Research Article / *Araştırma Makalesi*

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The Effects of Dexamethasone Used in the Treatment of Chronic Subdural Hematoma

Kronik Subdural Hematom Tedavisinde Deksametazonun Etkileri

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ABSTRACT

Aim: In this study, we aimed to analyze the properties of drained subdural fluid and post-operative follow-up of patients with chronic subdural hematoma subdivided randomly into two groups according to presence or absence of dexamethasone treatment.
Material and Methods: 42 patients with chronic subdural hematoma were involved in this study. The patients were divided into two groups according to dexamethasone treatment. 21 of the patients were treated with dexamethasone. All patients underwent burr hole craniotomy and a closed system drainage was constructed. The amount and properties of per-operative versus post-operative drained subdural fluid (hemoglobin, total protein and albumin levels) were analyzed. Cranial computerized tomography scans were used for follow-up and presence of fluid collection in subdural space was controlled.
Results: When compared to per-operative laboratory results, statistically significant decrease was observed in both groups. However, the decrease in dexamethasone group was more significant compared to none-dexamethasone group. Follow-up computerized tomography results showed rare new subdural fluid collection development in dexamethasone group.
Conclusion: As a result, Our findings suggest that surgery with dexamethasone treatment in chronic subdural hematoma patients has a more favourable clinic result compared to surgery without dexamethasone treatment.

Keywords: Chronic subdural hematoma, subdural hematoma, dexamethasone, steroid treatment

ÖZ

Amaç: Bu çalışmada amacımız kronik subdural hematomlu hastalarda randomize olarak seçilen tedavide kullanılan deksametazon alan hastalar ve deksametazon almayan hastaların drene olan mayinin özelliklerinin karşılaştırılması ve postoperatif seyirlerinin takibidir.
Yöntem ve Gereç: Çalışmamızda 42 kronik subdural hematomlu hastanın takip ve tedavisi yapıldı. Bu hastaların 21'ine deksametazon tedavide verildi, 21 hastaya ise deksametazon tedaviye eklenmedi. Her iki hasta grubuna operasyonda burr-hole kraniotomi uygulandı ve kapalı drenaj sistemi oluşturuldu. Operasyon sırasında

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alınan ve sonrasında alınan kavite materyalinin özellikleri (mayide hemoglobin, total protein ve albümin düzeyleri) ve drene olan mayi miktarı karşılaştırıldı. Bu hastaların takiplerinde kranial bilgisayarlı tomografi çekildi. Hastalarda kontrol tomografilerinde subdural aralıkta kolleksiyon olup olmadığı kontrol edildi.
Bulgular ve Sonuç: Her iki hasta grubumuzda operasyonda alınan örneklerle karşılaştırıldığında kendi içlerinde anlamlı düşüşler tespit edildi. Ancak deksametazon kullanılan hasta grubumuzda düşüşler deksametazon almayan hasta grubumuzla karşılaştırıldığında azalma deksametazon alan hasta grubu lehine anlamlı olmuştur.

Anahtar Kelimeler: Kronik subdural hematom, subdural hematom, deksametazon, steroid tedavisi

INTRODUCTION

The head trauma, which has become one of the most important problem in our time; is a pathology that requires long-term treatment and care and can be fatal, can cause disabling, and ranks 4th among the causes of death. Traffic accidents, falls, beatings, work accidents, and injuries occurred during sports or at home creates the main causes of head trauma. The relative frequency of each cause varies according to different age groups and between regions.

The collection of blood in the subdural space between the dura mater and arachnoid membrane called subdural hematoma (SDH). SDHs can be classified as acute, subacute, and chronic according to torn vessel size, shape hematoma development and more importantly, formed by the interest rate and severity of the signs and symptoms [1]. *Acute Subdural Hematoma* refers to bleeding in the subdural space after the early phase (first 72 hours) of the trauma. Subacute Subdural Hematoma refers to the subdural hemorrhage collected between 3 days-3 weeks. However, these lesions are generally behave clinically like acute or chronic hematoma. *Chronic Subdural Hematoma* refers to bleeding detected after the 3rd week.

Originally, chronic subdural hematoma (cSDH) first defined by Virchow "Pachymeningitis haemorrhage of interna" in 1857. Despite being a frequently encountered types of intracranial hemorrhage, the pathogenesis is still unclear. CSDH is a collection between the dura and arachnoid. It is developing a capsule in cSDH and hematoma is trapped in the capsule.

The main problem is how the hematoma grows? [2]. The most commonly accepted theory for today is the theory of recurrent bleeding that result of hyper fibrinolysis of the macro capillaries in outer membrane of chronic subdural hematoma, or increased levels of plasmin compared to antiplasmin [3,4].

The initial factors of cSDH can be both of subdural hemorrhage or parainfectious. Subdural blood accumulation in the beginning is often traumatic. This results from injury caused by parasaggital bridge veins acceleration after direct or indirect cranial trauma. Skull fracture and consequent damage to some neighboring stand may result in a subdural hematoma causing a laceration in the venous sinuses. Nontraumatic origins of subdural blood and fibrin accumulation included AVMs of convexity, other cerebrovascular lesions and the aneurysm, bleeding diathesis, the infectious disease, brain tumors, especially convexity meningioma, meningeal carcinomatosis and sarcomatosis [5-8].

To summarize the physiopathogenesis of cSDH development; cSDH starts with subdural hemorrhage, a membrane that outer portion of it containing many abnormal blood vessels acts like a capsule and wraps the blood.

Local hyperfibrinolysis causes subdural hematoma liquefaction, cleavage products increase the bleeding by causing recurrent microhaemorrhages from peripheral vascular membrane and causes hematoma growth.

CSDH symptoms and signs are variable and are not pathognomonic. Clinical manifestations include headache, nausea, vomiting, imbalance in local progressive neurological deficits and the slow-growing mass lesions or symptoms may resemble dementia in older patients. The most common symptoms; headache, mental changes and hemiparesis. Headache occurs in 30-90% of patients. Headaches can be mild or generalized [9].

Chronic subdural hematoma diagnosis is based on the clinician's ability to understand and suspicion. Because cSDH can be presented in many different ways to complicate clinical diagnosis. Brain Tomography (CT) is the first diagnostic tool in the diagnosis of the CSDH because it is quite effective and non-invasive. CSDH can be diagnosed by CT accurately and quickly. When radiographic imaging considered for cSDH, it should be remember that there is not a clear correlation between hematoma size and clinical sings and symptomps. Therefore, selection of patients for surgical treatment based on clinical findings other than radiographic criteria.

CSDH can be treated as medical, surgical or both medical surgery.

Medical treatment of cSDH: post-traumatic and post-operative prophylaxis of seizures, and for preventing edema and ischemia. Anticonvulsant agents can be cut off after a few weeks if postoperative seizures do not appear at all.

Surgical treatment: Surgery has been shown to be most effective in the treatment cSDH The evacuation of subdural collections form the basis of the surgery in cSDH [10-12].

Craniotomy and capsule resection method, burr-hole method, twist drill method, fontanel tapping method, peritoneal shunt or cardiac catheter with an internal method, permanent subcutaneous reservoir subdural resist are a number of different surgical techniques [13].

After treatment, residual subdural fluid collections are common. The most important and dangerous complications of surgical treatment of acute postoperative bleeding. Infectious complications such as subdural empyema, brain abscess and meningitis can occur. These are rare and are between 1.5 to 4.2% (14). Epilepsy has been reported in approximately 10% of patients and all patients with cSDH should receive prophylactic anti-convulsant therapy before surgery. If seizures are not seen in 1 month postoperatively, treatment can be terminated [14].

In this study; we aimed to show the impact of CSDH expansion and re-accumulation of hematoma by measuring the penetration of 99mTc-human albumin complex into the hematoma cavity which is an indirect method. For this purpose, features of the fluid drains from subdural cavity were observed in a total of 42 patients with cSDH and treated and followed by our clinic. These patients underwent control CT and evaluated. In these patients, the effects of dexamethasone on the fluids drained and impact on recurrence-residual disease was observed.

MATERIAL AND METHODS

In this study, 42 patients were treated and evaluated who diagnosed with chronic subdural hematoma and admitted the Neurosurgery Clinic of Okmeydani Training and Research Hospital between January 2004 and March 2010. The diagnosis of all patients was confirmed by computed tomography. 21 randomly selected patients with chronic subdural hematoma were started on dexamethasone, and the other 21 patients were not given dexamethasone. The hemoglobin, total protein and albumin levels were determined in sample of chronic subdural hematoma cavity taken during the operation, and the fluid drained from the operation area. The amount of fluid that drains was measured daily.

The patients were operated under general anesthesia. The burr-hole craniotomy method was applied to all patients. Skin incisions opened according to the localization of the hematoma and the way to match the flap removal. Burr-hole opened in accordance with 2.5cm in diameter hematoma localization. Paying attention to hemostasis, chronic subdural hematoma opened dura mater plus incision in a way that will not damage the outer membrane. Burr hole was burned to the bone boundary with bipolar. Chronic subdural hematoma fluid was taken two syringes in a way will not contaminated with blood samples. There was inner and outer membrane of hematoma in all chronic subdural hematoma patients who received surgery. The cavity was irrigated with serum physiological with drains placed in the chronic subdural hematoma cavity. Each burr hole by placing a drain connected to the glove off the end of the drainage system. In this closed system, the amount of the daily drain may have been identified and sampled.

The fluid samples taken from chronic subdural hematoma cavity during and after the operation were studied in terms of and hemoglobin, total protein and albumin levels in biochemistry and microbiology laboratories. After the operation, the amount of drained from the drain of the patients which chronic subdural hematoma were measured.

The computed tomography was used for the diagnosis of patients. By using the Yamashima classification [15], hematomas were divided into five different types according to the CT appearance as hyperdense, hypodense, isodense, mixed-density and layered (layering).

The computed tomography was used in the postoperative 1st and 3rd month for following patients with chronic subdural hematoma.

Markwalder neurological classification was used in the clinical classification of patients with chronic subdural hematoma (Table 1).

Statistical analysis

SPSS 16 (statistical package for social sciences) for Win7 and Office2007 was used for evaluating statistically the data obtained in this study. Data were analyzed using descriptive statistical methods as well as the Mann-Whitney U and paired sample t test (paired t test) were used. Results at 95% confidence interval and the $p < 0.005$ level is evaluated.

RESULTS

1) Albumin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the albumin levels in fluids. Figure 1 shows that these differences are decreasing direction ($p<0.05$).

Table 1: Markwalder's Grades of Chronic Subdural Hematoma

Grade 0: Patient neurologically normal
Grade 1: Patient alert and oriented; mild symptoms, such as headache; absent or mild symptoms or neurologic deficit, such as reflex asymmetry
Grade 2: Patient drowsy or disoriented with variable neurological deficit, such as hemiparesis
Grade 3: Patient stuporous but responding appropriately to noxious stimuli; several focal signs, such as hemiparesis
Grade 4: Patient comatose with absent motor response to painful stimuli; decerebrate or decorticate posturing

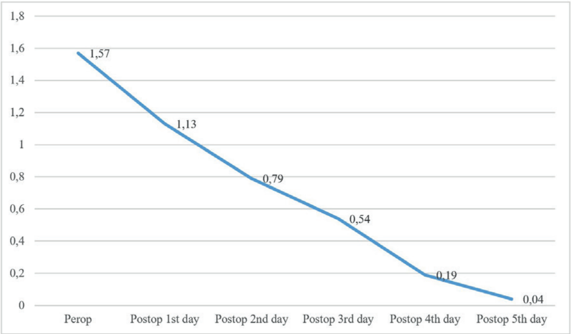

Figure 1. Change in Mean Albumin Levels in Fluids in İntraoperative And Postoperative Periods

2) Total Protein Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the total protein levels in fluids ($p<0.05$). Figure 2 shows that these differences are decreasing direction.

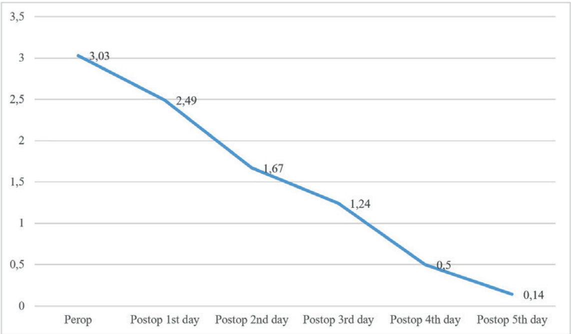

Figure 2. Change in Mean Total Protein Levels in Fluids in İntraoperative And Postoperative Periods

3) Hemoglobin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the hemoglobin levels in fluids ($p<0.05$). Figure 3 shows that these differences are decreasing direction.

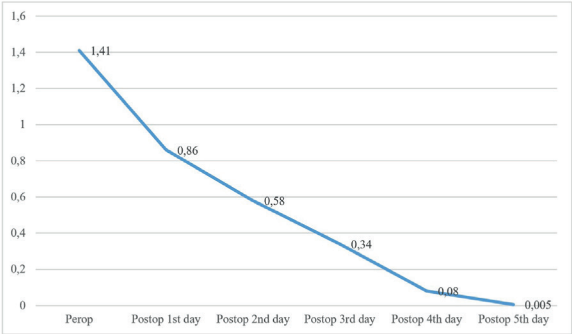

Figure 3. Change in Mean Hemoglobin Levels in Fluids in Intraoperative And Postoperative Periods

4) Amount Fluid Daily Drains

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the amount fluid daily drains levels ($p<0.05$). Figure 4 shows that these differences are decreasing direction.

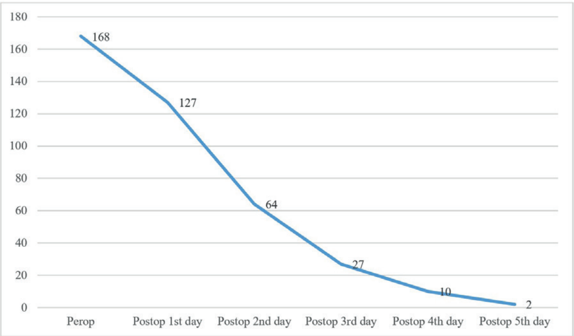

Figure 4. Change in Fluid Amount Daily Drains in Intraoperative And Postoperative Periods

Paired t test Analysis (Without Dexamethasone)

1) Albumin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the albumin levels in fluids ($p<0.05$). Figure 5 shows that these differences are decreasing direction.

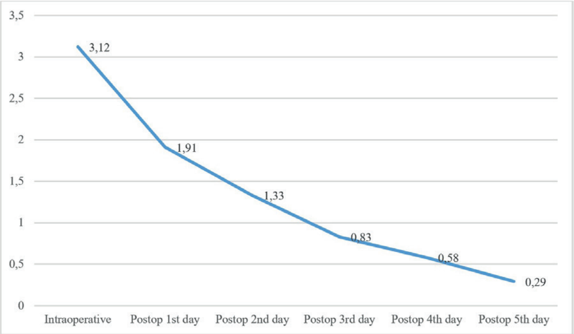

Figure 5. Change in Mean Albumin Levels in Fluids in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

2) Total Protein Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the total protein levels in fluids ($p<0.05$). Figure 6 shows that these differences are decreasing direction.

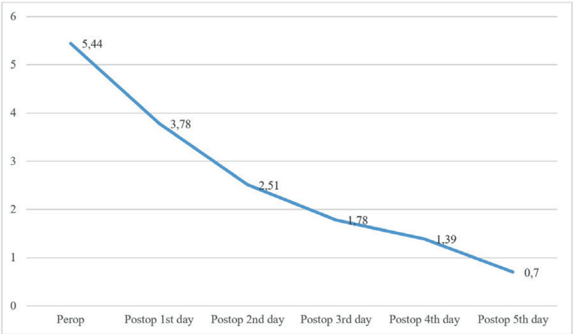

Figure 6. Change in Mean Total Protein Levels in Fluids in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

3) Hemoglobin Levels

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the hemoglobin levels in fluids ($p<0.05$). Figure 7 shows that these differences are decreasing direction.

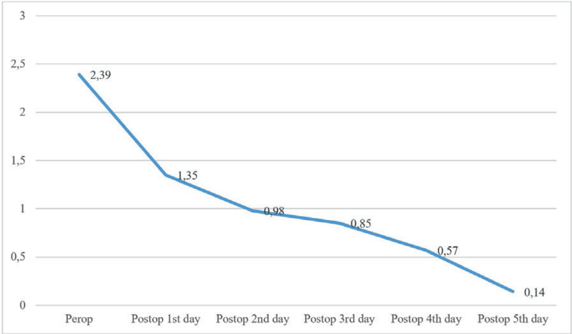

Figure 7. Change in Mean Total Hemoglobin Levels in Fluids in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

4) Fluid Amount Daily Drains

A statistically significant difference was found between in surgery and 1, 2, 3, 4 and 5th day after surgery in terms of the fluid amount daily drains levels ($p<0.05$). Figure 8 shows that these differences are decreasing direction.

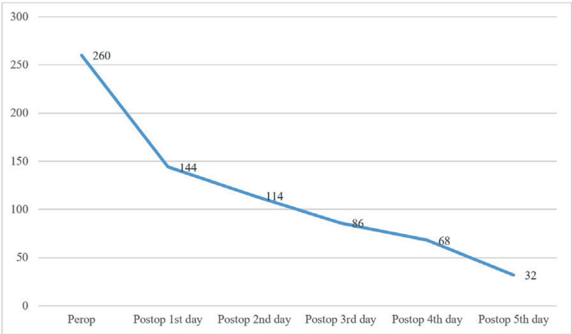

Figure 8. Change in Amount Fluid Daily Drains in Intraoperative And Postoperative Periods in Patients Dexamethasone not Used

Comparative Analysis

1) Albumin Levels

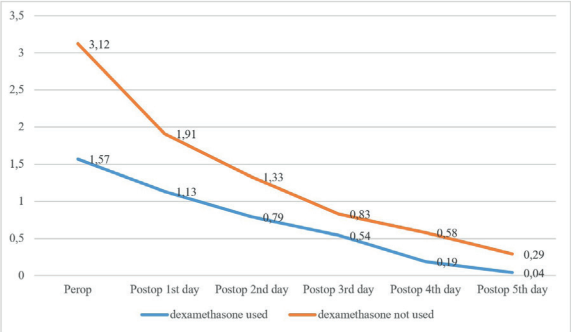

Figure 9. Average Albumin Levels in Fluids Taken From Patients Dexamethasone Used and Dexamethasone not Used

Figure 9 considering that; the average levels of albumin in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of albumin levels in the fluid taken intraoperatively ($p<0.05$). However, there was no difference for 1st, 2nd and 3rd day in terms of albumin levels in fluids between two groups dexamethasone used and not used. There was a significant difference again for 4th day and 5th day after the operation ($p<0.05$).

2) Total Protein Levels

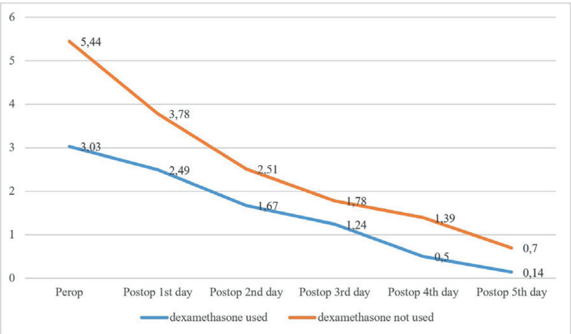

Figure 10. Average Total Protein Levels in Fluids Taken From Patients Dexamethasone Used and Dexamethasone not Used

As shown in Figure 10; the average levels of total protein in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of total protein levels in the fluid taken intraoperatively ($p<0.05$). However, there was no difference for 1st, 2nd and 3rd day in terms of total protein levels in fluids between two groups dexamethasone used and not used. There was a significant difference again for 4th and 5th days after the operation ($p<0.05$).

3) Hemoglobin Levels

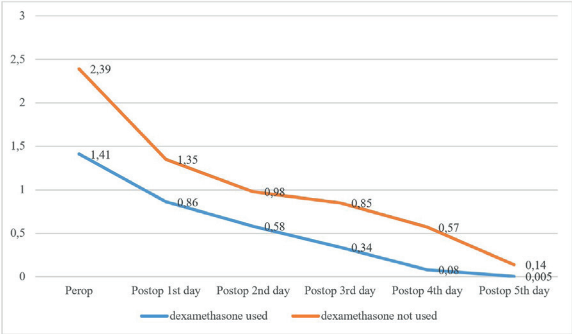

Figure 11. Average Hemoglobin Levels in Fluids Taken From Patients Dexamethasone Used and Dexamethasone not Used

Figure 11 shows that the average levels of hemoglobin in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of hemoglobin levels in the fluid taken intraoperatively, and 1st, 2nd, 3rd, 4th and 5th days after the operation ($p<0.05$).

4) Fluid Amount Daily Drains

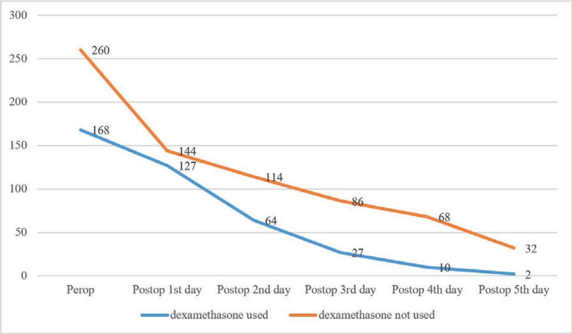

Figure 12. Fluid Amount Daily Drains in Patients Dexamethasone Used and Dexamethasone not Used

Figure 12 shows that the average levels of fluid amount daily drains in the fluids taken from patients dexamethasone used were significantly lower in every stage than the patients dexamethasone not used ($p<0.05$). Mann-Whitney U test was used to evaluate whether the difference was significant or not. According to the test results; there was a statistically significant difference in terms of fluid amount daily drains taken intraoperatively, and 2nd, 3rd, 4th and 5th days after the operation ($p<0.05$). Only postoperative day 1, fluid amounts were similar for both groups.

Tomography Findings

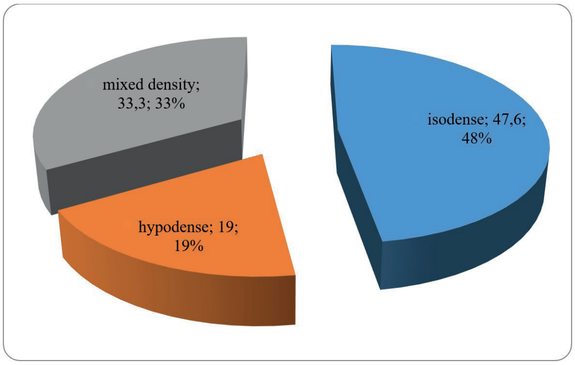

Figure 13. On the CT scan, isodensity was detected in 48%, mixed density was in 33% and hypodensity was in 19% of patients in the dexamethasone used group. Hyperdense and layering condition was not observed in these patients.

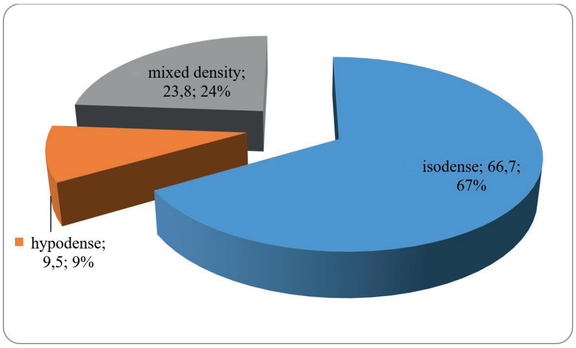

Figure 14. On the CT scan, isodensity was detected in 67%, mixed density was in 24% and hypodensity was in 9% of patients in the dexamethasone not used group. Hyperdense and layering condition was not observed in these patients.

DISCUSSION

Chronic subdural hematoma is a type of intracranial hemorrhage frequently encountered in brain surgery, but the pathophysiology has not been fully clarified [12,16-18].

Several ideas have been proposed about growth of hematoma. 150 years ago, Bayle reported that chronic bleeding causes the growth of subdural hematoma. Putnam and Cushing, Dandy, Apfelbarum et al. reported that chronic subdural hematoma expansion is caused by the recurrent bleeding from the capsule of hematoma [19-21].

The recurrent bleeding theory as a result of increased levels of plasmin from macro-capillary of the outer membranes of chronic subdural hematoma is the most accepted theory for today [3,4].

In the literature, it was indicated that microcapillary in outer membrane of chronic subdural hematoma is extremely permeable, this structures not or partly containing basement membrane and containing gap junctions, cause the plasma leakage into the hematoma. As a result, it was reported that exudation and transudation via macrocapillary can play an important role in expansion of chronic subdural hematoma.

More recently, local hyperfibrinolysis in outer membrane has been reported as major etiological factor of chronic subdural hematoma [3,8,22].

According to the Markwalder neurological grade, 14 patients were identified as grade 1 and 7 patients were grade 2 in patients dexamethasone used. Similarly, 15 patients were identified as grade 1 and 6 patients were grade 2 in patients dexamethasone not used.

The average age of our patients was 59.9 in patients dexamethasone used, and was 63.2 in patients dexamethasone not used.

As showed in Figure 13 and 14; On the CT scan, isodensity was detected in 48%, mixt density was in 33% and hypodensity was in 19% of patients in the dexamethasone used group. Similarly, isodensity was detected in 67%, mixt density was in 24% and hypodensity was in 9% of patients in the dexamethasone not used group. Hyperdense and layering condition was not observed in both of groups.

Unilateral chronic subdural hematoma was detected in 20 patients and bilateral chronic subdural hematoma was in 1 patient in the patients dexamethasone used. On the other hand; 18 patients have unilateral, and 3 patients have bilateral chronic subdural hematoma in dexamethasone not used group.

The control tomography had taken at 1st and 3rd month after the operation in these patients. The collection was re-detected in 11 patients dexamethasone not used in the control tomography results. Based on clinical condition, 3 patients were reoperated. Unlike, in the dexamethasone used group, the collection was observed in 3 patients in the control tomography results. Based on the clinical condition, none of these patients was operated. Dexamethasone that dose reducted and cutted was added to the treatment again, and the patients were followed up. The collection was not detected again in 3 patients in the control tomography.

The reduction of total protein and albumin levels in the fluids followed daily from the closed drainage system was statistically significant in patients dexamethasone not used ($p<0.05$). Similarly, the decrease in total protein and albumin levels were significantly in the patients dexamethasone used. The reduction of these two groups was compared. There was no significant difference in the first days after the operation, but it has become significantly after the 3rd day after the operation. Possible reasons are that the reduction of amount drained and quicker terminated closed drainage system in some patients dexamethasone used.

The hemoglobin levels were measured in samples of cavity taken during operation and daily fluids draining from the cavity after operation in patients dexamethasone not used. It was detected that the reduction of hemoglobin levels was statistically significant ($p<0.05$). This reduction was observed similarly in patients dexamethasone used.

When two groups compared, the observed decrease in hemoglobin for p-value levels in patients dexamethasone used was found to be more meaningful.

When the amount of fluids that drain from the cavity to the closed drainage system after operation compared on a daily basis (with paired samples t test), p-value was found significant in terms of reduction of the amount drained both in patients dexamethasone not used and dexamethasone used ($p<0.05$).

CONCLUSION

In this study; the number of patients seen collections in the control tomography was more in the group dexamethasone not used, and some patients required re-surgery in this group. However, the number of patients seen collections in the control tomography was so less in the group dexamethasone used and no patient required re-surgery. The amount of fluid is drained from the cavity was statistically significant less in dexamethasone use group compared the dexamethasone not used group ($p<0.05$).

Consequently, the use of dexamethasone in patients with chronic subdural hematoma reduce the amount of accumulation of fluids and therefore recurrence-residue risk is also being reduced.

Conflict of interest: There is no conflict of interest in our study.

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