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Seroma as a rare complication of autologous arteriovenous fistula creation in the forearm of a hemodialysis patient: a case report

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Keywords
renal dialysis; seroma; arteriovenous fistula

Abstract

Aim of the study: Seromas are rarely reported as complications of autologous arteriovenous fistula creation. **Case description:** An 89-year-old woman was hospitalized for hemodialysis and underwent an autologous arteriovenous fistula creation in the forearm. During cephalic vein expansion using a heparinized saline solution, leakage occurred. A suture was placed to control the leakage, and a Penrose drain was inserted. Serosanguineous drainage ceased on postoperative day two; however, a seroma occurred approximately two weeks after the surgery. Follow-up ultrasonography revealed no growth tendency; therefore, excision and aspiration were unnecessary. **Conclusion:** This seroma was associated with postoperative dead space, surgical technique, and patient clinical status. Sufficient preoperative ultrasonographic vascular mapping is required to avoid inappropriate handling of veins and prevent seroma formation. Postoperative ultrasonographic follow-up is recommended due to the future risk of fistula dysfunction and infection associated with seroma enlargement, which may necessitate surgical seroma excision.

Introduction

Postoperative seroma formation often follows axillary dissection for breast cancer treatment or inguinal hernia repair, where dead space is likely to occur[1,2]. During vascular access creation for hemodialysis, seromas occur following expanded polytetrafluoroethylene arteriovenous graft placement due to mechanical properties, predisposing patient factors, and surgical technique[3–5]. However, they are rarely reported in autologous arteriovenous fistula (AVF) creation. Herein, we report a case of seroma formation following autologous AVF creation in the forearm.

Case report

An 89-year-old woman with end-stage renal disease, chronic heart failure, and hepatitis C was hospitalized for uremic encephalopathy. Her medication included carvedilol, spironolactone, and lactulose. She attended our hospital for hemodialysis initiation. Her vital signs on admission were as follows: blood pressure, 136/69 mmHg; heart rate, 69 beats/min; body temperature, 36.6°C; respiratory rate, 16 breaths/min; blood oxygen saturation level, 96% without oxygen administration; Glasgow coma scale score, E3V5M6. Blood-test results are presented in Tab. 1. The uremic encephalopathy improved on day four.

An autologous radio-cephalic fistula was created in the left forearm on day nine, as previously described[6]. A 4-cm skin incision was made under local anesthesia. Heparinized saline solution was injected to expand the cephalic vein before anastomosis creation. Unfortunately, saline leakage from a small branch of the vein occurred. A suture (7-0 Prolene®, Ethicon) was placed five times to control the leakage. The heparinized saline solution was re-injected, and the vein was expanded successfully. A 6-mm side-to-side anastomosis was created using continuous 7–0

Tab. 1. *Laboratory findings on admission*

Blood cell count	
WBC	3,660/μL
RBC	2.95 × 106/μL
Hb	9.2 g/dL
Ht	28.9%
PLT	9.0 × 104/μL
Blood chemistry	
CRP	0.01 mg/dL
TP	5.7 g/dL
Alb	2.5 g/dL
AST	12 U/L
ALT	11 U/L
LDH	150 U/L
T-Bil	0.5 mg/dL
BUN	86.4 mg/dL
Cre	5.69 mg/dL
eGFR	5.90 mL/min
Na	142 mEq/L
K	4.3 mEq/L
Cl	109 mEq/L
Ca	8.7 mg/dL
iP	4.1 mg/dL
HbA_{1c} (NGSP)	5.3%
NH3	96 μg/dL
BNP	659 pg/mL
Coagulation	
PT-INR	1.06
APTT	32.2 sec
Fibrinogen	374.8 mg/dL
Infection	
HBs antibody	Negative
Anti-HBs antibody	Negative
Anti-HBc antibody	Negative
Anti-HCV antibody	Positive
HCV-RNA PCR	5.9 Log IU/mL

BNP – brain natriuretic peptide; HCV – hepatitis C virus; RNA – ribonucleic acid; PCR – polymerase chain reaction

Prolene® sutures (22 sutures in total: 10 and 12 on the anterior and posterior walls, respectively). Oozing was noted in the subcutaneous connective tissue; however, no active bleeding was observed from the anastomosis, radial artery, or cephalic vein. Despite intrawound saline irrigation, the source of bleeding could not be identified. A Penrose drain was inserted to prevent anastomosis compression secondary to postoperative bleeding. The incision was closed with vertical mattress sutures and covered with hydrocolloid dressing. The patient was pain-free after the two-hour procedure.

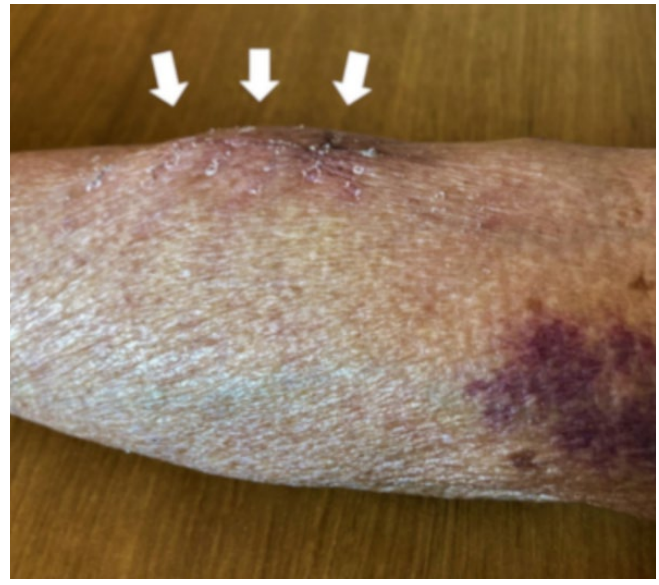

Fig. 1. *Appearance of the left forearm: a raised mass was observed under the wound (white arrows)*

A low-pitched and continuous thrill was detected. Serosanguineous drainage ceased on postoperative day two (hospital day 11), and the drain was removed (total drainage: 5–10 mL). The wound healed without infection, and the sutures were removed on postoperative day eight (hospital day 17). However, an immobile soft mass was palpable under the wound on postoperative day 13 (hospital day 22) (Fig. 1). Ultrasonography revealed an avascular anechoic mass with a fibrous capsule above the anastomosis (Fig. 2). Abscess formation was unlikely, as no infectious symptoms were observed. These ultrasonographic findings were suggestive of a seroma. Follow-up ultrasonography revealed no increase in size (Fig. 3); therefore, excision and aspiration were deemed unnecessary. The AVF could be used for hemodialysis without complications (flow volume, 474 mL/min; resistivity index, 0.49). The patient was discharged on postoperative day 27 (hospital day 36). A schematic outline is shown in Fig. 4.

Discussion

Postoperative seroma formation is associated with dead space[1–2]. Seromas post autologous AVF creation have been reported following more complex procedures such as upper-arm basilic vein transportation and femoral vein harvest[7–8]. The incision is larger in these procedures; therefore, dead space creation is more likely. As the incision size was only 4 cm in our case, seroma formation was unexpected.

The etiology of our patient's seroma had three possible explanations.

First, dead space might have been generated by fluid accumulation under the wound or drain insertion site. Fine anastomotic sutures prevented active bleeding from the

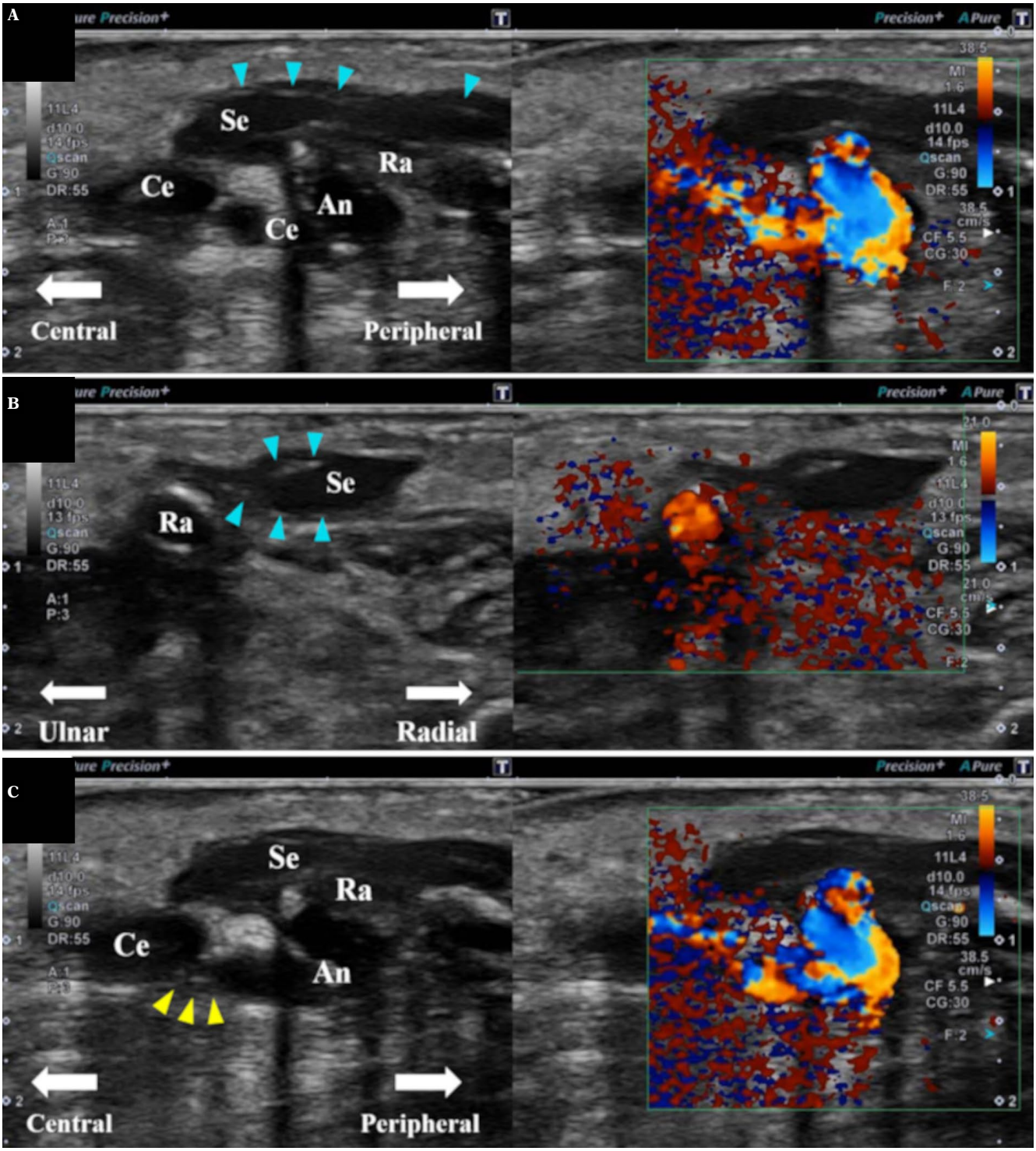

Fig. 2. *Ultrasonographic findings on postoperative day 13 (hospital day-22):* ***A.*** *long-axis and* ***B.*** *short-axis color Doppler image showing an anechoic mass without blood flow immediately above the anastomosis. In both images, a fibrous capsule around the mass was shown (cyan arrowheads).* ***C.*** *long-axis image showing a ligation-induced venous stenosis 1.3 mm in diameter (yellow arrowheads). (Se: seroma, Ra; radial artery, An: anastomosis, Ce: cephalic vein)*

AVF; however, the intraoperative oozing was attributed to several risk factors for bleeding (uremia, anticoagulant use during hemodialysis, and chronic hepatitis-induced thrombocytopenia). The dead space may have been generated in the space originally occupied by the serosanguineous fluid or Penrose drain, following its removal when the drainage spontaneously ceased.

The second possible cause is extravascular plasma leakage. A single suture was placed on a small branch during

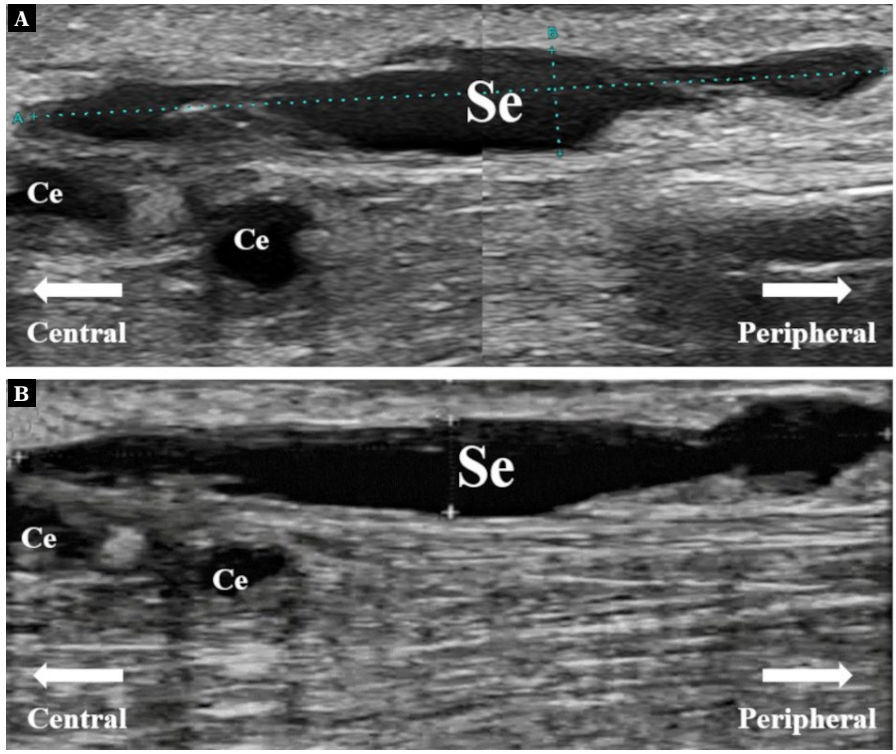

Fig. 3. *Initial and follow-up ultrasonography:* ***A.*** *on postoperative day 13 (hospital day 22) and* ***B.*** *postoperative day 26 (hospital day 35) showing little changes in size or echogenicity. (****A****: 4.0 cm × 1.5 cm × 0.5 cm,* ***B****: 3.7 cm × 1.4 cm × 0.5 cm) (Se: seroma, Ce: cephalic vein)*

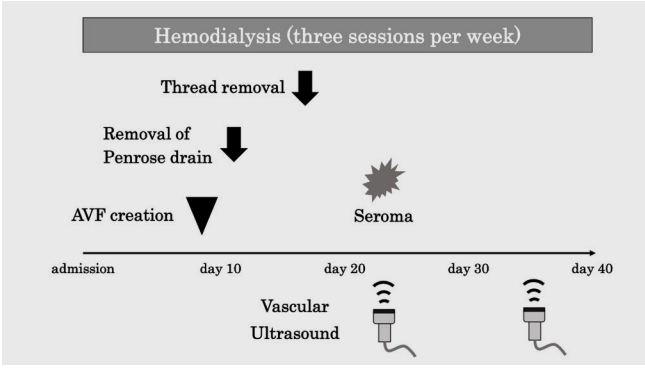

Fig. 4. *Timeline of the clinical course*

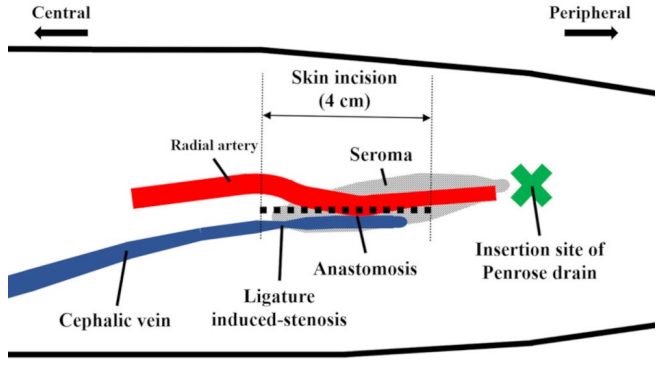

Fig. 5. *Schematic illustration of the arteriovenous fistula and seroma*

cephalic vein expansion, and venous stenosis (1.3 mm) was observed postoperatively (Fig. 2C). Plasma leakage might have occurred due to vascular injury at the ligation point or stenosis-induced elevated intravascular pressure. Indeed, the seroma extended from the ligation point, across the anastomosis, to the drain insertion point (Fig. 5).

The third possible etiology of seroma formation was hypoalbuminemia secondary to malnutrition and chronic hepatitis, which caused plasma leakage into the extravascular space.

Significant stenosis is defined as a vascular diameter (<2 mm) or higher peak systolic velocity (>500 cm/s)[9–10]. In our case, the diameter of the ligation-induced venous stenosis was 1.3 mm, and its peak systolic velocity was 544 cm/s; thus, the stenosis had the potential to reduce AVF performance. Interventional or surgical therapy was unnecessary during hospitalization, as follow-up ultrasonography demonstrated preserved AVF function. However, periodic ultrasonographic follow-up was required after discharge because the patient was at risk of long-term AVF failure.

Although fluid was not aspirated or examined, two facts support the diagnosis of seroma. First, ultrasonography revealed fluid collection, suggesting a hematoma or seroma. Conventionally, ultrasonographic characteristics of a hematoma depend on when it is imaged; hyperacute hematomas are often anechoic (1–3 days) and become hypoechoic when acute (3–7 days), heteroechoic when subacute (7 days to 3 months), and hyperechoic when chronic

(3–5 months). Contrastingly, a seroma often remains anechoic[11–13]. In this case, initial ultrasonographic findings were compatible with a seroma and hyperacute hematoma (Fig. 3A); however, the echogenicity of the mass did not change over time (Fig. 3B), supporting the diagnosis of a seroma. Second, infection and malignancy were clinically ruled out.

In summary, the patient developed a seroma due to postoperative dead space, the surgical technique, and her clinical status. Seroma formation could have been prevented if the small branch of the cephalic vein had not been overlooked. Sufficient preoperative ultrasonographic vascular mapping is required to avoid inappropriate handling of veins. Postoperative ultrasonographic follow-up is recommended for post-autologous AVF seromas due to the risk of AVF dysfunction and infection associated with seroma enlargement, in which case, surgical seroma excision should be considered.

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Conflict of interest

The authors do not report any financial or personal connections with other persons or organizations which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

Informed consent

Informed consent was obtained from the participant included in the study.

Author contributions

Original concept of study: TT, KY, MT, NI. Writing of manuscript: TT, KY, MT, NI. Analysis and interpretation of data: TT, KY, MT, NI. Final acceptation of manuscript: TT, KY, MT, NI. Collection, recording and/or compilation of data: TT, KY, MT, NI. Critical review of manuscript: TT, KY, MT, NI.

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