Pediatr Surg Int (1998) 13: 610–612 

CASE REPORT

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# Calcified catheter "cast": a rare complication of indwelling central venous catheters in infants

Accepted: 15 July 1997

**Abstract** Peri-catheter calcification is an unusual and previously unreported complication of central venous (CV) catheterization in infants. A 1.9 Fr Silastic CV catheter was placed in a term infant for administration of total parenteral nutrition and antibiotics following intra-abdominal sepsis. The catheter was removed, without complication, at a later date after another septic episode. Imaging studies performed in the investigation of a possible intra-abdominal abscess revealed a cylindrical density within a clot in the inferior vena cava (IVC). The density was presumed to be a retained catheter fragment. Further investigation indicated total occlusion of the IVC. Surgical exploration of the IVC revealed only a calcified thrombus. This case represents a rare and previously unreported complication of CV catheterization in infants. Diagnosing this condition on radiographic evidence alone can be difficult. It is hoped that awareness of the potential for this complication will avoid unnecessary invasive procedures in the future. We also suggest a high level of clinical suspicion and routine Doppler ultrasound investigations to detect IVC thrombosis when indwelling CV catheters are used in infants.

**Key words** Central venous catheters · Venous thrombosis

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## Introduction

Central venous catheters (CVC) are indispensable in the management of severely ill neonates, but complications have been associated with their use [3, 5, 7–11]. Ongoing controversy exists regarding the safety of superior vena caval (SVC) versus inferior vena caval (IVC) placement of CVCs in infants. We present an unusual complication of a CVC that has not been previously reported.

## Case report

A full-term male with meconium aspiration syndrome and persistent pulmonary hypertension was treated with antibiotics, inotropic agents, corticosteroids, surfactant, and mechanical ventilation. A 1.9 Fr Silastic catheter (Per-Q-Cath) was inserted via the right saphenous vein and used for total parenteral nutrition (TPN) and antibiotics. Intra-abdominal sepsis led to an exploratory laparotomy and the finding of *Candida* peritonitis. Amphotericin B was started via the CVC and continued for a total of 15 days. The infant slowly improved until day 49, when he developed abdominal distension, fever, and acute respiratory failure. The CVC was removed uneventfully as a possible septic focus. An abdominal computed tomography (CT) scan was performed to investigate the possibility of an intra-abdominal abscess. A longitudinal cylindrical density within the IVC was an incidental finding on this otherwise normal scan. The density was ring-like and suggestive of a retained catheter (Fig. 1). Doppler ultrasound (US) documented a thrombus in the IVC extending from the iliac veins to above the renal veins, surrounding a presumed retained catheter (Fig. 2).

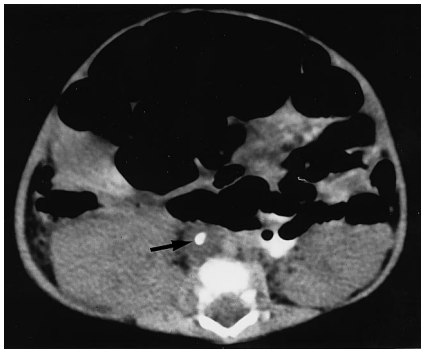

**Fig. 1** Abdominal CT image showing cylindrical density (*arrow*) in inferior vena cava

Upon transfer to another institution, a venogram identified total occlusion of the IVC with extensive collateral circulation. Attempts to remove the presumed catheter percutaneously were unsuccessful. Surgical exploration of the IVC was performed via a retroperitoneal approach through the bed of the 11th rib. No foreign body was identified, however, and a calcified thrombus was removed from the IVC. The infant's condition subsequently improved, and at discharge only a small residual thrombus remained in the IVC.

## Discussion

This case illustrates a unique variation of a known complication of CVC placement. Thrombosis has

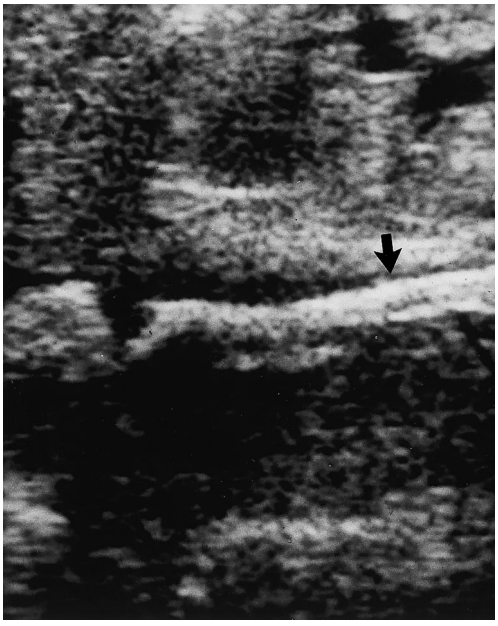

**Fig. 2** Abdominal US scan demonstrating hyperechoic cylindrical density (*arrow*) within thrombus in inferior vena cava

been reported previously as a complication of both SVC and IVC catheterization [3, 5, 7–11]. Calcification of an IVC thrombus, extending from the catheter tip into the right atrium, has also been reported [11]. However, this is to our knowledge the only report of a uniform peri-catheter calcification. This complication was of significance in this instance because its appearance mimicked a retained catheter fragment.

The possibility of Silastic catheter breakage is small but real. There are reported cases of IVC catheters located within thrombus being so adherent to the thrombus that at attempted removal the catheter fractured, leaving varying lengths of retained catheter within the vein [3, 5–9]. In several instances, when IVC exploration was performed, the catheter was found to be so adherent to the thrombus that it could not be removed. In these cases the catheter was sutured to the vena cava to prevent embolization [3, 5].

Ideally, all CVCs should be inspected and accurately measured upon removal to ensure that the length equals the length at insertion. Although in this case the catheter was felt to be intact on gross inspection, no accurate measurement was recorded. This left us unable to completely exclude the possibility of a retained catheter fragment. The insertion instructions recommend cutting the catheter to an appropriate length prior to insertion [4]. The absence, therefore, of a standard catheter length underscores the need for accurate length measurement on both insertion and removal.

In retrospect, there was radiographic evidence that could have aided in discerning the residual "cast" of the peri-catheter calcification we observed from a true catheter. The diameter of the IVC density on CT was larger than that expected from a 1.9 Fr catheter. US of the IVC with the catheter in situ performed several weeks prior to removal showed the sharply defined, linear catheter walls versus the somewhat indistinct borders of the cast.

Various studies have suggested a correlation between the risk of thrombosis and catheter composition, purpose, location, duration of use, and patient age. Silastic catheters commonly utilized today are less thrombogenic than the polyvinyl chloride catheters previously used [12]. The incidence of caval thrombosis occurring when CVCs are utilized for central pressure monitoring is reported to be less than in those used for infusing TPN [6]. This supports the suggestion that hyperosmolarity of the TPN solution is more likely responsible for endothelial damage than mechanical irritation by the catheter itself. Fonkalsrud et al. reported the duration of catheter use in those who developed thrombosis to be almost twice that of those who did not develop thrombotic complications [3]. In one series, it was noted that all patients who developed IVC thrombosis were less than 1 year of age at the time of catheter insertion [2]. Precipitation of calcium salts has been reported with the use of high calcium and phosphate concentrations in TPN solutions [1]. Our TPN protocol maintains calcium and phosphate levels below the threshold thought to permit precipitation.

Some studies have suggested that IVC thrombosis occurs less frequently than SVC thrombosis and is associated with fewer complications and decreased mortality [6]. These studies are, however, retrospective and identify thrombus only when symptoms lead to investigation. A recent prospective study by Pippus et al. suggests that the rate of IVC thrombosis exceeds that of the SVC and is higher than in previous reports [9] .

This case represents a rare and previously unreported complication of CVC placement. Diagnosing this condition radiographically can be exceedingly difficult. It is hoped that awareness of the potential for calcified casts will avoid unnecessary invasive exploratory procedures in the future. Finally, we suggest that routine Doppler US should be performed at 1- to 2-week intervals in all infants with a CVC to detect thrombosis.

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