

CASE REPORT

Endovascular Repair of Bilateral Carotid Dissection in a Near Hanging Victim

Viviana Manuel ^{a,d}, Ryan Gouveia e Melo ^{a,c,d,*}, Ruy Fernandes e Fernandes ^{a,c,d}, Ana Rita Santos ^{b,d}, Luís Silvestre ^{a,c,d}, Emanuel Silva ^{a,d}, Tony Soares ^{a,d}, Luís Mendes Pedro ^{a,c,d}

^a Vascular Surgery Department, Hospital Santa Maria, Centro Hospitalar Lisboa Norte (CHLN), Avenida Prof. Egas Moniz, 1649-035 Lisboa, Portugal

^b Ear, Nose & Throat Department, Hospital Santa Maria, Centro Hospitalar Lisboa Norte (CHLN), Avenida Prof. Egas Moniz, 1649-035 Lisboa, Portugal

^c Faculty of Medicine, University of Lisbon, Avenida Prof. Egas Moniz, 1649-035 Lisboa, Portugal

^d Lisbon Medical Academic Center, Avenida Prof. Egas Moniz, 1649-035 Lisboa, Portugal

Introduction: There is much debate in the literature regarding the management of blunt cervical carotid injuries. This report describes a case of bilateral carotid artery dissection in the very uncommon case of a near hanging victim and the treatment controversies regarding its management.

Report: A 50 year old male patient was admitted after attempted suicide through hanging, having been swiftly rescued by a bystander. On admission, six hours after the event there was no neurological deficit. There was evidence of soft tissue damage related to the rope position, subcutaneous emphysema, and neck swelling. The CT angiogram showed dissection of both common carotid arteries with significant luminal narrowing as well as fracture of the thyroid cartilage; brain injury was excluded. Heparin infusion was started and an endovascular repair with bilateral covered stent placement, requiring coverage of the external carotid artery on the left side, was performed. The vascular procedure was uneventful. The patient was discharged 36 days after the event, on dual antiplatelet drugs and under regular psychiatric and speech therapy care, and is currently alive and well 22 months after surgery with no neurological damage.

Discussion: The choice of treatment was not straightforward as there are no guidelines or consensus around its management. In this case, however, an endovascular repair seemed suitable and the result was optimal, with no neurological damage and a good result after 22 months.

© 2018 The Author(s). Published by Elsevier Ltd on behalf of European Society for Vascular Surgery. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Article history: Received 13 June 2018, Revised 12 August 2018, Accepted 23 August 2018,

Keywords: Carotid blunt injury, Endovascular repair, Near-hanging, carotid dissection

INTRODUCTION

Hanging is the most frequent cause of strangulation in adults¹ and survivors are referred to as “near hanging” victims (NHVs). The gravitational drag of the victim’s body-weight sustained in the neck against a rope results in blunt cervical trauma with damage to neck structures. Injury to cervical vessels is not uncommon, and arterial injury is estimated to be between 2% and 16.1%.¹ Dissection is one form of injury, and usually presents as transverse laceration of the intima, known as the Amussat’s sign.²

Management of blunt cervical carotid injuries (BCCI) has led to much debate in the literature. Endovascular treatment in these patients is controversial³ and reports regarding endovascular treatment of carotid injuries in NHVs are scarce.¹

This is a report of a case of NHV with subsequent bilateral carotid dissection which was treated successfully by endovascular repair.

CASE REPORT

A 50 year old male patient was swiftly rescued by a bystander after attempting suicide by hanging and having sustained blunt neck trauma, and was taken to the local hospital’s emergency department. The patient was transferred to the study hospital and arrived with a six hour delay after the initial event. On admission, he had a GCS of 15, with no neurological deficit, and was intubated for upper airway protection. On initial assessment, there was soft tissue damage and subcutaneous emphysema, neck swelling, and a horizontal abrasion coincident with the rope position (Fig. 1A and B). The CT angiogram showed bilateral contusion and dissection of the common carotid arteries (CCA) with a degree of luminal narrowing measured by CT angiogram of 70% on the right and 80% on the left (Figs. 1B and 2A–C), as well as fracture of the thyroid cartilage; there were no acute findings in the vertebral arteries or cervical spine and brain injury was excluded.

A heparin infusion was started pending endovascular treatment of the carotid lesions.

* Corresponding author. Hospital de Santa Maria – Centro Hospitalar Lisboa Norte, EPE, Serviço de Angiologia e Cirurgia Vascular, Avenida Professor Egas Moniz, 1649-035 Lisboa, Portugal.

E-mail address: ryan@campus.ul.pt (Ryan Gouveia e Melo).

2405-6553/© 2018 The Author(s). Published by Elsevier Ltd on behalf of European Society for Vascular Surgery. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<https://doi.org/10.1016/j.ejvsr.2018.08.003>

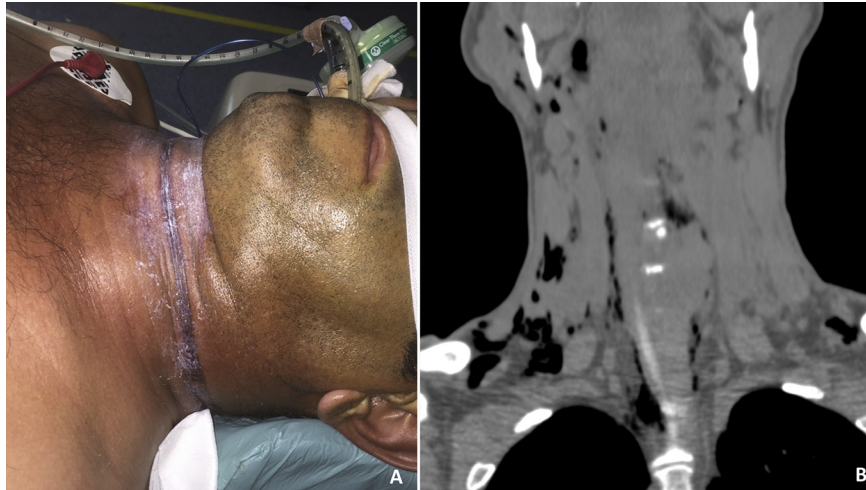


Figure 1. (A) Pre-operative picture showing soft tissue damage and subcutaneous emphysema, neck swelling, and a horizontal abrasion coincident with the rope position. (B) Pre-operative CT angiography showing subcutaneous emphysema and soft tissue swelling.

The procedure was performed in an angiography suite, with the patient under general anaesthesia and systemic heparinisation (as required to achieve a target ACT = 200 seconds).

Right common femoral percutaneous access was obtained. A 7F guiding sheath was initially placed in the proximal descending thoracic aorta. Catheterisation of the CCAs was obtained using a 0.035 floppy hydrophilic guidewire (HighWire, COOK Medical, Bloomington, IN, USA), supported by a 5F Headhunter catheter, and placed in the external carotid artery (ECA). This allowed the placement of a 7F sheath in the CCAs. Then, the internal carotid arteries (ICA) were carefully catheterised using the same guidewire.

On the right side, an 8 × 38 mm covered balloon expandable stent (Advanta V12, Atrium Medical Corporation,

Hudson, NH, USA) was then placed in the distal two thirds of the CCA (Fig. 3A and B). On the left side, however, because of the extent of the dissection which prolapsed into the ICA (Fig. 4A), an 8 × 59 mm covered balloon expandable stent (Advanta V12, Atrium Medical Corporation) was placed in the CCA extending to the ICA, thus excluding the ECA (Fig. 4B).

The thyroid cartilage fracture was managed conservatively with continuous upper airway protection, and no neurological deficit resulted from the procedure.

Post-operatively the heparin infusion was stopped and the patient was started on dual antiplatelet therapy (DAPT) the next day.

Four days after the trauma, an infra-isthmus tracheostomy was performed, and the patient was transferred from the ICU to the vascular surgery ward the next day.

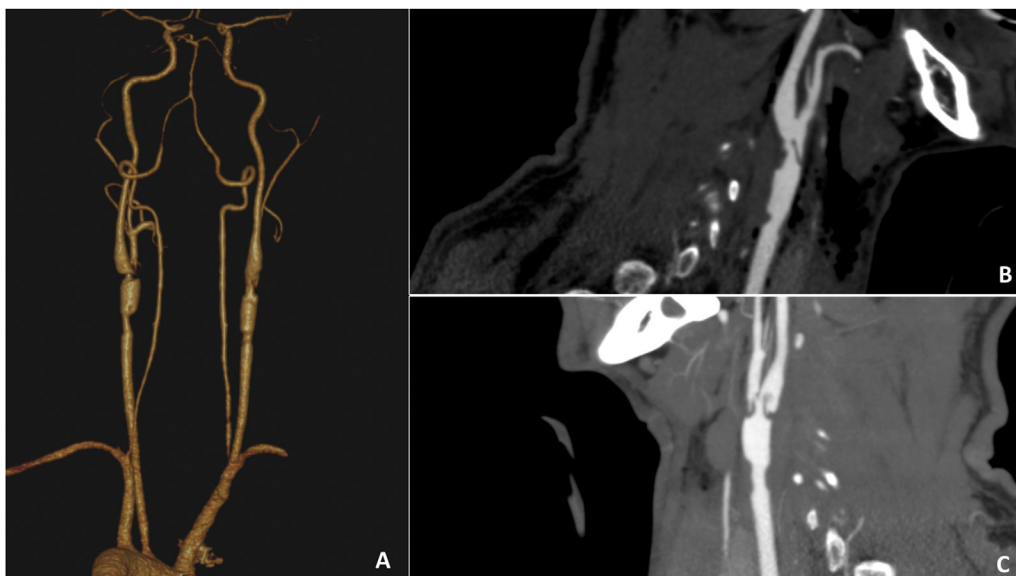


Figure 2. (A) Pre-operative CT angiography showing bilateral contusion and dissection of the CCAs with a high degree of luminal narrowing. (B) Pre-operative CT angiography of the right carotid bifurcation. (C) Pre-operative CT angiography of the left carotid bifurcation.



Figure 3. (A) Intra-operative angiography showing right CCA dissection. (B) Confirmation angiogram after stent placement.

One week after the procedure, the patient developed fever (39°C) and elevated CRP levels. A cervical abscess, anterior to the larynx, adjacent to the thyroid fracture was diagnosed by CT and treated by surgical drainage and appropriate antibiotic therapy. The tracheostomy was removed after 27 days, when all the infection and soft tissue swelling was resolved, thus assuring upper airway safety. The patient was discharged after a total of 36 days on DAPT and under regular psychiatric and speech therapy, for paresis of the right vocal cord. The control CT angiogram showed an optimal result with no complications (Fig. 5A and B) and the patient is alive and well 22 months after surgery with complete recovery of his speech.

DISCUSSION

The true incidence of vascular injuries in hanging victims is unknown, as most do not survive the injury. However, a 2% incidence in non-fatal and a 16.1% incidence in fatal victims of hanging is reported regarding carotid injury.¹

Reports on carotid injuries in NHVs are scarce¹ and a publication bias is recognised, rendering conclusions about the management and outcomes difficult to obtain.

BCCI, in general, has been better discussed in the literature and is a topic of much debate. With the evolving use

of imaging techniques and pre-hospital care, an increased number of these patients are being diagnosed and treated. As a result, BCCI has been reported in 0.1–1.55% of all trauma patients.⁴

Currently, CT angiography is recognised as the best image modality because of the high degree of vascular injury detection and also because it allows the assessment of surrounding tissue damage and surgical planning.⁴

After the diagnosis, treatment options include anticoagulation, antiplatelet agents, open surgery, and endovascular treatment. The selection of which lesions should be addressed by medical or interventional treatment remains controversial.

The rationale for anticoagulation and antiplatelet therapy is to prevent cerebral embolisation from the dissected artery and to prevent occlusion. Systemic heparin is associated with a reduction in the number of strokes and prevents neurological deterioration; however, in many trauma patients the risks of bleeding might outweigh its benefits.⁴ In the present case, as there were no concomitant injuries which increased the risk of bleeding, a heparin infusion was started to prevent thrombosis, embolisation, or occlusion of the injured carotid arteries.

The need for surgery is determined by the thrombogenicity of the injured carotid artery, the state of the collateral

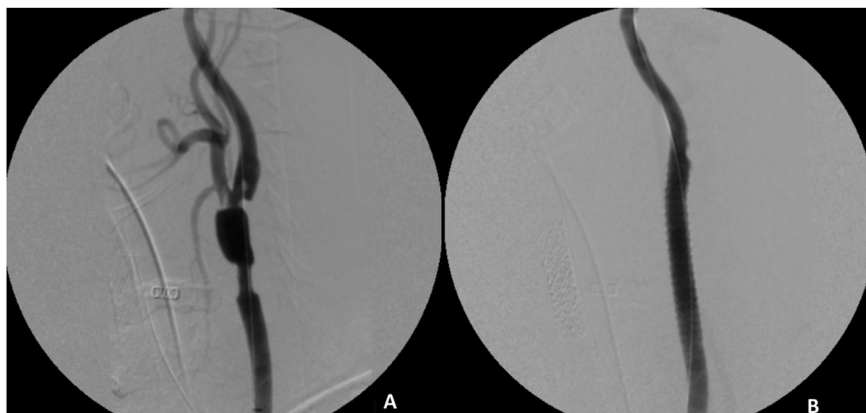


Figure 4. (A) Intra-operative angiography showing left CCA dissection extending into the internal carotid artery. (B) Confirmation angiogram after stent placement with coverage and exclusion of the external carotid artery.

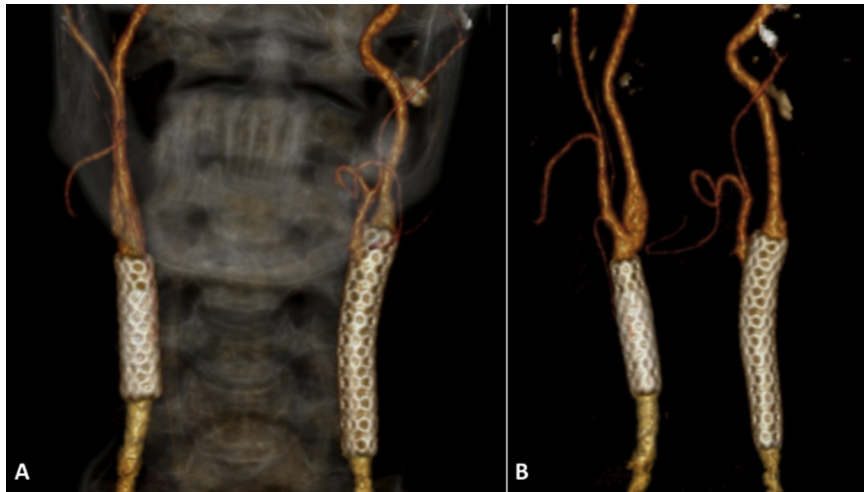


Figure 5. (A) Anterior view of post-operative 3D CT angiogram. (B) Left lateral view of post-operative 3D CT angiogram.

circulation to the brain, the presence of an expanding haematoma, or worsening neurological symptoms despite anticoagulation. Open surgery allows assessment and treatment of concomitant surrounding tissue damage,⁴ and has been shown to have good results with a low stroke rate, but with a high rate of cervical nerve injury.⁵

However, in cases of distal internal carotid artery injury, surgical exposure is difficult, requiring extensive dissection and special exposure manoeuvres³ and also has a higher risk of graft infection given the possibility of concomitant laryngeal injuries.¹ In these settings, endovascular techniques seem technically appealing.

A systematic review to evaluate endovascular strategies for ICA injuries (both blunt and penetrating trauma) from 1994 to 2008, showed the feasibility and safety of these repairs. In this review, 77% of 113 patients were submitted to stenting, with a 76.1% technical success rate, with a follow up patency rate of 79.6% and no treatment related mortality, with new neurological deficits occurring only in 3.5% of patients.⁶

The biggest controversy, however, exists between medical treatment alone versus intervention, as antithrombotic therapy alone seems adequate for most of the BCCI and stenting might increase the potential risk of stroke or related complications.^{7,8}

Berne et al. compared early anticoagulation alone with stenting for Grade III BCCIs and showed no procedure related mortality or in stent thrombosis in the intervention group, suggesting the safety of intervention in these patients.⁹

In this regard, most authors suggest use of selective stenting in patients with enlarging pseudoaneurysms or dissections with significant narrowing.³

Some authors consider that the acutely injured internal carotid artery should not be manipulated within 48–72 hours of the event because of the thrombotic and embolic risk.¹⁰ However, most reports agree on immediate treatment, provided no contraindication exists, and choosing it on an individual patient basis, depending on the neurological status, and the morphology of the lesion.^{3,9}

In the present case, immediate stenting was performed. This decision was made because this was a bilateral carotid injury with a high degree of luminal narrowing caused by a severely injured carotid wall, which seemed to increase the risk of cerebral events.

Open surgical repair was also considered, however because a conservative approach regarding the thyroid cartilage fracture was made by the ENT department, the endovascular approach reduced the chances of graft infection.

Although no cerebral protection devices were used, no neurological deficits resulted from the procedure. The decision not to use them was taken because this was an emergency trauma case and these devices have not been used in these settings.

The choice of using covered balloon expandable stents was empirical, to scaffold the lesion and prevent as much of the risk of thrombus embolisation as possible.

The later infection and psychiatric care were responsible for the prolonged hospital stay. As a result of the infection, concern was raised regarding the possibility of stent infection; however, after the antibiotic regimen no signs of infection were present and the patient is alive and well 22 months after surgery.

CONCLUSION

This is a report of a very unusual case of a NHV with bilateral carotid dissection and highlights the possibilities of endovascular procedures in this type of injury, which allowed for a successful repair in a patient at high risk of graft infection and stroke. The lack of available literature and the fact that there are no guidelines meant this was a highly controversial clinical decision.

CONFLICTS OF INTEREST

None.

FUNDING

None.

REFERENCES

- 1 Aspalter M, Linni K, Domenig CM, Mader N, Klupp N, Hölzenbein TJ. Successful repair of bilateral common carotid artery dissections from hanging. *Ann Vasc Surg* 2013;**27**:1186.e7–15.
- 2 Amussat JZ. *Recherches experimentales sur les blessures des artères et des veines. Resume des trois memoires lus à l'Academie royale des sciences*. Paris, France: Dupont; 1843.
- 3 Shahan CP, Sharpe JP, Stickley SM, Manley NR, Filiberto DM, Fabian TC, et al. The changing role of endovascular stenting for blunt cerebrovascular injuries. *J Trauma Acute Care Surg* 2018;**84**:308–11.
- 4 Fusco MR, Harrigan MR. Cerebrovascular dissections: a review. Part II: blunt cerebrovascular injury. *Neurosurgery* 2011;**68**:517–30.
- 5 Attigah N, Kulkens S, Zausig N, Hansmann J, Ringleb P, Hakimi M, et al. Surgical therapy of extracranial carotid artery aneurysms: long-term results over a 24-year period. *Eur J Vasc Endovasc Surg* 2009;**37**:127–33.
- 6 DuBose J, Recinos G, Teixeira PG, Inaba K, Demetriades D. Endovascular stenting for the treatment of traumatic internal carotid injuries: expanding experience. *J Trauma* 2008;**65**:1561–6.
- 7 Laser A, Bruns BR, Kufera JA, Kim AI, Feeney T, Tesoriero RB, et al. Long-term follow-up of blunt cerebrovascular injuries: Does time heal all wounds? *J Trauma Acute Care Surg* 2016;**81**:1063–9.
- 8 CADISS trial investigators, Markus HS, Hayter E, Levi C, Feldman A, Venables G, et al. Antiplatelet treatment compared with anticoagulation treatment for cervical artery dissection (CADISS): a randomised trial. *Lancet Neurol* 2015;**14**:361–7.
- 9 Berne J, Reuland K, Villarreal D, McGovern T, Rowe S, Norwood S. Internal carotid artery stenting for blunt carotid artery injuries with an associated pseudoaneurysm. *J Trauma* 2008;**64**:398–405.
- 10 Biffi WL, Moore EE, Ray C, Elliott JP. Emergent stenting of acute blunt carotid artery injuries: a cautionary note. *J Trauma* 2001;**50**:969–71.