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Management of Traumatic Neck Injury and Ways of Management in the ED Setting

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ABSTRACT

Background: Neck trauma is a significant presentation in the emergency department. A catastrophic neck injury affect critical tissues, including the airway, digestive tract, and carotid and vertebral arteries. Emergency doctors should be equipped to detect and manage concealed and delayed manifestations of damage associated with neck trauma. This supplement examines advancements and optimal methodologies in the assessment and treatment of patients with cervical injuries. *Methods:* A systematic review was conducted using original studies selected from electronic databases. Eligible articles studied ED diagnostic pathways and management of traumatic neck injury and detected a need for operative intervention, complications, blunt cerebrovascular injury detection, stroke, and mortality. *Results:* we include ten studies include both penetrating and blunt mechanisms. Penetrating neck injury studies advice strategies based on clinical signs and investigations, mandatory exploration was associated with high rates of negative operations in previous studies. Clinical examination show high negative predictive value for injuries requiring repair. For blunt trauma, CTA-based screening identified BCVI that missed by risk-factor criteria alone, and pediatric studies show variationin performance of screening rules. Some of the included studies show the importance of early airway planning in laryngeal trauma. *Conclusion:* Rapid airway control and CTA guided evaluation should be the priority in ED management to support detection of vascular and aero digestive injuries and minimize unnecessary surgery.

Keywords: Penetrating neck trauma, Traumatic neck injury, blunt neck trauma, emergency department, computed tomography angiography

1. INTRODUCTION

A neck injury is a common and serious emergency department presentation. We should do immediate assessment and swift action due to the critical structures present in the neck. The evaluation must be conducted according to ATLS guidelines. An appointment with a trauma department is needed for individuals suspected of having vascular, tracheal, or esophageal injuries (Rincon et al., 2025; Shilston et al., 2021).

The priorities in managing patients with neck trauma are same to those for any patient with a life-threatening disease. The priorities are airway management, ventilation maintenance, bleeding control, and shock treatment. Assess vital signs and evaluate the patient's stability. Patients with cervical injuries possess additional life-threatening conditions that take priority (Alao et al., 2025).

The primary objective is airway stabilization, especially in patients with cervical injuries, while ensuring cervical spine immobilization. Stabilization must be sustained when there is a suspicion of a cervical spine injury. 10% of patients with penetrating neck injuries have airway impairment (Mahmoodie et al., 2012).

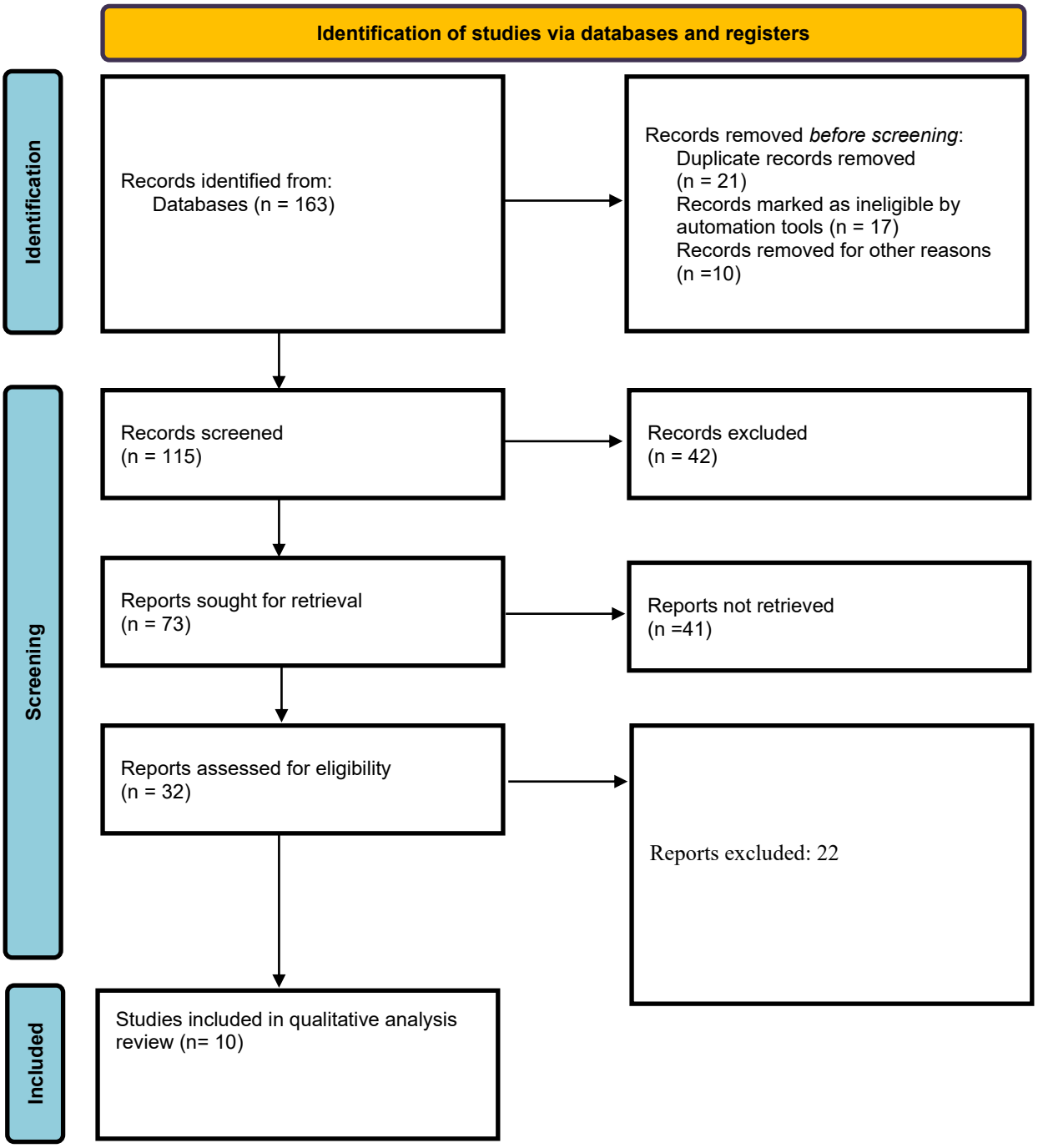

Figure 1: PRISMA consort chart

Direct pressure on the exposed wounds should be done to manage hemorrhage in the emergency room. Wounds exhibiting air suction or bubbling must be occluded with Vaseline-impregnated gauze. Blind probing of the incision and clamping of the vessels

should not be performed in the emergency room. It is crucial to avoid occluding both carotid arteries or obstructing the patient's airway. Refrain against nasogastric tube insertion in individuals with penetrating neck injuries due to the risk for hematoma rupture. The patient's anxiousness during tube insertion induce bleeding (Palmer et al., 2022). As much as 5% of neck traumatic injuries result from blunt force trauma. Motor vehicle collisions are the predominant cause. This occurs when individual impacts the neck against a dashboard or steering wheel (Moonsamy et al., 2018).

Trauma is addressed by a multidisciplinary team of experts, including nurses, physical therapists, nutritionists, social workers, and occupational therapists. Neck injury patients with neurological abnormalities require extended therapy that can last for several months (Tayyab et al., 2025). Patients experience dysphagia due to esophageal damage need a feeding tube. Individuals with a tracheostomy want the assistance of a home care nurse until they are liberated from the tracheal tube. Enhanced results and increased quality of life for these individuals can only be achieved via interprofessional treatment (Kaman et al., 2010). This systematic review analyzed ED management strategies and outcomes in the included studies of traumatic neck injury to inform practical care pathways.

2. REVIEW METHODS

Study design: This systematic review follows PRISMA guidelines. We aimed to analyze original studies in emergency department (ED) evaluation and management strategies for traumatic neck injury, and associated clinical outcomes.

Information sources and search strategy: we collect the included studies from electronic databases (PubMed, PMC, WOS and Scopus). The search strategy includes controlled vocabulary and keywords for traumatic neck injury, penetrating neck injury, blunt neck trauma, laryngeal trauma, blunt cerebrovascular injury, CT angiography, and emergency care.

Eligibility criteria: We included full-text studies that examined ED diagnostic pathways and management of traumatic neck injuries and need for surgical exploration or repair, complications, stroke, mortality, and diagnostic accuracy. Studies were excluded if not directed to traumatic neck injury management or did not give extractable ED outcomes.

Study selection: we initially screened titles and abstracts were screened, followed by full-text eligibility assessment. The final set included in this review includes 10 studies. Study selection process presented in (Fig 1).

Data extraction: we used a standardized extraction form we collect data on study year and setting, design, patient population, sample size, ED diagnostic and management strategy, and reported outcomes including diagnostic accuracy, operative findings, complications, mortality, and stroke.

Risk of bias and synthesis: Newcastle-Ottawa Scale used for cohort studies and QUADAS-2 for diagnostic-accuracy studies. Meta-analysis was not performed for this study because outcomes and designs were not homogeneous.

3. RESULTS

We include ten studies, five about penetrating neck trauma and five on blunt neck injury pathways or blunt associated laryngeal injury (Table 1). Mandatory exploration of patients led to a high proportion of negative explorations (69%) in a Harlem Hospital cohort whereas a selective strategy reduced unnecessary operations and allowed observation of 69 patients without later operative intervention (Table 2).

We found that the most comment injury type was Zone II injury and most patients were young males. In a 10 year single centre series, zone II was involved in 56.3% of cases, of them 52.1% had surgery and the complication and mortality rates were 9.3% and 1.5% respectively. A tertiary ENT led cohort of 66 penetrating neck injuries also found zone II involvement in 43 cases.

A study of 207 ED patients with penetrating neck trauma classified 36.2% as asymptomatic. Any soft sign had high sensitivity (97.4%) and negative predictive value (98.7%) for injuries requiring surgical repair. In a screening cohort assessing CT angiography for BCVI, CT angiography detected a fraction of injuries compared with angiography. A large proportion of BCVI missed if imaging were restricted to patients meeting standard risk-factor criteria (Table 2).

Seat-belt sign alone was not associated with BCVI in one cohort, in patients undergoing neck CT angiography after blunt trauma, it is insufficient single trigger for imaging. In a separate pediatric trauma-system analysis EAST and Utah criteria show high miss rates for BCVI compared with a Denver-based approach. A National Trauma Data Bank analysis of laryngeal trauma characterized ED outcomes, indicate the severity of blunt associated aero digestive injury and the need for early airway management and specialist involvement. The characteristics of the studies included and main findings were presented in Table 1 and table 2 respectively.

Table 1. Characteristics of included studies

Study	Country and setting	Design	Population	Sample size	ED focus
Ayuyao et al., 1985	USA, Harlem Hospital Center	Retrospective cohort	Penetrating neck wounds (stab and gunshot)	257	Mandatory and selective exploration; observation; selective studies as indicated
Mahmoodie et al., 2012	Iran, Alzahra Hospital	Retrospective descriptive-analytical	Penetrating neck trauma	192	Zone-based selective protocol; surgery and conservative management; complications
Isaza-Restrepo et al., 2020	Colombia, Hospital Occidente Kennedy	Retrospective diagnostic-accuracy study	Penetrating neck wounds	207	Clinical exam guiding selective studies, observation and exploration
Puttamadaiah et al., 2022	India, Tertiary care hospital	Retrospective cohort	Penetrating neck injuries	66	Airway-first management; exploration and repair; tracheostomy rates and complications
Nowicki et al., 2018	UK	Clinical guide/review	Penetrating neck injuries		Algorithmic ED evaluation
Miller et al., 2002	USA, trauma screening program	Retrospective screening cohort	Blunt trauma screened for BCVI	Cohort screened; BCVI identified	CT angiography compared with angiography for BCVI screening; stroke prevention context
Harper et al., 2022	USA, trauma system	Retrospective cohort	Blunt trauma with CTA neck screening	17,054 blunt trauma; 4,923 CTA	Routine CTA screening yield; BCVI detection beyond standard risk-factor criteria
Desai et al., 2014	USA, imaging cohort	Retrospective cohort	Patients with blunt trauma undergoing CTA neck	463 CTA; 137 blunt trauma	Seat-belt sign and BCVI association; imaging triggers
Cook et al., 2018	USA, paediatric trauma system	Retrospective cohort	Paediatric blunt trauma with BCVI	7,440 admissions; 96 BCVI patients	Comparison of screening criteria performance
Xu et al., 2023	USA (NTDB)	Registry and database analysis	Laryngeal trauma	6,890	Airway interventions, operative repair patterns, and in-hospital outcomes

Table 2. Main findings relevant to ED management

Study	Key ED management element	Main quantitative finding	Outcomes reported	Implication for ED practice
Ayuyao et al., 1985	Mandatory and selective exploration	Mandatory: 92/134 (69%) explored without injury; selective era: 9/40 (22%) explored without injury; 69 observed without later surgery	Morbidity 5% vs 5.5%; mortality 3% vs 5.5%	Selective exploration reduced non-therapeutic operations while maintaining similar outcomes
Mahmoodie et al., 2012	Zone-based selective management	Zone II 56.3%; surgery 52.1%; exploration positive 84.4%; complications 9.3%; mortality 1.5%	Complications and mortality; operative procedures	Expect vascular injuries; explore for unstable patients and deep injury patterns
Isaza-Restrepo et al., 2020	Soft sign based clinical assessment	Any soft sign: sensitivity 97.4% and NPV 98.7% for injuries requiring surgical repair; 36.2% asymptomatic	Diagnostic accuracy; management pathways	Observation testing is supported when no soft signs are present
Puttamadaiah et al., 2022	Airway-first operative management	Tracheostomy in 44 of 66; zone II injuries 43/66; 2 deaths; vocal cord palsy (19) and tracheal stenosis (15) reported	Airway interventions; complications; mortality	Show the importance of early airway control and ENT surgery involvement
Harper et al., 2022	Routine CTA neck	17,054 blunt trauma; 4,923 CTA	BCVI detection yield;	Restrictive risk-factor screening

	screening for BCVI	neck; 160 patients with 191 BCVI; 16% had no standard risk factors	screening sensitivity by risk criteria	miss BCVI, consider protocolised CTA in selected blunt-trauma populations
Desai et al., 2014	Paediatric CTA triggers	Seat-belt sign alone was not associated with BCVI in the blunt-trauma cohort undergoing CTA	BCVI prevalence; association with clinical signs	Seat-belt sign alone may be insufficient as an imaging trigger without other concerns
Cook et al., 2018	Paediatric BCVI screening criteria	EAST and Utah screening tools had high miss rates for BCVI compared with a Denver-based approach	Missed-injury proportions by screening rule	Use criteria with higher sensitivity to avoid missed BCVI
Xu et al., 2023	Registry outcomes for laryngeal trauma	Large NTDB cohort reported airway intervention patterns and in-hospital mortality	Mortality; airway intervention and repair patterns	Blunt laryngeal trauma is high risk, early airway planning and multidisciplinary input are essential
Miller et al., 2002	CTA as BCVI screening test	CTA identified a clinically good subset of BCVI compared with angiography; sensitivity was incomplete	Diagnostic performance; stroke outcomes	CTA supports rapid screening and false negatives necessitate careful protocols and follow-up
Nowicki et al., 2018	Algorithmic ED approach	Immediate exploration for hard signs; CTA-based selective work-up for stable patients	Practice recommendations	Modern selective management emphasizes CTA and sign-based triage

4. DISCUSSION

Our study supports a clinical approach to traumatic neck injury in the ED, operative management for unstable patients or those with hard signs, and structured imaging evaluation for patients. Surgical study compare mandatory versus selective exploration found that routine exploration produce high rates of non-therapeutic surgery.

Non operative treatment has progressed as surgeons recognize the inherent risks associated with non-therapeutic therapies. Triple endoscopy combined with a conventional angiography of the cervical arteries was regarded as the gold standard for non-operative treatment. Triple endoscopy involves doing laryngoscopy, bronchoscopy, and endoscopy to evaluate injuries to the aero digestive tract, addressing concerns about overlooked injuries with a singular approach. Endoscopy carry risks such as perforation and bleeding, whereas angiograms present heightened radiation exposure, the possibility of contrast-induced kidney damage, and difficulties at the local cannulation site (Nowicki et al., 2018).

Multidetector CTA of the cervical and thoracic regions offers better resolution for assessing vascular, airway, and aerodigestive tract injuries. The American College of Radiology reports a sensitivity of 90% to 100% and specificity of 98.6% to 100% for assessing vascular damage with CTA, with a sensitivity of 100% and specificity of 93.5%–97.5% for aerodigestive injuries. Patients safely monitored if no damage is identified. In individuals with missile tracts next to pharyngoesophageal structures, sensitivity diminishes to as low as 53%. Confirmatory tests including contrast esophagram followed by esophagoscopy are essential in instances of non-diagnostic findings (Osborn et al., 2008; Feliciano et al., 2001; Loss et al., 2024).

Our study had some limitations such as inclusion of retrospective and registry-based studies, with heterogeneous populations, mechanisms, and outcome definitions. Several studies were single center and not generalize to different trauma systems or resource settings. Screening criteria for BCVI and indications for operative and endoscopic evaluation varied, introducing selection bias.

5. CONCLUSION

We found that ED care for traumatic neck injury arranges early airway planning and physiologic stabilization for penetrating and blunt mechanisms. For stable patients, selective evaluation guided by hard and soft signs with CT angiography as the imaging test improves the detection of vascular and aero digestive injury and reduces non-therapeutic exploration.

List of abbreviations

BCVI, Blunt cerebrovascular injury

CT, Computed tomography

CTA, Computed tomography angiography
EAST, Eastern Association for the Surgery of Trauma
ED, Emergency department
ENT, Ear, nose and throat
NPV, Negative predictive value
NTDB, National Trauma Data Bank
PMC, PubMed Central
PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QUADAS-2, Quality Assessment of Diagnostic Accuracy Studies-2
UK, United Kingdom
USA, United States of America
WOS, Web of Science

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Conflict of interest
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Data and materials availability
All data associated with this study will be available based on reasonable request to the Corresponding Author.

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