Lumbar drainage of cerebrospinal fluid in a child with tetralogy of Fallot and cerebral infarct

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INTRODUCTION

Cerebral infarcts are a known complication of tetralogy of Fallot (TOF) and often manifest with raised intracranial tension (ICT).¹ Various measures to reduce ICT include ventriculostomy, decompressive craniectomy, hyperventilation, furosemide, mannitol, barbiturates, and steroids. External cerebrospinal fluid (CSF) drainage through lumbar approach is also known to benefit in cases refractory to other measures.²

We report a two-year-old child born with TOF who developed malignant cerebral infarct with raised ICT and underwent a decompressive craniectomy. Subsequently, controlled lumbar drainage of CSF was performed for persistent CSF leak from scalp sutures and it helped her improve.

CASE DESCRIPTION

A two-year-old full-term normal delivery boy born was diagnosed to have congenital cyanotic heart disease at one year of age. He was apparently asymptomatic till a year back, except for poor weight gain, when he developed left hemiparesis. His haemoglobin was 10 g/dL and haematocrit was 30%. The other haematological and biochemical parameters were normal. On detailed investigation, he was found to have TOF with a large subaortic ventricular septal defect, bidirectional shunt, severe pulmonic stenosis, overriding of aorta with a small sized pulmonary artery on echocardiography.

The computed tomography scan revealed a right middle cerebral artery territory infarct for which he was managed conservatively and he improved neurologically in a month. He was discharged and referred to a cardiothoracic centre for surgery.

During his work up for cardiac surgery he again developed a malignant right parietal lobe infarct with features of raised ICT.

A decompressive right hemi-craniectomy with a cruciate durotomy was done under general anaesthesia. The child developed CSF leak from the surgical site. The amount of leak could not be quantified but on weighing the soaked wound dressing an estimated 80–100 mL was lost per day. An attempt to re-suture the wound under anaesthesia did not help and then on the third day it was decided to place an external lumbar drain for controlled CSF drainage.

Written informed consent was obtained from the parents for the procedure. With full monitoring, intravenous dexmedetomidine 1 µg/Kg and ketamine 1 mg/Kg were administered over 10 minutes. Subarachnoid puncture was done with complete asepsis using an 18G Tuohy needle at L3–4 level in left lateral position. Local lignocaine infiltration was also used for the needle puncture. Supplemental Oxygen was given by mask. Additional doses of ketamine 1.0 mg/Kg and dexmedetomidine 0.5 µg/Kg/hr were given to maintain anaesthesia. The child was breathing spontaneously and there was no significant change in heart rate. The baseline heart rate was 102 ± 10/min and it increased by 4–5/min during the procedure. The respiratory rate was 18–20/min and oxygen saturation maintained at 90–92%. A 20G epidural catheter was placed approximately 2 cm in the subarachnoid space and tunnelled out subcutaneously from right flank. A three-way stop clock was placed and the catheter was attached aseptically to a lumbar drain. There was a free flow of CSF in the drain and about 60–70 mL was collected every day for five days. A sample of CSF was sent for bacterial culture every day and there was no growth reported. The surgical site on the scalp started drying up and the catheter was removed on the fifth day. The child improved dramatically and was discharged to home after three days. He was advised to report to the cardiac centre for surgery after three months.

DISCUSSION

Historically, cerebrovascular events occur in congenital cyanotic heart disease during the first two years of life in up to 75% of cases.¹ Tetralogy of Fallot accounts for majority of these cases. Cerebral infarcts of arterial origin are commoner in children with low haematocrit whereas high haematocrit predisposes to venous occlusions.¹ They usually manifest with neurological deficit in the territory of one major cerebral vessel and larger lesions result in raised ICT.

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There is a high incidence of morbidity and mortality associated with increased intracranial pressure and it often becomes difficult to treat in children. However, early multimodal approach improves outcome dramatically. Surgical management of mass lesions is the first tier treatment along with medical measures like positioning, sedation, mild hyperventilation, hyperosmolar therapy, steroids, and hypothermia.² Decompressive craniectomy is often required as an emergency measure in large malignant cerebral infarcts reduce ICT in children. In our patient, duraplasty could not be done because of massive cerebral oedema. The child developed CSF leak from the scalp sutures which delayed wound healing.

The use of external lumbar subarachnoid drainage following ventriculostomy is known in children with severe diffuse head injuries associated with raised ICT. It has shown a substantial and lasting decrease in intracranial pressure, obviating the need for continued barbiturates and hyperventilation.^{3,4}

Cerebrospinal fluid leak is the main non-endocrine postoperative complication associated with trans-sphenoidal surgeries (TSS). During surgery if there is a CSF leak, a lumbar drain is usually placed to drain CSF in order to decrease CSF volume and pressure. Postoperative leaks are also treated effectively with lumbar drain. Elgamal et al studied CSF leaks associated with TSS and observed intra-operative CSF leak in 21% cases which were all successfully treated with lumbar drain. He found it to be effective in four out of five cases of postoperative leaks.⁵ Viswanathan et al also confirmed that lumbar drainage of CSF is an effective and safe technique, and an alternative to ventriculostomy placement, in accomplishing brain relaxation and minimal retraction in occipital lobe approaches in children.⁶

Lumbar drain however poses a potential threat of infection and meningitis can appear within 24 hours after the placement. The skin organisms are usually responsible and therefore full asepsis should be maintained. Cerebrospinal fluid samples should be sent daily for bacterial culture. In their study on 312 cases of lumbar drain insertion, Coplin et al concluded that it carries a low risk of bacterial infection and should be accepted as a safe alternative to ventriculostomy or serial lumbar punctures.⁷

Persistent leak of CSF or nerve injury can be a problem after removal of lumbar drain and may cause postdural puncture headache. Grady et al found no nerve injury in a one year follow-up of 530 cases of lumbar drainage of CSF for TSS. However, postdural puncture headache was present in 2.5% patients out of which 1.3% required epidural blood patch.⁸ Epidural blood patch through lumbar or caudal approach is effective in children though there is no consensus about when to give the blood patch and how much volume of blood to be used in paediatric age group.⁹

Lumbar drainage is also used in the treatment of refractory intracranial hypertension in bacterial meningitis.¹⁰

To our knowledge, there is no case reported in children developing CSF leak following cerebral infarct with TOF and treated with lumbar drain. In our patient, the cyanotic heart

disease was not yet surgically corrected and anaesthesia had to be administered to him several times during the entire course of hospitalisation. We used dexmedetomidine with ketamine in titrated doses and it found to be very effective for such short duration procedures. The child maintained spontaneous breathing at all times and was haemodynamically stable. Other reports have also cited the benefits of this combination for congenital heart disease.¹¹ The tachycardia and rise in blood pressure caused by ketamine is negated by the dose dependent decrease in heart rate and blood pressure by dexmedetomidine. The later also prevents the undesirable side-effects of ketamine like delusions, hallucination etc.

Cerebrospinal fluid drainage through a lumbar drain was found to be very effective to treat CSF leak in this child with TOF.

CONFLICTS OF INTEREST

None identified.

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