SIGNA VITAE 2011; 6(2): 89 - 90

CASE REPORT

Unintentional Cannulation of Aberrant Radial Artery: Review and Treatment Recommendations

FRANCIS X. WHALEN (✉) •
DAVID P. MARTIN
Department of Anesthesiology
Mayo Clinic,200 First St., SW
Rochester, MN 55905
Phone: 507-255-5432
Fax: 507-255-4267
E-mail: whalen.francis@mayo.edu

FRANCIS X. WHALEN • DAVID P. MARTIN

ABSTRACT

We present the case of a patient who had an unintentional placement of an arterial catheter in an aberrant radial artery. This arterial abnormality is reviewed, as are the potential consequences of intra-arterial injection. Finally, treatment recommendations are summarized.

Key words: aberrant radial artery, intra arterial injection, vasospasm

Case report

An 81-year-old man underwent cervical exploration for hyperparathyroidism. His past medical history was significant for coronary artery disease, hypertension, diabetes type II, chronic renal insufficiency, paroxysmal atrial fibrillation, anemia and gammopathy of unknown significance.

After application of monitors in the operating room, a tourniquet was applied and intravenous access (IV) access was obtained with a 20 gauge catheter. Intravenous access was somewhat difficult, but eventually successful in dorsum of the right arm near the wrist. This was the same side as the non-invasive blood pressure cuff. After catheter placement, blood return was noted through the intravenous tubing coincident with inflation of the blood pressure cuff. After cuff deflation, the blood return was noted to be pulsatile and once attached to the monitor, found to be arterial. The catheter was used to monitor the patient throughout the procedure and removed uneventfully at the end of the procedure. No adverse sequelae were observed.

Figure 1 shows the course of the aberrant radial artery. Note its position lateral to the radial malleolus.

Discussion

Unintentional placement of radial arterial catheters has been reported previously, as early as 1939. (1) A study by McCormack (2) in 1953 involved the dissection of 750 cadavers, and is likely the largest collection of anatomical specimens to date. He reported that the incidence of arterial abnormalities, particularly aberrant radial artery, was 0.8%. With 22 million anesthetics per year in the United States, this means that there may be up to 176,000 patients each year affected with this anatomical feature.

A thorough review of the pathophysiology and treatments available was compiled by Sol M. Cohen, (3) a surgeon from South Africa. He described a series of cases involving accidental intraarterial injection of thiopentone. He states, "intra-arterial puncture is not followed, as is commonly imagined, by a gush of blood blowing off the syringe piston." He postulates that the mechanisms of vascular injury include distal arterial and arteriolar spasm, arterial thrombosis, extensive venous spasm, diffuse venous thromboses and possible mechanical blockage due to protein flocculation or drug precipitation. Iatrou et al. proposed that highly lipid soluble drugs are more likely to be problematic because a high concentration collects in endothelial cells causing cell disruption, edema, thrombosis, and gangrene. (4) He describes injection through an unintentionally placed arterial catheter in the radial artery. They left the catheter in place and instilled heparinized saline for 24 hours. The patient suffered no sequelae.

The immediate and delayed clinical presentation is described, including pain (immediate), distal vasospasm with pallor in the hand and cyanosis of the fingers. This is followed by extensive edema of the hand and forearm (within five hours). Extensive injury often includes nerve damage, as the blood supply is sacrificed. Secondary injury with compartment syndrome must be considered and fasciotomies performed to save tissue. Intuition is confirmed that an injection in the brachial artery is associated with more tissue damage than radial or ulnar. (3) Subsequent complications of intra-arterial thiopental injection includes gangrene of fingers, hand, forearm, leading to eventual

Figure 1. Tracing of an aberrant radial artery.

amputation of hand or fingers. Additionally, contraction deformities of fingers and atrophy of antebrachial muscles may occur, in addition to amputation.

Surgical exploration of the affected areas uniformly describes thrombosed portion of artery. If distribution of the anesthetic is spread to muscle, a compartment syndrome is the likely complication; if the agent remains in the vasculature, thrombosis is seen.

Cohen recommended the following steps if this occurs; interestingly, there are few little modifications used today. Sympathetic blockade with brachial plexus block should be performed as soon as possible; heparinization with continuous infusion, as soon as well in light of ongoing/recent surgery; consider general anesthesia for further sympatholysis but avoidance of hypotension to maintain perfusion. Postoperatively recommended is limb elevation, maintaining warmth and consider the use of vasodilators intra-arterially, including papaverine. Surgical exploration to extract thrombus should be considered early. (3)

At this time, the use of thiopental is less common than in the past. However, complications have occurred with other induction agents. Ang (5) describes the course after injection through an aberrant radial artery upon induction with propofol. This can be particularly difficult to diagnose clinically during induction because even intravenous administration can range from painless to significant distress. He noted pain in the hand and blanching of the skin in the distal portion of the hand after 140mg with 2mls of 1% lidocaine. Loss of consciousness occurred quickly; he then noted hyperemia of hand. Arterial cannulation was confirmed by pressure transducer.

Table 1. Treatment recommendations for unintentional radial artery injections:

Leave catheter in place
Consider performing sympathetic block of affected extremity
Heparin 1000 units indwelling in arterial catheter/affected artery
Lidocaine 2ml of 1% indwelling in arterial catheter/affected artery
Phentolamine 5mg
Papavérine 30-65 mg (rarely up to 120 mg); may repeat every 3 hours
Elevation of extremity
Monitoring with pulse oximetry distal to affected area
Careful observation of perfusion to the affected extremity

30 Units of heparinized saline and 2mls of 1% lidocaine were injected through the arterial catheter. The surgery proceeded uneventfully; postoperatively there was a 10cm x5 cm area proximal to injection site that was hyperemic; the forearm and hand became edematous. There was no pain, sensory or motor symptoms. Papaverine was injected around arterial puncture site; an interscalene block with bupivacaine was performed. There were no other sequelae and complete resolution occurred within 12 days.

It appears that the literature supports the treatment plan as outlined by Dr. Cohen 60 years ago and successfully used by Mazumder, (6) outlined in table 1. A method of assessment after unintentional injection and during treatment could be use of pulse oximetry. Software present in pulse oximetry calculates the Perfusion Index (PI) automatically: $PI = (V_{max}-V_{min})/V_{max}$ mean (where V_{max} is the peak velocity; V_{min} is the lowest velocity). (7) Comparison from the affected to non-affected side can assist in assessing the adequacy of sympathetic blockade as well as possibly indicating further intervention (e.g. surgery). This has been shown to be an effective monitor in patients undergoing thoracic endoscopic sympathectomy for hyperhydrosis. (7)

Of course, prevention is better that treatment. What can we do to prevent this from occurring in the first place? It has been recommended that contralateral placement of the tourniquet and blood pressure cuff; confirm presence of intravenous flow prior to injection of medications, (5) palpation for a pulse over what appears to be a vein before cannulation; test dose injection (again, this may not be helpful with propofol); and during injection close observation to the hand distal to injection.

REFERENCES

1. Evans F . Thrombosis after injection of pentothal sodium. Lancet 1939;234(6048):252-3.
2. McCormack LJ, Cauldwell EW, Anson BJ. Brachial and antebrachial arterial patterns; a study of 750 extremities. Surg Gynecol Obstet 1953;96(1):43-54.
3. Cohen SM. Accidental intra-arterial injection of drugs. Lancet 1948;255:361-71;409-16.
4. Iatrou C, Robinson S, Rosewarne F. Inadvertent intra-arterial midazolam. Anaesth Intensive Care 1997;25(4):431.
5. Ang B. Prolonged cutaneous sequelae after intra-arterial injection of propofol. Singapore Med J 1998;39(3):124-6.
6. Mazumder JK, Metcalf IR, Holland AJC. Inadvertent intra-arterial injection of thiopentone. Can Anaesth Soc J 1980;27(4):395-8.
7. Klodell CT, Lobato EB, Willert JL, Gravenstein N. Oximetry-derived perfusion index for intraoperative identification of successful thoracic sympathectomy. Ann Thorac Surg 2005;80(2): 467-70.