

# Current status and future options for trauma and emergency surgery in Europe

## Travma ve acil cerrahiyle ilgili Avrupa'daki güncel durum ve gelecekte uygulanabilecek seçenekler

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Currently, there is great variation in the way trauma and non-trauma emergency surgery is organized in Europe. Trauma system development based on orthopedic trauma surgery seems to be more advanced in the central European countries and less developed in Scandinavia, The Baltic States, United Kingdom and the Mediterranean countries. Specific training for trauma surgery correlates with higher level of trauma system development. Multiple common features in the management of a surgical emergency, whether caused by injury or acute disease process, would favor the integration of these two disciplines into a single organizational and educational entity based on regionalization of emergency surgical services and general surgery-based education aiming for multidisciplinary team leadership and decision making skills, and surgical competence in acute life- and limb-saving surgery.

**Key Words:** Acute abdomen; emergency surgery; Europe; surgical education; trauma.

Halen, Avrupa'da uygulanmakta olan travma cerrahisi bakımından büyük farklar bulunmakta, travma dışı cerrahideyse düzenlemeler yapılmaktadır. Ortopedik travma cerrahisini esas alan travma sistemi, Orta Avrupa ülkelerinde daha yaygın görünürken, İskandinavya, Baltık Ülkeleri, Birleşik Krallık ile Akdeniz ülkelerinde daha az karşılaşılmaktadır. Travma cerrahisine yönelik özgün eğitim, daha üst düzey travma sisteminin gelişmişliğiyle korelasyon göstermektedir. Gerek yaralanma gerekse akut hastalık sürecine bağlı oluşan acil hastalıkların tedavisinde yer alan çok sayıda ortak özellik, bu iki disiplinin multidisipliner ekip liderliği ve karar alma becerileri ile acil yaşam ve acil ekstremiteler kurtarma cerrahisinde yeterliliği amaçlayan, acil cerrahi servislerin bölgeselleştirilmesine ve genel cerrahi temelli eğitime dayanan tek bir organizasyonel ve eğitimsel kuruma entegre edilmesini destekleyecektir.

**Anahtar Sözcükler:** Acil cerrahi; akut karın; Avrupa; cerrahi eğitim; travma.

### Introduction

The organized approach to major trauma care in the United States from the late 1960's resulted in the creation of trauma centers, trauma systems and a surgical specialty of trauma surgery and surgical critical care. Trauma system is an organized approach to provide severely injured patients rapid initial treatment, and are designed to promote optimum care along a continuum from prehospital care through rehabilitation to provide patients with the best out-

come possible.<sup>[1]</sup> The trauma surgeons were trained to manage the whole chain of management from emergency department through the operation room and intensive care unit. They operated on injuries of the anterior neck, chest, abdomen and major vessels comfortably, and managed their patients afterwards in surgical critical care units.

The expansion of nonoperative treatment sometimes accompanied by interventional radiological or endoscopic procedures reduced the operative load

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and operating room presence of trauma surgeons leading to decreased operative experience and exposure of trauma surgeons-in-training. Together with other difficulties in organizing affordable trauma care, a new paradigm was created by establishing a new specialty, *Acute Care Surgery*, essentially combining visceral and vascular trauma surgery with non-trauma emergency general surgery and surgical critical care.<sup>[2]</sup>

In Europe, trauma surgery with the dominance of blunt trauma has mainly been the domain of orthopedic surgeons, whereas visceral and vascular injuries have been managed first by general surgeons and subsequently with the fragmentation of surgical training by surgical subspecialists or even organ-specific surgeons. Although non-trauma emergency general surgery has been traditionally carried out by broadly trained general surgeons, the same fragmentation has affected the emergency surgery area as well. This has and will increasingly lead to centralization of emergency surgical services, because smaller hospitals can not have multiple surgeons on call every night without risking their elective surgical services.

The aim of this review is to assess the current trends in trauma and emergency surgery in Europe and outline the future options for developing the care of this most vulnerable patient population, the severely ill and injured.

### **Common ground in trauma and emergency surgery**

Emergency surgery can be broadly defined as all non-elective surgery performed because of acute threat to the patient requiring surgical decision making and intervention. The acute threat can be caused by external trauma, acute disease process, or sometimes by a complication of previous elective or emergency surgery. Although the underlying cause can be variable, there are many common features supporting a similar approach to these patient groups (Table 1).

Because of the many similarities in managing trauma and non-trauma surgical emergencies, it is intuitively appropriate that surgeons with comprehensive training in this field manage or coordinate the management of both patient groups, especially

**Table 1.** Common features of trauma and non-trauma emergency surgical patients

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Manifestation
Hemorrhage
Contamination or infection
Organ ischemia
Obstruction
Acute and severe physiological derangement
Cellular shock
Organ dysfunction
Threat to vital functions
Diagnostic tools and evaluation
Rapid initial assessment and structured secondary survey
Imaging and endoscopic investigations
Decision making based on assessment of physiological reserve
Interventions
Acute surgery, option for abbreviated procedure and planned reoperations
Interventional radiology
Endoscopic procedures
Nonoperative management
Complications requiring reinterventions
Postoperative or recurrent bleeding
Infections
Abdominal compartment syndrome
Wound complications, staged wound closure

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when a multidisciplinary approach is needed. Organizationally, it can also be justified that both patient groups are managed within a single emergency surgical system.

### Trauma epidemiology in Europe

In a prospective registration of all severely injured patients hospitalized during 2000-2002 in the western part of Norway and including prehospital deaths registered retrospectively identified 558 patients with an Injury Severity Score (ISS) >15.<sup>[3]</sup> The incidence of severely injured patients was 30/100.000/year. Road traffic accidents were the cause of injuries in 42% and falls in 39%, and the proportion of penetrating injuries was 7%.

In a national survey from Finland in 2004, the incidence of major trauma was 1000-1300/year with an annual incidence of 19-25/100.000 population. They were treated in 36 different hospitals with the caseload varying from 4-12 patients/month in university hospitals to 0.5-2 patients/month in smaller hospitals.<sup>[4]</sup>

A prospective, population-based study from northern Italy analyzed 627 patients with ISS>15 who either died in the prehospital setting or were admitted to any of the region's hospitals.<sup>[5]</sup> The incidence of major injury was 52/100.000/year. Trauma mechanisms included traffic accident in 81%, fall in 9% and interpersonal violence in 2%.

### Trauma systems and training in Europe today

The development of systematic trauma care in Europe started with the development of helicopter air rescue systems and the training of general surgeon-traumatologists.<sup>[6]</sup> In a survey from 2002 of 12 European countries, eight had trauma centers, although in many cases university hospitals managing all surgical emergencies including trauma were labeled as trauma centers.<sup>[7]</sup> Subsequently several articles have been published characterizing trauma care in individual European countries, such as Germany, Switzerland, The Netherlands, Belgium, Norway, Russia and Bosnia and Herzegovina.<sup>[8-14]</sup>

In the United Kingdom a pilot trauma system was started in 1991 in Stoke-on-Trent.<sup>[15]</sup> The evaluation of the pilot system showed a decreasing trend in mortality that was halved in 6 years. Whether the improved outcomes merely reflected national trends and would have been observed irre-

spective of the introduction of the trauma system was not clear.

In a review comparing two differing trauma systems-one in the USA with the focus on trauma center with lesser emphasis on prehospital care, and one in France, with more emphasis on prehospital care coordinated by a prehospital system lead mostly by anesthesiologists showed that the crude injury mortality rates from motor vehicle accidents were higher in France than in the USA.<sup>[16]</sup> However, adjusted mortality rates suggested equivalent outcomes among patients who survived to hospital.

The results from an email survey among physicians treating trauma patients daily in different European countries with special emphasis on the current structure of trauma system as well as trauma surgery training were published in part in a recent review.<sup>[17]</sup> The recipients were asked to rate on a scale of 0-10 the current level of trauma system development in their country with additive points for trauma system development, regionalized trauma care, trauma centers and trauma registry, and the integration of prehospital care into the trauma care system, respectively. In the second question, the recipients were asked to characterize the level of specialization for trauma surgery providers by rating them from 0-10 with 0-1 points representing a situation where every significant organ injury is cared by an individual "organ-specific" specialist, and 8-10 points representing a situation where trauma surgery is an individual specialty covering all or almost all aspects of trauma care from prehospital care, ED resuscitation, operative care (visceral, orthopedic, neurosurgical), and intensive care to rehabilitation.

The replies were received from 24 countries. Trauma system development was in a more advanced stage (score >6 to the first question) in the central European countries, most of them from the Austro-German surgical tradition (Germany, Austria, Hungary, Czech Republic, Slovakia, Switzerland, The Netherlands, Denmark). The Scandinavian and Baltic countries, United Kingdom and the Mediterranean countries had various degrees of trauma system components (score 3-6), whereas Spain (score 2) and Belgium (score 1.5) had least developed trauma systems. The trauma surgery specialization was also more extensive (including orthopedic trauma care) in central Europe. In general,

**Table 2.** Options for organizing trauma and emergency surgical services in Europe in the future

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Organization
Regionalization of trauma and emergency surgery services
Two-layer system
Emergency surgery centers with a population base of about 1 million
Basic surgical emergencies treated at regional hospitals
Single system for trauma and non-trauma surgical emergencies
Prehospital and emergency department management run by emergency physicians
Intensive care units run by anesthesiology-based intensivists
Surgical training
Based on general surgery training (4-5 years)
Additional training tailored individually (2-3 years)
Leads a multidisciplinary emergency surgery team (in major centers)
Life- and limb-saving emergency surgery in all body areas (in regional hospitals)
Qualities and concepts
Control of bleeding
Control of infection source
Indications and techniques of damage control surgery
Definitive repair of visceral and vascular injuries not requiring subspecialty skills
Principles of managing severe physiologic derangement and surgical critical care
Decision making in managing severe surgical complications

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there was a clear positive correlation between specialized trauma surgery training and the level of trauma system development with a few exceptions such as Denmark having a high level of trauma system development (score 8) and poor identification and training of trauma surgery specialists (score 1), and Slovenia where the reverse was true (scores 3 and 6, respectively).

#### **Advantages and disadvantages in combining trauma and emergency surgery**

Adding emergency general surgery into an established trauma service in Philadelphia showed no difference (before and after) in mortality, number of preventable trauma deaths or provider-related complications.<sup>[18]</sup> In Seattle, caring for patients with ruptured abdominal aortic aneurysms at regional trauma centers actually improved their outcome due to faster mobilization and better availability of surgeons.<sup>[19]</sup>

However, combining the mastering of a longitudinal treatment chain (emergency department, operation room, intensive care unit) with a broad set of surgical skills and competencies (multiple body regions and organ systems) is very challenging and it is hard to imagine a training program that would

produce a surgeon with expertise and operative capability of all fields of trauma and emergency surgery with additional skills in prehospital and emergency medicine as well as surgical critical care, and even interventional radiology (vascular stents).<sup>[20]</sup>

#### **Trends and options for Europe**

Currently, three trends in trauma care can be observed in Europe. The first one follows the past United States model with trauma systems and trauma surgery based education (*Advanced Trauma Life Support*, regionalization of trauma care, trauma centers). The second one aims to integrate trauma care with non-trauma emergency surgery, such as the *Acute Care Surgery* model in the United States. The third option is based on the past orthopedic surgeon dominated trauma surgery model with visceral and vascular injuries managed either by broadly trained trauma orthopedic surgeons, or visceral specialists under the coordination and leadership of orthopedic surgeons.

Although each country and region might proceed along their own line depending on local and historical circumstances, some kind of general guidelines and recommendations might be useful.

They are listed in Table 2, and reflect the author's personal preferences. However, they might serve as a starting point for further discussion within and between various European countries.

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