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ORIGINAL ARTICLE

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Standardized whole-body computed tomography as a screening tool in blunt multitrauma patients

Abstract The authors present the potential of using a preset CT protocol covering the whole body of the patient who has suffered blunt trauma to screen for injuries, based on a review of the literature and on 4 years' direct experience. Standardized whole-body CT is the fastest method of examining the whole body, capable of detecting a wide variety of traumatic lesions with a high sensitivity and specificity. Multidetector CT allows a full-body examination to be completed within 5 min, thus minimizing time to diagnosis and the institution of definitive clinical care. Current imaging algorithms that include abdominal ultrasonography and plain radiographic studies need to be reassessed in view of the technical advances in CT diagnosis, but should ultimately depend on the particular imaging capabilities and experience of a given trauma center.

Key words Standardized whole body computed tomography – Multiple trauma – Blunt trauma – Trauma routine – Emergency radiology – Screening

Introduction

When a trauma patient is examined with CT, by tradition the examination is directed to one or several body regions, based on clinical suspicion or findings of injury. The purpose of this article is to first review the literature in order to discuss the value of using a preset CT protocol covering the whole body of the blunt trauma patient to screen for injuries. The possibilities and limitations of a standardized whole-body CT (SWB-CT) trauma protocol depending on the performance of the CT equipment is discussed together with the authors' personal experience over 4 years using SWB-CT at the Karolinska Hospital in Stockholm, Sweden.

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For which trauma patients is SWB-CT suitable?

Inclusion algorithm

Any injured patient should be assessed and resuscitated according to the ATLS standards [1] in the trauma admission room. The hemodynamically unstable patient is not fit to move to a CT suite. The hemodynamically stable patient is thus the patient who should be considered the most suitable for SWB-CT evaluation (Fig. 1).

The stable patient

The decision to regard a patient as hemodynamically stable enough to move to the CT scan room is at the discretion of the attending trauma surgeon. It is influenced not only by the patient's clinical status but also by the distance to the scanner and the anticipated examination time. Physiological monitoring and support facilities in the CT room should be adequate to support critically ill patients. An expeditious CT routine will enable more severely injured patients to be examined.

The ATLS routine [1] includes anteroposterior radiographs of the chest and pelvis in the trauma room, together with a lateral cervical spine radiograph. The use of ultrasonography in the trauma room to detect thoracic and abdominal free fluid is becoming increasingly common [2]. Depending on the individual logistics and geographical setting these examinations should be

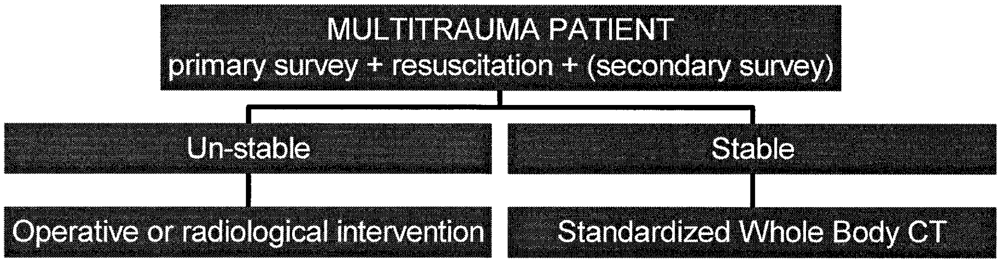

Fig. 1 SWB-CT triage algorithm for blunt trauma victims

time-limited to select the patient in most immediate need of operative treatment, or else should be reconsidered to save time when the patient is scheduled to undergo SWB-CT.

To what extent can clinical examination exclude injury?

It is well known that a patient may have a serious intracranial injury without exhibiting clinical signs of decreased level of consciousness or neurological deficits. Clinical exclusion of spinal injuries is based on a normal level of consciousness, a normal clinical examination, and the absence of major distracting injuries. This makes it impossible to clinically exclude cervical spine injuries among most multitrauma patients. Furthermore, clinical examination cannot exclude many pulmonary and mediastinal injuries, including lung contusion or laceration, pneumothorax, hemothorax, mediastinal hemorrhage, and intrapericardial blood or air among others. According to the ATLS standards it is not possible to exclude significant injury to the abdomen and pelvis clinically [1]. The clinical evaluation is especially difficult in unconscious, obtunded, or unreliable patients, including those with drug or alcohol intoxication. Thus, several types of significant injuries cannot be detected or excluded by clinical examination alone and require complimentary diagnostic imaging. A review of the literature offers insights that establish the advantages of CT as the diagnostic study of choice in blunt multitrauma patients.

Why whole-body CT?

General advantages of SWB-CT

Radiological investigation is necessary to detect or exclude injuries in all body regions referred to above. In ATLS management, the secondary survey is a complete physical examination from head to toe. Given recent advances in CT technology, it is possible to make a corresponding "whole-body" radiological survey in a short time, thus both identifying critical occult injuries and decreasing the number of overlooked lesser injuries. This approach expands present CT routines of scanning selected body regions based on clinical suspicion. SWB-CT is the fastest possible radiological investigation permitting "complete" body coverage in the multitrauma patient while supporting definitive care within the "golden hour" after injury. With state-of-the-art hardware capacity it is also possible to evaluate the entire spine and pelvis with excellent image quality within the same CT examination (Fig. 2).

Fig. 2 Coronal and sagittal reformats of thoracolumbar spine and pelvis from 3-mm-collimated helical scanning reconstructed by 2-mm intervals

It is possible to detect critical vascular injuries including direct signs of vascular injury [3, 4, 5], diminished or occluded organ perfusion, active bleeding [4, 6, 7, 8], and pseudoaneurysms [3, 9]. The severity of bleeding and the need for intervention may be graded according to Taylor [10]. It is also possible to detect clinically occult hypovolemia [11].

Table 1 Glasgow Coma Scale [15]. GCS score = (E + M + V); best possible score = 15; worst possible score = 3

Eye opening (E)	Best motor response (M)	Best verbal response (V)
4 – Spontaneous	6 – Obeys commands	5 – Oriented
3 – To speech	5 – Localizes pain	4 – Confused conversation
2 – To pain	4 – Normal flexion	3 – Inappropriate words
1 – None	3 – Abnormal flexion	2 – Incomprehensible sounds
	2 – Extension	1 – None
	1 – None	

Radiological evaluation area by area

Head imaging

Three different studies [12, 13, 14] comprising 4,006 patients with a GCS score [15] (Table 1) of 13–15 revealed that 20 % of these patients had relevant pathological CT findings; of these, 4.6 % required craniotomy. Of patients with a GCS score of 15 (i. e., normal level of consciousness), 6 % were diagnosed with craniocerebral injuries, which indicates the need for head CT even in the neurologically intact patient. The Scandinavian Neurotrauma Committee guidelines [16] recommend cranial CT evaluation for both mild head injury, defined as GCS 14–15, loss of consciousness for less than 6 min without focal neurological deficit, as well as for minimal head injury, defined as GCS 15 without loss of consciousness, *but* with risk factors present (such as multiple injuries!). This view also argues the necessity of performing head CT in all multiple trauma patients.

Facial imaging

Since the early 1980 s facial CT has played an increasing role [17]. Faster imaging with thinner slices has enabled the covering of successively larger volumes with increased resolution. The advent of image postprocessing and algorithms for multiplanar, 3D, and volume-rendering reconstruction has further enhanced the diagnostic procedure [18]. Rehm and Ross [19] have shown that facial injuries are difficult to reliably diagnose or exclude clinically. They studied 116 intubated, multiply injured patients with head CT, revealing 27 clinically unsuspected fractures which resulted in operative treatment of 13 patients. Rhea [18] suggests that indications for facial CT are broad and that CT compares favorably with plain film economically. In the case of the multitraumatized patient the facial examination is often not of the highest priority, but there are clear advantages to having the examination performed on admission to enable adequate surgical repair planning [20]. The facial CT can easily be incorporated in the SWB-CT concept.

Thoracic imaging

Compared to plain chest radiographs, spiral CT is more sensitive and specific for most thoracic pathology seen in blunt trauma patients, inducing therapy changes in a considerable number of patients [21, 22, 23]. Rhea et al. [24] investigated 174 multitrauma patients with abdominal CT and reviewed the included lower thoracic scans. CT showed 55 additional thoracic injuries in 41 patients, of whom 7 required alteration of planned treatment. Karaaslan et al. [25] studied 47 severe brain-injured patients with limited chest CT. This CT study added information in 14 patients and altered the management of six.

The sometimes very difficult diagnosis of traumatic diaphragmatic injury is often delayed. Guth et al. [26] reviewed 57 cases where 7 % were missed on the first admission and as many as 37 % of those diagnosed were diagnosed peroperatively while undergoing surgery for other diagnosis. Thoracic CT, as demonstrated by Scaglione et al. [27], can enhance the diagnostic work-up.

The value of CT in the exclusion of thoracic aortic injury is extensively investigated. Relying solely on the appearance of the mediastinum on plain radiographic evaluation results in a high number of thoracic angiograms showing a normal aorta. Articles by Mirvis et al. [28, 29] summarize the literature and the personal experience of the authors proving that CT is an accurate tool in evaluating the mediastinum for thoracic aortic injury. When a protocol of 2.5- to 3-mm collimated helical scanning is included in the SWB-CT, the normal mediastinum and most injuries can be well defined, leaving only a few cases that require supplementary thoracic aortic angiography. The poor reliability of chest radiography has been shown by Demetriades et al. [30], who investigated 112 patients involved in high-speed deceleration accidents using helical CT, regardless of chest radiographic findings. Overall, they found nine patients with traumatic aortic injury of whom four had the chest radiograph interpreted as normal. Thus, the SWB-CT protocol can be expected to show the presence and extent of thoracic injuries more accurately than conventional radiography, reducing the number of unnecessary thoracic aortograms and altering management for many patients.

Abdominal imaging

A normal initial clinical examination of the abdomen cannot exclude significant intraabdominal injury by ATLS standards [1]. Due to distracting extraabdominal injuries, clinical examination of the abdomen proved to be falsely negative in 10 (7%) out of 142 awake and alert adult patients in a study by Ferrera et al. [31]. Schurink et al. [32] investigated the value of physical examination in blunt abdominal trauma and found it unreliable in 45% of multiply injured patients and in 84% of those with suspected "isolated" head injury as compared to radiological evaluation. The clinical difficulties are also shown in two studies where abdominal CT was performed because of suspicion of or uncertainty of abdominal trauma. Despite negative abdominal physical findings, Beaver et al. [33] found significant intraabdominal injuries in 12 (21%) out of 56 brain-injured children, of whom 2 underwent celiotomy. Neubert et al. [34] found intraabdominal injuries in 27 (47%) out of 58 multitrauma patients, resulting in 11 celiotomies.

From the early 1980s CT was reported by Federle and Wing et al. [35, 36, 37] to be highly accurate for abdominal organ injury, replacing other modalities such as ultrasound, angiography, and peritoneal lavage. Use of CT has a tremendous clinical impact on the acute evaluation and management of blunt abdominal trauma victims. The advent of CT has enabled an increase in conservatively treated patients as well as the selection of patients who benefit from interventional radiological measures.

In the 1980s CT was considered to be relatively inaccurate for detecting bowel and mesenteric injuries [38, 39]. In the last decade there has been steady improvement in CT accuracy with these injuries, due to improved technology and better general appreciation of the CT signs of bowel and mesenteric injury [40, 41].

Ultrasonography may be used to detect free fluid in the peritoneal cavity, pleural spaces, and the pericardium. This is of special value in the hemodynamically unstable patient who is unable to be moved to a CT scanner. Ultrasonography, though, cannot be used as a substitute for a CT examination since the absence of free fluid does not exclude significant abdominal injury. This was shown by Shanmuganathan et al. [42], who found absence of hemoperitoneum in 34% of patients with abdominal visceral injury (of whom 17% required surgical or angiographic intervention).

In summary, since the physical examination of the abdomen in the multitraumatized patient is not reliable in excluding injuries, additional evaluation is necessary. CT examination has largely replaced diagnostic peritoneal lavage, is highly accurate, and is considered the method of choice for abdominal imaging.

Cervical spine imaging

Nuñez et al. [43] showed the superiority of helical CT over plain radiographs in a study of 88 patients of whom 32 had 50 fractures not shown by radiography. One-third of these fractures were judged to be either clinically significant or unstable. Hanson et al. [44] showed that when helical CT was used as screening tool in 601 high-risk blunt trauma patients a 95% sensitivity and 93% specificity for cervical spine injuries was obtained. Thin-collimation protocols increase the diagnostic value of CT as shown by Rubenstein et al. [45] in an experimental study. They used a phantom consisting of an undisplaced type II odontoid fracture and scanned it using different scanners and different slice collimation. No images thicker than 2 mm were able to show the fracture. The new multidetector CT (MD-CT) devices facilitate the use of 1-mm collimation for the entire cervical spine within a multitrauma screening protocol. Depending on CT equipment capability, the cervical spine is included in the SWB-CT examination.

Thoracolumbar spine, pelvic, major skeleton, and retroperitoneal imaging

In the obtunded or uncooperative multitrauma patient the skeleton is difficult to evaluate clinically, and significant injury is often missed. Anderson et al. [46] reported 24% delayed diagnosis of thoracolumbar fractures, the majority of these (77%) occurring in unstable patients. Mackersie et al. [47] made a routine radiological survey of 789 trauma patients obtunded by head injury, drugs, or hypotension with GCS < 10, mapping potentially occult injuries. They revealed an overall 31% incidence of major skeletal injury (axial spine 14%, pelvis 10%, hip or lower extremity long bones 15%). Ward and Nunley [48] found missed orthopedic injuries in 20 of 111 multitrauma patients, concluding that due to the nature and extent of the overall trauma, not all injuries could be diagnosed initially. The diagnostic problem could partly be solved with SWB-CT as screening tool, especially with the extended coverage made possible by MD-CT. The accuracy of CT is supported in a study by Rhea et al. [49] where the need for plain films of the thoracolumbar spine after a thoracoabdominal CT study is questioned. Rhea found that the CT examination accurately identified and characterized 30 (97%) of 31 fractures, compared to 19 (59%) of 31 fractures for conventional radiography.

Pelvic imaging with CT has been shown to be more sensitive than plain film in fracture detection [50, 51], as well as more reliable in demonstration of bleeding source [52, 53]. Pelvic CT can also help predict sites of bleeding prior to interventional angiographic procedures [54, 55], but above all a CT examination can differentiate between intra- and retroperitoneal damage with high specificity.

Other retroperitoneal injuries are identified and CT is helpful in monitoring conservative treatment of the kidneys [54, 55]; this is especially important since operative treatment should be used very selectively because of the high complication rate [56].

Summary of literature review

CT is the method of choice in the acute evaluation of possible craniocerebral injury, and is even needed in multitrauma patients without any clinical signs of injury. Detailed assessment of facial fractures and associated soft tissue injuries requires CT scanning that can permit 2D and 3D imaging to assist in clinical appreciation of complex injuries. CT is clearly superior to plain chest radiographs for evaluation of the lung parenchyma, pleural and pericardial spaces, and mediastinum, leaving few patients who require thoracic angiography to exclude traumatic aortic injury. In the abdomen, CT is the method of choice, locating and defining the extent of injury, including renal function/injury, and demonstrating retroperitoneal injury. Routine spinal and major skeletal imaging is indicated in the obtunded patient. With helical CT, high-quality imaging of the entire spine, pelvis, and proximal extremities is possible, thus obviating time-consuming plain radiographs during the acute phase. The SWB-CT examination substitutes for conventional plain films of both the cervical and thoracolumbar spine. The number of plain film studies needed may thus be kept to a minimum, concentrating on imaging of distal extremities.

There are several indications necessitating the transport of the patient to a CT scanner for the evaluation of a single body region. Once the patient is on the CT table, scanning the whole body adds only a short time to the procedure and gives the benefit of ensuring diagnosis of clinically silent injuries. The additional time needed to complete a full body study is shorter with CT than any combination of other imaging methods. The choice of CT as the method for a radiological trauma whole-body survey eliminates unnecessary delay. Standardization of the CT examination offers a routine that is straightforward for training imaging technologists.

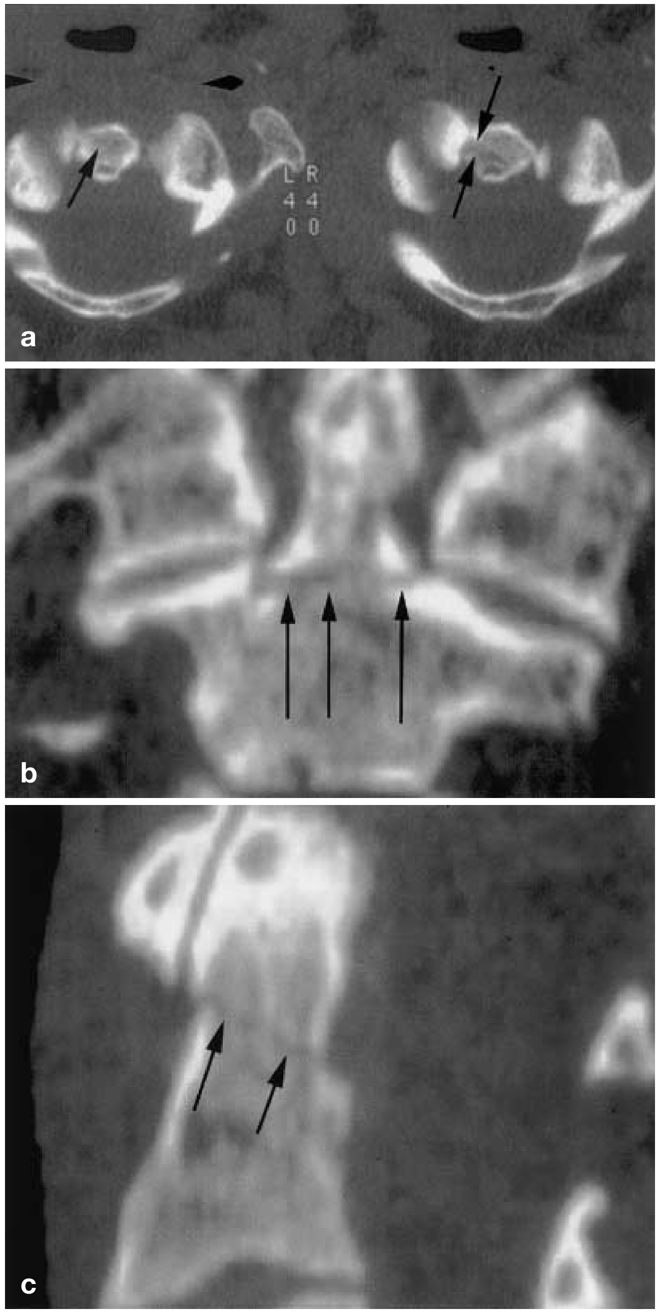

Fig. 3 a–c Helical scan protocol of the whole cervical spine should use as thin collimation as possible. This results in higher quality of the reformat, facilitating the diagnosis of slightly dislocated fractures. The images in **a** show an axial scan of an odontoid fracture of type II *(arrows)* and prevertebral swelling *(arrowheads)*, acquired with 1-mm-collimated helical scanning from the SWB-CT protocol. **b** Coronal reformation delineating the odontoid fracture *(arrows)*. **c** Sagittal reformation delineating the odontoid fracture *(arrows)*

Personal experiences with SWB-CT

The authors have had personal experience with SWB-CT screening in multiply traumatized patients in Sweden since 1991, starting in a trauma level 2 hospital. Aiming at fast (20 min) head and body coverage, the sequential CT technique with 4–5 images per minute (Philips Tomoscan LX, Philips Medical Systems, Best, the Netherlands) allowed only a limited survey with non-contiguous body scanning imaging. The study gave essential but incomplete information regarding trunk injuries since the spine could not be fully evaluated [57]. Today, using single-detector helical CT it is possible both to fully cover the head, thorax, abdomen, and pelvis, and, within the survey, to examine the cervical spine from the occipital condyles to T1 using 1-mm collimation. In the authors' experience this CT protocol is superior diagnostically to the five-view plain radiographic examination [58] (Fig. 3) and is therefore included in the Karolinska SWB-CT trauma protocol.

Since the Trauma Center initiated operations at the Karolinska Hospital in September 1996, the single-slice helical SWB-CT protocol has been used for approximately 85 % of trauma patients. Close to 2,100 patients to date have been examined. The method has gained

Table 2 SWB-CT protocol, Karolinska Hospital, Stockholm, Sweden

Brain	Spiral interpolated 3-mm collimation/5-mm reformation/5-mm reconstruction index covering the posterior fossa to the orbital roof and thereafter axial 8-mm collimation/8-mm index slices to vertex. Exposure data: 120 kV, 300 mAs, 1 s.
Thorax–abdomen	Examined with arms raised above the head, with i. v. contrast medium, (Ultravist, Schering, Berlin, Germany,) 100 ml, 300 mg I/ml, 2–3 ml/s with a 50-s delay. Initially a pilot view extending from distal femora to the neck is obtained, followed by the spiral examination: 8-mm collimation/pitch 2 /6-mm reconstruction index. Exposure data: 120 kV, 225 mAs, 1 s.
Cervical spine	Examined in stiff neck fixation from the occipital condyles to and including the first thoracic vertebra. Spiral with 1.5-mm collimation/pitch 1.5 –2/1.0-mm reconstruction index; acquisitions made with bone algorithm. Exposure data: 120 kV, 175 mAs, 1 s. Reformatted images are also obtained in four planes.
Facial skeleton	Spiral 3-mm collimation/pitch 1/1.5-mm reconstruction index, covering from the top of the frontal sinus to the chin. Coronal reformations are obtained.
Modification	At Huddinge University Hospital the thoracoabdominal scanning is slightly different, geared to optimized visualization of the spine. A spiral with 3-mm collimation/pitch 2/2-mm reconstruction index is used (for resulting image quality see Fig. 2).

wide clinical acceptance in Sweden today, with 94 % (67/71) of the hospitals treating multitrauma patients using variants of our SWB-CT protocol. The examination time of 15–30 min including patient handling is well in accordance with reports from other European centers [59, 60, 61].

SWB-CT protocols and trauma routines at the Karolinska Hospital Trauma Unit

The Karolinska Hospital is the only level 1 trauma hospital in the metropolitan Stockholm area of 1.8 million inhabitants. Six level 2 centers exist in the same area.

The trauma unit in the Karolinska Hospital is located in the central operating department with ready access from the emergency department and the helipad. The unit consists of one operating room, one fully equipped trauma triage room with operating capacity, and one CT scanner room in a row.

Plain films can be exposed in the triage room and CT room. The patient is first evaluated in the trauma room adjacent to the CT scanner, where plain films of the chest, pelvis, and lateral cervical spine are exposed. A sonographic examination of abdomen, pleurae, and pericardium is obtained by the attending radiologist. These initial examinations aim at *selecting the patient in immediate need of operative intervention*.

When a decision to perform SWB-CT is reached, the patient can be transferred to the CT table without disconnecting airway tubes and other monitoring equipment. During the entire proceedings, including patient transfer, the patient is continually monitored by anesthesiological staff and the patient is moved with the entire spine stabilized. The patient is examined on the CT table in a plastic stiff neck collar and positioned in a special low-profile head holder (aiming at a straight cervical spine). The patient's arms are positioned alongside the body for the brain and cervical spine scan, and positioned above the head for the thoracoabdominal scan.

The scanner used is a PQ 5000 single-slice spiral tomograph (Marconi Medical Systems, Cleveland, Ohio). The current SWB-CT protocol sequence starts with brain scanning, followed by thoracoabdominal examination with intravenous contrast, and finishing with the cervical spine. Supplementary facial scanning is performed if indicated. Thus, a standardized procedure (Table 2), adhered to every time, is used for this patient category.

The scout (overview) images are also used diagnostically and are helpful in identifying femoral fractures, tube positioning, etc. All CT examinations (except the brain) are viewed by the attending radiologist in multiplanar reconstruction mode – “cine mode” – with multiple standardized window settings. Sometimes additional CT studies with thinner collimation are indicated, i. e., of vertebral or acetabular injuries. The results are communicated to the attending trauma surgeon. No more cervical spine plain films are obtained if the examination quality is of good quality (motion artifacts may necessitate supplementary radiographs). The thoracolumbar spine and pelvis are evaluated from the thoracoabdominal examination in focused cine mode and supplementary spine radiographic studies are not obtained in the acute setting. Additional plain radiographs can also be obtained in the CT room, and are mainly used to assess extremity injuries. Once the SWB-CT is complete (with an approximate table examination time of 20 min), the patient is transferred to the operating theatre if indicated or to observation in the intensive care unit.

The location of the CT room in the central operating department and the use of a fixed SWB-CT protocol has enabled the trauma team to reduce substantially the duration of radiological examination and the time from admission to definitive operating treatment. Many time-consuming transports are avoided, and the policy of obtaining as many definitive studies as possible on admission also improves efficiency.

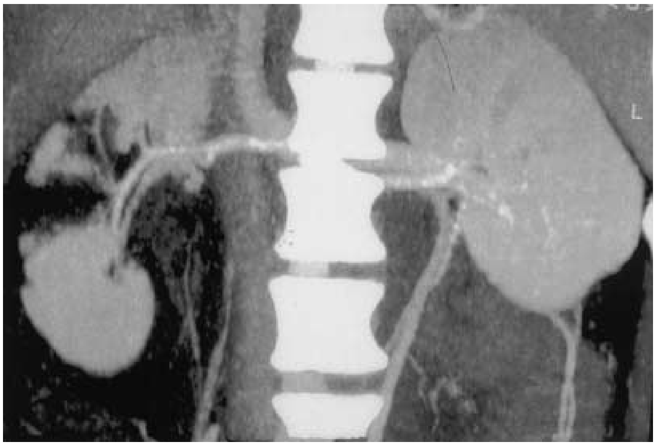

Fig. 4 Maximum intensity projection of right renal rupture. New imaging techniques enhance the understanding and presentation of injuries for clinicians

Technical developments enabling the SWB-CT concept

During the last decade a major increase in CT scanning capability has emerged. Moving from a maximum of five images per minute with single-slice conventional scanners, to helical scanning with 60 images per minute, to the latest multidetector CT scanners capable of 480 images per minute has created a 100-fold increase in capacity. This development now enables detailed coverage of almost the whole body in less than 2 min, which has contributed to the establishment of SWB-CT as the primary imaging method of choice for the multitraumatized patient. Hardware factors that may influence overall performance besides CT generation include scanning velocity, tube cooling capacity, image reconstruction time, image transfer time to workstations, and workstation performance. Each institution therefore must tailor their SWB-CT trauma protocol to their specific hardware and software capacity. The eight-fold increase in helical CT image acquisition due to MD-CT development should further support the use of SWB-CT trauma imaging. The increased performance provides an opportunity to use thinner slice collimation (i.e., superior spatial resolution), leading to superb skeletal visualization and more extensive body coverage in shorter examination time. Thinner slice profiles improve multiplanar 2D and volume-rendered 3D images by decreasing motion artifact and volume averaging [62]. Currently, a MD-CT trauma screening protocol that images the head, thorax, abdomen, and pelvis with 4 × 2.5-mm collimation and the cervical spine with 4 × 1-mm collimation in a total scan time of 50 s with 60 s added for scan set-up is available. Including image reconstruction, the total examination time should be less than 5 min.

The increased CT capacity should also make it possible to create a SWB-CT protocol that includes vascular imaging of the extremities and neck [63, 64].

Progress in workstation capabilities such as angiographic CT and new viewing modes such as maximum intensity projection (Fig. 4) and volume rendering increase the useful information that can be extracted from a single CT scan in less time and with less data manipulation than previously available from single-slice helical CT systems.

SWB-CT screening considerations

The need to move the patient to a separate table or separate room for CT study remains a major problem in handling the critically injured patient. The interventional potential of CT is limited to guidance for drainage procedures. Traditional interventional angiography is still occasionally required as a second-line diagnostic study and is fundamental to the diagnosis and treatment of vascular injuries and ongoing hemorrhage. The CT examination is per se only “a snapshot in time,” obtained during the course of a dynamic process, and changes in the patient’s clinical status should require repeat CT, perhaps focused on a specific problem area, or direct intervention as angiography or surgery.

The value of the routine three-film sequence in the trauma room may be questioned in the obviously stable patient who is scheduled for immediate CT, and is often left out in routine practice in Huddinge University Hospital. If the CT scanner is located in the primary trauma room, the initial evaluation and resuscitation of the severely injured patient may be done directly on the CT table, thus minimizing radiological evaluation time by obviating patient transportation.

The radiation dose for the Karolinska SWB-CT protocol has been calculated at a maximum of 13 mSv, the equivalent of about 3 years of background radiation in Sweden. The increased number of images necessitates a working picture archiving and communication system with high-speed image transfer. The SWB-CT protocol is more or less incompatible with hardcopy printing.

Costs with the Swedish economic system are difficult to compare internationally, but about US$ 600–900 is charged depending on time of day and number of studies included. This cost is probably offset by a considerable savings in the number of diagnostic studies required subsequently. The savings are of course especially important in the obtunded patient in need of monitoring and continuous care during the studies. In addition, time-consuming transports and personnel time are saved using SWB-CT.

Practical issues

As pointed out by Bode [65], the close involvement of the radiologist in the trauma team and in the trauma room is essential. Adherence to a routine SWB-CT protocol for trauma facilitates the radiological imaging process. Ideally, the trauma surgeon should accompany the patient to the CT suite to receive the examination result immediately from the radiologist during the on-screen evaluation. Decisions concerning further patient investigation and handling are then made jointly. The routines should be agreed on in trauma committee work with involvement of all concerned subspecialties. The solutions will differ depending on the volume of trauma patients and hospital size.

Conclusion

Standardized whole-body CT should be considered the method of choice for injury screening in the hemodynamically stable multitraumatized patient. It functions as an ATLS tertiary survey and fits well with the concept of the "golden hour." The new multidetector spiral CT makes it possible to perform a high-quality CT scan of the whole patient within 5 min. The radiologist should participate in the care of the trauma patient as an integral member of the trauma team.

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