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A Case Report of Radial Artery Pseudoaneurysm After Repeated Radial Puncture for Arterial Blood Gas

Um Caso Clínico de Pseudoaneurisma da Artéria Radial Após Punção Radial Repetida para Realização de Gasometria

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ABSTRACT

Arterial blood gas, with subsequent radial arterial puncture as a simple access point, comprises a ubiquitous medical procedure in the diagnostic workup of patients admitted to the emergency department with dyspnea. Despite being a relatively safe and technically straightforward procedure, due to its considerable use, it is of vital importance to be able to promptly recognize its potential complications. We present the case of a 96-year-old female patient admitted to the emergency department with dyspnea and cough who underwent left radial arterial puncture for arterial blood gas. A total of three puncture attempts were performed until arterial blood was collected. Roughly two weeks upon observation, the patient was readmitted to the emergency department after the insidious appearance of a painful swelling in the left wrist, with progressive worsening since hospital discharge. On physical examination, a painful erythematous pulsatile swelling in the left wrist's volar aspect was observed, and further point-of-care ultrasound evaluation documented a cystic-like collection, communicating with the radial artery's lumen, and suggesting the probable diagnosis of iatrogenic radial pseudoaneurysm. The patient was hospitalized and underwent surgical resection of radial pseudoaneurysm, with subsequent arterial repair. Although severe complications from arterial blood gas have a low incidence rate, prompt diagnosis and management are required. Therefore, point-of-care ultrasound, as an additional diagnostic tool, may play a role in minimizing the risk of procedural complications.

Keywords: Aneurysm, False/diagnostic imaging; Blood Gas Analysis/adverse effects; Emergency Service, Hospital; Point-of-Care Systems; Radial Artery/diagnostic imaging; Ultrasonography

RESUMO

A gasometria arterial, com consequente punção arterial radial enquanto forma simplificada de acesso, constitui um procedimento médico ubíquo na abordagem diagnóstica dos doentes que recorrem ao serviço de urgência por dispneia. Apesar de se tratar de um procedimento relativamente seguro e tecnicamente simples, dada a sua elevada utilização, é especialmente importante ter a capacidade de reconhecer precocemente as potenciais complicações que dele poderão advir. Apresentamos, em seguida, o caso clínico de uma doente do sexo feminino com 96 anos de idade, que foi admitida no serviço de urgência por dispneia e tosse, tendo sido submetida a punção arterial radial esquerda para realização de gasometria arterial nesse contexto. Um total de três tentativas de punção foram efetuadas até colheita de sangue arterial com sucesso. Aproximadamente duas semanas após este episódio de urgência, a doente foi readmitida no serviço de urgência por aparecimento insidioso de tumefação dolorosa ao nível do punho esquerdo, em agravamento progressivo desde a data de alta hospitalar prévia. No exame físico foi documentada uma tumefação dolorosa, eritematosa e pulsátil na região volar do punho esquerdo, com subsequente avaliação por ecografia clínica à cabeceira-do-doente, documentando uma coleção com aparência cística, comunicando com o lúmen da artéria radial esquerda, enquadrável num diagnóstico provável de pseudoaneurisma radial de etiologia iatrogénica. A doente ficou internada e foi submetida a resseção cirúrgica do pseudoaneurisma radial, com subsequente reparação arterial cirúrgica. Embora as complicações severas da gasometria arterial apresentem baixa incidência, o seu diagnóstico deve ser precoce e a sua abordagem célere. Por conseguinte, o uso da ecografia clínica à cabeceira-do-doente, enquanto complemento diagnóstico prontamente disponível, poderá contribuir para minimizar o risco de complicações.

Palavras-chave: Artéria Radial/diagnóstico por imagem; Falso Aneurisma/diagnóstico por imagem; Gasometria/efeitos adversos; Serviço de Urgência Hospitalar; Sistemas Automatizados de Assistência Junto ao Leito; Ultrassonografia

INTRODUCTION

Arterial blood gas (ABG), with subsequent radial arterial puncture as a simple access point, constitutes a ubiquitous medical procedure in the diagnostic workup of patients admitted to the emergency department (ED) with dyspnea.[1]

Due to its ease of access, simple hemostasis and reduced risk of bleeding, the radial artery has been increasingly selected for performing percutaneous procedures with other diagnostic and therapeutic purposes, as it yields comparable results to other vascular access sites, but with fewer procedure-related complications.[2-5]

Despite being a relatively safe and technically straightforward procedure, it is of vital importance being able to promptly recognize its potential complications. Even though pain and regional hematoma are frequently observed, other possible iatrogenic complications include arterial occlusion/perforation, vasospasm, non-occlusive injury, arteriovenous fistulization, nerve damage or arterial pseudoaneurysm (PSA) formation.[1,4,6]

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CASE REPORT

We present the case of a 96-year-old female patient, with prior relevant history of asthma, initially admitted to the ED with dyspnea and cough for two weeks. On physical examination, low peripheral oxygen saturation was detected (86%), as well as globally reduced vesicular murmur in pulmonary auscultation. For this reason, ABG was obtained using a 23-gauge needle with heparinized syringe after a total of three punctures in the left radial artery, with posterior haemostatic compression, displaying slight hypoxemia and hypocapnia. Blood work revealed elevated inflammatory markers with borderline value for high-sensitivity cardiac troponin (reference range < 40 pg/mL), so the patient underwent thoracic computed tomography (CT) scan with pulmonary angiography that depicted bilateral segmental pulmonary embolism. Treatment with low-molecular weight heparin was promptly initiated, and after recovery, the patient was discharged with oral anticoagulation using an anti-Xa factor inhibitor.

Roughly two weeks upon observation, the patient was readmitted to the ED after insidious appearance of painful swelling in the left wrist, with progressive worsening since hospital discharge. On physical examination, a painful erythematous pulsatile swelling in the left wrist's volar aspect was observed, without local signs of skin necrosis nor digital ischemia or neurological deficit (Fig. 1). Further point-of-care ultrasound (POCUS) evaluation documented a cystic-like collection, measuring about 16 mm (height) x 24 mm (width) x 32 mm (length), communicating with the radial artery's lumen, with a visible swirling pattern flow (Figs. 2 and 3). The lesion was easily compressible but refilled rapidly upon decompression, and there was no evidence of thrombus inside. The diagnosis of probable iatrogenic radial PSA due to repeated radial puncture was assumed. The patient was admitted and underwent surgical resection of radial PSA, with subsequent arterial repair. In the operating room, the presence of a vascular lesion of approximately 0.6 cm was confirmed. The patient went on to full recovery with discharge within four days.

Figure 1 – Patient's left wrist with visible erythematous swelling

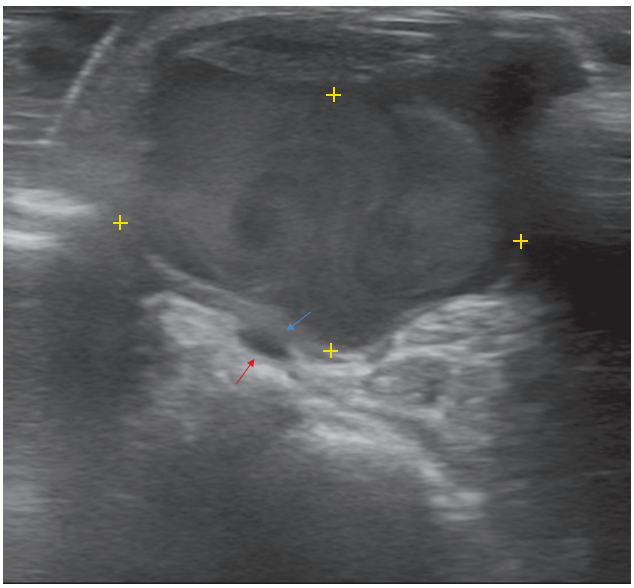

Figure 2 – Short-axis (transversal) view over left wrist swelling. The red arrow indicates the radial artery. The blue arrow pinpoints the vessel wall injury site, communicating with the pseudoaneurysmatic sac. The yellow markers limit the pseudoaneurysm's walls (width: 24 mm, height: 16 mm). A turbulent flow inside the pseudoaneurysm, forming a "yin-yang" sign, is visible.

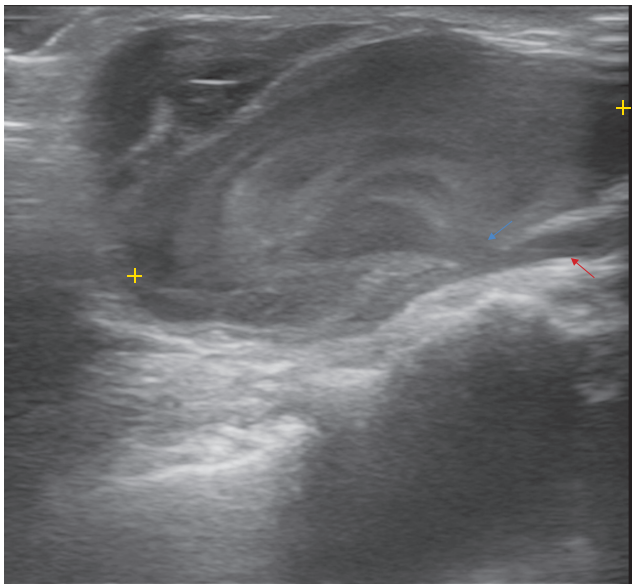

Figure 3 – Long-axis (longitudinal) view over left wrist swelling. The red arrow indicates the radial artery. The blue arrow pinpoints the vessel wall injury site, communicating with the pseudoaneurysmatic sac. The yellow markers limit the pseudoaneurysm's length (32 mm).

DISCUSSION

Iatrogenic radial PSA forms when an incomplete hemostatic plug, at the radial puncture site, leads to extravasation of blood outside the arterial wall, that is contained by a false aneurysmatic sac.[7]

It is a very uncommon complication of radial artery access, with a reported incidence rate of less than 0.1%, when considering cardiac catheterization.[8] However, a higher risk has been linked with multiple arterial punctures, delayed bleeding due to anticoagulation, larger needle/sheath sizes and inadequate post-procedural compression.[4] Furthermore, we believe that vascular ageing and progressive arterial stiffness in elderly patients may also play a role in increasing the possibility of arterial puncture complications, not only by often requiring multiple punctures, but also due to increased vascular frailty, which is particularly enhanced in patients under anticoagulation.

Pseudoaneurysm typically presents as an asymptomatic pulsatile swelling, that develops many days or weeks after arterial puncture. However, more severe presentations with distal ischemia and pain may occur, especially when ulnar collateral circulation is insufficient, which is most frequently seen in the elderly.[4,7,9] Easy compression of the blood-filled sac with subsequent fast refill, as well as, an audible bruit over the swelling are also suggestive of PSA.[7] Prompt POCUS assessment can easily confirm the diagnosis by displaying a pulsatile cystic-like collection with turbulent flow. A 'yin-yang' sign (similar to the traditional Chinese philosophical symbol), and a neck region that bridges communication between the true vessel lumen and the PSA sac are frequently observed on ultrasound. Spectral Doppler with a 'to-and-from' waveform at the neck region of the PSA is also highly suggestive of the diagnosis.[4,7,10]

The natural history of small asymptomatic PSA is spontaneous thrombosis and resolution within a few weeks. Therefore, conservative (serial observation, compression bandages and ultrasound-guided compression) or minimally invasive (ultrasound-guided thrombin injection) management is typically adequate. Symptomatic and larger PSA, with distal ischemia, frequently require surgical correction.[4,7,11,12] Despite PSA being a rare occurrence, controlling the risk factors predisposing to this complication may limit potentially severe consequences. Ultrasound-guided arterial puncture may play a role, particularly in populations like the elderly, with increased vascular frailty, anticoagulation therapy or complex vascular access.

POCUS is revolutionizing the clinical approach to critically ill patients, particularly in emergency scenarios, although its usefulness encompasses every moment of clinical contact. As a whole, it combines traditional clinical skills, that obviously retain their fundamental value, with newer and sophisticated means, allowing better diagnostic and therapeutic results within a shorter timeframe, that is essential in time-sensitive critical conditions, such as hemoperitoneum, cardiac tamponade, massive pneumothorax, among other scenarios. The portability of bedside ultrasound machines also allows us to incorporate this instrument in the clinical workup right at the patient's bedside, performing an evaluation based on clinical problems (we could even call it problem-based ultrasound) instead of the more traditional organ-oriented approach.

The usefulness of POCUS came to light during the SARS-CoV-2 pandemic, in which bedside lung ultrasound enabled resource optimization, and making a swifter diagnosis, while reducing the risk of staff infection.[13,14] Moreover, the value of ultrasound as an adjuvant tool for many invasive maneuvers is well established, leading to improved outcomes and reduced risks.

CONCLUSION

Since ABG, with radial artery puncture, is one of the most frequent procedures in clinical practice, healthcare professionals should be aware of possible complications, including those that are uncommon like PSA, in order to appropriately diagnose and manage them. Point-of-care ultrasound presents itself as a valuable tool to quickly confirm diagnosis and guide management, especially in patients at higher risk of developing complications, while offering the possibility of minimizing risks and improving efficacy, as already seen with other types of ultrasound-guided accesses.

AUTHOR CONTRIBUTIONS

NC, CC: Literature review, draft of the manuscript.
MB: Critical review of the manuscript.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in 2013.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

PATIENT CONSENT

Obtained.

COMPETING INTERESTS

NC has received payment or honoraria for lectures, presentations, speakers' bureaus, manuscript writing or educational events from the School of Medicine of University of Minho and POCUS X – Point-of-care Ultrasound Training

Company; is a member of secretariat of Núcleo de Estudos de Ecografia – Sociedade Portuguesa de Medicina Interna (Ultrasound Study Group of the Internal Medicine Portuguese Society).

All other authors have declared that no competing interests exist.

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REFERENCES

1. Dev SP, Hillmer MD, Ferri M. Arterial puncture for blood gas analysis. N Engl J Med. 2011;364:e7.
2. Kumar AJ, Jones LE, Kollmeyer KR, Feldtman RW, Ferrara CA, Moe MN, et al. Radial artery access for peripheral endovascular procedures. J Vasc Surg. 2017;66:820-5.
3. Mohapatra A, Saadeddin Z, Avgerinos ED, Al-Khoury GE, Hager ES, Eslami MH. Utilization and outcomes of radial artery access for lower extremity endovascular intervention. Ann Vasc Surg. 2021;77:94-100.
4. Bhat T, Teli S, Bhat H, Akhtar M, Meghani M, Lafferty J, et al. Access-site complications and their management during transradial cardiac catheterization. Expert Rev Cardiovasc Ther. 2012;10:627-34.
5. Agostoni P, Biondi-Zoccai GG, de Benedictis ML, Rigattieri S, Turri M, Anselmi M, et al. Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures: systematic overview and meta-analysis of randomized trials. J Am Coll Cardiol. 2004;44:349-56.
6. Russo G, Cherubini A, Fisicaro M, Cioffi G, di Lenarda A. Radial pseudoaneurysm after a puncture for blood gas analysis. Am J Emerg Med. 2016;34:757.
7. Patel KN, Gandhi SP, Sutariya HC. Radial artery pseudoaneurysm: a rare complication after a single arterial puncture for blood-gas analysis. Indian J Crit Care Med. 2016;20:622-6.
8. Sanmartín M, Cuevas D, Goicolea J, Ruiz-Salmerón R, Gómez M, Argibay V. Vascular complications associated with radial artery access. Rev Esp Cardiol. 2004;57:581-4.
9. Collins N, Wainstein R, Ward M, Bhagwandeen R, Dzavik V. Pseudoaneurysm after transradial cardiac catheterization: case series and review of the literature. Catheter Cardiovasc Interv. 2012;80:283-7.
10. Bouch DC, Hall A. Ultrasound diagnosis of a false radial artery aneurysm in ICU. Anaesthesia. 2006;61:1018.
11. Krueger K, Zaehringer M, Strohe D, Stuetzer H, Boecker J, Lackner K. Postcatheterization pseudoaneurysm: results of US-guided percutaneous thrombin injection in 240 patients. Radiology. 2005;236:1104-10.
12. Leone V, Misuri D, Console N. Radial artery pseudoaneurysm after a single arterial puncture for blood-gas analysis: a case report. Cases J. 2009;2:6890.
13. Caroselli C, Blaivas M, Marcosignori M, Chen YT, Falzetti S, Mariz J, et al. Early lung ultrasound findings in patients with covid-19 pneumonia: a retrospective multicenter study of 479 patients. J Ultrasound Med. 2022;41:2547-56.
14. Caroselli C, Blaivas M, Falzetti S. diagnostic imaging in newborns, children and adolescents infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): is there a realistic alternative to lung high-resolution computed tomography (HRCT) and chest X-rays? A systematic review of the literature. Ultrasound Med Biol. 2021;47:3034-40.