



Endoscopic ultrasonic aspiration of brain abscess

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Abstract

Background Intracerebral abscess is a rare, but very serious complication of neonatal sepsis. Aggressive medical and surgical strategy is warranted in patients with large abscesses.

Case report A neonate with bilateral large frontal abscesses, caused by *Serratia marcescens*, was operated using a neuroendoscope coupled with an ultrasonic aspiration device. To our knowledge, this is the first report of such utilization of this new tool. The left abscess was surgically drained through endoscopic aspiration using ultrasonic aspirator. Clinical condition rapidly improved, and postoperative MRI of the brain revealed an almost complete resolution of the left abscess. A second endoscopic procedure was performed 1 week later, and the right abscess was endoscopically drained with the same technique. The remaining clinical course was uneventful.

Discussion and conclusion Ultrasonic aspiration is effective in obtaining complete removal of the purulent material and of the dense fibrin layer adherent to the capsule. However, further studies are warranted to determine its real effectiveness, compared with the classic technique. In our opinion, it should be considered an option in more difficult cases, such as abscesses caused by aggressive germs in young or immunocompromised patients, or in case of recurrent lesions, in order to avoid craniotomy and open surgery.

Keywords Neuroendoscopy · Ultrasonic surgical aspirator · Brain abscess · Neonate · Infection

Introduction

Cerebral abscess is a very serious clinical condition. Mortality is 2% and morbidity is not negligible, with about 39% of patients suffering clinical sequelae, above all epilepsy [9]. Surgery is indicated in lesions larger than 25 mm in diameter. Stereotactic neuronavigation or ultrasound guided aspiration and drainage is considered the first-line treatment of brain abscesses. The adjunct of an endoscope has been proposed in the 1990s, with the theoretical advantages of direct visualization (with visual awareness that purulent material has been

removed) and possibility of treating multiseptated abscesses [2, 3, 5, 6, 11]. Recently, an ultrasonic aspirator was developed that can be used inside the working channel of an endoscope (Sonoca, Söring GmbH, Quickborn, Germany). It was mainly used for removal of intraventricular tumors [1]. We report the use of this device in removal of a large intracerebral abscess in a neonate and describe the surgical technique.

Case report

A male neonate was delivered by caesarean section at 33 weeks gestation with a weight of 2050 g. This infant developed mild respiratory distress syndrome that quickly resolved on day 1. On day 8, his clinical conditions worsened with evidence of sepsis at laboratory investigations. *Serratia marcescens* was isolated from blood and CSF cultures. In vitro assays showed adequate sensibility to meropenem, cefotaxime, and gentamicin; therefore, antibiotics were changed to intravenous cefotaxime (150 mg × 4/day) and meropenem (120 mg × 3/day). An ultrasound scan of the brain showed diffuse areas of increased echogenicity in bilateral frontal lobes. On day 33, despite improvement in laboratory

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investigation, a magnetic resonance imaging (MRI) of the brain revealed a left frontoparietal abscess and two right smallest frontoparietal abscesses, with midline shift to the right side (Fig. 1a). The baby was referred to our hospital for neurosurgical consultation. The left abscess was surgically drained through endoscopic aspiration using ultrasonic aspirator.

Surgical technique (Video 1) The left frontal abscess was operated with the patient in supine position. Electromagnetic neuronavigation was used to guide the endoscope in the center of the abscess (StealthStation Axiem, Medtronic, Minneapolis, USA). The left lateral angle of the fontanelle was used as entry point. The sheath of the endoscope was advanced under neuronavigation control until it encountered capsule resistance. Once the internal cavity was reached, discharge of purulent material was observed and specimens were sampled for microbiological investigation. The rigid endoscope (Gaab endoscope—Karl Storz, GmbH, Tuttlingen, Germany) was introduced into the purulent cavity. The endoscopic ultrasonic aspirator (Sonoca, Söring GmbH, Quickborn, Germany) was inserted in the operative channel

of the endoscope. The pus was aspirated, and the cavity was washed with antibiotics until a clear view was obtained (Fig. 2a). Ultrasonic aspiration allowed easy removal of the dense fibrin and pus layers adherent to the capsule (Fig. 2b, c). This tool allowed both fragmentation and aspiration of this tissue. Twenty percent of aspiration power as well as 20% of cavitation power were used as standard initial settings. Irrigation with Ringer lactate at 36 °C was started as soon as aspiration was activated in order to prevent collapse of the cavity and continued during all the time that aspiration was on. Aspiration was stopped when minor bleeding from the internal wall was observed, indicating that the capsule was reached (Fig. 2c, d). Bleeding was easily controlled by irrigation alone.

Follow-up and outcome

Clinical condition rapidly improved, and postoperative MRI of the brain revealed an almost complete resolution of the left abscess (Fig. 1b). One of the right abscesses increases in volume (Fig. 1c). A second endoscopic procedure was performed

Fig. 1 Radiological investigations. **a** Preoperative axial computed tomography, showing a large cyst lesion in the left frontal lobe, with marginal contrast enhancement, plus meningeal and ependymal enhancement. Another smaller cystic lesion with incomplete marginal contrast enhancement can be observed in the right frontal lobe. **b** Postoperative T1-weighted MR image following aspiration of the left abscess, showing disappearance of the left abscess' cavity. **c** T1-weighted MR image, 1 week later showing increasing in size of the right frontal abscess (arrow). **d** Follow-up T1-weighted MR image showing good evolution of the surgical sites (at 2 months from initial surgery)

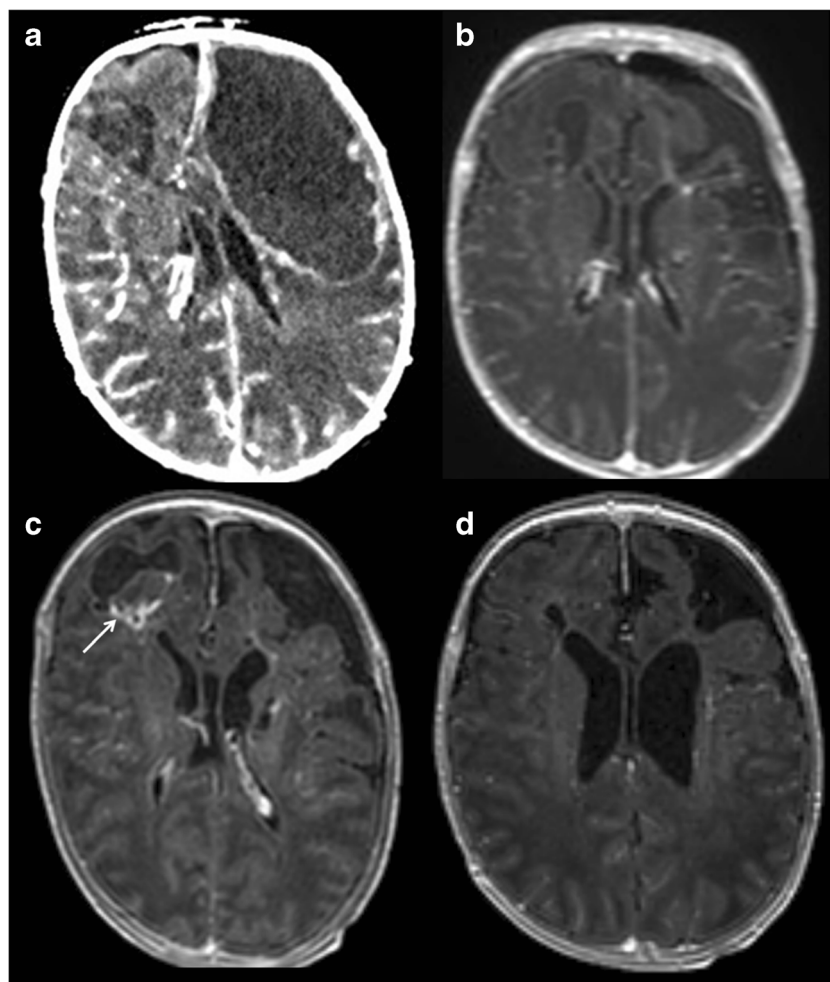
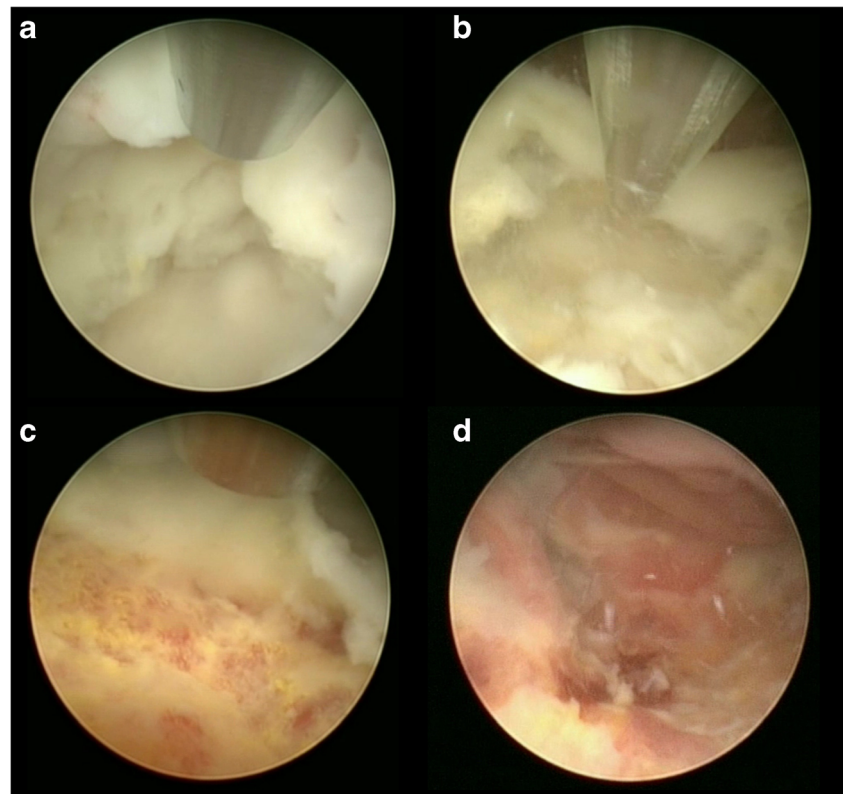


Fig. 2 Intraoperative neuroendoscopic images of the first operation. **a** Initial aspiration of purulent material by ultrasonic aspirator. **b** Removal of the pus from the capsule. **c** Dissection of the most adherent pus from the capsule. **d** Final endoscopic view, in which almost all the purulent material has been removed



1 week later, and the right abscess was endoscopically drained with the same technique. The remaining clinical course was uneventful. Intravenous antibiotics were suspended on day 64, and the infant was discharged with normal neurological development for age. Oral trimethoprim-sulfamethoxazole was continued 30 days more. A follow-up brain imaging showed good evolution of the surgical sites (Fig. 1d).

Discussion

The first experience with ultrasonic aspiration in neuroendoscopy was reported by Oertel et al. in 2008 [8]. Selvanthian et al. [10] reported the first case of solid tumor removed by an ultrasonic aspirator. It was a small tumor inside the aqueduct (benign glioneuronal tumor). Our group recently reported our experience in utilization of ultrasonic aspirator in pure endoscopic removal of intraventricular tumors [1]. To our knowledge, this is the first report in which endoscopic ultrasonic aspirator was used to treat an intracerebral abscess. We decided to operate in such way a neonate with very large abscesses caused by *Serratia marcescens*.

Cerebral abscesses are extremely rare in neonates and usually arise in the setting of sepsis in patients with several other morbid conditions [4]. *Serratia marcescens* is a frequent cause of sepsis in neonatal intensive care units, usually involving

preterm, low birth weight, and other immunocompromised neonates. Cerebral abscesses secondary to *Serratia* sepsis are extremely rare [4]. Antibiotic therapy for *S. marcescens* CNS infections is difficult because of rapidly developing in vivo resistance in spite of in vitro sensibility, due to an inducible cephalosporinase. Because bacterial load reduction is an important adjuvant to antibiotic therapy [7], aggressive medical and surgical approach is indicated in patients with large abscesses.

In our case, the left frontal abscess was very large; we chose to treat it with ultrasonic endoscopic aspiration, to increase the efficacy of aspiration and to reduce the length of operation in a very young and instable baby.

The endoscopic treatment of brain abscesses is not new, but has roused little interest, with no study demonstrating superiority of this approach over conventional treatment [6]. The adjunct of an ultrasonic aspirator, to standard endoscopic technique, may facilitate complete and faster pus removal and may increase efficacy of the procedure, potentially leading to better outcomes.

Our experience assesses feasibility and efficacy of the neuroendoscopic approach with ultrasonic aspirator; however, further studies are warranted to determine its real effectiveness, compared with the classic technique. In our opinion, endoscopic ultrasonic aspiration of brain abscess should be considered an option in more difficult cases, such as abscesses

caused by aggressive germs in young or immunocompromised patients, or in case of recurrent lesions, in order to avoid craniotomy and open surgery.

Compliance with ethical standards

Conflict of interest The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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