

Endoscopic technique in the treatment of patients with colloid cysts of the third ventricle. Report based on over a decade of experience

Technika endoskopowa w leczeniu pacjentów z torbielą koloidową komory III mózgu. Raport na podstawie ponaddziesięcioletniego doświadczenia

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Abstract

Background and purpose: The aim of the work was a retrospective analysis of the efficiency of endoscopic treatment of patients with colloid cysts of the third ventricle.

Material and methods: The analysis covered 17 patients. There were 19 operations in total. The follow-up period ranged from 21 to 130 months. The effectiveness of the method was evaluated by comparing neurological condition and magnetic resonance imaging (MRI) before and after treatment.

Results: The mean duration of surgery was 81 minutes. The cyst was removed completely in 8 patients, subtotally in 5, partially in 3, and in 1 case a biopsy was performed. No persistent intra- or postoperative complications or deaths occurred. Immediately after the operation symptoms withdrew completely in 8 patients and partially in 9. In the long term follow-up period, all symptoms receded completely in 11 patients and a further 6 patients showed partial improvement. MRI revealed the absence of the cyst in 8 patients, in 2 patients the tumor was smaller in size and in a further 7 patients some small parts of the walls of the cyst were present. The width of the ventricle system returned to its normal size in 8 patients, decreased in 8 patients and in 1 case remained at its initial size. In 2 patients temporary postoperative complications occurred. The average hospitalization time was 9 days.

Streszczenie

Wstęp i cel pracy: Celem pracy była retrospektywna analiza skuteczności operacyjnego leczenia pacjentów z torbielą koloidową komory III mózgu z zastosowaniem techniki endoskopowej.

Materiał i metody: Analizie poddano 17 chorych z torbielą koloidową komory III mózgu operowanych metodą endoskopową, u których wykonano łącznie 19 zabiegów. Czas obserwacji chorych wynosił 21–130 miesięcy. Skuteczność metody oceniano, porównując stan neurologiczny i obraz radiologiczny mózgowia przed zabiegiem i po zabiegu.

Wyniki: Średni czas operacji wynosił 81 min. Torbiel usunięto całkowicie u 8, prawie całkowicie u 5, a częściowo u 3 pacjentów. W jednym przypadku wykonano biopsję. Nie odnotowano zgonów okołoperacyjnych ani trwałych powikłań. Bezpośrednio po operacji ustąpienie wszystkich objawów choroby stwierdzono u 8, a częściową poprawę u 9 osób. W odległym okresie u 11 pacjentów ustąpiły wszystkie objawy kliniczne, a u 6 nastąpiła częściowa poprawa. W badaniu za pomocą rezonansu magnetycznego brak torbieli wykazano u 8 chorych, u 2 stwierdzono guz o mniejszych rozmiarach, a u 7 resztkową ścianę torbieli. Szerokość układu komorowego powróciła do normy u 8 pacjentów, zmniejszyła się u 8 osób, a pozostała w stanie wyjściowym w 1 przypadku. U 2 pacjentów w okre-

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Conclusions: Recurrences of colloidal cysts after subtotal and partial removal do not occur very often, and the time of the recurrence may either be very long or it may not happen at all. Although we recommend complete removal of the cyst, this should not be pursued at the cost of incurring operative complications.

Key words: colloid cyst of the third ventricle, neuroendoscopy, ventriculostomy, hydrocephalus.

sie bezpośrednim wystąpiły przejściowe powikłania operacji. Średni czas hospitalizacji wynosił 9 dni.

Wnioski: Wznowy torbieli koloidowych po prawie doszczętnym lub częściowym usunięciu nie występują często; czas do ich pojawienia się po operacji może być bardzo długi lub wznowa może nie pojawić się w ogóle. Autorzy rekomendują dążenie do doszczętnego usunięcia torbieli, lecz nie kosztem wystąpienia powikłań operacyjnych.

Słowa kluczowe: torbiel koloidowa komory III, neuroendoskopia, wentrykulostomia, wodogłowie.

Introduction

Although the colloid cyst of the third ventricle (TVCC) is a benign tumour of neuroepithelial origin, it can be potentially lethal [1-3]. There is also the risk of neurological deterioration or death due to hydrocephalus [4].

For more than 10 years the endoscopic technique has been an alternative to microsurgical procedures [2,5-7]. On the other hand, with currently available endoscopic technique, to obtain total resection of the cyst seems to be more difficult than with 'conventional' microsurgical technique. A neurosurgeon who decides to perform an endoscopic TVCC resection faces a decision when to cease the surgery to decrease the probability of complications which can occur with this 'minimally invasive' method. The majority of surgeons prefer the approach of 'minimal complication rate' to total endoscopic resection of the cyst at all cost. Nevertheless, complete tumour removal remains 'a gold standard' of surgery and according to some reports can be achieved nearly as frequently as with microsurgery in specialized centres [1,5]. One could even say that the endoscopic removal of TVCC has become a standard treatment in many medical centres. However, only a few centres prefer the endoscopic method, in spite of the fact that conventional microsurgical access usually contributes to a higher rate of complications and often accounts for additional neurological deficits.

In this report we summarize our over ten years of experience in endoscopic surgery of TVCC. Our intention is to illustrate the problem from the perspective of an average, non-specialized neurosurgical ward which routinely uses endoscopic technique. The objective of this contribution is to attempt to find and discuss an optimal 'trade-off' between the desire to remove the tumour totally and the risk of complications which can result from such a radical approach.

Material and methods

Seventeen patients (6 males and 11 females) were analysed. Mean age of patients was 44 (range 23-77). They were treated at the Neurosurgery Department of the Silesian Medical University in Katowice, between 2000 and 2010, for third ventricle colloid cysts. Nineteen endoscopic procedures in total were performed in those patients as well as ventriculostomy for obstructive hydrocephalus resulting from TVCC. The diameter of the tumours ranged from 5 mm to 23 mm (mean 15.75 mm). Diagnoses were made on the basis of magnetic resonance imaging (MRI) and computed tomography (CT) as well as on the basis of postoperative histological examination. Patients were operated on using a Storz neuroendoscope with a 5 lens via a standard third ventricle approach. In the majority of cases (all except 1 patient) ventriculostomy was performed after the tumour removal. This technique, tools and approach were described in detail in our recent papers [15,16]. None of the patients required microsurgical removal of remnants of the tumour via craniotomy. The radicality of TVCC removal has been assessed on the basis of the surgeon's intraoperative report as well as MRI performed between the third and the sixth month of the postoperative period. In the postoperative period all the patients had MRI once a year for a period of 5 years, after which the imaging was repeated after 3 and 5 years. Clinical assessments were performed twice: directly after the operation and in the long-term postoperative period. The patients were followed prospectively (average 67.8 months, range 21-130 months). Clinical symptoms before and after operations, the results of the operative procedure, radiological findings before and after the treatment and other details relating to the patients are presented in Table 1.

Table 1. Clinical symptoms before and after surgery, completeness of third ventricle colloid cyst removal, radiological findings before and after surgery, complications and current neurological status of the patientsa

Patient no.	Age [years]/sex	Symptoms at admission	CT/MRI findings at admission	Operative procedure	Complications	Follow-up [months]	CT/cine MRI control examination
1.	30/M	Headache, vomiting, diplopia	Cyst size 15 mm, hydrocephalus	Subtotal cyst evacuation, ventriculostomy	No	81	Residual membrane, enlarged ventricular size
2.	23/F	Acute headache, vomiting, memory deficits	Cyst size 18 mm, hydrocephalus	Subtotal cyst evacuation, ventriculostomy	No	50	Complete resection, normal ventricular size
3.	77/F	Mental status change, gait disturbances, nystagmus, lower limbs weakness	Cyst size 23 mm, hydrocephalus	Subtotal cyst evacuation, ventriculostomy	No	40	Residual membrane, enlarged ventricular size
4.	53/M	Acute headache, vegetative symptoms, mental status change	Cyst size 16 mm, hydrocephalus	Partial cyst evacuation, ventriculostomy	Transient CN III palsy	63	Small residual cyst, normal ventricular size
5.	32/M	Visual deficits	Cyst size 17.5 mm, hydrocephalus	Total cyst evacuation, ventriculostomy	No	41	Complete resection, normal ventricular size
6.	33/F	Headache, vomiting, vertigo, somnolence, depression, visual deficits, numbness, pyramidal signs	Cyst size 13 mm, hydrocephalus	Total cyst evacuation, ventriculostomy	No	41	Complete resection, normal ventricular size
7.	34/F	Nystagmus, tremor	Cyst size 8 mm, hydrocephalus	Subtotal cyst evacuation, ventriculostomy	No	80	Residual membrane, normal ventricular size
8.	31/M	Headache, vomiting, mental status change, urinary incontinence	Cyst size 20 mm, hydrocephalus	Cyst biopsy, no ventriculostomy	No	105	Residual membrane, enlarged ventricular size
9.	34/M	Headache, vomiting	Cyst size 17 mm, hydrocephalus	Total cyst evacuation, ventriculostomy	No	130	Complete resection, enlarged ventricular size
10.	50/F	Drop attack, headache, vomiting, vertigo, diplopia, nystagmus, ataxia	Cyst size 10 mm, hydrocephalus	Partial cyst evacuation, ventriculostomy	No	58	Residual membrane, normal ventricular size
11.	49/F	Headache, vomiting, vertigo, somnolence, ataxia, tremor, nystagmus	Cyst size 15 mm, hydrocephalus	Total cyst evacuation, ventriculostomy	No	110	Complete resection, normal ventricular size
12.	41/F	Headache, vomiting	Cyst size 16 mm, hydrocephalus	Total cyst evacuation, ventriculostomy	No	86	Complete resection, enlarged ventricular size
13.	32/M	Headache	Cyst size 22 mm, hydrocephalus	1. Cyst biopsy and ventriculostomy 2. Partial cyst evacuation 3. Partial cyst evacuation	No	82	Small residual cyst, normal ventricular size

Table 1. c.d.

Patient no.	Age [years]/sex	Symptoms at admission	CT/MRI findings at admission	Operative procedure	Complications	Follow-up [months]	CT/cine MRI control examination
14.	63/F	Memory deficits	Cyst size 15 mm, hydrocephalus	Total cyst evacuation, ventriculostomy	Transient wound liquorrhoea, transient CN III palsy	21	Complete resection, enlarged ventricular size
15.	73/F	Mental status change, loss of consciousness, urinary incontinence	Cyst size 15 mm, hydrocephalus	Subtotal cyst evacuation, ventriculostomy	No	100	Residual membrane, enlarged ventricular size
16.	61/F	Psychosis, dementia	Cyst size 16 mm, hydrocephalus	Total cyst evacuation, ventriculostomy	No	44	Complete resection, normal ventricular size
17.	50/F	Headache, vertigo, memory deficits	Cyst size 5 mm, hydrocephalus	Partial cyst evacuation, ventriculostomy	No	22	Residual membrane, enlarged ventricular size

M – male; F – female; MRI – magnetic resonance imaging; CT – computed tomography; CN – cranial nerve

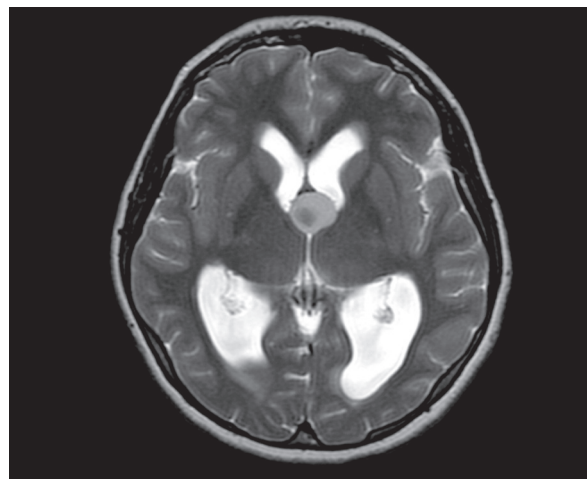
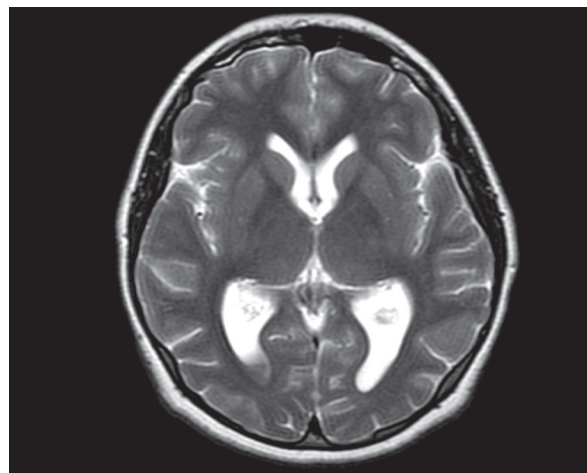
Results

Total TVCC resection was obtained in 8 patients, subtotal in 5 patients, partial in 3 patients and in 1 case a biopsy was performed. The mean procedure duration, including the anaesthesia induction and recovery period, was 81 minutes. None of the patients required a ventriculo-peritoneal shunt. No persistent intraoperative or postoperative complications or deaths occurred during the surgery. In the immediate postoperative observation (understood here as the time from the operation to discharge from hospital) clinical symptoms receded completely in 8 patients and partially in the other 9. Some temporary postoperative complications appeared in two patients. One had transient liquorrhoea treated non-operatively and transient oculomotor nerve palsy (probably because of an overblown balloon of a Fogarty's catheter during ventriculostomy). The second had transient oculomotor nerve palsy only. The mean hospitalisation period was 9 days. In the long-term follow-up, all patients showed clinical improvement. In 11 patients all symptoms receded completely and 6 patients showed partial improvement. MRI revealed total cyst removal in 8 patients, in 2 cases a small residual cyst was still present and in 7 patients some small residual membranes were found. Hydrocephalus disappeared in 9 patients, diminished partially in 7 patients and showed no reduction in 1 patient (Figs. 1 and 2). We concluded that 8 out of 17 patients (47%) had their TVCC removed totally. In a further 5 patients (29%), we estimated the removal to be subtotal, as according to the surgeon, only a small part of a fine residual connective tissue of membranes was left. They were typically small parts of the walls of the cyst integrated with the thalamostriate vein. In 2 cases, despite the fact that MRI revealed a small part of membrane, we deemed the surgery as only partial (to be consistent with the surgeon's intra-operative report). To a certain extent one could also consider those 7 procedures as 'radical', and thus the percentage of radical operations could be as high as 88%. Nevertheless, we still performed ventriculostomy to prevent the symptoms of an existing or a potential hydrocephalus.

The patient marked as no. 13 in Table 1 was treated endoscopically three times. The first operation with a right-hand approach was limited to a biopsy and ventriculostomy due to the unfavourable position of the thalamostriate vein. Clinical improvement was achieved. Severe preoperative conditions due to acute hydrocephalus disappeared. The second operation was performed two months later with a left-hand sided

Table 2. The literature data related to the surgical treatment of third ventricle colloid cysts: number of patients, number of total resections and recurrences, mean follow-up and complications

Authors, publication year [reference]	No. of patients	No. (%) of total resections	No. (%) of recurrences	Mean follow-up [months]	Morbidity (no.)
Teo <i>et al.</i> , 1999 [38]	18	18 (100%)	0 (0%)	32	aseptic meningitis (2)
Schoeder <i>et al.</i> , 2002 [39]	12	8 (67%)	0 (0%)	56	intraoperative bleeding (3), memory deficits (1)
Hellwig <i>et al.</i> , 2003 [1]	20	0 (0%) ('part of the cyst membrane was left behind in all patients')	1 (5%)	64	intraoperative bleeding (1), aseptic meningitis (1), memory deficits (4), psychosis (1), third nerve paralysis (1), salt wasting syndrome (1), loss of consciousness (1), headache (1)
Acerbi <i>et al.</i> , 2007 [2]	6	4 (67%)	0 (0%)	52.5	septic ventriculitis (1), pulmonary embolism (1)
Grondin <i>et al.</i> , 2007 [18]	25	24 (96%)	1 (4%)	38	hemiparesis (1), pulmonary embolism (1)
Charalampaki <i>et al.</i> , 2006 [26]	28	28 (100%)	0 (0%)	no data	none of the patients deteriorated
Longatti <i>et al.</i> , 2006 [27]	61	25 (41%)	7 (11%)	32	two complications
Stachura <i>et al.</i> , 2009 [35]	10	6 (60%)	0 (0%)	31	memory deficits (2), temporary mutism (1)

**Fig. 1.** T2-weighted MRI of patient no. 2 (as in Table 1) before surgery. Clinical signs before surgery: acute headache, vomiting, memory deficits. Third ventricle colloid cyst size: 18 mm. Obstructive hydrocephalus**Fig. 2.** T2-weighted MRI of patient no. 2 (as in Table 1) after surgery shows total tumour removal and normalisation of the size of the ventricular system. Neurological signs disappeared completely

approach, and also in this case the tumour could not be totally removed due to the unfavourable position of the thalamostriate vein. The follow-up lasted 6 years. During this period MRI was performed three times. The last examination showed tumour progression. Partial tumour removal was achieved during the third operation and the patient with no symptoms was able to return to his regular job in a coal mine.

Discussion

With neuroimaging being now so common, 'accidental' TVCCs are found much more often than in the past [1]. Non-surgical treatment and long-term observation

seem to be the correct attitude in asymptomatic cases; in older patients where a TVCC is small, no hydrocephalus is present and the cyst is hypointense in T2-weighted MR images. Therefore, only symptomatic patients should be operated on [2,3]. The majority of neurosurgeons, however, recommend cyst removal as it poses a risk of sudden neurological deterioration [10]. The endoscopic removal is considered a therapy of choice, due to satisfactory outcomes compared to microsurgical and stereotactic procedures, minimal rate of complications and short hospitalisation and operation time [1,3,5,11]. Despite neuroendoscopic treatment being more and more effective, the recurrence risk seems to be still higher in comparison with an open approach. [1,6,12-18]. Analysis by Grondin *et al.* shows that in 24 out of 25 patients treated with an endoscopic procedure the TVCC was totally removed. In a 5-year follow-up no recurrence was observed [11]. Charalampaki *et al.* [19] present similar results: no recurrence was observed in any of 28 patients and in all cases the cyst was removed completely, including its wall. Longatti *et al.* [20] describe 61 cases of neuroendoscopic TVCC removal with at least 36 subtotal procedures. In 1 to 132-month follow-up 7 non-symptomatic recurrences were observed, but only in 3 of them was a postoperative cyst remnant present. Stachura *et al.* [14,21] listed difficulties in keeping intraoperative haemostasis, or too dense consistency of the TVCC, or too large size of the TVCC, as the reason for non-total tumour resection. The time of sprouting of subtotally removed TVCCs remains unknown [5]. The above-mentioned analyses emphasise the necessity for continuous observation of the patient's clinical state and their radiological surveillance. Lack of such care poses a risk of the condition recurring which in turn can lead to neurological deterioration and even death resulting from acute hydrocephalus [2,4,5].

The endoscopic approach for the excision of TVCC offers the advantages of good visualisation and a minimally invasive corridor through the dilated ventricular system, thus avoiding damage to the important structures in the anterior third ventricle [1,6,21]. The most significant but relatively rare late clinical complications of endoscopic TVCC resection as well as the percentage of totally removed tumours and the percentage of TVCC recurrences in other published series are presented in Table 2.

Comparing our results concerning the degree of completeness of TVCC removal (47% of absolutely total removal and 88% of radical removal, proved in MRI) with the other series of patients, we have to say that our percentage of total resections is relatively low. Authors such as Acerbi *et al.* [2], Grondin *et al.* [11], and Char-

alampaki *et al.* [19] have obtained better results in this respect (67%, 96%, 100%, respectively). It may be a result of the fact that our series included also patients operated on at the beginning of our activity. In 16 cases with the follow-up period lasting from 21 to 130 months, we did not observe any progression of the tumour remnants or any recurrence of totally removed cysts. Neurological conditions improved or all symptoms receded in all patients. In spite of our earlier experience in brain endoscopy, we were very careful during TVCC procedures and were not determined enough to radicalise the surgery. The radicality of our operations increased according to the 'learning curve'. Another reason for our lower radicality of operations was the attitude of patients. They usually opted to avoid any actions which could lead to an increased risk of complications. Such a strategy seems to be right as the percentage of long-term permanent complications resulting from the surgery in our group equals zero. In spite of our cautious attitude we by no means have given up the desire to remove TVCC completely whenever such a possibility occurs. With the improvement of our operative technique the results have been getting better, including the radicality of TVCC extirpation.

Another question is how often and when after subtotal surgery there is a need of subsequent surgery due to TVCC progression. In our group we have observed no recurrences and rather stable condition of the patients who underwent non-radical TVCC resection for 105, 100, 100, 81, and 80 months, respectively (Table 1). There is no evidence, therefore, that patients after non-radical TVCC removal would ever have to be operated on because of recurrence. The mean time of recurrence after subtotal or even partial resection is not known either. On the other hand, even total TVCC removal does not guarantee that there will be no recurrence of the tumour in the future. This has been noted by Longatti *et al.* [20] who, in their group, describe 4 cases of TVCC recurrence after operations which were regarded as complete.

Our philosophy does not require gross total TVCC resection at all costs. TVCCs differ in the wall thickness, the presence of lining, the colloid density, the wall vascularisation and, most importantly, the thalamostriate vein location. The foramen of Monro size is also crucial. Fine-wall cysts without lining are resected most easily and safely, especially when the colloid is watery, the foramen of Monro is dilated and the thalamostriate vein passes round the tumour surface. In such cases, the capsule of the cyst is incised and a thin catheter is inserted through the working channel used for aspiration of the colloid content of

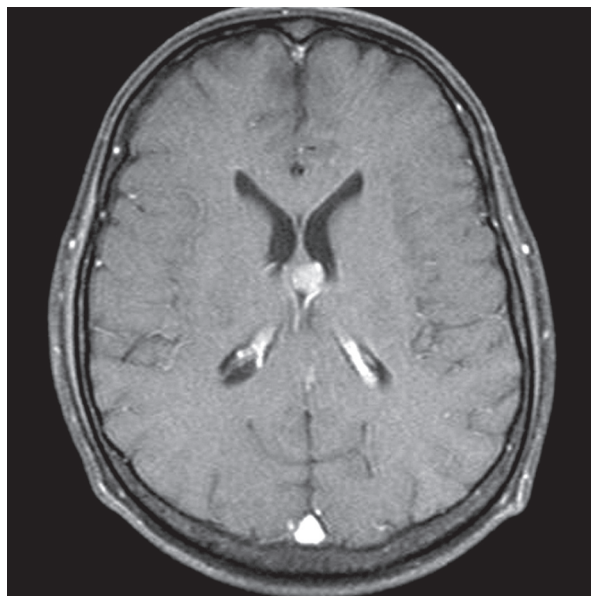


Fig. 3. Asymmetric colloid cyst location. In such cases a left-hand side approach is recommended, even though it is the dominant hemisphere

the cyst. When the cyst is empty, the capsule is mechanically removed. The unfavourable position of the thalamostriate vein may result in bleeding or vein damage with severe or even lethal complications. These cases in our opinion should be treated with capsule incision, total colloid aspiration and cyst wall coagulation without total wall resection.

Also the side of approach is of great importance. In cases when MRI shows a symmetric ventricular system with the tumour located in the midline, the non-dominant hemisphere approach is of choice. In cases of asymmetric location of the tumour or of the foramen of Monro, and also in the unfavourable position of the thalamostriate vein, a more convenient approach is chosen, even if this requires dominant hemisphere side access (Fig. 3).

Closing procedures must be performed very precisely due to a liquorrhoea risk. The approach canal is filled with haemostatic gel-foam. The dura mater incision should be sewed or at least brought together and protected with tissue glue or other methods. The skin wound must be sewed tightly. In all but one cases ventriculostomy was also carried out. We therefore think that hydrocephalus is an important factor of symptoms presentation in patients with TVCC. These symptoms may be present temporarily or permanently even after total tumour removal. Ventriculostomy is a rather simple and safe procedure. In our opinion ventriculostomy is expedient in order to facilitate postoperative CSF flow and to reduce the risk of liquorrhoea.

Conclusions

Colloid cyst of the third ventricle recurrences after subtotal or partial resection do not occur frequently. Sprouting time might be very long, or such a recurrence may not happen at all. We do recommend a strategy to remove TVCC totally but not at the expense of incurring post-operational complications.

Disclosure

Authors report no conflict of interest.

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