ , although the difference is not of statistical significance with a P value of 0.37 (see Table 3). Length of hospital stay was more for GA patients with a mean of 7.6 days compared with LA patients with a mean of hospital stay of 3.1 days. The mean cost for GA group patients was \$243, while the mean cost for LA group patients was \$26, considering only the cost of anesthetic drugs. Longer hospital stay would also influence the cost. According to our series, Markdwalder grading score of the LA patients was mostly o on day 1 postoperative (see Table 2).

In our series, 18 patients had only head trauma in anamnesis, 11 had prolonged use of blood thinners, and 38 had both prolonged use of blood thinners and head trauma in anamnesis, which was the most viable risk factor. Most patients aged older than 60 had comorbidities, although they were not a contraindication for surgery. The older the patients, the higher the risks and comorbidities (see Table 1). Diabetes, hypertension, atherosclerosis, atrial fibrillation, and ischemic heart disease with prolonged use of blood thinners are the most common comorbidities forcing the surgeon and anesthesiologist to consider LA over GA to minimize risk.

Postoperative outcome was similar in both groups. The most common complications experienced were recollection of hematoma requiring reoperation within 30 days and tension pneumocephalus. Pneumocephalus was managed with fluid therapy, 2000 mL postoperative day 1, and oral water intake from day 2. Recurrence was observed in 5 patients more than 30 days post operation; they presented with neurologic symptoms and required reoperation. Most patients were admitted with specific neurologic symptoms: hemiparesis, headache, general weakness, and aphasia, with GCS scores ranging from 12–15 points and Markwalder score 1–2. All 67 cases were discharged with Markwalder score 0 and GCS score 15, except for 2 patients discharged with GCS scores 13 and 14 to another medical department to continue treatment (see Table 3).

### DISCUSSION

Evacuation of symptomatic CSDH is a common procedure for neurosurgeons, with no consensus on the best type of anesthesia for this procedure.<sup>3,6,8,10,13,18,25,32,33,36</sup> On the basis of the literature, authors have suggested local anesthesia in contrast to general anesthesia, basing their choice on the effectiveness of LA over GA. Less time of operation, benefits of LA with elderly patients aged older than 65 years in relation to comorbidity, economic benefit, minimal intensive care unit stay, cough reflex that helps brain reexpansion, and hospital stay time are the benefits of LA. GA is recommended for patients with contraindications to LA (e.g., lidocaine intolerance or patients).<sup>1,4,18,19,24,25,30,31</sup> overagitated Postoperative complications are similar in both groups. While reviewing available literature and our series, it was found that when there is an age-associated risk or comorbidity that is a contraindication to GA, LA is most preferable. It is important to use anxiolytics (diazepam) or mild sedatives when LA is chosen.<sup>3,11,18,21,31,32,34</sup> The preference for LA is recommended, especially in lowincome countries with few resources and emergency cases. It is a familiar procedure for military doctors who work in the field.<sup>3,19,25</sup> Brain reexpansion and pneumocephalus in some patients postoperatively were managed with fluid therapy of 2000-3000 mL on postoperative day 1 and continued oral intake from day 2. Passive drains are important for at least 8 hours

Table 2. Clinical Presentation						
Clinical Presentation	Group GA (n = 44)	Group LA (n $= 23$ )	Total (n = 67)			
Hemiparesis	91% (40)	78% (18)	87% (58)			
Aphasia	30% (13)	26% (6)	28% (19)			
Headache	93% (41)	83% (19)	90 (60)			
General weakness	82% (38)	65% (18)	84% (56)			
Memory impairment	25% (11)	9% (2)	19% (13)			
Seizures	7% (3)	9% (2)	7% (5)			
Nausea	46% (20)	35% (8)	42% (28)			
Bilateral chronic subdural hematoma	30% (7)	13% (3)	15% (10)			
Preoperative Glascow Coma Scale	<15 = 7 (30.4%)	<15 = 3 (13%)	15% (10)			
Preoperative Markwalder's Neurologic Scale	>1 = 38 (86.4%)	>1 = 15 (65.2%)	79% (53)			

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Group GA (n = 44)	Group LA (n $=$ 23)	Statistical Significance
73.4 ± 48.1	53.8 ± 18.9	U = 439, P = 0.37
$7.6\pm6.03$	3.1 ± 2.63	U = 163, P = 0.01
Group GA (n = 44)	Group LA (n $= 23$ )	Statistical significance
11% (5)	9% (2)	P = 1
7% (3)	9% (2)	P = 1
27% (12)	13% (3)	P = 0.231
<15 = 2	<15 = 0	P = 0.541
>0 = 2	>0 = 0	P = 0.541
10-48 hours	8-24 hours	
	Group GA (n = 44) $73.4 \pm 48.1$ $7.6 \pm 6.03$ Group GA (n = 44)           11% (5)           7% (3)           27% (12)           <15 = 2	Group GA (n = 44)Group LA (n = 23) $73.4 \pm 48.1$ $53.8 \pm 18.9$ $7.6 \pm 6.03$ $3.1 \pm 2.63$ Group GA (n = 44)Group LA (n = 23) $11\% (5)$ $9\% (2)$ $7\% (3)$ $9\% (2)$ $27\% (12)$ $13\% (3)$ $<15 = 2$ $<15 = 0$ $>0 = 2$ $>0 = 0$ $10-48$ hours $8-24$ hours

after an operation. In our series we used passive drains, freely draining into the dressing gauze for 10-48 hours in the GA group and 8-24 hours in the LA group.<sup>12,15,21,23,29</sup> Recurrence of CSDH after surgical evacuation is common, for some in less 30 days and for others in more than 30 days. Continuous use of blood thinners and early return to the use of blood thinners in elderly patients with high-risk comorbidities like hemophilia, atrophied brain parenchyma, and hepatic disorders are the outstanding risk factors of CSDH recurrence and postoperative outcome.<sup>2,3,9,14,16,23,28,31,33,37</sup> A follow-up brain CT scan is recommended for patients older than 65 years of age and those with elevated risk factors.<sup>4,5,7,12,14,37,38,41</sup> We recommend a larger

patient study on the noninferiority of LA to GA in patients with symptomatic CSDH surgical intervention.

### **CONCLUSIONS**

LA has proven to be as effective as GA, with the advantage of time conservation and overcoming most adverse effects of GA on elderly patients with comorbidity. However, some patients who are hyperactive or have a contraindication against LA will require GA. More patients should be managed with LA, considering its affordability and better efficiency in the field. Quick activation of



operated on under general anesthesia. (A) Preoperative, showing bilateral chronic subdural evacuated hematoma and pneumocephalus (yellow arrow, left-side single burr hole).

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hematoma (CSDH), causing a midline shift toward the

left. (B) Postoperative, showing evacuated CSDH. (C)

pneumocephalus (yellow arrow, right-side burr hole).

Preoperative, showing right-side CSDH. ( $\mathbf{D}$ )

**UNCITED REFERENCE AND FIGURES** 

Postoperative, showing evacuated CSDH and

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