VRAM steal syndrome – a unique cause of flap necrosis in chest wall reconstruction

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ABSTRACT

The pedicled vertical rectus abdominis myocutaneous (VRAM) flap is a robust flap, which is considered to be a 'workhorse' regional option for chest wall reconstruction. We describe a previously unreported complication of partial flap loss due to 'steal syndrome', whereby arterial supply was diverted away from the flap due to dialysis from an ipsilateral arteriovenous fistula.

KEYWORDS

Steal syndrome – Coronary artery bypass grafting – Arteriovenous fistula – Pedicled flap – Rectus abdominis

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Background

The pedicled vertical rectus abdominis myocutaneous (VRAM) flap is a robust flap, which is considered to be a 'workhorse' regional option for chest wall reconstruction. We describe a previously unreported complication of partial flap loss due to 'steal syndrome', whereby arterial supply was diverted away from the flap due to dialysis from an ipsilateral arteriovenous fistula, which is thus far undescribed in the medical literature.

Case history

A 50-year-old man with end stage renal failure and ischaemic heart disease who was dependent on renal dialysis underwent coronary artery bypass grafting while awaiting a kidney transplant. His dialysis was performed thrice weekly via an arteriovenous fistula sited in his left antecubital fossa. His comorbidities included type II diabetes, ischaemic heart disease, end stage renal failure and morbid obesity.

The right internal mammary artery was used as the donor vessel for bypass instead of the usual left internal mammary artery as 'coronary steal syndrome' is an established entity in dialysis patients who undergo this procedure with an ipsilateral fistula. The contralateral internal mammary artery is therefore selected to avoid this complication. Postoperatively, the patient developed a sternal dehiscence, leaving a complex, full-thickness defect measuring 20 x 15 cm. This defect was initially treated with debridement and negative pressure therapy. Once the exudate reduced and the wound became cleaner, a reconstruction was undertaken.

The initial plan included a pedicled omental flap; however, given his comorbidities and recent ventilator-acquired

pneumonia, the morbidity associated with entering the abdomen was thought to be too great. Free flap reconstruction was not an option given his multiple comorbidities and the requirement for a relatively long anaesthetic time. Bilateral pectoralis major flaps were considered to be futile owing to the inferior location of the defect. A left-sided pedicled VRAM flap was therefore selected for reconstruction, given the relatively short anaesthetic and surgical time and the considerable tissue bulk required to fill the defect. The flap was raised on the superior pedicle in the traditional manner and the deep inferior epigastric artery was isolated. This was clamped off for 20 minutes to ensure that the flap remained perfused via the superior epigastric pedicle when disconnected distally. The deep inferior epigastric artery was then divided and the flap rotated on its superior epigastric artery pedicle, which arises from the left internal mammary artery.

In the early postoperative period, the flap remained well perfused. The patient was monitored on the intensive care unit and received haemofiltration via a central venous catheter rather than his arteriovenous fistula. On day 7 he was transferred to the renal ward and dialysis via the arteriovenous fistula was recommenced. He had dialysis for two to three hours three times a week. During this period the superior aspect of the flap, furthest from the blood supply, underwent slow necrosis of skin and fat resulting in a 7 x 6 cm defect. This was treated with further vac therapy and the wound slowly improved as the flap healed. This episode was highly suggestive of the flap being affected by a steal syndrome, where the arterial input to the flap was diverted towards a lower pressure system created by the arteriovenous fistula (Fig 1).

Discussion and conclusions

Coronary steal syndrome is a phenomenon whereby blood is diverted away from one region of the coronary circulation to another, causing cardiac ischaemia. Most commonly, this is reported when vasodilators act selectively on one portion of the coronary tree. It has also been described in patients with an upper extremity arteriovenous fistula who undergo coronary artery bypass grafting using the ipsilateral internal mammary artery.¹ Both the fistula and the internal mammary artery arise from the subclavian artery and, when the volume of circulation through the fistula increases during dialysis, the fistula can 'steal' blood away from the internal mammary artery. Indeed, studies have demonstrated both reduced two and even retrograde three flow within the internal mammary artery when an ipsilateral arteriovenous fistula is in use, leading to angina and infarction. Cardiac surgeons preferentially use the contralateral internal mammary artery for coronary artery bypass grafting in patients who have an arteriovenous fistula and are undergoing dialysis.

No such phenomenon has been recognised affecting pedicled flap reconstructions. In our patient, the flap remained well perfused for the first week while the patient

was being dialysed through central lines. The progressive flap necrosis that occurred after dialysis through the arteriovenous fistula was re-started, which is highly suggestive of a steal syndrome: we hypothesise that the flow through the left internal mammary artery to the flap was significantly reduced during the periods of dialysis, leading to flap loss.

In such patients, it would be advisable to look for alternative reconstructive options, rather than the ipsilateral internal mammary artery-based reconstruction. We caution against the use of the ipsilateral internal mammary artery as a donor artery for free flap anastomosis. Consideration of turbocharging the flap using the inferior system is also recommended in this patient group.

References

1. Crowley SD, Butterly DW, Peter RH, Schwab SJ. Coronary steal from a left internal mammary artery coronary bypass graft by a left upper extremity arteriovenous hemodialysis fistula. *Am J Kidney Dis* 2002; **40**(4): 852–855.
2. Kato H, Ikawa S, Hayashi A, Yokoyama K. Internal mammary artery steal in a dialysis patient. *Ann Thorac Surg* 2003; **75**(1): 270–271.
3. Gaudino M, Serricchio M, Luciani N *et al.* Risks of using internal thoracic artery grafts in patients in chronic hemodialysis via upper extremity arteriovenous fistula background. *Circulation* 2003; **107**(21): 2,653–2,655.