



# Evaluation of the Terror and Disaster Surgical Care course

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Received: 18 February 2020 / Accepted: 15 June 2020 / Published online: 4 August 2020  
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## Abstract

**Background** Mass-casualty terrorist incidents are a medical and organisational challenge for every hospital. The Terror and Disaster Surgical Care (TDSC<sup>®</sup>) course was developed because such incidents are associated with special injury patterns, escalating situations, and surges of casualties and haemodynamically unstable patients requiring treatment and can overwhelm the resources of hospitals.

**Materials and methods** The course currently lasts two-and-a-half days and is designed for 18–21 experienced surgeons, anaesthetists and clinical emergency physicians (who form groups of three for the tabletop simulation game). From 2017 to 2019, a total of 20 courses with 437 participants were conducted. The data in this study were collected from these 437 participants.

**Results** Most of the participants were male (82%); 64% of participants specialised in a major field of surgery (general surgery, visceral surgery, vascular surgery, trauma surgery and orthopaedics). At the time of the course, most participants (86%) were department heads, senior physicians or specialists. The tabletop simulation game, which was specifically developed for the course, as well as the presentations were rated good to very good. The result of the overall course evaluation, which included aspects such as organisation, professionalism, content and teaching, was on average 1.34 and thus very good.

**Discussion** The TDSC course complements already established courses and provides training in tactical surgical care after hospital admission. The TDSC course integrates and builds on elements of individualised trauma care such as the primary survey and the extended focused assessment with sonography in trauma (eFAST). This underlines again that it complements and does not replace other course formats. We can conclude that the presentations and the tabletop simulation game were well suited to the target group and that the participants were able to increase their knowledge of this complex subject.

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## Introduction

### Idea and background

After the attacks in Paris and various terrorist incidents in Germany, the Deployment, Disaster and Tactical Surgery Working Group (Arbeitsgemeinschaft Einsatz-, Katastrophen- und Taktische Chirurgie) of the German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie) conducted four regional information events on terrorism and terrorism-related injuries in the trauma networks of the German Trauma Society in 2016 (Fig. 1). The spokespersons of the various networks were invited to start a nation-wide discussion of this subject. These meetings were complemented by two national emergency conferences in Frankfurt and Berlin.

In cooperation with the Joint Medical Service of the German Armed Forces, the trauma networks used these conferences to conduct advanced training on typical injuries

**Information events of the trauma networks in 2017 on the subject of terrorism**



**Fig. 1** Information events of the trauma networks on the subject of terrorism

associated with different attack scenarios and to provide political background information.

In addition, working groups at these conferences identified the need for improvements at the regional level when it comes to the organisation of prehospital and in-hospital care, special medical training requirements, and the lack of knowledge and experience regarding expected special injury patterns and surgical treatment.

Based on the results of these conferences, the Deployment, Disaster and Tactical Surgery Working Group developed the Terror and Disaster Surgical Care (TDSC®) course

in cooperation with the medical societies and working groups mentioned in Table 1.

The first two pilot courses took place in Munich in March 2017 and in Frankfurt in May 2017.

The contents of all training courses were evaluated and the participants were analysed. For the first time, this study compares the results of the courses from 2017 to 2019 with the original objectives of this new course.

The evaluation focuses on whether the target group was successfully addressed and how the individual topics and the interactive tabletop game were accepted and perceived. Therefore, the participants had the chance to grade the whole course or the respective topics. The rating was done according to the school grade system (1 = very good, 2 = good, 3 = satisfactory, 4 = sufficient, 5 = poor, 6 = deficient). The tabletop simulation game was exclusively developed for the course (Fig. 2). A discussion of the results will be followed by an outlook on future developments.

### **Objective of the Terror and Disaster Surgical Care course**

Mass-casualty terrorist incidents can result in special injury patterns, an escalating emergency situation, and a surge of casualties and haemodynamically unstable patients requiring treatment. Such incidents may overwhelm the resources of hospitals, which is why the TDSC® course was developed [1–4].

The main objective of the course is to train participants to rapidly identify haemodynamically unstable patients with life-threatening uncontrollable bleeding, which is the most frequent severe injury in such scenarios. The primary objective of all measures and efforts is to organise and perform surgery without delay, and to make available essential resources for as many patients as possible.

The course gives participants a tactical and strategic understanding of in-hospital procedures in the event of a mass-casualty (terrorist) incident [5]. Information on special injury patterns caused by a mass-casualty terrorist incident, such as gunshot and blast injuries, is provided in

**Table 1** Participation and cooperation in the development of the TDSC course

Participation and cooperation in the development of the TDSC® course

#### **German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie)**

German Society for General And Visceral Surgery (Deutsche Gesellschaft für Allgemein- und Viszeralchirurgie)

German Society for Military Medicine and Pharmacy (Deutsche Gesellschaft für Wehrmedizin und Wehrpharmazie e.V.)

German Society for Burn Medicine (Deutsche Gesellschaft für Verbrennungsmedizin)

German Society for Anaesthesiology and Intensive Care (Deutsche Gesellschaft für Anästhesiologie and Intensivmedizin)

German Society for Vascular Surgery (Deutsche Gesellschaft für Gefäßchirurgie und Gefäßmedizin)

Joint Medical Service of the German Armed Forces (Zentraler Sanitätsdienst der Bundeswehr)



Fig. 2 Tabletop simulation game

presentations. Each presentation is followed by an interactive case discussion.

The course also includes an interactive tabletop simulation game. It is used to teach course participants, i.e. primarily experienced hospital physicians, what options are useful in such situations. In groups of three, players face four different incident scenarios in a hospital.

The game is used to practice organisational procedures in a hospital after a mass casualty terrorist incident.

It shows players the consequences of tactical medical decisions on individual patients as well as on available hospital resources. In contrast to the individualised management of patients in the trauma room (ATLS® or ETC® in teams) and surgical treatment in accordance with the principles of Early Total Care (ETC) and Damage Control Surgery (DCS), the course focuses on the necessary allocation of resources in accordance with Tactical Abbreviated Surgical Care (TASC) until capacities are no longer overwhelmed [5, 6].

An important part of the game is the code book, which documents the clinical management of each patient depending on the selected diagnostic procedures and treatment approach (ETC, DCS or TASC). The code book also specifies the time units required for each measure. This also has an impact on patient outcome. The condition of each patient is shown by the remaining health points.

The course is designed for all physicians. The target group, however, comprises experienced surgeons, anaesthetists and clinical emergency physicians who may have to act as decision-makers in hospitals after a mass-casualty (terrorist) incident. The objective is to train teams led by an emergency operational and medical coordinator (EOMC) which are able to manage major incidents in a hospital, as is discussed in the first article in this magazine.

The care principles presented and taught in the game also apply to conventional mass-casualty incidents in which resources are overwhelmed. They are based on real cases taken from the gunshot and blast register [7].

The course focuses on the personnel, material resources, diagnostic procedures, and interventional and surgical measures required to maximise the number of survivors through the provision of what may be termed “minimum essential care for as many patients as possible”.

The topics for the presentations and interactive case discussions were extrapolated from the evaluations of the emergency conferences and the pilot courses. The selection of topics was also based on the fact that, in such situations, physicians may have to take treatment decisions and define treatment aims which are outside their area of expertise (the initial target group was experienced surgeons). Topics such as blast lung injuries, burns, replacement therapy during the first 24 h, and damage control resuscitation were thus coordinated with the relevant specialist associations.

Teamwork was also a guiding principle when it came to selecting and preparing topics. Physicians must understand of the concepts and objectives of all specialties involved in patient treatment when resources are inadequate. This reduces friction and problems that arise when tasks and responsibilities overlap.

In addition to the algorithm CATEGORISING– PRIORITISING– COORDINATING– IMPLEMENTING and situation-oriented tactical surgery (DCS and TASC) to ensure patient survival, the course presents approaches to the calculated replacement of procoagulants and blood

products and to organisational measures for extending available resources, assigning personnel, allocating rooms, and maintaining material.

The course currently lasts two-and-a-half days and is designed for 18–21 participants (who will form groups of three for the tabletop simulation game). It is targeted towards experienced trauma surgeons, surgeons, anaesthetists and clinical emergency physicians. In our opinion, leadership should generally be assumed by experienced trauma surgeons, as is customary in trauma care.

## Evaluation results

A total of 20 courses with 437 participants were conducted from 2017 to 2019. These 437 participants were our study group.

Figure 3 provides an overview of the hospitals where the participants worked and the places where the training courses were held.

## General data

Most of the participants were male (82%), and 64% specialists and junior physicians were represented, visceral surgery, vascular surgery, trauma surgery and orthopaedics) (Table 2).

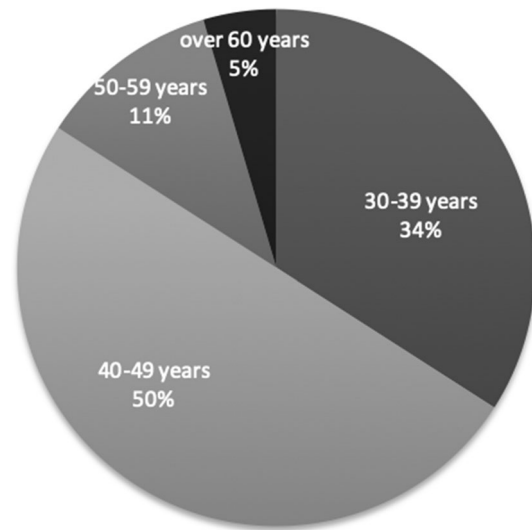
**Hospitals where the participants worked (red) Course venues (red)**



**Fig. 3** Hospitals where the participants worked are shown in red. Cities are marked yellow for orientation purposes

**Table 2** Shows the specialties and status of participants from 2017 to 2019 (264 of 437 participants provided details of their qualifications)

	Visceral/vascular surgery	Anaesthesiology	Internal medicine	Emergency medicine	Orthopaedics	Trauma surgery	Radiology	Plastic surgery	Paediatrics	Other	Total
Department head	1	5	2	2	2	25	1	-	-	-	38
Senior physician	5	35	5	8	4	77	-	2	-	9	145
Specialist	5	13	1	2	-	20	-	-	1	1	43
Junior physician	3	5	-	2	1	23	-	-	-	4	38
Total	14	58	8	14	7	145	1	2	1	14	264



**Fig. 4** Age groups of the participants

Most of the participants were senior physicians. Department heads, specialists and junior physicians were represented in almost equal numbers. At the time of the course, most participants (86%) were experienced physicians (Table 2).

The following diagram (Fig. 4) shows that mostly older and more experienced colleagues attended the TDSC courses, and thus the primary target group was reached.

**Evaluation of the course topics**

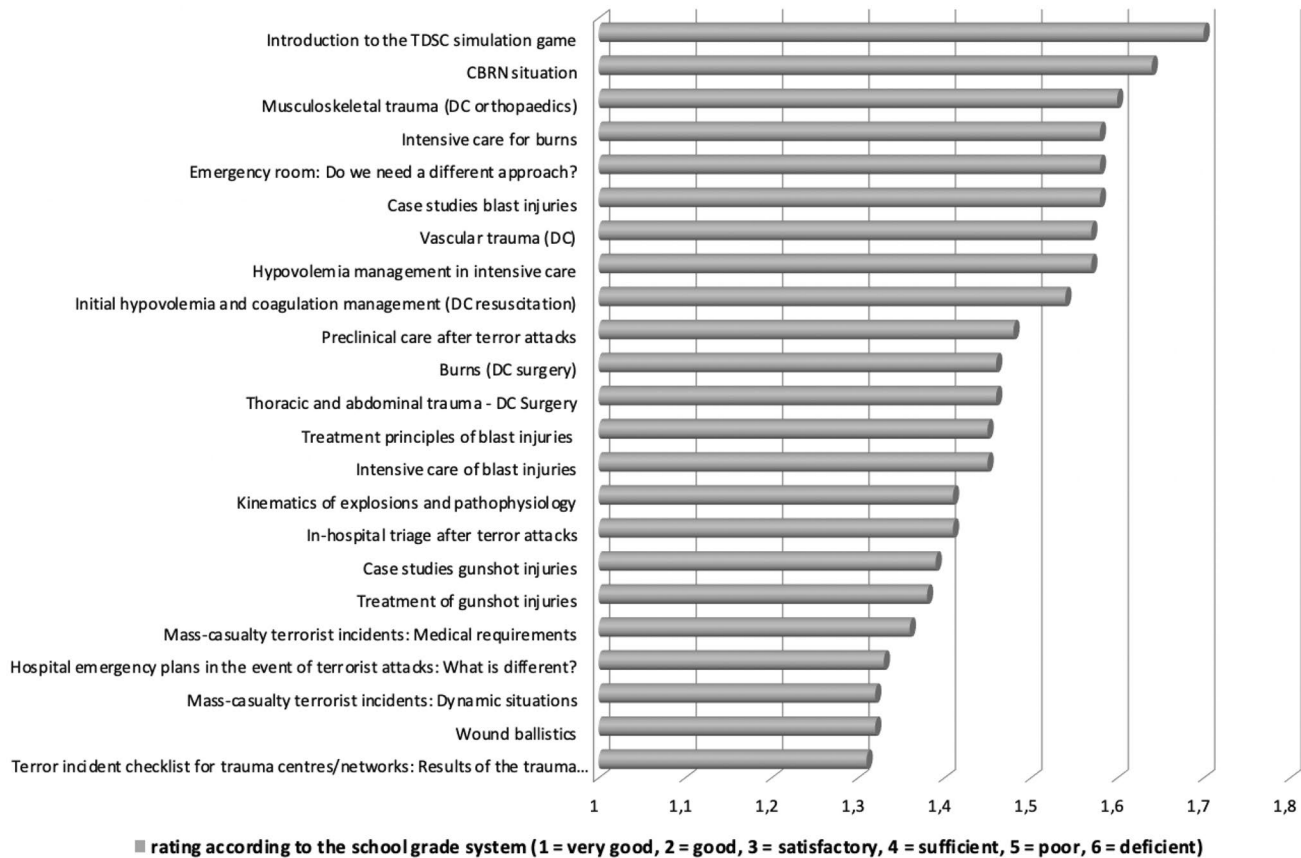
As mentioned above, the course contents were selected based on a requirements analysis performed during the emergency training days of the regional trauma networks and at two national conferences on emergencies. They were tested during two pilot courses.

The final selection of topics was based on the assumption that, in such situations, physicians may have to take treatment decisions and define treatment aims which are outside their area of expertise (the initial target group was experienced surgeons). Physicians must understand the concepts and objectives of all specialties involved in patient treatment when resources are inadequate. This reduces friction and problems that arise when tasks and responsibilities overlap. The participants evaluated the course in accordance with these aspects.

Figure 5 shows the topics that received good to very good overall results.

Although the overall evaluation exceeded our expectations, we must conclude that topics such as vascular trauma and the introduction to the rules of the simulation game were felt to be demanding and unattractive in comparison

## Participant evaluation of course topics



**Fig. 5** Evaluation of topics by participants

to other topics. These topics are necessary, however, and still received a good average rating of 1.7.

Topics such as hospital emergency plan and gunshot injuries were rated best. The results of this analysis were used to review the presentations and to optimise the didactic approach and orientation.

### Overall evaluation of courses

In terms of content, the course appears to have fulfilled the expectations of the participants. They were asked to evaluate the overall course. This evaluation included aspects such as organisation, professionalism, contents and didactic approach. The TDSC<sup>®</sup> course received a total average score of 1.38, which was a very good result.

### Concept implementation during exercises (Ulm and Saarland)

Two TDSC courses were conducted at each of two venues (Ulm University Medical Centre and German Armed Forces Hospital Ulm and Saarland University Medical Centre) in

preparation for a terror incident exercise. At both venues, the organisational structures defined in the hospital emergency plan were complemented by tactical medical organisational elements, namely the senior triage coordinator and the emergency operational and medical coordinator (EOMC). Patient management was also structured in accordance with concepts from the course.

Course concepts were readily adopted, and patient management at the hospitals was improved through standardised principles, aims and treatment strategies according to the assessment of the responsible executives in the debriefings.

Another result was that the local implementation of tactical medical treatment in accordance with TDSC principles in preparation for a terrorism-related incident always requires the critical adaptation of local organisational structures and existing elements of individualised trauma care.

## Discussion

Terrorism-related mass casualty incidents are a medical and organisational challenge for every hospital on account of the special injury patterns involved, the time of the incident, the development of the situation, the initial lack of information, the number of casualties, and the fact that slightly injured or uninjured victims may arrive at the hospital on their own [8, 9].

These circumstances and the large number of patients with penetrating injuries, a permanent risk of uncontrollable bleeding, and other life-threatening injuries call for strategic and tactical surgical care [10, 11].

The Terror and Disaster Surgical Care (TDSC<sup>®</sup>) course was developed to address such mass-casualty terrorist incidents and to provide participants with the specialist medical and surgical knowledge and skills required in these special situations. The course also trains participants in decision-making to ensure targeted surgical stabilisation and the care of patients. The TDSC<sup>®</sup> course focuses on the provision above all of surgical care and the allocation of scarce resources in order to maximise the number of survivors.

Surgical decision-makers from trauma network hospitals were identified as the target group. We were successful in reaching this target group as most of our participants were surgeons in senior positions and were between 40 and 60 years of age. The analysis of their workplaces shows that the participants came from all over Germany.

Our course has been successfully attended by over 437 participants from 53 registered trauma networks with 677 participating hospitals. Theoretically, it would have been possible to include all trauma networks of the German Trauma Society. According to our detailed analysis there are, however, regions and metropolitan areas that have not yet prepared themselves for a terrorism-related incident [12].

When the course was being developed, the authors had many in-depth discussions about whether the concepts could be conveyed in a game format and whether a tabletop simulation game was suitable for the target group (experienced surgeons and senior hospital physicians).

The presentations were well adapted to the target audience, and the subsequent case discussions were used to exchange ideas and share experiences. Specialist topics such as gunshot and blast injuries, wound ballistics, and the pathophysiology of blast injuries as well as basic lectures on mass-casualty terrorist incidents, in-hospital triage, and hospital emergency plans received excellent ratings of 1.4 or better on average.

## How does the TDSC course compare to other courses?

The TDSC training course complements already existing courses on structured trauma care and the management of major incidents because of its focus on in-hospital tactical surgical and intensive care in the event of a mass-casualty (terrorist) incident in a hospital or trauma network [13]. As we see it, one of the advantages of this course format is the opportunity to reach the target group in all parts of the country.

The TDSC training course integrates and builds on elements of individualised trauma care such as the primary survey and eFAST. It thus complements and extends the care spectrum and in-hospital organisation [14].

Practical surgical skills are deliberately not taught, as they are successfully conveyed in the DSTC, CAMIN and AO training courses. The TDSC course therefore does not replace the advanced training courses for surgical skills required to manage a mass-casualty terrorist incident under situational constraints.

The TDSC course focuses on the organisational framework of structured in-hospital tactical and medical care for decision-makers in exceptional situations.

Once the course becomes more established and more target group members become acquainted with the course contents, medical care can be ensured with greater success during a mass-casualty terror incident and in a situation with temporarily inadequate resources.

## Way ahead

The subject of preparing for a mass-casualty terrorist incident was also included in the new edition of the Trauma Care White Paper of the German Trauma Society.

Since the concepts can also be successfully applied to “conventional” incidents, decision-makers of the individual trauma networks should take this course in order to prepare for such rare incidents. It is no longer sufficient to prepare for the individualised medical care of severely injured patients. Trauma networks, trauma centres and traumatologists are starting to realise that, in view of recent events, the management of a mass-casualty (terrorist) incident should definitely be part of their portfolio.

Initial problems were solved by improving the tabletop simulation game and by optimising the presentations. The new design of the game board allows local hospital conditions to be taken into consideration. This will improve team training in in-house courses. Such courses help identify problems with overlapping tasks and responsibilities, improve organisational structures, and train local decision-makers.

We are currently developing electronic learning tools (electronic patient code book, electronic course-specific programmes for triage training), which will allow participants to study at home. These tools will allow us to optimise the course format, which is already highly interactive. It will also be possible to expand the course contents to include other topics concerning mass-casualty (terrorist) incidents.

We are also considering an English version of the course. A course manual is already in preparation. We see the course as an international supplement to and continuation of already existing course formats. Especially the in-hospital management approach combined with detailed case discussions regarding the different surgical strategies (ETC, DCS and TASC) represent a unique concept.

### Compliance with ethical standards

**Conflict of interest** DB and GA are instructors of the TDSC course. AF and BF are directors of the TDSC course. DB, AF, BF and GA developed the TDSC course concept. MH is the educator of the TDSC course. MB and JS are executive directors of the AUC GmbH which offers the TDSC course.

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