Reminder of important clinical lesson

Bilateral total parenteral nutrition pleural effusions in a 5-week-old male infant

Christopher Flannigan, Thomas Bourke, Karen Keown, Mark Terris

Paediatric Intensive Care Unit, Royal Belfast Hospital for Sick Children, Belfast, UK

Correspondence to Dr Christopher Flannigan, cflannigan@doctors.org.uk

Summary

A 5-week-old male infant was admitted to the paediatric intensive care unit with small bowel obstruction secondary to an inguinal hernia. His postoperative course was complicated by suspected migration of his left internal jugular central venous catheter into branches of the inferior thyroid artery and mediastinum. This resulted in bilateral pleural effusions which were biochemically and visually similar to the total parenteral nutrition he was receiving. After drainage of the pleural effusions he made an uneventful recovery.

BACKGROUND

Total parenteral nutrition (TPN) administration via a central vein is a well-established therapy in infants where enteral feeding may be significantly delayed. Unilateral TPN effusions have been reported in children as a result of central line malposition or later migration out of a vessel.¹⁻² Bilateral effusions are extremely rare with only a few cases reported in adults.³⁻⁵ This report emphasises the need to consider this important complication in any child who deteriorates while receiving an infusion via a central venous catheter. It also highlights the need to distinguish chylothorax from a TPN effusion particularly in postsurgical infants where thoracic duct injury is a possibility.

CASE PRESENTATION

A 5-week-old male infant presented to the emergency department (ED) with a 4 day history of non-bilious vomiting, 2 day history of constipation and 1 day history of abdominal distension, reduced feeding, drowsiness and irritability. There was no history of fever and no other systemic symptoms.

He was born at 33 weeks gestation weighing 930g. His neonatal course was complicated by an episode of suspected necrotising enterocolitis which was managed conservatively. He had been discharged from the neonatal unit 10 days previously. He was not on any regular medications and had no known allergies.

At presentation, he had signs of shock including a tachycardia of 180 beats per min, a tachypnoea of 80 breaths per min, a prolonged capillary refill time and a decreased level of consciousness. Auscultation of his cardiovascular and respiratory systems was normal. His abdomen was grossly distended with palpable dilated loops of bowel and an obvious inguinal hernia which had not been noted previously. Initial investigations included a plain abdominal radiograph (figure 1) which confirmed small bowel obstruction and a capillary blood gas which demonstrated a mixed respiratory and metabolic acidosis (pH 7.164, PaO₂ 12.36 kPa, PaCO₂ 7.83 kPa, bicarbonate 20.7 mmol/l, base excess -8.7).

He was resuscitated with 57 ml of 0.9% sodium chloride intravenously (30 ml/kg based on weight of 1.9 kg). His inguinal hernia was successfully reduced in the ED. He subsequently developed frequent apnoeic episodes and was transferred to the paediatric intensive care unit (PICU) where he was intubated and ventilated. He was managed conservatively overnight with nasogastric drainage, intravenous fluids at 120 ml/kg/day and intravenous amoxicillin, gentamicin and metronidazole.

The following day a laparotomy was performed where a segment of thickened and oedematous distal ileum was identified, consistent with bowel that had been trapped in a hernia. The bowel was felt to be viable and his right inguinal ring was closed.

Before his laparotomy he had a 4 Fr 5 cm double lumen central line inserted via the left internal jugular vein using the landmark technique after a failed attempt at a right sided internal jugular line. Both lumens were aspirated and flushed and a chest radiograph (figure 2) was performed to check line position. Blood gas analysis or central venous pressure monitoring was not performed.

Figure 1 Abdominal radiograph showing dilated bowel loops with bowel wall oedema in keeping with intestinal obstruction.

Figure 2 Chest radiograph postinsertion of central line demonstrating a left-sided central venous line crossing the midline and lying horizontally at the level of T3.

Figure 3 Chest radiograph with moderate sized right pleural effusion and left hydropneumothorax.

He returned to PICU postoperatively where he was progressing well. He was commenced on TPN and kept nil by mouth as recommended by the paediatric surgical team. On day 3 of admission he deteriorated with bradycardic episodes, increasing peak inspiratory pressures to achieve effective ventilation and a respiratory acidosis. An urgent chest radiograph (figure 3) was performed which revealed bilateral pleural effusions and a left-sided pneumothorax.

The pleural effusions were confirmed by ultrasound and bilateral chest drains were inserted. Milky non-purulent fluid similar in appearance to the TPN that was infusing via the central line drained from both pleural cavities. It was sent for microbiology and biochemistry analyses. Drainage of the effusions was associated with clinical and radiological (figure 4) improvement. A total of 80 ml of fluid drained from the right pleural drain and 50 ml from the left drain. Culture of the fluid was negative.

Biochemical analysis of the pleural fluid indicates that the aspirated fluid was probably TPN (table 1). Pleural fluid

Figure 4 Chest radiograph following insertion of bilateral chest drains demonstrating significant improvement with resolution of bilateral pleural effusions with a persistent left pneumothorax. Bilateral perihilar pulmonary oedema is noted.

Table 1 Biochemical analysis of TPN, pleural fluid and patient's serum

Electrolyte	Pleural fluid	TPN	Patient's serum
Na	126 mmol/l	26.6 mmol/l	142 mmol/l
K	3.3 mmol/l	13.3 mmol/l	3.8 mmol/l
Glucose	38.2 mmol/l	555 mmol/l	5.3 mmol/l
Triglycerides	7.18 mmol/l	11.4 mmol/l	

TPN, total parenteral nutrition.

and TPN triglyceride levels were similar. The ratio of pleural fluid glucose to serum glucose was high and the sodium concentration lay between the TPN and patients serum, similar to previous reports.^{3 6} An echocardiogram demonstrated normal anatomy of the heart and great vessels.

At this stage it was noted that neither of the lumens was aspirating blood. In view of concern that the central line tip may have migrated, a linogram (figure 5) was performed. Contrast injected via the line is present in vessels which track superiorly up the neck and along both sides of the mandible suggesting that the contrast originates in inferior thyroid arterial branches. The precise location of the central venous line tip, and any communication with these vessels, cannot be ascertained radiologically. In view of this the left internal jugular line was removed and a femoral venous line was inserted.

OUTCOME AND FOLLOW-UP

The rest of his intensive care stay was uneventful. He was extubated and had his chest drains removed on day 6 of admission. A chest radiograph postdrain removal demonstrated good resolution of the effusions. On day 8 he was discharged to the surgical ward on full enteral feeds where he continued to recover until discharge.

DISCUSSION

Complications of central line insertion in infants and children include arrhythmias, arterial puncture, haematomas, pneumothorax, pleural effusions, infection and malpositioning.^{1-5 7} Although ipsilateral TPN or intravenous fluid

Figure 5 Linogram demonstrating contrast tracking superiorly up the neck and along both sides of the mandible.

effusion from internal jugular line malposition may occur in as many as 0.17% of cases⁸ bilateral effusions are very uncommon and the exact mechanism of their development is not clear.

In this case the anatomical landmark technique was used by an experienced anaesthetist for the insertion of the left internal jugular line. Satisfactory line position was confirmed by aspiration from both lumens, together with a postprocedure radiograph. Although modern techniques including ultrasound guidance can assist safe catheter placement by inexperienced operators meta-analysis suggests that it does not decrease failure rate or complications.⁹ Erratic or increasing central venous pressure trace and an inability to aspirate blood may be early clues to vascular erosion.⁹ The adult literature suggests that left-sided internal jugular line insertion is more likely to be associated with vascular erosion.^{8 10} This is probably secondary to the catheter lying against the right lateral wall of the superior vena cava at 45 degrees, the so called 'danger zone', as occurred in this case.¹⁰ This may be indicated by a gentle curve in the catheter (not present in this case).¹⁰

In this patient, bilateral pleural effusions occurred several days after TPN was commenced via this left internal jugular venous line. The demonstration of contrast within small arterial vessels on the linogram suggests that at least one lumen of the catheter had migrated into a minor artery. We suspect that this tip migration also allowed fluid to pass into the mediastinum and from there into both pleural cavities. Mediastinal widening preceding hydrothorax has been reported in this context indicating that communication between the right and left pleural spaces is possible.¹⁰ Although there was a significant volume of TPN in the child's pleural space he did not suffer from hypoglycaemia or electrolyte disturbance. It is possible that some of the infusion was entering his circulation via the venous or arterial circulation or that glucose was absorbed via the pleura as has been described previously.¹¹

An important differential in this case was bilateral chylothoraces, due to thoracic duct injury during central line insertion. Triglycerides are present in both TPN and chyle and therefore cannot reliably differentiate between the two.⁶ Biochemical analysis of the pleural fluid must be conducted to compare the electrolyte and glucose profile with the fluid being infused. Chylothorax can be confirmed by the presence of chylomicrons with high levels of triglycerides and the absence of large quantities of glucose or electrolytes.⁶ A ratio of pleural fluid glucose to serum glucose of >1 suggests that the effusion may be caused by the infusion fluid.¹⁰

Learning points

- ▶ Line migration out of a vessel can occur subsequent to successful insertion of a central venous line.
- ▶ Consider iatrogenic pleural effusion in any child who deteriorates while receiving an infusion via a central venous line.
- ▶ Have a high degree of suspicion of line migration if the line ceases to allow aspiration of blood.
- ▶ Do not forget to differentiate biochemically between chylothorax and TPN effusion as both can appear as a white milky fluid.

Competing interests None.

Patient consent Obtained.

REFERENCES

1. **Tu S**, Wang X, Bai L, *et al.* Complications of 1309 internal jugular vein cannulations with the anatomic landmarks technique in infants and children. *J Vasc Access* 2012;**13**:198–202.
2. **Traen M**, Schepens E, Laroche S, *et al.* Cardiac tamponade and pericardial effusion due to venous umbilical catheterization. *Acta Paediatr* 2005;**94**:626–8.
3. **Paw HG**. Bilateral pleural effusions: unexpected complication after left internal jugular venous catheterization for total parenteral nutrition. *Br J Anaesth* 2002;**89**:647–50.
4. **Campagnutta E**, Segatto A, Maesano A, *et al.* [Bilateral hydrothorax with hydromediastinum after cannulation of the left internal jugular vein]. *Minerva Ginecol* 1989;**41**:479–83.
5. **Simmons TC**, Henderson DR. Bilateral pleural and pericardial effusions because of mediastinal placement of a central venous catheter. *JPEN J Parenter Enteral Nutr* 1991;**15**:676–9.
6. **Wolthuis A**, Landewé RB, Theunissen PH, *et al.* Chylothorax or leakage of total parenteral nutrition? *Eur Respir J* 1998;**12**:1233–5.
7. **Merrer J**, De Jonghe B, Golliot F, *et al.*; French Catheter Study Group in Intensive Care. Complications of femoral and subclavian venous catheterization in critically ill patients: a randomized controlled trial. *JAMA* 2001;**286**:700–7.
8. **Walshe C**, Phelan D, Bourke J, *et al.* Vascular erosion by central venous catheters used for total parenteral nutrition. *Intensive Care Med* 2007;**33**:534–7.
9. **Sigaut S**, Skhiri A, Stany I, *et al.* Ultrasound guided internal jugular vein access in children and infant: a meta-analysis of published studies. *Paediatr Anaesth* 2009;**19**:1199–206.
10. **Duntley P**, Siever J, Korwes ML, *et al.* Vascular erosion by central venous catheters. Clinical features and outcome. *Chest* 1992;**101**:1633–8.
11. **Ball GV**, Whitfield CL. Studies on rheumatoid disease pleural fluid. *Arthritis Rheum* 1966;**9**:846–50.

This pdf has been created automatically from the final edited text and images.

Copyright 2012 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Please cite this article as follows (you will need to access the article online to obtain the date of publication).

Flannigan C, Bourke T, Keown K, Terris M. Bilateral total parenteral nutrition pleural effusions in a 5-week-old male infant .
BMJ Case Reports 2012;10.1136/bcr.01.2012.5608, Published XXX

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow

Keep up to date with all published cases by signing up for an alert (all we need is your email address) <http://casereports.bmj.com/cgi/alerts/etoc>