FACULTY OF PRE-HOSPITAL CARE

Pre-hospital Management of Penetrating Neck Injuries

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Contents

Introduction

Timely and effective pre-hospital management of penetrating neck injuries (PNI) is critical to improve patient outcomes. Pre-hospital interventions in patients with PNI can be especially challenging due to the anatomical injury site coupled with a resource-limited environment. [1, 2]

Background

Penetrating neck injury (PNI) is defined as any trauma to the neck that violates the platysma muscle layer [3]. This injury is relatively rare but is a challenging clinical presentation due to the anatomical structures which may be injured.

PNI account for up to 1% of all trauma patients with an associated mortality of 3–6% [4]. Pre-hospital teams delivering enhanced care (e.g. HEMS / MERIT) are often requested to attend patients with PNI due to the nature of the injury and likelihood of clinical deterioration during conveyance to definitive hospital care [5].

Injuries can span many anatomical structures and physiological systems. Airway insufficiency may result from direct tracheal or external compromise. Ventilatory compromise may result from wounds extending into the thoracic cavity. Haemorrhage from underlying vascular structures can be non-compressible, challenging to control, necessitate advanced resuscitative interventions and result in significant circulatory and potentially neurological compromise. Similarly, direct spinal cord injury may co-exist or be an isolated injury.

In the main, these patients benefit from expeditious transport to a specialist trauma centre. However, the presence of medical professionals, from the first responder to advanced critical care teams, enables clinicians to provide pre-hospital interventions [6]. Being able to provide appropriate, evidence-based interventions at the scene of the incident, in a time sensitive manner, is important as evidenced within international guidance [3].

Consensus Recommendations

Hierarchy of evidence is applied to all consensus statement recommendations. The grade of each recommendation is outlined below after the careful review of all available evidence by the consensus panel (Appendix C).

All consensus statements were constructed and proposed based on a variety of evidence levels, obtained via a scoping review [1]. Consensus was achieved from Delphi analysis (Level IV, Grade of Recommendation D).

1. Management of catastrophic haemorrhage [7-12]

1. Pack wounds with haemostatic gauze (when possible) and apply direct pressure. [Grade D]

Rapid catastrophic haemorrhage control is the primary life-saving intervention in PNI. Haemostatic gauze with firm packing and sustained direct pressure provides effective temporisation and can be delivered quickly with minimal equipment. [7-12]

2. Consider temporary rapid wound closure with staples, sutures, or an appropriate wound-closure device, where feasible and without delaying wider management and conveyance. [Grade D]

For wounds where external compression is difficult to maintain, rapid temporary closure can augment tamponade and free hands for other critical tasks. This should be used as an adjunct and should not prolong on-scene time. [7-12]

3. Consider balloon catheter tamponade for haemorrhage control using an appropriate device, for example a urinary catheter, when clinically appropriate and within scope of practice. [Grade D]

Balloon tamponade can provide internal pressure within a wound tract where junctional compression is limited. It is a temporising measure that may reduce ongoing blood loss during transfer to definitive care. [7-12]

4. Once haemostasis has been achieved, the dressing or device should not be removed until a place of safety is reached. [Grade D]

Premature removal of packing or tamponade risks loss of haemostasis and rebleeding. Definitive reassessment and removal should occur in a controlled environment with appropriate resources. [7-12]

2. Management of Airway, Breathing and Ventilation [13-26]

5. Clinicians should not delay on-scene time where transfer to an appropriate centre is clinically and logistically appropriate. Advanced airway and breathing interventions should be balanced against time-critical transfer to definitive care. [Grade D]

PNI patients benefit from rapid access to definitive care and prolonged on-scene time can worsen outcomes if it delays surgical control and specialist management. Advanced interventions should be undertaken only when they are clearly indicated and deliver net benefit balanced against hard indications existing and mindful of not elongating on-scene time. [13-26]

6. PHEA may be life-saving, though should be reserved for clear pre-hospital indications and conducted by an appropriate specialist team in as rapid and safe a manner as feasible. [Grade D]

PHEA can be lifesaving e.g. for managing a threatened airway, however carries procedural risk and may add delay. In the absence of overt pre-hospital indications for PHEA and/or a suitably qualified pre-hospital team, prioritising rapid transfer while maintaining oxygenation and ventilation is the safest and most expedient course. [13-26]

7. PHEA through Rapid Sequence Induction (RSI) should be the first attempted airway intervention. Cricoid pressure is not recommended. [Grade D]

RSI provides the highest likelihood of timely first-pass success where definitive airway management is required. RSI procedure, induction drugs and airway devices should reflect locally agreed and established SOPs aligned to clinician competence. This said, cricoid pressure can impair laryngoscopy and ventilation in an extremely precarious patient cohort and is not recommended. [13-26]

8. Front of neck access should be undertaken promptly in a cannot intubate, cannot oxygenate (CICO) scenario. [Grade D]

CICO is immediately life-threatening. Airway management failure should be verbalised and difficult airway algorithms followed. Prompt front of neck access (FONA) is the definitive rescue technique and should not be delayed once failure to oxygenate is recognised. [13-26]

9. If a definitive airway cannot be achieved through RSI, direct intubation of a transected trachea should be considered when applicable. [Grade D]

In complete or near-complete laryngotracheal disruption, conventional laryngoscopy may fail and 'fresh' FONA may delay optimal care and introduce further risk. Direct intubation of the distal trachea in such situations may be the only effective route to oxygenation and ventilation. [13-26]

10. Clinicians should consider the risks of positive pressure ventilation (PPV) in patients with a known or possible airway injury, due to the risk of worsening surgical emphysema. [Grade D]

PPV can exacerbate air leak in laryngotracheal injury, leading to rapidly progressive subcutaneous emphysema and physiological compromise. If PPV is required, use the lowest effective pressures and reassess frequently. [13-26]

11. Clinicians should be aware of the specific risks from bougie use in PNI, however this should not discourage its routine use. [Grade D]

Bougies can improve intubation success, but disrupted airway anatomy increases the risk of false passage and a misplaced endotracheal tube. Meticulous technique and multi-point confirmation of tube position are essential in this setting. [13-26]

12. Clinicians should be aware of the potential for intrathoracic injury and treat in accordance with clinical assessment and accepted guidelines. [Grade D]

PNI trajectories can involve thoracic structures, with missed pneumothoraces or haemothoraces potentially causing rapid and unanticipated deterioration. Management should follow established trauma assessment and treatment pathways. [13-26]

3. Resuscitation Measures [27-32]

13. Traumatic Cardiac Arrest (TCA) management in PNI should focus foremost on remediating hypovolaemia, hypoxia and tension pneumothoraces as led by clinical presentation and clinician assessment. [Grade D]

In patients who have sustained cardiac arrest from penetrating neck injury, immediate haemorrhage control is the priority. Exsanguination is a common reversible cause of TCA in the PNI cohort. Immediate haemorrhage control, with parallel intravenous (IV) or intraosseous (IO) volume resuscitation, provides the best chance of successful ROSC while maintaining focus on time-critical definitive care.

Following this, interventions specific to the patient's clinical presentation should be undertaken concurrently whenever possible. This may include definitive airway management, chest decompression and resuscitative thoracotomy where appropriate.

Clearly the clinical presentation may guide TCA management, though the focus by default should be on haemorrhage control and volume replacement, oxygenation and consideration as to chest decompression via finger thoracostomies. [27-32]

14. TCA or peri-arrest patients may benefit from resuscitative thoracotomy (RT) for PNI in close proximity to the clavicle, provided that team competence, timeframes and realistic patient benefit are assured. [Grade D]

RT may enable the management of intrathoracic PNI in peri-arrest or TCA patients. Management endpoints in the pre-hospital setting include relieving cardiac tamponade, direct haemorrhage control of proximal thoracic vasculature injury or direct cardiac injuries.. Patient selection and speed of delivery are central to potential benefit. [27-32]

4. Disability prevention [33-39]

15. Careful patient handling, positioning and packaging must be ensured, with cervical spine control balanced against the need for reassessment and ongoing treatment priorities. [Grade D]

Patient handling, positioning and packaging should aim to protect neurological function while not obstructing or impeding airway management, haemorrhage control, or reassessment. Selective and proportionate spinal precautions support both patient safety and timely definitive care, guided by local SOPs, clinical assessment and extant guidelines. [33-39]

16. Cervical collars should generally be avoided. Spinal immobilisation should be achieved through the use of alternative methods and should be reserved for patients with hard neurological signs [Grade D]

Cervical collars can impede access to the neck, compromise haemorrhage and airway management and worsen patient discomfort / agitation. Alternative immobilisation can provide stabilisation while preserving access for critical interventions and represents a sensible balance of treatment priorities unless there are hard neurological signs. Routine cervical spine immobilisation is unlikely to benefit most PNI patients and may introduce harm through delay and restricted access. Hard neurological signs warrant targeted spinal precautions in parallel with addressing life-threatening injuries. [33-39]

Conclusion

Pre-hospital interventions in patients with PNI can be challenging. The mainstay of treatment lies in haemorrhage control. Advanced airway management is not always required and should not delay transfer to a place offering definitive care. Where required, in most cases drug assisted PHEA using a RSI should be considered as the first attempted airway intervention. A cannot intubate cannot oxygenate scenario should lead to prompt FONA. Direct intubation of a transected trachea is a viable alternative and may represent the best solution in certain clinical scenarios.

Following haemorrhage control, interventions specific to the patient's clinical presentation should be undertaken concurrently whenever possible for those in sustained cardiac arrest.

Cervical spine immobilisation should be reserved for patients with hard neurological signs and collars should be avoided in favour of head blocks and tape.

Appendix A - References

Scoping Review:

1. Simpson C, Tucker H, Hudson A. Pre-hospital management of penetrating neck injuries: a scoping review of current evidence and guidance. Scand J Trauma Resusc Emerg Med. 2021;29(1):137.

Delphi Analysis:

2. Simpson, C., Tucker, H., Griggs, J. *et al.* Pre-hospital management of penetrating neck injuries: derivation of an algorithm through a National Modified Delphi. *Scand J Trauma Resusc Emerg Med* **32**, 123 (2024). https://doi.org/10.1186/s13049-024-01291-1

Background

3. Nowicki J, Stew B, Ooi E. Penetrating neck injuries: a guide to evaluation and management. Ann R Coll Surg Engl. 2018;100(1):6–11.

4. Brywczynski JJ, Barrett TW, Lyon JA, Cotton BA. Management of penetrating neck injury in the emergency department: a structured literature review. Emerg Med J EMJ. 2008;25(11):711–5

5. Gavrilovski M, Griggs JE, ter Avest E, Lyon RM. The contribution of helicopter emergency medical services in the pre-hospital care of penetrating torso injuries in a semi-rural setting. Scand J Trauma Resusc Emerg Med. 2021;4(29):112.

6. Tucker H, Griggs JE, Gavrilovski M, Rahman S, Simpson C, Lyon RM, et al. Pre-hospital management of penetrating neck injuries: an evaluation of practice. Air Med J. 2024;43(1):2

Reference	Type of Study	Grade of Evidence
Catastrophic Haemorrhage		
7. van Oostendorp S, Tan E, Geeraedts L. Pre-hospital control of life-threatening truncal and junctional haemorrhage is the ultimate challenge in optimizing trauma care; a review of treatment options and their applicability in the civilian trauma setting. Scand J Trauma Resusc Emerg Med. 2016;24:110.	Systematic review	1a
8. Boulton A, Lewis C, Naumann D, Midwinter M. Pre-hospital haemostatic dressings for trauma: a systematic review. Emerg Med J. 2018;35:449–57.	Systematic review	1a

9. Shina A, Lipsky A, Nadler R, et al. Pre-hospital use of hemostatic dressings by the Israel Defense Forces Medical Corps: a case series of 122 patients. J Trauma Acute Care Surg. 2015;79(4):S204–9.	Retrospective review	III
10. Ministry of Defence. Clinical guidelines for operation. Joint Service Publication 999; 2013.	Guidelines	
11. Hatamabadi H, Asayesh Z, Kariman H, et al. Celox-coated gauze for the treatment of civilian penetrating trauma: a randomized clinical trial. Trauma Mon. 2015;20(1):e23862.	Randomised clinical trial	1b
12. Leonard J, Zietlow J, Morris D, et al. A multi-institutional study of haemostatic gauze and tourniquets in rural civilian trauma. J Trauma Acute Care Surg. 2016;81:441–4.	Retrospective review	III
Airway / Ventilation		
13. Kristensen M, McGuire B. Managing and securing the bleeding upper airway: a narrative review. Can J Anesth. 2020;67:128–40.	Narrative Review	IV
14. Crewdson K, Lockey D, Voelckel W, et al. Best practice advice on pre-hospital emergency anaesthesia and advanced airway management. Scand J Trauma Resusc Emerg Med. 2019. https://doi.org/10.1186/s13049-018-0554-6.	Guidelines	
15. Mercer S, Jones C, Bridge M, et al. Systematic review of the anaesthetic management of	Systematic review	1a

non-iatrogenic acute adult airway trauma. Br J Anaesth. 2016;117(Suppl 1):i49–59.		
16. Mandavia D, Qualls S, Rokos I. Emergency airway management in penetrating neck injury. Ann Emerg Med. 2000;35:221–5.	Retrospective case study	III
17. Shearer V, Giesecke A. Airway management for patients with penetrating neck trauma: a retrospective study. Anesth Analg. 1993;77:1135–8.	Retrospective study	III
18. Brywczynski J, Barrett T, Lyon J, Cotton B. Management of penetrating neck injury in the emergency department: a structured literature review. Emerg Med J. 2008;25:711–5.	Literature review	Ia
19. Lewis S, Butler A, Parker J, Cook T, Smith A. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. Cochrane Database Syst Rev. 2016;11(11):CD011136.	Cochrane systematic review	Ia
20. Knapp J, Eberle B, Bernhard M, et al. Analysis of tracheal intubation in out-of-hospital helicopter emergency medicine recorded by video laryngoscopy. Scand J Trauma Resusc Emerg Med. 2021;29:1–10.	Prospective observational study	III
21. Barnard E, Ervin A, Mabry R, Bebarta V. Pre-hospital and en route cricothyotomy performed in the combat	Prospective, multi-centre, observational study	III

setting: a prospective, multicentre, observational study. J Spec Oper Med. 2014;14:35–9.		
22. Hubble M, Wilfong D, Brown L, Hertelendy A, Benner R. A meta-analysis of pre-hospital airway control techniques part II: alternative airway devices and cricothyrotomy success rates. Prehosp Emerg Care. 2010;14:515–30.	Meta-analysis	Ia
23. Aziz S, Foster E, Lockey D, Christian M. Emergency scalpel cricothyroidotomy use in a pre-hospital trauma service: a 20-year review. Emerg Med J. 2021;38:349–54.	Retrospective observational study	III
24. Battacharya P, Mandal M, Das S. Airway management of two patients with penetrating neck trauma. Indian J Anaesth. 2009;53:348–51.	Case report	IV
25. Hanlon D, Adams D. Penetrating neck trauma. *Trauma Rep*. 2017.	Animal experimental study	IIa
26. Tsur N, Benov A, Nadler R, et al. Neck Injuries-Israel defense forces 20 years' experience. Injury. 2020;52(2):274–80.	Case series	IV
CIRCULATION / RESUSITATION		
27. Filips D, Logsetty S, Tan J, et al. The iTClamp controls junctional bleeding in a lethal swine exanguination model. Prehosp Emerg Care. 2013;17:526–32.	Animal experimental study	
28. Tan E, Peters J, Mckee J, Edwards M. The iTClamp in the management of pre-	Observational study	III

hospital haemorrhage. Injury. 2016;47:1012–5.		
29. Onifer D, Mckee J, Fudree L, et al. Management of haemorrhage from craniomaxillofacial injuries and penetrating neck injury in tctical combat casualty care: iTClamp mechanical wound closure device TCCC guidelines proposed change June 2019. J Spec Oper Med. 2019;19(3):31–44.	Guideline	
30. Jose A, Arya S, Nagori S, Thukral H. Managment of life-threatening haemorrhage from maxillofacial firearm injuries using Foley catheter balloon tamponade. Craniomaxillofac Trauma Reconstr. 2019;12:301–4.	Case series	III
31. Burlew C, Moore E, Moore F, et al. Western trauma association critical decisions in trauma: resuscitative thoracotomy. J Trauma Acute Care Surg. 2012;73:1359–63.	Guidelines	
32. Sheppard F, Cothren C, Moore E, et al. Emergency department resuscitative thoracotomy for nontorso injuries. Surgery. 2006;139:574–6.	Prospective study	III
Disability		
33. Vanderlan W, Tew B, Seguin C, et al. Neurolgogic sequelae of penetrating cervical trauma. Spine. 2009;34:2646–53.	Multicentre, retrospective chart analysis	III
34. Lustenberger T, Talving P, Lam L, et al. Unstable cervical spine fracture after	Retrospective analysis	III

penetrating neck injury: a rare entity in an analysis of 1069 patients. J Trauma. 2011;70(4):870–2.		
35. Vanderlan W, Tew B, Mcswain N Jr. Increased risk of death with cervical spine immobilisation in penetrating cervical trauma. Injury. 2009;40:880–3.	Retrospective chart analysis	III
36. Haut E, Kalish B, Efron D, et al. Spine immobilisation in penetrating trauma: more harm than good? J Trauma Injury Infect Crit Care. 2010;68:115–21.	Retrospective analysis	III
37. Ramasamy M, Midwinter M, Mahoney P, Clasper J. Learning the lessons from conflict: pre-hospital cervical spine stabilisation following ballistic neck trauma. Injury. 2009;40:1342–5.	Retrospective analysis	III
38. Barkana Y, Stein M, Scope A, et al. Pre-hospital stabilization of the cervical spine for penetrating injuries of the neck—is it necessary? Injury. 2000;31(5):305–9.	Retrospective analysis	III
39. Maschmann C, Jeppesen E, Rubin M, Barfod C. New clinical guidelines on the spinal stabilisation of adult trauma patients-consensus and evidence based. Scand J Trauma Resusc Emerg Med. 2019;27:77.	Guidelines (based on a systematic review of the literature and grading of the evidence, in addition to a standardised consensus process)	Ia

Appendix B - Methods

The consensus statements were informed by a scoping review of current evidence and a subsequent national modified e-Delphi analysis.

The scoping review followed the standardised systematic review methodology, it included 27 papers, spanning a 20 year period (1/1/2000 – 31/07/2025).

The e-Delphi analysis consisted of 3 rounds, with Round 1 presenting statements drawn from the literature, Round 2 a structured discussion of the statements and an online survey serving as the final ratification in Round 3. Achievement of consensus was set at 70%. All proposed statements achieved consensus. It was conducted with subject matter experts (SMEs) from multiple professional specialities with experience in the management of PNI (67 invited to participate, 28 participated – 42% response rate).

Members of the working group

All members of the working group assisted in manuscript progression and finalisation into an FPHC Consensus Statement. Harriet Tucker, Anthony Hudson, Christopher Simpson and Jo Griggs were involved in the underpinning SJTREM publications as per Appendix A References 1 & 2. Florence Kinder was responsible for converting the initial Delphi project into an FPHC Consensus Statement.

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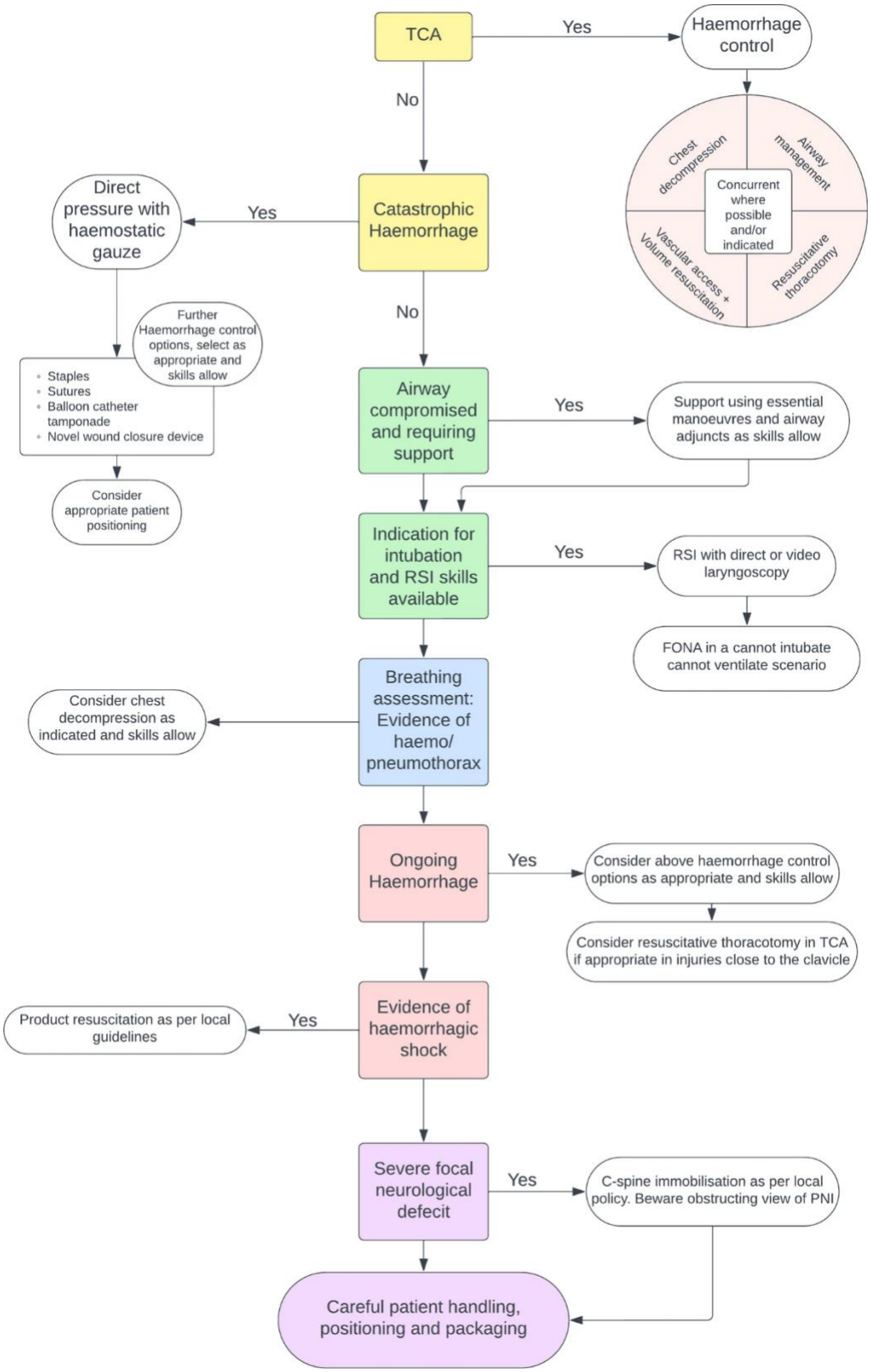
Appendix C – Diagrams

Pre-hospital management of penetrating neck injuries



Appendix D - Hierarchy of evidence & grading of recommendations

Hierarchy of Evidence

Level of evidence	Type of evidence
Ia	Evidence from systematic reviews or meta-analysis of randomised controlled trials
Ib	Evidence from at least one randomised controlled trial
IIa	Evidence from at least one controlled study without randomisation
IIb	Evidence from at least one other type of quasi experimental study
III	Evidence from non-experimental descriptive studies such as comparative studies, correlation studies and case-control studies
IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities

Grade of recommendation	Type of evidence
A	Based on hierarchy I evidence
B	Based on hierarchy II evidence or extrapolated from hierarchy I evidence
C	Based on hierarchy III evidence or extrapolated from hierarchy I or II evidence
D	Directly based on hierarchy IV evidence or extrapolated from hierarchy I, II or III evidence

Shekelle PG, Woolf SH, Eccles M, et al. (1999). Clinical guidelines: developing guidelines. BMJ: British Medical Journal. Feb 27;318(7183):593.

Quick Reference Guide

Summary of Recommendations

1. Pack wounds with haemostatic gauze (when possible) and apply direct pressure. [Grade D]

2. Consider temporary rapid wound closure with staples, sutures, or an appropriate wound-closure device, where feasible and without delaying wider management and conveyance. [Grade D]

3. Consider balloon catheter tamponade for haemorrhage control using an appropriate device, for example a urinary catheter, when clinically appropriate and within scope of practice. [Grade D]

4. Once haemostasis has been achieved, the dressing or device should not be removed until a place of safety is reached. [Grade D]

5. Clinicians should not delay on-scene time where transfer to an appropriate centre is clinically and logistically appropriate. Advanced airway and breathing interventions should be balanced against time-critical transfer to definitive care. [Grade D]

6. PHEA may be life-saving, though should be reserved for clear pre-hospital indications and conducted by an appropriate specialist team in as rapid and safe a manner as feasible. [Grade D]

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8. Front of neck access should be undertaken promptly in a cannot intubate, cannot oxygenate (CICO) scenario. [Grade D]

9. If a definitive airway cannot be achieved through RSI, direct intubation of a transected trachea should be considered when applicable. [Grade D]

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13. Traumatic Cardiac Arrest (TCA) management in PNI should focus foremost on remediating hypovolaemia, hypoxia and tension pneumothoraces as led by clinical presentation and clinician assessment. [Grade D]

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15. Careful patient handling, positioning and packaging must be ensured, with cervical spine control balanced against the need for reassessment and ongoing treatment priorities. [Grade D]

16. Cervical collars should generally be avoided. Spinal immobilisation should be achieved through the use of alternative methods and should be reserved for patients with hard neurological signs [Grade D]