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Carotid Artery Thrombosis Following Blunt Neck Trauma; a Case Report

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Abstract

Introduction: This case emphasizes on the importance of detecting thrombosis and carotid artery injuries and the need for rapid treatment of blunt neck traumas.

Case presentation: A 43-year-old male motorcyclist rider, rode into a rope and suffered blunt neck trauma. At admission to the emergency department (ED), he was fully conscious with Glasgow coma scale of 15. The biochemical tests and X-rays were normal, but initial examination revealed paresthesia in the right-hand fingertips, which exacerbated over the first 24 hours of admission. Doppler ultrasound of the neck arteries and computed tomography (CT) angiography reports showed thrombosis of the right common carotid artery, which spread to the right subclavian and vertebral arteries. Treatment was initiated with heparin injection followed by daily administration of oral warfarin, and seven days later, symptoms were relatively improved.

Conclusion: Considering possible vascular injuries following blunt neck trauma should be kept in mind when dealing with such patients, and necessary physical examination required to rise the impression. By reviewing the literature, it seems that although CT angiography is usually used in screening carotid injuries, this modality appears to have poor sensitivity in this regard, and digital subtraction angiography (DSA) is still considered the gold standard for detecting carotid artery injury.

Key words: Carotid Artery Thrombosis; Multiple Trauma; Neck; Wounds, Nonpenetrating

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INTRODUCTION

Most traumatic carotid artery injuries are caused by sharp objects directly penetrating the neck (1). Following blunt neck trauma, carotid artery injuries cause delayed neurological damage in 0.08-0.86% of cases, with predicted mortality rate of 40% (2, 3). Carotid artery trauma may cause arterial thrombosis and occlusion followed by reduced blood supply to the brain, resulting in cerebral infarction, hemiplegia, and hemiparesis, which are the most common signs of obstruction in carotid and vertebrobasilar arteries (2). On many occasions, these injuries are not diagnosed upon admission to the emergency department (ED), resulting in delayed treatment (4, 5). This report addresses a rare case of thrombosis of carotid and vertebrobasilar arteries following a blunt neck trauma in a 43-year-old man.

CASE PRESENTATION

Two hours before admission to ED, a 43-year-old male motorcyclist rider rode into a rope and was thrown off his motorcycle and suffered trauma to the head, neck and chest. On admission to the ED, he was fully conscious with Glasgow coma scale (GCS) of 15, normal pupil size and normal reaction to the light, stable vital signs, and normal head and neck and abdominal examinations with no pathological problems. Neurological examination at admission to the ED showed paresthesia in his right-hand fingertips with no motor dysfunction, and normal sensory and motor examination of other limbs.

Medical history of the patient showed that he has type II diabetes mellitus treated with insulin twice a day. In initial examinations, blood biochemistry tests, 3D X-ray of the neck and chest X-ray and extended focused assessment with sonography in trauma (e-FAST) were reported normal. The contrast-free head and neck computed tomography (CT) scans were also normal. After initial examinations in the ED, the patient was admitted to the surgery ward for further serial examinations. On the second day of admission, the surgeon noticed that the patient's fingertip paresthesia had spread to his palm. Motor function of the right upper limb was normal and symmetrical to his left upper limb. The head CT scan was repeated and was still normal.

Suspecting neck artery damage, neck artery doppler ultrasound (DUS) was requested. DUS report revealed a large hypo-echo thrombosis in the right common carotid spreading to the right subclavian and vertebrobasilar arteries with reversed blood flow from the left vertebrobasilar artery to basilar artery, but no collateral. Treatment was immediately initiated with intravenous heparin, and the patient was referred to another well-equipped center for CT angiography. The result of CT angiography showed right innominate artery cut off from proximal portion; Right common carotid artery was occluded; Right subclavian artery showed cut off at origin and run off after the origin of vertebral artery; Right vertebral artery was occluded at proximal portion and rest of it fill via left side. Right ICA and ECA showed patent and very poor flow (figures 1, 2 and 3). Left common, internal and external carotid arteries were patent and normal. The patient's brain CT angiography images showed totally intact blood supply to the brain and no evidence of ischemia. Seven days after initiation of intravenous heparin and daily oral warfarin, paresthesia was relatively improved in fingertips. Treatment of the patient with warfarin continued after discharge and followed up as outpatient.

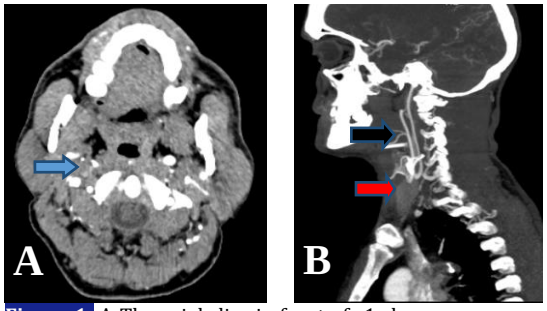

Figure 1: A-The axial slice in front of c1 shows very poor flow in right internal carotid artery (blue arrow) indicating thrombosis. B-The sagittal view of CT angiography of cervical arteries shows poor blood flow in both internal and external carotid arteries (black arrow) and occlusion in common carotid (red arrow).

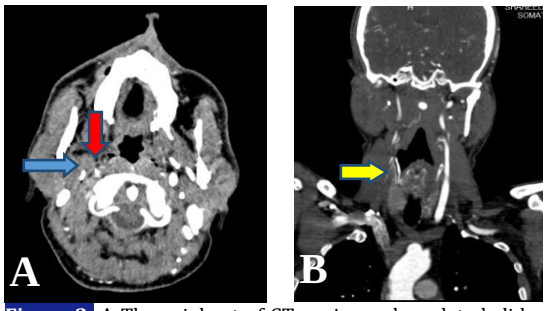

Figure 2: A-The axial cut of CT angiography related slide at the level of c1 above the level of common carotid bifurcation, showing the low blood flow in right internal carotid artery (red arrow) and external carotid artery (blue arrow). B-The coronal view of carotid artery, demonstrating diffuse carotid thrombosis and occlusion in common carotid artery (yellow arrow).

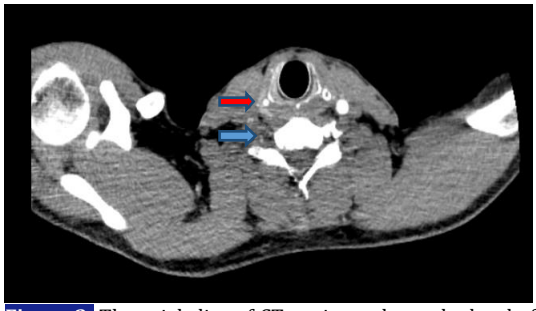

Figure 3: The axial slice of CT angiography at the level of the sixth vertebral body, related to common carotid artery, shows a complete filling defect in right common carotid artery (red arrow) and right vertebral artery (blue arrow).

Discussion

Awareness of the prevalence of the neck artery injuries in patients with face and neck trauma and possibility of their progress has a major role in preventing stroke signs or even death (6).

In both penetrating and blunt neck traumas, prognosis is directly associated with the severity and extent of arterial injury and subsequent neurological disorder. Unlike penetrating trauma (with or without mild focal neurological disorder) where surgery and full recovery is possible, in blunt trauma, signs can be more severe and it is harder to diagnose and manage arterial injury (1, 3). Therefore, the approach to patients with blunt neck trauma is different, and diagnosis of injury is difficult and complex in many cases. Unlike penetrating neck trauma, in which, site of injury is totally visible, in blunt neck trauma, there may be no sign of trauma on the neck, and arterial injury may be diagnosed with progress of neurological symptoms in early hours of injury. Although the signs can be caused by the formation of clot in the damaged arteries and thromboembolism, the cause of delayed onset of neurological symptoms is still unclear (3). The prevalence of carotid artery injury in head and neck traumas is negligible, which delays diagnosis (1, 7).

Blunt neck trauma leads to the incidence of clinical signs in 3-10% of cases (5). Normally, signs and symptoms such as transient ischemic attack (TIA), hemiparesis can indicate ischemia in branches of the carotid artery, but these neurological signs and defects may be attributed to the head trauma in patients with head and neck trauma, hence arterial injury is overlooked (1).

Therefore, all patients with head and neck traumas should be examined for post-traumatic carotid artery injury and brain infarction (2).

Seizure, drowsiness, retrograde amnesia, aphasia, and isolated sensory or motor problems are rare in carotid artery injury (1). Observing any of the above signs in the patient should prompt examining the neck artery lesion with DUS, CT angiography, or angiography, and anticoagulants should be initiated immediately (8).

In the present case, the patient with trauma to head, neck and chest, presented to the ED late. Furthermore, his mild fingertip paresthesia was overlooked in the initial visit and his neurological signs were attributed to head and neck trauma. Therefore, diagnosis and treatment of the extensive right carotid and vertebrobasilar artery thrombosis were delayed, recovery was slow, and response to the treatment was partial.

The delay between blunt carotid artery trauma and onset and progress of neurological symptoms is quite common. Thus, these factors can also delay treatment, as happened in this patient. In most cases, injuries to the neck arteries are asymptomatic, and therefore, life-threatening conditions and their assessment may be overlooked. Delayed diagnosis can lead to morbidity and mortality in patients. The prevalence of neck artery injuries in blunt traumas to neck is negligible and varies from 0.08-0.4% (9). Late diagnosis and treatment of blunt carotid injuries is associated with high rates of ischemic stroke (60%) and mortality (19-43%) in untreated injuries of the external carotid artery, and signs clearly subside with early treatment (10). Injuries of the internal carotid artery have a worse prognosis than those of the external carotid artery, and require rapid and early management and treatment (6).

Four imaging modalities are used in diagnosing blunt carotid injury, including CT angiography, magnetic resonance angiography (MRA), conventional angiography, and DUS. Since failure to diagnose blunt carotid injuries can irreversibly harm the patient, physicians should be fully aware of the advantages and disadvantages of each technique (1, 2, 6, 9). Recent studies have shown that of the 785 specialists in trauma, general surgery, radiology, neurosurgery, and vascular surgery, who treated blunt carotid and vertebrobasilar arterial injuries, 60.5% preferred CT angiogrphy, 22.8% preferred MRA/MRI, 15% preferred angiography, and 1.7% preferred DUS in the first stage of screening for carotid injuries (6). The choice of treatment for arterial injuries resulting from blunt neck trauma depends on the findings of diagnostic techniques, including chest and neck X-rays, bronchoscopy, esophagoscopy, and angiography. CT scan or MRI are used in diagnosis of brain infarction. CT angiogrphy and MRA can be useful in diagnosis of arterial stenosis, thrombosis, occlusion, and separation or tearing of the intima in carotid artery wall (9). Although many studies have referred to CT angiogrphy as a screening tool for neck artery injuries, angiography remains the gold standard for diagnosis of neck artery injuries (6, 9, 11).

Digital subtraction angiography (DSA) facilitates definitive diagnosis and visualization of blunt carotid injury and makes endarterectomy and intervention during angiography possible. This technique is expensive and invasive, and has complications (1% as cited in reliable sources), and not available in all trauma centers (6, 9). DSA is recommended in cases with highly suspected artery injury, or where endarterectomy or concurrent surgery is possible, or when symptoms are inconsistent with DUS or CT angiography findings (9).

As discussed above, blunt neck traumas with carotid artery injury are very rare; However, early diagnosis of injuries and immediate interventions are essential. The injury must be strongly suspected before using CT angiography. This modality was also recommended in previous conducted studies and even CT angiography was preferred over arteriography for faster diagnosis of the injuries (9, 12). It is worth noting that CTA can accurately detect traumatic and non-traumatic neck artery and non-neck artery lesions (9). In many patients with multiple traumas, initially CT scan of the head, chest and abdomen is performed. It appears more logical to perform CT angiography simultaneously with the other CT scans rather than MRA in patients suspected of neck artery injury to save time for a possible vascular surgery (8).

Although Eastern Trauma Association (ETA) and Western Trauma Association (WTA) recommend CT angiography as the initial screening modality, some studies show its poor sensitivity in detecting arterial injuries (6, 11, 13). The benefits of CT angiography include non-invasiveness, availability, and possibility of use in early minutes and hours of assessing trauma patients.

Previous studies have recommended DSA only when CT angiography is abnormal. The exact sensitivity and specificity of CT angiography is not known because normal or false negative CT angiographies have not been confirmed by DSA in

patients with blunt carotid traumas (6). Malhorta et al. performed CT angiography and DSA modalities concurrently in 92 patients with blunt carotid traumas and found that four patients had normal CT angiography and non-normal DSA, and concluded that CT angiography has sensitivity of 67%, specificity of 96%, PPV of 73% and NPV of 95% (14). In a similar study, Dicocco et al. performed CT angiography and DSA concurrently for 684 patients and found that CT angiography was normal in 47 patients (6%) with blunt carotid trauma with complications, and 79% of high-grade arterial injuries had been missed. The author concluded that with inadequate sensitivity of 51%, specificity of 97%, PPV of 43% and NPV of 98%, CT angiography is not appropriate for screening blunt carotid traumas (15). In a meta-analysis by Roberts et al. on 5704 patients with neck traumas undergoing CT angiography, sensitivity and specificity of CTA was estimated at 66% and 97%, respectively (16). Disadvantages of CT angiography include exposure to radiation (especially in children), lack of time for injecting contrast, and artefacts in images due to the presence of metals or dental filling materials. Interpretation of CT angiography is dependent on the radiologist's skill and experience (17).

MRA is also used as a screening technique in blunt carotid traumas. Its main advantage is non-exposure to radiations, making it harmless for children. This technique has adequate sensitivity (50% to 75%) and reliability in detecting carotid injuries. Its drawbacks include unavailability in all health centers, and time-consuming interpretations (18). MRA/MRI is an appropriate and safe technique for detecting arterial injuries, but it is not normally performed in emergency settings as it is often not available and transferring the multiple trauma patients to MRI centers is difficult. Therefore, it is not used as the first line in trauma patients (9).

DUS is not well accepted in assessing neck traumas and lacks adequate sensitivity in detecting carotid artery injuries (38.5%) (17). This technique depends on factors such as operator skill, location of arteries, presence of open wound, progressive hematoma, subcutaneous emphysema, or even pain, and therefore delays surgical intervention (9). This technique is highly operator-dependent and requires accuracy and expertise. Yet, it is used as a modality in patient follow-up (6). Doppler ultrasound differentiates between acute and chronic thromboses. In the acute thrombosis, the vein is dilated by a hypoechoic and large thrombus and shows no or partial compressibility without collaterals. In chronic thrombosis, the vein cannot be fully uncompressed, and an irregular, thin and echogenic thrombus is observed attached to the vein wall with several collaterals (19).

Various modalities can be used to treat carotid artery injuries. Depending on the signs, and size and site of the thrombus, treatment includes observation, administering anticoagulants, ligation of carotid artery with or without intra- or extracranial bypass, restoration, and intravascular interventions. However, most studies have cited the use of anticoagulants to reduce the risk of stroke following thromboembolism in neck artery traumas (1, 5, 6).

Conclusions

Considering possible vascular injuries following blunt neck trauma should be kept in mind when dealing with such patients, and necessary physical examination required to rise the impression. By reviewing the literature, it seems that although CT angiography is usually used in screening carotid injuries, this modality appears to have poor sensitivity in this regard, and digital subtraction angiography (DSA) is still considered the gold standard for detecting carotid artery injury.

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Authors' contribution

All the authors fulfil the criteria of authorship based on the recommendations of the International Committee of Medical Journal Editors (ICMJE).

Conflict of interest

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