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Clinical Article

Long-term surgical outcome in patients with intracranial hydatid cyst

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Summary

Background. Cerebral hydatid cysts account for up to 3.6% of all intracranial space-occupying lesions, in endemic countries. The vast majority of patients affected are children. Computed tomography (CT) and magnetic resonance imaging (MRI) have greatly contributed to a more accurate diagnosis of hydatids. However, correct pre-operative diagnosis still remains quite puzzling. Extirpation of the intact cyst is the treatment of choice, resulting in most cases to a complete recovery.

Method. In our retrospective study, we have reviewed 76 cases of intra-cranial hydatid disease operated on in our hospital over a 22 year period. Presenting clinical symptoms and signs and the radiological findings on CT and MRI were documented. Albendazole was given preoperatively to patients with giant (>5 cm) or multiple cysts and postoperatively to all patients. The follow-up period ranged from 12 months to 22 years and the outcome was assessed using the Glasgow Outcome Scale (GOS).

Findings. Sixty seven (95.7%) of our patients were children. Increased intracranial pressure and papilledema were the predominant findings in this group, whereas focal neurological deficits were most prevalent in adults. CT and MRI revealed round cystic lesions, isodense and isointense respectively to cerebrospinal fluid (CSF), with no rim enhancement or perifocal edema. Multiple cysts were identified in 3 cases. Extirpation of the cyst without rupture was accomplished in 56 patients (73.7%). Recurrences occurred in 19 patients (25%). 4 patients (5.3%) died within 6 months after surgery; 3 of these patients had multiple cysts and one died shortly after the operation due to anaphylactic shock following intra-operative rupture of the cyst.

Conclusion. Long-term follow-up confirms that intracranial hydatid cysts should always be surgically removed without rupture; the outcome remains excellent in these cases. Correct preoperative diagnosis is vital for the successful outcome of surgery. A high index of suspicion is therefore required in endemic areas despite the availability of advanced neuro-imaging. Medical treatment with albendazole seems to be beneficial both pre- and post-operatively. Newer diagnostic methodologies, such as MR spectroscopy and MR diffusion weighted imaging, might lend themselves to the diagnosis of intracranial hydatid cysts.

Keywords: Cerebral hydatid disease; cyst location; magnetic resonance imaging; albendazole; outcome; MR spectroscopy.

Introduction

Echinococcosis (hydatidosis) is caused by infestation with the tapeworm E. granulosus and, much less frequently, E. multilocularis. The disease is endemic in South America, the Middle East, Australia, the Mediterranean, India and northwest China [12–14, 16–18, 25, 35, 39, 43–45, 47, 48, 52]. The incidence of hydatidosis ranges from 3 to 50 cases per 100,000 inhabitants in endemic areas [28, 33, 51]. Dogs and rarely foxes are the definitive hosts of E. granulosus; herbivore intermediate hosts, mainly sheep, become infected by ingesting eggs passed in the feces of the definitive hosts. The cycle is completed when dogs eat the infected meat of sheep. Humans acquire the infection by ingesting water and food, contaminated by ova passed by the dogs.

The hallmark of this infection is the developing of hydatid cysts in various organs, most commonly the lungs and liver. Cerebral manifestation of the disease is rare, present in about 2–3% of all E. granulosus infections [2, 3, 6, 7, 11, 17, 19, 21, 24, 27, 28, 30, 38, 39, 52].

In our current communication, we present our experience with 76 patients with intracranial cysts who were admitted to our hospital over a period of 22 years.

Material and methods

This study included 76 patients operated on for cerebral hydatid cyst between 1981–2003 in the 1st Department of Neurosurgery, Clinic Hospital "Bagdasar-Arseni", Bucharest, Romania. Sixty seven of the patients were children (95.7%) (median age 8.7 years old) and 9 were adults (4.3%) (median age 29.3 years old). The male to female ratio was 45:31. The diagnostic modality employed was CT-scan in all cases and MRI in 32 cases. Presenting clinical symptoms and signs and radiological findings were reviewed. The post-operative complications were documented and the outcome of the patients was evaluated and measured by utilizing GOS. The follow-up period ranged between 12 months and 22 years after the initial operation.

Results

Clinical presentation

The presenting clinical symptoms and signs in the childhood age group were dominated by increased ICP in 61/67 cases (91.1%), accompanied by papilledema in 52 cases (77.6%), while motor deficits were present in 41 cases (61.2%). In the adulthood group, consisting of 9 cases, the most frequent clinical presentation was with headache in 8/9 cases (88.9%) and focal neurological deficits in 6/9 cases (66.7%).

Radiological findings and localization of cyst

CT scan of the brain was obtained in all of our patients, whereas MRI in 32 patients, since MRI was not available before 1983. It is noteworthy that MRI significantly contributed to accurate localization and diagnosis in our patients. Hydatid cysts presented as spherical, CSF isodense lesions with no or minimal rim enhancement or perifocal edema on CT scans. The vast majority (94.8%) of the cysts were supratentorial; only 4 cysts were located infratentorially, 3 of them

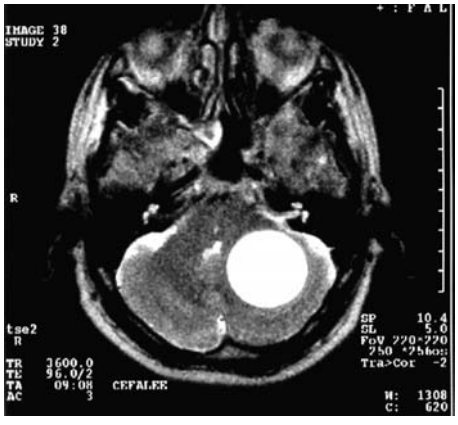


Fig. 1. T2 weighted MRI shows a hydatid cyst in the left cerebellar hemisphere in the posterior fossa

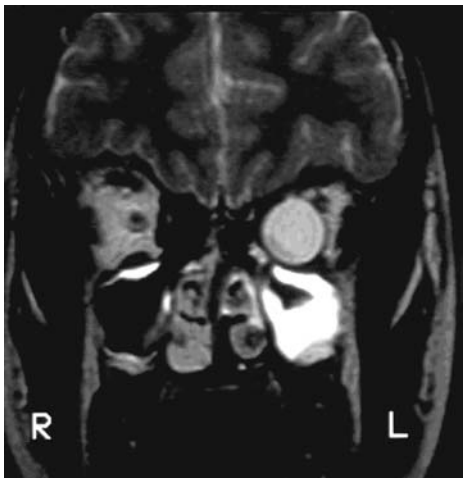


Fig. 2. T2 weighted MRI shows a left orbital hydatid cyst

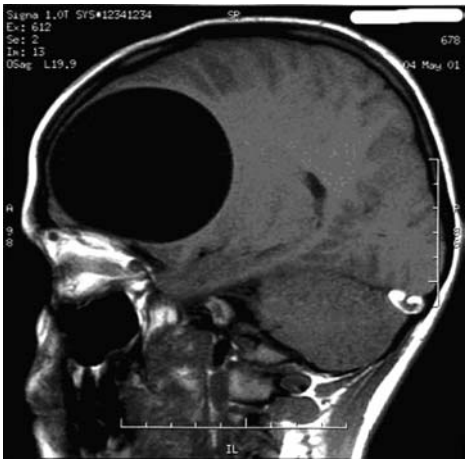
Table 1. *Intracranial hydatid cysts-distribution by location in 76 cases admitted to Bagdasar-Arseni Hospital between 1981–2003*

Supratentorial		Infratentorial		Other	
1 lobe	33	post fossa	3	orbitary	2
2 lobes	26	brainstem	1		
3 lobes	9				
Intraventricular	1				
Extradural	1				

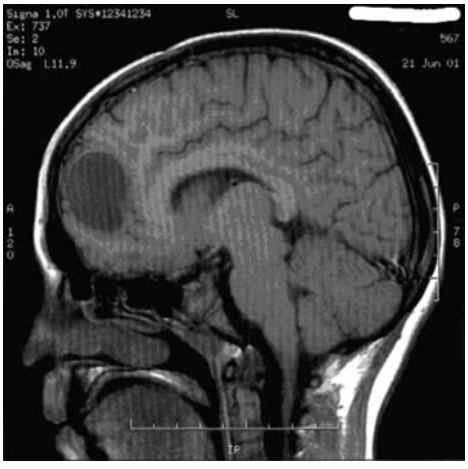
(3.9%) in the posterior fossa (Fig. 1) and 1 (1.3%) in the brain stem; in 2 cases (2.6%), the cysts were found in the orbital fossa (Fig. 2) (Table 1). In 3 cases (3.9%), multiple cysts were identified; in 2 cases multiplicity was due to recurrence, while in the other case it was attributed to embolization from an extra-cranial location. Chest x-ray, abdominal ultrasound and/or CT scan were performed in all patients in search of systemic disease. Unfortunately, although heart echocardiography is indicated to establish possible communication between the right and left cardiac cavities, this was not performed in our series. However, the authors have now started performing heart ultrasound to all such patients. In 18 cases (26.9%), an association between cerebral cysts and extracerebral hydatid disease was established. Hydatid cysts were revealed in the liver in 8 patients, lung in 6 patients, spine in 3 patients and kidney in a single patient. The size of the intracranial cysts ranged between 1–3 cm in 20 cases, 3–5 cm in 49 cases and more than 5 cm in 7 cases (Figs. 3 and 4).

Surgery

The surgical technique used, was that proposed by Dowling; the main objective was to remove the cysts



a



b

Fig. 3. (a, b) Giant left frontal hydatid cyst. (a) Pre-operative T1 weighted MRI. (b) Post-operative T1 weighted MRI

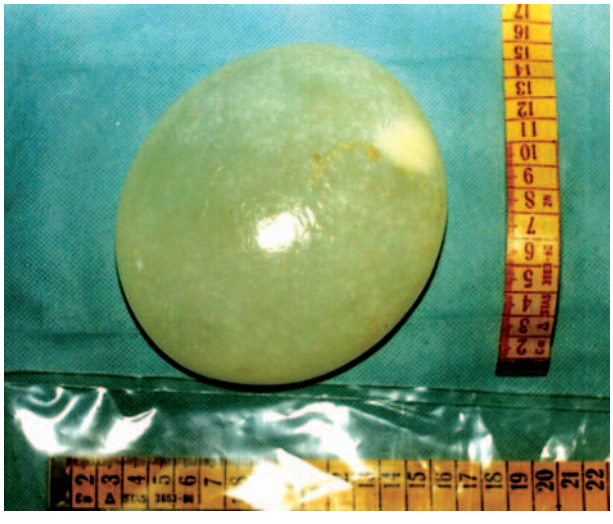


Fig. 4. Histopathological macroscopic aspect of intact, removed, giant left frontal hydatid cyst

unruptured, in order to prevent spillage of cyst fluid and dissemination of the disease. Cyst exposure was followed by continuous mild saline irrigation of the cyst-brain interface, and finally, microscopical hydatid cyst removal. Despite our meticulous microdissection technique, intra-operative rupture was reported in 20 cases (26.3%). Prompt irrigation with hypertonic saline (10% NaCl) was employed in these cases. Surgery was accomplished in one stage in 73 cases (96.1%) and two stages in 3 cases (3.9%). Our strategy, in cases with multiple intracerebral hydatid cysts, is to perform two stage surgery; the first removal being the cyst with the greatest size or the cyst responsible for the majority of the symptoms and signs. In cases in which the cysts were located in the same hemisphere or/and in close proximity to each other, more cysts can be removed at the same operation. Interestingly, all the cases of intracerebral multiple hydatid cysts were adults, infested by E. multilocularis, and died postoperatively at 2 weeks, and 4 months.

After the establishment of the role of albendazole in the treatment of cerebral hydatidosis [36, 37, 46], preoperative chemotherapy with albendazole was given in 13 cases as a pre-surgical treatment to reduce the size of the cyst and to decrease the risk of dissemination. This treatment was given predominately to patients with giant (more than 5 cm) and multiple (intra- or extracranial) cysts. Post-operative chemotherapy was given in all cases for 3–12 months after 1985. Our current protocol of administration is: 200 mg twice a day for 1–8 cycles of 28 days each, separated by drug free intervals of 14–28 days.

Complications

One of our patients died in the early post-operative period, due to anaphylactic shock following intra-operative rupture of the cyst. Post-operative complications occurred overall in 51 cases (67.1%). More specifically, subdural effusions were noted radiographically in 28 cases (36.8%) and in 9 of these a subduroperitoneal shunt was needed. Obstructive hydrocephalus was clinically and radiographically documented in 7 cases (9.2%) and was treated with a ventriculoperitoneal shunt. Post-operative seizures were present in 13 cases (17.1%). Finally, one patient (1.3%) developed an infection of the surgical wound and 2 patients (2.6%) non-bacterial meningitis.

Follow-up

The follow-up period ranged between 12 months and 22 years, with an average period of 13.7 years. Recur-

rences occurred in 19 cases (25%); in 2 patients the recurrence was multiple. The average period for development of recurrences was 3.2 years. Sixteen of these cases were attributed to intra-operative rupture of the cyst, whereas the remaining 3 were considered to be due to re-infestation, since intact removal of the cyst was accomplished on the initial surgical intervention. In solitary recurrences, surgical removal was re-employed with good results. The outcome at six months after surgery was evaluated by Glasgow Outcome Scale (GOS). Good recovery (GR) was established in 56 cases (73.7%), moderate disability (MD) in 15 cases (19.7%), severe disability (SD) in 1 case (1.3%) and death in 4 cases (5.3%). No patients were found to be in a vegetative state. The outcome at 2 years was: GR in 49 cases (64.5%), MD in 22 cases (28.9%), SD in one case (1.3%) and death in 4 cases (5.3%). Interestingly, three of the patients who died were infested with E. multilocularis. Another patient died shortly after operation due to anaphylactic shock.

Discussion

Hydatid cysts of the brain are an uncommon disease, accounting for 2–3.6% of all intracranial space-occupying lesions in endemic areas [14, 33, 34, 40, 49]. Associated extracranial cysts are common, making a thorough radiological evaluation of the patient, with chest x-ray and abdominal ultrasound or CT scan, mandatory [17]. Furthermore, heart ultrasound is indicated especially in children, where the occurrence of primary cerebral hydatid cysts may imply a communication in the right and left side of the heart [30]. Children are much more frequently affected compared to adults; 50–93% of intracranial cysts are found in children younger than <17 y. In our study, this percentage was even higher reaching 95.7%. It has been suggested that ductus arteriosus patency during the neonatal period may be a cause of increased vulnerability of children, by allowing passage of the parasites from the periphery to the brain [30].

Cerebral hydatid cysts are usually unilocular [22, 43]. They are most often supratentorially localized in the distribution of the terminal braches of the middle cerebral artery, usually temporo-parieto-occipitally [34, 35]. Cysts may rarely be found in other locations. Intraventricular [11, 25, 30] or extradural [8, 17, 42] cysts have been previously reported; interestingly, one case from each of these two uncommon sites was found in our series. Posterior fossa distribution is also a rare occurrence [1, 20, 30]; in our series, 3 such cases (3.9%) were admitted to our hospital over 22 years. A handful of brainstem localized cysts have been previously reported [10, 15, 26, 31, 34]; the occurrence in our data was a single case (1.3%). Another rare site is the orbital fossa [29]; we report 2 such cases (2.6%). Multiple intracranial hydatid cysts are also a rare finding [9, 22, 43, 52]. Multiple larval intake is also a theoretical possibility, but a debatable, pathophysiologic mechanism. Interestingly, in all of our cases with multiple hydatid cysts the patients were adults and the causative agent was identified as E. multilocularis. Multiple intracranial hydatid cysts should be considered a malignant disease [4, 26]; a finding that is confirmed by our findings since all of our patients died post-operatively at 2 weeks and 4 months.

Clinical presentation of cerebral hydatidosis is somewhat different in children and adults. Signs of increased intracranial pressure with papilledema dominate in the younger age group, whereas focal findings such as hemiparesis, speech disorders, and hemianopsia, sometimes associated with epileptic seizures, are more prevalent in the older age group [17, 33].

The diagnosis of hydatid cysts remains a pathological one. Radiological investigations though can be very helpful in identifying hydatid cysts preoperatively. CT and MRI are the current diagnostic modalities of choice. MRI appears to be superior to CT in the detection of rim enhancement and surrounding edema [5, 47], when present, as well as in the determination of the degree of mass effect [47]. The fact that hydatid cysts are metabolically active cavities makes them potential candidates for proton MR spectroscopy. Previous reports have defined the spectroscopic profile of hydatid cysts [29, 34, 41]. The role of diffusion weighted MRI in the diagnosis of cerebral hydatid disease is currently under investigation [27].

A number of pathological conditions may resemble a hydatid cyst. Brain abscess and cystic astrocytoma may be differentiated because of the rim enhancement and the perifocal edema they usually cause [17]. Moreover, arachnoid, porencephalic, as well as other benign neuroepithelial cysts, which may resemble hydatid cysts, are rarely spherical and are not entirely surrounded by brain tissue [17].

Definitive treatment of cerebral hydatid cyst is surgical removal in toto. The most widely employed surgical technique is that proposed by Dowling [12], which comprises of continuous saline irrigation of the cyst-brain interface aiming to ‘‘give birth’’ to the intact cyst. Intra-operative rupture of the cyst with consequent spillage of its contents into the surrounding brain tissue

results in a greatly elevated risk for the formation of recurrent, secondary cysts. Generous irrigation of the surgical field with hypertonic saline should be undertaken to reduce the risk for recurrences [17]. In our series, despite our microsurgical dissection, intra-operative cyst rupture was noted in 20 cases (26.3%), which is comparable to other studies in the literature [17, 30]; of these 20 patients, 16 (80%) developed recurrent disease within an average period of 3.2 years. In cases where the cysts are adherent to the brain surface or when their location or size makes them not amenable to Dowling's technique, aspiration of the cystic fluid followed by cyst removal has been employed; it needs to be emphasized though, that the risk of contamination remains extremely high. Intracystic injections of hypertonic saline, hydrogen peroxide, 0.5%, silver nitrate or 1% aqueous iodine solutions should be undertaken to destroy the residual larvae [17]. Formalin should not be used because of its toxicity to brain tissue.

Subdural effusions [2, 17] and development of obstructive hydrocephalus [17] are well documented post-operative complications; the former was encountered in 36.8% of our patients and approximately 1/3 of them required treatment with a subduroperitoneal shunt. Obstructive hydrocephalus was successfully managed with VP shunting. Postoperative seizures [17], development of porencephalic cysts [17, 32, 50], focal signs (e.g. paresis) and non-bacterial meningitis have also been reported [30]. Intra-operative rupture of the cyst may result in early death due to anaphylactic shock, as was the case in one of our patients. Recurrence and multiplicity of cysts seems to be the most significant negative factors affecting the long-term outcome of patients with intracranial hydatid disease. Three of our four patients who died had multiple cysts due to E. multilocularis infestations.

Additionally, medical treatment with mebendazole [16, 17] and more recently, with albendazole [9, 15, 23] has been undertaken for the treatment of recurrent cases and for cases in which intra-operative cysts rupture occurred. Chemotherapy might be useful in inoperable cases as well as preoperatively to reduce the size and number of multiple cysts. It should be emphasized that medical treatment is never used alone but only as an adjunct to surgery.

Conclusions

In toto surgical removal of intracranial hydatid cysts remains the treatment of choice for cerebral hydatidosis. If the cyst ruptures during surgery, vigorous irrigation with hypertonic saline should be employed. Medial treatment with albendazole in cases of recurrences, intra-operative cyst rupture, as well as when giant or multiple hydatid cysts are encountered, seems to be beneficial both pre- and post-operatively. Prognosis depends largely on accurate preoperative diagnosis, which is of extreme importance for the successful removal of an unruptured cyst. Although CT scan and MRI have greatly contributed to a correct early diagnosis, in a substantial number of cases diagnosis is obtained post-operatively. A high index of suspicion, when a cystic mass is found on CT or MRI, is therefore required in endemic areas, but also in non-endemic areas, since migration and frequent travelling have changed the worldwide occurrence. Newer imaging techniques, such as MR spectroscopy and diffusion weighted MRI might further refine the diagnostic armamentarium.

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Comment

This is a well written paper which describes a large series.

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