CASE REPORT

Fat embolism: a rare cause of perioperative renal transplant dysfunction

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SUMMARY

Fat embolism is a recognised complication of bony injury and orthopaedic surgery, commonly involving the long bones and pelvis. We report on the case of a 68-year-old renal transplant recipient who developed acute kidney injury following surgical stabilisation of metastatic carcinoma of the acetabulum and replacement of the proximal femur. A CT renal angiogram demonstrated a large fat embolus in the inferior vena cava (IVC) and left iliac veins below the level of IVC filter, with impaired renal perfusion. The risks of open or endovascular lipothrombectomy were felt to outweigh the potential benefits. The patient was managed with systemic anticoagulation and prepared for transplant failure. Subsequently, there was spontaneous improvement in urine output and 4 months postoperatively her transplant function had returned to her baseline level and this has remained stable at 1 year postsurgery.

BACKGROUND

To our knowledge this is the first reported presentation of a patient with an inferior vena cava (IVC) filter preventing systemic fat embolism syndrome (FES) post hip surgery but causing acute kidney injury due to transplant renal vascular anatomy. We demonstrate successful conservative management of a fat embolus with systemic anticoagulation alone which led to transplant survival.

CASE PRESENTATION

A 68-year-old woman with a normally functioning renal transplant, presented with a 3-month history of left hip pain. Her medical history included bilateral native nephrectomies for oncocytoma and renal cell carcinoma of the right and left kidneys in 2000 and 2012, respectively. After 4 years on peritoneal dialysis, a deceased donor transplant was successfully performed in 2009 with standard vascular anastomosis to left external iliac artery and vein. Additional medical history included hypertension, osteoarthritis, echocardiographic evidence of severe left ventricular hypertrophy and a deep venous thrombosis of the left calf 10 months prior to the current presentation. She had received 6 months of warfarin therapy for the latter condition.

MRI of the hip demonstrated a 5 cm expansile destructive lesion of the left proximal intertrochanteric femoral region with a further 3 cm lesion in the left superior acetabulum. The imaging was consistent with a metastatic deposit from the renal cell carcinoma. Staging CT of the abdomen

and pelvis excluded further metastatic deposits. On admission, renal function was stable: creatinine 90 µmol/L and urea 5.2 mmol/L; however, corrected serum calcium was raised at 2.67 mmol/L having been in the normal range earlier that year. A CT-guided biopsy was obtained and the histopathology confirmed metastatic disease consistent with clear cell renal carcinoma.

Complex left hip reconstruction was planned. Prior to surgery it was noted that the patient's left leg was swollen. Venous duplex scanning revealed an occlusive thrombus in the popliteal, peroneal and posterior tibial veins extending above the knee. A Bard Denali retrievable IVC filter was inserted into the infrarenal IVC via the right femoral vein to prevent a pulmonary embolus. Angiography demonstrated hypervascular metastases in left proximal femur and acetabulum. Transarterial selective embolisation of both the femoral and acetabular metastases was performed 1 day prior to surgery to reduce intraoperative bleeding. Embolisation of renal metastases is routine in our institution prior to surgery. Embolisation resulted in successful devascularisation of the lesions with no collateral or non-target embolisation.

She underwent uneventful complex left hip reconstruction surgery. The acetabular lesion was stabilised using a cage construct (Stryker, USA) to bypass the lesion after it had been curetted and filled with cement. The destructive proximal femoral lesion was excised en-masse and replaced with a cemented proximal femoral replacement (Stanmore Orthopaedics Ltd, UK). To prevent dislocation, a captured cup was cemented into the cage. A 28 mm femoral head was used. Standard blood loss was noted for this procedure and prior embolisation had been successful in reducing the risk of uncontrolled bleeding. An unfractionated heparin infusion was commenced postoperatively. Despite clinical evidence of euvoaemia and an adequate unsupported blood pressure, severe oliguria and transplant dysfunction developed on the first postoperative day.

INVESTIGATIONS

Obstruction of the urinary tract was excluded by ultrasound. CT angiography of the renal and abdominal vessels revealed a large volume fat embolus in the venous system below the level of the IVC filter (figure 1A). Venous return was impaired with near complete occlusion of the IVC. The transplant renal vein and artery were normally opacified, however there was poor enhancement of the kidney

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Figure 1 (A) The superior and inferior arrows highlight the IVC filter and fat embolus, respectively. Venous phase coronal images. (B) Patchy hypoperfusion of the left iliac fossa renal transplant with patent transplant renal artery (oblique sagittal plane). IVC, inferior vena cava.

in the arterial phase (figure 1B). A small infarct was suggested by a focal area of low density with arterial enhancement. No significant contrast excretion was noted.

TREATMENT

Transplant dysfunction due to venous infarction/venous hypertension secondary to proximal fat embolism obstruction of the IVC/left iliac vein was diagnosed. There was no evidence of pulmonary or systemic fat embolism, and other than transplant dysfunction, the patient remained well. The vascular team considered hybrid endovascular/open venotomy and embolectomy, and simultaneous removal of IVC filter. After appropriate counselling, the patient chose to undergo conservative management in view of the high predicted mortality risk. Therapeutic anticoagulation with unfractionated heparin was continued.

In view of ongoing oligoanuria and stage 3 acute kidney injury, the patient was commenced on continuous venovenous haemofiltration (CVVH) on day 2 postoperatively. Immunosuppression with tacrolimus (Adoport) 3 mg two times daily and prednisolone 15 mg once daily were continued with the intention of planning for elective transplant nephrectomy at a future date.

OUTCOME AND FOLLOW-UP

By 72 hours postoperatively, the urine output started to increase, and renal replacement therapy with CVVH was discontinued on day 5. There was progressive slow improvement in the transplant function. Histology confirmed complete tumour excision. The patient was commenced on chemotherapy and at 12 months postoperatively remains well, with no clinical or radiological

signs of tumour progression. The transplant function remains stable with a serum creatinine of 90–100 $\mu\text{mol/L}$.

DISCUSSION

The term fat embolism can be used to describe any case in which fat globules are found in the peripheral microcirculation or lung parenchyma.¹ Fat embolism is relatively common following significant fractures of bone and indeed has been found in over 90% of trauma patients.² It is rarer in elective orthopaedic surgery. The incidence of fat embolism increases with the number of bones involved, from 1%–3% for a single long bone to 33% of those with bilateral femoral fractures.³ Management is usually supportive only.

Histological evidence confirms that fat globules can cause blockage of blood vessels, however local effects are rarely clinically significant and are likely to be commonly overlooked. Systemic embolisation of fat particles can however result in the potentially fatal condition of FES, first diagnosed clinically by von Bergmann in 1873.⁴ The classic triad of features include hypoxaemia, neurological abnormalities and a petechial rash, and can present from 12 hours to 2 weeks following injury.⁵ Pulmonary involvement occurs in approximately 75% of patients⁶ and is often the earliest manifestation, presenting with tachycardia, tachypnoea and hypoxaemia. Since the publication of Gurd's initial diagnostic criteria in 1970,⁷ several further scoring systems have been devised with greater emphasis of pulmonary signs. Mortality from FES is 5%–15%.⁸

Our patient was protected from the development of both pulmonary embolus and FES by the placement of an IVC filter. Vena cava thrombosis and increased risk of recurrent deep vein thromboses are recognised complications of IVC filters. Our patient demonstrated pronounced local effects of venous occlusion as a result of the anomalous anatomy of the renal transplant. Renal vein involvement would be uncommon in the native kidney due to the distal location of the filter within the IVC.

Learning points

- ▶ Major orthopaedic surgery is common in oncology. Fat embolism is a potential complication of such operations.
- ▶ Systemic fat embolism can be avoided by placement of an inferior vena cava (IVC) filter, but this may not prevent fat embolus affecting the anomalous venous drainage after renal transplantation.
- ▶ The position of an IVC filter should take into account unusual venous anatomy (congenital or postsurgical).
- ▶ Conservative management with therapeutic anticoagulation and supportive care may result in excellent recovery of kidney function in renal transplant recipients, as with other patients.

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