

# Bilateral chylothorax as a complication of internal jugular vein cannulation

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## ABSTRACT

Central venous catheterization is one of the most prevalent procedures in the Intensive Care Unit. Complications are reported in about 15% of the patients and usually comprise of infection, arterial puncture, malpositioning, pneumothorax, local hematoma, hemothorax, and so on. Chylothorax is a rare complication of this procedure. We present a 42-year-old lady, who developed bilateral massive chylothorax after cannulation of her left internal jugular vein (IJV), due to direct injury to the thoracic duct during the procedure. The patient was successfully managed with bilateral chest tube drainage and omission of oral feeds for four days. Development of bilateral chylothorax as a complication of IJV cannulation is rare, but merits reporting, in view of a large number of central venous cannulations being undertaken. Critical care professionals should be aware of this rare complication of a common procedure to facilitate early identification and institute appropriate therapy.

**KEY WORDS:** Bilateral, central venous catheters, chylothorax, complication, internal jugular vein cannulation, thoracic duct

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## INTRODUCTION

Central venous catheter (CVC) placement is one of the most frequent interventions in the critical care units. Several complications with varying frequencies have been reported following CVC placement. One review has described an overall complication rate of 15%,<sup>[1]</sup> while another observational cohort study reported that 14% of the placement attempts were associated with mechanical complications.<sup>[2]</sup> Failure to place, arterial puncture, malpositioning and hematoma formation are common immediate complications. A recent review done on complications of CVC in the pediatric age group classified the complications as early and late and further into fatal and non-fatal. Pneumothorax, hydrothorax, hemothorax, and cardiac tamponade were reported as the most common early complications whereas septic and embolic complications, dislodgement, cardiac tamponade,

catheter disruption and thrombotic complications were reported as the most common late complications.<sup>[3]</sup> We report a rare complication of CVC placement where a left sided internal jugular vein (IJV) cannulation led to the development of a bilateral chylothorax, due to direct injury to thoracic duct. Only five such cases have been reported in literature.

## CASE REPORT

A 42 year old lady, a known case of Systemic Lupus Erythematosus (SLE), on disease modifying drugs, presented with acute calculous cholecystitis and underwent an open cholecystectomy. Her baseline hemogram, biochemical parameters, chest x-ray, and ultrasound abdomen were normal except for transient leukocytosis and abnormal gall bladder imaging. On day three, postoperatively she developed sepsis with multiorgan dysfunction. In view of suspected catheter-related blood stream infection (CRBSI), a CVC that had been placed preoperatively in the right subclavian vein was removed and a new CVC (Romsons Centro, double lumen, 7 Fr, 16 cm) was placed in the left IJV.

The vein was successfully cannulated in the second attempt and there was free flow of blood from all ports.

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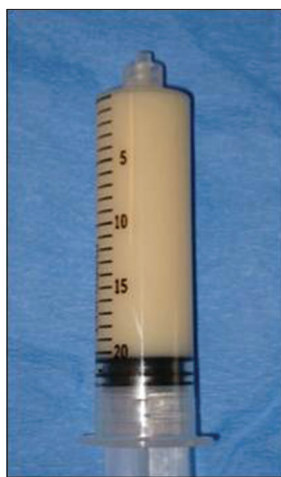
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The follow-up chest x-ray was normal, confirming the correct positioning and absence of pneumothorax. On the second day after catheter placement, she was noted to have a swelling on the left side of neck around the site of catheter insertion. The swelling was 2 cm × 2 cm in size, fluctuant and non-tender. No new remarkable systemic findings were appreciated. A local hematoma was considered as a possibility. The left-sided catheter was immediately removed and a new catheter was placed in the right IJV. The next day she complained of rapidly worsening dyspnea, which was followed by desaturation at room air. An examination revealed diminished breath sounds bilaterally and urgent ultrasonography (USG) and a chest x-ray showed bilateral pleural effusion. Bilateral pleurocentesis revealed a milky effusion [Figure 1] with biochemical analysis reporting increased triglycerides (588 mg/dl), strongly supporting the diagnosis of bilateral chylothorax. In the absence of any lymph-related disease pathology and with a history of left IJV cannulation, the etiology in the present case was believed to be a direct injury to the thoracic duct during central venous cannulation. Intra pleural drainage tubes were placed on both sides and under-water seals were established. Around 2 L of chyle was drained bilaterally. The patient was also kept nil per mouth to give the bowel the required rest. Subjective improvement took place immediately after the placement of bilateral chest drains. The total chest tube drainage reduced progressively over the next few days and the drains were successfully removed on the ninth day.

## DISCUSSION

Chylothorax refers to accumulation of chyle in the pleural space and is an infrequent, but potentially life-threatening complication, with profound respiratory, nutritional, and immunological consequences. Disruption or blockage of the thoracic duct or its



**Figure 1:** Chylous effusion

lymphatic tributaries, at some point along their course in the chest, is the most common cause of chylothorax.<sup>[4]</sup> Malignancies, like lymphoma, chronic lymphocytic leukemia, and metastatic cancers, account for a majority of cases of non-traumatic chylothorax. Surgical procedures, most notoriously cardiac and esophageal surgeries, have been implicated in the most traumatic cases of chylothorax.

The thoracic duct arises from cisterna chyli at the level of first lumbar vertebra. It ascends through the abdomen and chest and reaches behind the left subclavian artery, to about 3 – 5 cm above the clavicle. Then it angles forward acutely and enters the venous system near the junction of the left subclavian and internal jugular vein. Before termination, it receives additional lymph from the left bronchomediastinal, left subclavian, and left jugular trunks. On the right side, the jugular, subclavian, and bronchomediastinal lymphatic trunks converge together to form the ‘Ductus lymphaticus dexter’ (right lymphatic duct), which runs for about 1.3 cm. It receives lymphatic drainage from the right arm and right side of the thorax and head and empties into the right subclavian vein. Wide variations exist in the anatomy of the lymphatics. On both sides, the jugular, subclavian, and bronchomediastinal lymphatic trunks may drain directly into the adjacent veins. Also, the right lymphatic duct and the thoracic duct may terminate variably in the ipsilateral subclavian, jugular or brachiocephalic veins.

In a healthy adult, 1.5–2.2 l of chyle flows through the thoracic duct per day. This gets altered with varying fat content of the diet, level of activity, and bowel function. Remarkable increase is seen after a meal rich in long chain triglycerides, whereas, a flow as low as 0.2–0.3 l/d may be observed during periods of immobility, starvation, and continuous nasogastric suction. This forms the basis of using bowel rest as the cornerstone of conservative management for chylothorax.<sup>[4]</sup>

Chylothorax is typically suspected when pleural fluid shows a milky or creamy appearance. However, since not all cases of chylothorax have the typical appearance, an index of suspicion should be high whenever the risk factors exist (like malignancy, thoracic surgery or trauma). Diagnosis is established if the pleural fluid triglyceride levels are above 110 mg/dl. When the triglycerides are low, but the suspicion is high, the fluid should be subjected to lipoprotein electrophoresis, wherein, detection of chylomicrons would confirm the diagnosis of chylothorax.<sup>[4]</sup>

Differentials to be considered when pleural fluid is milky or creamy in appearance, apart from chylothorax are, cholesterol effusions (pseudochylothorax or chyloform effusions) and empyema. In empyema the appearance is caused by high numbers of white blood cells and thus

the 'milky' would disappear after centrifugation, which will not happen in the other two cases. Addition of ethyl alcohol to the supernatant fluid will clear the creamy appearance if it is due to cholesterol globules. Also, pleural fluid to serum cholesterol ratio will typically be less than 1 in chylothorax and not so in cholesterol effusions. Similarly, absolute pleural fluid cholesterol levels would be less than 200 mg/dl in chylothorax unlike that in pseudochylothorax. Once chylothorax is confirmed, imaging studies are typically required to hunt for the etiology unless it is obvious. In traumatic causes, lymphangiography or lymphoscintigraphy may be required to assess the site of the leak.<sup>[4]</sup>

Total parental nutrition (TPN) with central venous catheters leading to unilateral<sup>[5]</sup> as well as bilateral<sup>[6,7]</sup> pleural effusions, with 'milky' pleural fluid with high triglyceride content, have been described. TPN extravasation can be differentiated from chylothorax by pleural fluid analysis, which shows characteristics similar to TPN fluid, a notably high glucose content. Central line placement has been reported as a rare cause of chylothorax.

We did an exhaustive literature search and found 22 reports describing a total of 27 cases of chylothorax attributable to CVC placement [Table 1]. Complete information could not be obtained in seven of the twenty-two reports and these have been listed at the end of the table [Table 1: Serial numbers 16 to 22]. Out of the 19 cases where relevant information could be obtained, only in five cases was the chylothorax attributed to direct injury to the thoracic duct (as in our case). Thrombosis of the central veins was implicated as the cause of chylothorax in the remaining cases. Incidence of this complication appeared to be slightly higher in paediatric age group and when the cannulation was done on the left side. There was no difference in the frequency of chylothorax based on whether IJV or the subclavian vein was chosen.

Out of the five cases, where direct injury to the thoracic duct was implicated, three were placed through the left (two IJV and one external jugular) and two through the right side (one IJV and one subclavian). In both of the latter two cases, an aberrant anatomy of the thoracic duct was described. Two out of these five cases had bilateral chylothorax. All of these five cases were successfully managed with conservative management alone. In contrast, among the 22 cases with thrombosis related chylothorax, 6 patients died and only 5 cases (Table 1: Serial numbers 7, 13, 16, 21) improved with conservative management alone. Two cases had associated chylo-pericardium and one had chylo-peritoneum.

Despite the close anatomic proximity between the venous and lymphatic system, chylothoraces due to central venous catheterization have been infrequently described in literature. The pathogenesis of such a

complication varies. It may be a direct disruption of the thoracic duct, catheter-induced intrinsic thrombosis of the lymphatic-venous system or extrinsic venous compression from the extravasated fluid [see Table 1]. Classically, a chyloma (collection of chyle) below the pleura develops when the thoracic duct first leaks, which may give rise to a swelling in the supraclavicular fossa.<sup>[4]</sup> This collection can then leak into the pleural cavity through a pleural breach from the needle or following mediastinal pleural rupture. Some authors have reported instances where a thoracic duct injury has occurred following CVC placement, without causing chylothorax.<sup>[8,9]</sup> Suspicion of a thoracic duct injury should arise whenever a swelling appears in the left supraclavicular fossa after central vein cannulation procedure. In all such cases, the central line should be removed, pressure dressing should be applied and patient should be kept fasting for 2-3 days to minimize the flow of chyle and promote spontaneous recovery. In few cases, total parenteral nutrition or a "medium-chain triglycerides"-based diet may be required to reduce the chyle flow. Thurer described a case where, after CVC placement, extravasation of the intravenous hyperalimentation solution occurred, resulting in mediastinitis and venous obstruction of the jugulosubclavian confluence bilaterally, leading to bilateral chylothorax.<sup>[10]</sup>

Our patient was noticed to have a left supraclavicular swelling on the second day, from left-sided IJV catheterization. This was followed by the development of bilateral massive chylothorax. Bilateral chylothorax in our patient was most likely due to direct injury of the thoracic duct during left IJV cannulation. Thrombosis of the veins was unlikely, as the chylothorax regressed spontaneously in four days without any intervention. To the best of our knowledge, bilateral chylothorax as a complication of left internal jugular vein catheterization has been reported in only one case prior to this [Table 1]. Also, this is the first comprehensive review of all the reported cases where chylothorax has occurred secondary to CVC placement.

## CONCLUSION

Development of chylothorax is a rare complication of central venous catheterization and can cause serious morbidity and even mortality if not recognized. It is of utmost importance that intensive care professionals should be made aware of this eventuality. The complication is perhaps more common in the neonates and infants. As the left IJV is in close proximity to the thoracic duct under the usual circumstances, right-sided catheterization should be preferred. Thoracic duct injury should be suspected if the patient develops ipsilateral supraclavicular swelling or unilateral or bilateral pleural effusion after central venous catheterisation. The fluid

**Table 1: Summary of all reported cases of chylothorax secondary to CVC placement**

	Author, year, journal	Age	Site of CVC	Side	Remarks/Management
Probable mechanism:					
Direct injury to thoracic duct/lymphatic vessels					
1	Varache N, 1991, Am J Emerg Med	44 years	Right IJV	Bilateral	Repeated pleurocentesis and bowel rest with TPN. (Situs inversus with right-sided thoracic duct)
2	Hsu LH, 1997, Chin Med J (Taipei)	79 years	Left IJV	Left	Low-fat, high-protein and high-carbohydrate diet and tube drainage
3	Valassiadou K, 2000, Intensive Care Med	72 years	Left external jugular vein	Left	Catheter removal, thoracostomy Tube drainage and bowel rest with TPN
4	Schummer W, 2003, Anaesthesist	73 years	Left IJV	Bilateral	Conservative
5	Beljaars GH, 2006, Eur J Pediatr	Four years	Right subclavian vein	Right	Catheter removal, thoracic drainage and MCT diet
Thrombosis of central veins					
6	Hinckley, 1969, N Engl J Med	Neonate	PICC (Left)	Bilateral*	Resulted in fatality. Diagnosis confirmed during autopsy
7	Dhande V, 1983, Pediatrics	Five neonates <sup>^</sup>	IJV (placed surgically)	Bilateral	Four died; one survived with thoracostomy and supportive management
8	Smedts F, 1989, Klin Wochenschr	47 years	Left Subclavian vein	Right	Resulted in fatality due to pericardial tamponade due to chylopericardium
9	Schiller G, 1992, Bone Marrow Transpl	19 years	Right subclavian vein	Left	Tube thoracostomy, IV urokinase and elemental fat free diet
10	Veldhuizen, 1996, American Journal of Clinical Oncology	56 years	Left subclavian Hickman	Right	Managed with anticoagulants (IV heparin followed by warfarin). Catheter not removed
11	Kurekci E, 1998, J Pediatr	Two years	MediPort	Bilateral*	Bilateral chest tubes and a pericardial drain, LMWH and removal of MediPort
12	Hsu HF, 2003, Chang Gung Med J	Six months <sup>^</sup>	PICC (left basilic)	Bilateral	After conservative management failed, surgical intervention was done
13	Wu ET, 2006, Anaesthesia	Five months	PICC (right basilic)	Left	Managed by removal of catheters, drainage and supportive treatment
14	Bouziri A, 2011, Tunis Med	Neonate	Left IJV	Bilateral	Managed with tube drainage, Heparin and TPN followed by total enteral feeding by medium-chain triglycerides formula
15	Siu SL, 2012, J Paediatr child health	Neonate <sup>^</sup>	PICC (right cubital)	Right	Catheter had already been removed. Managed with initial bowel rest followed by an MCT-based formula diet, LMWH and pleural drainage
Complete information unavailable					
16	Piro J, 1975, Ann Anesthesiol Fr	Two cases	One left IJV and one left subclavian	-	Removal of catheters and supportive management
17	Orlovskii SP 1979, Anesteziol Reanimatol	Six months	Subclavian	-	-
18	Ruggiero RP, 1985, Parenter Enteral Nutrition	-	Subclavian vein	-	-
19	Iberti TJ, 1987, Mt Sinai J Med	-	Subclavian	Bilateral	-
20	Loeb T, 1997, Ann Fr Anesth Reanim	-	Right subclavian vein	-	Apart from continuous drainage of the pleural space, cessation of oral intake and mechanical ventilation, successful management after addition of positive end-expiratory pressure to ventilation
21	Muangman P, 2008, J Med Assoc Thai	-	IJV	Left	Tube thoracostomy and oral supplementation with a low fat, high carbohydrate, high protein diet
22	Wildenauer R, 2009, Unfallchirurg	16 years	Right subclavian	Bilateral	-

\*Chylothorax with chylo-peritoneum, <sup>^</sup> Premature neonates. PEEP: Positive end-expiratory pressure, MCT: Medium-chain triglycerides, CVC: Central venous catheter, IJV: Internal jugular vein, PICC: Peripherally inserted central catheter, IV: Intra-venous, LMWH: Low molecular weight heparin

should be aspirated and analyzed for appearance and triglyceride levels. Among those with chylothorax secondary to CVC placement, those having direct injury to the thoracic duct/lymphatic vessels have a better outcome and usually respond to conservative treatment without any need for medical or surgical intervention.

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