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(CASE REPORT)

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FATAL RIGHT HEART THROMBUS-IN-TRANSIT AT THE END OF HIP HEMIARTHROPLASTY UNDER HYPOBARIC SPINAL ANAESTHESIA IN A FRAIL OCTOGENARIAN WITH A NEGLECTED FEMORAL NECK FRACTURE: A CASE REPORT

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ABSTRACT

Intraoperative massive pulmonary embolism is a rare but catastrophic complication of hip fracture surgery that is easily mistaken for the effects of neuraxial anaesthesia or for bone cement implantation syndrome. We report an 86-year-old man with dementia, severe frailty (Clinical Frailty Scale 7) and a body mass index of 19 kg/m^2, admitted four days after a fall with a displaced (Garden IV) left femoral neck fracture. Preoperative transthoracic echocardiography was normal; no venous Doppler ultrasound was performed, and enoxaparin prophylaxis was started on admission. Cemented hemiarthroplasty was performed under unilateral hypobaric spinal anaesthesia (bupivacaine 5 mg, fentanyl 25 µg) with low-dose noradrenaline, and the 90-minute procedure was haemodynamically stable. During skin closure, the patient developed extreme bradycardia (35 beats/min) with loss of consciousness, followed by cardiac arrest. After return of spontaneous circulation, subxiphoid point-of-care echocardiography showed a large mobile right atrial thrombus prolapsing into a dilated right ventricle, with paradoxical septal motion. Thrombolysis was withheld because of the immediate postoperative context, and embolectomy was discussed with cardiovascular surgeons. A second arrest (pulseless ventricular tachycardia) was reversed by defibrillation, but a third arrest was refractory, and the patient died after 30 minutes of resuscitation. A normal preoperative echocardiogram does not exclude venous thrombosis after delayed presentation; under spinal anaesthesia, sudden bradycardia may be the first sign of massive embolism, and bedside echocardiography is decisive for the diagnosis.

Keywords: Pulmonary Embolism; Hip Fracture; Spinal Anaesthesia; Cardiac Arrest; Point-of-Care Ultrasound; Thrombus-in-Transit

1 INTRODUCTION

Guidelines for hip fracture in older adults recommend surgery within 36 hours of admission, a haemodynamically conservative anaesthetic technique and systematic thromboprophylaxis [1]. Delayed presentation increases venous thromboembolic risk: among elderly patients admitted 48 hours or more after injury, 17.1% already had deep vein thrombosis on admission [2]. Intraoperative massive pulmonary embolism is rare but often fatal, and under neuraxial anaesthesia or cemented arthroplasty it may be misattributed to sympathetic blockade or to bone cement implantation syndrome; point-of-care echocardiography can separate these mechanisms [3,4]. We report a fatal right heart thrombus-in-transit at the end of a cemented hemiarthroplasty under hypobaric spinal anaesthesia.

2 CASE PRESENTATION

2.1 Patient information and clinical findings

An 86-year-old man with known dementia, previously independent at home, was admitted to orthopaedic trauma four days after a fall from standing height (neglected fracture). He had no history of venous thromboembolism. His body mass index was 19.03 kg/m^2, his Clinical Frailty Scale score was 7 (severely frail), and his ASA (American Society of Anesthesiologists) physical status was IV. The patient was conscious (Glasgow Coma Scale 15), eupnoeic, with oxygen saturation of 92% on room air, blood pressure 120/70 mmHg and heart rate 83 beats/min. The left lower limb was shortened and externally rotated; neurovascular examination was normal, and there were no clinical signs of deep vein thrombosis. The timeline of the case is summarised in Table 1 (Day 0: admission).

2.2 Diagnostic assessment

The anteroposterior pelvic radiograph showed a displaced Garden IV fracture of the left femoral neck with proximal migration and external rotation of the femoral shaft, on diffuse bone demineralisation (Figure 1). The chest radiograph showed no consolidation, effusion or cardiomegaly, and an unfolded thoracic aorta (Figure 2). The electrocardiogram showed sinus rhythm, left axis deviation and complete left bundle branch block. Transthoracic echocardiography on Day 0 was normal: left ventricular ejection fraction 65%, non-dilated right cavities, no pulmonary hypertension, and a non-dilated compliant inferior vena cava. No lower limb venous Doppler ultrasound was performed, and D-dimers were not measured. Haemoglobin was 10.7 g/dL, platelets 241 × 10^3/µL, prothrombin time 79% (INR 1.22) and creatinine 13 mg/L. Given the preoperative anaemia, he received 300 mg of intravenous iron sucrose. Enoxaparin 4000 IU once daily was started on admission, and the last dose respected the recommended interval before neuraxial puncture.



Figure 1: Preoperative anteroposterior radiograph of the pelvis and left hip showing a displaced Garden IV fracture of the left femoral neck, with proximal migration and external rotation of the femoral shaft, on diffuse bone demineralisation



Figure 2: Preoperative anteroposterior chest radiograph showing no focal parenchymal consolidation, pleural effusion or cardiomegaly; unfolded thoracic aorta

2.3 Anaesthetic management

Surgery was performed on Day 2 (sixth day after injury) with standard monitoring (non-invasive blood pressure, electrocardiography, pulse oximetry and respiratory rate, without capnography) and two peripheral venous lines. Cefalotin 2 g, calcium gluconate 1 g and tranexamic acid 1 g were given. In right lateral decubitus, spinal anaesthesia was performed with a 25-gauge needle using a hypobaric solution of 0.5% isobaric bupivacaine 5 mg (1 mL) diluted with 1 mL of sterile water, plus fentanyl 25 µg (0.5 mL). No sedation was given, and oxygen was delivered by nasal cannula. Noradrenaline (8 µg/mL) was infused after the spinal injection at 1–10 mL/h. The cemented hemiarthroplasty lasted 90 minutes, with an estimated blood loss of 150–200 mL, 1 L of crystalloid and no transfusion. Heart rate remained at 80–95 beats/min and the lowest blood pressure was 103/56 mmHg, with no event at cementation or reduction.

2.4 Intraoperative cardiac arrest

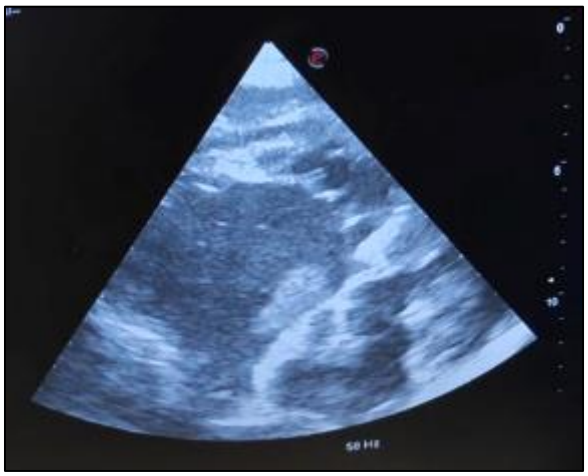


Figure 3: Subxiphoid point-of-care transthoracic echocardiography after return of spontaneous circulation (still frame photographed from the monitor) showing dilatation of the right heart cavities with paradoxical septal motion and a large mobile echogenic thrombus in the right atrium prolapsing into the right ventricle (thrombus-in-transit)

During skin closure, the patient suddenly developed bradycardia at 35 beats/min with loss of consciousness, followed by cardiac arrest. He was turned supine; chest compressions, adrenaline, fluid expansion, orotracheal intubation and a right femoral central line with noradrenaline infusion were instituted. Venous blood gas showed pH 7.33, PCO_2 31.9 mmHg, bicarbonate 16.8 mmol/L, potassium 4.8 mmol/L, ionised calcium 1.27 mmol/L and haemoglobin 12.3 g/dL, excluding haemorrhage and major electrolyte disorders. After return of spontaneous circulation (heart rate 100

beats/min, blood pressure 80/50 mmHg under high-dose vasopressors), subxiphoid point-of-care echocardiography showed a large, mobile, echogenic thrombus in the right atrium prolapsing through the tricuspid valve into a markedly dilated right ventricle, with paradoxical septal motion (Figure 3), in contrast with the normal Day 0 study. Massive pulmonary embolism with a right heart thrombus-in-transit was diagnosed; computed tomography pulmonary angiography was precluded by instability. Thrombolysis was withheld because of the immediate postoperative context, and the cardiovascular surgery team was contacted for embolectomy.

2.5 Outcome

A second arrest with pulseless ventricular tachycardia (230 beats/min) was reversed by external defibrillation. A third arrest was refractory, and death was pronounced after 30 minutes of cardiopulmonary resuscitation. No autopsy was performed.

Table 1: Timeline of the case

Time	Event
Day −4	Fall from standing height; closed trauma to the left hip; no medical care
Day 0 (admission)	Displaced left femoral neck fracture; admission to orthopaedics; enoxaparin 4000 IU/day started
Day 0	Cardiology evaluation: sinus rhythm, complete left bundle branch block; normal transthoracic echocardiography (LVEF 65%, non-dilated right cavities, no pulmonary hypertension)
Day 1	Pre-anaesthetic evaluation: fit for surgery; Hb 10.7 g/dL; iron sucrose 300 mg
Day 2, T0	Unilateral hypobaric spinal anaesthesia (bupivacaine 5 mg + fentanyl 25 µg); low-dose noradrenaline; tranexamic acid 1 g
T0 → T+90 min	Cemented hemiarthroplasty; stable (HR 80–95/min, lowest BP 103/56 mmHg); blood loss 150–200 mL
End of surgery (skin closure)	Bradycardia 35/min, loss of consciousness → cardiac arrest; CPR, adrenaline, intubation, femoral central line
After ROSC	Subxiphoid point-of-care echocardiography: mobile right atrial thrombus prolapsing into a dilated right ventricle, paradoxical septal motion; thrombolysis withheld; cardiovascular surgery contacted
Thereafter	Second arrest: pulseless ventricular tachycardia (230/min) → defibrillation, ROSC; third arrest refractory → death after 30 min of CPR

LVEF: left ventricular ejection fraction; Hb: haemoglobin; HR: heart rate; BP: blood pressure; CPR: cardiopulmonary resuscitation; ROSC: return of spontaneous circulation.

3 DISCUSSION

This patient combined advanced age, severe frailty, dementia and, above all, four days of immobilisation before admission without prophylaxis. In a comparable population (median delay 120 hours), Bengoa *et al.* found deep vein thrombosis on admission in 17.1% and recommended routine venous ultrasound screening after a delay of 48 hours or more [2]. The normal preoperative echocardiogram excluded right ventricular overload at that time but gave no information on the peripheral veins; compression ultrasound was the missing examination, and a proximal deep vein thrombosis would have changed the strategy (therapeutic anticoagulation, discussion of an inferior vena cava filter, timing of surgery) [1,2].

3.1 Imaging diagnosis

Bedside echocardiography was decisive. A mobile, serpiginous thrombus crossing the tricuspid valve, with right ventricular dilatation and paradoxical septal motion on a subxiphoid view, is the signature of embolism from the deep veins. It contrasts with the showers of small echogenic particles of bone cement implantation syndrome, which typically occurs at cementation, prosthesis insertion or reduction [5]. The late onset at skin closure and the single macroscopic thrombus favour a femoral or iliac clot dislodged by hip reduction, limb manipulation or repositioning. The subxiphoid window is often the only one available during resuscitation in a lateral or recently turned patient, and it proved sufficient here.

3.2 Why bradycardia first?

Cardiac arrest under spinal anaesthesia is classically vagal, early after injection and associated with a high block [6]. Here, the low unilateral hypobaric dose, 90 minutes of stability and the late onset argue against this mechanism. Without capnography in a spontaneously breathing patient, the drop in end-tidal CO_2 that signals embolism under general anaesthesia [3] was unavailable, so bradycardia with loss of consciousness was the first sign. Acute right ventricular strain superimposed on the pre-existing left bundle branch block may also have caused high-grade atrioventricular block, although this was not documented.

3.3 Prognosis and treatment

Right heart thrombi, found in about 4% of acute pulmonary embolisms, doubled 14-day mortality in the ICOPER registry (21% versus 11%) [7]. The 2026 AHA/ACC guideline places refractory shock and cardiac arrest in the most severe category and considers systemic thrombolysis, catheter-directed therapy or mechanical thrombectomy reasonable, favouring advanced reperfusion over anticoagulation alone when a free-floating right heart thrombus is present [8]. Recent major surgery, however, is a major relative contraindication to full-dose thrombolysis, leaving surgical embolectomy or percutaneous thrombectomy as alternatives where available; in our setting, the fatal recurrence occurred before they could be implemented.

3.4 Comparison with the literature

Dudaryk *et al.* documented a right atrial thrombus during limb manipulation, treated successfully by catheter-directed thrombolysis [3]; Lee *et al.* reported a fatal embolism after spinal anaesthesia for hip arthroplasty [4]; Li and Cai [9] and Tang *et al.* [10] reported survival after thrombolysis following prolonged immobilisation (Table 2). Our case differs by its late onset under low-dose hypobaric spinal anaesthesia and by the echocardiographic documentation of a thrombus-in-transit after a normal preoperative study. Its limitations are the absence of computed tomography pulmonary angiography and autopsy, and a still frame photographed from the monitor without an archived cine loop.

Table 2: Published cases of perioperative massive pulmonary embolism in proximal femoral fracture surgery compared with the present case

Case	Patient / fracture	Anaesthesia; timing	Imaging	Treatment; outcome
Dudaryk *et al.* 2018 [3]	M 59 y; subtrochanteric fracture (road accident)	General; limb manipulation after induction	TTE: RV dilation, septal flattening; TEE: RA thrombus + PFO	Catheter-directed ultrasound-assisted thrombolysis; survived
Lee *et al.* 2011 [4]	F 80 y; femoral fracture, hip arthroplasty	Spinal (bupivacaine); after spinal block	TEE: RA/RV enlargement; emboli in the left lower lobe arteries	Supportive; died (17 h)
Li & Cai 2023 [9]	M 59 y; femoral fracture (polytrauma), several days of bed rest	General; ~1 h after induction	CT pulmonary angiography: bilateral main pulmonary artery emboli	CPR, IVC filter, thrombolysis; ROSC, discharged against medical advice
Tang *et al.* 2026 [10]	F 85 y; intertrochanteric fracture, 11 days of immobilisation	General; after induction	Echo: RA and RV enlargement	Alteplase 50 mg; survived
Present case	M 86 y; neglected Garden IV femoral neck fracture (6 days)	Unilateral hypobaric spinal; skin closure (end of surgery)	Subxiphoid POCUS: mobile RA thrombus prolapsing into a dilated RV, paradoxical septum	Thrombolysis withheld; embolectomy discussed; died

TTE: transthoracic echocardiography; TEE: transoesophageal echocardiography; RA: right atrium; RV: right ventricle; PFO: patent foramen ovale; IVC: inferior vena cava; CPR: cardiopulmonary resuscitation; ROSC: return of spontaneous circulation; POCUS: point-of-care ultrasound.

4 CONCLUSION

A normal preoperative echocardiogram does not exclude deep vein thrombosis in a frail patient with a neglected hip fracture; venous compression ultrasound should be performed when admission is delayed by 48 hours or more. Under spinal anaesthesia, unexplained late bradycardia should prompt immediate subxiphoid echocardiography, and hospitals should plan a pathway for high-risk pulmonary embolism in the immediate postoperative period.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Ethical approval was not required for this single anonymised case report, in accordance with institutional practice.

Statement of informed consent

Written informed consent for publication of this case report and its images was obtained from the patient's next of kin.

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