Scalp Intravenous Catheter Infiltration Leading to Subdural and Intraparenchymal Fluid Collection and Severe Neurologic Sequelae: A Case Report

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CLINICAL MEDICINE

ABSTRACT

Introduction: Preterm infants require intravenous (IV) access for administration of medications, IV fluids, and parenteral nutrition. The scalp is a common site for obtaining IV access, and in children with hydrocephalus or wide fontanelles and sutures, there is a high probability of penetrating the meninges and brain matter with the scalp IV needle. If this penetration occurs and remains unnoticed, the contents of the IV infusion can infiltrate into the brain and cause severe brain damage. Case Presentation: A 3-day-old female neonate, born with myelomeningocele, was receiving total parenteral nutrition through a scalp-vein IV. She experienced a sudden increase in head circumference, a bulging fontanelle, and respiratory distress. Magnetic resonance images demonstrated subdural fluid collection, and the patient underwent emergency surgery. The dura, when opened, exuded milky-white fluid consistent in color with parenteral nutrition. Postoperative imaging showed a parenchymal abnormality caused by the intracranial and intraparenchymal infusion of parenteral nutrition. Four years later, the child had a shunt and had mild cognitive impairment.

INTRODUCTION

Preterm infants require intravenous (IV) access for administration of medications, IV fluids, and parenteral nutrition. Finding adequate access in these small babies can be challenging. The scalp is a common site for obtaining IV access because of the large scalp veins. In children with hydrocephalus or wide fontanelles and sutures, there is a high probability of penetrating the meninges and brain matter with the scalp IV needle. If this occurs and is unnoticed, the contents of the IV infusion can infiltrate into the brain and cause severe brain damage. In this case report, we describe the rare complication of inadvertent intracranial infusion of total parenteral nutrition (TPN) and the necessary management.

CASE PRESENTATION

Presenting Concerns

A 3-day-old female neonate born with myelomeningocele experienced a sudden increase in head circumference and a bulging fontanelle. She was born without signs of hydrocephalus, and her head size had been stable since birth. She was receiving TPN, and access had been obtained through a scalp vein. On physical examination, her head circumference was found to be 3 cm larger than the previous day. The patient also had respiratory distress and required immediate intubation.

An ultrasonogram performed at the bedside revealed a cystic mass in the right hemisphere (Figure 1). A computed tomography (CT) scan of the head revealed hypodensity in the right frontoparietal area with an associated subdural hematoma (Figure 2). Results of a subsequent magnetic resonance image (MRI) of the brain further differentiated a subdural fluid collection and a mass overlying the right frontoparietal region (Figure 3).

Therapeutic Intervention and Treatment

The patient was taken emergently to the Operating Room for craniotomy and evacuation of the subdural fluid collection. When the bone flap was removed,
the dura was noted to be under tension. Once the dura was opened, milky-white fluid, consistent in color with TPN, exuded from the wound (Figure 4). The wound was copiously irrigated until the irrigation water ran clear.

**Follow-up and Outcomes**

Postoperatively, the patient did well, her head circumference returned to normal, and no signs of infection appeared. Unfortunately, hydrocephalus developed, requiring placement of a ventriculoperitoneal shunt. Postoperative imaging showed the presence of a parenchymal abnormality as a result of the intracranial and intraparenchymal TPN infusion. On follow-up 4 years later, the child had mild cognitive impairment but was otherwise well.

**DISCUSSION**

Scalp IV catheter placement is a common practice in the pediatric Intensive Care Unit setting, because reliable IV access is needed for administration of fluids and medications. There are 4 possible veins into which the IV catheter can be inserted: supratrochlear, anterior facial, superficial temporal, and posterior auricular veins. Unfortunately, in the presence of open sutures and no bone over the fontanelles, the placement of the scalp IV catheter can lead to severe complications. If the supratrochlear vein is accessed for placement of an IV catheter, ultrasonography can be used to confirm the placement of the IV in the scalp vein and not in the superior sagittal sinus. In addition, the IV catheter should be inserted in the direction away from the sinus and away from the fontanelle and the suture.

Inadvertent intracranial infusion of IV fluids, medications, and TPN has been reported in the literature. The cause of this infusion is often a misplaced catheter. Because the neonatal tissues are fragile, it is easy to penetrate the meninges during insertion of the IV catheter. Placement of scalp IV catheters has many potential complications, including air embolism and inadvertent infusion of medications, blood products, and parenteral nutrition into the subdural space or brain, leading to life-threatening complications including meningitis, hydrocephalus, seizure, and death.

In our case, the infant was very small and IV access had been difficult. The baby received a scalp IV with a small-bore needle with retractable sheathing that was designed for safe and easy usage. The insertion was relatively uneventful and there was no concern for infiltration until the ultrasonogram of the head was obtained.

The most common management of subdural parenteral nutrition infusion includes supportive care, followed by subdural aspiration or subdural drain placement. The first reported cases of accidental infiltration of parenteral nutrition indicated that the patients were managed with supportive care. In both cases, the patients died. In another report, a patient managed with supportive care survived. Other case reports indicate that subdural aspiration of fluid was used with good outcome in some patients. However, in other cases, subdural aspiration of fluid proved unsuccessful. This variation in outcomes indicates that other factors, including the state of prematurity and the presence or development of comorbidities, such as meningitis, have an effect on the outcome.

In the present case, because of the rapid enlargement of the head circumference and the presence of an intraparenchymal mass on the computed tomography scan, the decision was made to surgically wash out the parenteral nutrition, which was in contact with the patient’s right hemisphere. The poor outcomes previously reported in the literature associated with administration of parenteral nutrition into the subdural space led us to be aggressive in the management of this patient. The open procedure was performed to maximize the amount of drainage and the possibility of removing the source of the infection.

![Figure 3. T2-weighted (a) and T1-weighted (b) magnetic resonance images of the brain showing subdural fluid collection and an associated brain mass in the right hemisphere.](image)

![Figure 4. Intraoperative images during craniotomy (a and b). There is evidence of milky-white fluid in the cranial cavity, which was under pressure.](image)
of washing out most of the parenteral nutrition infiltrating the subdural space.

CONCLUSION
Accidental intracranial administration of parenteral nutrition is a rare complication of scalp IV catheter placements. In these cases, we recommend that aggressive therapy be pursued to minimize the risks of developing comorbidities, such as meningitis, and to allow for maximal functional recovery. Craniotomy and complete evacuation of the intracranial parenteral nutrition resulted in a good outcome for our patient. 

Disclosure Statement
The author(s) have no conflicts of interest to disclose.

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