

Clinical Reports

Post-cannulation radial artery aneurysm - a rare complication

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The following case report describes an expanding aneurysmal dilatation of the radial artery which developed 17 days following cannulation. Possible causes of this complication are: abnormal state of the vessel wall, multiple attempts at cannulation, and haematoma or infection at cannulation site. Other major and minor sequelae following arterial cannulation are reviewed.

Nous vous présentons un cas de dilatation anévrysmale progressive de l'artère radiale survenue 17 jours après l'insertion d'une canule artérielle. L'athérosclérose de la paroi vasculaire, les multiples tentatives d'insertion de même qu'un hématome et une infection au site de la canule peuvent avoir joué un rôle dans la genèse du problème. Nous passons aussi en revue les autres complications des canules artérielles.

Percutaneous radial artery catheterisation for blood gas monitoring and continuous arterial pressure recording is frequently used in the management of critically ill patients. Radial artery aneurysm is a rare complication of arterial cannulation. One previous case has been documented following cannulation.¹ This report describes an expanding aneurysmal dilatation of the radial artery following cannulation.

Case report

A 78-yr-old farmer was admitted to the Intensive Care Unit with a presumptive diagnosis of tetanus. Past medical history revealed osteoarthritis of the hips and spine. The patient was not taking medications before

Key words

ARTERIES: radial, cannulation;
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FIGURE Aneurysm of the radial artery 17 days following cannulation.

admission to hospital. On admission he was centrally cyanosed, had laboured respiration and had a tachycardia of $130 \cdot \text{min}^{-1}$. Arterial blood was withdrawn from the right radial artery by direct puncture. Blood gas values with FiO_2 0.6 were: $\text{PaO}_2 = 49$ mmHg, $\text{PaCO}_2 = 25$ mmHg, $\text{HCO}_3 = 15$ meq $\cdot \text{L}^{-1}$ base excess = -6.5 , $\text{pH} = 7.4$. The patient's trachea was intubated with an oro-tracheal tube and controlled mandatory ventilation was commenced. An intravenous infusion of midazolam for sedation and vecuronium for neuromuscular blockade was initiated and continued for 21 days. A modified Allen's test at the left wrist was normal and a 20-gauge Vygon (teflon) cannula was introduced percutaneously by direct cannulation, at the second attempt, into the left radial artery under aseptic conditions for continuous blood pressure monitoring and serial blood gas analysis. On the following day a haematoma was noticed at the radial artery cannulation site. Six days later the cannulation site was noted to be infected and the cannula was removed. On the 17th day following radial artery cannulation a pulsating haematoma-like area appeared (Figure). A radial artery aneurysm with a 2 cm diameter was diagnosed clinically. The following day the aneurysm

was resected under local anaesthesia, and the radial artery was ligated. Cultures of the aneurysm obtained prior to resection failed to grow any microorganisms. During the period from initial cannulation of the radial artery to resection of the aneurysm the patient remained haemodynamically stable, and vasopressors were not utilized. A respiratory tract infection did develop which responded to antibiotic therapy. There was no evidence of hypercoagulable state.

Discussion

The anatomy of the arterial supply of the hand has been comprehensively described by Anson and Colman in 1961.² Allen's test was originally described in 1929 for the purpose of evaluating palmar collateral circulation in thromboangitis obliterans.³ In 1973 Bedford and Wollman used a modification of the Allen test to evaluate ulnar artery patency prior to radial artery cannulation.⁴

The radial artery is most frequently chosen for continuous monitoring of blood pressure and for repeated sampling of arterial blood because it is accessible, is easy to cannulate percutaneously and usually has abundant collaterals. There are many reports of ischaemic complications following radial artery cannulation,⁵⁻¹⁰ ranging from mild ischaemia following embolisation to severe ischaemia and gangrene requiring amputation. However, a study by Slogoff on 1699 radial artery cannulations demonstrated that although partial or complete occlusion of the radial artery occurred in 25 per cent of patients following decannulation, no ischaemic injury to the hand or disability occurred in any patient.¹¹ Abnormal flow following decannulation was more common in females, following haematoma formation, and following the use of extracorporeal circulation. In four per cent of patients the Allen test was abnormal prior to cannulation; none had abnormal "Doppler" flow or ischaemia post-cannulation. Neither cannula size or material, nor duration of cannulation were determinants of abnormal flow. The author concluded that the benefits of radial artery cannulation far outweigh its possible risks and that in the absence of peripheral vascular disease the Allen test is not an accurate predictor of ischaemia.

Two methods of percutaneous radial artery cannulation are practised: transfixing, in which both the anterior and posterior wall of the radial artery are deliberately punctured; and direct cannulation, in which the posterior wall is not punctured. A study by Jones *et al.* demonstrated no significant difference between the two methods of cannulation with regard to vessel blood flow and ischaemic sequelae.¹² The Seldinger technique, using a flexible steel guide wire, for radial artery cannulation may also be utilized, although a study by Mortensen demonstrated a

high incidence of complications when this technique was used for cannulation of the femoral artery.¹³

A false aneurysm may develop following trauma, surgery or arteriography; predisposing factors include abnormal state of the vessel wall (atherosclerosis), multiple attempts at cannulation and haematoma or infection at the cannulation site. A radial artery aneurysm is a rare complication of arterial cannulation. In our elderly patient, with significant atherosclerosis of his arterial tree, as demonstrated by significant aortic calcification on x-ray, a false aneurysm developed where the arterial wall was punctured. Injury to the vessel wall resulted in a leakage of blood into the surrounding tissues. In the course of time a saccular cavity developed which became walled off by fibrous tissue and partly lined with endothelium derived from the intima. A rounded pulsating swelling in the line of the radial artery developed, which continued to expand.

Radial artery cannulation is part of the routine management of the critically ill patient to allow continuous assessment of cardiovascular and respiratory parameters. Minor sequelae and rare complications may be minimized by careful attention to detail in the performance of such procedures and care of the patient after cannulation.

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References

- 1 Mathieu A, Dalton B, Fischer JE, Kumar A. Expanding aneurysm of the radial artery after frequent puncture. *Anesthesiology* 1973; 38: 401-3.
- 2 Coleman SS, Anson BJ. Arterial patterns in the hand based on upon a study of 60 specimens. *Surg Gynecol Obstet* 1961; 113: 409-24.
- 3 Allen EA. Thromboangitis obliterans: methods of diagnosis of chronic occlusive arterial lesions distal to the wrist with illustrative cases. *Am J Med Sci* 1929; 178: 237-44.
- 4 Bedford RF, Wollman H. Complications of percutaneous radial artery cannulation: an objective prospective study in man. *Anesthesiology* 1973; 38: 288-96.
- 5 Mangano DT, Hickey RF. Ischemic injury following uncomplicated radial artery cannulation. *Anesth Analg* 1979; 58: 55-7.
- 6 Cannon BW, Meshier WT. Extremity amputation following radial artery cannulation in a patient with hyperlipoproteinemia type V. *Anesthesiology* 1982; 56: 222-3.
- 7 Matthews JJ, Gibbons RB. Embolization complicating radial artery puncture. *Ann Intern Med* 1971; 75: 87-8.
- 8 Wyatt R, Glaves I, Copper DJ. Proximal skin necrosis after radial artery cannulation. *Lancet* 1974; 1: 1135-8.

- 9 Katz AM, Birnbaum M, Moylan J, Pellet J. Gangrene of the hand and forearm: a complication of radial artery cannulation. *Crit Care Med* 1974; 2: 270-2.
- 10 Baker RJ, Chunpraph B, Nyhus LM. Severe ischemia of the hand following radial artery catheterization. *Surgery* 1976; 80: 449-57.
- 11 Slogoff S, Keats AS, Arlund C. On the safety of radial artery cannulation. *Anesthesiology* 1983; 59: 42-7.
- 12 Jones RM, Hill AB, Nahrwold ML, Bolles RY. The effect of method of radial artery cannulation on postcannulation blood flow and thrombus formation. *Anesthesiology* 1981; 55: 76-8.
- 13 Mortensen JD. Clinical sequelae from arterial needle puncture, cannulation, and incision. *Circulation* 1967; 25: 1118-23.