

CASE REPORT

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Hypnatremia-induced Neurologic Complications After Hepatic Hydatid Cyst Surgery: Pretreat to Prevent

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ABSTRACT

Introduction: Surgery is effective treatment for echinococcosis; however, there is a risk of hypertonic saline resorption and acute hypnatremia. **Aim:** We report two cases of severe hypnatremia following hydatid cyst removal. **Case reports:** A 17-year-old girl underwent surgical removal of hepatic hydatid cyst. Following the surgery, she developed seizures evolving to status epilepticus, and was sedated and mechanically ventilated. Blood chemistry showed hypnatremia. Fluid resuscitation with 5% dextrose infusions was started in combination with furosemide. Electrolytes were monitored frequently until plasma sodium levels normalized, 30 hours later. The patient was seizure free 48 hours later. The second patient is a 70-year-old man with hepatic hydatid cyst. After the surgery he became somnolent and confused due to severe hypnatremia. Intravenous administration of five percentage dextrose was initiated and high doses of furosemide. Sodium level normalized within 38 hours. The patient's mental status improved. **Conclusion:** A hospital protocol was established aiming to prevent hypnatremia and neurological complications.

Keywords: Hypnatremia, Hydatid cyst, Neurologic complications.

1. INTRODUCTION

Human echinococcosis is a zoonotic disease, which was traditionally found in parts of Europe, Africa, Asia, the Middle East, and Central and South America. With recent migration trends it becomes globally distributed, i.e. there is a relocation of patients with cystic echinococcosis from highly endemic to non-endemic countries, which are less experienced in its treatment (1). Treatment options for cystic echinococcosis (hydatid disease) include anthelmintic drugs, percutaneous aspiration, and surgery; however, surgery remains the most effective treatment and can lead to a complete cure. Hydatidectomy consists of puncture of the cyst and aspiration of the content, an introduction of a scolicidal agent (20% hypertonic sodium chloride - HS) and aspiration thereafter. The procedure carries the risk of hypertonic saline resorption and subsequent acute hypnatremia have been reported to cause a variety of neurological symptoms (2, 3).

2. AIM

We report two cases of severe hypnatremia following hydatid cyst removal.

3. CASE REPORTS

We report two notable cases of severe hypnatremia after hepatic hydatid cyst removal, as well as thereafter established preventive protocol and the impact of its implementation on postoperative sodium levels in 68 consecutive patients.

Ethical approval for this study (Ethics Committee No 21) was provided by the Ethics Committee of Anesthesia Department, Medical Faculty, Skopje, N Macedonia.

A 17-year-old girl, ASA-Physical Status 1, with normal laboratory examinations, underwent surgical removal and hypertonic saline irrigation of large hepatic hydatid cyst (10 cm). In the perioperative period dextrose 5% / 500 ml and normal saline 0.9% / 1000 ml were intravenously used as perioperative hydration. The operation went uneventful. The cyst was punctured and partially aspirated, afterward 400 ml of scolicidal agent-HS 20% was introduced and after 5 minutes total aspiration was performed; further hydatidectomy was done and irrigation with HS 20% into the cyst cavity. Histopathological findings confirmed echinococcosis. Following the sur-

gery, the patient was conscious and completely stable, but two hours later, she developed repeated generalized tonic-clonic seizures which evolved to status epilepticus. Intravenous diazepam was administered and because of ongoing seizure activity, thiopental was initiated. The patient was intubated and mechanically ventilated. Blood chemistry analysis showed hypernatremia of 166 mmol L⁻¹ and plasma osmolality of 340 mOsm kg⁻¹. Fluid resuscitation with 5% dextrose infusions was started immediately, and water via nasogastric tube in combination with natriuretic diuretics (Furosemide 1 mg kg⁻¹). Electrolytes status was monitored every 4 hours until plasma sodium levels reached reference values, 30 hours after admission to ICU. Thiopental and mechanical ventilation were resumed within several hours after normalization of sodium plasma levels, and the patient was awake and seizure-free 48 hours after the beginning of seizures. CT scan of the brain on day 2 showed no significant abnormalities.

The second patient is a 70-year-old man, ASA-Physical Status 2, with normal baseline electrolyte status, who was subjected to a surgical treatment of large hepatic hydatid cyst (12 cm). Perioperative period was unremarkable; cyst was punctured and filled with scolicedal agent HS 20%. Total aspiration with hydatidectomy was performed. The patient perioperative received 500 ml of dextrose 5% and 1000 ml normal saline 0.9% intravenously. Although the patient awoke after the operation normally, in the following few hours his mental status deteriorated. He became somnolent, inattentive and confused. Neurological examination revealed an absence of any motor deficit or cranial nerve dysfunction. Blood chemistry tests showed severe hypernatremia of 170 mmol L⁻¹ and plasma osmolality of 353 mOsm kg⁻¹. Fluid resuscitation with 5% dextrose i.v. and water via nasogastric tube was applied, followed by high doses of furosemide (1.5 mg kg⁻¹). Sodium level was evaluated every 4 hours, and it reached normal values within 48 hours. The patient's mental status improved in the additional 3 days. His brain CT was within normal limits. The patient was discharged completely recovered 10 days after the surgery.

Having in mind these cases, a hospital protocol was established in order to prevent potential hypernatremia and subsequent neurological complications due to hypertonic saline irrigation during hydatidectomy. Accordingly, at the time of cyst irrigation with 20% HS, the patients receive 5% dextrose solution i.v. (10 ml kg⁻¹h⁻¹), followed by diuretic (furosemide 0.5 mg kg⁻¹) at the end of the surgery. Electrolyte status is monitored one hour after the surgery, and then twice a day if the sodium levels exceed the normal range. If hypernatremia occurs, infusion of 20 ml kg⁻¹h⁻¹ of 5% dextrose solution is initiated for the first hour, followed by 10 ml kg⁻¹h⁻¹ until the normalization of plasma sodium levels, as well as 2000 ml of water via nasogastric tube in the following 24 hours, and furosemide (1 mg kg⁻¹). It is worth noting that we also apply anaphylactic prophylaxis with chlorpyramine hydrochloride 20 mg, and methylprednisolone 1 mg kg⁻¹

one hour before the surgery, although its efficacy further needs to be established (4).

After the introduction of the aforementioned protocol, a total of 68 patients with liver hydatid cysts were operated between January 2015 and December 2017. 60 patients had a single cyst, while seven had two cysts, and one patient had four hydatid cysts. Postoperative hypernatremia was observed in only eight patients (9%) out of 68 operated in three consecutive years. The sodium level in the first postoperative hour ranged between 143 - 153 mmol L⁻¹, with a mean value of 146 mmol L⁻¹. Its normalization was always achieved within 24 hours. Neurological complications in the hypernatremic patients were rare and mild, usually drowsiness and anxiety episodes that quickly resolved after the normalization of natremia.

4. DISCUSSION

The standard first line procedure for treating patients with hydatid cyst is surgery, according to the World Health Organization (WHO) experts and expert consensus from 2010. The HS, from 3% to 30%, is recommended by WHO/OIE for irrigation of the hydatid cyst for preventing recurrence (5). Severe hypernatremia following hypertonic saline irrigation of hydatid cyst during surgery has been repeatedly reported in the literature (2-4, 6). Hypernatremia was also the major underlying complication in our patients. During the surgery the surrounding tissue of the lesion was cautiously protected and there was no fluid spillage. We assume that the HS might have been absorbed through the cyst walls or peritoneal membrane. Transfer of the fluid from intracellular to extracellular compartment results in pulmonary edema and brain dehydration. Associated clinical symptoms of central nervous system injury were described in a form of epileptic seizures and epileptic status, changes in mental status, irritability, lethargy or coma. Furthermore, two fatal outcomes due to epileptic status were reported (7, 8). Although neurological symptoms are dominant clinical feature in acute hypernatremia, CT scan of the brain might be presented as normal (9) and the diagnosis is based on clinical symptoms and laboratory findings. Normal findings in CT scans appeared in our cases as well. Raising awareness of these possible complications among anesthesiologists and surgeons, taking precautions to prevent hypernatremia during surgery, as well as close monitoring of plasma sodium levels and possible changes in patient's mental status or other neurological signs and symptoms immediately after surgery, are crucial in the prevention of severe neurological complications. If hypernatremia occurs, normalization of the sodium levels should be done following guidelines for correction of acute and severe hypernatremia (8, 10). In the presented cases we follow the recommendations, because inappropriate extracellular osmotic tonicity correction could result in central nervous system swelling, which also contributes to this patient's brain injury. Acute hypernatremia should be meticulously treated; correction rate of the serum sodium level limited from 8mmol/L to 10 mmol/L, in the first 24 hours, and 18mmol/l for the period of 48 hours. Serum sodium lev-

el corrections from 1 to 2 mmol/L are allowed in the early recovery period and usually improve clinical symptoms. Isotonic intravenous fluids could also restore hemodynamics. Intracellular fluid volume and osmolarity may be corrected by 5% dextrose infusion, and furosemide is recommended to prevent water intoxication resulting from inappropriate correction of electrolyte levels (10).

5. CONCLUSION

Our simple yet efficient protocol may lead to a reduction of acute hypnatremia after hydatid cyst removal, improved surgical outcome and patient safety, shorter hospital stay and lower healthcare costs.

- **Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms.
- **Author's contribution:** Each author gave substantial contribution to the conception or design of the work and in the acquisition, analysis and interpretation of data for the work. Each author had role in drafting the work and revising it critically for important intellectual content. Each author gave final approval of the version to be published and they agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
- **Conflicts of interest:** There are no conflicts of interest.
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