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Life-Saving Improvements after Implementation of Trauma Systems: Is it Good Enough and Can it also Work for you?

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Introduction

In the Netherlands, approximately 80.000 trauma patients are transported to the hospital per year, of which 6% is severely injured with an ISS ≥ 16 [1]. This last group consists of a relatively young population, with an average age of 56 years old, making the relevance of early diagnosis and accurate definitive treatment essential for quality of life and overall or lifelong costs of healthcare. In our recent study [2], we showed that, with a 24/7 in-hospital availability of an experienced trauma team, simulation training for the team, strong and clearly defined procedures and a hypermodern trauma room with an in-room CT scanner, the mortality decreased significantly (OR=0.63; CI 0.42-0.95; p=0.030). In addition, there was an improved adherence to processes and improved clinical outcome [2].

In this editorial, we present our concept and discuss three themes for further optimization of the process and will show that our concept may be generalizable to your setting and infrastructure. Figure 1 demonstrates the key concept indicators that may help you to focus on potential handholds in your emergency department. The three themes we would like to discuss are 1) a change in the ABCDE: More efficient use of the ultrasound, 2) the structured addition of a 'code red' system for certain patient categories and 3) support for generalizability to other settings through a description of process steps and analysis.

Our workflow concept is based on the situation as in many other hospitals, in which real availability 24/7 is difficult. That is why we prefer to create a small, focused group, who work together in an organized fashion, striving to perform the trauma admission waltz as carefully as possible. All team members perform specific tasks appropriate to their competences, but are coupled to another member from another discipline who can perform the role if a team member cannot attend due to other, more pressing duties. An example of this is the "resuscitator role" for the (trauma) anesthesiologist or the critical care physician; one is active, the other as consultant available. In addition, when we were rebuilding our emergency department we decided to put in an in-room CT scanner. Because, the availability of a CT scan in the trauma room, with the initial survey being performed on the CT table (so called "entry through the gantry"), lowers the threshold to perform a trauma CT scan, shortens the time until start of scan, avoids instability during the scan and reduces the total time in the trauma room, all of which contributes to improved clinical outcome [2,3].

A Change in the ABCDE: More Efficient with Use of the Ultrasound

The ABCDE system is used in the initial care of trauma patients, supplemented with imaging such as chest and pelvic X-ray, an Extended Focused Assessment Sonography for Trauma (E-FAST) [5] and CT-scan. In a noisy trauma room, auscultation and palpation of the thorax is challenging and therefore might lead to failure in timely recognition of life-threatening conditions such as a hematothorax or (tension) pneumothorax. Hence, we have replaced auscultation/palpation of the thorax and the standard X-ray of the chest by the use of the ultrasound (6 points: Pneumo- and hematothorax focus), as a forward movement of the E-FAST. This saves time, increases sensitivity but also efficiency because necessary, immediate treatment of any hematothorax or (tension) pneumothorax could follow ensuring that safe use of the CT-scan is possible. We note that we consider any interruption of the CT-scan process for adjustments in therapy or for patient safety to be a complication.

'Code Red' (Direct to OR) for Certain Patient Categories

Some 30% to 40% of all traumatic deaths are due to exsanguinations. For those who reach the

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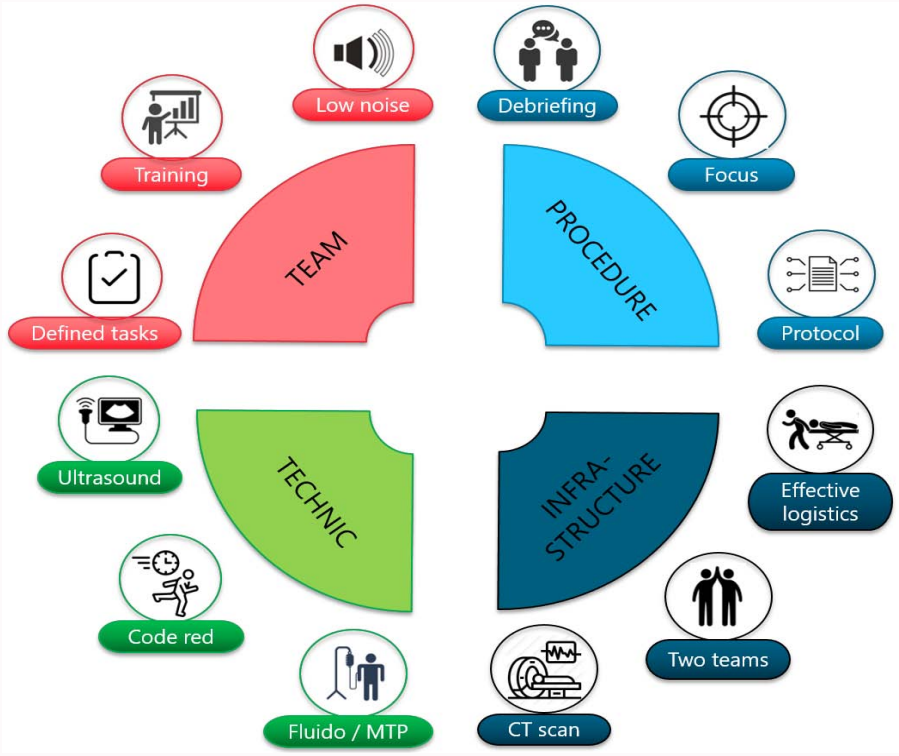

Figure 1: Key concept indicators that may help you to optimize the setting in your emergency department.

hospital alive (about 50%) early mortality is caused by continued hemorrhage and incomplete resuscitation [6]. Earlier studies demonstrated that every three minutes of delay in definitive (surgical/damage control) treatment would lead to an increase in mortality of 1% [4]. Thus, in trauma patients with massive bleeding, time is life! When selecting (based on pre-hospital criteria) a severely injured cohort at high risk for surgery to control the bleeding, a direct-to-OR-protocol could reduce mortality significantly (5% *vs.* 10%) [7]. However, most of the patients in the study from Martin et al. suffered from penetrated injury, while in our country 88% of the injuries are blunt force trauma. This requires other treatment strategies such as interventional radiology to control the bleeding by embolization. Recently, Jang et al. [8] evaluated their experience with the use of a hybrid OR to control the hemorrhage in severely injured trauma patients. They found a long median time between ER arrival and the start of the hemostatic procedure in hybrid OR of 69.5 min [CI: 44.75–83.25], with increasing mortality rates. However, an important limitation was that due to different locations of the hybrid OR and ER, patients were transported to the hybrid OR only after initial resuscitation had been performed, which takes time and might explain their mortality rates.

Based on the results and limitations of previous studies we developed a code-red protocol for this patient category. When, based on the pre-hospital report, the risk of massive bleeding is high (i.e. hemodynamically unstable, positive E-FAST, presence of HEMS physician, blood products given), the patient is brought to the ER, remains on the stretcher, and an E-fast is repeated with the trauma surgeon watching in real time. If positive, the patient is transported directly to the hybrid OR where resuscitation and the surgical and/or radiological intervention can be performed simultaneously. Note that this also requires the OR staff to be fully involved as parts of the primary and secondary survey also move to the OR setting.

Generalizability to other Settings through Process Steps and Analysis

In the last decade we have improved our in-hospital infrastructure related to trauma care, approached the process of care from a logic and quality viewpoint, and reduced and focused the team that is involved. This resulted in improved processes, clinical outcome and survival rates [2]. Specific things we changed: first two new trauma rooms with a movable in room CT were builded. In addition, we redefined the roles, tasks and competencies and selected only team members that are 24/7 available with appropriate skills and knowledge, while keeping the number of professionals involved at a minimum. We made a distinction between the Basic Trauma Team (BTT, low ISS) and the Multi Trauma Team (MTT, higher risk patients) based on specific criteria, and trained both teams in trauma care and CRM. During the trauma admission everyone has its own tasks and place in the room and in order to decrease the noise in the trauma room everyone is directed by the trauma leader. Finally, we provided a moment to debrief while the CT scan is performed and use that moment also to make a further plan.

We realize that all of our adjustments mentioned above may not be feasible for every hospital. But our believe is that a process approach, above and beyond ATLS is needed to structure and improve trauma survivability. And that every change you can make is a step in optimizing your care!

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