To cite this article : Comert S. Comparison of surgical and medical treatment in patients with spontaneous ıntracerebral hemorrhage. Turk J Clin Lab 2022; 3: 290-295.

Original Article

# Comparison of surgical and medical treatment in patients with spontaneous intracerebral hemorrhage

## *Spontan intraserebral hemorajili hastalarda cerrahi ve medikal tedavilerin kıyaslanması*

Serhat Comert*

Department of Neurosurgery, Yildirim Beyazit University Yenimahalle Training and Research Hospital, Ankara, Turkey

## ABSTRACT

**Aim:** Intracerebral hemorrhage (ICH) is a subtype of stroke whose risk factors are chronic hypertension, amyloid angiopathy, anticoagulants, and malformations. Primary or spontaneous ICH constitutes a significant portion of hemorrhagic strokes. Management of ICH ranges from medical management to open surgery. In this study, surgical and medical treatments applied to the patients were compared with the Glasgow Coma Scale (GCS).

**Material and Method:** A total of 32 patients with ICH were included in the study. Diagnosis was made by cranial computed tomography (CT) and magnetic resonance imaging (MRI) in all patients. Medical treatment was applied to 19 patients among the participants. Surgical treatment was applied to 13 patients. GCS points of patients presenting with intracerebral hematoma were recorded and compared at their first admission and after treatment.

**Results:** In this study, a total of eight patients died, four of whom were followed up with medical treatment and four of those who underwent surgical treatment. Participants were examined in terms of pre- and post-treatment GCS scores according to the location of the lesion. As a result of the analysis of the data obtained, it was determined that there was a significant difference between the GCS values of the participants before and after the surgical and medical treatment. The mean GCS values of those who were treated medically were higher than those who were treated surgically. GCS values were very close to each other after treatment and no statistically significant difference was found between the groups.

**Conclusion:** In the light of the findings obtained in the study, it was concluded that surgical treatment was not superior to medical treatment.

**Keywords:** Spontaneous Intracerebral Hemorrhage, Surgical Treatment, Medical Treatment

Corresponding Author*: Serhat Comert, Department of Brain and Nerve Surgery, Yildirim Beyazit University Yenimahalle Training and Research Hospital, Ankara Turkey
E-mail: serhatcomert@hotmail.com
ORCID: 0000-0001-8810-5787
Recevied: 20.04.2022 accepted: 31.08.2022
Doi: 10.18663/tjcl.1106642

TJCL Volume 13 Number 3 p: 290-295


## ÖZ

**Amaç:** İntraserebral hemoraji (ISH), kronik hipertansiyon, amiloid anjipati, antikoagülanlar ve malformasyonlar risk faktörleri sonucunda oluşan, inmelerin bir türüdür. Primer ve spontan ISH, hemorajik inmelerin büyük bir kısmını oluşturur. ISH tedavisi, medikal ve cerrahi yaklaşımları kapsar. Bu çalışmada, cerrahi ve medikal tedaviler Glasgow Coma Scale (GCS) kullanılarak kıyaslanmıştır.

**Gereç ve Yöntem:** Çalışmaya ISH'li 32 hasta katılmıştır. Tüm hastalarda tanı, kraniyal bilgisayarlı tomografi ve magnetik rezonans görüntüleme yöntemleri ile konulmuştur. Medikal tedavi 19 ve cerrahi tedavi 13 hastaya uygulanmıştır. İntrasebral hematomlu hastalarda, GCS skorları ilk kabulde ve tedavi sonrasında belirlenmiştir ve kıyaslanmıştır.

**Bulgular:** Çalışmada, 4'ü medikal tedavi alan ve 4'ü opere edilen toplam 8 hasta hayatını kaybetmiştir. Katılımcılar, lezyonun lokasyonuna göre, pre- ve post-tedavi GCS skorlarına göre incelenmiştir. Elde edilen veriler, GCS skorlarının, medikal ve cerrahi uygulama gruplarında, işlem öncesi ve sonrası istatiksel olarak anlamlılık olduğunu göstermiştir. Medikal olarak tedavi edilen hastaların GCS skorları, opere edilenlerinkine göre daha yüksek bulunmuştur. Tedaviler sonrası GCS skorları iki grup arasında yakın bulunmuş ve istatiksel bir fark tespit edilmemiştir.

**Sonuç:** Çalışma sonucunda elde edilen veriler, cerrahi tedavinin medikal tedaviye kıyasla daha iyi olmadığını göstermiştir.


**Anahtar Kelimeler:** Spontan İntraserebral Hemoraji, Cerrahi Tedavi, Medikal Tedavi

## Introduction

Intracerebral hemorrhage (ICH) is a subtype of stroke. Hemorrhage may extend to the ventricles. Non-traumatic ICH accounts for nearly 15% of all strokes associated with high risk of mortality and morbidity (1). Primary or spontaneous ICH constitutes a significant portion of hemorrhagic strokes. The diagnosis is usually made by the absence of another pathological or structural cause, a chronic hypertension history, increased age, and the clot location. The resulting brain damage is usually classified as primary. Primary damage is the damage to the parenchyma by the blood clot. Secondary damage is caused by complications from intracranial hemorrhage (2).

Management of ICH ranges from medical management to open surgery where the hematoma is actively drained. Our understanding of the ICH has evolved in recent years. However, there is no specific treatment that provides a cure. Treatments targeting hematoma expansion, such as aggressive reduction in blood pressure, use of tranexamic acid and recombinant activated factor VII, have failed to improve functional outcome. Evacuation of hematoma has therapeutic potential by inhibiting the acute effects of hematoma on healthy brain parenchyma. However, since the most common sites of ICH are deep brain structures such as the basal ganglia and thalamus, iatrogenic damage to healthy brain tissue may develop during surgery. Additionally, neurosurgical procedures are not free of risks and side effects. Post-surgical complications such as bleeding and infection are not uncommon and morbidity and mortality rates are high. Open craniotomy is the most studied approach in ICH. However, other surgical approaches have also been tried, such as decompressive craniectomy±hematoma drainage, stereotactic endoscopic aspiration, and minimally invasive catheter evacuation. None of these surgical techniques improved clinical outcome compared to best medical treatment. However, large lobar hemorrhages or hematomas in the posterior fossa can lead to life-threatening cerebral or brainstem herniation, which may require life-saving emergency surgical evacuation (3).

The incidence of both ischemic and hemorrhagic stroke has approached 40 million cases worldwide. The incidence of ICH is twice as high in low- and middle-income regions as in economically developed countries. It is more common in the elderly (>55 years) people of African/Asian descent, and the male population (4,5).

ICH localized in different parts of the brain. The most common locations are cerebral lobes, basal ganglia, thalamus, brain stem, and cerebellum. In large hematomas, blood may spread to the ventricles. Permanent sequelae are seen with a frequency of 15-30% due to stroke that develops after ICH (6).

In this study, patients who were treated for hematoma secondary to spontaneous intracerebral hemorrhage in our center between 2016 and 2020 were examined. The surgical and medical treatments applied to the patients were compared with the Glasgow Coma Scale (GCS) scores and efficacy of treatments were examined.

## Material and Methods

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All persons included in the study signed the informed consent form.

The sample of the present study consists of those who applied to a tertiary healthcare institution due to intracerebral hemorrhage between 2016 and 2020. A total of 32 patients with intracerebral hemorrhage were included in the study. Diagnosis was made by cranial CT and cranial MRI in all patients. In the post-treatment period, the participants were reevaluated with neurological examination and control cranial CTs. The location of the lesions was determined in all participants, and patients with infratentorial hemorrhage and traumatic intracerebral hematoma were not included in the study.

In the study, GCS value, localization of hematoma, neurological situation, hematoma volume, mass effect arising from hematoma and radiological examination results were taken into consideration in the selection of surgical or medical treatment. Medical treatment was applied to 19 patients among the participants. Surgical treatment was applied to 13 patients. GCS points of patients presenting with intracerebral hematoma were recorded and compared at their first admission and after treatment.

### Statistical analysis

The data of the study were analyzed in the IBM SPSS version 22.0 statistical package program. Wilcoxon sequential sign test was used to compare GCS values before and after treatment. The groups were compared with the Mann Whitney U test. Statistical significance level was accepted as $p<0.05$.

## Results

The sample of the present study consists of those who applied to a tertiary healthcare institution due to intracerebral hemorrhage between 2016 and 2020. A total of 32 patients with intracerebral hemorrhage were included in the study. Twenty of the patients were female and 12 were male. It was determined that the average age of the participants was 66. Diagnosis was made by cranial CT and cranial MRI in all patients. In the post-treatment period, the participants were reevaluated with neurological examination and control cranial CTs. The location of the lesions was determined in all participants, and patients with infratentorial hemorrhage and traumatic intracerebral hematoma were not included in the study.

The patients were evaluated with neurological examination and control cranial CTs in the post-treatment period. In the study, a total of eight patients died, four of whom were followed up with medical treatment and four of those who underwent surgical treatment.

Bleeding volume is an important data in hematomas. The volume being less or more than 20 ml is an important factor affecting treatment choices and prognosis (7). Participants were also examined in this respect and were classified as those with hematoma volume below or above 20 ml. ABC/2 method was used to calculate the hematoma volume (8).

Spread of bleeding into the intraventricular space is an indicator of poor prognosis in ICH. Hydrocephalus due to ventricular outflow obstruction increases intracranial pressure. In most cases, the increased intracranial pressure and acute hydrocephalus caused by ICH are managed with the placement of an external ventricular drainage (7,8). In our study, intraventricular bleeding was found in seven patients. Four of them have ventricular drainage placed. Three patient was medically treated with sedation and osmotic diuretics.

Systemic arterial hypertension and cerebral amyloid angiopathy are the two main risk factors in ICH. Systemic arterial hypertension was detected in half of the participants of our study.

GCS points of patients with intracerebral hematoma were recorded at their first admission and after treatment. Detected GCS scores were compared. Medical treatment was applied to 19 patients among the participants. Medical treatment includes treatments to prevent the expansion of deep hematoma, monitoring of hypertension and blood glucose level, use of anticonvulsants, and monitoring of intracranial pressure. Surgical treatment was applied to 13 patients among the participants. In surgical treatment, craniotomy was performed, hematoma was evacuated, and bleeding was controlled by placing a drainage catheter.

According to the generally accepted view today, surgical intervention is supported in the following cases. The participants of the study were examined in terms of these criteria.

- Superficial bleeding,
- Volume of clot > 20ml;
- Severe neurologic deficits and altered consciousness,
- Young cases,
- Increased intracranial pressure
- Bleeding in sensitive areas (such as motor area),

• Cases with radiological compression of the quadrigeminal cistern (even if conscious is clear),

• Expanding hematomas

• Life-threatening lobar and cerebellar hematomas >3 cm or causing hydrocephalus (7).

Participants were examined in terms of pre- and post-treatment GCS scores according to the location of the lesion. Lobar hematomas are hemorrhages involving the brain lobes. It is most commonly seen in the occipital lobe. No lobar involvement was found among the cases examined in the study. While the most common intraparenchymal lesions were observed in the participants, the cerebellum was the least localized location (Table 1). Lesion locations were compared in terms of post-treatment GCS values, and no significant difference was found between them (p>0.05).

**Table 1.** Location of hematomas.

| Location | Cases | |
|---|---|---|
| | No | % |
| Brain-stem | 8 | 25 |
| Thalamus | 7 | 22 |
| Putaminal | 6 | 19 |
| Caudal | 6 | 19 |
| Cerebellar | 5 | 15 |

Cerebellar hemorrhage was found in five of the participants. It is accepted that there is an indication for emergency surgery in cerebellar hemorrhages greater than 3 mm in diameter. None of the participants with cerebellar hemorrhage had a bleeding diameter of more than 3 mm. It was determined that the hematoma volume was above 20 ml in four of the participants. All of them were treated surgically and three of them died.

As a result of the analysis of the data obtained, it was determined that there was a significant difference between the GCS values of the participants before and after the surgical and medical treatment (p=0.04 and p=0.03, respectively) (Table 2).

**Table 2.** Comparison of treatment groups in terms of GCS values.

| | ARRIVAL | | | FOLLOW-UP | | | p[a] |
|---|---|---|---|---|---|---|---|
| | Mean | Min | Max | Mean | Min | Max | |
| SURGERY | 8,2 ∓ 4,3 | 3 | 15 | 11,4 ∓ 4,8, | 5 | 15 | 0,02 |
| MEDICAL | 9,3 ∓ 3,4 | 4 | 15 | 11,7 ∓ 4,6 | 5 | 15 | 0,03 |
| p[b] | 0,04 | | | 0,65 | | | |

a: Wilcoxon sequential sign test
b: Mann Whitney U

The relationship between the GCS values of the participants before and after surgical and medical treatment was examined. Accordingly, the mean GCS values of those who were treated medically were higher than those who were treated surgically. The difference between the groups was statistically significant (p=0.03). On the contrary, GCS values were very close to each other after treatment and no statistically significant difference was found between the groups (p=0.65) (Table 2). Accordingly, no significant superiority of surgical treatment to medical treatment has been demonstrated.

## Discussion

The main goals of surgical treatment of intracerebral hemorrhages in the early period can be listed as removing the distortion in the tissue, preventing intracranial pressure and reducing the damage caused by the toxic elements of the hematoma (9).

Some studies on surgical treatment and early evacuation of hemorrhage and some stereotactic aspiration studies were examined, and it was determined that they did not have any clinical benefit (10,11). Hematomas formed as a result of lobar and deep ICHs larger than 20 ml were evacuated by craniotomy four hours after the symptoms started, and the results were examined. It was determined that the procedure performed increased the risk of bleeding (12). The International Study of Surgery for Intracerebral Hemorrhages (STICH) was conducted to determine whether early surgical evacuation of the hematoma would improve outcome compared to medical treatment in selected patients. It is the largest study comparing early surgery with early medical treatment. The results of this study indicated that there was no significant difference in prognosis between the two treatment groups. (13).

Results vary when it comes to lobar hemorrhages. Results from patients randomized to lobar hemorrhage in three different studies were analyzed by meta-analysis. Results showed that early surgery in lobar hemorrhages is associated with a good prognosis (14). A group of patients with lobar hemorrhages <1 cm from the cortical surface was studied. The results supported that surgical treatment is more beneficial than medical treatment. Surgical treatment was found to be approximately 30% more beneficial than medical treatment. (15).

When cases of ICH worsen clinically or radiologically, surgical intervention with open craniotomy or stereotactic approaches can be performed. Placement of an external ventricular drain during surgical intervention enables intracranial pressure measurement and cerebrospinal fluid drainage. Severe brain stem hemorrhages and massive dominant hemisphere hemorrhages in ICH cases usually result in death. In addition, small lobar hemorrhages that do not show enlargement usually have a good prognosis (15).

Newer surgical techniques include hemicraniectomy with stereotactic aspiration and thrombolysis. Of these, stereotactic aspiration and thrombolysis are considered safe techniques. It can improve the clinical status of patients and reduce the hematoma volume by more than 80% (16,17).

In a study using recombinant tissue plasminogen activator in addition to minimally invasive surgery in the evacuation of intracerebral hemorrhage, a stereotactic catheter was placed in ICH patients and the bleeding was aspirated. Recombinant tissue plasminogen activator was administered through the catheter until the bleeding volume fell below a certain level, then the catheter was opened and free drainage was provided. With this application, a reduction of nearly 50% was detected in hematomas. On the other hand, the shrinkage rate remained at 4% in the medical care group. It was reported that the complications determined in minimally invasive surgical intervention remained within the safety limits, and it was stated that the effect on the long-term prognosis should be investigated (18).

One of the techniques applied in the surgical intracerebral hemorrhage treatment is hemicraniectomy. Hemicraniectomy is a surgical treatment aimed at reducing the intracranial pressure to prevent the effects of edema. It mainly aims at the rapid removal of displacements in the tissues (19). This treatment can be applied alone or simultaneously with evacuation of the hematoma. According to the data obtained from the patient groups examined retrospectively, a decrease in mortality was recorded with hemicraniectomy (20).Randomized studies on this treatment method used in intracerebral hemorrhage should be planned.

## Conclusion

In the light of the findings obtained in the present study, it was concluded that surgical treatment was not superior to medical treatment. This situation was attributed to the better neurological status of the patients who presented with intracerebral hematoma and received medical treatment. The results are compatible with the literature. It is thought that the additional burden of surgical treatment negatively affects the healing process. Regardless of the hematoma volume, bleeding in the posterior fossa, especially in the cerebellum, is life-threatening. Therefore, although the literature data is limited, surgical treatment should be considered as a life-saving option in posterior fossa hematoma.

## References

1. Ziai WC, Carhuapoma JR. Intracerebral Hemorrhage. Continuum (Minneap Minn). 2018 Dec;24(6):1603–22.
2. Elliott J, Smith M. The acute management of intracerebral hemorrhage: a clinical review. Anesth Analg. 2010 May;110(5):1419–27.
3. de Oliveira Manoel AL. Surgery for spontaneous intracerebral hemorrhage. Crit Care. 2020 Feb 7;24(1):45.
4. Poon MTC, Bell SM, Al-Shahi Salman R. Epidemiology of Intracerebral Haemorrhage. Front Neurol Neurosci. 2015;37:1–12.
5. Rymer MM. Hemorrhagic stroke: intracerebral hemorrhage. Mo Med. 2011;108(1):50–4.
6. Balami JS, Buchan AM. Complications of intracerebral haemorrhage. Lancet Neurol. 2012 Jan;11(1):101–18.
7. Siddique MS, Mendelow AD. Surgical treatment of intracerebral haemorrhage. Br Med Bull. 2000;56(2):444–56.
8. Kothari RU, Brott T, Broderick JP, Barsan WG, Sauerbeck LR, Zuccarello M, et al. The ABCs of measuring intracerebral hemorrhage volumes. Stroke. 1996 Aug;27(8):1304–5.
9. Xi G, Keep RF, Hoff JT. Mechanisms of brain injury after intracerebral haemorrhage. Lancet Neurol. 2006 Jan;5(1):53–63.
10. Morgenstern LB, Demchuk AM, Kim DH, Frankowski RF, Grotta JC. Rebleeding leads to poor outcome in ultra-early craniotomy for intracerebral hemorrhage. Neurology [Internet]. 2001 May 22;56(10):1294 LP – 1299. Available from: http://n.neurology.org/content/56/10/1294.abstract
11. Zuccarello M, Brott T, Derex L, Kothari R, Sauerbeck L, Tew J, et al. Early surgical treatment for supratentorial intracerebral hemorrhage: a randomized feasibility study. Stroke. 1999 Sep;30(9):1833–9.
12. Morgenstern LB, Frankowski RF, Shedden P, Pasteur W, Grotta JC. Surgical treatment for intracerebral hemorrhage (STICH): a single-center, randomized clinical trial. Neurology. 1998 Nov;51(5):1359–63.
13. Gregson BA, Rowan EN, Francis R, McNamee P, Boyers D, Mitchell P, et al. Surgical Trial In Traumatic intraCerebral Haemorrhage (STITCH): a randomised controlled trial of Early Surgery compared with Initial Conservative Treatment. Health Technol Assess. 2015 Sep;19(70):1–138.
14. Mendelow AD, Unterberg A. Surgical treatment of intracerebral haemorrhage. Curr Opin Crit Care. 2007 Apr;13(2):169–74.
15. Gurol ME, St Louis EK. Treatment of cerebellar masses. Curr Treat Options Neurol. 2008 Mar;10(2):138–50.

16. Miller CM, Vespa PM, McArthur DL, Hirt D, Etchepare M. Frameless stereotactic aspiration and thrombolysis of deep intracerebral hemorrhage is associated with reduced levels of extracellular cerebral glutamate and unchanged lactate pyruvate ratios. Neurocrit Care. 2007;6(1):22–9.
17. Vespa P, McArthur D, Miller C, O'Phelan K, Frazee J, Kidwell C, et al. Frameless stereotactic aspiration and thrombolysis of deep intracerebral hemorrhage is associated with reduction of hemorrhage volume and neurological improvement. Neurocrit Care. 2005;2(3):274–81.
18. Morgan T, Zuccarello M, Narayan R, Keyl P, Lane K, Hanley D. Preliminary findings of the minimally-invasive surgery plus rtPA for intracerebral hemorrhage evacuation (MISTIE) clinical trial. Acta Neurochir Suppl. 2008;105:147–51.
19. Murthy JMK, Chowdary GVS, Murthy TVRK, Bhasha PSA, Naryanan TJ. Decompressive craniectomy with clot evacuation in large hemispheric hypertensive intracerebral hemorrhage. Neurocrit Care. 2005;2(3):258–62.
20. Mitchell P, Gregson BA, Vindlacheruvu RR, Mendelow AD. Surgical options in ICH including decompressive craniectomy. J Neurol Sci. 2007 Oct;261(1–2):89–98.