

## CG015 Suspension Trauma

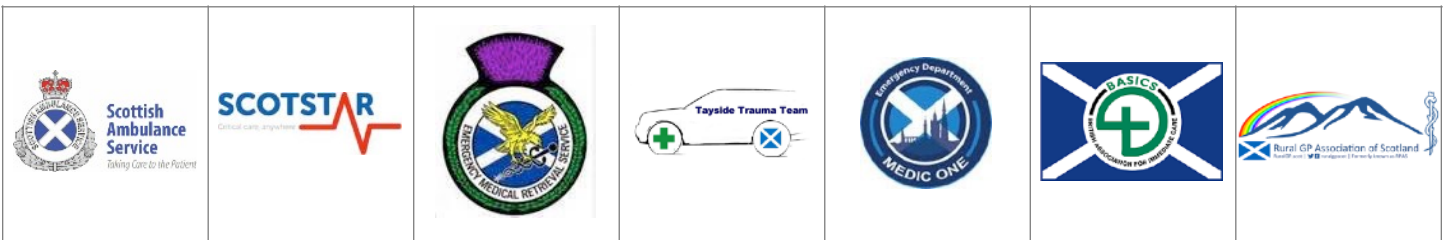
### 1. Key Recommendations for operational use

**For use by:** All pre-hospital teams. **Internet:** Yes

1	Identification	<ul style="list-style-type: none"> <li>Identify early patients at risk of 'suspension trauma' and allocate an appropriate specialist response.</li> </ul>
2	Risk reduction	<ul style="list-style-type: none"> <li>Where possible, avoid suspension from a chest harness or strap (including single helicopter strops).</li> </ul>
3	All patients	<ul style="list-style-type: none"> <li>In all patients who are suspended: <ul style="list-style-type: none"> <li>lower to the ground or move out of suspension to a safe position as quickly as possible irrespective of their level of consciousness or other injuries.</li> <li>do not delay efforts to rescue the patient by attempting to provide definitive treatment whilst suspended.</li> </ul> </li> </ul>
4a	Mobile patients	<ul style="list-style-type: none"> <li>If the patient is unable to be released from suspension and is conscious and able to move: <ul style="list-style-type: none"> <li>encourage uninjured patients to adopt a sitting position with continuous movement of the limbs.</li> <li>as feasible encourage injured patients to move unaffected limbs and maintain a semi-seated position; consider using additional aids to facilitate this.</li> </ul> </li> </ul>
4b	Immobile patients	<ul style="list-style-type: none"> <li>Where the patient is unable to be released from suspension and is unconscious or unable to move: <ul style="list-style-type: none"> <li>secure the patient(s) to reduce the risk of further injury.</li> <li>ideally support immobile patients in a supine position.</li> <li>avoid hyperextension of the cervical spine.</li> <li>where possible partially flex at hip.</li> <li>prioritise early transfer onto a horizontal stretcher.</li> </ul> </li> </ul>
5	Post recovery	<ul style="list-style-type: none"> <li>Once released, manage patients in a horizontal position where feasible. <ul style="list-style-type: none"> <li>assess and treat using the &lt;C&gt;ABCDE algorithm without modification.</li> </ul> </li> </ul>
6	Fluid management	<ul style="list-style-type: none"> <li>Consider fluid resuscitation of patients who have undergone prolonged suspension or have become symptomatic at any point.</li> </ul>
7	Advanced care	<ul style="list-style-type: none"> <li>Consider point-of-care testing, where available, to assess and manage electrolyte derangement.</li> </ul>
8	Cardiac arrest	<ul style="list-style-type: none"> <li>Use standard ALS / BLS protocols.</li> <li>Consider hyperkalemia and pulmonary embolus as potentially reversible causes.</li> </ul>

## CG015 Suspension Trauma

2. Document History			
Reference Number	CG015		
Version	2		
Writing group (Lead author in bold)	Alastair Glennie	Medical Officer	Scottish Mountain Rescue
	Stephen Hearn	Consultant	EMRS West
	<b>David Strachan</b>	Medical Officer	Tayside MRT
Associate Medical Director	Andrew Cadamy		
Date issued	4th August 2023	v1. April 2020	
Date for review	August 2026		
Distribution	BASICS Scotland		✓
	Medic 1		✓
	Referring centres via service websites		✓
	Rural GPs Association of Scotland		✓
	SAS	Specialist Services Desk	X
	ScotSTAR	Air Ambulance	✓
		EMRS West	✓
		EMRS North	✓
		Paediatric	X
		Neonatal	X
Tayside Trauma Team		✓	



## CG015 Suspension Trauma

### 3. Scope and purpose

- Overall objectives:

The aim of this guideline is to summarise a stepwise approach to patients who are found suspended in a harness, or who have been recently lowered to the ground in the prehospital environment whether remote mountain crags or an industrial setting. It is designed to harmonise the approaches and priorities of the diverse teams that are likely to attend such incidents and acknowledge the spectrum of settings in which prolonged suspension can occur. A cooperative multidisciplinary approach using subject matter experts with knowledge appropriate to the environment as well as medical specialists is likely to improve outcomes.

- Statement of intent:

This guideline is not intended to be construed or to serve as a standard of care. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. Clinicians using this guideline should work within their skill sets and usual scope of practice.

- Feedback:

Comments on this guideline can be sent to: [sas.cpg@nhs.scot](mailto:sas.cpg@nhs.scot)

- Equality Impact Assessment:

Applied to the ScotSTAR Clinical Standards group processes.

- Guideline process endorsed by the Scottish Trauma Network Prehospital, Transfer and Retrieval group.



4. Explanatory Statements		
4.1 Identification.	Authors' recommendation	Level [Reference]
<p>Suspension trauma' is a poorly defined term to cover a range of pre-syncopal symptoms occurring in patients suspended above a surface for a prolonged period. <b>This can include patients who have been packaged onto rescue equipment during a prolonged non-horizontal evacuation.</b> The exact mechanisms are still debated however the cases reported form a defined clinical syndrome with life threatening immediate and delayed sequelae.</p> <p>Symptoms suggestive of the development of suspension trauma include:</p> <ul style="list-style-type: none"> <li>- Pre-syncopal symptoms</li> <li>- Shortness of breath</li> <li>- 'Greying' or visual changes</li> <li>- Reduction in consciousness irrespective of cause</li> </ul>	Information only	
<ul style="list-style-type: none"> <li>• <i>Identify early patients at risk of 'suspension trauma' and allocate an appropriate specialist response.</i></li> </ul> <p>This may include:</p> <ul style="list-style-type: none"> <li>- SAS / SORT / SCAA</li> <li>- 'Yellow' and 'Red' medical teams</li> <li>- Scottish Fire and Rescue</li> <li>- Mountain Rescue (via Police control rooms)</li> <li>- HM Coastguard</li> </ul> <p>Early discussion with Red/Yellow Medical Teams and consideration of transport options will allow for enhanced care once the patient is out of suspension.</p>	GPP	

4.2 Risk reduction	Authors' recommendation	Level [Reference]
<ul style="list-style-type: none"> <li>• <i>Where possible, avoid suspension from a chest harness or strap (including single helicopter strops).</i></li> </ul> <p>Suspension in a chest harness or upper body strop is thought to exacerbate venous pooling in the lower limbs, especially in a non-moving patient. There is a simultaneous increase in intrathoracic pressure with reduction in cardiac pre-load, blood pressure and a quasi-vasovagal syncope. Additionally, pain is thought to trigger a von Bezold-Jarish reflex, leading to paradoxical bradycardia, syncope and rapid progression to cardiac arrest.</p> <p>Once an unassisted patient loses consciousness they are at risk of sliding out of a single strop due to a loss of muscle tone.</p> <p>It is recognised that there are situations in which the sole use of a chest strop or harness is unavoidable. Such cases should be dynamically risk assessed by a competent person, the duration of suspension minimised and the patient observed for early symptoms with a robust management plan in place to manage a sudden loss of consciousness.</p>	Strong	1+ [2] 4 [1,3]
4.3. All patients	Authors' recommendation	Level [Reference]
<ul style="list-style-type: none"> <li>• <i>In all patients who are suspended:</i> <ul style="list-style-type: none"> <li>- <i>lower to the ground or move out of suspension to a safe position as quickly as possible irrespective of their level of consciousness or other injuries.</i></li> <li>- <i>do not delay efforts to rescue the patient by attempting to provide definitive treatment whilst suspended.</i></li> </ul> </li> </ul> <p>Treatment of other injuries should be limited to temporising time critical problems whilst the main effort remains movement out of suspension.</p> <p>Syncope following suspension has been reported in immobile patients in as little as 7 minutes in a chest harness to around 15 minutes in a front suspended waist harness (90% of healthy volunteers at 1 hour) in non-mobile casualties. Cardio-respiratory co-morbidities appear to heighten this risk.</p>	Strong	Guideline [5] 4 [1,4]

4.4a Mobile patients	Authors' recommendation	Level [Reference]
<ul style="list-style-type: none"> <li>• <i>If the patient is unable to be released from suspension and is conscious and able to move:</i> <ul style="list-style-type: none"> <li>- <i>encourage uninjured patients to adopt a sitting position with continuous movement of the limbs.</i></li> <li>- <i>as feasible encourage injured patients to move unaffected limbs and maintain a semi-seated position; consider using additional aids to facilitate this.</i></li> </ul> </li> </ul> <p>It is believed that any movement of limbs serves to minimise venous pooling and improve circulation, reducing the likelihood of symptoms or at least delaying onset.</p> <p>The use of additional strops, 'boson's chair' type harnesses and 'rescue pedals' or improvised alternatives should be considered to facilitate a seated or semi-seated position. Device preference will be situation driven, but the goal of a seated position with legs partially flexed appears to increase time to symptoms.</p> <p>Where possible transferring load from a chest-based harness system to a pelvic system will reduce intrathoracic pressure and is likely to improve cardiac preload and blood pressure.</p>	Strong	Guideline [5]
4.4b. Immobile patients	Authors' recommendation	Level [Reference]
<ul style="list-style-type: none"> <li>• <i>Where the patient is unable to be released from suspension and is unconscious or unable to move:</i> <ul style="list-style-type: none"> <li>- <i>secure the patient(s) to reduce the risk of further injury.</i></li> <li>- <i>ideally support immobile patients in a supine position.</i></li> <li>- <i>avoid hyperextension of the cervical spine.</i></li> <li>- <i>where possible partially flex at hip.</i></li> <li>- <i>prioritise early transfer onto a horizontal stretcher.</i></li> </ul> </li> </ul> <p>Initial responders should aim to make themselves and the patient safe before attempting to support the suspended patient in a supine position. Limited evidence suggests that dorsal anchor points exacerbate venous pooling and decrease time to cardiovascular collapse.</p> <p>Hyperextension of the cervical spine may be associated with reflex stimulation and airway compromise. Ideally the supine, supported position would include bringing the thighs to between 180 and 90 degrees to the torso to limit functional compression of the femoral veins and improve venous return.</p> <p>Early transfer onto an appropriate stretcher for the environment should be prioritised with an aim to keep the patient horizontal as far as possible throughout the remainder of the rescue.</p>		

<b>4.5 Post recovery</b>	<b>Authors' recommendation</b>	<b>Level [Reference]</b>
<ul style="list-style-type: none"> <li>Once released, manage patients in a horizontal position where feasible               <ul style="list-style-type: none"> <li>assess and treat using the &lt;C&gt;ABCDE algorithm without modification.</li> </ul> </li> </ul> <p>It is recognised that relief of suspension is not synonymous with a definitive 'rescue' but may involve a temporising step to allow further assessment, basic treatment and packaging pending definitive movement.</p> <p>The use of a semi-seated position once on the ground is not supported by evidence and not recommended as a treatment for suspension.</p>	Strong	4 [8]
<b>4.6 Fluid Management</b>	<b>Authors' recommendation</b>	<b>Level [Reference]</b>
<ul style="list-style-type: none"> <li>Consider fluid resuscitation of patients who have undergone prolonged suspension or have become symptomatic at any point.</li> </ul> <p>Pre-syncope, bradycardia or any physiological derangement should be considered as the initial phases of 'suspension trauma'.</p> <p>Multiple case reports of rhabdomyolysis and hypovolaemic collapse following prolonged suspension are noted in the literature. To avoid such sequelae, judicious fluid administration is recommended for patients who have become symptomatic at any point. This will, however, need to be weighed against the risks associated with large volume resuscitation in trauma.</p>	Conditional	4 [7]
<b>4.7 Advanced Care</b>	<b>Authors' recommendation</b>	<b>Level [Reference]</b>
<ul style="list-style-type: none"> <li>Consider point-of-care testing, where available, to assess and manage electrolyte derangement.</li> </ul> <p>Cases of rhabdomyolysis and hyperkalaemia have been reported following release of suspension and return of pooled blood. Duration and position of suspension and pre-existing comorbidities are likely to be indicative of the degree of derangement identified. Serum creatanine kinase should be measured when possible; increasing levels may identify patients at risk of late complications.</p> <p>Hypothermia, hypoglycaemia, acidosis and coagulopathy are likely to be noted in prolonged suspensions and should be identified and treated early where possible.</p>	GPP	



4.8 Cardiac arrest	Authors' recommendation	Level [Reference]
<ul style="list-style-type: none"> <li>• <i>Use standard ALS / BLS protocols</i></li> <li>• <i>Consider hyperkalemia and pulmonary embolus as potentially reversible causes.</i></li> </ul> <p>Cardiac arrest following suspension in the pre-hospital or mountain environment may be further complicated by trauma or hypothermia, however in the otherwise minimally injured patient, the pathophysiology of suspension suggests an increased risk of cardiac arrest secondary to derangements in serum potassium levels or due to migration of a DVT from a lower limb compartment. Early consideration should be given to these causes in the event of a loss of output and treatments initiated based on available resource.</p>	GPP	

### 5. References

1. Leal S, Becker F *et al.* Proposal of an Effective Algorithm to Manage Suspension Trauma in the Field. Trauma-Acute-Care Vol1:2 2015.
2. Roeggla M, Brunner M *et al.* Cardiorespiratory response to a free suspension simulating the situation between fall and rescue in a rock climbing accident. Wilderness Environ Med 7 (1996): 109-114.
3. Pasquier M, Yersin B *et al.* Clinical update: suspension trauma. Wilderness Environ Med. 2011 Jun;22(2):167-71.
4. Lee C, Porter K. Suspension trauma. Emerg Med J 2007; 24:237-238.
5. Adisesh A, Robinson L *et al.* Evidence-based review of the current guidance on first aid measures for suspension trauma <http://www.hse.gov.uk/research/rrpdf/rr708.pdf>
6. Beverly J, Zuhl M *et al.* Harness Suspension Stress: Physiological and Safety Assessment. Journal of Occupational and environmental Medicine 61:1 (2019) 35-40
7. Mortimer R. Risks and management of prolonged suspension in an Alpine harness Wilderness Environ Med. 2011 Mar;22(1):77-86.
8. Thomassen O, Skaiaa S *et al.* Does the horizontal position increase risk of rescue death following suspension trauma? Emerg Med J 2009;26:896-898.