The Optimal Surgical Approach for Treatment of Chronic Subdural Hematoma: Questionnaire Assessment of Practice in Iran and Review of Literature

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Abstract- Chronic subdural hematoma (CSDH) is a curable entity frequently encountered by neurosurgeons. The present study was conducted to explore expert opinion and common practice in Iran. Besides, a Review of randomized clinical trials in literature was performed. A questionnaire including six questions discussing major aspects of practice on CSDH, with multiple choices was designed. A pilot study was performed for reliability analysis of the questionnaire. A total of 100 neurosurgeons were selected randomly from the members of Iranian Association of Neurological Surgeons. Frequency of answers to each item, differences in response rates and correlation of various categories were analyzed using Chi-square statistics. The mean duration of experience was 15.4 ± 5 years, with a range of 10 to 37 years. The most common initial procedure of choice was burr-hole drainage (64%). At recurrent cases, surgical approach was changed to craniotomy at one-third of those treated initially with burr-hole drainage. The participants believed that surgical technique was predictive of outcome and recurrence. Burr-hole without drainage was used by less expert neurosurgeons (mean 12.5 ± 6), however, burr-hole drainage was the dominant technique at more than 15 years of experience and craniectomy was used only by participants with more than 30 years of experience (10%). Irrigation was used by most of the neurosurgeons (87.5%) in combination with drainage and burr-hole. The majority of participants used flat position at the postoperative period. At the current study, the pattern of management for CSDH was similar to other reports at literature suggesting the burr-hole drainage and irrigation as optimal treatment. Individualized decision-making could be made at challenging cases.

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Introduction

Chronic subdural hematoma (CSDH) is clinically defined as a hematoma lasting for more than three weeks, which looks hypodensity on computed tomography scan (1). The main risk factor is old age and it usually appears after minor head trauma. With improved quality of life in Iran, the incidence of CSDH will further increase at elderly individuals.

CSDH is one of the most common entities requiring intervention in neurosurgery. It is a curable disease and has low morbidity and mortality rates, but high rates of recurrence challenge treatment options (2). Since 1857 that Virchow described the disease, several surgical methods are described including craniotomy with membranectomy; twist drill craniostomy and burr-hole carniostomy. These approaches can be combined with subdural drainage and/or irrigation (2).

The optimal surgical approach for the treatment of chronic subdural hematoma is challenging (3-5). Several randomized trials are conducted, but the results are not concordant (1,4-14,15). According to the systematic review by Weigel *et al.*, using drainage may improve the outcome and burr-hole craniostomy is the optimal approach for the treatment of CSDH (2). Since the publication of this study, new well-designed trials are conducted, and now the result may be different (4-

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9,12,16).

At first, a systematic review and then a randomized trial were previously conducted by authors to find the response for the optimal approach. The aim of the present study, as the third phase of the survey, is organizing expert opinion on the optimal management of CSDH. Furthermore, a review of randomized trials is performed.

Materials and Methods

Considering controversies present at literature on the optimal management and outcome of CSDH, a questionnaire was designed, which included the followings: 1) the choice of surgical approach at primary cases, 2) use of drainage, 3) use of irrigation, 4) management of recurrent CSDH, 5) role of postoperative position (flat vs. upright) at the outcome, 6) role of diameter of the created hole at the outcome. The years of experience as a neurosurgeon were also recorded. The format of the questionnaire was multiple choices, with squares to mark. The pilot study was performed with 20 expert participants selected to fill in the questionnaire and repeat this again one month later, for reliability analysis of the questionnaire. Cronbach's alpha was 0.21.

The first question was about the procedure of choice for initial treatment, including burr-hole with and without drainage, craniotomy, trephine and "other". The next questions were on the role of irrigation, surgical technique, the diameter of the hole, and the postoperative position at the outcome of CSDH. The outcome was defined as morbidity, mortality, and recurrence. The last question asked about the preferred technique for treatment of recurrent CSDH.

Participants were 100 neurosurgeons, selected randomly from members of Iranian association of neurological surgeons. The frequency of answers to each item was analyzed using SPSS version 17. Differences between various categories were evaluated using Chi-square statistics. Statistical significance was considered as $P<0.05$.

Results

The mean duration of experience was 15.4 ± 5 years, with a range of 10 to 37 years. The most common initial procedure of choice was burr-hole drainage (64%), and a craniotomy was performed only by one neurosurgeon. At recurrent cases, craniotomy and aspiration puncture of the previous site, both constituted 25% of procedures, and burr-hole drainage was used at 45% of cases (Figure1).

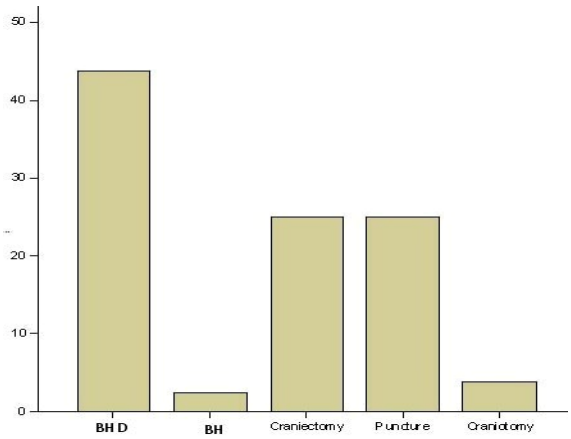

Figure 1. Surgical procedure of choice for recurrent chronic SDH

At recurrent cases, surgical approach was changed to craniotomy at 28% of those treated initially with burr-hole drainage. Comparing the answers for initial and recurrent cases, a significant difference was detected (*P*. value <0.001).

The participants believed that surgical technique was predictive of outcome and recurrence (82.5%). Considering the diameter of the hole for the evacuation of hematoma, less than half of the neurosurgeons (44%) believed that there was no relation with the outcome, and so, craniostomy and craniotomy had similar effects. Burr-hole without drainage was used by less expert neurosurgeons (mean 12.5 ± 6), however, burr-hole drainage was the dominant technique at more than 15 years of experience and craniectomy was used by participants with more than 30 years of experience

(10%).

Irrigation was used by most of the neurosurgeons (87.5%) in combination with drainage and burr hole. The majority of participants used flat position at the postoperative period (66%) and believed that upright position will increase the rate of recurrence.

Discussion

Iranian neurosurgeons preferred burr-hole combined with subdural drainage and irrigation at initial and recurrent cases. A craniotomy was mostly used at recurrent cases and by expert neurosurgeons. The flat position was believed to reduce the rate of recurrence, but there was a lack of consensus on the role of the diameter of the hole, installed for hematoma evacuation. They believed in neurosurgical technique as the main factor influencing the outcome.

Craniotomy was previously used for treatment of CSDH, but further studies revealed that burr-hole seems to be optimal and since 1980s burr-hole became the dominant technique for treatment of CSDH, either initially or at recurrences (2). Burr-hole craniostomy is also the safest mode of treatment, with fewer complications (2). Membrenectomy associated with craniotomy doesn't seem to improve the outcome since the hematoma itself is the cause of chronicity (12). Hematoma contains vasoactive cytokines, VEGF, fibrinolytic agents and inflammatory factors 17. Tissue plasminogen activator is also secreted from hematoma membrane, and it liquefies hematoma (12,17,18).

Several clinical trials have compared techniques with and without subdural drainage (4,7,9,11,14,19,20). It seems that drainage and irrigation are not the main factors involved at the outcome of CSDH and mostly are confounders (9). Drainage has some complications including incomplete drainage, hemorrhage and seizure (4,11). Also prolonged duration of drainage can cause infection and two days of drainage seems to be enough and safe (8).

Irrigation may reduce fibrinolytic activity and decrease rate of recurrence (5,12). Those contradicting irrigation believe that pneumocephalus would happen after irrigation, and this could be the main risk factor of recurrence (1,6,7,11). In Twist drill craniostomy, the cavity is not irrigated at all and only closed drainage is maintained, so that no air could enter the cavity and pneumocephalus be prevented (6,7,10). The outcome is comparable with burr-hole irrigation using the aforementioned technique. Some imply that irrigation lowers intracranial pressure rapidly causing endothelial damage and increased recurrence. Continuous irrigation may decrease recurrence in comparison with temporary one, as evaluated by Ram *et al*., (1).

Most of the participants believed in keeping flat position at the postoperative period. Well conducted clinical trials recommend that upright position can be maintained when necessary such as pulmonary disease without significant effect on the outcome (13).

The common idea of neurosurgeons in Iran is that surgical technique predicts the outcome of CSDH. This idea has been assessed in several clinical trials (Table 1). Some studies detected no difference at the outcome between groups (4,9,11) but others were in favor of using drainage (14,19,20). Patients were also randomized for the duration of drainage without proving any benefits for prolonged drainage but more complications (8). Irrigation itself made no difference at recurrence rates (16) but the duration of irrigation seemed to be an important predictor (1). Irrigation with thrombin solution detected less recurrence than saline irrigation, esp. at high-risk patients receiving antiplatelet medications (18). The latest studies compared the outcomes of twist-drill craniostomy and burr-hole drainage, which were in favor of better outcomes at TDC without irrigation (6,7,12,21).

Lega *et al.,* conducted a decision analysis on existing data and made some recommendations (30). Burr-hole craniostomy was the most efficient modality for surgical drainage of uncomplicated CSDH with low recurrence rate and low rate of complications (30). They also concluded that postoperative drainage may improve outcome. However, no significant differences existed to support the role of drainage or irrigation. Considering TDC, there was insufficient data for the conclusion (30). Almenawer *et al.,* designed a systematic review and analyzed the data of 34829 patients from 250 studies (31). They concluded that percutaneous bedside twist-drill drainage was a relatively safe and effective first-line management option. These findings may result in potential health cost savings and eliminate perioperative risks related to general anesthesia (31).

A survey from Canada reported similar results (3). Canadian neurosurgeons preferred burr-hole craniostomy for initial management and craniotomy was preferred for recurrent cases. Surgeons preferred irrigation and use of a subdural drain, but no corticosteroids. There was a lack of consensus with the prolonged postoperative supine position. Another study from the United Kingdom reported somehow different management patterns (15). The optimal technique was burr-hole evacuation, but most surgeons preferred not to

place a drain. However, diverse practices were demonstrated due to lack of evidence.

Table 1. Summary of trials comparing outcomes at different surgical techniques

	Year	Author	Number of cases	Compared surgical techniques at study groups
1	1989	Laumer [11]	96	Burr-hole with and without drainage. Irrigation was performed at both techniques
2	1990	Wakai [20]	38	Burr-hole with and without drainage. Irrigation was performed at both techniques
3	1993	Ram [1]	37	Continuous irrigation with temporary one-time irrigation at burr-hole drainage technique
4	1993	Hamilton [22]	92	Craniotomy with burr hole. Irrigation was performed
5	1997	Tsutsumi [19]	118	Burr -hole with and without drainage. Irrigation was performed at both techniques
6	1997	Smely [23]	66	Twist-drill craniostomy and burr-hole irrigation.
7	1999	Hennig [24]	137	Continuous irrigation with temporary one-time irrigation at burr-hole technique
8	2001	Kuroki [10]	101	Strict closed-system drainage with burr-hole drainage-irrigation.
9	2002	Nakajima [13]	46	Supine and sitting position at burr-hole without drainage.
10	2002	Okada [14]	40	Burr-hole drainage without irrigation and burr-hole with irrigation
11	2005	Horn [25]	79	Twist-drill craniostomy and burr-hole irrigation.
12	2005	Miele [26]	44	Head flat and head elevation at Twist-drill craniostomy
13	2005	Erol [4]	70	Burr-hole irrigation with and without irrigation
14	2005	Muzii [12]	47	Twist-drill craniostomy and burr-hole drainage irrigation.
15	2007	Kiymaz [27]	50	Burr-hole without irrigation
16	2007	Gurelik [7]	80	Twist-drill craniostomy and burr-hole drainage irrigation.
17	2008	Gokmen [6]	70	Twist-drill craniostomy and burr-hole drainage irrigation.
18	2008	Zakaraia [16]	82	Burr-hole drainage with and without irrigation
19	2009	Ishfaq [28]	60	Head elevation and head flat at burr-hole
20	2009	Santarius [5]	215	Burr-hole with and without drainage
21	2009	Shimamura[18]	79	Irrigation with saline and thrombin at burr-hole drainage
22	2009	Lee [29]	87	One burr-hole, two burr-holes and small craniotomy, all with drainage
23	2010	Ibrahim [8]	65	Twist-drill craniostomy
24	2011	Javadi [9]	40	Burr-hole irrigation with and without drainage

The limitation of the current study may be a lack of assessment of corticosteroid therapy. Corticosteroids may suppress vascular endothelial growth factor, inflammatory and fibrinolytic processes to reduce recurrence, but no randomized trial is available, and the role of steroids is not well defined (32,33).

In the current study, the pattern of management for CSDH was similar to other reports at literature suggesting the burr-hole drainage and irrigation as optimal treatment. Individualized decision-making could be made at challenging cases.

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