Many traumatic and nontraumatic conditions affecting the adult neck may present emergently. A prompt and accurate imaging assessment is vital to patient management in many of these conditions. In this review we will discuss the imaging assessment of both penetrating and blunt vascular and laryngeal trauma, infectious neck emergencies such as supraglottitis and septic thrombophlebitis, and nontraumatic airway conditions that may present emergently such as subglottic stenosis and angioneurotic edema.

Key words: Neck – Emergencies – Trauma – Nontraumatic – Imaging

Introduction

The neck is a complex anatomic area that contains many vital structures in a relatively small area. In this review we will discuss emergencies which affect the adult neck (exclusive of the cervical spine) and their imaging correlates. The major categories that we will cover are trauma (with a focus on vascular and laryngeal trauma), infection, and nontraumatic airway emergencies. As this will bring up a diverse range of pathology, focused anatomic considerations and imaging recommendations will be reviewed in individual sections.

Trauma

Vascular

The carotid and vertebral arteries are vulnerable to injury in the setting of blunt or penetrating trauma. Clinical criteria of vascular injury include a history of arterial bleeding or ongoing arterial bleeding, a large or expanding hematoma, a carotid bruit, decreased or absent carotid or upper extremity pulses, and the presence of neurologic abnormalities secondary to central nervous system ischemia [1]. Types of vascular injury that are commonly encountered include dissection, pseudoaneurysm formation, occlusion, arteriovenous fistula formation, and active hemorrhage with hematoma formation. The primary imaging modality in the setting of vascular trauma is catheter angiography, but in certain situations (see below) there may be a role for computed tomography (CT), CT angiography (CTA), magnetic resonance imaging (MRI), MR angiography (MRA), or duplex ultrasonography.

Penetrating trauma

Penetrating trauma typically results from gunshot or stab wounds and is more likely than blunt trauma to injure vessels. Hemorrhage, shock, and airway compromise secondary to hematoma are major factors causing death after penetrating injury. Central nervous system (CNS) ischemia is also a significant factor in morbidity and/or mortality after penetrating vascular injury. Patients with penetrating trauma should undergo anteroposterior and lateral radiography of the neck with markers on the entrance and exit wounds in order to assess the trajectory of the injury and to look for missile fragments, fractures, and foreign bodies [2]. Noncontrast CT may be indicated to assess injury to structures such as the cervical spine or larynx (see below), or to better assess the trajectory of a missile, but is not generally indicated to specifically assess the vasculature. If a CT
scan is performed, soft tissue infiltration and hematoma may be identified. The CT also provides additional information about the path of injury, which may alter the work-up and prompt angiography. The potential role of contrast-enhanced spiral CTA has not been formally evaluated in the setting of penetrating neck trauma. It has recently been suggested [3] that CTA performs comparably to angiography or surgery in the diagnosis of penetrating vascular injury; however, CTA is limited in fine detail compared with conventional catheter angiography and is also subject to artifacts related to bone, retained metallic foreign bodies, and patient motion.

Angiography is frequently indicated to evaluate vascular injury, but its role is somewhat controversial and in evolution. Angiography is not performed in unstable patients, as they generally require emergent surgery. In stable patients, surgical exploration of all wounds penetrating the platysma was initially suggested in the 1950s in order to avoid missing asymptomatic injuries [4]. Because of a high rate of negative explorations and advances in imaging technology, angiography became the study of choice for all patients with penetrating neck injuries but without signs of arterial injury [5, 6]. However, this led to high utilization of arteriography and a high rate of negative studies.

At present, when considering the need for arteriography in the stable patient with a penetrating neck injury, the neck is divided into three zones (Fig. 1): zone I extends from the clavicle to the cricoid, zone II from the cricoid to the angle of the mandible, and zone III from the angle of the mandible to the base of skull [7]. Note that some authors define zone I as below the level of the sternal notch, with zone II extending from the sternal notch to the angle of the mandible [1], but these minor differences do not affect recommendations. Penetrating trauma to zones I and III usually mandates arteriography since (a) clinical evidence of vascular injury may be lacking because of collateral circulation, and (b) surgical exploration of these regions is difficult because of limitations to providing adequate surgical exposure and their inherent anatomic complexity (Fig. 2) [8]. Zone II is relatively accessible to physical examination, and multiple studies [9–11] have shown that findings on physical examination are good predictors of zone II arterial injury and can exclude injury in over 99% of patients. Some investigators do advocate arteriography in stable patients with zone II injuries and no definite evidence of vascular injury on physical examination if a missile trajectory crosses the path of a major vessel (Fig. 3) [11] or if the injury is transcervical [12]. Duplex sonography has also been proposed to evaluate stable patients with zone II injuries [13].

Additional potential advantages of angiography beyond simply diagnosing vascular injury include generation of a roadmap for the surgeon, temporary control of vascular injuries with balloons while surgical access is being obtained, and definitive control of bleeding in some cases with transcatheter embolization. The latter is particularly useful in zone III injuries and vertebral artery injuries [12] (Fig. 4). Vertebral artery injuries following penetrating trauma are relatively rare compared with carotid injuries. Because the vertebral artery is comparatively inaccessible surgically, however, suspected vertebral injury may be an additional indication for catheter angiography. Vertebral artery dissections or occlusions are usually managed by close clinical observation or possibly anticoagulation if other injuries allow, while pseudoaneurysms, arteriovenous fistulae, and extravasations discovered angiographically are usually managed by transcatheter embolization [14].

When arteriography is performed in the setting of penetrating trauma, the most common findings are dissection, pseudoaneurysm formation, occlusion, and arteriovenous fistula formation. Pseudoaneurysms and arteriovenous fistulae may also present in a delayed fashion, as vascular spasm resolves or narrowed vessels (recanalize). The major angiographic features of carotid dissection are luminal stenosis, intimal flaps, and aneurysmal dilatation [15]. Carotid occlusion complicates 20% of dissections and is usually seen angiographically as a smooth tapering of the contrast column extending 1–3 cm above the carotid bifurcation (Fig. 5). Pseudoaneurysms appear as smooth or irregular contrast collections extending eccentrically from the vessel (Fig. 6), while arteriovenous fistulae result in poor arterial flow beyond the level of the fistulous communication and early filling of venous structures. Zonal anatomic contents and a guide to which vessels should be studied angiographically is provided in Table 1.

The most important clinical sequelae of penetrating vascular injury include hemorrhage and ischemia. Ongoing hemorrhage requires surgical or endovascular intervention to avoid shock and death. CNS ischemic injuries may be difficult to diagnose in the trauma patient.