CASE REPORT

Multidetector CT angiography influences the choice of treatment for blunt carotid artery injury

Andrei M Beliaev,¹ Ian Civil²¹Department of General Surgery, Auckland City Hospital, Auckland, New Zealand²Department of Trauma Service, Auckland City Hospital, Auckland, New Zealand**Correspondence to** Dr Andrei M Beliaev, andreib@adhb.govt.nz

Accepted 21 July 2014

SUMMARY

A 43-year-old woman presented with a 2 h history of left neck pain after striking her neck against a marble bench while playing with her son. The patient was screened for blunt cerebrovascular injury (BCVI) and a left carotid bruit was identified. Subsequently, she underwent multidetector CT angiography (MCTA) of the aortic arch and neck vessels, which demonstrated a flow-limiting dissection of the left common carotid artery (CCA). The patient was started on heparin infusion and underwent an emergency operation. At surgery, a circumferential intimal dissection was excised and the arteriotomy defect closed with an autologous venous patch. This case emphasises the importance of adequately examining patients with direct injury to the neck, screening relevant patients for BCVI and investigating them with MCTA that influences the choice of a treatment option.

BACKGROUND

Blunt cerebrovascular injury (BCVI), a blunt injury to the carotid or vertebral arteries or both, occurs in 0.2–2.7% of blunt trauma patients.^{1 2} The incidence of stroke following BCVI exceeds 60% for blunt carotid artery injury.³ Patients with BCVI have 30% mortality, with 80% of the deaths due to stroke.⁴

Management of patients with BCVI includes antiplatelet therapy, anticoagulation, acute thrombolysis, endovascular mechanical thrombectomy, endoluminal stenting and surgical treatment.^{5–7} At present, there are no prospective randomised controlled trials to determine the best treatment for patients with BCVI.^{3 8} We present a case and emphasise the importance of screening trauma patients for BCVI and discuss an individualised treatment algorithm for blunt common carotid artery (CCA) dissection.

CASE PRESENTATION

A 43-year-old woman presented with a 2 h history of left neck pain after striking her neck against a marble bench while playing with her son. As the patient had a direct blow to the neck she was screened using the Auckland City Hospital protocol for BCVI and a very loud left carotid bruit was identified (box 1).

Subsequently, she underwent multidetector CT angiography (MCTA) of the aortic arch to the mid-cranial level, which demonstrated a flow-limiting dissection of the left CCA at the level of the left transverse process of the C5 vertebra. The dissection was 1.5 cm proximal to the carotid bifurcation

and extended over a length of 1.5 cm (figure 1). Distally, the dissection flap created a true lumen of 2 mm in diameter (figure 2).

The patient was started on a heparin infusion without a loading dose and was immediately transported to the operation room for left CCA exploration. Left CCA arteriotomy revealed a circumferential intimal dissection consistent with compression of the artery against a cervical vertebra. There was a distal dissection flap almost occluding the lumen of the artery (figure 3). The dissection flaps were excised and the distal end of the intima was tacked with 6/0 Prolene sutures. The proximal intimal end was trimmed and not tacked. The autologous great saphenous vein segment was used for patching of the arteriotomy site. The patient was discharged home the next day.

INVESTIGATIONS

Screening of trauma patients with Auckland City Hospital protocol for BCVI, multidetector CT angiography.

DIFFERENTIAL DIAGNOSIS

Blunt neck trauma with and without BCVI.

TREATMENT

Antithrombotic (antiplatelets, anticoagulation) therapy, carotid artery stenting and surgical treatment.

OUTCOME AND FOLLOW-UP

The patient was followed up in an outpatient clinic with Doppler cervical ultrasound. It showed the left CCA, including the repaired portion, was widely patent with no evidence of residual dissection flaps or stenosis. Aspirin was discontinued after 3 months.

DISCUSSION

This case emphasises the importance of screening of neck trauma patients for asymptomatic BCVI and investigating screen positive patients with MCTA. MCTA allows a detailed appreciation of the anatomy of the vascular injury and influences the choice of treatment. In this case, the positive protocol finding of a loud unilateral carotid bruit mandated MCTA.

Optimal imaging for diagnosing BCVI is a subject of ongoing debate. Duplex cervical ultrasound is considered inadequate for diagnosing BCVI.⁹ “Its usefulness as a non-invasive modality is limited by the absence of acoustic windows into the mediastinum, skull base, supra-mandibular and

CrossMark

To cite: Beliaev AM, Civil I. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-200659

Box 1 Auckland City Hospital protocol's screening criteria for BCVI

- ▶ Potential arterial haemorrhage from neck/nose/mouth
- ▶ Cervical bruit and neck tenderness
- ▶ Cervical haematoma
- ▶ Focal or lateralising neurological defect: TIA, hemiparesis, cerebellar/brainstem symptoms, Horner's syndrome
- ▶ Neurological deficit inconsistent with head CT
- ▶ Single bolus intravenous contrast CT chest findings suggestive of proximal BCVI
- ▶ Stroke on CT or MRI
- ▶ HET with displaced mid-face fracture (LeFort II or III)
- ▶ HET with petrous bone fracture
- ▶ HET with cervical ecchymosis
- ▶ Closed head injury consistent with diffuse axonal injury and GCS <6
- ▶ Cervical subluxation or ligamentous injury. C1-C3 fracture.
- ▶ Cervical vertebra fracture involving transverse foramen or body
- ▶ Near hanging with anoxic brain injury
- ▶ Clothes line type injury or seat belt abrasion with significant swelling, pain or altered mental status

BCVI, blunt cerebrovascular injury; GCS, Glasgow Coma Scale; HET, high energy transfer mechanism of injury; TIA, transient ischaemic attack.

intracranial regions.”¹⁰ However, carotid ultrasound can be used for carotid artery injury healing assessment.¹⁰

A four-vessel digital subtraction angiography (DSA) remains the gold standard diagnostic investigation. However, newer diagnostic imaging techniques including MCTA and brain MR angiography are increasingly used. MCTA is recommended for

Figure 1 Multidetector CT angiography showed the left common carotid artery dissection with proximal (a small arrow) and distal dissection flaps (a large arrow).

Figure 2 A reconstructed three-dimensional CT angiography demonstrated a dissection of the left common carotid artery at 1.5 cm proximal to the carotid bifurcation (an arrow).

patients with positive criteria on the Denver protocol for BCVI and if results are inconclusive DSA should be used.⁵ MCTA permits not only diagnosis of BCVI, but also characterises vascular lesions according to Biffi's classification.¹¹ Grade I injury involves arterial wall lesions with wall irregularity, dissection or intramural haematoma with less than 25% stenosis. Grade II injuries have intraluminal thrombus or a raised intimal flap or a

Figure 3 The left common carotid artery exploration revealed an intimal dissection with a long distal dissection flap nearly occluding the lumen of the artery.

dissection or intramural haematoma, which results in at least 25% luminal stenosis. Grade III injuries are characterised by the presence of a pseudoaneurysm. Grade IV injuries demonstrate a complete thrombotic occlusion of the vessel and grade V injuries have radiological evidence of transection and contrast extravasation.

Antithrombotic therapy was thought likely to fail in this patient, because the dissection flaps nearly occluded the artery lumen. Carotid artery stenting was considered to be risky, because it is associated with 2% occlusion and 2% pseudoaneurysm formation rates.⁷ In addition, long-term consequences of carotid artery stenting are yet not known. Surgical treatment was the preferred treatment option, because it restores an arterial blood flow and has an excellent long-term outcome in carotid artery disease.

Learning points

- ▶ Patients with blunt neck trauma with a direct force to the neck should be screened for asymptomatic blunt cerebrovascular injury and if positive investigated with multidetector CT angiography (MCTA).
- ▶ MCTA allows a detailed appreciation of the anatomy of vascular injury and influences the choice of a treatment option.
- ▶ Young healthy patients with a flow-limiting common carotid artery injury can benefit from surgical treatment.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Cook A, Osler T, Gaudet M, *et al*. Blunt cerebrovascular injury is poorly predicted by modeling with other injuries: analysis of NTDB data *J Trauma* 2011;71:114–19.
- 2 Franz R, Willette P, Wood M, *et al*. A systematic review and meta-analysis of diagnostic screening criteria for blunt cerebrovascular injuries. [Review]. *J Am Coll Surg* 2012;214:313–27.
- 3 Miller PR, Fabian TC, Bee TK, *et al*. Blunt cerebrovascular injuries: diagnosis and treatment. *J Trauma* 2001;51:279–85; discussion 85–6.
- 4 Fabian TC, Patton JH, Croce MA, *et al*. Blunt carotid injury. Importance of early diagnosis and anticoagulant therapy. *Ann Surg* 1996;223:513–22; discussion 22–5.
- 5 Burlew C, Biffl W, Moore E, *et al*. Blunt cerebrovascular injuries: redefining screening criteria in the era of noninvasive diagnosis. *J Trauma Acute Care Surg* 2012;72:330–5; discussion 6–7.
- 6 Fields JD, Lutsep HL, Rymer MR, *et al*. Endovascular mechanical thrombectomy for the treatment of acute ischemic stroke due to arterial dissection. *Interv Neuroradiol* 2012;18:74–9.
- 7 Seth R, Obuchowski AM, Zoarski GH. Endovascular repair of traumatic cervical internal carotid artery injuries: a safe and effective treatment option. *AJNR Am J Neuroradiol* 2013;34:1219–26.
- 8 Cothren CC, Moore EE. Blunt cerebrovascular injuries. *Clinics* 2005;60:489–96.
- 9 Bromberg WJ, Collier BC, Diebel LN, *et al*. Blunt cerebrovascular injury practice management guidelines: the Eastern Association for the Surgery of Trauma. *J Trauma* 2010;68:471–7.
- 10 Singh RR, Barry MC, Ireland A, *et al*. Current diagnosis and management of blunt internal carotid artery injury. *Eur J Vasc Endovasc Surg* 2004;27:577–84.
- 11 Biffl WL, Moore EE, Offner PJ, *et al*. Blunt carotid arterial injuries: implications of a new grading scale. *J Trauma* 1999;47:845–53.

Copyright 2014 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow