



## Bilateral Hydrothorax after Left Internal Jugular Venous Catheterization in Infant

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### Abstract

In intensive care units, central venous catheters are frequently used to resuscitate ill patients by administration of intra-venous fluids, medication, and giving parenteral nutrition. But these devices are source of complications that can sometimes be life threatening. We describe a case of pleural effusion that appears many days after internal jugular central line insertion and discuss the mechanism and management of this serious complication.

**Keywords:** Central line; Internal jugular vein; Pleural effusion, Infant

### Case Presentation

We report the case of a 3 months old female, with history of intrauterine growth restriction, no history of chronic constipation, who was admitted 4 days back for fever and poor feeding. These symptoms have been related to infection and the child was managed by empiric triple antibiotic with an initially improvement... Suddenly, this patient develops huge abdominal distension, bilious vomiting and continuous crying. At the clinical examination the child was lethargic, septic, pale and dehydrated. Abdomen is distended and tender. The nasogastric tube gives fecal fluid. Rectum was empty with only bloody mucus. The abdominal X-ray shows a moderate distension of the small intestine with ascites and air-fluid levels, there is no pneumatocele or pneumoperitoneum. At biology there is anemia with Hb=7.5 gm/dl, platelet was 26 000, hyponatremia at 127 mmol/l and urea is 25 gr/ml. The abdominal ultrasound shows distended bowel loops with a thick wall and moderate amount of turbid intra-peritoneal free fluid. The child was intubated, sedated and placed under mechanical ventilation. After rapid resuscitation and transfusion, an exploratory laparotomy was performed. It shows the appearance of necrotizing enterocolitis of the terminal ileum and right colon without perforation, a proximal ileostomy with peritoneal toilet and drainage was performed. A left internal jugular central venous catheter size 4 fr was inserted surgically with open technic uneventful. In post-operative period, the child remained under mechanical ventilation, triple antibiotic (vancomycin, meropenem, and flagyl), inotropes and parenteral nutrition. Chest radiography (Figure 1) showed a central line in place in the superior vena cava. The evolution was progressively favorable, the stoma starts to run 3<sup>rd</sup> postoperative day, the nasogastric tube no longer brings bile, and abdomen becomes gradually soft, lax and painless. The child is still under NPO and on parenteral nutrition; he was extubated at day 5 post op. On 7<sup>th</sup> day post op patient becomes polypneic with inter-costal retraction, hypoxic and febrile. Pulmonary auscultation shows diminution of breath sounds with some crepitation in left hemi-thorax, and chest radiography shows bilateral pleural effusion mainly in the left side. The child was intubated and mechanically ventilated. Pleural puncture brings clear serous fluid rivalta negatif with high level of glucose. A chest tube was than inserted and brings back 90 cc liquid. The central line was closed then withdrawn and two peripheral lines were placed (Figure 2). Evolution was marked by the progressively healing of the pleural effusion and the patient was extubated after three days. One month later closure of the ileostomy was performed after verification of the permeability of the distal ileum and colon.

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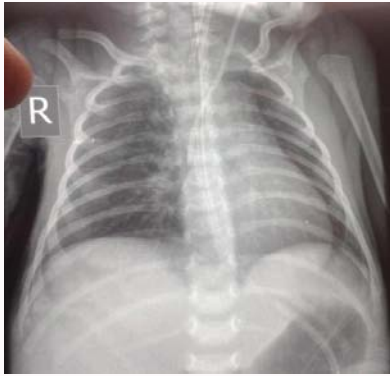
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### Discussion

Intra-venous central line is an important devise for the management of severely ill patients in the ICU for delivering fluids, nutrients, medication and monitoring the volume status. The correct position of the central line is usually confirmed by perioperative fluoroscopy or postoperative chest X-ray. But despite the advances made in the design, material of the catheter and the technique of insertion, still there are many complications that can happen at the time of insertion of this devices



**Figure 1:** Chest x rays after left jugular CL insertion show CL well placed in the superior vena cava.



**Figure 2:** Chest x rays show left pleural effusion and the tip of the central line migrating to the right side.

or later on [1].

These complications can be immediate or delayed. Acute complications are usually mechanical such as pneumothorax, hemothorax or arterial puncture. They are more frequent and occur in up to 3% of cases [1]. Delayed complications are mostly infection and thrombosis of the central line, less frequently pleural and pericardial effusions or even cardiac tamponade [2,3].

Pleural effusion following central line insertion is rarely reported. It account for about 0.5% of known complications related to this procedure and is very uncommon to be bilateral [2]. The incidence of this complication is much lower with jugular vein than with the subclavian route and in man than in woman [1,4].

Generally, catheterization via the left internal jugular vein results in more malposition and vascular perforation than a catheter placed from the right internal jugular vein. This is because the right internal jugular vein runs into the right brachiocephalic vein in a fairly straight course whereas the left internal jugular vein forms a greater bend when it becomes in the left brachiocephalic vein [1,5,6]. In this way, the catheter is lying against the right lateral wall of the superior vena cava at 45 degrees. This close contact of the catheter tip with the vein wall leads to endothelial cell damage and then adherence of platelets and activation of the coagulation cascade. The resulting thrombus fosters attachment of the catheter tip to the vein wall, causing irritation of the endothelial cell and osmotic injury. Through the damaged lining, fluid can diffuse into the pleural cavity forming an effusion [7,8].

Bilateral effusion is due to passage of the liquid from a displaced catheter into the mediastinum and then into both pleural cavities via anatomical communications between them [5].

In this patient, bilateral pleural effusions occurred several days after TPN was started via this left internal jugular venous line. 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 [6].

An important differential diagnosis in this situation is chylothorax, due to direct injury of the thoracic canal during central line insertion. Biochemical analysis of the pleural fluid must be done to compare the electrolyte and glucose profile with the infused fluid. Chylothorax can be confirmed by the presence of chylomicrons with high levels

of triglycerides and the absence of large quantities of glucose or electrolytes. A ratio of pleural fluid glucose to serum glucose of  $>1$  suggests that the effusion may be caused by the infusion fluid [6].

Other reviews confirmed the hazards of delayed diagnosis of hydrothorax from jugular vein cannulation. The patients typically presented with symptoms of breathlessness or chest discomfort at about  $2.9 \pm 0.8$  days (ranging from 1 to 7 days) after catheter insertion. The pleural fluid aspirated appeared transudative with variable glucose concentrations [1,7,8].

#### Many factors have been advocated to explain vein wall erosion

- 1) The fixation of the catheter to the skin allow the back and forth movement of the tip against the venous wall combined with head and neck motion.
- 2) A stiff catheter in the left internal jugular vein takes a curved course to the SVC bringing the catheter tip into close proximity of the wall of SVC.
- 3) High acidity, alkalinity and osmolality of the infused liquids may contribute to the erosion, e.g., total parenteral nutrition, antibiotics infusion (vancomycin) and sodium bicarbonate.
- 4) Poor nutritional state of this sick patients resulting in poor tissue condition.
- 5) Female patients have higher incidence may be due to a smaller veins [1].

The incidence of this complication can be reduced to minimum by using soft tissue line with length and size adapted at the newborn. If there is no free back flow, the cannula tip may be in closed contact with the vessel wall. In this situation, the cannula should be repositioned till blood can be easily aspirated. If this cannot be achieved the cannula should be removed because movement of the cannula tip against the vessel wall may result in devascularisation, erosion, and perforation. The cannula should be firmly secured to the skin to prevent movement of its tip against the vessel wall [2].

Management of pleural effusion involves stopping of all infusions through the CVC followed by aspiration from the catheter, drainage of the pleural cavity, maintaining the patient's hemodynamics, and adequate oxygenation. Removal of the improperly placed catheter is firmly indicated [3,7].

## Conclusion

In recent years, catheterization of the superior vena cava via the sub-clavian or the internal jugular vein became a routinely procedure in ICU to facilitate management of these critical patients. Pleural effusion related to central line malposition is a rare but serious complication. Its incidence can be reduced to minimum by performing ultra-sound guided canulation and the use of the smallest and soft lines. The need for such lines should be constantly reviewed and as soon as they accomplish their role they should be removed [2].

This case report aims to sensitize the physicians to this complication and emphasize the importance of ensuring a good position of the catheter by aspiration of venous blood, immediate post insertion X-ray with contrast injection confirming the correct position and the use of ultra-sonographic guidance whenever available especially in difficult cases.

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