# The Neuroendoscopic Assisted Microsurgical Evacuation of Chronic Subdural Hematomas

## Kronik Subdural Hematomların Endoskopik Mikrocerrahi Yöntemle Boşaltılması

Subdural Hematomların Endoskopik Mikrocerrahisi / Neuroendoscopic Microsurgery for Subdural Hematomas

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**Özet**

Amaç: Bu çalışmanın primer amacı burr hole yardımıyla kronik subdural hematomların mikrocerrahi tedavisinde nöroendoskop kullanılmasının önemini vurgulamaktır. Gereç ve Yöntem: İllüstratif olgu 67 yaşında bir haftalık başağrısı olan bir erkek hastadır. Elde olunan bilgisayarlı tomografi tetkiki solda frontopariyetal bölgede kronik subdural hematomun varlığını göstermiştir. Bulgular: Hasta genel anestezi altında ameliyat edilmiştir. Frontal ve pariyetal bölgeye iki adet burr- hole açıldı. Dura mater ve hematomun pariyetal membranı açıldıktan sonra hematom mikrocerrahi yöntemlerle boşaltıldı. Bu aşamadan sonra kavite içerisinin panoramic görüntüsünü elde edebilmek için nöroendoskop kullanıldı. İçeride hematom bulunup bulunmadığı ve aktif kanama varlığı nöroendoskopla kontrol edildi. Aynı zamanda kateterin doğru pozisyonda yerleştirilip yerleştirilmediği nöroendoskopla kontrol edildi. Tartışma: Kronik subdural hematomların nöroendoskopik mikrocerrahi yöntemlerle boşaltılması cerrahi girişimi nöroendoskopinin cerrahi kaviteyi eş zamanlı panoromik olarak görüntülemesi nedeniyle daha güvenli hale getirmekle birlikte aktif kanama, septal kavitasyonlar, parietoviseral asıcı yapılar, birikintiler, venöz anatomi ve kateter pozisyonu hakkında da bilgi vermektedir.

**Anahtar Kelimeler**

Nöroendoskopi; Mikrocerrahi; Kronik Subdural Hematomlar

**Abstract**

Aim: The primary objective of this study was to emphasize the importance of using neuro-endoscope in the microsurgical evacuating of chronic subdural hematomas with the placement of bur hole(s). Material and Method: The illustrative case was a 67 years old male with one week history of headache. Obtained computed tomography of the head showed the presence of the left frontoparietal chronic subdural hematoma. Results: The patient was operated under general anesthesia. Two burr-holes were placed on the frontal and parietal regions. The chronic subdural hematoma was micro-surgically evacuated after opening of the Dura mater and the parietal membrane of hematoma. After this stage, neuro-endoscopic assistance was used in the obtaining of panoramic view inside the cavity. The presence of hematoma and active bleeding was observed in the cavity. In the other hand the correct placement of drainage catheter was checked by using endoscopic guidance. Discussion: It was concluded that neuro-endoscopic procedure could make microsurgical evacuation of chronic subdural hematoma safer with intraoperative real-time panoramic visualization of the space and may also allow for the identification of active bleeding, septal cavitations, parietal-visceral bridging structures, sediment collections, venous indentations, and catheter position within the cavity.

**Keywords**

Neuroendoscopy; Microsurgery; Chronic Subdural Hematomas

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## Introduction

Chronic subdural hematomas (CSHs) are relatively common encountered pathology in neurosurgical practice. The incidence is one to two per 100 000 population per year [1]. It can be seen at any age of the population but it is commonly seen in geriatric age. The term of CSH is used to describe the hematomas located at the subdural space and aged over the 21 days of age. The subdural hematomas that develop from three days to three weeks after head injury are called sub-acute, and those that appear later than 3 weeks after injury are called chronic. In clinical practice the appearance on computerized tomography (CT) scan more useful in the classification of subdural collections. The hyperintense appearance on CT scan is named as acute subdural hematomas. The isodense appearance is generally equal the age of 2-20 days and named as subacute subdural hematoma. The CSHs are older than 20 days of age and are hypointense in comparison with the brain. CSH can be seen at the site of unilateral or bilateral hemistructure of the cranium [2- 4].

The treatment of the pathology is mainly based on the surgical intervention. But there is no common consensus for the type of the surgical treatment. Craniotomy and membrane removing, burr-hole drainage, twist-drill burr-hole and drainage are some of the type of surgical intervention.

In this study, it was aimed to investigate the capability of neuroendoscopy making the procedure safer and identification of active bleeding, septal cavitations, tortuous collections, and catheter positions during the microsurgical evacuation of chronic subdural hematoma.

## Material and Method

Sixty-seven-year old male patient with headache and paresis on the right side of his body was brought to the emergency clinic. Complaints of the case were begun about 15 days ago and on his history there was minor head trauma one month before from the present admission. There was no evidence of pathological finding on his physical examination. The neurological examination revealed that the presence of dysphasia and right hemiparesis. Hematologic examination of patients (hemoglobin, hematocrit and white blood cell) revealed no pathological findings. Sodium, potassium, blood urine nitrogen and Creatine levels were found within normal limits.

Chronic subdural hematoma was found in the imaging of computerized tomography localized on the left frontal, temporal and parietal region. Average hematoma was measured up to 3 cm in thickness. There was approximately 1-cm shift effect of midline structures. In area of the frontal region there was septation. Postoperative computed tomography revealed the presence of air in the hematoma cavity. Shift had been recovered.

### *Operative Technique*

The patient was positioned on the operating table in supine with head slightly turned to right. Incisions about 3 cm long were done on the marked skin areas. A burr hole was done at the place of bone prepared for procedure. The diameter of bur hole was measured as 2-3 cm in diameter (Figure 1). The Dura mater area limited by burr hole bone was coagulated with bipolar coagulator in the form of a plus sign. Dura mater was cut with 15 number knife blades like a plus sign as previously coagulated. The dark membranous structure belong to the chronic subdural hematoma was observed under the incised Dura mater. The membranous structure of hematoma was cut using a surgical knife. The content of chronic subdural hematoma with

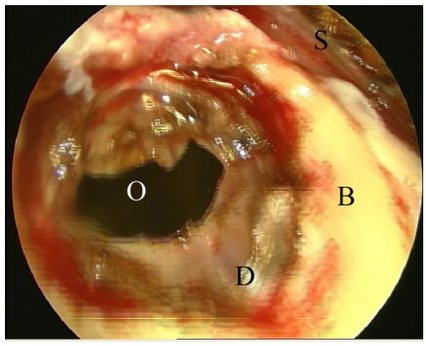



Figure 1. The appearance of burr hole from the endoscopic view (O: Opening of the cavity, B: Bone, D: Dura Mater, S: Skin).

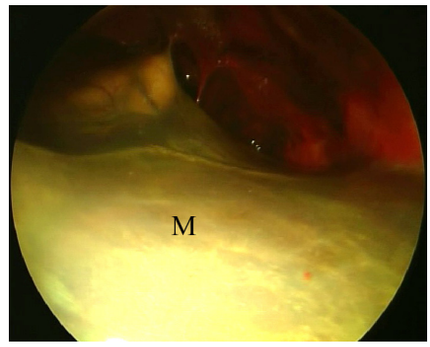



Figure 2. The general appearance of inside the cavity (M: Membrane).

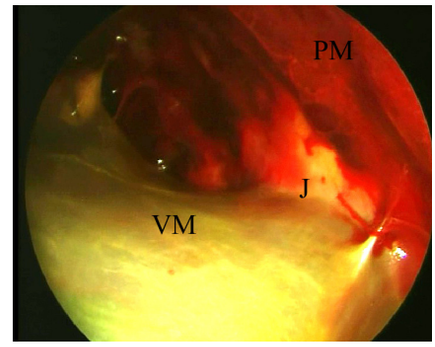



Figure 3. The endoscopic appearance of visceral and parietal membrane (VM: Visceral membrane, PM: Parietal Membrane, J: Junction of visceral and parietal membrane).

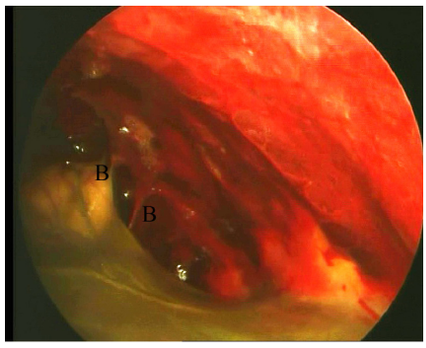



Figure 4. The bridges between parietal and visceral membrane (B: Bridges).

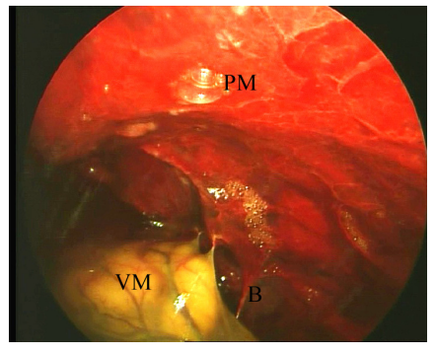



Figure 5. The relationship between the visceral and parietal membrane (VM: Visceral membrane, PM: Parietal membrane, B: Bridge).

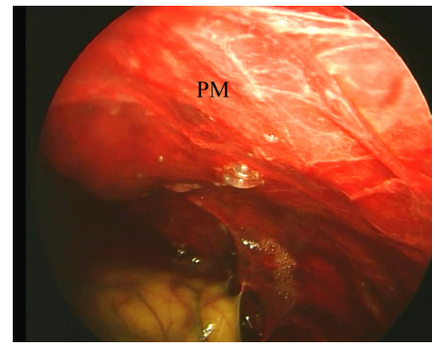



Figure 6. The clear appearance of parietal membrane (PM: Parietal membrane).

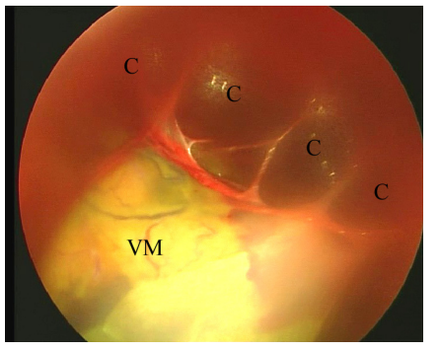



Figure 7. Cavitations inside the chronic subdural hematoma space (C: Cavitations, VM: Visceral Membrane).

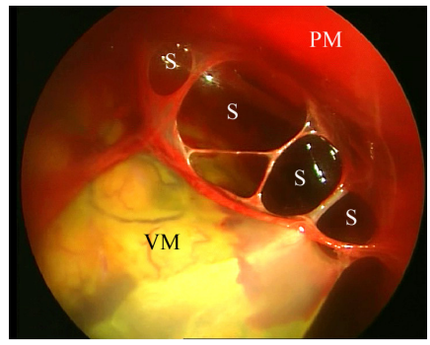



Figure 8. After opening the cavities the appearance of the septations (S: Septa, VM: Visceral membrane, PM: Parietal Membrane).

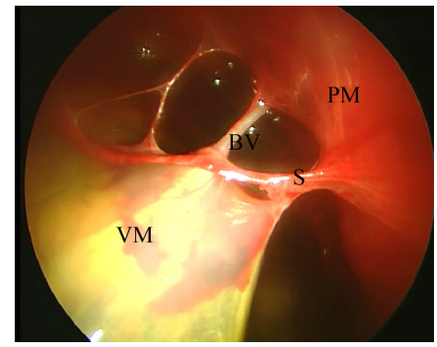



Figure 9. The appearance of bridging vein and septa (S: Septa, VM: Visceral membrane, PM: Parietal Membrane, BV: Bridgin vein).

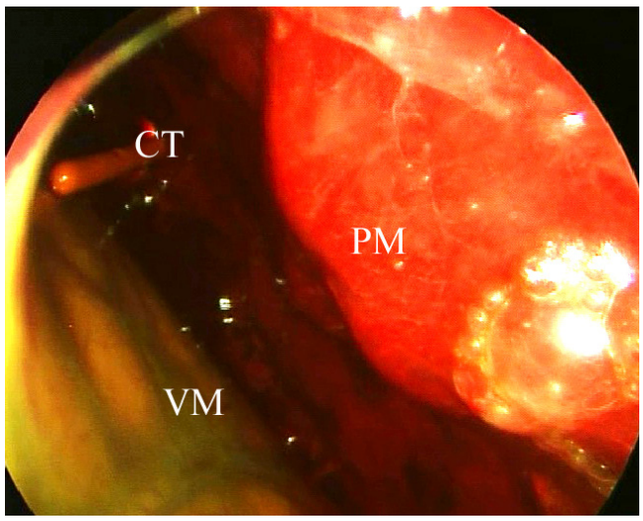



Figure 10. The appearance of drainage catheter (CT: Catheter, VM: Visceral membrane, PM: Parietal Membrane).

high pressure was drained. The irrigation water was given at the in front burr-hole and the coming of water was observed at the rear burr hole with the aid of gravity. The general appearance of burr-hole was shown in Figure 1. After this stage the neuro-endoscope was prepared for use.

An Aesculap neuro-endoscope with 30 degree angled was used for neuro-endoscopy. Camera attachment was covered with sterile cover. The connection of telescope and the camera was done. White and black color balance was done. Superior and inferior direction was set. The telescope of endoscope was send through the burr hole. The telescope was turned inside the cavity seeing interior wall of the cavity. At the first step of the endoscopic approach the hematoma cavity should be generally inspected (Figure 2). Figure 2 showed the general appearance of the cavity. The parietal membrane, visceral membrane should be inspected. Figure 3 showed the appearance of parietal and visceral membrane and the junction of parietal and visceral membrane at the corner of skull bone. During moving of the surgical endoscope surgeon should be careful for bridges (Figure 4). Figure 4 showed the bridges inside the cavity. Figure 5 also showed the relationship between parietal and visceral membrane and their bridges. The endoscope provides better visualization of the parietal membrane and its structure (Figure 6). The cavitations inside the chronic subdural hematoma space may also be visualized by using surgical endoscope (Figure 7). The cavitations inside the space were shown in Figure 7. Figure 8 showed the septation after opening the isolating cavity inside the space. The bridging veins inside the cavity are also important structures (Figure 9). The bridging veins and septa were shown in Figure 9. The position of the drainage catheter is also visualized by using endoscope (Figure 10). Figure 10 showed the position of the drainage catheter inside the cavity.

*Postoperative Course*

Post-operative period the patient was followed at regular patient room in neurosurgical department. The patient was mobilized on the first day after surgery. Subdural drainage catheter is removed on the third day after the surgery. Postoperative computed tomography was taken on the first and the third day. In the postoperative period local (skin, subcutaneous tissues, and surgical region of interest) and systemic (heart, lung, gastrointestinal tract and kidneys) complication was not encountered. Steroid treatment was not given the patient; in the other hand antiepileptic prophylaxis was started and maintained.

## Discussion

There is no common consensus in the surgical treatment of chronic subdural hematomas in terms of the type of the surgical technique [1-4]. Twist drill and bur hole(s) drainage, evacuation of the hematoma via craniotomy had been the most widely used in the literature [1-4]. Craniotomy procedure and membrane excision should be considered as a different category among the surgical techniques for chronic subdural hematomas. The size of the opening is also important in craniotomy procedure. Adequate level of membrane removal or degradation of the integrity of the membrane can be done by using craniotomy procedure. In the same time, the cavity can be evaluated better with the application of craniotomy [4]. Craniotomy may be useful in cases with septated cavity and hematoma content.

Another alternative method is the surgical hematoma evacuation with burr hole. It seems as a less invasive method than craniotomy procedure. It is an advantage that it may be used under sedation or under local anesthesia, in the patients with inappropriate general condition. It can be opened single or multiple bur holes in different locations. Washing inside the cavity is also possible. But in the bur-hole application the interior cavity cannot be fully seen. Active bleeding, the presence of septation, the remnant of the hematoma, and tortuous content may be overlooked with bur hole application alone. We hypothesize the use of rigid endoscopes may be used for showing the inside of the cavity as a minimally invasive procedure in the cases under-

went bur hole or minicraniotomy application for the evacuation of chronic subdural hematoma. The neuro-endoscope may enhance the effectively draining of hematoma content.

In our application we used the endoscope through a single bur hole. A learning curve usually is not needed because it is a simple procedure. Using a 45-degree angled tip may provide an advantage for observing of under the skull bone. For this reason, we generally prefer a 45-degree angled endoscope. If a catheter is decided to put into the cavity, the endoscope may also helpful in the evaluating the position of the catheter.

### *Conclusion*

The use of neuroendoscope during the surgical treatment of chronic subdural hematoma should not be regarded as a sophisticated method. Neuro-endoscopic procedure is a very useful method in the visualization of a cavity surrounded by a membranous structure such as chronic and/ or subacute subdural hematomas. Investigating of a residual hematoma after blinded evacuation, examining the presence of septation, and evaluating the presence of active bleeding may be demonstrated by using neuro-endoscope during surgery. We concluded that this type of cases required the use of neuro-endoscope during the microsurgical evacuation of the hematoma content.

### *Competing interests*

The authors declare that they have no competing interests.

**References**

1. Fagelholm R, Waltimo O. Epidemiology of chronic subdural haematoma. Acta Neurochir (Wien) 1975;32(3-4):247-50.
2. De Jesus O, Pacheco H, Negron B. Chronic and subacute subdural hematoma in the adult population the Puerto rico experience. PR Health Sci J 1998;17(3): 227-33.
3. Penchet G, Loiseau H, Castel JP. Chronic bilateral subdural hematomas. Neurochirurgie 1998;44(4):247-52.
4. Robinson RG, Chronic subdural hematoma: Surgical management in 133 patients. J Neurosurg 1984;61(2):263-8.