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Original Article

The impact of different surgical treatments for intracerebral hemorrhage on functional outcomes during the convalescent stage

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ABSTRACT

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Objective: We examined whether different surgical methods for intracerebral hemorrhage have an impact on functional outcomes at discharge from the Kaifukuki Rehabilitation Ward (KRW).

Methods: The participants included 100 patients with first-onset hypertensive ICH. Craniotomy was performed in 52 patients, endoscopic hematoma evacuation in 31 patients, and functional independence measure (FIM), length of hospitalization, and rate of discharge to the home of the two groups were examined retrospectively.

Results: The time between surgery and admission to the KRW was significantly shorter in the endoscopic hematoma evacuation group than in the craniotomy group. Although there was no significant difference in the functional prognosis at discharge, endoscopic hematoma evacuation may contribute to higher FIM gain, shorter length of hospitalization, and a higher rate of discharge to home because of the ability to transfer to KRW earlier than in the case of craniotomy, owing to less surgical invasion.

Conclusion: Endoscopic hematoma evacuation had a shorter time to admission to KRW than craniotomy; however, differences in surgical methods did not result in a difference in functional outcomes.

Key words: Kaifukuki Rehabilitation Ward, functional prognosis, craniotomy, endoscopic hematoma evacuation

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Introduction

The Kaifukuki Rehabilitation Ward (KRW) was established in April 2000, and with the introduction of the rate of discharge to home in FY2008, improvements are now required. A performance index was introduced in FY2016, which requires qualitative improvements in addition to the rate of discharge to home.

Prognosis prediction at the time of discharge from KRW is critical because when the performance index does not reach a certain level, a rehabilitation fee is added.

According to a fact-finding report by the KRW Association (2019) [1], stroke patients in KRW are characterized by a longer time from onset to admission (29.6 d) and a similarly longer length of hospitalization (83.2 d) compared to orthopedic patients. In particular, there is a high tendency for patients with intracerebral hemorrhage to be admitted to the hospital for longer periods than those with cerebral infarction and subarachnoid hemorrhage.

The functional prognosis of intracerebral hemorrhage is better than that of cerebral infarction when the two have a similar disability profile from subacute to convalescence as the risk factors are mainly confined to hypertension and younger age of onset [2].

Concerning intracerebral hemorrhage, there have been reports on the functional outcomes at discharge from acute hospital care [3] and a comparison of conservative and surgical treatment [4]. However, no reports have compared the outcomes of intracerebral hemorrhage at discharge from the KRW for different surgical methods. We believe that examining the factors influencing the functional prognosis of ICH may help predict the outcome at discharge from KRW.

In this study, we compared cases of intracerebral hemorrhage treated using craniotomy or endoscopic hematoma evacuation and examined the impact on functional outcomes at discharge from KRW.

Methods

We included 512 patients with ICH who were transferred from an acute care hospital to our hospital (convalescent hospital) between April 2011 and March 2018 (Figure 1). In addition, 100 patients with first-onset ICH with a modified Rankin Scale (mRS) score of zero before the onset of the hemorrhage. The procedures included craniotomy (55 patients), endoscopic hematoma evacuation (36 patients), ventricular drainage (five patients), and stereotactic hematoma evacuation (four patients). A comparison was made between 52 patients in the craniotomy group and 31 patients in the endoscopic hematoma evacuation group, excluding patients who were transferred to an acute care hospital or other convalescent hospitals for specialized treatment of comorbidities. Age, sex, time to hospital transfer, functional independence measure (FIM), mRS score, length of hospitalization, and rate of discharge to home in the two groups were retrospectively examined. Statistical analysis was performed using the R software (version 3.4.3), with the *t*-test for age, Fisher's exact test for sex and outcome destination, and the Mann-Whitney *U* test for days to hospitalization, FIM, mRS, and length of hospitalization. All significance levels were set at 5%. This study was approved by the Ethics Review Committee of Fukuoka Rehabilitation Hospital (approval number: FRH2018-R-004).

Results

The type of surgery for the damaged area owing to cerebral hemorrhage was craniotomy in 52 patients (32 putaminal, 10 subcortical, seven cerebellar, one thalamus, one caudate nucleus, and one mixed) and endoscopic hematoma evacuation in 31 patients (15 putaminal, six subcortical, five cerebellar, five mixed, and one thalamus). The results of the comparison between the two groups (craniotomy and endoscopic hematoma evacuation groups) are illustrated in the table.

1. Age (Figure 2)

There was no significant difference between the craniotomy and endoscopic hematoma evacuation groups at 62.2 ± 11.7 years and 62.2 ± 15.2 years, respectively.

2. Sex

There were 34 men (65.4%) and 18 women (34.6%) in the craniotomy group and 20 men (64.5%) and 11 women (35.5%) in the endoscopic hematoma evacuation group, with a similar ratio of men to women in both groups. Men accounted for more than 60% of the patients.

3. Time to transfer to KRW (Figure 3)

The time to transfer to KRW was 30.3 ± 12.7 days and 20.1 ± 10.8 days in the craniotomy and endoscopic hematoma evacuation groups, respectively. The time to transfer was significantly shorter in the latter group ($p<0.001$).

4. FIM (Figure 4)

The FIM on admission in the craniotomy and endoscopic hematoma evacuation groups was 54.7 ± 30.0 points and 53.9 ± 32.4 points, respectively, and FIM at discharge was 87.4 ± 31.3 points and 93.1 ± 26.8 points, respectively, with no significant difference between FIM on admission and at discharge. However, FIM gain was higher in the endoscopic hematoma evacuation group (39.2), than in the craniotomy group (32.7).

There was also a higher FIM gain in both the craniotomy and endoscopic hematoma evacuation groups, with a shorter duration of hospitalization (Figure 5).

There was no significant difference in the total FIM score for motor FIM scores at admission and discharge. On admission, the FIM scores in the craniotomy and

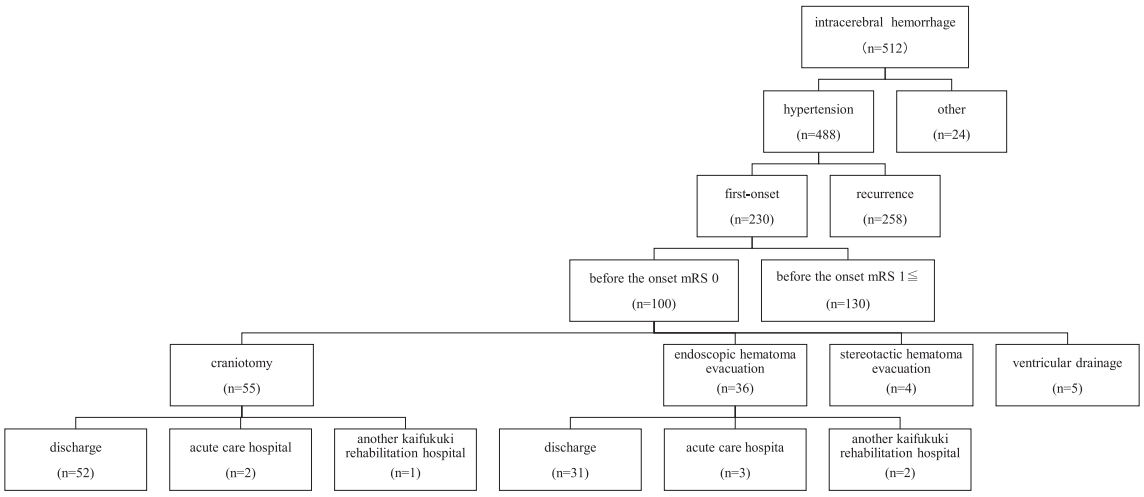

Figure 1. Classification of patients with intracerebral hemorrhage.

Table. Comparison of craniotomy and endoscopic hematoma evacuation.

	Craniotomy (*n*=52)	Endoscopic hematoma evacuation (*n*=31)	
Age (mean±SD) (years)	62.2±11.7	62.2±15.2	n.s.
Sex male: female	34 : 18	20 : 11	
Time to hospital transfer (mean±SD) (days)	30.2±12.7	20.1±10.8	$p<0.001$
FIM total score (mean±SD) (points)			
On admission	54.7±30.0	53.9±32.4	n.s.
At discharge	87.4±31.3	93.1±26.8	n.s.
FIM gain (points)	32.7	39.2	n.s.
mRS (median)			
On admission	4	4	n.s.
At discharge	4	4	n.s.
mRS5 patients			
On admission	17	14	
At discharge	13	4	
Length of hospitalization (mean±SD) (days)	126±53.9	116±61.6	n.s.
Rate of discharge to home (%)	61.5	71.0	n.s.

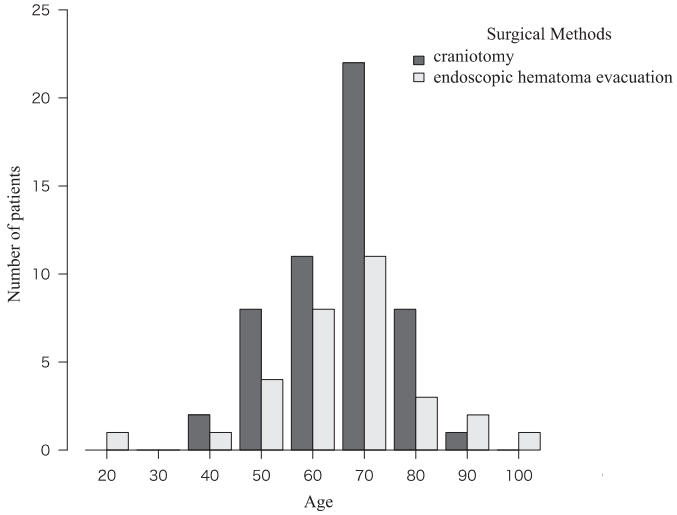

Figure 2. Age distribution.

endoscopic hematoma evacuation groups were 36.9 ± 23.0° and 36.5 ± 24.9°, respectively, while at discharge, they were 62.7 ± 23.9 points and 68.8 ± 21.7, respectively. However, the degree of improvement was higher in the endoscopic hematoma evacuation group.

There was no significant difference in the cognitive FIM scores at admission and discharge. At admission, the cognitive FIM in the craniotomy and endoscopic hematoma evacuation groups was 17.9 ± 8.5 points and 17.5 ± 10.7 points, respectively. At discharge, it was 24.7 ± 8.8 points and 24.9 ± 7.7 points, respectively.

5. mRS (Figure 6)

The median mRS on admission and median mRS at discharge for both the craniotomy and endoscopic hematoma evacuation groups were 4.

The number of severe cases of mRS5 on admission in the craniotomy and endoscopic hematoma evacuation groups was 17 (32.7%) and 14 (45.2%), respectively. However, at discharge, 13 patients (25.0%) in the craniotomy group and four (12.9%) in the endoscopic hematoma evacuation group. There were fewer severe cases in the endoscopic hematoma evacuation group (Table).

6. Length of hospitalization

The length of hospitalization for the craniotomy and endoscopic hematoma evacuation groups was 126.2 ±

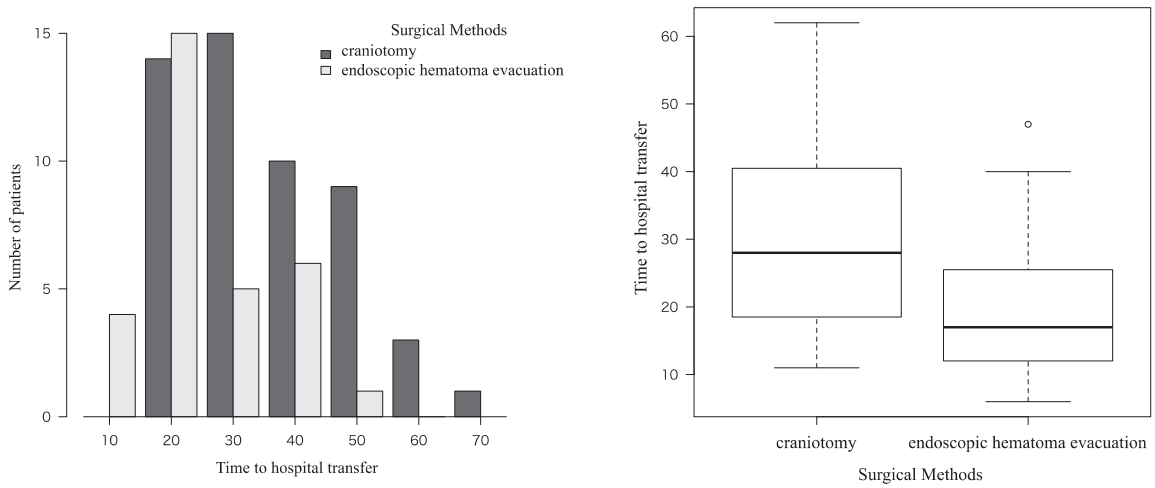

Figure 3. Time to transfer to KRW (left figure: distribution of waiting days; right figure: boxplot).

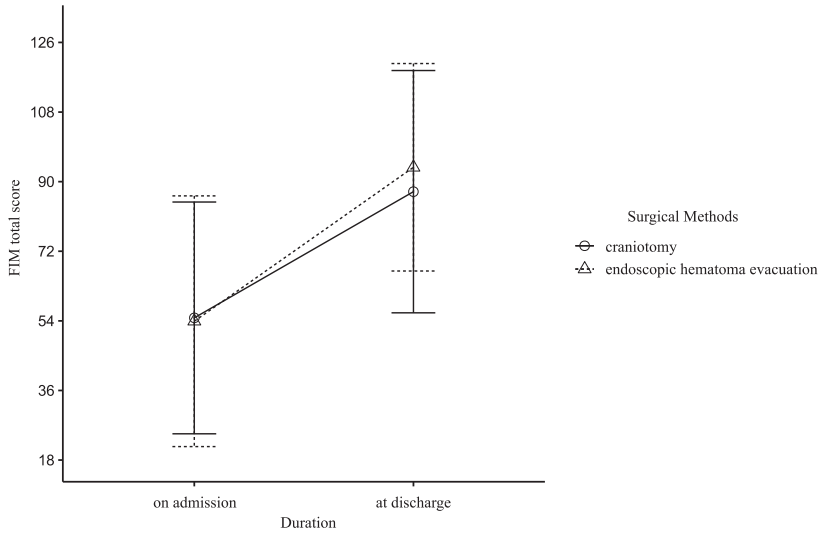

Figure 4. Difference in FIM total score by surgical method.

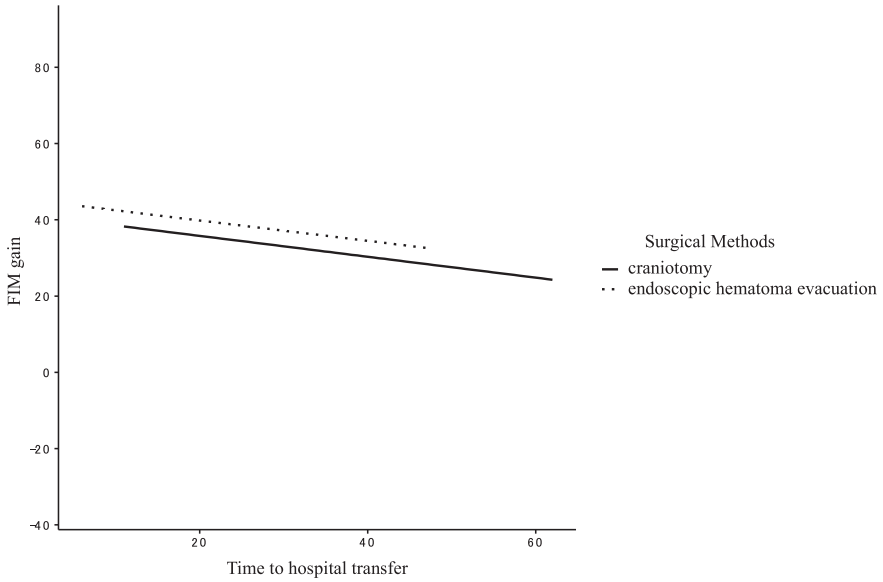

Figure 5. Time to hospital transfer and FIM gain.

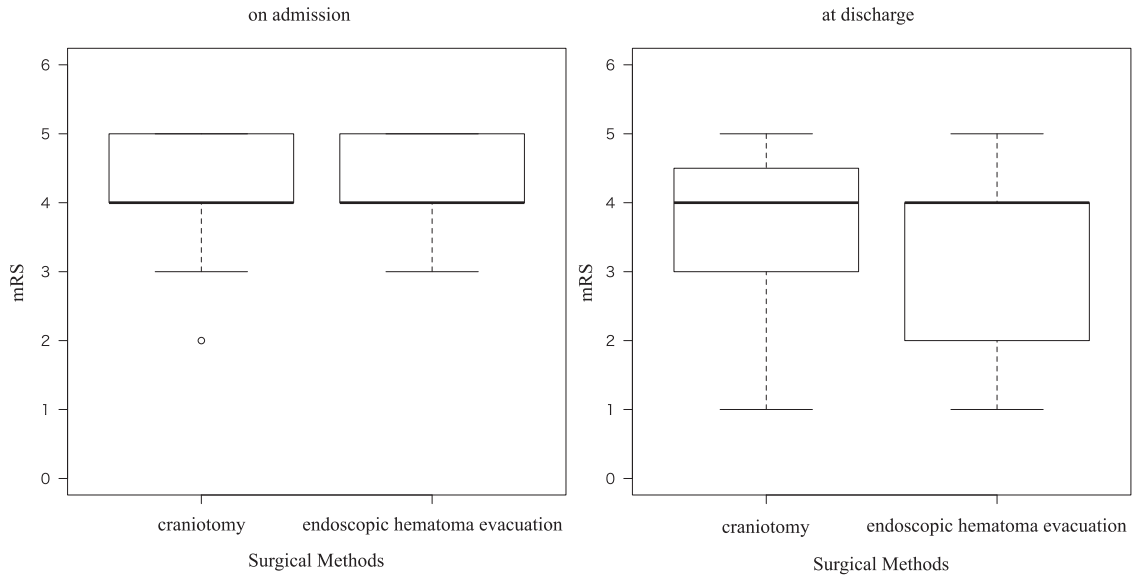

Figure 6. mRS (left figure: on admission, right figure: at discharge).

53.9 days and 116.5 ± 61.6 days, respectively, which was 9.5 days shorter in the latter group, although the difference was not significant.

7. Rate of discharge to home

There was no significant difference in the rate of discharge to home between the two groups, with 61.5% of patients in the craniotomy group and 71.0% in the endoscopic hematoma evacuation group and a higher rate of discharge to home.

Discussion

The Japanese and American guidelines provide scant evidence on the efficacy of surgery in the surgical treatment of hypertensive intracerebral hemorrhage. However, stereotactic hematoma evacuation is recommended for putaminal hemorrhage, and surgery is recommended for cerebellar hemorrhage with advanced deterioration or brainstem compression [5].

Endoscopic hematoma evacuation is recommended as a potential minimally invasive procedure (grade C1) in the Japanese Guidelines for the Management of Stroke 2015 [6], with anticipated approval in the future [7]. In terms of interoperative efficacy, endoscopic hematoma evacuation has a shorter operative time than craniotomy and may allow for an earlier transition to convalescent rehabilitation, owing to its less invasive nature, not only in terms of systemic conditions but also in terms of neurological tissue [3]. This study demonstrated that endoscopic hematoma evacuation resulted in a significantly shorter length of hospitalization. The duration of stroke onset to KRW admission has been cited as one of the factors affecting the activities of daily living in patients with severe hemiplegia at discharge [8]. Early transfer to a convalescent hospital and provision of intensive rehabilitation is important and may have led to a difference in the number of patients with mRS5 on admission who improved at discharge.

Although there was no significant difference between surgical methods concerning the impact on functional outcomes at discharge from KRW, endoscopic hematoma evacuation may contribute to better FIM gain, shorter length of hospitalization, and a higher rate of discharge to home as it is less invasive than craniotomy and allows for early postoperative transfer to a convalescent hospital. We will continue to increase the sample size and evaluate the results.

The limitations of this study are that the hematoma volume at the time of onset was not compared due to missing data on some hematoma volumes as the patients were referred from multiple institutions, and the amount of rehabilitation provided in acute care hospitals could not be investigated; this was a retrospective study of the progress from admission to KRW.

Conclusion

Endoscopic hematoma evacuation had a shorter time to admission to KRW than craniotomy; however, differences in surgical methods did not result in differences in functional outcomes.

References

1. Kaifukuki Rehabilitation Ward Association. Annual survey of current status and problems in the Kaifukuki rehabilitation wards; 2019. p. 30–48.
2. Koyama T. Predictional functional prognosis for stroke. Mon Book Med Rehabil 2019; 236: 37–45.
3. Yamamoto T, Esaki T, Nakao Y, Mori K. Endoscopic hematoma evacuation for the hypertensive putaminal hemorrhage. Jpn J Stroke 2010; 32: 595–601.

4. Sakoh M, Ohmura Y, Fujii R, Horimi H, Ishihara K, Ishikawa M. Examination of acute treatment strategies in 314 patients with putaminal hemorrhage from the view point of funchional prognosis in Kaifukuki rehabilitation wards. Jpn J Stroke 2010; 32: 602−10.
5. Suzuki H, Ono T, Yamaguchi S, Nishino K, Shimizu H. Intracerebral hemorrhage: the role of surgery. Jpn J Stroke 2019; 41: 45−51.
6. Japan Stroke Society Stroke Guideline Committee, editor. Japanese Guidelines for the Management of Stroke 2015; 2015. p. 155−9.
7. Kobayashi S, editor. Japan Stroke Data Bank 2015; 2015. p. 136−7.
8. Hirano Y, Hayashi T, Nitta O, Nishio D, Miyakawa T, Ikeda M, et al. Factors affecting the ADL of severe hemiplegic stroke patients at discharge from a convalescence rehabilitation hospital. J Phys Ther Sci 2015; 30: 563−7.