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Case Report

Retained Peripherally Inserted Central Venous Catheter in a Neonate: Consider Thrombosis

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Abstract We report two neonates with stuck Premicath® being freed with topical and systemic thrombolytic respectively. One term baby with Premicath® inserted for hyperosmolar dextrose solution infusion. On removal after 13 days' use, difficulty was noted in pulling out the distal 3.5 cm part. Three thousand units of urokinase in 0.3 ml normal saline was instilled and aspirated after 14 hours, together with the intact Premicath® removed. Another extreme preterm baby had Premicath® inserted for paternal nutrition infusion. Removal of Premicath® was decided on day 23 of catheter use. However, great resistance was noted after pulling out 4 cm to 10 cm marking at entry site. Ultrasound study suggested thrombosis inside the lower end of IVC, with extension to the upper left common iliac vein. Six weeks course of subcutaneous enoxaparin was started and the intact Premicath® was successfully removed on day 12 of enoxaparin treatment.

Key words *Neonate; Low molecular weight heparin; Stuck catheter; Thrombosis; Urokinase*

Introduction

The term "stuck catheter" was first mentioned as a unique problem of central venous catheter use in 1997.[1] Premicath®, Vygon, a 28-G polyurethane catheter was first reported to have this problem arising from calcified fibrinous tissue adherent it to the venous endothelial surface in 2005.[2] We used Premicath® since 2012 and had encountered stuck Premicath® twice since 2017. We successfully freed the two stuck Premicath® in the following ways.

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Case 1

A 3-day-old Chinese girl, born at 39+2 weeks of gestation with a birth weight of 2.94 kg was transferred in Special Care Baby Unit (SCBU) from postnatal ward for symptomatic hypoglycaemia. There is no parental consanguinity, maternal diabetes nor risk factors for sepsis. On admission, she had 10% weight loss and the first blood glucose was undetectable. After bolus intravenous glucose infusion, her blood glucose normalised and hypoglycaemic symptoms resolved. She required high glucose infusion rate (GIR) to maintain normal blood glucose, necessitating hyperosmolar dextrose solution infusion. Therefore, on day 4 a Premicath® was inserted over her right cubital fossa with catheter tip inside superior vena cava for dextrose 15% infusion. Her GIR requirement peaked at 16.9 mg/kg/min and hypoglycaemic kit work up results showed low fatty acids with high insulin level consistent with hyperinsulinism. When the result of hyperinsulinism was available on day 10, Endocrine Team doctor started diazoxide. On that day, the Premicath® was blocked but fortunately, after instillation with urokinase 5000 units in 0.5 ml normal saline for 2 hours, patency was

re-established. Gradually upon stepping up milk fortified with Polycal and weaned down of dextrose infusion, full enteral feeding was established on day 16.

Upon removal of Premicath® on day 16, day 13 of catheter insertion, difficulty was noted in pulling out the distal 3.5cm of Premicath® (Figure 1). Orthopaedic surgeon's opinion was sought; they offered surgical exploration to remove the Premicath® if conservative means for removal failed. With the belief that a small thrombus at the tip of the Premicath® causing catch up at the small peripheral vein, instillation of urokinase was tried. Three thousand units of urokinase in 0.3 ml normal saline was instilled and aspirated after 14 hours, together with the intact Premicath® removed.

Case 2

A Chinese baby girl born at 24+6 weeks of gestation with a birth weight of 620 g had umbilical venous catheter changed to Premicath® for paternal nutrition infusion on day 14. The Premicath® was inserted via left long saphenous vein with tip reaching upper border of L2 and it functioned well all along. On day 35, clinical sepsis was suspected in view of increase ventilatory requirement and platelet dropped abruptly from 365 to $113x10^9$/L over two days but with normal coagulation. After sepsis work up, empirical course of Vancomycin and Cefotaxime was started. Two days later, the platelet dropped further down to $70x10^9$/L despite antibiotics treatment. Uncontrolled catheter related sepsis was suspected and by then the baby nearly reached full enteral feed. Therefore, removal of Premicath® was decided on day 23 of catheter insertion, Friday. Upon removal of Premicath®, great resistance was noted after pulling out for 4 cm to 10 cm marking at entry site. Abdominal X-ray showed the Premicath® tip lied anteriorly to the 3rd and 4th lumbar spine. The position of the Premicath® tip corresponded to the inferior part of the inferior venous cava (IVC). Therefore, venous thrombosis was suspected and urgent ultrasound with Doppler study was arranged. After this attempt of Premicath® removal, the platelet count started to rise; to $126x10^9$/L on Saturday and to $128x10^9$/L on Sunday and back to $223x10^9$/L on Monday, day 40.

On day 40, day 26 of catheter insertion, USG study showed a focal echogenic lesion present inside the lower end of IVC, with extension to the upper left common iliac vein, most likely representing a thrombus. Haematologist's opinion was sought, after counselling parents on the pathogenesis of catheter related thrombosis, its potential complications like worsening of thrombo-embolism, residual thrombosis and post-thrombotic syndrome, benefit and risk with low molecular weight heparin treatment, parents showed understanding and agreed for treatment. Six weeks course of subcutaneous enoxaparin was started on day 40 at 1.5 mg/kg every 12 hourly, with anti-factor

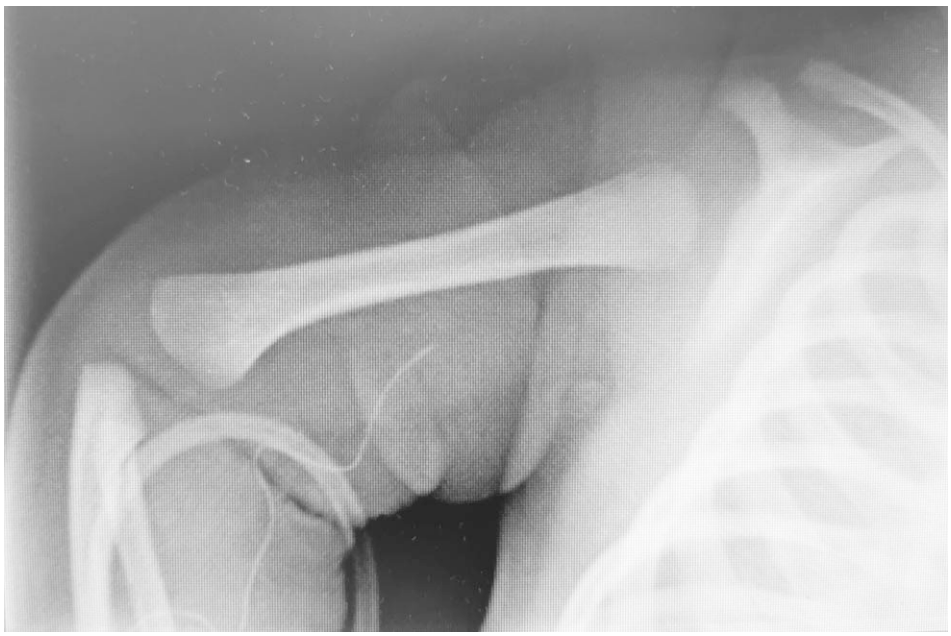

Figure 1 Distal 3.5 cm of Premicath® stuck.

Xa monitoring. The intact Premicath® was successfully removed on day 52, the 12th days of enoxaparin treatment. The 6 weeks course of enoxaparin was completed uneventfully and the platelet count was monitored during treatment which remained normal. Repeated USG IVC post enoxaparin treatment showed no thrombus.

Discussion

Most of the typical strategies to facilitate Premicath® removal like repositioning of the arm in case 1 and the leg in case 2, application of heat and vessel message was used unsuccessfully. Traction over time is one reported strategy for percutaneous inserted central catheters (PICC) removal in Neonatal Intensive Care Units and was reported to be successful in 44.4 percent of the cases in which they were performed.[3] However, the thin walls of the 28-G Premicath® with limited tensile strength make them prone to fracture and we dare not to try traction over time. Reinsertion of the stylet into the lumen of the catheter to facilitate PICC removal had been reported to be a novel technique for difficult removal of neonatal PICC.[4] However, the inner lumen of this Premicath® is 0.17x0.35 mm and the Premicath® is a catheter with stylet and split cannula introducer in one piece. This made finding of a suitable stylet impossible and this way to remove PICC is at risk for catheter puncture or breakage that can become an embolism. Therefore, we decided for systemic anticoagulation.

Our attempt to try intra-catheter instillation of urokinase in the first case echoed with adult report of using tissue plasminogen activator to free stuck PICC.[5] In adult report, their approach of using low dose thrombolytic therapy was based on the presumed pathophysiology that the adhesions prevent PICC removal, and the adhesion developed initially from fibrin sheaths. In our case, if adhesion had occurred, we should have faced difficulty in initial removal of the PICC, not till the final 3.5 cm. Anyway, thought different belief, both use of topical thrombolytic therapy were successful. While tissue-type plasminogen activator is largely responsible for initiating intravascular fibrinolysis, urokinase is the major activator of fibrinolysis in the extravascular compartment. If our conservative approach was unsuccessful, alternative option would be surgical exploration; therefore, this enzymatic approach is worth trying if the PICC is still patent.

The use of central venous catheter (CVC) is the most common cause of thrombosis in newborn infants, accounting for up to 89% cases.[6] Previous reports have indicated that, compared with adults and children, neonates are at greater risk for thrombosis owing to their immature haemostatic and coagulation systems, small blood vessel diameter, need for infusion of high-osmolar solutions, and low flow rate of infusate.[7] Haemostatic imbalance associated with infection and dehydration adds to the predisposition for CVC-related thrombi in neonates. In our second case, the catheter related blood stream infection was disproved by negative blood culture but she required fluid restriction for patent ductus arteriosus and bronchopulmonary dysplasia, putting her at high risk for developing catheter related thrombus on the 23rd day of Premicath® insertion. The majority of CVC-related thrombi are silent, but some are associated with line dysfunction, limb swelling, altered skin color or perfusion, and/or thrombocytopenia.[8] The resolution of her thrombocytopenia after 4 cm of Premicath® was pulled out in the absence of culture proven infection highly suggested that her thrombocytopenia was caused solely by the thrombus formation.

For neonates with asymptomatic catheter-thrombosis, guideline suggests supportive care and close monitoring of the size of the thrombus.[9] In our case, the need for treatment is obvious as the thrombus stuck the Premicath®. Among neonates requiring treatment for thrombosis, low molecular weight heparin (LMWH) is the treatment of choice. Enoxaparin is a LMWH with 100 units of anti-factor Xa activity per mg. LMWH has many advantages over unfractionated heparin. These include greater bioavailability when given by subcutaneous injection, longer duration of anticoagulant effect, and clearance that is independent of dose, which results in a more predictable response. They can be administered subcutaneously and require minimal laboratory monitoring and dose adjustment. Other potential advantages are the reduced risk of immune-mediated thrombocytopenia and osteoporosis.

In summary, stuck Premicath® seems unavoidable with the survival of smaller babies. In dealing with this problem, we propose imaging to rule out knots and adherent focus in preventing removal first. If nothing can be identified in preventing removal, for patent Premicath® stuck at limbs, topical urokinase instillation may be tried. For Premicath® stuck in major vessels, consider thrombosis and manage accordingly.

Declaration of Interest

None

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