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ORIGINAL ARTICLE

Utility of Multidetector Computed Tomography Angiography in evaluation of post traumatic neglected vascular injuries of the upper extremity

Inas M. Elfiki, Tamir A. Hassan *

Radiodiagnosis Department, Faculty of Medicine, Zagazig University, Egypt

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KEYWORDS

MDCTA;
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Abstract *Background:* Vascular injuries of the upper limb are rare, and CT angiography (CTA) may be performed to assess vascular complications in neglected trauma patients.
Objectives: The aim of this study was to evaluate the role of CTA in evaluation of neglected vascular injuries.
Subjects & methods: This prospective study included 20 patients with previous trauma history, with clinically suspected vascular lesion. CTA was done for all patients followed by surgical treatment.
Results: CTA detects pseudoaneurysm in 11 (55%) patients, stenosis in 5 (25%) patients, total occlusion in 2 (10%) patients, and arteriovenous fistula (AVF) in 2 (10%) patients. One patient (5%) had metallic artifact that alters image interpretation. The accuracy of CTA in detecting vascular lesion in the examined patients was 95% with sensitivity and specificity of 95% and 100%, respectively.
Conclusions: MDCT angiography is highly accurate initial noninvasive diagnostic tool for the evaluation of vascular abnormalities of the upper extremity arterial system in patients with suspected neglected extremity trauma. Limitation of CTA examination was the presence of metallic artifact adjacent to the examined arteries.

1. Introduction

Trauma is a great public health dilemma in developing and developed countries and frequently involves young people. Among different kinds of trauma, vascular injuries of the extremities need special consideration because they can be threatening to limb and life. Although the rate of successful management of these injuries has been increased owing to proper pre hospital care, early referral of patients to specialized trauma centers, and proper surgical interventions, these injuries remain a challenging problem, especially in developing countries (1,2).

Traumatic injuries to the axillary and brachial arteries remain rare, representing 15–20% of arterial injuries to the upper extremity (3). Approximately 6% of these injuries are attributable to blunt trauma, with the majority occurring

* Corresponding author.
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fooling fracture-dislocations. Less than 1% of vascular injuries to the upper extremity are associated with a traumatic dislocation alone (4).

Late sequel of untreated vascular injuries includes arterial occlusion, pseudoaneurysm, and arteriovenous fistula (5). The diagnosis of a vascular injury begins with the physical examination. Clinical signs of arterial injury include "hard signs" (such as pulsatile bleeding, increasing hematoma, pulse deficits, distal ischemia, and thrill/bruit due to AVFs) and "soft signs" (such as proximity of the injury to a major artery, stable hematoma, hypotension, and neurological deficit) (5). Physical and ultrasound examinations after trauma to the extremity are reliable means of detecting an occult arterial lesion. Available imaging modalities include conventional angiography (CA), Doppler ultrasound, computed tomography angiography (CTA) and magnetic resonance angiography (MRA). Digital subtraction angiography is considered the gold standard; however, it is invasive benign procedure and not readily available (6–9). The procedure may be time-consuming, delay definitive treatment, and may lead to complications including general contrast toxicity and pseudoaneurysm formation (6–10).

With recent advances in MDCT allowing routine acquisition of sub-millimeter isotropic data sets, CT angiography (CTA) has become a noninvasive alternative to DSA. Combined with standard post-processing techniques, CTA becomes rapid, accurate noninvasive tool for evaluation of the upper extremity arterial vasculature (11). The aim of this study was to evaluate the role of CTA in evaluation of neglected vascular injuries of the upper extremity following trauma in order to identify the presence of lesion, its nature and exact site.

2. Subjects and methods

This prospective study was conducted during the period between June 2012 and December 2014 and included 20 patients with assumed neglected vascular injury in the upper extremity as a consequence of previous trauma. Written consent was obtained from all patients and approval of the medical ethics committee was obtained. All patients were subjected to full history about type of trauma, immediate vascular, orthopedics, neurological or visceral injury. The methods of management of the trauma, appearance of any early complication and hospitalization period were also included. The period between trauma and the emergence of new symptoms was also noted.

Inclusion criteria:

- Any patient with suspected neglected vascular injury in the upper extremity as a sequel of previous trauma.

Exclusion criteria:

- Patients with contraindication for contrast media injection were excluded from the study.

2.1. CTA technique

The selected 20 patients underwent 64-slice MDCT angiography (CT Light speed, GE Healthcare). Circulation time was determined with a timed bolus of 15 ml of omnipaque 350 mg Iodine/ml (Iohexol, GE health care Ireland, Cork, Ireland) and region of interest was placed at the aortic arch. Contrast enhancement was achieved using a bolus of 80 ml of omnipaque 350 mg followed by 40 ml of normal saline injected at 5 ml/s using a 18 gauche cannula at the anticubital fossa in the contralateral extremity. CTA was acquired with detector collimation of 64 · 0.625 mm at 0.625-mm increments and with a gantry rotation time of 0.35 s. The patients were positioned supine, or rolled into posterior oblique (modified swimmers) position with the non-examined arm raised over the head and positioned near the gantry isocenter. Tape was used to immobilize the forearm, and the fingers were spread and taped in a comfortable position to minimize motion artifact.

2.2. Interpretation of CTA

All data were transferred to dedicated workstation (AW 4.6, GE Healthcare). Curved multiplanar reformations (MPR), volume rendered (VR), and maximum intensity projection (MIP) reconstructions were performed interactively. Images were reviewed independently by the radiologists with 10 experiences in CT angiography (CTA) reading. The agreement on the CTA findings was 95% between the two radiologists. In particular, the reading by the two examiners was coincident in 19 of the 20 patients. In this 1 patient, the final diagnosis was agreed after conjoint re-evaluation of the processed images. Any abnormality was documented and compared with the operative finding.

2.3. Surgical management

Surgical management was performed for all patients once vascular injury was diagnosed by CT angiography using open surgical technique, in form of direct artery repair or interposition grafts.

3. Results

The study included 20 patients, they were 15 males (75%) and five females (25%) with male to female ratio 3:1, and their age ranged between 17 and 47 years (mean 23 ± 6 years). Time delay between trauma and the recent presentation ranged from 5 days to 3 years.

The patients presented with localized swelling, sign of distal ischemia and/or pain (Table 1). Selected patients had history

Table 1 Clinical presentation of the 20 patients.

Presentation	Number (%)
Localized swelling	
Pulsatile	3 (15%)
Non pulsatile	1 (5%)
Distal ischemia	
Rest pain	0
Intermittent claudication	0
Coldness of limb	1 (5%)
Pain	0
Redness and hotness	0