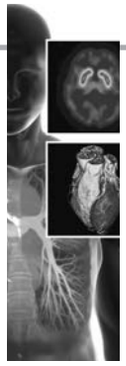

# The role of the radiologist: when images save lives

*"MDCT has proven to be a valuable, rapidly accessible imaging tool. As a consequence, more than ever before, the radiologist has a duty as well as the opportunity to rapidly detect and to communicate life-threatening injuries to the trauma team."*

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Trauma causes greater mortality than cardiovascular disease and cancer combined. It is the most common cause of death for people under the age of 40 years [1]. Time is one of the most important factors for the survival of traumatized patients, a fact that has been documented as the proverbial golden hour of shock. As a member of the trauma team, the radiologist is responsible for the rapid diagnosis of traumatic disorders with appropriate imaging modalities. Of equal importance, the findings must be communicated effectively. The radiologist helps to facilitate triage and to assess the optimal treatment for traumatized patients, thus, contributing to the improvement of patient outcomes.

## The radiologist: a member of the trauma team

In Austria and Germany, approximately 500,000 people are injured per year [2]. The probability of survival is predominantly determined by the injury mechanism [3]. However, the preclinical and clinical trauma management within the first hour after an injury are of particular relevance. The infrastructural and medical improvements during the last 30 years have helped to decrease the death rate caused by motor vehicle accidents by 50%, despite the growing numbers of accidents [2].

In dedicated trauma centers, trauma teams usually consist of surgeons, anesthesiologists and radiologists, with the surgeons being the team leaders. In particular, in the workup of poly-traumatized patients, this team works together from the time the patient arrives at the emergency department. The surgeons and anesthesiologists delineate whether the patient is in a vitally stable condition, with regard to vital parameters and on the basis of the injury pattern.

If the patient is considered to be vitally unstable, an emergent surgical treatment is usually performed. In this situation, it is the duty of the radiologist to rapidly assess the radiographs of the chest, pelvis and a lateral view of the cervical spine. Additionally, a sonographic assessment of the abdomen is performed. With 'focused assessment with sonography for trauma' (FAST), the right and left upper quadrants, the paracolic gutters and the pelvis are investigated in order to detect free fluid. In most trauma centers, all this is done within the first 6 min of the patient's arrival.

It is not only the rapid accessibility of an imaging modality, but also the accuracy that renders the method a valuable tool in the diagnostic algorithm. In this regard, a quick, stable, highly specific and sensitive method has a high impact on the improvement of patient outcomes. In the last 10 years, the role of the radiologist has substantially changed, particularly in trauma centers, with the implementation of multidetector CT (MDCT) as a permanent part of the emergency department.

## State-of-the-art: MDCT

Sonography has a sensitivity of 42–69% for the detection of intraperitoneal blood and, to be detected, approximately 500 ml of free fluid must be present in the peritoneal cavity. By contrast, with MDCT, as little as 10 ml is readily detectable [4]. Additionally, up to 48% of organ injury occurs without the presence of a hemoperitoneum [5]. Furthermore, sonography fails to visualize approximately half of all traumatic organ lesions.

The trauma team deals with stabilized patients more often than with vitally unstable patients. In this situation, the radiologist has approximately 30 min to perform and read a whole-body CT. Depending on the particular diagnostic algorithm, not only the head, chest and abdomen are scanned, but also the arms and legs. The latter two regions can readily be assessed with a comparably low radiation dose by the latest-generation scanners.

Multidetector CT allows the immediate diagnosis of life-threatening conditions. In particular, the radiologist first assesses detectable causes of hypovolemia and hypoventilation, such

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as pneumothorax, tracheobronchial disruption, pericardial and pleura effusion, lung contusion, aortic rupture or dissection, fracture of the pelvis together with the extent of intra- and extraperitoneal bleeding, and neurologically relevant injuries of the brain and the spine.

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Another important argument for the early use of MDCT in the diagnostic algorithm of traumatized patients is that dedicated organ injury scores have only been developed for CT imaging. These scores are based on the clinical, radiologic and pathologic findings [6]. Of course, the trauma team is aware that, in each case, the stability of the vital signs is most relevant for the treatment plan. However, the organ injury scores help the trauma team predict whether the patient will need surgery or could be handled with a wait-and-see strategy. Radiologists do not need to memorize the organ injury scores; however, they should know the grades that usually mark the threshold between conservative and surgical treatment.

## Diagnosis & therapy through teamwork

In the same way that the surgeon benefits from the radiologist's work for the trauma team, radiologists also benefit from the knowledge of the other team members. For example, the radiologist can be sure that the information regarding the force and site of the injury are specific. This is particularly relevant since traumatic disorders caused by specific mechanisms are stereotypical and not random. Radiologists see common patterns of injury and recognize fingerprints that are characteristic of particular injuries. Detailed information regarding the accident contributes to a directed radiologic search for lesions and, therefore, reduces the time to reach a diagnosis. It is unequivocal that, with regard to the golden hour of shock, this information contributes to the improvement of patient outcomes.

The latest MDCT scanners generate so-called isotropic voxels (i.e., each pixel has the size of a cube with an edge length as small as 0.6 mm). The image information can be rapidly processed and reformatted in each desirable dimension, resulting in high-resolution and high-quality images.

Associated with the recently improved MDCT equipment are high-power workstations. These workstations help to generate multiplanar and 3D images within a few seconds subsequent to the scan process. The 3D images, in particular, contribute to effective communication and interdisciplinary therapy considerations. Compared with the radiologic standard 15 years ago, this is an unforeseen step towards the optimal radiologic management of traumatic disorders.

## Images save lives

In conclusion, the radiologist's responsibility for the success of a trauma team has substantially risen with the advent of CT. The latest step in this technical development was the implementation of MDCT as a permanent part of the structure of the emergency department. MDCT has proven to be a valuable, rapidly accessible imaging tool. As a consequence, more than ever before, the radiologist has a duty as well as the opportunity to rapidly detect and to communicate life-threatening injuries to the trauma team. With this approach, radiologic images can contribute to an improved outcome for injured patients.

### Financial & competing interests disclosure

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