



WHOLE BODY COMPUTED TOMOGRAPHY (WBCT) SCAN IN TRAUMA – GUIDELINES, ST GEORGE HOSPITAL (SGH)

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| 1. Purpose | To provide guidelines and recommendations for the imaging of adult patients (>18 yrs) with known and suspected blunt and penetrating injury. To establish standards and ensure optimal care. |
| 2. Risk Rating | Medium |
| 3. National Standards | 1 – Clinical Governance 5 – Comprehensive Care |
| 4. Employees it Applies to | Senior Medical Officers managing trauma patients in the ED Trauma/Surgical Consultants, Fellows and Registrars Radiologists Radiographers |

5. PROCESS

DEFINITIONS

Whole Body computed tomography (WBCT, CT Pan Scan)

⇒ Standard

- Non-contrast – head, cervical spine
- Intravenous contrast – Arterial phase of chest and upper abdomen (included kidneys) or chest to pelvis with suspected pelvis injury
- Portal Venous - Abdomen and pelvis
- With 3D reconstructions

⇒ Additional protocols to be ordered based on clinical findings or initial imaging

- CT angiography (CTA) of COW (Circle of Willis)– evidence of blunt cerebrovascular injury (BCVI)
- CT facial bones – Clinical indication of facial fractures/CT head demonstrates fractures
- CTA of carotid arteries – evidence of seat belt bruising of anterior neck or evidence of cervical spine fractures
- CT cystogram – pelvic fracture in female
- CT pelvis with rectal contrast – clinical suspicion of rectal injury
- CTA or CT of extremities – evidence of limb injury +/- concern for vascular compromise

5.1 BACKGROUND

[Modified and updated from [STAN Clinical Practice Guidelines \(phsa.ca\)](http://phsa.ca) with acknowledgement]

- 1) Rapid diagnosis and treatment remains the cornerstone of trauma management
- 2) Standardised whole-body computed tomography (WBCT) imaging is appropriate in most patients injured by a major mechanism.¹
- 3) WBCT extends imaging from head to pelvis in order to identify a wide range of clinically important occult injuries which are important in appropriate triage, management and disposition planning.²
- 4) Early WBCT can currently be accomplished rapidly with a minimum of radiation exposure and frequently obviates the need for repeat imaging.



5.2 TRIGGERS FOR CONSIDERING WBCT³

5.2.1 Mechanism

- MVC > 50k/h or MBC > 30 k/h >50km/h
- Falls: heights >3m
- Assaults: GCS <13
- Penetrating injury: through the peritoneum
- Pedestrian or cyclist struck by motor vehicle regardless of velocity
- Penetrating trauma to head, neck, torso

5.2.3 Physiological derangement with any of the above mechanisms

- Shock with systolic BP <90 +/- HR > 100
- Intubated patient where physical examination is compromised
- Airway distress
- Respiratory distress with rate <10 or >25
- GCS ≤8
- Evidence of spinal cord injury where physical examination is compromised
- *Note:* These are recommendations only to trigger consideration of WBCT.
- Clinical judgement and collaboration between treating clinicians is the optimal approach to selecting appropriate imaging for trauma patients.
- Where differing opinions exist, discussion should take place at a Consultant level to facilitate decision-making.

5.3 WBCT SCANNING OF THE UNSTABLE TRAUMA PATIENT

5.3.1 Unstable Patient Responding to Resuscitation ⁴

- It is widely accepted that CT imaging of the unstable trauma patient who has responded, even transiently, to resuscitation is appropriate and facilitates better clinical decision-making.
- This is only advisable when imaging can be completed within a reasonable time with appropriate monitoring and medical supervision of the patient.
- Expert clinical judgment and collaboration between senior medical staff is required to determine the suitability of expedited WBCT in unstable responders. The use of CT in unstable responders is well supported by current evidence.

5.3.2 Unstable Patient Transiently Responding to Resuscitation ^{5, 6}

- Unstable patients may respond to resuscitation only briefly or transiently (transient responders) suggesting the presence of ongoing haemorrhage.
- WBCT in these patients is more controversial. If ongoing physiologic support can be maintained, and scanning can be expedited rapidly in direct proximity to the ED, then the imaging findings may assist in targeting the management plan toward treatment of critical, life-threatening injuries.
- Expedited WBCT targets the presence of critical injuries including:
 - Intracranial haemorrhage with signs of raised intracranial pressure (ICP)
 - Unstable spine fracture
 - Major visceral injury with active haemorrhage
 - Pelvic fracture associated with active haemorrhage



- Aortic disruption with contained or free extravasation
- Major blunt cervical vascular injury
- *Note:* If the patient deteriorates further during scanning, they should be immediately transferred to the operating theatre or for definitive management of haemorrhage.

5.4 PRACTICE NOTES

5.4.1 Intravenous contrast⁷

- Intravenous contrast should be administered when imaging the vascular system and/or abdomen and pelvis when there is no known anaphylaxis to contrast.
- There is a low risk for contrast-induced nephropathy in patients with history of pre-existing renal insufficiency, diabetes mellitus, nephrotoxic or diuretic drug administration
- In major trauma where the clinical scenario warrants the use of contrast, renal function tests should not delay the CT scan.
- Contrast reaction
 - Carries a risk of anaphylactic reaction but is rare. (0.04-0.22% of studies)
 - Seafood allergy does not increase the risk for anaphylactic contrast reaction
 - Atopic tendencies do not increase risk for anaphylaxis with contrast
 - Patients with a history of previous contrast reaction have the highest risk
 - Contrast reaction can be attenuated with steroids
 - Need to be given 4 hours before the scan- not practical in acute trauma

Do not delay emergent scans unless true history of mild, moderate or severe reaction then → non-contrast study

- *Note:* Oral contrast is not used in acute WBCT scan in trauma.

5.4.2 Radiation dose^{7,8,9,10}

- The Royal College of Radiologists (UK) recommends whole body contrast enhanced MDCT (WBCT) in all severely injured patients as a standard.
- There is debate in the literature whether the benefits of routine WBCT in major trauma patients outweigh risks associated with radiation exposure.
- Radiation exposure should be limited in all patients, particularly in the paediatric and pregnant population.
- Multi-detector computed tomography (MDCT) technology dose-adjusting software, based on body region, patient body habitus, and iterative reconstruction methodologies, has reduced radiation exposure significantly on modern scanners
- Expert consensus currently does not specify a definitive lifetime risk for malignancy, though it is likely to be exceedingly small.^{7,8}
- It is important to understand this issue and balance the diminutive risk of exposure against the risk from potential missed or delayed diagnosis.
- A reasonable risk-benefit assessment must guide all imaging investigations in trauma patients. Consultation with attending radiologists to determine the preferred approach to imaging in complex situations is encouraged.

American College of Radiology (ACR) Appropriateness Criteria® Major Blunt Trauma (acr.org)



5.4.3 WBCT scan in the pregnant trauma patient¹¹

- CT is the preferred imaging choice for pregnant trauma patients. Where practical, reduce radiation exposure while using an adequate dose to achieve a diagnosis. Radiation dose should follow the principle of **ALARA: As Low As Reasonably Achievable**
- The risks of ionising radiation to the pregnant patient and foetus are small compared with the risk of missed or delayed maternal injury diagnosis.
- The safety of Omnipaque for use in pregnancy has not been established. Teratogenicity studies have been performed in animals and no evidence of harm to the embryo or foetus, or of impaired fertility has been demonstrated.

5.5 DOCUMENTATION.

- The use of WBCT scan should be documented for periodic review. This information can be recorded at the Radiation Safety Committee and shared with Trauma/Emergency.

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| 6. Cross References | SGH BR 701 - Trauma - Radiographer response to Emergency Department Trauma Activation – St George Hospital SGH BR 548 – Code Crimson Trauma SGH BR 159 – Management of the Pregnant Trauma Patient |
| 7. Keywords | Trauma imaging, CT Pan scan, CT – whole body CT in trauma, Radiology |
| 8. BR Location | SGH-TSH Business Rule Webpage – Trauma St George Hospital |
| 9. External References | <ol style="list-style-type: none"> 1. Huber-Wagner S, Lefering R, Qvick LM, Korner M, Kay MV, Pfeifer KJ, et al. Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. <i>Lancet</i>. 2009;373(9673):1455–61 2. Treskes K, Saltzherr T, Luitse J, Beenen L, Goslings JC Indications for total-body computed tomography in blunt trauma patients: a systematic review. <i>Eur J Trauma Emerg Surg Eur</i>. 2017 Feb;43(1):35-42. 3. 17_C List triggers Standard Trauma Imaging CT Protocol.pdf (phsa.ca) 4. Huber-Wagner S, Biberthaler P, Häberle S, Wierer M, Dobritz M, Rummeny E, et al. Whole-Body CT in Haemodynamically Unstable Severely Injured Patients – A Retrospective, Multicentre Study. <i>PLoS One</i> [Internet]. 2013 Jul 5. Ordoñez CA, Herrera-Escobar JP, Parra MW, Rodriguez-Ossa PA, Mejia DA, Sanchez AI, et al. Computed tomography in hemodynamically unstable severely injured blunt and penetrating trauma patients. <i>Journal of Trauma and Acute Care Surgery</i>. 2016 Apr;80(4):59 6. Tsutsumi Y, Fukuma S, Tsuchiya A, Ikenoue T, Yamamoto Y, Shimizu S, et al. Computed tomography during initial management and mortality among hemodynamically unstable blunt trauma patients: a nationwide retrospective cohort study. <i>Scand J Trauma Resusc Emerg Med</i> [Internet]. 2017 Jul 19 7. imaging_guidelines.pdf (facs.org) 8. The Royal College of Radiologists. Standards of practice and guidance for trauma radiology in severely injured patients, second edition [Internet]. London: The Royal College of Radiologists, 2015 [cited 2017 Oct 5]. Available from: https://www.rcr.ac.uk/publication/standards-practice-and-guidance-trauma-radiologyseverely-injured-patients-second |



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| | <p>9. McCollough CH, Bushberg JT, Fletcher JG, Eckel LJ. Answers to common questions about the use and safety of CT scans. <i>Mayo Clin Proc.</i> 2015; 90(10): 1380-1392.</p> <p>10. Amis ES, Butler PF, Applegate KE, Birnbaum SB, Brateman LF, Hevezi JM, et al. American College of Radiology white paper on radiation dose in medicine. <i>J Am Coll Radiol.</i> 2007 May;4(5):272–84.</p> <p>11. Raptis C, Mellnick V, Raptis D, Kitchin D et al. Imaging of Trauma in the Pregnant Patient. <i>RadioGraphics</i> Vol. 34, No. 3: 748-764</p> <p>12. STAN Clinical Practice Guidelines (phsa.ca)</p> |
| 10. Consumer Advisory Group (CAG) Approval | Not Applicable |
| 11. Aboriginal Health Impact Statement | The Aboriginal Health Impact Statement does not pertain: there is no impact on Aboriginal people. All trauma patients, including Aboriginal people, presenting to the St George Hospital Trauma Service are managed according to American College of Surgeons Committee on Trauma Guidelines (See below). Appropriate radiological imaging is essential for diagnosing significant injury in any patient with significant mechanism. |
| 12. Implementation and Evaluation Plan | <p>This is a new BR which has been discussed at the St George Trauma Committee whose members include ED Consultants and Senior Nurses.</p> <p>In-service education will be provided for ED staff. The BR will be presented at Surgical Grand Rounds</p> <p>Implementation evaluation and provision of evidence to the CGDC is the responsibility of the coordinator/author.</p> <p>Implementation: The document will be published on the SGH-TSH business rule webpage and distributed via the monthly SGH-TSH CGD report.</p> <p>Evaluation: The use of CT Pan scan is audited regularly by the ED.</p> |
| 13. Knowledge Evaluation | <p>Q1: What images are included in the standard WBCT protocol? A1: <i>Non-contrast CT brain and C-spine. Intravenous contrast enhanced chest, abdomen and pelvis.</i></p> <p>Q2: When should a CT carotids and Circle of Willis (CT COW) be considered? A2: <i>When there is evidence of blunt cerebrovascular injury, evidence of seat belt bruising of anterior neck or presence of cervical spine fractures</i></p> <p>Q3: What does ALARA stand for when considering radiation dose in CT scanning particularly in pregnant patients? A3: <i>As Low As Reasonably Achievable</i></p> |
| 14. Who is Responsible | Director of Trauma |



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| Approval for: WHOLE BODY CT SCAN IN TRAUMA – GUIDELINES | |
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| Specialty/Department Committee | Committee: SESLHD Network Trauma Committee Chairperson: Sarah O'Hare District Trauma CNC Date: 11.04.2023 |
| Nurse Manager / Divisional Director (SGH) | Name, position: Megan Foreshew for Hayley Smithwick, Divisional Director Critical care & Medical Imaging Date: 1.04.2023 |
| Medical Head of Department (SGH) | Dr Mary Langcake, Director of Trauma Date: 11.04.2023 |
| Executive Sponsor / s | Name, position: Andrew Bridgeman, Divisional Director Surgery Date: 17.04.2023 |
| Contributors to BR | Contribution (current revision) Mary Langcake, Director of Trauma Sarah O'Hare, District Trauma CNC |
| | Consultation: Southern Sector Radiation Safety Committee |

| Revision and Approval History | | | | |
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| Revision Date | Revision number | Reason | Coordinator/Author | Revision Due |
| May 2023 | 0 | New Updated from April 2008 version | Sarah O'Hare, SESLHD CNC Trauma | May 2026 |

| General Manager's Ratification | |
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| Angela Karooz (SGH) | Date: 25.05.2023 |