

Effect of DC on Herniated Group and Non-herniated Group in MCA Infraction

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บทคัดย่อ Abstract

Introduction: Middle Cerebral Artery (MCA) infraction has a high mortality rate of 70–80%. Conservative treatment tends to be ineffective. Decompressive Craniectomy (DC) can reduce mortality rate. But at 72 hours post – stroke onset is not different from conservative treatment.

Objective: This study assessed the effect of waiting time for decompressive craniectomy for MCA infraction on patients' mortality rate and a good outcome (MRS < 3) at 6, 12 and more than 12 months following surgery.

Methods: This study was a retrospectively reviewed medical records between 2011–2017 of patients who were diagnosed with MCA infraction and underwent decompressive craniectomy. The primary was a mortality rate at discharge and the secondary outcome was good outcome (MRS < 3) at 6, 12 and more than 12 months following surgery. Data were analyzed by descriptive analysis, Student t-test, Rank Sum test, Exact Probability test, Logistic Regression and Predictive model. A P value of < 0.05 was considered statistically significant.

Results: Of 31 patients, there were 12 patients with clinical herniation and 19 patients with non-clinical herniation. The mortality rates of clinical and non-clinical patients at discharge were 33.3% and 26.3%, respectively. The mortality rates depend on waiting time for decompressive craniectomy. Good outcome was inversely proportional to the waiting time for surgery. Decompressive craniectomy at 48-hour post stroke, the non-herniated group has a better outcome than the herniated group. (MRS < 3 at 6, 12, and more than 12 months are 53% vs. 24%, 58% vs. 18% and 62% vs. 2%, respectively).

Conclusion: Early decompressive craniectomy can reduce mortality and increase good outcome especially in the non-herniated group. This finding can be applied to clinical practice for MCA infraction patients in order to improve the patient outcome. Further studied in prospective manner with larger number of patients may provide more information on this important issue.

Keywords: DC (Decompressive Craniectomy), MCA (Middle cerebral artery)

Introduction

Middle cerebral artery (MCA)¹ infraction occurs in 1-10% of supratentorial infraction. It has a very high mortality rate of 70-80%. Conservative treatment tends to be ineffective. Decompressive Craniectomy (DC) increases space for brain swelling and decreases intracranial pressure to prevent secondary brain injury. It can decrease mortality and increase good outcome (MRS \leq 3). DESTINY¹, HAMLET² and DECIMAL³ studies had varying duration of waiting time for surgery.

Objective

The aim of this study is to assesses the effect of waiting time for surgery on two outcomes. The primary outcome is mortality rate at discharge and secondary outcome is good outcome (MRS \leq 3) at 6, 12 and more than 12 months following surgery.

Materials and Methods

The data were collected from the medical records of Lampang Hospital patients between 2011- 2017. The inclusion and exclusion outcome were summarized in the Table 1.

The collected data included death and MRS at discharge 6, 12 and more than 12 months following surgery. The MRS of 3 or less was considered a good outcome. The data were analyzed using descriptive analysis, mean, standard deviation, frequency and percentage, Student t-test, Rank Sum Test, Exact Probability test, Log Regression and Predictive Model to compare between herniated group with the non-herniated group. A P value < 0.05 was considered statistically significant.

Results

Between 2011-2017, there were 84 patients. Thirty-one patients were included in the study. Mean age was 52.9 ± 5.6 years (range, 83-59 years). Twelve patients (38.7%) were in the herniated group. The waiting time for surgery was $35.0 + 20.6$ hours (range, 10.4 - 103.5 hours). Nine patients (29%) died. Number of patients in the study at 6, 12 and more than 12 months following surgery were 19, 19 and 18 patients with a good outcome in 47.4%, 42.1% and 44.4%, respectively.

The waiting time for surgery in the herniated group (H) and the non-herniated group (NH) were $35.6 \pm$

Table 1 The inclusion and exclusion of studied patients

Inclusion criteria	Exclusion criteria
- Age 18 - 60 years	- Ischemic stroke of the whole cerebral hemisphere.
- Diagnosis of Acute ischemic stroke in the territory of middle cerebral artery	- Life expectancy is less than 3 years.
- Ischemic change on CT that affects two - third or more of the territory of the middle cerebral artery and formation of space occupying edema.	- Decrease level of consciousness partially because due to causes other than brain edema, for instance metabolic disturbance or medication effect
	- Any other coincidental brain lesion that might affect outcome, for instance brain, tumor, abnormal vascular disease.

13.8 hours and 34.7 ± 24.3 hours, respectively ($p = 0.478$). The mortality rate was not statistically different in both groups (33.3% vs. 26.3%, $p = 0.704$). Good outcome was not statistically different in both groups in 6, 12 and more than 12 months following surgery. (Table 2)

According to AHA guideline 2018 and Meta-analysis, DESTINY and HAMLET, decompressive craniectomy within 48 hours was suggested. The mortality rate and good outcome at 6, 12 and more than 12 months following surgery were collected and ana-

lyzed using predictive model to predict probability of death and good outcome versus waiting time for surgery. The predicted mortality rates of decompressive craniectomy at 48 hours post stroke in the herniated group and the non-herniated group were 38% vs. 28%, respectively (Figure 2). Mortality rate was in direct variation with waiting time for surgery in both groups. The herniated group was more effective than the non-herniated group in longer waiting time for surgery.

Good outcome in both groups was analyzed by predictive model for surgery at 48-hour post stroke.

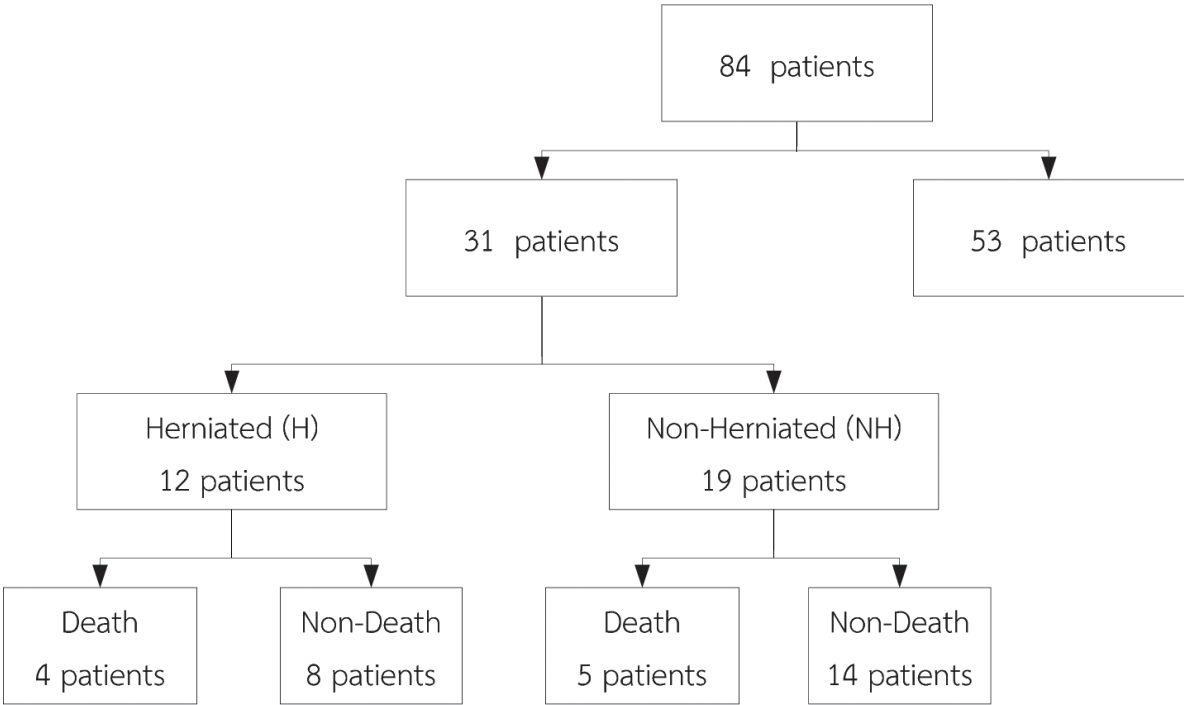


Figure 1 Study flow of the studied patients

Table 2 Outcome of treatment in herniated group and non-herniated group

Outcome	Non-herniated group (NH)	Herniated group (H)	P-value
Death (Total = 31, H = 12)	5 (26.3)	4 (33.3)	0.704
Good outcome in 6 months (Total =19, H = 8)	6 (54.6)	3 (37.5)	0.650
Good outcome in 12 months (Total =19, H = 7)	6 (50.0)	2 (28.6)	0.633
Good outcome in more than 12 months (Total =18, H = 6)	6 (50.0)	2 (33.3)	0.638

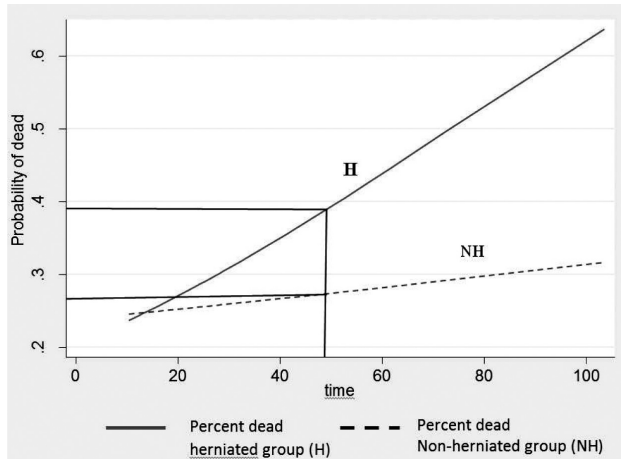


Figure 2 The relationship of death to time of surgery in 48 hours.

Good outcome at 6, 12 and more than 12 months between the herniated group and the non-herniated group were 24% vs. 53% (Figure 3), 18% vs. 58% (Figure 4) and 2% vs. 62% (Figure 5), respectively. The good outcome in both groups were inversely proportional to waiting for surgery and the herniated group was more affected than the non-herniated group. When compared the outcome at 6 months and 12 month following surgery, the non-herniated group increased from 53% to 58% while the herniated group decreased from 24% to 18%. Decompressive craniectomy provided a good outcome in the herniated group which rapidly decreased if surgery was performed later than 30-hour post stroke. The non-herniated group provided a good outcome with indirect effect to waiting time for surgery. This result is similar to previous studies of AHA 2018 and Meta-analysis DECIMAL, DESTINY and HAMLET recommended for early surgery to improve outcome.

Conclusion and Discussion

Malignant MCA infraction has a high morbidity and mortality rate. Conservative treatment is mainly inef-

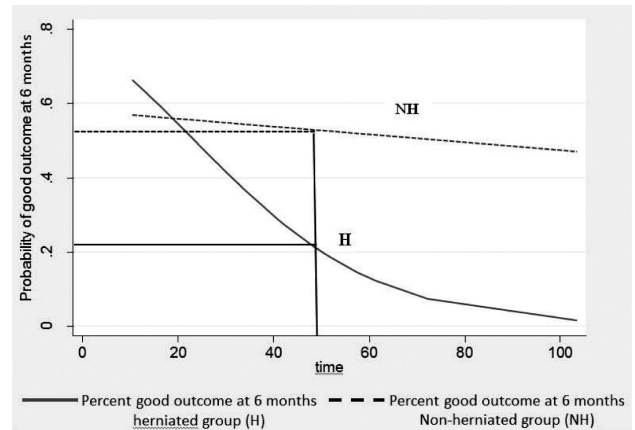


Figure 3 The relationship of a good outcome at 6 months following surgery and 48-hour waiting time.

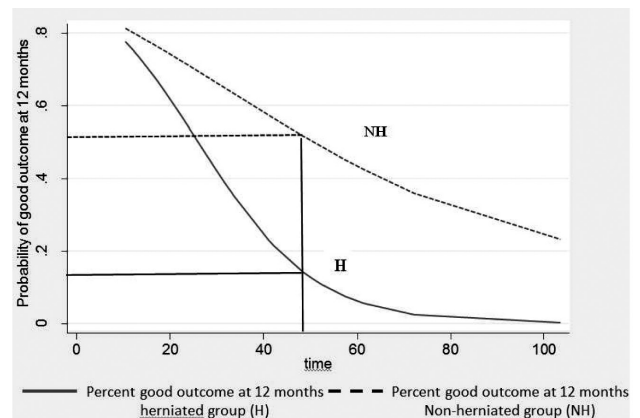


Figure 4 The relationship of a good outcome at 12 months following surgery and 48-hour waiting time.

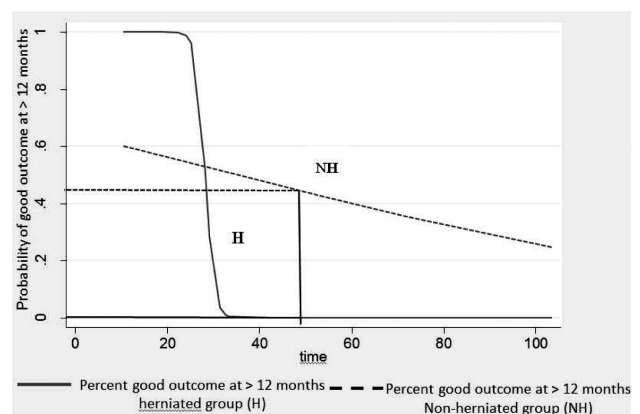


Figure 5 The relationship of a good outcome at more than 12 months following surgery and 48-hour waiting time.

fective. Decompressive Craniectomy can reduce mortality by preventing secondary brain damage.

DESTINY¹ compared the surgical group with 36-hour waiting time for surgery with the conservative treatment. Surgical intervention can significantly reduce mortality in 30 days and improve good outcome in 6–12 months (47% vs. 88% and 47% vs. 27%).

Meta-analysis (DECIMAL, DESTINY and HAMLET)² studying the effect of waiting time for surgery at 30, 36 and 48 hours, showed reduction of a poor outcome (ARR 16%, -0.1 to 33) and mortality rate (ARR 50%, 14 to 66).

Der-yang³ studied ultra-early decompressive craniectomy in patients with middle cerebral artery infarction and compared the outcome of the surgical group with waiting time of less than 6 hours, more than 6 hours and the conservative group. The mortality rates were 8.7%, 36.7% and 88%, respectively. The group which underwent surgery in less than 6 hours has significantly better in Barthel Index than the other groups.

This study demonstrates the relationship of waiting time for surgery and the outcome. It shows that mortality rate is proportional to the duration of the waiting time for surgery, that is, the longer the waiting time, the worse the outcome.

The herniated group has worse outcome than the non-herniated group in both the mortality rate and outcome, although they are not significantly different. It may be due to a small number of samples in the study. However, previous studies and AHA guideline 2018, suggested that the operate be performed withing 48-hour post stroke.

This study suggests that early decompressive craniectomy particularly for non-herniated patients can

significantly improve the outcome. Further studies in a prospective manner with larger number of patients may provide more information on this important issue.

References

1. Jüttler E, Schwab S, Schmiedek P, Unterberg A, Hennerici M, Woitzik J, et al. Decompressive Surgery for the Treatment of Malignant Infarction of the Middle Cerebral Artery (DESTINY): a randomized, controlled trial. *Stroke* 2007;38(9):2518–25.
2. Hofmeijer J, Kappelle LJ, Algra A, Amelink GJ, van Gijn J, van der Worp HB, et al. Surgical decompression for space-occupying cerebral infarction (the Hemicraniectomy After Middle Cerebral Artery infarction with Life-threatening Edema Trial [HAMLET]): a multicentre, open, randomised trial. *Lancet Neurol* 2009;8(4):326–33.
3. Vahedi K, Vicaut E, Mateo J, Kurtz A, Orabi M, Guichard J-P, et al. Sequential-design, multicenter, randomized, controlled trial of early decompressive craniectomy in malignant middle cerebral artery infarction (DECIMAL Trial). *Stroke* 2007;38(9):2506–17.
4. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, et al. 2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke* [Internet]. 2018 Mar [cited 2018 Sep 27]; Available from: <https://www.ahajournals.org/doi/abs/10.1161/STR.000000000000158>
5. Cho D-Y, Chen T-C, Lee H-C. Ultra-early decompressive craniectomy for malignant middle cerebral artery infarction. *Surg Neurol* 2003;60(3):227–32.
6. Cruz-Flores S, Berge E, Whittle IR. Surgical decompression for cerebral oedema in acute ischaemic stroke. *Cochrane Database Syst Rev* 2012;1:1–22.