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The Effectiveness of Simple Drainage Technique in Improvement of Cerebral Blood Flow in Patients with Chronic Subdural Hemorrhage

Kronik Subdural Kanamalı Hastalarda Basit Drenaj Tekniğinin Serebral Kan Akımının Düzelmesinde Etkinliği

Metin KAPLAN[1]
Fatih Serhat EROL[2]
Zülküf BOZGEYİK[3]
Mehmet KOPARAN[4]

[1,2,4] Fırat University, Neurosurgery, Elazığ, Turkey
[3] Fırat University, Radiology, Elazığ, Turkey

ABSTRACT

OBJECTIVE: In the present study, the clinical effectiveness of a surgical procedure in which no draining tubes are installed following simple burr hole drainage and saline irrigation is investigated.

METHODS: 10 patients, having undergone operative intervention for unilateral chronic subdural hemorrhage, having a clinical grade of 2 and a hemorrhage thickness of 2 cm, were included in the study. The cerebral blood flow rates of middle cerebral artery were evaluated bilaterally with Doppler before and after the surgery. All the cases underwent the operation using the simple burr hole drainage technique without the drain and consequent saline irrigation. Statistical analysis was performed by Wilcoxon signed rank test ($p<0,05$).

RESULTS: There was a pronounced decrease in the preoperative MCA blood flow in the hemisphere the hemorrhage had occurred ($p=0,008$). An increased PI value on the side of the hemorrhage drew our attention ($p=0,005$). Postoperative MCA blood flow measurements showed a statistically significant improvement ($p=0,005$). Furthermore, the PI value showed normalization ($p<0,05$). The paresis and the level of consciousness improved in all cases.

CONCLUSION: Simple burr hole drainage technique is sufficient for the improvement of cerebral blood flow and clinical recovery in patients with chronic subdural hemorrhage.

KEY WORDS: Chronic subdural hemorrhage, Cerebral blood flow rates, Simple burr hole drainage, Transcranial doppler ultrasound

ÖZ

AMAÇ: Bu çalışmanın amacı sadece basit burr hole drenaj ve serum fizyolojik ile irrigasyon yapıldıktan sonra subdural mesafeye dren yerleştirilmeden yapılan cerrahi yaklaşımın klinik iyileşmedeki etkinliğinin incelenmesidir.

YÖNTEMLER: Çalışma için tek taraflı kronik subdural kanama nedeniyle opere edilen, klinik grade 2 kanama kalınlığı ise 2 cm olan 10 hasta seçildi. Ameliyat öncesi ve sonrası bütün olguların transkranial doppler ile iki taraflı middle serebral arterden serebral kan akım hızları ölçüldü. Olguların hepsi genel anestezi altında drensiz basit burr-hole drenajla birlikte serum fizyolojik ile irrigasyon tekniği kullanılarak opere edildi. İstatiksel analiz Wilcoxon signed ranks testi ile yapıldı ($p<0,05$).

BULGULAR: Ameliyat öncesi kanamayla aynı tarafta olguların MCA kan akımlarında belirgin bir azalma vardı ($p=0,008$). PI değerlerinde kanamayla aynı tarafta artış dikkat çekiyordu ($p=0,005$). Ameliyat sonrası ölçümlerde MCA kan akım hızlarında istatiksel olarak anlamlı bir iyileşme izlendi ($p=0,005$). Ayrıca PI değerlerinde kanamasız tarafla karşılaştırıldığında bir normalleşme görüldü ($p<0,05$). Olguların hepsinde parezi ve bilinç durumu ameliyat sonrası erken dönemde düzeldi.

SONUÇ: Kronik subdural kanamalı hastalarda basit burr hole drenaj tekniği klinik iyleşme ve serebral kan akımlarının düzelmesinde yeterli ve etkili bir yöntemdir.

ANAHTAR SÖZCÜKLER: Kronik subdural kanama, Serebral kan akım kızı, Basit burr hole drenaj, Transkranial dopler ultrasound

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Correspondence address:
Metin KAPLAN
Fırat University, Neurosurgery,
Elazığ, Turkey
Phone: +90 424 233 35 55
E-mail : mtkaplan@yahoo.com.tr

INTRODUCTION

Different surgical procedures are currently utilized for the treatment of chronic subdural hemorrhage. Craniotomies have recently been replaced by drainage techniques with burr holes. Installation of a temporary drainage tube following burr hole drainage is still a subject of debate [1]. The physiopathology of the neurological picture in chronic subdural hemorrhage is characterized by the decrease in cerebral blood flow rates. In the present study, the clinical effectiveness of a surgical procedure, in which no draining tubes are installed following simple burr hole drainage and saline irrigation, is investigated.

MATERIALS AND METHODS

10 patients, having undergone operative intervention for unilateral chronic subdural hemorrhage in our clinic in 2005-2006, with a clinical grade of 2 [2] and a hemorrhage thickness of ?2 cm, were included in the study. All the patients had decreased middle cerebral artery (MCA) blood flow in the ipsilateral side of the hemorrhage and their pulsatility index (PI) values were increased. The data of the cases according to age, sex, clinical grade and CT images [3] are displayed in Table I.

The cerebral blood flow rates in all patients were evaluated by transcranial Doppler ultrasound before and after the surgery. Transcranial Doppler ultrasound was performed after a 5-minute rest in the supine position. The middle cerebral arteries were evaluated bilaterally during examination with Doppler. For this purpose, a Toshiba Applio SSA 770A/80 (Tokyo, Japan) device, which was available in our clinic, was used. Transcranial Doppler examination of MCAs was performed by a 2-3 MHz sector probe with color Doppler technique using a temporal window and transtemporal perspective. The peak systolic flow rate and PI of MCA were measured in the transcranial examination. Measurements were performed by the automated measurement technique of the device on the wave in which the flow pattern was most clearly observed.

All the cases underwent the operation using the simple burr hole drainage technique without the drain and consequent saline irrigation under general anesthesia. Taking into consideration the fact that the drain system placed following burr hole drainage is generally kept in place for two days in patients with chronic subdural hemorrhage, the postoperative cerebral blood flow rate measurements were performed on the 3rd day. Table II presents the preoperative and postoperative cerebral blood flow rates. The degree of clinical recovery and the improvement in blood flow rates were evaluated. Statistical analysis was performed by Wilcoxon signed rank test for dependent variables ($p<0,05$).

RESULTS

There was a pronounced decrease in the preoperative MCA blood flow in the hemisphere the hemorrhage had occurred ($p=0,008$). An increased PI

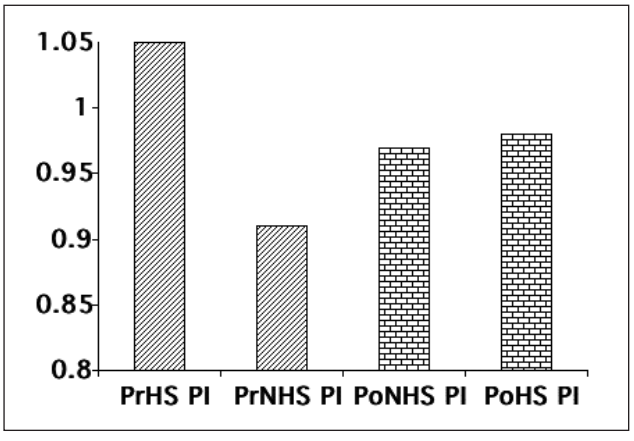
Table I: The data of the cases

Case No:	Age	CT Findings				Clinical Grade
		Location	Density	Shift	Thickness	
1	66	R FP	Mixed	++	3.5 cm	2
2	73	L FP	Hypodense	++	3 cm	2
3	76	R FP	Mixed	+	2.3 cm	2
4	73	R FT	Isodense	+	2.2 cm	2
5	76	L FT	Hypodense	++	3 cm	2
6	43	R FP	Hypodense	++	2 cm	2
7	71	L FT	Hypodense	++	3 cm	2
8	69	L FP	Isodense	+	2.5 cm	2
9	41	R FP	hypodense	++	2.4 cm	2
10	69	L FT	Isodense	-	2 cm	2

Table II: The preoperative and postoperative cerebral blood flow rates. **R;** Right, **L**; left, **MCA**; Middle cerebral artery, **PI**; pulsatility index

	Preoperative				Postoperative			
CASE NO	**R MCA peak systolic**	**L MCA peak systolic**	**R MCA PI**	**L MCA PI**	**R MCA peak systolic**	**L MCA peak systolic**	**R MCA PI**	**L MCA PI**
1	73.2	111.2	1.30	1.16	123.9	100.3	1.28	1.36
2	73.9	57.7	1.10	1.20	90.9	86.1	0.81	1.18
3	41.2	67.6	1.15	0.86	71.5	70.9	0.77	0.76
4	58.4	105.2	0.91	1.06	79.7	89.9	0.93	1.13
5	86.2	83.1	0.77	0.96	86.9	113.9	1.32	1.16
6	56.2	81.7	0.94	0.78	135.0	103.7	1.03	1.03
7	104.4	82.8	0.98	1.30	101.0	98.8	0.96	1.02
8	87.2	44.7	1.15	1.23	111.2	123.2	1.02	1.07
9	78.4	110.0	0.85	0.79	93.5	97.0	0.72	0.70
10	87.2	72.4	0.67	0.68	84.5	81.4	0.95	0.91

value on the side of the hemorrhage drew our attention (p=0,005). Postoperative MCA blood flow measurements showed a statistically significant improvement (p=0,005). Furthermore, the PI value showed normalization, when compared with the contra lateral non-hemorrhagic side (p<0,05) (Graphic 1).



Graphic 1: PrHS PI; preoperative hemorrhagic side pulsatility index, PrNHS PI; preoperative non-hemorrhagic side pulsatility index, PoNHS PI; postoperative non-hemorrhagic side pulsatility index, PoHS PI; postoperative hemorrhagic side pulsatility index.

The paresis and the level of consciousness improved in the early postoperative period in all cases. Despite a decrease in severity, headache persisted in two patients. These two patients did not have any headache symptoms a month later on examination. On control tomographies performed a month later, the hemorrhage was seen to have completely resorbed in all patients. No recurrences were seen in any patients.

DISCUSSION

The cerebral blood flow in patients with chronic subdural hemorrhage (CSH) is decreased due to shifting and distortion of the brain caused by the local compressing effect of the hemorrhage [4, 5]. The decrease in cerebral blood flow is more pronounced in the central parts. Although the blood flow to the cortical areas is also decreased, the clinical picture is thought to be due to involvement of the central parts [6]. However, the clinical grade and the decrease in the cerebral blood flow do not exhibit a linear relationship [7], due to utilization of compensatory mechanisms in these patients, which occur in order to keep the cerebral blood flow within normal limits. Maintenance of cerebral perfusion pressure is the major issue; however, raising the cerebral blood flow by peripheral vasodilatation is not always possible

in cases with significantly decreased MCA blood flow due to central shifting. At this stage, peripheral vascular resistance should increase in order to maintain the cerebral perfusion pressure. The increase in the PI value indicates an increase in the peripheral vascular resistance [8, 9]. Therefore, we suggest that the normalization of the PI value, which is an indicator of the activation of compensatory mechanisms, is an important criterion in evaluating the effectiveness of the surgical technique on recovery [10].

A hematoma located in the subdural space constitutes an effective force on the cerebral parenchyma (pathological forces), causing displacement of cerebral structures and decrease in cerebral blood flow. The cerebral parenchyma applies a reaction force in accordance with the action-reaction law (Figure 1). This reaction force is the basic force, which provides the drainage of the blood through the burr hole. Additionally, physiological force vectors, initially present in the normal individual, which affect the CSF pressure (priori-physiological forces), also contribute (Figure 2). The intracranial pressure is increased in patients with chronic subdural hemorrhage due to the space-occupying effect of bleeding, whereas the priori forces are decreased due to decreased cerebral blood flow. Therefore, it is clinically observed during drainage that the cerebral tissue cannot sufficiently expand and refill the space created by the hematoma in the early period. In the technique we use, passive drainage of the blood in the subdural space is provided mainly by the effect of pathological forces and partially by the effect of priori forces. Passive drainage continues until a balance between intracranial and extracranial pressure is established. This balance means that the space-occupying effect of the hematoma has subsided. The improvement in the mean blood flow rates in all of our patients proves the disappearance of the hematoma. Additionally, amelioration of the elevated PI value, which indicates the activation of the compensatory mechanisms, is another supportive finding.

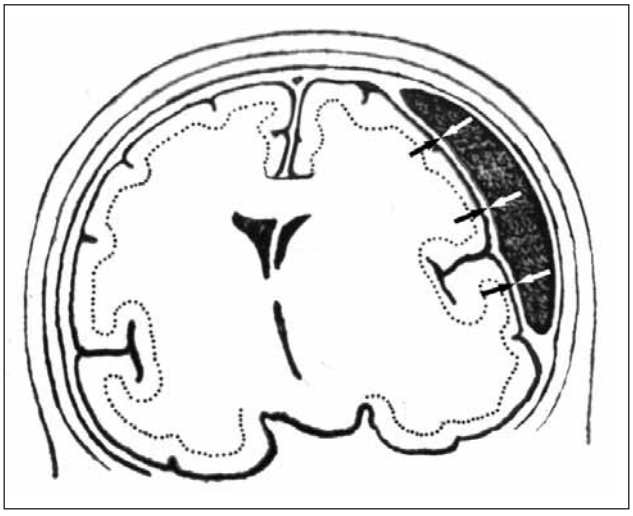


Figure 1: Action forces of hemorrhage (white arrows), which provide the drainage of the blood through the burr hole (black arrows).

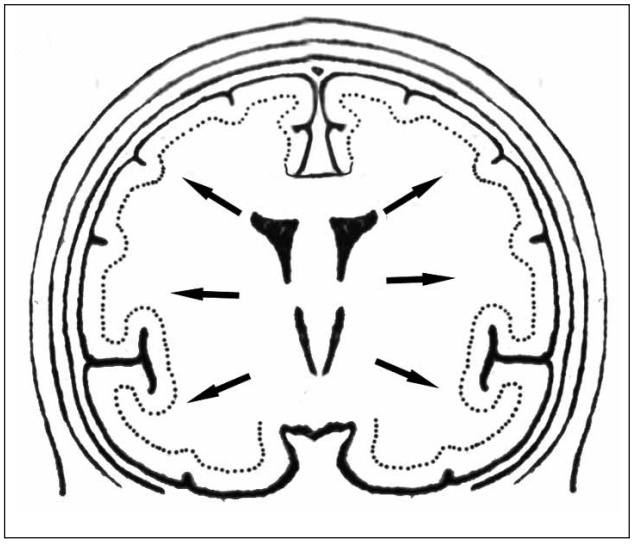


Figure 2: Physiological force vectors, initially present in the normal individual, which affect the CSF pressure (arrows).

In conclusion, we would like to state that the technique in which the surgery for chronic subdural hemorrhage is performed by simple burr hole drainage and saline irrigation without the use of a drain system is sufficient for improvement of cerebral blood flow rates and clinical recovery.

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