CASE REPORTS

Iatrogenic asymptomatic subclavian arteriovenous fistula after percutaneous catheterization

Sam Aruputha John*[1], Abdullah Rajab[1], Ahamed Faiz Ali[1], Rasha Kassem[1], Hosam Atiya[2], Aisha S. Khan[1]

[1] *Department of Pediatric Surgery, Ibnsina Hospital, Kuwait*
[2] *Department of Radiology, Ibnsina, Kuwait*

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ABSTRACT

A 4-year-old child with chronic enteropathy underwent left percutaneous internal jugular vein Hickman catheter insertion for total parenteral nutrition (TPN) under general anaesthesia. Previously this child had undergone percutaneous Hickman line insertion on the right internal jugular vein in 2013 and the right subclavian vein in 2015. These lines had been removed before due to catheter sepsis. During the present procedure, 6.6 french Hickman line was inserted into the left internal jugular vein by percutaneous peel away technique under ultrasound guidance. Later in the ward it was noticed that Hickman line was not functioning and there was reverse flow of blood into the intravenous (IV) line. Blood gas sample taken from the line showed arterial values and the catheter was subsequently removed. Computed tomography (CT) angiography was done which reported arteriovenous (AV) fistula with pseudoaneurysm of the right subclavian vein. The child was then referred to department of cardiothoracic surgery for further management. From the above case report we can infer that patients who underwent repeated percutaneous central line insertions may develop iatrogenic AV fistula or pseudo aneurysm. These complications can be asymptomatic for years. Failure to recognize this may lead to catastrophe during reinsertion. Hence proper history taking, clinical examination for bruit, thrill over the neck veins and cardiac examination should be done preoperatively if there is past history of multiple insertions. Investigations like venous blood gas sampling, USG doppler for neck veins, echocardiography, and CT angiography should be done in these cases preoperatively.

Key Words: Arteriovenous fistula, Percutaneous, Computed tomography angiography, Hickman line, Complications

1. INTRODUCTION

Central line insertions are planned procedures. Since percutaneous insertion of catheter is a blind technique there is a chance of inadvertent puncture of large arteries during these procedure. This may present immediately as massive bleeding in the chest or remain asymptomatic as pseudoaneurysm or arteriovenous (AV) fistula. Failure to recognize these conditions during the time of reinsertion can result in catastrophe. Hence numerous issues like number of previous insertions, patient anatomy, comorbidity, the primary disease itself, long term durability of catheter and the real indication of the procedure should be considered before embarking on reinsertion. A thorough clinical examination with appropriate pre-operative investigations will go a long way in preventing morbidity or mortality in these patients. Intraoperative Doppler and fluoroscopic guidance decreases the trials of multiple cannulation.

2. CASE PRESENTATION

A 4-year-old boy suffering from chronic enteropathy, was referred to us by pediatric gastroenterologist for percutaneous Hickman line insertion for total parenteral nutrition

*Correspondence: Sam Aruputha John; Email: samaruputha@yahoo.com; Address: Department of Pediatric Surgery, Ibnsina Hospital, Kuwait.

(TPN) purpose. This child had undergone insertion of central lines in right internal jugular vein and right subclavian vein during the years 2013 and 2015 respectively. These were removed earlier due to development of catheter sepsis. A pre-operative complete blood count and coagulation profile values were normal. A Doppler ultrasound of neck showed normal and patent internal jugular veins on both sides. Under general anaesthesia, with Doppler and fluoroscopic guidance, the left internal jugular vein was cannulated percutaneously with 6.6 Hickman catheter by peel away sheath technique. Persistent ectopics were noted during guide wire insertion and the color of blood was slightly brighter. The catheter could not be negotiated into the heart and was positioned at the region of left innominate vein by fluoroscopy. A good inflow and outflow of blood/fluids through the catheter was observed at that time. Child was then shifted to the ward and an intravenous (IV) line was connected to the catheter. As there was a reverse flow of blood into the IV line, an urgent blood gas analysis sample was taken from catheter. This sample showed arterial blood values. A peripheral venous sample taken at the same time also showed the same arterial blood values. Urgent Doppler neck done by the radiologist for suspected arterial catheterization showed the catheter going inside the left jugular vein. Since the catheter was not functioning and a significant shunting of blood at some level was realized, this catheter was immediately removed.

2.1 Investigation

Echocardiogram done was normal. Computed tomography (CT) chest angiography done reported mixed venous and arterial flow at arterial phase (intracranial and neck). Whole of the superficial and deep venous system of the right upper limb was seen. The subclavian vein and cephalic vein with its small tributaries were seen dilated forming anterior and posterior chest wall collaterals with azygous vein. Aneurysmal dilatation was noticed at right brachiocephalic vein just cranial to the insertion of subclavian vein. Right jugular vein was distally stenosed. Suspected AV fistula was noticed between right subclavian vein and artery at its proximal 1/3 (see Figures 1-5).

2.2 Management

Child was referred to the department of cardiothoracic surgery for further management of the AV fistula.

3. DISCUSSION

Paediatric surgeons are actively involved in the vascular access. There are several indications for venous access in neonates and children. The central venous access by cathether or by port device provides reliable vascular access and is used for administering fluids and for obtaining blood samples. However these procedures do carry some intra and post-operative complications.[1,2]

Figure 1. During insertion Hickman line was positioned at left bracheocephalic vein as it could not be negotiated to the heart

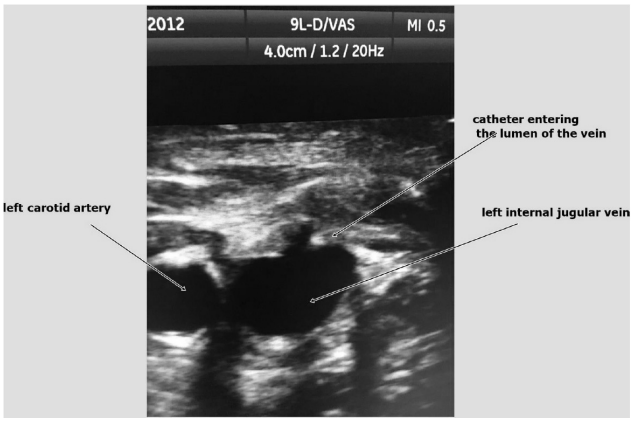

Figure 2. Doppler ultrasound neck showing Hickman entering left internal jugular vein after insertion
This was done by Radiologist because the blood gas analysis sample taken from the line after insertion had shown showed arterial values.

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The first percutaneous placement of subclavian vein catheter was reported in 1956.[3] With the progress in industrial technology, catheters with greater pliancy and with reduced thrombogenic properties became available resulting in lower complication rates.

Figure 3. CT Angiogram-Arterial phase with contrast injected in left forearm
Opacification of right subclavian vein with collaterals noticed indicating AV fistula at that region

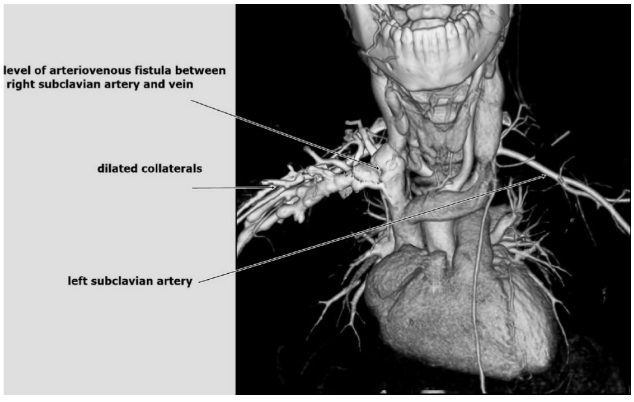

Figure 4. Reconstructed CT angio showing the opacification of the the right subclavian vein with prominant collaterals during arterial phase

Insertion technique had also remarkably improved over the time. In 1953 Seldinger described his technique of introducing the catheter over guide wire into blood vessel by direct needle puncture. The original Seldinger technique has become more improvised now, leading to the use of a sheath that has to be peeled away after the introduction of the catheter. Ultrasound guided insertion has decreased the rate of catheter related thrombosis. This is because ultrasound has decreased the number of trials during cannulation. A multiple number of blind trials can disrupt the endothelial line of vessel, increasing the risk of catheter related thrombosis.[4] The most common complications are hematoma, arterial puncture, AV fistula, nerve injury, hemothorax and pneumothorax. Central venous access procedures are associated with inadvertent arterial puncture in upto 6% of patients when using external landmark technique.[5] This can subsequently lead to haemorrhage, pseudoaneurysm, AV fistula formation, arterial dissection, neurological injury and lethal airway obstruction.[6] Accidental arterial catheterization should be suspected immediately on excessive or pulsatile backflow of well oxygenated blood through the catheter or local hematoma at the site of catheterization. Delayed diagnosis will result in serious morbidity or mortality. Air embolism is rare but is a potentially fatal complication of central venous catheter procedure.

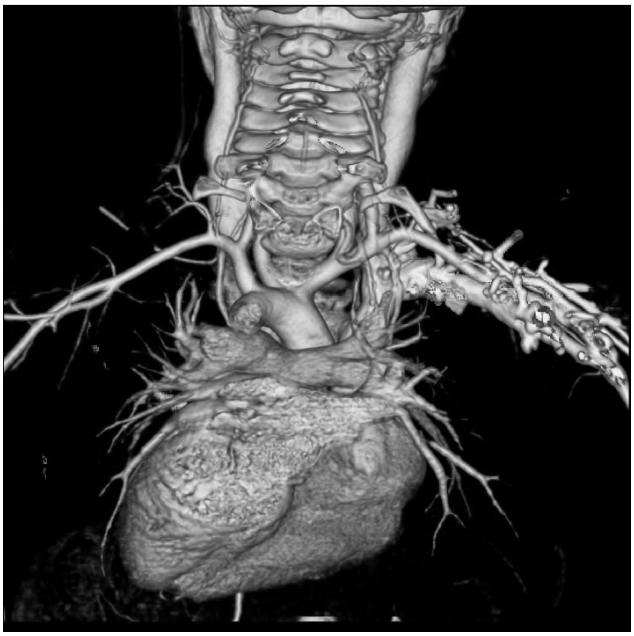

Figure 5. Posterior view of right subclavian AV fistula

Emergency central venous catheterization for IV access in a hypovolemic/shock patients is contraindicated. Patient with hypotension and low hemoglobin saturation should be considered as a particular risk for inadvertent arterial catheterization. The hypovolemic state may render accidental arterial puncture more likely and more difficult to detect due to less pulsatile backflow of deoxygenated blood. Obesity, short neck and associated comorbidity are the other risk factors.

There are numerous reports of inadvertent arterial placement of large bore catheters despite the use of ultrasound guidance.

There are a number of reasons for this complication to occur. Either the needle tip may not be seen in the ultrasound beam or the needle may move into the artery during placement of the guide wire.[7] False aneurysm or AV fistula can occur late after the pull and pressure technique.[8] Immediate removal of an accidental arterial catheterization can result in uncontrolled haemorrhage, pseudoaneurysm and AV fistula formation. Especially in patients who are treated with anticoagulants or antiplatelet agents.[9]

Thus from our case report we conclude that patients who undergo repeated percutaneous central line insertion can develop iatrogenic AV fistula with psuedoaneurysm due to inadvertent arterial puncture. This iatrogenic AV fistula can be asymptomatic for years. If the same veins are catheterized again, it can result in rupture of the pseudoaneurysm with catastrophic bleeding inside the chest. Hence a clear knowledge of the venous system at thoracic level is necessary before reinsertion in these patients. Pre-operative CT angiography in selected patients can avoid such a complication. A venous blood gas analysis can be used as screening method to rule out shunting of blood. Also proper history taking, clinical examination for bruit, thrill over the neck veins and thorough cardiac examination should be done preoperatively. Ultrasound doppler of neck veins and Echocardiogram are additional tools in the pre-operative planning.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflict of interest.

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