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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Post-Operative Functional Outcomes in Chronic Subdural Hematoma: The Impact of Prior Stroke

Kronik Subdural Hematomda Post-Operatif Fonksiyonel Sonuçlar: Önceki İnmenin Etkisi

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ABSTRACT

Aim: The study aims to evaluate the impact of prior stroke on functional outcomes following surgery for Chronic Subdural Hematoma (CSH).

Material and Method: Patients diagnosed with CSH between 2012-2023 were included, focusing on those with a history of stroke. All underwent "burr hole" surgery and were followed for 12-60 months. The Functional Independence Measure (FIM) was used to assess pre- and post-operative functional status.

Results: 84 patients were evaluated; 44 had a history of CVD. The study found a statistically significant decline in motor and cognitive function post-surgery in patients with a history of CVD. No significant decline was observed in patients without CVD.

Conclusion: Patients with a prior history of stroke who undergo surgery for CSH are at risk for enduring declines in motor and cognitive function. It's crucial to manage expectations and consider this risk when recommending surgery.

Keywords: Chronic subdural hematoma, stroke, functional independence measure, post-operative outcomes, motor and cognitive functions

ÖZ

Amaç: Çalışma, önceki bir inme geçmişinin Kronik Subdural Hematom (KSH) ameliyatı sonrası fonksiyonel sonuçlar üzerindeki etkisini değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntem: 2012-2023 yılları arasında KSH tanısı almış hastalar dahil edilmiş, inme geçmişi olanlar üzerinde odaklanılmıştır. Tüm hastalara "burr hole" ameliyatı yapılmış ve 12-60 ay süreyle takip edilmiştir. Fonksiyonel bağımsızlık durumunu değerlendirmek için Fonksiyonel Bağımsızlık Ölçümü (FIM) kullanılmıştır.

Bulgular: 84 hasta değerlendirilmiş; 44'ü inme öyküsü olanlardı. Çalışma, inme geçiren hastalarda ameliyat sonrası motor ve bilişsel işlevlerde istatistiksel olarak anlamlı bir düşüş buldu. İnme geçmişi olmayan hastalarda anlamlı bir düşüş gözlemlenmedi.

Sonuç: Daha önce inme geçmişi olan ve KSH ameliyatı olan hastalar, motor ve bilişsel işlevlerde sürekli düşüş riski altındadır. Ameliyat önerilirken bu riski göz önünde bulundurmak ve beklentileri yönetmek çok önemlidir.

Anahtar Kelimeler: Kronik subdural hematom, inme, fonksiyonel bağımsızlık ölçüsü, ameliyat sonrası sonuçlar, motor ve bilişsel fonksiyonlar

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INTRODUCTION

Chronic subdural hematoma (CSH) is a condition predominantly found in the elderly population. As the global population continues to age, the incidence of CSH is also increasing (1). This increase is especially significant among elderly patients with a history of stroke, who are often prescribed anticoagulant or antiplatelet medications, thereby elevating their risk for developing CSH.

Daily functions such as self-care, communication, social perception, sphincter control, and mobilization are markers of higher cognitive abilities and significantly contribute to a patient's quality of life. In elderly individuals with a history of Chronic Vascular Disease (CVD; Prior Stroke), a decline in cognitive functions and overall quality of life is expected. Consequently, when these individuals develop CSH, they are likely to experience further deterioration in one or more of these functional areas (1-4). The primary goal of CSH surgery is to drain the hematoma and relieve pressure on the brain's cortical structures. Nevertheless, both patients and their families often expect not just relief from symptoms but also a significant improvement in cognitive functions and quality of life post-surgery. Contrary to these expectations, our clinical experience suggests that some elderly patients with a history of CVD do not show the anticipated improvement in cognitive function and quality of life post-surgery, despite successful drainage of the hematoma and uncomplicated post-operative follow-ups.

To substantiate these clinical observations, this study aims to compare the pre- and post-operative functional independence of CSH patients with and without a history of CVD.

MATERIAL AND METHOD

The study protocol was approved by Selçuk University Hospital, Turkey, Selçuk University Hospital Scientific Researches Ethical Board in conformity with the Declaration of Helsinki (approval date/ number: 2023/17). Informed consent has been obtained from the patients whose tests and images have been shared

Between 2012 and 2023, we evaluated patients diagnosed with CSH at our clinic who underwent surgery using the "burr hole" method with irrigation and were subsequently monitored with a subdural drain for 48 hours post-operation. We included patients who:

- Experienced no surgical or post-operative complications
- Are currently alive, self-sufficient, and cognitively able to answer questions
- Have no other neurological diseases (e.g., Alzheimer's, dementia)
- Have not undergone any other cranial surgeries
- Were only treated for CSH via the "burr hole" method (those converted to craniotomy or who had multiple surgeries were excluded)
- Were monitored post-operatively for CSH between 12 to 60 months

We excluded patients with a follow-up period of fewer than 12 months to eliminate early post-operative effects. Additionally, to mitigate the impact of age-related cognitive decline, we excluded patients with a follow-up period exceeding 60 months.

The study distinguished between patients with a history of CVD who survived without sequelae and those who only received medical treatment for CVD, separating them from patients with no CVD diagnosis. These patients were grouped accordingly for analysis.

In this retrospective study, we sourced data from our hospital's information, specifically focusing on patients with a history of CVD who underwent CSH surgery. The sample size was inherently limited due to the specificity of the patient criteria. To ensure accurate data collection, only patients who received both neurological and neurosurgical treatment at our facility were included. During outpatient visits, we administered the Functional Independence Measure (FIM) by interviewing both the patients and their relatives. Owing to the COVID-19 pandemic, we conducted phone interviews for patients unable or unwilling to attend outpatient visits.

We compared this group to another set of patients without a CVD history but who had undergone surgery for CSH. These patients were selected to match the demographic characteristics of the first group (e.g., average age, gender distribution, absence of other major surgeries like cardiac bypass). We maintained a similar patient count for both groups. Patients or relatives who could not adequately answer our questions were excluded from the study.

For all included patients, interviews were conducted with both the patients and their relatives during outpatient visits or over the phone. We administered the FIM for both pre- and post-operative periods. This test examines 'motor functions' such as self-care, sphincter control, transfers, and locomotion, as well as 'cognitive functions' like communication and social cognition.

Statistical Analysis

We conducted our statistical analysis using SPSS version 22.0. Descriptive statistics were initially computed, followed by an assessment of the normality of the data distribution using the Shapiro-Wilk test. As the data did not follow a normal distribution, we employed the Wilcoxon test to analyze the differences between two dependent numerical variables. $p<0.05$ was considered statistically significant.

Prior to conducting the research, we calculated the study's statistical power using G*Power 3.1.9.4. Assuming an average difference of 5 between the two groups, and setting alpha at 0.05 and beta at 0.80, the required sample size was determined to be 84.

RESULTS

Our study included a total of 84 individuals, 44 of whom had a history of CVD, while the remaining 40 did not. The average age across all participants was 71.5 ± 10.08, ranging between 50 to 90 years. The gender distribution consisted of 47 males (55.9%) and 37 females (44.1%). Most patients, 61 in total (72.6%), underwent surgery for a unilateral subdural hematoma. Among the patients with a history of CVD, 75% (n=33) had a unilateral hematoma, compared to 70% (n=28) among those without a history of CVD. The average follow-up duration was 37.7 months, spanning from 12 to 60 months.

Motor Function Analysis

In our study, the pre-operative motor function scores of patients operated on due to CSH were statistically significantly higher than their post-operative scores (p=0.042, Wilcoxon) (**Table 1**).

Table 1. Motor, cognitive and total scores of patients operated for CSH before and after the operation

	Postoperative	Preoperative	p-value
Motor	91 (82-91)	86,5 (70,25-91)	0.042*
Cognitive	34 (30-35)	32 (28-35)	0.097*
Total	123 (108-126)	119 (94,75-125)	0.047*

* analyzed by Wilcoxon test.

Analysis Based on CVD History

Group 1 (With CVD history): Patients in this group exhibited statistically significant declines in motor, cognitive, and overall function scores post-operation compared to their pre-operative scores:

- Motor functions: p=0.049
- Cognitive functions: p=0.044
- Overall function scores: p=0.030 (Wilcoxon) (**Table 2**, **Figure 1**)

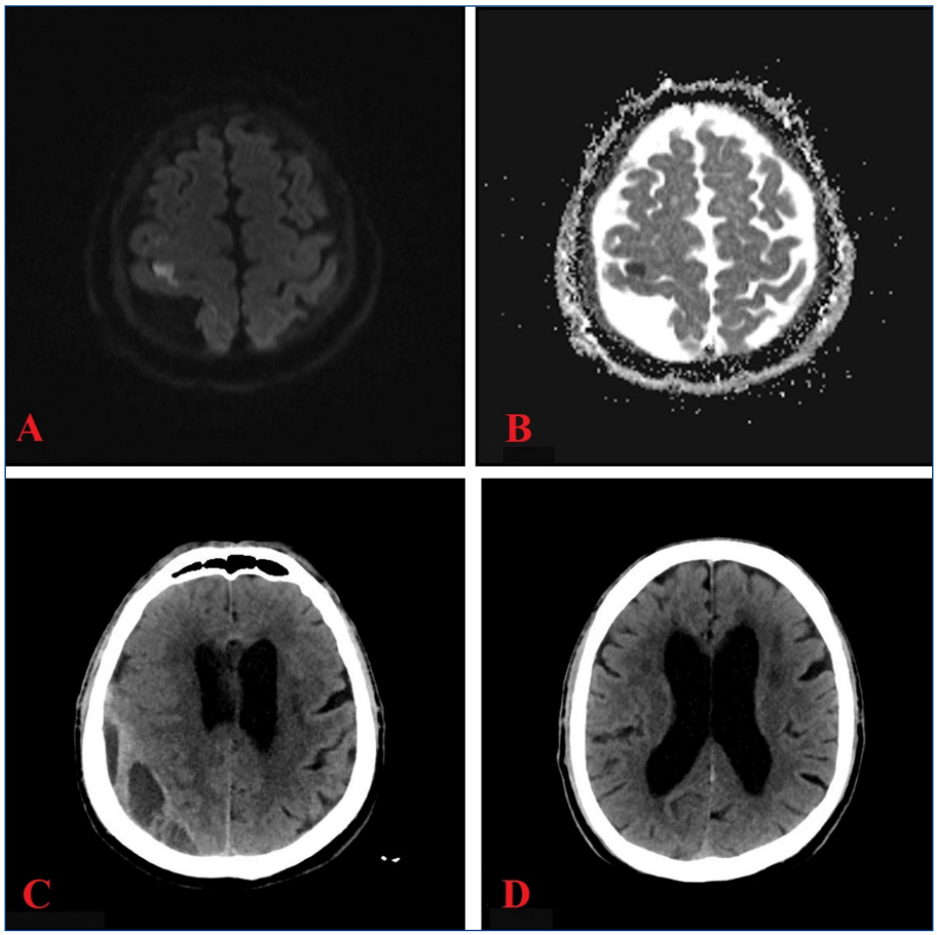

Figure 1A – The patient's DWI MRI imaging shows hyperintense areas. In **Figure 1B,** the corresponding ADC MRI reveals hypointense regions indicative of an acute stroke, along with an appearance compatible with subdural effusion on the same side. **Figure 1C** – On the cranial CT taken during the patient's one-year follow-up, it is observed that the right-sided subdural effusion has transformed into a subdural hematoma, causing cortical compression. **Figure 1D** – In the follow-up CT taken 12 months after the patient's surgery for CSH, the brain parenchyma appears expanded, the midline is properly aligned, and the sulci appear relaxed.

Group 2 (Without CVD history): In contrast, no statistically significant differences were observed between pre- and post-operative function scores in this group ($p > 0.05$, Wilcoxon) (**Table 2**).

These findings indicate a significant post-operative decline in both motor and cognitive functions in CSH patients with a history of CVD, a trend not observed in those without such history.

Unilateral vs. Bilateral Analysis

Across all groups, when pre- and post-operative scores for motor, cognitive, and overall functions were compared based on the type of CSH (unilateral vs. bilateral), a statistically significant decline was observed in post-operative scores among those with unilateral CSH. In contrast, for patients with bilateral subdural hematomas, no significant differences were noted between their pre- and post-operative scores in any category (**Table 3**). No significant difference emerged when these variables were stratified by groups.

DISCUSSION

In the study, when we compared the preoperative and postoperative motor, cognitive, and total scores of all patients with a history of CVD who underwent surgery for CSH, we found that the postoperative FIM test results were lower than the preoperative results. These findings were also statistically significant. While this outcome is noteworthy, what's even more critical is that the scores of those with a history of CVD were lower compared to those without a history of CVD. This observation essentially corroborates our clinical experiences that motivated us to initiate this study, thereby lending greater significance to our research. Our study conclusively showed that a surgical procedure, which already adversely affects the cognitive functions of patients with a prior history of CVD (**Table 1**), exacerbates the underlying decline in cognitive functions and quality of life, making this deterioration permanent.

In fact, authors of other studies with similar clinical experiences have also explored similar variables affecting the recovery process after CSH surgery. These studies have identified factors such as advanced age, prolonged preoperative hospital stays, the presence of dementia, the use of irrigation-based drainage during surgery, and preexisting limitations in daily activities as negative predictors for outcomes post-discharge (1, 2, 5). In addition to these factors, experimental studies have suggested that the type of anesthetic agents used during surgery can also impact postoperative cognitive function, particularly in elderly patients. For instance, agents like sevoflurane have been shown to contribute to postoperative cognitive dysfunction, whereas this effect is less pronounced with agents such as propofol. (6).

When the FIM test was administered to all patients participating in the study, the preoperative scores were statistically significantly higher than the postoperative scores for all patients (**Table 1**). This implies that there was a decline in both cognitive and motor functions of the patients after surgery compared to before surgery. We suspect that a contributing factor to this data may be the inclusion of patients with a history of CVD within this patient group. Indeed, when evaluating Group 2 independently, no significant difference was observed between preoperative and postoperative FIM scores (**Table 2**).

In existing literature, it is suggested that if there is no preexisting diagnosed dementia and cognitive dysfunction has developed due to CSH, early surgical intervention can largely reverse the impaired cognitive functions. Furthermore, motor deficits that have developed shortly before surgery or new motor deficits that appear postoperatively are also reported to have a high rate of improvement. (2, 7).

In the study, when we compared the preoperative and postoperative outcomes of patients who underwent surgery for unilateral CSH, the postoperative motor, cognitive, and overall scores were statistically

Table 2. Comparison of pre- and postoperative motor, cognitive and total scores of patients with a history of SVD accompanying CSH (Group 1) with the results of patients selected as the control group (Group 2)

	With CVD	With CVD	p-value	Without CVD	Without CVD	p-value
	Pre-op	Post-op		Pre-op	Post-op	
Motor İtems	91(66-91)	80 (53-91)	0.049*	91 (85-91)	91(85-91)	0,766*
Cognition İtems	34(21-35)	30 (15-34)	0.044*	34 (31-35)	34 (32-35)	0,398*
Total İtems	125(91-126)	110 (70-124)	0.030*	121(111-125)	125 (114-126)	0,688*

*analyzed by Wilcoxon test.

Table 3. Pre- and postoperative motor, cognitive and total scores according to unilateral or bilateral operation of CSH

	Unilateral (n=51)		p-value	Bilateral (n=23)		p-value
	Pre-op	Post-op		Pre-op	Post-op	
Motor İtems	91(85-91)	86(67,75-91)	0.011*	90,5 (74-91)	90,5(75,5-91)	0.779*
Cognition İtems	34 (30-35)	32(20,5-34)	0.005*	34 (24-35)	35(30,5-35)	0.373*
Total İtems	124 (107,75-126)	116(88,75-124,5)	0.003*	117,5(108-125,75)	125(98-126)	0.398*

*analyzed by Wilcoxon test

significantly lower than the preoperative scores (**Table 3**). When we separately evaluated Group 1 and Group 2, no statistically significant changes were observed in the preoperative and postoperative motor, cognitive, and overall FIM scores for patients undergoing surgery for either unilateral or bilateral CSH. Upon reviewing other studies in the existing literature, we found that there is no clear consensus regarding the postoperative prognosis of cognitive and motor functions in patients with CSH who have been operated on either unilaterally or bilaterally (1, 8-10).

Indeed, based on the poor prognostic factors identified in existing literature, one might expect that patients with bilateral CSH, owing to higher intracranial pressure from bilateral cerebral compression, longer durations of surgery, and more extensive irrigation, would experience worse postoperative functionality. However, our study has shown the exact opposite to be true. Our findings may be explained by our clinical experience, which suggests that unilateral compression might lead to a shift in intracranial structures, or that bilateral compression may provide a counterbalance, resulting in less hematoma growth. Regardless, these hypotheses should be the focus of future research.

The existing literature emphasizes the importance of a postoperative follow-up period extending beyond three months to accurately assess patient functionality (2). In our study, a key question that intrigued us was whether changes in functionality were permanent. For this reason, having postoperative follow-up periods extending up to 60 months was critical for the reliability of the data obtained. This extended timeframe has helped to mitigate the effects of hospitalization, anesthesia, and potential impacts of the surgery itself.

There are limitations to our study. Firstly, it is a retrospective study, and the majority of the data was sourced from written documentation. Future research could include a prospective study to better evaluate these concerns. Studies involving a larger patient population and employing more comprehensive tests than the FIM may yield different outcomes, particularly in areas where our results were not found to be statistically significant. During the planning phase of our research, we aimed to add objectivity by having the FIM test administered by the same individual for all patients. All patients in our study had CSH on the same hemisphere where their stroke occurred (**Figure 2**). Comparing these findings with a population that had surgery for CSH affecting the opposite hemisphere from where their stroke sequelae were could be essential for corroborating our results. In fact, such a comparison might yield very diverse data. We believe that the limitations of our study could serve as guiding parameters for future research, potentially leading to more conclusive results through studies with both fewer and larger patient numbers.

CONCLUSION

This study underscores the fact that patients who have previously suffered a stroke and later develop CSH are at risk for enduring motor and cognitive functional declines, even when surgical interventions are without complications. It's crucial to manage both patient and family expectations realistically before opting for surgery, and to explicitly communicate the possibility of these long-term outcomes. Being informed about these potential risks can equip patients and their families to better prepare for any functional losses that might manifest in the postoperative period. Furthermore, armed with this knowledge, patients may exhibit greater resilience against functional deficits and may be more proactive in their own recovery.

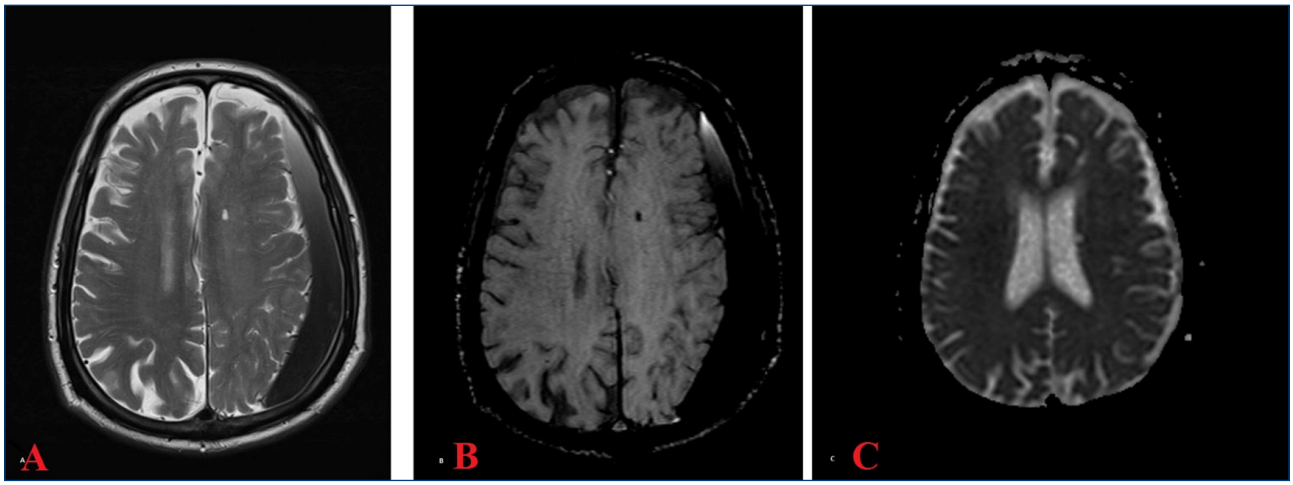

Figure 2 - The patient, who was treated for acute stroke two years ago, shows chronic ischemic changes in the follow-up diffusion MRI. Specifically, **Figure 2A** reveals hyperintense areas on ADC, and **Figure 2B** shows hypointense areas on DWI. The images also display a chronic subdural hematoma on the same side as the stroke sequelae, causing cortical compression. **Figure 2C -** In the MRI imaging taken 15 months post-surgery, the chronic ischemic changes persist; however, the chronic subdural hematoma has completely resolved, and the brain parenchyma appears expanded.

In summary, our study offers a meaningful contribution to existing literature, enhancing our comprehension of the possible long-term functional consequences following CSH surgery. The incorporation of this information into clinical practice has the potential to significantly improve patient care and outcomes.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study protocol was approved by Selçuk University Hospital, Turkey, Selçuk University Hospital Scientific Researches Ethical Board in conformity with the Declaration of Helsinki (approval date/ number: 2023/17).

Informed Consent: Informed consent has been obtained from the patients whose tests and images have been shared

Referee Evaluation Process: Externally peer-reviewed.

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