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20 years of trauma documentation in Germany—Actual trends and developments

TraumaRegister DGU®[1]

Committee on Emergency Medicine, Intensive Care and Trauma Management of the German Trauma Society (Sektion NIS)

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ABSTRACT

Introduction: The TraumaRegister DGU® has been founded 20 years ago. Although initially supported by larger hospitals and universities, it has recently become a representative registry for the care of severely injured patients in Germany. Based on the registry data some important trends and developments of the recent decades are presented.

Patients and methods: German trauma patients with an Injury Severity Score (ISS) $\geq$ 16 were eligible if primary admitted from the scene. All cases documented between 1993 and 2012 (20 years) were eligible. For selected variables, an average change per years was calculated using linear regression analysis.

Results: A total of 49,801 patients was analysed. The mean age was 46.3 years, and 72% were males. The following relevant trends could be observed: The average age increased dramatically from 38 to 50 years. Pre-hospital intubation rate was halfed in patients with Glasgow Coma Scale (GCS) > 8 but remained constant in unconscious patients (GCS $\leq$ 8; 90% intubation rate). Pre-hospital volume administration decreased as well, which led to less blood transfusions (from 45% to 16%). The use of helicopters for transportation into a trauma centre decreased as well but today still 27% of all cases are transported by air. Whole-body CT was performed in about 80% of patients; this value is stable in the last four years. Hospital mortality could be reduced and was 2–3% lower than expected in recent years. The Revised Injury Severity Classification (RISC) score used as a reference here was based on TR-DGU data from the 1990s.

Conclusion: Standardised prospective registration of severely injured patients over 20 years allows to empirically monitor trends and developments in acute trauma care.

Introduction

Twenty years ago, in 1993, the first patient has been documented in the TraumaRegister DGU® (TR-DGU). Inspired by results of the Major Trauma Outcome Study (MTOS) [1], five German hospitals initiated a prospective structured data collection of anonymized data of severely injured patients. From year to year, the number of participating hospitals as well as the number of documented cases increased. By the end of the century, more than 50 hospitals included nearly 2000 cases per year. This positive trend continued also in the new century, however, the big breakthrough was caused by the formation of local trauma networks [2] (see also Ruchholtz et al., in this issue). The German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie, DGU) suggested establishing such local networks in combination with a regular auditing and certification of all participating hospitals. As part of this certification process, obligatory participation in the TR-DGU was required. This led to an enormous increase in the number of TR-DGU hospitals as well as documented patients since 2009 (Fig. 1).

The continuous documentation of care over a long period of time offers a unique opportunity to discover trends and to support subjectively perceived developments with hard data. Some of these trends will be demonstrated in this study. We will restrict our analysis to Germany, although there is an increasing interest from other European countries as well (Austria, Belgium, Finland, Luxemburg, The Netherlands, Slovenia, Switzerland). Actually about 10% of cases were treated in non-German hospitals. The changes we observed during the recent years refer to all areas of trauma care: the patients, the pre-hospital care, the early in-hospital care, diagnostics, and finally the outcome.

[1] Rolf Lefering on behalf of the TraumaRegister DGU®
Institute for Research in Operative Medicine (IFOM), University of Witten/Herdecke, Ostmerheimer Str. 200, Building 38, 51109 Cologne, Germany.
Tel.: +49 221 98957 16; fax: +49 221 98957 30.
E-mail address: rolf.lefering@uni-wh.de.

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Patients and methods

A detailed description of the TR-DGU is given in "20 years TraumaRegister DGU" in this issue. The inclusion criteria were severely injured patients who were admitted via the shock room (trauma team activation), and who died or needed intensive care. Patients dead on arrival were excluded, as well as patients with burns, drownins and poisoning.

Patients were selected from the TR-DGU according to the following criteria: age and injury severity, i.e. AIS codes of all injuries and ISS, available (applies to 99.2% of all patients); primary admitted to a German hospital (79.8%); ISS ≥ 16 (58.2%). Patients treated in local trauma centres (level 3 centres according to the DGU White Book [2] were excluded here since their participation in the early years of the registry was only accidental. Only since the introduction of local trauma networks with obligatory participation in the TR-DGU their number increased. Level 3 trauma centres represented about 40% of all hospitals providing care for severely injured patients in 2012, but the mean number of cases with ISS ≥ 16 treated per year in such a hospital is only 4. In 2012, only 6% of cases were treated in a level 3 trauma centre (Fig. 1). The total number of severely injured trauma patients treated in German level 1 and 2 trauma centres according to the above defined criteria is thus 49,801 patients (of 122,742; 40.6%).

All cases documented from 1993 until 2012 were included. Data were presented on a yearly basis where the early years from 1993 until 1999 were merged into one category due to the limited number of cases. The sample size for each year is shown in Fig. 1. Formal statistical testing was avoided here because even minor trends would become highly statistically significant due to the large number of cases. Although some changes did not occur constantly over time, an estimated annual change was calculated using a linear regression analysis based on the years 2000 until 2012. The present study is in line with the publication guidelines of the TraumaRegister DGU® and registered as TR-DGU project ID 2011-018.

Results

Patients

Basic data of the 49,801 patients are presented in Table 1. The male:female ratio is about 3:1 which is typical for a trauma population.

Table 1
Basic descriptive data of the trauma patients with ISS ≥ 16. The range of values refers to the minimum and maximum value in the 14 different time periods. The estimated linear trend per year refers to the time period 2000–2012.

Characteristic	All patients	Range of values	Linear trend/year
Number of cases	49,801	1275–9547	+686
Age (years)[a]	46.3 (21.4)	38.6–50.1	+0.8 years
Children (age 1–15; %)	3.7	3.3–5.4	−0.1%
Males (%)	72.1	70.8–74.5	−0.2%
Traffic accidents (%)	60.2	56.9–67.1	−0.8%
Penetrating (%)	4.2	3.6–5.1	0.0%
Injury Severity Score[a]	28.4 (12.2)	27.0–30.9	−0.3 points
Head injury (AIS ≥ 3; %)	55.3	52.6–60.0	−0.6%
Hospital length of stay (days)[a]	23.0 (25.3)	19.6–30.0	−0.9 days
Hospital mortality (%)	19.0	16.8–23.7	−0.4%

[a] Continuous variables are presented as mean with standard deviation.

During the observation period of 20 years a continuous increase in age of trauma patients could be observed. This reflects in part the ageing population in Germany where 26.3% were aged 60 or older (2010, Federal Statistical Office of Germany, DESTATIS). In the same year, the portion of patients aged 60 and above among severely injured trauma patients in the TR-DGU was 32%, with a still increasing tendency (Fig. 2). The percentage of male patients, however, did not change over time, approximately three quarter of all trauma patients were males. This increasing fraction of elderly patients in the TR-DGU also has an effect on the mechanism of injury. Low falls (<3 m) which are the most common cause of injury in the elderly rose from values around 8% in 2002 to 19% in 2012 (low falls and high falls were separately documented since 2002). Traffic accidents as causing mechanism slightly decreased over time (Table 1), but the largest decrease was observed for road traffic accidents involving car passengers. This category fell from 40% in the first decade to 25% in 2012 reflecting an improved quality standard for cars and roads. The prevalence of penetrating injuries is traditionally low in Germany, ranging from 3.6% to 5.1%, without an obvious trend over time (Table 1).

Pre-hospital treatment

Nearly all severely injured patients in Germany (>95%) are seen by an emergency physician ('Notarzt') on scene, and a large

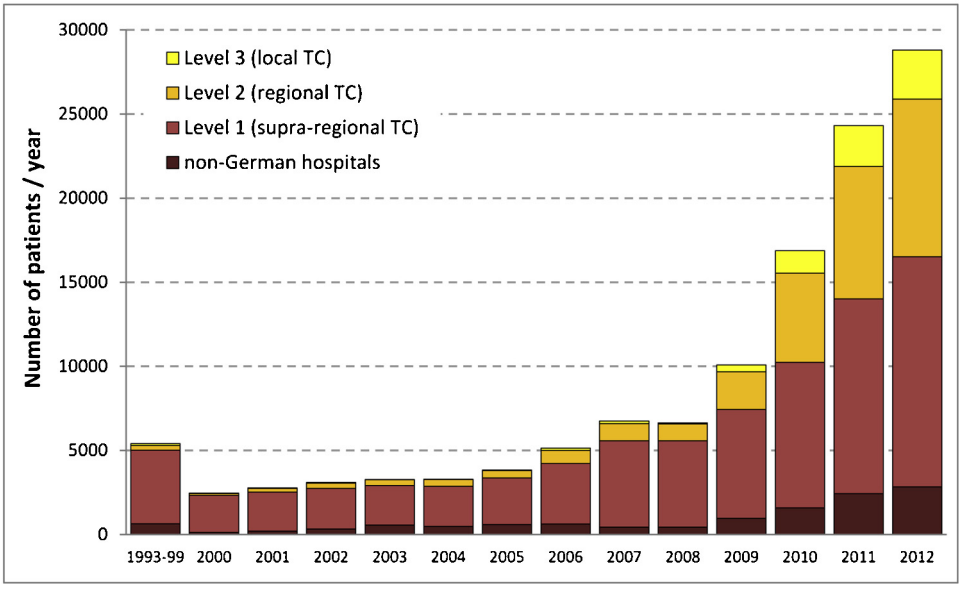

Fig. 1. Total number of yearly documented patients, presented separately for the level of trauma centre (TC). Patients documented by trauma centres outside Germany (overall 10%) are presented separately.