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Case report

Severe hypernatremia during hydatid cyst surgery: an anusual cause of acute abdomen

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ABSTRACT. Treatment of liver hydatid cysts is still in most cases surgical. To avoid the recurrence of hydatid cysts injection of scolicidal products inside the cystic cavity is an important step in the surgical procedure. Many scolicidal solutions are used. Hypertonic saline solution (HSS) is widely used by surgeons; however, there is a risk of hypertonic saline resorption and acute hypernatremia. Iatrogenic hypernatremia can be life-threatening. We report three cases of hypernatremia secondary to HSS injection for hydatid cyst disease treatment. The objective of this study was to discuss the clinical features, and treatment of this rare complication.

Keywords: liver, hydatid cyst, surgery, hypernatremia

Introduction

Surgery is an effective treatment for *Echinococcus granulosis* hydatid cyst. During surgical treatment of the hydatid cyst of the liver, the injection of scolicidal products inside the cystic cavity is an important step in the surgical procedure. Protoscolicidal agents are needed to avoid recurrence due to cyst content residues or spillage [1]. Different agents can be used. Among the scolicidal agents, hypertonic saline solution (HSS) is widely used by surgeons; however, there is a risk of hypertonic saline resorption and acute hypernatremia. Severe iatrogenic hypernatremia is associated with a high mortality rate [2]. Hypernatremia is defined as a plasma sodium level over 145mmol/l and is associated with severe mortality (40–60%) [3].

We will discuss this type of complication by reporting three cases of severe hypernatremia occurring after surgical treatment of hydatid cysts of the liver using HSS. This study aims to recall this rare complication for both the surgeon and anesthesiologist and the importance of discussing this complication with the patient to avoid medicolegal problems.

Case report

Case 1

A young 18-year-old patient, with no particular history, was consulted for pain in the right hypochondrium without fever. Abdominal ultrasound and computed tomography scan suggested the diagnosis of a hydatid cyst type I of Gharbi [4] occupying almost the entire right hepatic lobe. Serum electrolytes were found to be normal (Sodium Plasma Level 139 mmol/l). Hydatid serology was positive. The patient was operated by laparoscopic deroofing and underwent resection of a large protruding dome with sterilization of the cyst by an unspecified volume of 30% HSS, in addition to four abdominal gauze packs soaked with the same scolicidal agent were used to protect the operating field. The procedure lasted two hours and 30 minutes. The intervention was completed without any incident. Postoperatively, a few hours after waking up, the patient presented with confusion, hallucinations, and restlessness, followed by drowsiness. The patient was afebrile with a stable hemodynamic state. The postoperative biological assessment showed a sodium plasma level of 166 mmol/l. The patient had rehydration by

5% glucose solutions supplemented with potassium at a rate of 250 ml/h during the first 24 hours and 84 ml/h for the next 48 hours. The total volume of fluid administered during the 72 hours was 10,000 ml. Full normalization of blood serum level was obtained after 24 hours with a good neurological condition.

The evolution was favourable and clinic follow-up for six months after the intervention showed a patient in very good neurological condition and without any abdominal complaints.

Case 2

A young girl aged 24 years, with no significant medical history, consults for pain in the right hypochondrium without fever. Clinical examination and a biological assessment without abnormalities, in particular, a preoperative sodium plasma level was 137 mmol/l. Morphological explorations (ultrasound and abdominal CT scan) concluded the presence of nine hydatid cysts scattered in different segments of the liver. The indication for surgery was set in an ASA I patient. The operative procedure performed by a subcostal incision consisted of the resection of the protruding dome of the nine cysts with sterilization of these by 2500 ml of HSS at 30%, in addition to the use of compresses packs soaked in HSS to protect the operating field. The intervention lasted six hours and ended without any incident. At the end of this intervention, there was a delay in recovery from anaesthesia, with a neurological exam that showed a Glasgow score was 7/15 and the temperature was 36.8°C. Their blood pressure was normal. The sodium plasma level was assessed and the result was 174 mmol/l. The calculated plasma osmolarity was 361.2 mOsm/l. The patient was transferred to the surgical intensive care unit. She had rehydration with glucose fluids 2.5% hypotonic at a rate of 200 ml/h during the first 24 hours and 100 ml/h for the next 48 hours.

The total volume of fluid administered during the 72 hours was 9600 ml. Serum electrolytes showed complete normalization of the serum level of sodium at the end of 36 hours. The full wake-up call was obtained after 24 hours, with a normal state of consciousness without motor deficit allowing extubation of the patient. She was transferred to the visceral surgery department after 72 hours. Four months after the incident, the neurological examination was perfectly normal.

Case 3

A 45-year-old is admitted to the surgical department for right hypochondriac pain with fever and jaundice for three days. Physical exam confirms fever at 38.3°C and jaundice. The vitality signs were normal. Abdominal exam shows tenderness in the right hypochondriac region. A biological exam reveals hyperleukocytosis and elevated liver function enzymes. On the abdominal ultrasound, there was hydatid cyst type III in the classification of Gharbi in the right lobe of the liver associated with dilated common bile duct (12 mm). The diagnosis of hydatid cyst cholangitis is retained. ERCP was performed on the admission day. The patient was operated on by subcostal incision three days after resuscitation and intravenous antibiotics. After exploration and cyst liberation; aspiration of the cyst content reveals bilious aspects. 20 ml of HSS was injected into the cyst and about 30 ml around the cyst. A few minutes later; the patient developed a shock with severe hypotension and bradycardia. Resuscitation and vasoactive drogues are started. The surgery was cancelled and reported. The patient was shifted to ICU. The patient is kipped insured and monitored. The biological exam showed severe hypernatremia (175 mmol). Early correction of hypernatremia was started. Rehydration by 5% glucose solutions supplemented with potassium at a rate of 250 ml/h during the first 24 hours and 80 ml/h for the next 48 hours. The total volume of fluid administered during the 72 hours was 10,000 ml.

Three days after; hemodynamic status is restored to normal, serum natremia is normalised and the surgery was performed without HSS injection. Albendazole is prescribed before and after surgery.

Discussion

Hydatid disease is caused by *Echinococcus granulosis* [5]. Tunisia is an endemic country of hydatid cysts of the liver; hence the high frequency of published series. The treatment of choice is conservative. Conservative management is easier to perform than surgical resection procedures and does not require hepatobiliary expertise, but exposes the risk of recurrence. To avoid the recurrence of hydatid cysts the approach includes obligatory sterilization of the contents of the cyst. It is very common to irrigate the whole zone with different substances that sterilize the cyst and avoid the spillage of the parasite into the peritoneal cavity.

This procedure can be done with various scolicidal agents. In fact; formalin, hydrogen peroxide, povidone iodine and hypertonic saline may be effective but most can have unacceptable side effects limiting their use [6]. Sclerosing cholangitis can occur with a poor prognosis. Hypertonic sodium chloride (3%, 15%, or 30%) is used more often [7]. In our patients, we used a 30% saline solution for the cyst pouch. This antiparasitic solution may cause severe hypernatremia [5]. Few cases of hypernatremia after cyst injection with hypertonic saline have been described in the literature [6,8,9]. Hypernatremia can be caused by the absorption of hypertonic saline through cystic walls. For this reason, when cystic content is greenish secondary to biliary tract erosion, injection of hypertonic saline must be in small quantities to avoid biliary reabsorption. Furthermore, if vessels are injured and kept open some quantity of solution can be absorbed and may increase sodium levels dramatically or from the exchange of both salt and water through the peritoneal membrane. Moreover, inadvertent injection of hypertonic saline into a blood vessel cannot be excluded [6]. Absorption of hypertonic saline through blood and or peritoneum may be higher in case of increased intraabdominal pressure caused by laparoscopy [10] this hypothesis can explain hypernatremia caused in the first case; furthermore, surgeons have a tendency to irrigation with a high quantity to avoid spillage and contamination of the peritoneal cavity by the parasite. According to Gharbi classification [4], hydatid cyst type I is the most associated type with recurrence. The use of a laparoscopic approach increases the rate of recurrence [11] hence this type is the most immunogenic. Surgeons, by the way, in the case 1 the cyst was type I, and because the approach was laparoscopic, surgeons have a tendency to irrigation with a high quantity of HSS to avoid recurrence. This hypothesis can explain the aetiology of hypernatremia in this case.

In case 2, hypernatremia can be explained by the number of cysts. In this case, the surgeon used to repeat the procedure of irrigation of the cyst and his entourage by HSS. The use of a high quantity of HSS can explain this complication. In this case 3 hypernatremia can be explained by the biliary hypertonic reabsorption because of cystobiliary communication.

The clinical manifestations of hypernatremia are not specific. Elderly patients can develop neurological manifestations such as convulsions, vascular rupture with cerebral haemorrhage and permanent neurological damage [12]. Hypernatremia can also manifest in rare complications such as increased coagulopathy; leading to thrombotic complications [8]. The mechanism has not been identified. Other complications are reported ranging from benign such as fever and muscular manifestations, to more dangerous such as acute pulmonary oedema and congestive heart failure [8]. Serious complications can be seen after iatrogenic hypernatremia and can be lethal [8]. According to Rogers et al. [13], the prognosis of iatrogenic hypernatremia is poor in cases with very high concentrations of sodium levels exceeding 175mmo/l and in cases of rapid onset. Occurring of such acute hypernatremia is very dangerous and considered to have terrible consequences and can be life-threatening. In our three cases, a manifestation of hypernatremia was benign. Regarding case 2, the use of HSS caused hypernatremia which could interfere with the awakening of this patient. The other aetiologies (metabolic, ventilatory, homeostatic, ischemic or haemorrhagic brain damage) are probable but have been excluded. It is therefore a hypernatremia (174 mmol/l) that was responsible for the delayed awakening promoted by the transperitoneal diffusion of HSS. This diffusion of sodium was favoured by a long intervention period exceeding six hours and the large use of HSS. Measurement of serum sodium must be done when there is abnormal awakening after surgery, and when there are signs. Rapid initiation of treatment was the cause for resolving this complication without sequelae.

There is no consensus on the correction of hypernatremia because of the limited reported clinical experience [8]. Treatment of this hypernatremia is symptomatic. The amount of fluid to administer is difficult to estimate. It must be adapted according to the regular clinical and laboratory assessments [14] gradually over 48 hours. The goal is to decrease serum sodium by not more than 12 meq in 24 hours. Close serial monitoring of serum sodium every 2 to 4 hours is essential during the acute phase of correction. It is important to remember that rapid correction of hypernatremia can lead to cerebral oedema. Administration of intravenous hypotonic glucose solutions was effective [14].

Prevention of hydatid cyst infection remains the best since prevention is better than cure. It can eliminate the cycle of infection. Intraoperative

monitoring and serum sodium level when there is a clinical sign of hypernatremia is mandatory. An intraoperative limit of HSS use by an operative room nurse to prevent excessive use of HSS can be proposed.

Hypernatremia is a complication that should be always considered during surgical management of hydatid cysts with HSS. Hypernatremia leads to severe morbidity and mortality. Diagnosis and early intervention are crucial tools for avoiding devasting clinical outcomes. Peroperative monitoring and postoperative serum sodium level when there is a clinical sign of hypernatremia is mandatory. An intraoperative limit of HSS use by an operative room nurse to prevent excessive use of HSS can be proposed.

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