Pan computed tomography for blunt polytrauma: Are we doing too many?

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Background. Pan computed tomography (CT) is widely used in the evaluation of patients with blunt polytrauma, but there is growing concern about the radiation risks imposed.

Objectives. To ascertain whether we were possibly overutilising pan CT in our trauma service, and whether we could safely cut down on scans without missing significant injuries.

Methods. We audited all pan scans performed in the Metropolitan Trauma Service, Pietermaritzburg, South Africa, during the 12-month period 1 January - 31 December 2012. An analysis was done to determine what injuries were identified and how these findings influenced our management.

Results. Of the 140 pan scans, 108 (77.1%) influenced management. These included the following components: 62 brain scans (44.3%), 16 cervical spine scans (11.4%), 50 chest scans (35.7%) and 31 abdominal scans (22.1%). The remaining 32 pan scans (22.9%) did not influence management. However, it turned out that many of these 'clinically negative' scans were in fact clinically important, ruling out injury in patients in whom clinical assessment was regarded as unreliable: 3 patients (2.1%) were hypoxic and had to be sedated, intubated and ventilated; 14 (10.0%) had a Glasgow Coma Score (GCS) of <15; and 9 (6.4%) had major distracting injuries. This left only 6 pan scans (4.3%) that were not regarded as clinically helpful.

Conclusion. In our setting, the majority of pan scans influence management. By ruling out significant injuries, clinically negative scans are valuable in patients who are obtunded, intubated and ventilated, or have major distracting injuries. In patients with a GCS of 15, not sedated and ventilated and with no major distracting injuries, clinical assessment and alternative imaging modalities may suffice.


The advantages of a pan (head-to-pelvis) computed tomography (CT) scan in the blunt polytrauma setting are manifold, including rapid identification of multiple injuries, improved prioritisation of management, guided selection of non-operative management of solid organ injuries, and better selection of patients needing intensive care or those who can safely be admitted to the ward or discharged home. Pan CT in this setting has been shown to have a positive impact on survival.[1,2]

Unfortunately there are also a number of disadvantages to pan CT, including financial expense, potential overuse of limited resources, risks related to the use of intravenous contrast medium, and most worrisome, radiation risk. Relevant organ radiation doses from a full-body CT examination range from 10 to 16 mGy and result in a mean effective dose (weighted average over all relevant organs) of about 12 mSv.[3] The estimated lifetime cancer mortality risk from a single full-body CT examination is ~1:1 700 for a 45-year-old adult and ~1:1 250 for a 65-year-old adult.[3] The estimated risk is considerably higher in a 1-year-old: 0.18% for abdominal CT and 0.07% for head CT.[4] Although this may seem like a small risk to an individual, considering how many CT scans are being performed annually it constitutes a substantial population risk. This poses the challenge that we need to be as selective as possible when using pan CT, but without missing important injuries. To answer the question 'Can we safely cut down on pan scans?' we performed an audit of all the pan scans we performed in our metropolitan unit in 2012.

Methods

All data were retrieved from the prospectively maintained trauma registry in the Department of Surgery, University of KwaZulu-Natal, Pietermaritzburg, South Africa. Ethics approval was granted to perform retrospective audits from this registry (Biomedical Research Ethics Committee, No. 207/09). Our metropolitan trauma service comprises two busy urban hospitals (Edendale with 900 beds and Grey’s with 500 beds; 2 500 trauma admissions per annum combined).[5] We performed an audit of all pan CT scans done for blunt polytrauma at both hospitals in 2012. Indications for pan CT in our setting include injuries on both sides of the diaphragm (e.g. head injury and fractured femur), significant mechanism of injury (e.g. fall from a height or ejected from a moving vehicle), and depressed level of consciousness with unknown mechanism of injury (Table 1). Only well-resuscitated, haemodynamically stable patients are allowed pan CT.

<table>
<thead>
<tr>
<th>Table 1. Indication for pan CT in blunt trauma patients*</th>
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<td>Injuries on both sides of the diaphragm (e.g. head injury and fractured femur)</td>
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<td>Significant mechanism of injury (e.g. fell from a height or ejected from a moving vehicle) with evidence of polytrauma</td>
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<tr>
<td>Depressed level of consciousness with unknown mechanism of injury (e.g. found unconscious by the roadside)</td>
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*Patients must be haemodynamically stable.
Results
A total of 140 pan scans were performed in our metropolitan unit during 2012. Of these, 108 were done on males and 32 on females. The average age of our patients was 24 years (range 2 - 62). The mechanism of injury was vehicle related in 119 patients, the remaining injuries being related to assaults, falls and building collapse.

Five pan scans (3.6% of all pan scans performed) were totally negative, i.e., all components (head, neck, chest, abdomen, pelvis) were negative for any signs of injury. The remaining 135 scans (96.4%) had positive findings of some sort, major or minor.

Of the 140 pan scans, 108 (77.1%) demonstrated findings that influenced our management. These included the following components: 62 brain scans (44.3% of the total), 16 cervical spine scans (11.4%), 50 chest scans (35.7%) and 31 abdominal scans (22.1%) (Fig. 1).

The remaining 32 pan scans (22.9%) were either ‘radiologically negative’ or demonstrated findings that did not influence management (Fig. 2). To facilitate further analysis, these scans are referred to as ‘clinically negative’. Among the patients who had clinically negative scans, 3 (2.1%) were intubated and ventilated, admitted to the ICU, and kept sedated for >24 hours, due to hypoxia related to either lung contusion or aspiration or both. A further 14 patients (10.0%) had a Glasgow Coma Score (GCS) of <15 and could not be reliably assessed clinically, while 9 patients (6.4%) had major distracting injuries that made assessment of the cervical spine and abdomen unreliable. This left only 6 pan scans (4.3%) that were not regarded as clinically helpful; these patients were not sedated and ventilated, did not have a GCS of <15, and did not have major distracting injuries.

Discussion
There is little doubt about the radiation risks associated with CT imaging, and in particular the use of pan CT.[12] In a modern age where many imaging modalities involve radiation, the radiation burden to the population is already high.[11] CT has become the imaging modality of choice for a wide variety of medical conditions, and unfortunately carries a considerably higher radiation burden than other imaging modalities that involve radiation.[12]

Furthermore, CT has become a leading imaging modality in emergency rooms, and patients may be exposed to repeated CT scanning at separate visits to the emergency room.[13] Also of concern is the practice of repeat CT scanning of patients who have been referred from another centre where they have already been scanned but the images on the transferred storage disc are not compatible with the receiving centre’s technology.[14]

Balanced against the above concerns, modern trauma care has become inseparable from pan CT; the concept is embraced worldwide and the benefits are clear. However, in light of the risks, in particular radiation risk, clinicians have to weigh the risk v. the benefits for each individual patient.

The overriding concern is that of possible overuse of this imaging modality. Salim et al.[15] advocate a liberal policy in which pan CT is advocated for all patients with significant mechanisms of injury, even when they are clinically evaluable with no obvious signs of chest or abdominal injury. In their study, overall treatment was changed in 18.9% of patients based on abnormal CT scan findings. The concern arises that >80% of their patients could have been spared a pan scan, and the question arises whether other modalities may equally guide management in this setting.

Imaging of polytrauma patients at our institution is undertaken according to strict protocols, in an attempt to ensure that unnecessary investigations are minimised and that inappropriate patients are not sent for imaging. In our analysis, over three-quarters (77.1%) of scans influenced initial management of this cohort of trauma patients. This left 22.9% of patients in whom there were some CT findings that did not alter the initial management. While these scans were not necessarily radiologically negative, we considered them to be clinically negative.

The concern arises that these clinically negative scans may have been unnecessarily performed, and that we could have spared this group of patients the radiation burden. However, upon further scrutiny of this group, it became clear that a reassuring negative scan was vital in many of them, particularly those who were sedated or obtunded and those with major distracting injuries.

While CT of the head may be considered unnecessary in patients with minor traumatic brain injury,[16] the majority of our patients in this category had risk factors necessitating
References

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