

Clinical Article



Burr Hole Drainage versus Small Craniotomy of Chronic Subdural Hematomas

Yong Woo Shim , Won Hee Lee , Keun Soo Lee , Sung Tae Kim ,
Sung Hwa Paeng , and Se Young Pyo

Department of Neurosurgery, Inje University Busan Paik Hospital, Busan, Korea



Received: May 23, 2019
Revised: Aug 31, 2019
Accepted: Sep 2, 2019

Address for correspondence:

Won Hee Lee

Department of Neurosurgery, Inje University
Busan Paik Hospital, 75 Bokji-ro, Busanjin-gu,
Busan 47392, Korea.
E-mail: ywh9868@hanmail.net

Copyright © 2019 Korean Neurotraumatology Society

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ORCID IDs

Yong Woo Shim
<https://orcid.org/0000-0002-9364-0976>
Won Hee Lee
<https://orcid.org/0000-0002-3112-5354>
Keun Soo Lee
<https://orcid.org/0000-0002-3537-3080>
Sung Tae Kim
<https://orcid.org/0000-0002-3737-3850>
Sung Hwa Paeng
<https://orcid.org/0000-0002-8903-9117>
Se Young Pyo
<https://orcid.org/0000-0002-6578-6361>

Conflict of Interest

The authors have no financial conflicts of interest.

ABSTRACT

Objective: Chronic subdural hematoma drainage is one of the most common procedures performed in neurosurgical practice. Not only burr hole drainage but also small craniotomy (diameter 3–5 cm) is frequently used neurosurgical treatment of chronic subdural hematomas. We assessed to compare the postoperative recurrence rates between burr hole drainage versus small craniotomy with closed-system drainage for chronic subdural hematomas.

Methods: From January 2016 to December 2018, 75 patients who were treated with burr hole drainage and small craniotomy with closed system drainage for the symptomatic chronic subdural hematoma were enrolled. Pre and postoperative computed tomography (CT) were used for radiologic evaluation. The choice of procedure was decided by preoperative CT images.

Results: 60 patients out of 75 patients underwent burr hole drainage, whereas 15 patients underwent small craniotomy. The overall postoperative recurrence rate was 16%. The recurrence occurred in 8 patients out of 60 patients in burr hole drainage group (13.3%) and 7 patients out of 15 patients in small craniotomy group (46.7%). The number of days of hospitalization was 10.3 days in burr hole drainage group and 15.7 days in small craniotomy group.

Conclusion: Burr hole drainage would be sufficient to evacuate chronic subdural hematoma with lower recurrence rate, but small craniotomy was also needed in some cases such as hematoma has solid portion or multiple septum.

Keywords: Chronic subdural hematoma; Trephining; Craniotomy; Recurrence

INTRODUCTION

Chronic subdural hematoma is common in the elderly, with a rate of 1–2 per 100,000 population at age 60 and 7.4 at age 70.⁴⁾ About 80% of patients have head trauma, and most have mild trauma. Treatment consists of pharmacologic therapy and surgical therapy. Pharmacologic therapy includes steroid administration, and anticonvulsant drugs, hyperosmolar solutions such as mannitol, and hyperosmolar treatment, and diuretic can cause water and electrolyte imbalance.

Surgical treatment includes craniotomy, trephination, burr hole drainage, twist drill perforation.^{1,3,16,17)} The recurrence rate of chronic subdural hematoma was 3.0–37.0%.^{6,7)} The recurrence risk factors were age, brain atrophy, large hematoma, septum formation in

subdural hematoma, alcohol, anticoagulant, renal failure, malignant tumors, and metastasis in the dura mater.^{12,13} It is known that there is a high-risk of recurrence that has accumulated air in hematoma space.^{17,18} In this study, we analyzed the recurrence rate and number of hospitalization days of patients with chronic subdural hematoma in both of burr hole drainage group and small craniotomy group.

MATERIALS AND METHODS

Seventy-five patients who underwent surgery with chronic subdural hematoma in our hospital from January 2016 to December 2018. Patients with risk factors of recurrence such as previous history of ventriculoperitoneal shunt placement, hepatic failure, renal insufficiency, or anticoagulant therapy¹⁵ were excluded. As retrospective chart review study, it was granted by the Institutional Review Board of Inje University Busan Paik Hospital. Sixty patients were diagnosed to chronic subdural hematoma with homogeneous and low density on computed tomography (CT) images that was considered liquefied hematoma (**FIGURE 1A**) and underwent one burr hole drainage (**FIGURE 1B & C**), and 15 patients with heterogenous or high density on CT images that was considered solid or mixed form hematoma (**FIGURE 2A**) performed small craniotomy at frontal



FIGURE 1. (A) Pre-operative computed tomography showed isodensity crescentic shaped hematoma in left frontotemporoparietal area. (B, C) Seventy-one-year-old male patient with chronic subdural hematoma underwent burr hole drainage in left parietal area.



FIGURE 2. (A) Pre-operative computed tomography showed heterogenous, crescentic shaped hematoma in left frontotemporoparietal area. (B, C) Seventy-six-year-old male patient with chronic subdural hematoma underwent small craniotomy with drainage in left parietal area.

TABLE 1. Characteristics and clinical findings of patients

Characteristics	Burr hole drainage (n=60)	Small craniotomy (n=15)	Total
Sex			
Male	44 (73.3)	13 (86.7)	57 (76)
Female	16 (26.7)	2 (13.3)	18 (24)
Total	60 (100)	15 (100)	75 (100)
Mean age (years)	74.5 (67–90)	73.2 (65–83)	74.2
Head injury	30/60 (50)	10/15 (66.7)	40/75 (53.3)
Clinical symptoms			
Hemiparesis	37 (61.7)	8 (53.3)	45 (60)
Headache	19 (31.6)	4 (26.7)	23 (30.7)
Consciousness change	4 (6.7)	2 (13.3)	6 (8.0)
Seizure	0 (0)	1 (6.7)	1 (1.3)
Total	60 (100)	15 (100)	75 (100)

Values are presented as number (%).

TABLE 2. Location of chronic subdural hematomas

Location	Right	Left	Both	Total
Frontotemporoparietal	22	36	12	70
Parietal	3	2	-	5

or parietal area and was done hematoma removal and saline irrigation (FIGURE 2B & C). Drainage catheter was inserted into the subdural hematoma space in both burr hole drainage (FIGURE 1C) and small craniotomy group (FIGURE 2C). The surgical method was determined according to the pattern of hematoma on brain CT images. The recurrence rate and length of hospitalization days were compared between the patients with burr hole drainage and small craniotomy. Statistical analysis was performed using *t*-test and *p*-value <0.05 was interpreted to have statistically significance. In 75 patients, male to female ratio was 57:18 and mean age was 74.2 years old (range, 65–90 years old). The incidence of chronic subdural hematoma was higher in male patients. Forty patients (53.3%) had head trauma history, and 35 patients (36.7%) had no history of head trauma. The symptoms that presented when visited in hospital were hemiparesis in 45 patients (60%), headache without other neurologic symptoms in 23 patients (30.7%), and mental deterioration in 6 patients (8.0%), seizure in 1 patient (1.3%) (TABLE 1). Location of subdural hematoma was left frontotemporoparietal area in 36 patients (48.0%), right frontotemporoparietal area in 22 patients (29.3%), and both frontotemporoparietal area in 12 patients (16.0%), right parietal area in 3 patients (6.0%) and left parietal area in 2 patients (2.6%) (TABLE 2).

RESULTS

Sixty patients underwent burr hole drainage and 15 patients were performed small craniotomy. Of the 60 patients were performed with burr hole drainage, 8 patients (13.3%) were recurred and were operated again. Among the 15 patients were performed small craniotomy, 7 patients (46.7%) were recurred and underwent 2nd operation.

Average number of hospitalization days were 10.3 days (range, 6–29 days) in burr hole drainage group, and 15.7 days (range, 8–42 days) in small craniotomy group (TABLE 3).

TABLE 3. Post-operative recurrence rate and mean hospitalization days

Characteristics	Burr hole (n=60)	Craniotomy (n=15)	<i>p</i> -value
Recurrence (%)	8 (13.3)	7 (46.7)	0.03*
Mean hospitalized days	10.3 (6–29)	15.7 (8–42)	0.03*

**p*<0.05 indicates a statistically significant difference.

There were no complications such as acute bleeding, infection, or neurological deficit related to surgery in both groups.

DISCUSSION

Chronic subdural hematoma is a common disease in neurosurgery. It is generally known to occur in the elderly population, and is reported to be the highest incidence in the 60s and 70s. In addition, as the age increases, the incidence is increased sharply. In the 70s, there are 7.35 cases per 100,000 population, and the incidence of chronic subdural hematoma is likely to increase due to the increase in the elderly population.²⁾ Chronic subdural hematoma is known to be caused by various causes such as trauma, alcohol and anticoagulant administration, hemorrhagic disease.²²⁾ 60 to 80% occur after head trauma. Head trauma is often mild and patients may not be aware of it.²⁰⁾ In this study, 46.7% of patients denied head trauma.

The formation and growth mechanism of chronic subdural hematoma has not been fully elucidated yet.^{2,15)} The most common reason for elderly people affected well is physiological brain atrophy, which enlarges the space between the brain cortex and the dura mater, so tension of bridging vein increases and venous congestion occurs in the cerebral cortical vein, and dura mater is detached from the arachnoid membrane, that subdural hematoma occurs due to rupture or leakage of bridging vein, and patient is older, hemostatic function is decreased so hematoma can develop and grow easily.^{12,30)}

Symptoms of chronic subdural hematoma include hemiparesis, headache, loss of consciousness, and seizures, and presented symptoms was reported hemiparesis in 58%, headache in 14–80%, seizures in less than 6%, and unconsciousness in 36%.^{2,27)} The incidence of symptoms was similar in our study.

The treatment of chronic subdural hematoma is variable from pharmacologic therapy to operative therapy. However, most patients are operated if the patient is not inoperable condition or a small amount of hematoma with no symptom.^{9,22)} In chronic subdural hematoma, burr hole drainage is the most commonly used operative method. The overall morbidity rate is reported 0–2% and recurrence rate is 5–30%. Burr hole drainage is known to be the most effective method for treatment of chronic subdural hematoma with less complication.^{9,21,23)} On the other hand, if repeated recurrences, solid hematomas or septum in subdural hematoma are present, a small craniotomy can be performed.³²⁾ Especially, when presents multiple compartmentalized lesions in subdural hematoma, burr hole drainage may result in incomplete drainage, and acute hemorrhage may be occurred due to injury of the cortical vein during insertion of the drainage catheter, so these cases, small craniotomy should be performed.^{13,24,25)}

Santarius et al.⁵⁾ compared burr-hole evacuation with drains group versus no drains after burr-hole evacuation. The recurrence rate was lower in the drain group than in the no drain group. And at discharge of the hospital, neurological status was better and the mortality rate was lower at 6 months in drain group. So, burr hole drainage has been accepted as a general treatment strategy of chronic subdural hematoma, recently. Okada et al.³¹⁾ reported that to avoid infection, drainage for 2 days appears to be sufficient. So, in our study, the draining catheter was inserted subdural space in all patients who performed burr hole drainage and was removed 2 days after the operation.

In our study, 60 patients were performed burr hole drainage with irrigation. Zakaraia et al.¹⁹⁾ and Gurelik et al.¹⁰⁾ reported no difference in clinical efficacy and recurrence rate between the irrigation and non-irrigation groups. However, some studies reported a higher recurrence rate in the irrigation group. Okada et al.³¹⁾ compared the patients who were performed burr hole drainage and burr hole irrigation in terms of recurrence and hospitalization. In patients who were treated with burr hole irrigation was revealed higher recurrence rate and longer hospitalization. The intracranial pressure is decreased due to irrigation, and the inflation of air into the subdural space can interfere the brain expansion. In the drainage group, there is a relatively low-risk of recurrence, because the intracranial pressure is relatively slowly changed and the bridging vein is less damaged.^{26,29,33)} In addition, there is also a report that rapid changes in the intracranial pressure may lead to complications such as epilepsy, cerebral edema, and cerebral hemorrhage in irrigation group.^{11,34)}

Mondorf et al.²⁷⁾ conducted a retrospective study about treatment effect and recurrence of 193 patients with chronic subdural hematoma. Craniotomy were performed in 151 patients and burr hole drainage were performed in 42 patients. In that study, recurrence was developed in 27.8% of patients who underwent craniotomy and 14.3% in patients who underwent burr hole drainage. The complete neurologic recovery at the discharge was 52.3% in patients with craniotomy and 64.3% in patients with burr hole drainage. In that study, burr hole drainage was reported to be better in terms of recurrence rate and recovery of symptoms than craniotomy. In our study, recurrence rate is 26.7% in small craniotomy group, and 13.3% in burr hole drainage group. And average number of hospitalization days were 10.3 days in burr hole drainage group and 15.7 days in small craniotomy group. Patients who underwent burr hole drainage showed a lower recurrence rate and shorter hospitalization days than patients who underwent small craniotomy. We performed burr hole drainage in chronic subdural hematoma that showed homogenous and low-density CT images, and performed small craniotomy in patients with chronic subdural hematoma that revealed septum formation, and heterogenous or high density on CT images. The risk factor of recurrence of chronic subdural hematoma was reported with large amounts of hematoma, bilateral hematoma formation, present of septum in hematoma on CT images.^{8,14,22,28,29)} Ko et al.¹⁵⁾ also reported that heterogenous and high density in subdural hematoma on CT scan indicate a risk of recurrence. Because of these preconditions, the recurrence rate is considered to be higher in small craniotomy group in our study.

CONCLUSION

In patients with chronic subdural hematoma, burr hole drainage is considered safe and effective treatment method because of lower recurrence rate and short hospitalization days than small craniotomy. But if complete drainage may be difficult when performing burr hole drainage, in selective cases like that subdural hematoma has solid portion or multiple septum in CT findings, small craniotomy could be considered although small craniotomy has higher recurrence rate and longer hospitalization days than burr hole drainage in overall cases.

REFERENCES

1. Abouzari M, Rashidi A, Rezaii J, Esfandiari K, Asadollahi M, Aleali H, et al. The role of postoperative patient posture in the recurrence of traumatic chronic subdural hematoma after burr-hole surgery. *Neurosurgery* 61:794-797, 2007
[PUBMED](#) | [CROSSREF](#)

2. Adhiyaman V, Asghar M, Ganeshram KN, Bhowmick BK. Chronic subdural haematoma in the elderly. *Postgrad Med J* 78:71-75, 2002
[PUBMED](#) | [CROSSREF](#)
3. Amirjamshidi A, Abouzari M, Eftekhari B, Rashidi A, Rezaii J, Esfandiari K, et al. Outcomes and recurrence rates in chronic subdural haematoma. *Br J Neurosurg* 21:272-275, 2007
[PUBMED](#) | [CROSSREF](#)
4. Cousseau DH, Echevarría Martín G, Gaspari M, Gonorazky SE. Chronic and subacute subdural haematoma. An epidemiological study in a captive population. *Rev Neurol* 32:821-824, 2001
[PUBMED](#) | [CROSSREF](#)
5. Santarius T, Kirkpatrick PJ, Ganesan D, Chia HL, Jalloh I, Smielewski P, et al. Use of drains versus no drains after burr-hole evacuation of chronic subdural haematoma: a randomised controlled trial. *Lancet* 374:1067-1073, 2009
[PUBMED](#) | [CROSSREF](#)
6. Ahn SY, Kim JH, Ha SK, Kim JH, Kwon TH, Park YK, et al. Clinical analysis of risk factors associated with the recurrence of chronic subdural hematoma. *J Korean Neurotraumatol Soc* 7:68-73, 2011
[CROSSREF](#)
7. Ernestus RI, Beldzinski P, Lanfermann H, Klug N. Chronic subdural hematoma: surgical treatment and outcome in 104 patients. *Surg Neurol* 48:220-225, 1997
[PUBMED](#) | [CROSSREF](#)
8. Frati A, Salvati M, Mainiero F, Ippoliti F, Rocchi G, Raco A, et al. Inflammation markers and risk factors for recurrence in 35 patients with a posttraumatic chronic subdural hematoma: a prospective study. *J Neurosurg* 100:24-32, 2004
[PUBMED](#) | [CROSSREF](#)
9. Santarius T, Hutchinson PJ. Chronic subdural haematoma: time to rationalize treatment? *Br J Neurosurg* 18:328-332, 2004
[PUBMED](#) | [CROSSREF](#)
10. Gurelik M, Aslan A, Gurelik B, Ozum U, Karadag O, Kars HZ. A safe and effective method for treatment of chronic subdural haematoma. *Can J Neurol Sci* 34:84-87, 2007
[PUBMED](#) | [CROSSREF](#)
11. Sambasivan M. An overview of chronic subdural hematoma: experience with 2300 cases. *Surg Neurol* 47:418-422, 1997
[PUBMED](#) | [CROSSREF](#)
12. Jeong JE, Kim GK, Park JT, Lim YJ, Kim TS, Rhee BA, et al. A clinical analysis of chronic subdural hematoma according to age factor. *J Korean Neurosurg Soc* 29:748-753, 2000
13. Taussky P, Fandino J, Landolt H. Number of burr holes as independent predictor of postoperative recurrence in chronic subdural haematoma. *Br J Neurosurg* 22:279-282, 2008
[PUBMED](#) | [CROSSREF](#)
14. Kim HY, Kwon SC, Kim TH, Shin HS, Hwang YS, Park SK. Analysis of management according to CT findings in chronic subdural hematoma. *J Korean Neurosurg Soc* 37:96-100, 2005
15. Ko BS, Lee JK, Seo BR, Moon SJ, Kim JH, Kim SH. Clinical analysis of risk factors related to recurrent chronic subdural hematoma. *J Korean Neurosurg Soc* 43:11-15, 2008
[PUBMED](#) | [CROSSREF](#)
16. Krupp WF, Jans PJ. Treatment of chronic subdural haematoma with burr-hole craniostomy and closed drainage. *Br J Neurosurg* 9:619-627, 1995
[PUBMED](#) | [CROSSREF](#)
17. Kurokawa Y, Ishizaki E, Inaba K. Bilateral chronic subdural hematoma cases showing rapid and progressive aggravation. *Surg Neurol* 64:444-449, 2005
[PUBMED](#) | [CROSSREF](#)
18. Kuroki T, Katsume M, Harada N, Yamazaki T, Aoki K, Takasu N. Strict closed-system drainage for treating chronic subdural haematoma. *Acta Neurochir (Wien)* 143:1041-1044, 2001
[PUBMED](#) | [CROSSREF](#)
19. Zakaraia AM, Adnan JS, Haspani MS, Naing NN, Abdullah JM. Outcome of 2 different types of operative techniques practiced for chronic subdural hematoma in Malaysia: an analysis. *Surg Neurol* 69:608-615, 2008
[PUBMED](#) | [CROSSREF](#)
20. Lee SH, Ha SK, Kim JH, Kim JH, Kwon TH, Park YK. Age-specific characteristics in chronic subdural hematoma patients. *J Korean Neurotraumatol Soc* 7:83-87, 2011
[CROSSREF](#)
21. Lega BC, Danish SF, Malhotra NR, Sonnad SS, Stein SC. Choosing the best operation for chronic subdural hematoma: a decision analysis. *J Neurosurg* 113:615-621, 2010
[PUBMED](#) | [CROSSREF](#)

22. Yamamoto H, Hirashima Y, Hamada H, Hayashi N, Origasa H, Endo S. Independent predictors of recurrence of chronic subdural hematoma: results of multivariate analysis performed using a logistic regression model. *J Neurosurg* 98:1217-1221, 2003
[PUBMED](#) | [CROSSREF](#)
23. Weigel R, Schmiedek P, Krauss JK. Outcome of contemporary surgery for chronic subdural haematoma: evidence based review. *J Neurol Neurosurg Psychiatry* 74:937-943, 2003
[PUBMED](#) | [CROSSREF](#)
24. Weber G. Chronic subdural hematoma. *Schweiz Med Wochenschr* 99:1483-1488, 1969.
[PUBMED](#)
25. Wakai S, Hashimoto K, Watanabe N, Inoh S, Ochiai C, Nagai M. Efficacy of closed-system drainage in treating chronic subdural hematoma: a prospective comparative study. *Neurosurgery* 26:771-773, 1990
[PUBMED](#) | [CROSSREF](#)
26. Mohamed EE. Chronic subdural haematoma treated by craniotomy, durectomy, outer membranectomy and subgaleal suction drainage. Personal experience in 39 patients. *Br J Neurosurg* 17:244-247, 2003
[PUBMED](#) | [CROSSREF](#)
27. Mondorf Y, Abu-Owaimer M, Gaab MR, Oertel JM. Chronic subdural hematoma--craniotomy versus burr hole trepanation. *Br J Neurosurg* 23:612-616, 2009
[PUBMED](#) | [CROSSREF](#)
28. Murakami H, Hirose Y, Sagoh M, Shimizu K, Kojima M, Gotoh K, et al. Why do chronic subdural hematomas continue to grow slowly and not coagulate? Role of thrombomodulin in the mechanism. *J Neurosurg* 96:877-884, 2002
[PUBMED](#) | [CROSSREF](#)
29. Nakaguchi H, Tanishima T, Yoshimasu N. Relationship between drainage catheter location and postoperative recurrence of chronic subdural hematoma after burr-hole irrigation and closed-system drainage. *J Neurosurg* 93:791-795, 2000
[PUBMED](#) | [CROSSREF](#)
30. Oishi M, Toyama M, Tamatani S, Kitazawa T, Saito M. Clinical factors of recurrent chronic subdural hematoma. *Neurol Med Chir (Tokyo)* 41:382-386, 2001
[PUBMED](#) | [CROSSREF](#)
31. Okada Y, Akai T, Okamoto K, Iida T, Takata H, Iizuka H. A comparative study of the treatment of chronic subdural hematoma--burr hole drainage versus burr hole irrigation. *Surg Neurol* 57:405-409, 2002
[PUBMED](#) | [CROSSREF](#)
32. Quinones-Hinojosa A. Schmidek and sweet operative neurosurgical techniques, ed 6. Philadelphia, PA: Elsevier Saunders, 2012.
33. Robinson RG. Chronic subdural hematoma: surgical management in 133 patients. *J Neurosurg* 61:263-268, 1984
[PUBMED](#) | [CROSSREF](#)
34. Rohde V, Graf G, Hassler W. Complications of burr-hole craniostomy and closed-system drainage for chronic subdural hematomas: a retrospective analysis of 376 patients. *Neurosurg Rev* 25:89-94, 2002
[PUBMED](#) | [CROSSREF](#)