Major Trauma Centre

Collaborative Cheshire and Mersey Network

Cheshire & Mersey Major Trauma Referral Pathways

1. Summary of the Service at Aintree & WCNN MTC

The Major Trauma (MT) Service at Aintree runs 24 hours 7 days per week 365 days of the year. It is co-ordinated by MT Nurse Co-ordinators (TNC) who covers the service from 07:30hrs to 02:00hrs every day. There is a MT Consultant Trauma & Orthopaedic Surgeon and General Surgeon on duty for MT each day. The Trauma & Orthopaedic & Acute General Surgical Consultants are available to attend the MT Calls between 09:00hrs and 17:00hrs and for urgent surgery 24/7.

There is a multidisciplinary MT Meeting at 09:00hrs every day where all new MT patients are discussed. A daily board & ward round of all the patients follows the MT Meeting.

All new patients have a Tertiary Survey performed, on the day after admission. This is performed by the MT Orthopaedic and/or Acute General Surgical Consultants.

A weekly MD, performed jointly between Rehabilitation Medicine, WCNN and Aintree, is held every Wednesday at 10:00hrs in the Sid Watkins Building.

The Regional Orthoplastics Unit is currently located between Aintree & Broadgreen. The Plastics & Burns Unit is at Whiston & St Helens NHS Trust.

Advanced Cardiothoracic & Vascular Surgery is provided as both an in-reach and out-reach service from Liverpool Heart and Chest Hospital at Broadgreen and the LIVES Service from RLUH. Major traumatic vascular injury is managed by the Vascular LIVES Service.

A Consultant Trauma Team Leader (TTL) is available in Aintree MTC Emergency Department 24/7 365 days/year and is contactable via the Emergency Phone in the ED.

The MT TNC is contactable on a pager via Aintree Switchboard. The Consultant Trauma & Orthopaedic Surgeon and Acute General Surgeon are also contactable via Aintree Switchboard on their mobile phones. There is a pager for the Consultant Orthopaedic Surgeon during the day, again, via Aintree Switchboard.

The Consultant Neurosurgeon on call is available by telephone via the Aintree Switchboard. There are 2 Neurosurgical Registrars on call who are available on a pager via Aintree Switchboard.

2. Referral Pathways

As the Adult MTC for Cheshire & Merseyside we cover a vast area and a population of approximately 2 million people. The Cheshire & Merseyside MTN comprises 2 MTC's (Adults & Children) and 7 Trauma Units (TU's).

Types of Referrals to the MTC

There are, in broad terms, 2 main categories of patients requiring secondary transfer to Aintree MTC:

1) **'Urgent'** cases requiring immediate life-saving Damage Control Resuscitation (DCR) +/or Damage Control Surgery (DCS). Many of these patients by-pass TU's to come directly to the MTC via the Pre-hospital Pathfinder. However, there are still occasions when such patients are taken directly to TU's either because they are deemed 'too unstable' to bypass, or they are subsequently identified on arrival at the TU. These patients require a 'pitstop', instigation of DCR, often CT Scanning and immediate transfer to the MTC wherever possible.

2) **'Non-Urgent'** cases. These are **potential** MTC patients with significant injuries who are stable and do not require DCR or DCS, but may well require a specialist opinion, or transfer to the MTC for ongoing care. These patients do **not** require immediate transfer. These patients need to have their initial management (e.g. oxygen, analgesia, chest drains etc.) performed at, and admission arranged, at the TU. These patients can be referred to the MTC by contacting the MT TNC's between 07:30 and 02:00. They have direct contact with the MT Surgeons/Team and the cases can be discussed, either before or in the daily MT Meeting at 09:00hrs and a plan made.

The MTC has developed an internal Electronic MT Referrals Database to record all 'non-urgent' referrals. The MT TNC will enter all the appropriate referral information onto the database,. The information required includes the consultant in charge, contact details, location of patient, injuries sustained, basic trauma observations, imaging and interventions performed.

During the hours of 02:00 and 07:30 there is no TNC on duty and so, it is recommended that the TU's manage these 'Non-Urgent' patients according to local policy and the guidance below and make any referral between the hours of 07:30 and 02:00. If there is any concern that the patient is unstable or has another clinical reason for immediate transfer to the MTC during the hours of 02:00 to 07:30 then Aintree TTL may still be contacted at the discretion of the TU TTL.

2a. Urgent Referral Pathway

These are severe cases requiring DCR +/or DCS or polytrauma patients requiring an immediate specialist service that only the MTC can provide, who are stable enough for transfer. The decision MUST be made by an ED Consultant at the TU.

E.g. Multiple Long Bone fractures, Unstable Pelvic Ring Fractures, Open Pelvic Ring Fractures, Spinal Fracture with Neurological Deficit, Open Chest Injuries, Open Long Bone Fracture in a polytrauma patient, Traumatic Ischaemic Limb.

Isolated Severe Head Injuries need to be discussed with the Neurosurgical Team. All Head Injuries associated with Polytrauma need to come through Aintree MTC TTL and ED so they can have a full Trauma Team Activation on arrival.

The Trauma Team Leader (TTL) on duty at Aintree MTC should be phoned directly via the Aintree MTC Switchboard and urgent blue light ambulance transfer arranged.

2b. Non-Urgent Referral Pathway

It is a Consultant decision to refer to the MTC, after institution of local appropriate management. Ideally the referral should be made by the Consultant who is managing the patient.

Page the TNC at Aintree MTC via Aintree Switchboard between 07:30hrs and 02:00hrs. They are available to answer the pager promptly at all times, unless managing a complex Trauma Call. So, if there is a delay in response please be aware that they may be busy with an acutely unwell MT patient. If a Consultant-to-Consultant discussion is sought then a phone number can be given to the TNC and a return call can be arranged.

3. Specialist Referrals

3a. Chest Wall Injuries

All patients must be seen by a Consultant in the TU before consideration of a referral. All referrals not reviewed by a named Consultant will not be accepted.

Indications for consideration of Rib Fracture Referral:

1. ≥ 3 rib *clinical* flail (not simply a *radiological* flail).
2. ≥ 3 ribs with *severe displacement* (bi-cortical displacement, >100%) & associated chest wall deformity & ventilatory compromise despite optimal pain management.
3. Rib fracture(s) with associated lung herniation.
4. Need for mechanical ventilation with any of the above.
5. Open chest wound.
6. Large Haemothorax (>500mls drained through ICD).

The CT scan should give the best indication as to whether a patient requires discussion with the MTC. Multiple displaced rib fractures/sternal fracture, often with chest wall deformity, significant pulmonary contusions +/or haemo or large pneumothorax are the cases likely to be considered for surgery.

Not all patients on the above list need to be referred to the MTC. If a patient can sit forwards unaided, deep breathe and cough then it is unlikely they will benefit from rib fracture surgery and can be safely managed at the TU. Undisplaced rib fractures, or rib fractures with < 50% displacement, likewise, do not require rib fracture surgery. It is highly unlikely that patients with no chest wall deformity will be accepted for transfer (best seen on the axial CT scan). Some rib fractures are not amenable to fixation, namely fractures closely related to the transverse processes (< 10mm), fractures underneath the Scapula, or fractures of the 1st, 2nd & (often) 3rd.

Please be aware that patients with marked displacement on the CT Scan, but who seem stable and 'comfortable' initially have the potential to deteriorate and therefore, in these cases, the scan should push towards an early discussion with the MTC. These are often the more elderly patients with less reserve.

Patients who do not require referral:

1. Undisplaced/mildly displaced (<100% displaced), multiple rib fractures.
2. No chest wall deformity on CT Scan.
3. 1st – 3rd rib fractures or fractures directly under the scapula (not amenable to fixation).
4. Undisplaced sternal fracture(s).

Any patient with a clinically significant pneumothorax or haemothorax associated with a chest wall injury will require an Intercostal Drain (ICD). The decision to insert an ICD should be made by the local team in the TU and should not require discussion with the MTC. Any ICD should be inserted according to the British

Thoracic Society Guidelines, remembering the importance of position, technique and prophylactic antibiotics. Patients do not need to be transferred to the MTC to have an ICD inserted.

If, however, there is some equipoise as regards the need for surgical fixation or transfer, then they should be initially admitted to the TU and managed according to the BOAST Chest Wall Injury Guidelines and, if they do not improve or they deteriorate, a subsequent discussion with the TNC between 07:30 and 02:00 should be had.

Appropriate analgesia and therapy are the key interventions in these patients. All patients should be managed in accordance with the Trauma Network chest wall injury protocol within 4 hours of admission).

In patients with a displaced clavicle fracture and minimally/undisplaced upper rib fractures, then we may recommend isolated clavicle fixation at the TU.

Be aware of the delayed haemothorax, which can occur in approximately 5% of haemothoraces. Patients admitted with multiple rib fractures should always have regular observations and be considered for daily chest radiographs.

Be aware of the following:

The older patient is at much higher risk of mortality following multiple rib fractures. There is evidence that patients 65 years of age or older are 5 times more likely to die from rib fractures compared to patients younger than 65 years. So, a higher index of suspicion is required in the elderly patient.
Bergeron E, Lavoie A, Clas D, Moore L, Ratte S, et al. (2003) Elderly trauma patients with rib fractures are at greater risk of death and pneumonia. J Trauma 54: 478-485.

The higher the number of rib fractures, the greater the risk of morbidity & mortality. It has been reported that there is a 10% chance of mortality with > 4 rib fractures, rising to 34% with ≥ 8 rib fractures.
Flagel BT, Luchette FA, Reed RL, Esposito TJ, Davis KA, et al. (2005) Half-a-dozen ribs: the breakpoint for mortality. Surgery 138: 717-725.

3b. Pelvic & Acetabular (P&A) Fractures

All patients must be seen by a T&O Consultant in the TU before consideration of a referral. All referrals not reviewed by a named T&O Consultant will not be accepted.

Not all P&A fractures need referral to the MTC. Isolated pubic rami, undisplaced pelvic ring and undisplaced acetabular fractures can be safely managed at the TU by the Local Trauma & Orthopaedic (T&O) Service +/ or by other local guidelines.

Any patient who is haemodynamically unstable with a pelvic ring fracture requires urgent resuscitation in the TU and urgent transfer to the MTC. We advise urgent TU TTL-to-Aintree MTC TTL discussion in these cases.

A patient presenting with an acute dislocation or fracture-dislocation of the native hip ideally requires an urgent reduction under general anaesthesia with muscle relaxation in the TU, to avoid the complications of nerve palsy, chondrolysis or avascular necrosis. This should be performed by the T&O Team on call, with Consultant involvement. It is vital to perform and document a thorough neurovascular examination of the affected limb before and after reduction. Non-urgent referral to the MTC can then be made via the MT TNC at Aintree, if required. If there is any concern around the immediate clinical/surgical management of the acute dislocation then this should be managed by a T&O Consultant-to-Consultant phone call made via Aintree Switchboard at any time.

All suspected Pelvic Ring or Acetabular Fractures require resuscitation &/or a CT scan prior to referral. Most P&A fractures do *not* need urgent referral and should be admitted to the TU for T&O Consultant review. They can be referred during normal working hours by the admitting T&O Consultant at the TU to the MT TNC at Aintree MTC via Aintree Switchboard, if required.

If a pelvic binder is applied to a pelvic fracture then it should be left on for no more than 24hrs (ideally < 6hrs).

3c. Open Fractures

BOAST Guidance for the management of Open Fractures was published in December 2017.

Open fractures of the hand, wrist, forefoot or digits can be managed at the TU by the local Trauma & Orthopaedic Team and do not routinely require referral to the Orthoplastics Unit or MTC following similar principles laid out in the BOAST Guidance.

All unstable patients with polytrauma and open fractures of long bones, hind foot or midfoot require initial resuscitation at the TU, followed by urgent transfer to the MTC.

All stable patients with polytrauma and open fractures of long bones, hind foot or midfoot need initial management of the injuries as per local guidelines and BOAST

Open Fracture Guidance (Dec 2017) followed by discussion with the TNC at Aintree MTC between 07:30 and 02:00.

All stable patients with isolated Open Fractures of long bones, hind foot or midfoot require urgent referral to the Orthoplastics Unit at RLUH/Broadgreen.

Isolated, highly contaminated wounds (agricultural, aquatic or sewage), or open wounds with vascular compromise (arterial disruption producing ischaemia or compartment syndrome) should undergo immediate debridement using fasciotomy lines for wound extension. Patients with suspected arterial injuries should have an urgent CT Angiogram at the TU and, if any acute vascular injury identified, discussion with the Regional Vascular LIVES service and/or Aintree MTC.

Initial management of all Open Fractures requires administration of I/V antibiotics as soon as possible and ideally within 1 hour of injury. All open fractures should be photographed and covered with saline-soaked gauze and an occlusive dressing and splinted appropriately.

'Open Fractures' British Orthopaedic Association & British Association of Plastic, Reconstructive & Aesthetic Surgeons Audit Standards for Trauma December 2017.

'Standards for the Management of Open Fractures of the Lower Limb' BAPRAS 2009.

3d.Solid Abdominal Viscus Injuries

The patient with a simple (Grade 1 or 2) Splenic, Liver or Renal laceration can be managed by the General Surgeons at the TU according to local policy.

Any Splenic or Liver Laceration Grade ≥3 should be discussed with the MTC either urgently or non-urgently depending on the presenting condition of the patient, via the TNC (07:30 to 02:00) or the TTL (02:00 to 07:30) in case of urgent referral.

Any unstable patient requiring urgent Splenectomy can still be appropriately managed at the receiving TU if the appropriate service exists and the condition of the patient warrants it.

3e. Head Injuries

Head injuries presenting to a TU should be managed according to NICE guidelines.

Any patient with a severe head injury (GCS 3-8) with an abnormal or normal CT scan should be intubated and ventilated referred to neurosurgery (**appendix 1**).

All moderate head injured (GCS 9-12) with an abnormal scan should be referred to neurosurgery. All moderate head injuries with a normal scan should be referred to neurosurgery if:

- Unexplained confusion persists for more than 4 hours.
- Failure of GCS to improve
- Progressive focal neurological signs.
- A seizure without full recovery.
- CSF leak or new neurological deficit
- Definite or suspected penetrating injury

The Liverpool HITS score (**appendix 2**) may be used as a guide to aid decision making in the referral of mild head injury patients (GCS 13-15) to the neurosurgeon on-call. However, any patient where there is significant clinical concern may be referred to the neurosurgeon on-call.

The Liverpool HITS score classifies GCS 13 -15 head injuries radiologically as follows:

- **Score 0** – Normal scan. Clinical decision to admit for neurological observations. Does not require Neurosurgical opinion.
- **Score 1** – Abnormal scan. Admit locally for neurological observations. Follow head injury guidelines.
- **Score 2** – Abnormal scan. Admit for neurological observations. Rescan at 24 hours. Follow head injury guidelines.
- **Score 3 or above** – Surgically significant injury. Refer to neurosurgery on-call

If local management is advised please follow **appendix 3.**

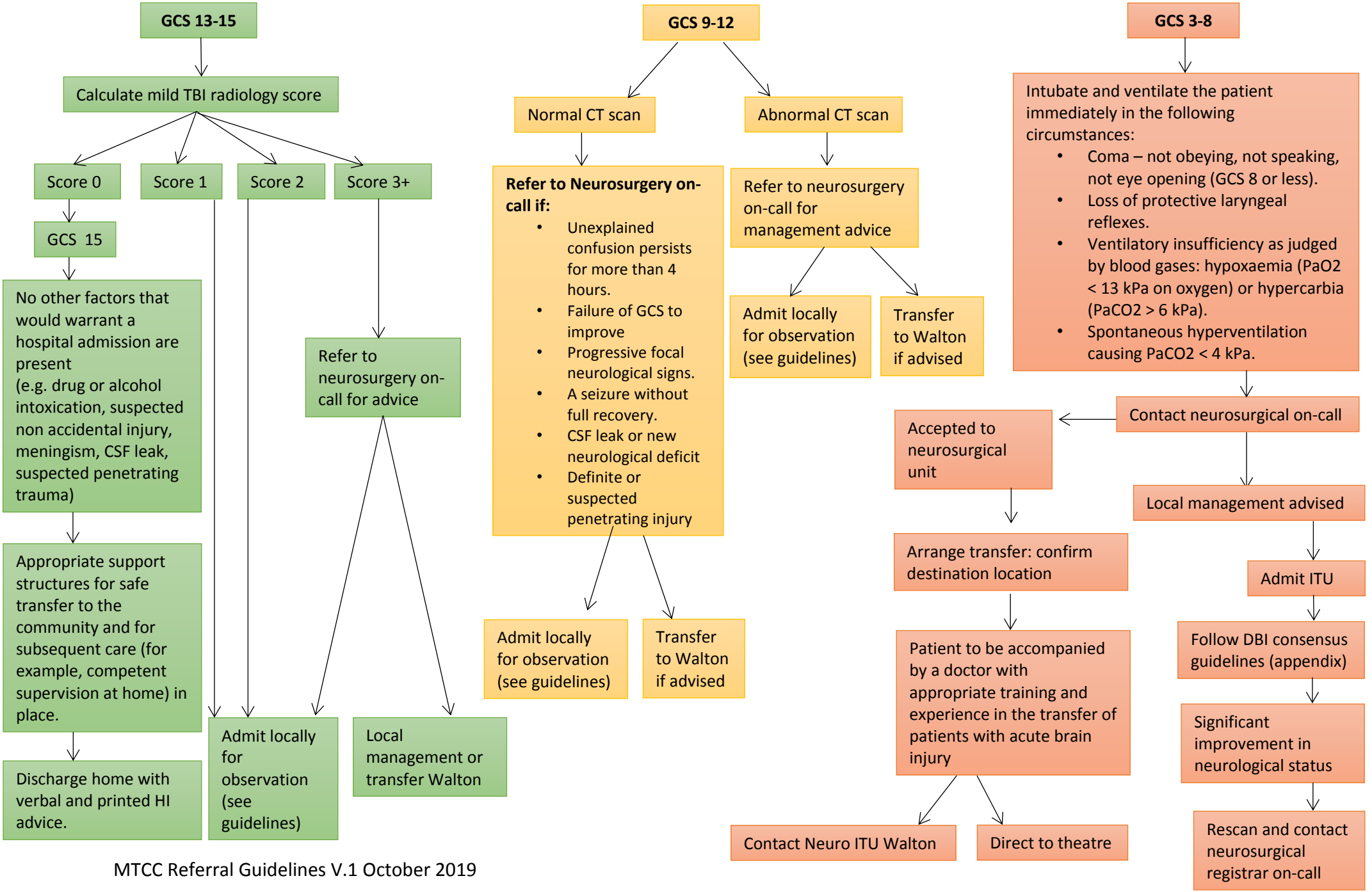
Any locally managed patient, with a mild, moderate, or severe head injury who causes significant clinical concern or radiological advice deems it necessary, may be referred to the neurosurgeon on-call for patient specific advice.

All head injured patients who have sustained polytrauma should be transferred via the major trauma centre at Aintree unless specified otherwise by the neurosurgical registrar on-call. Referral should be made via the major trauma nurse co-ordinator at Aintree prior to transfer (**0151 5292325)**

The Rapid Access transfer is available for all time critical referrals (**appendix 4**)

Patient undergoing CT scan for Traumatic brain injury (according to NICE criteria)

Appendix 1



Appendix 2

Liverpool Head Injury Tomography Score (HITS) for Mild Traumatic Brain Injury (GCS 13-15)

Extra-axial Haematomas	
Location of Haematoma	**Score**
No extra-axial haemorrhage	0
Tentorial and/or Parafalcine subdural haematoma	1
Subdural hygromas	1
Any other subdural haematoma	3
Extradural haematoma	3

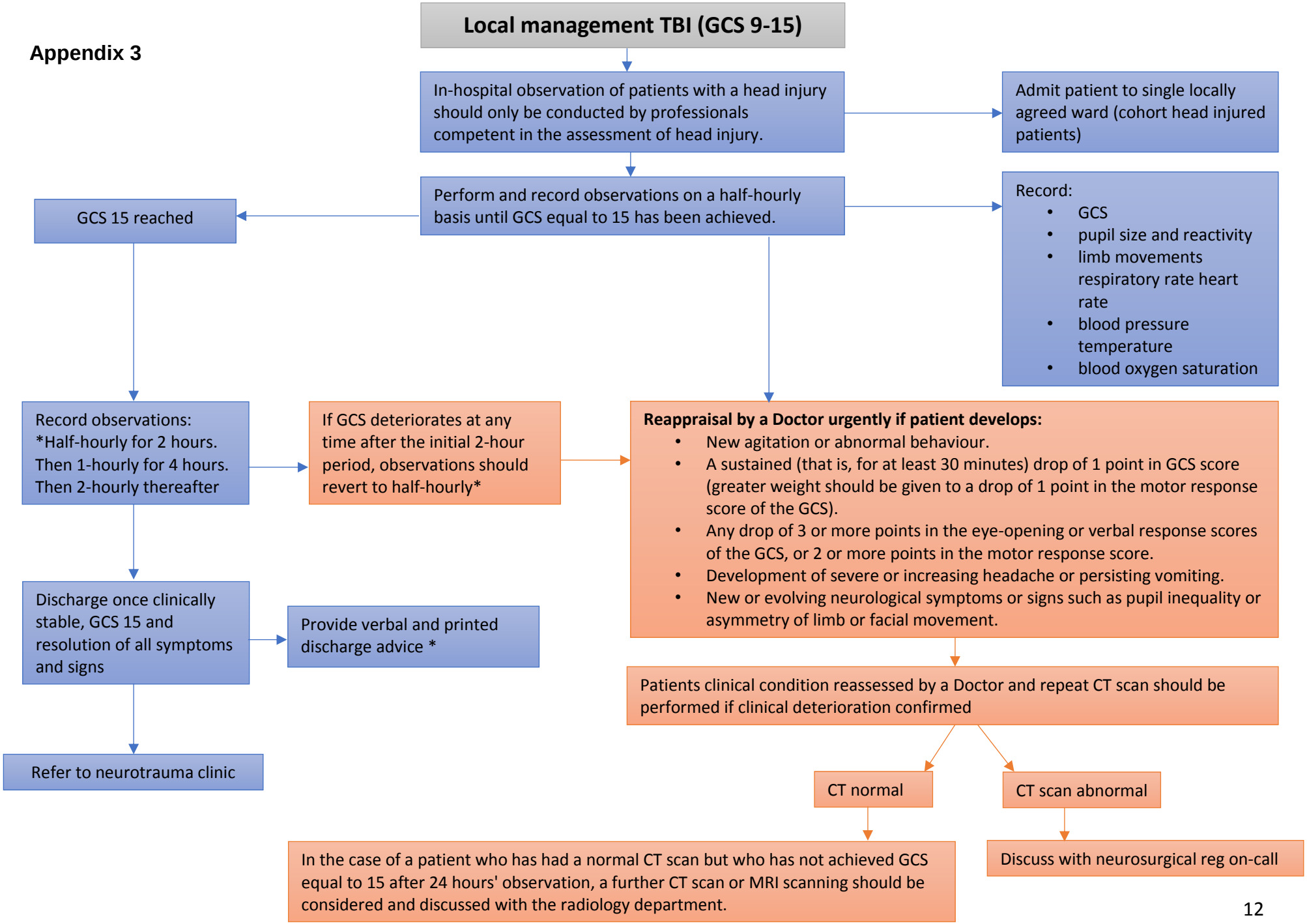
Subarachnoid Haemorrhage	
Location of Haemorrhage	**Score**
No SAH	0
Peripheral SAH only	1
Intraventricular haemorrhage	2
Blood around Circle of Willis or Sylvian fissures	3
Blood in basal cisterns	3

Parenchymal Contusion	
Size of Contusion	**Score**
No contusion	0
Single contusion < 1 cm	1
3 or less contusions all < 1 cm	2
One or more contusions, each > 1 cm	2
4 or more contusions (any size)	3
Any single contusion > 2 cm	3

Skull Fractures	
Fracture Type	**Score**
No fracture	0
Undisplaced	1
Depressed, comminuted or compound fracture	3
Penetrating injury or foreign body	3
Pneumocephalus or base of skull fracture	3

- **Score 0** – Normal scan. Clinical decision to admit for neurological observations. Does not require Neurosurgical opinion.
- **Score 1** – Abnormal scan. Admit locally for neurological observations. Follow head injury guidelines.
- **Score 2** – Abnormal scan. Admit for neurological observations. Rescan at 24 hours. Follow head injury guidelines.
- **Score 3 or above** – Surgically significant injury. Refer to neurosurgery on-call

Appendix 3


Local management TBI (GCS 9-15)
In-hospital observation of patients with a head injury should only be conducted by professionals competent in the assessment of head injury.
Admit patient to single locally agreed ward (cohort head injured patients)
Perform and record observations on a half-hourly basis until GCS equal to 15 has been achieved.
Record:
GCS
pupil size and reactivity
limb movements respiratory rate heart rate
blood pressure temperature
blood oxygen saturation
GCS 15 reached
Record observations: *Half-hourly for 2 hours. Then 1-hourly for 4 hours. Then 2-hourly thereafter
If GCS deteriorates at any time after the initial 2-hour period, observations should revert to half-hourly*
Reappraisal by a Doctor urgently if patient develops:
New agitation or abnormal behaviour.
A sustained (that is, for at least 30 minutes) drop of 1 point in GCS score (greater weight should be given to a drop of 1 point in the motor response score of the GCS).
Any drop of 3 or more points in the eye-opening or verbal response scores of the GCS, or 2 or more points in the motor response score.
Development of severe or increasing headache or persisting vomiting.
New or evolving neurological symptoms or signs such as pupil inequality or asymmetry of limb or facial movement.
Discharge once clinically stable, GCS 15 and resolution of all symptoms and signs
Provide verbal and printed discharge advice *
Patients clinical condition reassessed by a Doctor and repeat CT scan should be performed if clinical deterioration confirmed
Refer to neurotrauma clinic
CT normal
CT scan abnormal
In the case of a patient who has had a normal CT scan but who has not achieved GCS equal to 15 after 24 hours' observation, a further CT scan or MRI scanning should be considered and discussed with the radiology department.
Discuss with neurosurgical reg on-call

Walton Rapid Access Transfer Protocol AcSDH/EDH

Patient in CT scan with history of head trauma for CTB

Acute subdural blood clot > 1.5cm thickness
or
Extradural blood clot >1.5cm thickness

Neuroradiological evidence of TBI e.g. contusions, SAH, acute subdural<1.5, depressed skull fracture **or** no radiological abnormality and GCS <13

Complete full trauma CT while in scanner

GCS < 9

GCS 9-14

Discuss with registrar on-call Walton Neurosurgery via switch 0151 5253611

ACTIVATE WALTON RAPID ACCESS PROTOCOL

- Call Major Trauma Phone **07794242365** and state you have a patient fulfilling criteria for rapid access.
- If need for transfer confirmed with Walton:
- Call 0151 529 4455 to inform WCFT patient fulfils criteria and is ready for transfer.
- Complete "AT MIST" rapid handover proforma –Fax to WCFT **0151 529 5510**

Accepted for transfer Walton

Not accepted for transfer

Consider transfer via Aintree A and E if no urgent neurosurgical intervention required.

0151 529 2325

Refer Walton Neurotrauma clinic for follow up

Considerations precluding pathway

- **Severe co-morbidities e.g.** severe cardiorespiratory disease
- **Severe extracranial injury e.g. life threatening or leading to cardiovascular instability.**
- **Bilateral fixed and dilated pupils**
- **Haemodynamic instability**

Disclose to neurosurgical registrar

Appendix 5

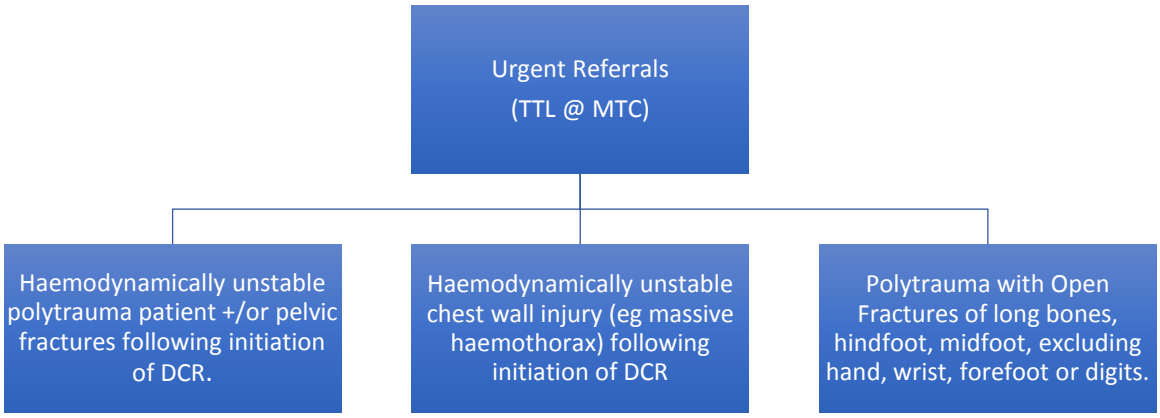
MTCC Referral Guideline Quick Reference Table

≥ 3 Rib ***clinical*** flail	Refer MTC
≥ 3 Ribs with ***severe displacement*** & associated chest wall deformity	Refer MTC
Undisplaced/mildly displaced (<100% displaced), multiple Rib fractures.	Local Management
No chest wall deformity on CT Scan	Local Management
Undisplaced P&A fractures	Local Management
Displaced P&A fractures	Refer MTC
Isolated Open Fractures (BOAST 4)	Orthoplastics at Broadgreen
Open Fractures with Vascular Injury	Refer MTC above the Elbow/Knee Refer Whiston below the Elbow/Knee?
Polytrauma with an Open Fracture	Refer MTC
Solid Organ Viscus Laceration Grade 1-2	Local Management
Solid Organ Viscus Laceration Grade > 3	Refer MTC

Appendix 6

Referral Process Flowcharts

a. Urgent Referral Process to the MTCC



b. Non Urgent Referral Process