



## Short emergency department length of stay attributed to full-body digital radiography – a review of 3 paediatric cases

Lizanne Koning, Tania S Douglas, Richard Pitcher, A B (Sebastian) van As

Multiple casualties strain the resources of emergency departments. Two polytraumatised patients arriving simultaneously can overwhelm a small community hospital, while the capacity of a large urban emergency department does not extend beyond the treatment of 3 - 4 severely injured patients at the same time using the routine trauma protocol.<sup>1</sup> Emergency department overcrowding because of multiple casualties leads to increased length of stay and can have an adverse effect on patient outcome. Variations from the norm in trauma management, particularly during the initial assessment and resuscitation phase of care, during a multiple casualty incident, has been associated with 10% and 9% incidence of preventable morbidity and mortality, respectively.<sup>2</sup> Inadequate evaluation may contribute to up to 30% of early deaths in children with polytrauma.<sup>3</sup>

Failure to perform appropriate radiography is the primary reason for missed injuries in emergency departments, with missed fractures comprising the largest proportion of such errors.<sup>4</sup> Radiographic examination of trauma patients is usually limited to anatomical areas indicated by clinical examination and experience to be at risk of injury. Fractures are particularly easy to miss in children and in polytrauma patients when clinical signs are absent and/or the patient is comatose, intubated or sedated. Full-body digital radiography has been shown to be valuable in the early detection of fractures in paediatric trauma patients,<sup>5</sup> and to reduce imaging time by 3 - 42 minutes when compared with conventional screen-film radiography.<sup>6</sup>

We report on 3 cases treated simultaneously in which we attribute short emergency department length of stay to full-body low-dose digital radiography obtained using the Statscan system. Emergency department length of stay is defined as the length of time between triage and discharge (home, to a hospital ward or to the operating room) of a patient.

*Department of Paediatric Surgery, Red Cross War Memorial Children's Hospital, Rondebosch, Cape Town*

**Lizanne Koning**, MB ChB  
**A B (Sebastian) van As**, FCS, PhD

*MRC/UCT Medical Imaging Research Unit, Department of Human Biology, University of Cape Town*

**Tania S Douglas**, PhD

*Department of Radiology, Red Cross War Memorial Children's Hospital, Cape Town*

**Richard Pitcher**, FCR

*Corresponding author: A B van As (abvanas@ich.uct.ac.za)*

### Methods

We report on patients treated at a level 1 trauma unit housing a Statscan (Lodox Systems (Pty) Ltd, Sandton, South Africa) low-dose linear slit scanning digital X-ray system. It produces high-quality digital X-ray images with low radiation exposure, approximately 2 - 72% of the standard conventional dose in trauma applications,<sup>6,7</sup> and is capable of taking full-body X-ray images in 13 seconds. The X-ray source and detector banks are mounted on a C-arm that can be rotated around the patient trolley, allowing for anterior-posterior (AP) and lateral X-ray images, without requiring the patient to be moved.<sup>8</sup> The standard polytrauma protocol for Statscan in our trauma unit is an AP full-body scan and a lateral cervical spine scan.

### Case reports

After a school bus was involved in a motor vehicle accident, several severely injured children were brought to our trauma unit.

#### Patient 1

A 12-year-old girl arrived by helicopter. She was haemodynamically unstable with a blood pressure of 80/60 mmHg and a pulse rate of 140/min. She responded well to fluid resuscitation. Examination revealed a large contaminated degloving wound in the occipitoparietal region, temporal lacerations, and abrasions on her chin. She also had flank and abdominal abrasions. She had no obvious fractures of the extremities, and her pelvis was stable. Her Glasgow Coma Scale was 15/15, with no focal neurological signs. Once resuscitated, digital full-body X-rays revealed a left temporal skull fracture and free fluid in the abdomen.

Twenty-nine minutes after arriving in the trauma unit, all her injuries had been diagnosed and imaged, her wounds had been sutured, and the degloving injury on her occiput had been dressed and prepared for theatre.

#### Patient 2

Twenty minutes after patient 1, a 12-year-old girl was brought to the trauma unit by ambulance. She was awake and orientated, and haemodynamically stable. She complained of pain in her left arm and hip. Examination revealed lacerations and abrasions to the left frontotemporal region, right cheek, left buttock and both legs. She also had a deep degloving laceration to the left elbow region.

Within 40 minutes of arriving at the trauma unit, she was ready for admission to the trauma ward. A digital full-body



scan had revealed a left distal radius and ulna fracture, and excluded any other injuries.

### Patient 3

Simultaneously with patient 2, a 12-year-old girl was brought to the trauma unit by ambulance. She complained of pain in her left leg and back. Examination revealed abrasions around the left eye, the left side of the back, and around the left knee. She was fully awake and orientated, and was haemodynamically stable.

Eighteen minutes later she was admitted to the trauma ward for observation after a full body X-ray showed that there were no significant injuries.

### Discussion

Whenever more than one polytrauma patient presents to the emergency department at the same time, length of stay increases and patient care may be compromised. Missed injuries, especially in polytrauma victims and in children, are an unfortunate reality in these circumstances. Using full-body radiography as a standard trauma protocol reduces the possibility of missed injuries. Although the number of simultaneous patients we report on falls within the capacity of a large urban trauma centre<sup>1</sup> and we do not claim that our trauma unit was overcrowded, we contend that reduced length of stay associated with a full-body digital radiography system has the potential to alleviate some of the difficulties presented by multiple casualty incidents.

McConnell *et al.*<sup>9</sup> showed average emergency department length of stay of 232, 368, 406 and 193 minutes for admission to intensive care units (ICUs), to telemetry beds, to ward beds and for discharge, respectively. Cornwell *et al.*<sup>10</sup> found discharge to operating room, ICU or observation ward to take place after 52 minutes, 118 minutes and 140 minutes, respectively.

For the 3 patients seen simultaneously at our trauma unit, the mean length of stay was 29 minutes. The timespan between the arrival of patient 1 and the discharge of patient 2, who was the last to be discharged, to the trauma ward, was 60

minutes. During this period of time, 1 patient was resuscitated, digital full-body X-rays of all 3 were obtained, all injuries were diagnosed, wounds were cleaned, sutured and dressed, and patients were discharged home, to the trauma ward, or to the operating room.

A conventional polytrauma radiography protocol would have required a lateral cervical spine, an AP chest and pelvic X-ray, and, in addition, X-rays of the long bones on indication (after clinical examination). The latter would have been indicated in patient 2. A skull X-ray and/or computed tomography (CT) would have been indicated in patient 1. Davis *et al.*<sup>11</sup> found CT and radiographic special procedures to be the strongest predictors of prolonged emergency department length of stay, while the number of conventional plain X-rays required had a smaller effect. Full-body digital radiography has been found to reduce X-ray acquisition time by 3, 21, and 42 minutes for ambulatory, stretcher-borne, and resuscitation adult trauma patients, respectively, when compared with conventional screen-film radiography.<sup>6</sup> Hence we attribute the shorter emergency department length of stay experienced by our 3 patients, when compared with published values, to the use of full-body digital radiography.

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