

CG017 Crush Injury

1. Key Recommendations for operational use

For use by: Pre-hospital care teams. **Internet:** Yes

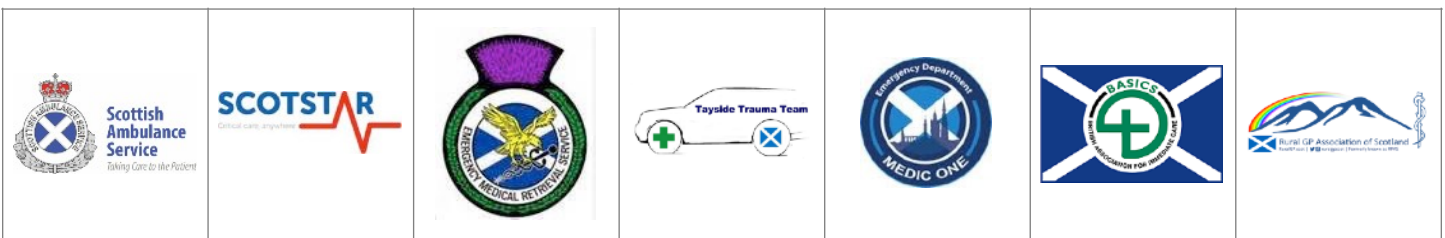
1	Scene safety	<ul style="list-style-type: none"> Refer to SG002 Safety at scene and OG0038 SORT. Do not enter the scene unless declared safe. Be mindful of masonry or heavy rescue equipment. Consider wearing a dust mask.
2	Assessment	<ul style="list-style-type: none"> Trauma patient with entrapment > 1 hour or clear crush injury or syndrome. Non-trauma patient with prolonged collapse due to, for example, stroke or intoxication. Perform structured A to E assessment with expectation of concomitant injuries: <ul style="list-style-type: none"> especially with explosions: consider blast or fragment injury. Document pulses and sensation distal to injury.
3	Fluid resuscitation	<ul style="list-style-type: none"> Prior to extrication (if possible): <ul style="list-style-type: none"> establish wide bore IV access commence 1 to 1.5 litres 0.9% saline to prevent acute kidney injury. Anticipate a redistributive hypovolaemia upon release of crushed body part.
		<ul style="list-style-type: none"> If patient is shocked, give blood (if available) prior to crystalloid. Do not use potassium containing solutions such as Hartmann's solution.
4	Analgesia	<ul style="list-style-type: none"> Ensure adequate parenteral analgesia or sedation, such as morphine or ketamine. Apply a non-compressive splint to the crushed limb.
5	Monitoring	<ul style="list-style-type: none"> Initiate ECG monitoring early to look for the signs of hyperkalaemia: <ul style="list-style-type: none"> flattened P waves, broad QRS, tented T waves.
6	Tourniquets	<ul style="list-style-type: none"> Do not use tourniquets for any purpose except to control exsanguinating haemorrhage. If severe haemorrhage is anticipated upon extrication, consider siting (but not tightening) tourniquets.
7	Amputation	<ul style="list-style-type: none"> Rarely indicated pre-hospital - discuss with another senior clinician if practicable. Indications: <ol style="list-style-type: none"> Patient in immediate danger Refractory haemorrhage despite direct pressure and tourniquet(s) Severely mangled, non-viable limb preventing extrication. Refer to CG014 Emergency Surgical Procedures.

CG017 Crush Injury

8	Hyperkalaemia	<ul style="list-style-type: none"> • Do not use Suxmethonium in crush injury. <hr/> <ul style="list-style-type: none"> • If ECG changes of hyperkalaemia are seen, or during prolonged entrapment (> 4 hours) in a major incident setting, give: <ul style="list-style-type: none"> - 5ml 10% Calcium Chloride (or 10-15 ml 10% Calcium Gluconate). • Consider administering Sodium Bicarbonate 1mmol/kg: <ul style="list-style-type: none"> - 1.26%: a 500ml polyfusor bottle will be appropriate for adults. - 4.2%: 2ml/kg. - 8.4%: 1ml/kg. • Consider point of care testing to confirm hyperkalaemia: <ul style="list-style-type: none"> - further treatment may be needed.
8	Triage	<ul style="list-style-type: none"> • Major Trauma Centre, ideally with on-site or immediately available Plastic Surgery.
9	Advice to remote/ rural referring hospital	<ul style="list-style-type: none"> • As above, plus: <ol style="list-style-type: none"> 1. Obtain X-rays of injured limb(s). 2. Do not elevate limbs. 3. Insert urinary catheter, dip for presence of Hb (false + for myoglobin). 4. Standard drugs for hyperkalaemia with ECG changes (Calcium IV, insulin/ dextrose infusion, nebulised salbutamol). 5. Continue target IV fluids to adequate urine output. 6. 0.9% saline at 500 ml/hr, aiming for urine output of 30ml/hr 7. Monitor patient for complications of crush injury: cardiac arrhythmia, hyperkalaemia, rhabdomyolysis and compartment syndrome.

CG017 Crush Injury

Document History				
Reference Number	CG017			
Version	2			
Writing group (Lead author in bold)	Kate Clayton	Emergency Physician	University Hospitals Birmingham	
	Martin Esposito	Consultant Paramedic for Major Trauma	SAS	
	JP Loughrey	Emergency Physician	EMRS West	
	Richard Lyon	Emergency Physician	Medic 1	
Associate Medical Director	Andrew Cadamy			
Date issued	26th July 2023	Version 1: July 2020		
Date for review	July 2026			
Distribution	BASICS Scotland		✓	
	Medic 1		✓	
	Referring centres via service websites		✓	
	Rural GPs Association of Scotland		✓	
	SAS	Specialist Services Desk	for information	
	ScotSTAR	Air Ambulance		✓
		EMRS West		✓
		EMRS North		✓
		Paediatric		X
Neonatal		X		
Tayside Trauma Team		✓		



Scope and purpose

- Overall objectives:

The aim of this guideline is to summarise safe and effective care for patients with crush injury or crush syndrome, whether in the pre-hospital or in the remote / rural hospital setting.

- 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

- Equality Impact Assessment:

Applied to the ScotSTAR Clinical Standards group processes.

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

Explanatory Statements		
	Authors' recommendation	Level [Reference]
4.1. Scene safety		
<ul style="list-style-type: none"> Refer to SG002 Safety at scene and OG0038 SORT. Do not enter the scene unless declared safe. Be mindful of masonry or heavy rescue equipment. Consider wearing a dust mask. 	Good practice point	
4.2 Assessment		
<ul style="list-style-type: none"> Trauma patient with entrapment > 1 hour or clear crush injury or syndrome. Non-trauma patient with prolonged collapse due to, for example, stroke or intoxication. Perform structured A to E assessment with expectation of concomitant injuries: <ul style="list-style-type: none"> especially with explosions: consider blast or fragment injury. Document pulses and sensation distal to injury. 	Good practice point	
4.3 Fluid resuscitation		
<ul style="list-style-type: none"> Prior to extrication (if possible): <ul style="list-style-type: none"> establish wide bore IV access commence 1 to 1.5 litres 0.9% saline to prevent acute kidney injury. Anticipate a redistributive hypovolaemia upon release of crushed body part. 	Strong	Guidelines [1,3] 4 [2,4,5,6,7,8]
<ul style="list-style-type: none"> If patient is shocked, give blood (if available) prior to crystalloid. Do not use potassium containing solutions such as Hartmann's solution. 		
4.4 Analgesia		
<ul style="list-style-type: none"> Ensure adequate parenteral analgesia or sedation, such as morphine or ketamine. Apply a non-compressive splint to the crushed limb. 	Good practice point	[8]
4.5 Monitoring		
<ul style="list-style-type: none"> Initiate ECG monitoring early to look for the signs of hyperkalaemia: <ul style="list-style-type: none"> flattened P waves, broad QRS, tented T waves. 	Strong	4 [4,6]
4.6 Tourniquets		
<ul style="list-style-type: none"> Do not use tourniquets for any purpose except to control exsanguinating haemorrhage. If severe haemorrhage is anticipated upon extrication, consider siting (but not tightening) tourniquets. 	Strong	Guideline [3] 4 [2,5,6,7,8]

4.7 Amputation	Authors' recommendation	Level [Reference]
<ul style="list-style-type: none"> • Rarely indicated pre-hospital - discuss with another senior clinician if practicable. • Indications: <ol style="list-style-type: none"> 1. Patient in immediate danger 2. Refractory haemorrhage despite direct pressure and tourniquet(s) 3. Severely mangled, non-viable limb preventing extrication. • Refer to CG014 Emergency Surgical Procedures. 	Strong	4 [2,5,6,7,8]
4.8 Hyperkalaemia		
<ul style="list-style-type: none"> • Do not use Suxmethonium in crush injury. <ul style="list-style-type: none"> • If ECG changes of hyperkalaemia are seen, or during prolonged entrapment (> 4 hours) in a major incident setting, give: <ul style="list-style-type: none"> - 5ml 10% Calcium Chloride (or 10-15 ml 10% Calcium Gluconate). • Consider administering Sodium Bicarbonate 1mmol/kg: <ul style="list-style-type: none"> - 1.26%: a 500ml polyfusor bottle will be appropriate for adults. - 4.2%: 2ml/kg. - 8.4%: 1ml/kg. 	Conditional	Guidelines [1,3,9,10] 4 [2,4,5,6,7]
<ul style="list-style-type: none"> • Consider point of care testing to confirm hyperkalaemia: <ul style="list-style-type: none"> - further treatment may be needed. 	Good practice point	
4.8 Triage		
<ul style="list-style-type: none"> • Major Trauma Centre, ideally with on-site or immediately available Plastic Surgery. 	Good practice point	
4.9 Advice to remote/ rural referring hospital		
<ul style="list-style-type: none"> • As above, plus: <ol style="list-style-type: none"> 1. Obtain X-rays of injured limb(s). 2. Do not elevate limbs. 3. Insert urinary catheter, dip for presence of Hb (false + for myoglobin). 4. Standard drugs for hyperkalaemia with ECG changes (Calcium IV, insulin/ dextrose infusion, nebulised salbutamol). 5. Continue Target IV fluids to adequate urine output. 6. 0.9% saline at 500 ml/hr, aiming for urine output of 30ml/hr. 	Good practice point	

References

1. American College of Surgeons 2018 ATLS® Student Course Manual 10th Edition.
2. Greaves I, Porter K, Wright C, 2019 Trauma Care Prehospital Manual. London, CRC Press.
3. NHS England 2020 Clinical Guidelines for Major Incidents and Mass Casualty Events.
4. Burns K, Cone DC, Portereiko JV. Complex extrication and crush injury. *Prehosp Emerg Care*. 2010 Apr-Jun; 14 (2): 240-4.
5. Greaves I, Porter K, Smith J. Consensus Statement on the Early Management of Crush Injury and Prevention of Crush Syndrome. *J Roy Army Med Corps* 2003; 149: 255-259.
6. Genthon A, Wilcox SR. Crush syndrome: a case report and review of the literature. *J Emerg Med*. 2014 Feb; 46 (2): 313-9.
7. Sever MS, Vanholder R. Management of crush victims in mass disasters: Highlights from recently published recommendations. *Clin J Am Soc Nephrol* 2013; 8: 328-334.
8. Haines LN, Doucet, JJ. Severe crush injury in adults. *UpToDate* (2021) <https://www.uptodate.com/contents/severe-crush-injury-in-adults> (Accessed:01/05/2023).
9. <https://www.gov.uk/drug-device-alerts/national-patient-safety-alert-potential-risk-of-underdosing-with-calcium-gluconate-in-severe-hyperkalaemia-natpsa-slash-2023-slash-007-slash-mhra>
10. Alfonzo A et al. Clinical practice guidelines: treatment of acute hyperkalaemia in adults. Renal Association 2020. Available at: <https://ukkidney.org/health-professionals/guidelines/treatment-acute-hyperkalaemia-adults>