

Ischemia of the fingertips necessitating surgery after radial artery cannulation

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Abstract

Fingertip Ischemia due to radial artery cannulation is a rare but feared complication.

We herein report a case of fingertip ischemia in a 41-year-old female. She was admitted to our hospital with recent palpitation. Coronary angiography revealed ASD and recommended ASD closure surgery. The patient began complaining of pain in the left hand 3 days after surgery. The angiogram revealed occlusion of the radial artery extending from the proximal radial artery to the distal part of it at wrist joint. She had successful surgical thrombectomy 4 days after catheter removal. Therefore, the hand regained its own palpable pulses. Eventually, she was discharged home in a good condition after her fingertips regained their natural color and activity.

Key words: Radial Artery, Ischemia, Catheterization, Thrombectomy

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Introduction

The radial artery catheters generally are used for continuous hemodynamic monitoring and frequent blood sampling during cardiac surgery.(1,2) The non-dominant radial artery (typically left side) is the most common site for cannulation. The complications of radial artery cannulation may occur in 0.1%–20% of patients.(3) Ischemic injury to the hand after radial artery catheterization is a rare, but feared complication. Herein, we present a case of hand ischemia following radial artery cannulation, which was treated successfully with delayed surgical thrombectomy.

Case Report

A 41-year-old woman was admitted to the emergency department for palpitation. Her past a large (2.1 x2.3cm) secundum atrial septal defect (ASD), left to right shunt, pulmonary hypertension (PAP= 60- 65 mmHg). Coronary angiography also reported ASD and recommended ASD closure surgery. Two days later, she was transported to the operating room and was prepared for the induction of anesthesia. In the operating room, the patient was monitored via standard electrocardiography and pulse oximeter. The left radial artery was cannulated atraumatically on the first attempt with a 20-gauge x 1-1/2 inch (4 cm) introducer needle; the Seldinger technique is then used to place a 20-gauge x 3-1/4 inch (8 cm) radiopaque polyurethane indwelling catheter (Arterial catheterization set ARROW) for continuous arterial pressure monitoring. Then the arterial catheter was secured with a simple interrupted suture. (Figure 1)

The surgery was successful, and the patient was transferred to the Intensive Care Unit, where she was extubated. She was treated with aspirin, and heparin during the post-operative period of the surgery. Three days after surgery and one day after catheter removal, the patient complained of pain in the left hand. Apart from the pain, other physical examination was normal and SpO₂ was 96. However, she gradually began complaining of coldness, numbness and discoloration in the fingertips. (Figure 2)

She was seen by a vascular surgeon, on the fourth day after placement of the radial artery line, who recommended anticoagulation therapy and Doppler ultrasonography (DE).

DE showed only low blood flow in one third of the proximal left radial artery. It also showed low blood flow in her left ulna artery. The angiogram revealed Interrupted blood flow in the proximal left radial artery that was re-filled by retrograde blood flow from left interosseous artery in the distal part of it (Figure 3). Therefore, thrombus resulting in digital necrosis was detected and she was sent for surgical Thrombectomy. However, the patient refused surgery and was discharged with medical therapy. Two days later, she re-admitted to hospital with severe pain in her left hand. However, she finally decided to accept Thrombectomy surgery. After surgery, her radial and ulna pulses were well palpable. The left fingertips regained their normal coloration and activity without pain.

Discussion

Percutaneous radial artery catheterization is one of the most common invasive procedures performed in cardiac surgery for beat-to-beat assessment of blood pressure, monitor of pulse contour and heart rate, and predict fluid responsiveness derived from pulse pressure variability and frequent arterial blood gas sampling. (4, 5)

The radial artery cannulation is generally chosen owing to the good collateral circulation of the hand, easy for nursing care, high success rate, low risk for artery thrombosis, low development of distal ischemia and easy hemostasis achievement after cannulation. It is also anatomically superficial and stable making it technically easy to cannulate. (6, 7)

The two most common materials used in arterial catheters are Teflon and polyethylene.

The catheters made from Teflon are softer and less thrombogenic, but are prone to kinking. (8, 9) A 20-gauge, 3- to 5-cm catheter, is the most commonly used for radial artery cannulation.

The insertion techniques for radial artery cannulation are generally Direct Cannulation, Transfixation (without using guidewire) and Seldinger Techniques.

Then, the catheter should be secured by suturing of catheters, tape, Stat Lock or other sutureless securement devices.

Radial artery cannulation is contraindicated in patients with a history of Raynaud's phenomena, Buerger's disease, severe burns or skin infection over cannulation area and inadequate circulation to the extremity.(6)

Inadequate circulation to the extremity can be evaluated by Allen test (or modified Allen test), although the predictive value of these tests is questionable and cannot be performed properly in an unconscious or uncooperative patient. (5, 7)

Although Radial artery line placement is considered a safe procedure, it is not entirely without complications.

The complications of radial artery cannulation are temporary radial artery occlusion (RAO), hematoma, hemorrhage, local infection, paralysis of the median nerve, compartment syndrome, carpal tunnel syndrome, pseudoaneurysm, thrombus formation and distal Ischemia.(2, 5,6, 9)

Thrombus formation seems to be associated with pathophysiology of early RAO and distal Ischemia. (9)

Risk factors for Thrombus formation are female sex, low body mass index, patient age (65 or older), smaller vessel diameter (2.0 mm or less), autoimmune disease, diabetes, disseminated intravascular coagulation, Preexisting peripheral vascular disease, hematoma formation, larger gauge cannulae, length of catheter more than 5 cm, catheter manufacturing material, repeated cannulation

Figure 1A



Figure 1B



Figure 2A



Figure 2B



attempts, duration of catheter placement longer than 72 hours, hypotension and use of vasopressors.(2- 4)

There are no relationships between risk of thrombus formation and puncture methods (direct, transfixing or modified Seldinger technique).

In this case, the risk factors were female sex, probably smaller vessel diameter, catheter length more than 5 cm, polyethylene catheter and securing catheter with a simple interrupted suture.

The optimal management of hand Ischemia after radial artery catheterization is controversial. Therefore, it should be managed on an individual basis. (3, 5)

If there is any evidence of cyanosis in fingers tips, coldness, pain, dampening pulse waveform on monitor, lack of sensation or capillary refill, the catheter must be removed immediately.

The hand should be elevated and heated and the patient should be treated with vasodilation and systemic anticoagulation therapy.

Invasive angiography can reveal the thrombus for the direct injection of vasodilatory agents to the vessel. However, this technique is not so appropriate for very distal Ischemia.

The other approaches for removal of thrombus are early surgical thrombectomy or using Fogarty balloon catheter. (2) In contrast to some reports which believe the outcomes of surgical intervention are low, our

case showed that in some situations, it can be an effective method for the treatment of this complication.(10)

Finally, to avoid this catastrophic complication, we advise to use a 20 or lesser gauge cannula, length of catheter less than 5 cm, Teflon catheter, securing catheter with two simple interrupted sutures or sutureless securement devices. (Figure 1) When this complication is suspected, rapid evaluation and a vascular surgeon consult are required to prevent it.

Conclusion

Fingertips ischemia due to radial artery cannulation is a rare complication of radial artery cannulation with favorable early and long-term outcomes when recognized timely and managed properly. Furthermore, surgical thrombectomy is still a safe and effective option for the treatment of it even more than a few days after it happens.

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Figure 3: Angiogram showing occlusion of the radial artery extending from the proximal radial artery to the distal part of it at wrist joint

