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The Value of the Ventriculo-Atrial Shunt Used before the Removal of a Posterior Fossa Tumour Determined by Cerebrospinal Fluid Pressure Recording

Ocena wartości zakładania zastawki komorowo-przedsionkowej przed usunięciem guza tylnej jamy czaszkowej w świetle pomiarów ciśnienia płynu mózgowo-rdzeniowego (CPMR)

Оценка ценности применения предсердно-желудочной створки дооперационного удаления опухоли задней черепной ямки на основании изменений давления церебно-спинальной жидкости (ДЦСЖ)

The necessity to avoid postoperative complication after *posterior fossa* surgery has initiated a search for eliminating sudden punctures of the ventricle or to maintain a prolonged ventricular drainage. Hence as early as in 1963, Abraham et al (1) started implanting the ventriculoatrial shunt as "the first" step of treatment, and in this way "preparing" the patient for the violent changes of intracranial pressure appearing in the postoperative period. This procedure, employed in individual cases has been reported in literature (2, 4, 5, 7).

The same procedure was introduced in the Neurosurgery Clinic in Lublin in 1974, initially in patients suffering from hydrocephalus caused by the angular ponto-cerebellar tumour, to extend it later to almost all patient with the hydrocephalus caused by posterior fossa tumours. After these patients have been diagnosed as having the hydrocephalus, the ventriculo-atrial shunt is implanted and, after some days (1—7, a suboccipital craniectomy is performed. To evaluate this procedure, we have analysed the clinical state and changes of the cerebrospinal fluid pressure before and after implanting the shunt, as well as after the removal of the

posterior fossa tumour. The monitoring of CSF pressure was according to Lundberg's method (3). A catheter placed in the frontal horn of the lateral ventricle was connected with a transducer and a registering apparatus. An analogue recording was carried out at a rate of 6 inches per hour during the period of about 24 hrs. (2 to 26 hrs.) before implanting the shunt, as well as after the implantation (in the course of one to 7 days), and during several hours after the surgical removal of the tumour. A detailed description of the technique has been presented elsewhere (4).

MATERIAL

In the period of 1974—1979, the ventriculo-atrial shunts were implanted in 109 patients suffering from various kinds of hydrocephalus, and one patient with a ventriculo-peritoneal shunt, with various levels of the opening pressure (high-, medium-, and low- pressure). The choice of the kind of shunt depended upon the intraventricular pressure ascertained during the preoperative period of monitoring. The kinds of illnesses in which that treatment was carried out are presented in Table 1. The subsequent considerations will focus on patients with posterior fossa tumours (60 cases). Shunts of the Pudenz type were implanted in 57 patients, and 3 patients were provided with ones of the Holter type. The patients were divided into 2 groups: the first group of 38 patients whose tumours had been removed completely, no matter what kinds of tumours they were (glioma, meningioma, neurinoma, and also a single cancer metastases removed totally); the second group consisted of 22 patients whose tumours could not be removed completely. The division was introduced in the face of the ascertained differences in the levels of CSF pressure in the succesive stages of the surgical treatment.

Table 1. Types of illnesses in which ventriculo-atrial shunts were implanted

Type of illness		Number of patients	Number of CSF pressure records
Posterior fossa tumours	removed totally	38	12
	removed partially	22	2
3rd ventricle tumours		19	3
Closed hydrocephalus (post-inflamation, post-traumatic, post-haemorrhagic, etc.)		25	8
Open hydrocephalus		6	5
Total		110	30

RESULTS

The evaluation of the clinical status and the degree of improvement obtained after implanting the shunt is presented in Table 2. A good result was scored in cases of a significant improvement, consisting of an im-

provement in the level of consciousness, a complete elimination of, or a significant relief from, headaches and vomiting, and the abatement of Bruns' symptom, while the symptoms of the damage of the cranial nerves, nystagmus, ataxia, or a disturbance of balance remained unchanged or improved only slightly. As a moderate result, we regarded a slight improvement, an unsatisfactory result mans no improvement whatsoever after implanting the shunt. No instances of death were encountered immediately after the surgical intervention, and those included in Table 2 (9 patients) were caused by the actual illness (i.e./the tumour) or postoperative diseases (pneumonia, encephalomalacia).

Table 2. Results of treatment with ventriculo-atrial shunt

Type of illness	Number of patients	Result obtained after implanting the shunt				
		good (significant improvement)	moderate (little improvement)	unsatisfactory (lack of any improvement)	death (directly after implantation)	Delayed death (after craniectomy)
Tumours removed totally	38	37	—	1	—	4
Tumours removed partially	22	19	1	2	—	5
Total	60	56	1	3	—	9

Monitoring of the CSF pressure was carried out in 14 patients; 11 of them were subjected to monitoring before and after implanting the shunt and after removing the tumour, and the remaining 3 were monitored only before and after the implantaion of the shunt. The time of monitoring ranged from 29 to 111 hours, the mean time of monitoring being 88 hours. The obtained results are presented in Table 3. The CSF pressure before the implantation ranged from 14 mm Hg to 56 mm Hg, the mean value being 36.1 mm Hg. After implantation, it lowered to 7—26 mm Hg, the mean value being 17.2 mm Hg. Simultaneously, a lowering of the CSF pressure curve and the disappearance of the pathological waves was observed. After the total removal of the tumour a further normalisation of the CSF pressure, consisting in the lowering of the CSF pressure curve and a further lowering of the CSF pressure to the value of 4—12 mm Hg, the mean value being 7 mm Hg are noticed.

A particularly striking improvement after implanting the shunt was noticed in patients in a most severe condition, with an initial high CSF pressure and numerous instances of the appearance of A-waves during monitoring before the implantation. In patients in which the total re-

Table 3. Results of monitoring of the CSF pressure (CSFP) in patients with posterior fossa tumours before and after implanting ventriculo-atrial shunt and after removing the tumour

Case No	Case sheet No	Results of Monitoring the CSF Pressure (CSFP)					
		before implantation		after implantation		after removal of the tumour	
		CSFP in mm Hg	existence of A waves	CSFP in mm Hg	existence of A waves	CSFP in mm Hg	existence of A waves
40	6503	52	+	14	+–	8	–
55	6526	46	+	12	–	6	–
55	6573	34	+	9	–	6	–
57	6554	25	+	18	–		
59	6638	32	–	13	–	10	–
62	6772	15	+	14	–	7	–
65	6898	15	+	14	+	7	–
80	7187	26	–	8	–		
90	7368	36	–	12	–	8	–
108	6560	14	–	26	–	12	–
109	6878	56	+	14	–	4	–
110	6405	28	–	7	–		
Mean CSFP in group I		31,6 mm Hg		13,4 mm Hg		7 mm Hg	
58	6675	32	–	27	–	26	–
60	6650	49	+	15	–	15	–
Mean CSFP in group II		40,5 mm Hg		21,0 mm Hg		20,5 mm Hg	
Mean CSFP total		36,1 mm Hg		17,2 mm Hg		13,8 mm Hg	

moval of the tumour was impossible, no improvement of the CSF pressure record was observed after the surgical treatment. In one patient (case no. 65), no improvement in the CSF pressure record, nor any disappearance of the A-waves were recorded, and the reason for it was an occlusion in the shunt. In one more case a malfunctioning of the shunt was observed. A replacement of the shunt in both of the patients mentioned above resulted in an expected improvement of their condition and a normalisation of the CSF pressure record. In one case of a cachectic child, a decubitus over the finishing reservoir of the shunt was formed. During the postoperative period, symptoms of meningitis appeared in 7 patients. In two of them, a CSF pressure monitoring had been conducted. In these cases, however, we are inclined to regard as the cause of the inflammation of the cerebrospinal fluid a long exposition of the operating wound during the removal of the tumour, rather than procedures connected with the implantation of the shunt or conducting the monitoring of the CSF pressure.

CONCLUSIONS

1. Both the observations of the clinical condition of the patients, and the examination of the CSF pressure record indicate that the implantation of the shunt essentially influences the intraventricular pressure, lowering it to normal values, excluding the pathological waves, and successfully eliminating undesirable fluctuation of the CSF pressure.

2. The implantation of the ventriculo-atrial shunt before a scheduled operation on the posterior fossa in hydrocephalic patients is an easy undertaking which improves the patient's condition before the operation; it also makes it easier to carry out the operation, and it prevents the patient from undergoing sudden changes in the CSF pressure during the postoperative treatment.

3. The observed cases of the lack of normalisation in the CSF pressure record were due to malfunctioning of the shunt.

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STRESZCZENIE

Przedstawiono wyniki leczenia 60 chorych z guzem tylnej jamy czaszkowej, powodującym wodogłowie, przy pomocy zastawki komorowo-przedsionkowej, założonej przed kraniektomią i usunięciem guza. U 38 chorych guz usunięto całkowicie, u 22 częściowo. Dużą poprawę stanu klinicznego chorych spostrzegano bezpośrednio po założeniu zastawki u 56 pacjentów, niewielką u 1, u pozostałych 3 chorych poprawy nie było.

Spośród wyżej wymienionych chorych u 14 przeprowadzono stały pomiar ciśnienia płynu mózgowo-rdzeniowego (CPMR) w komorze bocznej mózgu sposobem

Lundberga. Pomiar prowadzono przed i po założeniu zastawki oraz po usunięciu guza. Czas pomiaru wahał się od 29 do 111 godz., średnio 88 godz.

Stwierdzono, że założenie zastawki komorowo-przedsionkowej powoduje normalizację zapisu CPMR, wyrażającą się obniżeniem ciśnienia śródkomorowego z wartości średniej przed leczeniem 36,1 mm Hg do 17,2 mm Hg i zanikaniem fal patologicznych (fal A) po założeniu zastawki. Dalsze obniżenie wartości CPMR do średniej wartości 7 mm Hg wraz z dalszą normalizacją zapisu spostrzegano po całkowitym usunięciu guza. Brak poprawy w zapisie CPMR po założeniu zastawki stwierdzono u chorych z wadliwie działającą zastawką.

РЕЗЮМЕ

В статье представлены результаты лечения 60 больных с опухолями задней черепной ямки, вызывающей гипертензию, которые лечились с помощью предсердно-желудочной створки, заложенной до кранектомии и удаления опухоли. У 38 больных опухоль была удалена тотально, у 22 частично. Значительное улучшение клинической картины больных констатировано непосредственно после применения створки у 56 больных, незначительное улучшение у 1, а у оставшихся 3 больных улучшения состояния не констатировано.

Среди вышеуказанных больных в 14 случаях проводился постоянный учет ДЦСЖ в боковом желудочке мозга по способу Люндберга. Измерения проводились до и после заложения створки, а также после удаления опухоли. Время измерений колебалось от 29 до 111 часов, в среднем 88 часов.

Установлено, что применение предсердно-желудочной створки вызывает нормализацию записи ДЦСЖ, проявляющейся снижением внутрижелудочного давления в среднем с 36,1 мм Hg перед лечением до 17,2 мм Hg. Одновременно исчезали патологические волны (волны А) после заложения створки. Дальнейшее снижение ДЦСЖ до средних показателей 7 мм Hg с одновременной дальнейшей нормализацией записи, наблюдалось после тотального удаления опухоли. Отсутствие улучшения клинической картины по записям ДЦСЖ после заложения створки обнаружено у больных с неполным функционированием створки.