INDEX POLYTRAUMA

Serial lactate and admission SOFA scores in trauma: an analysis of predictive value in 724 patients with and without traumatic brain injury.

Dubendorfer C, Billeter A T, Seifert B, Keel M, Turina M.

Eur J Trauma Emerg S. 2013;39(1):25-34.
10.1007/s00068-012-0212-z

Objective
Arterial lactate, base excess (BE), lactate clearance, and Sequential Organ Failure Assessment (SOFA) score have been shown to correlate with outcome in severely injured patients. The goal of the present study was to separately assess their predictive value in patients suffering from traumatic brain injury (TBI) as opposed to patients suffering from injuries not related to the brain.

Materials and methods
A total of 724 adult trauma patients with an Injury Severity Score (ISS) >= 16 were grouped into patients without TBI (non-TBI), patients with isolated TBI (isolated TBI), and patients with a combination of TBI and non-TBI injuries (combined injuries). The predictive value of the above parameters was then analyzed using both uni- and multivariate analyses.

Results
The mean age of the patients was 39 years (77 % males), with a mean ISS of 32 (range 16-75). Mortality ranged from 14 % (non-TBI) to 24 % (combined injuries). Admission and serial lactate/BE values were higher in non-survivors of all groups (all $p < 0.01$), but not in patients with isolated TBI. Admission SOFA scores were highest in non-survivors of all groups ($p = 0.023$); subsequently septic patients also showed elevated SOFA scores ($p < 0.01$), except those with isolated TBI. In this group, SOFA score was the only parameter which showed significant differences between survivors and non-survivors. Receiver operating characteristic (ROC) analysis revealed lactate to be the best overall predictor for increased mortality and further septic complications, irrespective of the leading injury.

Conclusion
Lactate showed the best performance in predicting sepsis or death in all trauma patients except those with isolated TBI, and the differences were greatest in patients with substantial bleeding. Following isolated TBI, SOFA score was the only parameter which could differentiate survivors from non-survivors on admission, although the SOFA score, too, was not an independent predictor of death following multivariate analysis.

Keywords

Trauma - infection - sepsis - lactate - base excess - sofa score - glasgow coma scale - persistent occult hypoperfusion - critically-ill patients - organ failure - base deficit - serum lactate - significant increase - infection-rate - anion gap - mortality

Cause of death and time of death distribution of trauma patients in a Level I trauma centre in the Netherlands.

Lansink K W W, Gunning A C, Leenen L P H.

Eur J Trauma Emerg S. 2013;39(4):375-383.
10.1007/s00068-013-0278-2

The classical trimodal distribution of trauma deaths describes three peaks of deaths following trauma: immediate, early and late deaths. The aim of this study was to evaluate whether further maturation of the trauma centre and the improvement of survival have had an effect on the time of death distribution and resulted in a shift in causes of death.
All trauma patients from 1999 to 2010 who died after arrival in the emergency room and prior to discharge from the hospital were included. Deaths caused by drowning, poisoning and overdose were excluded.
A total of 16,421 trauma patients were admitted to our hospital. 772 (4.7 %) patients died, of which 720 were included in this study. The trauma mechanism was predominantly blunt (94.7 %). 530 patients (73.6 %) had Injury Severity Score (ISS) a parts per thousand yen25. The most frequent causes of death were central nervous system (CNS) injury (59.9 %), exsanguinations (12.9 %) and pneumonia/respiratory insufficiency (8.5 %). The first peak of death was seen in the first hour after arrival at the emergency department; subsequently, a rapid decline was observed and no further peaks were seen. Over the years, we observed a general decrease in deaths due to exsanguination ($p = 0.035$) and a general increase in deaths due to CNS injury ($p = 0.004$).
The temporal distribution of trauma deaths in our hospital changed as maturation of the trauma centre occurred. There is one peak of trauma deaths in the first hour after admission, followed by a rapid decline; no trimodal distribution was observed. Over time, there was a decrease in exsanguinations and an increase of deaths due to CNS injury.

Keywords
trauma - trauma deaths - mortality - outcome - trimodal distribution - cause of deaths - multiple organ failure - injury severity score - trimodal distribution - epidemiology - care - population - mortality - system - prevention

History, development and future of trauma care for multiple injured patients in the Netherlands.

Lansink K W W, Leenen L P H.

Eur J Trauma Emerg S. 2013;39(1):3-7.
10.1007/s00068-012-0223-9

Introduction
The development of trauma systems all over the world resulted in improved outcome for a broad range of trauma victims. In this review, we demonstrate the developments of an inclusive regionalised trauma system in the Netherlands and the subsequent developments in our level one trauma centre and trauma region in comparison.

Comparison with other trauma systems With the seasoning of the trauma system, further improvements in outcome could be demonstrated, in the region an OR of 0.84 and in the trauma centre an OR of 0.61, in a later comparison over the years another OR 0.74 was noted. In addition, a further diversification of the trauma populations was seen in the various hospitals with different levels, based on a pre-hospital triage system. Torso and multiple injured patients were more seen in the trauma centre and increased to more than 350 patients with an ISS of >15, whereas monotrauma was almost exclusively seen in the level two and three hospitals. The further development of the trauma system is discussed, in which the minimum requirements of the individual trauma surgeon and institution are taken as a guideline.

Future, discussion and conclusion Based on these considerations, a further concentration of the most severely injured patients is proposed in a small country as the Netherlands culminating in one trauma centre for the most severely injured patients, combined with an integrated pre-hospital helicopter system, on top of the current good functioning inclusive trauma system. These developments could be a template for further developments of trauma systems in Europe.

Keywords
trauma systems - polytrauma - quality assessment - systems - mortality - registry - service

Lactic acidosis is associated with multiple organ failure and need for ventilator support in patients with severe hemorrhage from trauma.

Lefering R, Zielske D, Bouillon B, Hauser C, Levy H.

Eur J Trauma Emerg S. 2013;39(5):487-493.
10.1007/s00068-013-0285-3

Lactate is a biomarker for hypoperfusion and subsequent resuscitation in trauma. It is also a predictor of mortality, but few studies have correlated lactate levels with relevant morbidities after trauma.
A retrospective review was performed of severely injured trauma patients entered into the Trauma Registry of the German Society for Trauma Surgery (TR-DGU) between 2002 and 2008. Adults requiring intensive care were categorized into two groups: lactate and no lactate. The lactate group had three subgroups: normal, elevated, and high lactate. Mean multiple organ failure (MOF) rates and composite endpoint of time (days) to complete organ failure resolution (CTCOFR) for 14 and 21 days and ventilator-free days (VFD) were compared, as well as other endpoints.
We analyzed 2,949 patients, of which 1,199 had lactate measurements. The percentage of patients with MOF increased in each higher lactate subgroup ($p < 0.001$), as did the mean CTCOFR14 and CTCOFR21 scores ($p < 0.001$ and < 0.001, respectively). Conversely, the mean VFD decreased in each higher lactate subgroup ($p < 0.001$). Thus, patients in the elevated and high lactate subgroups had greater MOF rates; required more days, on average, to resolve organ failure; and required more days of ventilator support than patients in the normal lactate subgroup.
Elevated blood lactate levels from trauma were closely correlated with worse outcomes. Thus, lactate shows promise as a biomarker for resuscitation as well as a predictor of mortality. Furthermore, this study supports its use in critical care trials as an outcome measure.

Keywords
lactate - hemorrhage - morbidity - mortality - ventilator-free days - multiple organ failure - major trauma - occult hypoperfusion - lactate clearance - severe sepsis - mortality - epidemiology - transfusion - multicenter - management - predictors

Vascular complications and special problems in vascular trauma.

Martin M J, Perez-Alonso A J, Asensio J A.

Eur J Trauma Emerg S. 2013;39(6):569-589.
10.1007/s00068-013-0336-9

The evaluation and management of patients with vascular trauma or injury often involve rapid decision making in less than ideal circumstances. Immediate consequences such as hemorrhage, ischemia, compartment syndrome, thrombosis, and embolization may be life threatening and require immediate intervention. In addition, a number of regional and systemic complications of the initial vascular pathology are possible, such as shock, acute renal failure, myocardial infarction, or stroke. Understanding the disease process, as well as the optimal diagnostic and therapeutic interventions, is critically important to minimize the risk of these highly morbid or potentially mortal complications. The managing physician must be adept and well versed at both the initial management of the specific vascular injury and the many potential complications that may subsequently arise. This article will review a number of vascular-specific complications and provide details of strategies for their prevention or optimal management. These problems include traumatic injuries to the arterial or venous system, failure of vascular repairs or reconstructions, surgical site and graft infections, anastomotic complications, and compartment syndromes. In addition, arterial and venous complications secondary to the use of illicit intravenous drug use and cocaine-related vascular injury will be discussed. Finally, the increasingly important topic of iatrogenic or procedure-related vascular injuries and complications will be reviewed.

Keywords
vascular injury - trauma - complications, endovascular - iatrogenic - vascular imaging - drug abuse - penetrating extremity trauma - iatrogenic venous pseudoaneurysm - phlegmasia cerulea dolens - guided compression repair - abdominal aortic-aneurysm - endovascular stent graft - single-center experience - acute arterial injuries - pressure wound therapy - intravenous drug-abuse

Quality improvement in trauma care.

Marzi I.

Eur J Trauma Emerg S. 2013;39(1):1-2.
10.1007/s00068-013-0252-z

Does ATLS trauma training fit into Western countries: evaluation of the first 8 years of ATLS in Germany.

Muenzberg M, Paffrath T, Matthes G, Mahlke L, Swartman B, Hoffman M, Lefering R, Wolfl C G.

Eur J Trauma Emerg S. 2013;39(5):517-522.
10.1007/s00068-013-0316-0

With over 2 million certified physicians worldwide, the Advanced Trauma Life Support (ATLS) program is one of the most successful international medical education programs. Germany joined the ATLS program in 2003. Before implementation of the program, there was a controversial discussion as to whether a country like Germany with a long history of trauma care needed ATLS at all. 197 courses with nearly 3,000 providers were performed until December 2010.
We assessed the course evaluations since the implementation of ATLS in Germany using the participants' systematic feedback.
During the course, each participant evaluated each presentation, skill station, and simulation on a rating scale from 1 to 4 (1 being the best, 4 being the worst). The participants completed the evaluation forms during the course and before they received their results. The course coordinator made sure that all forms were returned. The feedback forms were collected anonymously and were entered into a database. Statistical analysis was performed using frequencies and mean values.
The cumulative evaluation of all courses revealed an average performance score of 1.39 (1.06-1.86; n = 197). The lectures, skill stations, and simulations were individually evaluated as follows: lectures 1.61 (1.00-2.81; n = 197), skill stations 1.40 (1.00-2.40; n = 197), and surgical skill stations 1.35 (1.00-2.38; n = 197). Practical skills simulation (case scenarios) received the highest grade of 1.24 (1.00-1.57; n = 197). There were no significant changes during the time concerning the results of the evaluation.
The overall assessment showed constantly good and excellent evaluations by the participants over the years. In general, skill stations and simulations performed better than lectures. According to these results, the course format is well accepted by the participants and, therefore, can be recommended to all physicians treating trauma patients. Our results also underline the value of such a course format in an industrial country with an already established trauma system.

Keywords
polytrauma - atls - golden hour - trauma training - trauma management - life-support - quality improvement - multiple trauma - education - care

Penetrating peripheral vascular injury management in a Sri Lankan military hospital.

Ratnayake A, Samarasinghe B, Halpage K, Bala M.

Eur J Trauma Emerg S. 2013;39(2):123-129.
10.1007/s00068-012-0228-4

Vascular injuries in austere military conflict settings are a challenging problem. The goal of the current study was to analyze the unique features associated with the management and early outcome of penetrating vascular injuries resulting from the conflict in Sri Lanka.
All adults with extremity vascular injuries admitted to the Military Base Hospital Anuradhapura in an eight-month period were prospectively recorded in a data sheet and retrospectively analyzed. Mechanism, location, method of repair, and outcomes were analyzed.
Out of a total of 5,821 combat-related casualties, there were 128 victims with vascular injuries (2.2 %). The overall limb salvage rate was 83 % with an all-cause mortality of 3.1 %. Combined arterial and venous injuries were most common (44 %), predominantly in the popliteal zone. Among the arterial injuries, 70 % were repaired with a vein interposition graft and 7 % were primarily repaired. The majority of the venous injuries (54 %) were ligated. Twenty early major complications were recorded. A temporary intraluminal shunting technique was applied in the 14 most severely injured patients. This patient population was followed up for an average of 35 days institutionally before they were referred to rehabilitation (60 %) or transferred to other institutions (26 %).
Vascular reconstruction using vein, combined with a wound management strategy and early fasciotomy, resulted in a high limb salvage rate and remarkably low infection, delayed amputation, and mortality rates. Management of combat vascular injuries based on clinical guidance is feasible and leads to good outcome in a minimally equipped setting during local military conflicts. Surgeons in military hospitals should be trained in vascular injury repair to save the lives and functional limbs of patients.

Keywords
vascular injuries - combat experience - military hospital - limb salvage - early fasciotomy - iraq - trauma - war

Impact of fluid therapy on apoptosis and organ injury during haemorrhagic shock in an oxygen-debt-controlled pig model.

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Eur J Trauma Emerg S. 2013;39(4):405-414.
10.1007/s00068-013-0279-1

Apoptosis, or programmed cell death, seems to play a role in the physiology of shock. The influence of fluid resuscitation on the occurrence of apoptosis during haemorrhage is still unclear. Using an experimental randomised study, the goal of this investigation was to find a relation between different frequently used resuscitation fluids and evidence of apoptosis.
Sixty female pigs with a mean body weight of 20 kg were randomised into six groups, each receiving a different resuscitation fluid therapy: malated Ringer, lactated Ringer, hypertonic saline, hypertonic saline solution/Dextran 60, carbonate/gelatine and a sham group (no shock, no resuscitation). A haemorrhagic shock with a predefined oxygen debt with high mortality expected was induced for a period of 60 min. Then, the resuscitation fluid therapy within each group was initiated. At the beginning, after 1 h of shock and 1 and 2 h after resuscitation, biopsies from the liver were taken, as one of the most important metabolism organs of shock. Three hours after the beginning of the resuscitation period, the animals were allowed to recover under observation for 3 days. At the end of this period, a state of narcosis was induced and another liver biopsy was taken. Finally, the animals were sacrificed and samples were taken from the liver, kidney, heart and hippocampus. The TUNEL method was used for identifying apoptosis. Impairment of liver function was indicated by the measurement of transaminase levels.
There was no observed difference in the rate of apoptosis in all groups and a low number of apoptotic cells were found in all the organs sampled. The sham group also showed a low count of apoptosis. The hypoxia-sensitive neurons within the hippocampus did not show any signs of apoptosis. The high oxygen debt during haemorrhage led to a high mortality. The non-treated animals died very quickly, as an indicator for severe shock. Animals treated with hypertonic saline showed a significant increase in aspartate transaminase (AST) plasma levels on the first day after shock.
The different resuscitation fluids used in the treatment of haemorrhagic shock in this experimental model showed no evidence of a different apoptosis rate in the end organs.

Keywords
Apoptosis - shock - haemorrhagic - reperfusion injury - ischemia-reperfusion injury - ringers solution - resuscitation - identification - trauma - rats

The influence of alcohol intoxication on the severity of injuries suffered by drivers in road traffic accidents.

Ristic B, Rancic N, Maksimovic M, Ignjatovic-Ristic D.

Eur J Trauma Emerg S. 2013;39(4):363-368.
10.1007/s00068-013-0276-4

To determine the severity of injuries in drunk and sober drivers in traffic accidents, by using the Injury Severity Score (ISS), as well as the most vulnerable body region of those involved.
This was an observational case-control study covering a 1-year period of patients treated in the emergency department of the Health Center in Kraljevo, Serbia. Seventy-five patients were identified as drunken drivers [blood alcohol concentration (BAC) > 0.03 %] (group of cases), while 70 patients were found to be sober drivers (group of controls). Injuries were categorized by body region according to the ISS.
Half of all drivers (51.7 %) injured in traffic accidents were under the influence of alcohol. Males represented a substantial majority of both groups. In both categories of drivers, the greatest incidence of traffic accidents was in the age group 19-35 years. Injuries of drunken drivers were more frequently present in all body regions except in the areas of limbs with shoulder and pelvic bones. Drivers under the influence of alcohol have a 3.80 times greater risk of suffering deadly injuries in traffic accidents. The average ISS in drunken drivers was higher in comparison to sober drivers ($p < 0.05$). The greatest ISS was in the drunk group with BAC level over 0.051 % (the ISS range was 15-20). A strong correlation was found between the BAC level and the degree of injury ($r = 0.63$).
The severity of injuries and, especially, the 3.80 times greater risk of suffering deadly injuries in traffic accidents for drunken drivers obliges us to pay attention to prevention strategies.

Keywords
injury severity score (iss) - driver - traffic accident - blood alcohol concentration (bac) - body regions - drink driving situation - vehicle accidents - difference - mortality - vietnam

Increased mortality with undertriaged patients in a mature trauma center with an aggressive trauma team activation system.

Rogers A, Rogers F B, Schwab C W, Bradburn E, Lee J, Wu D, Miller J A.

Eur J Trauma Emerg S. 2013;39(6):599-603.
10.1007/s00068-013-0289-z

Purpose
The American College of Surgeons Committee on Trauma (ACS-COT) has determined that a 5 % pre-hospital undertriage [UT; defined as Injury Severity Score (ISS) > 15 and not sent to a trauma center] is an acceptable rate for pre-hospital transfer to a non-trauma center. We sought to determine if this level of undertriage is acceptable within a mature Level II trauma center as a measure of the adequacy of its trauma activation system.

Methods
Our trauma activation system encompasses anatomic, physiologic, and mechanism of injury criteria. We defined UT as ISS[15 and no trauma activation. All UT patients during the period 2000-2010 were compared to properly triaged patients (CT). The variables examined were mortality, emergency department (ED) length of stay (LOS), hospital LOS, complications, Coumadin use, and age >64 years.

Results
There were 18,324 patients admitted, with 1,156 (6.3 %) UT. UT is associated with an increase in mortality [odds ratio (OR) 3.0; 95 % confidence interval (CI) 2.4-3.8; p< 0.001), longer ED LOS (OR 54.5; 95 % CI 45.5-63.5; p< 0.001), and longer hospital LOS (OR 1.7; 95 % CI 1.4-2.1; p< 0.001). In addition, UT patients had a two-fold increase in complications (OR 2.0; 95 % CI 1.6-2.5; p<0.001). When controlling for age C65 years, Revised Trauma Score (RTS) > 7.0, and one or more comorbidities, UT patients had 2.18 times higher odds of mortality than their CT counterparts (OR 2.18; 95 % CI 1.57-3.01; p < 0.001). Patients on pre-hospital Coumadin (OR 3.61; 95 % CI 3.04-4.30; p < 0.001) and age >64 years (OR 4.93; 95 % CI 4.36-5.58; p < 0.001) were significant predictors of being undertriaged. A p-value <= 0.05 was considered to be significant.

Conclusions
Standard trauma activation criteria may not be adequate to identify the at-risk severely injured trauma patient. Further refinement of in-house trauma triage protocols is necessary if trauma centers are to improve outcomes following trauma.

Keywords
undertriage - increased mortality - triage - protocol

Motorcycle injuries at a tertiary referral hospital in Kenya: injury patterns and outcome.

Saidi H, Mutisto B K.

Eur J Trauma Emerg S. 2013;39(5):481-485.
10.1007/s00068-013-0280-8

The rise in the use of motorcycles in Kenya in the last 10 years has been associated with increased injury rates. Between 2004 and 2009, motorcycle injuries increased at a rate of 29 % and, in some hospitals, motorcycle users have become the predominant road user category injured. Although most road traffic injuries occur in Nairobi, there has been no previous account of motorcycle injury and associated outcomes at its main hospital.
To describe the injury patterns and outcomes following motorcycle trauma at the Kenyatta National Hospital.
All motorcycle trauma admissions during one calendar year were analyzed. The data captured included demographics, injury patterns and outcomes, lengths of hospital stay, hospitalization cost, and early hospital mortality. Factors associated with outcomes were analyzed by univariate and multivariate means. The probability of survival was estimated using the Trauma and Injury Severity Score (TRISS) methodology for each patient.
Two hundred and five patients were reviewed. Motorcycle trauma admissions formed 22.3 % of all road traffic injury admissions. Male riders predominated. The average age and modal age group was 30.78 and 21-30 years, respectively. Half of riders and 20 % of passengers used protective helmets. Injuries were mostly to the extremities (60.7 %) and head/neck (32.07 %), and the average Injury Severity Score (ISS) was 7.57 + 4.0 (median 9.0).
At 2 weeks, 9.0 % of patients had died. The estimated probability of survival ranged from 0.86 to 0.97. Surgical interventions were needed for 51.7 % of patients. The mean length of stay in the hospital was 24.3 days, while the cost of treatment was 31,783 Kenya Shillings (Kshs). Injury severity ($P < 0.001$), admission to the intensive care unit (ICU) ($P < 0.001$), non-surgical treatment ($P = 0.003$), blood transfusion ($P = 0.029$), head injury ($P < 0.001$), and low Glasgow Coma Scale (GCS) score at admission were significantly associated with mortality.
Injuries to the lower limbs and the head predominate in motorcycle trauma. The high mortality rate, need for surgery in the majority of patients, and prolonged admission days call for motorcycle control and expedited care. Significant head injury mortality calls for efforts to embrace helmet laws for riders and passengers.

Keywords
motorcycle injuries - africa - patterns - outcome - road traffic injuries - developing-countries

Civilian injuries due to unexploded ordnance in military training areas in southern Israel.

Shaked G, Beck G, Sebbag G, Yitzhak A, Zlotnik A, Czeiger D.

Eur J Trauma Emerg S. 2013;39(2):113-115.
10.1007/s00068-012-0239-1

The problem of unexploded ordnance (UXO) is global and is usually associated with active or former war zones. Civilian injuries due to UXO in military training areas are not common.
This is a retrospective case series study based on prospectively collected data on patients who sustained injuries from UXO explosions and were admitted to the Soroka University Trauma Center during a five-year period.
Twelve patients were included in this series. All patients were Bedouin and the distribution of injuries was concentrated around the head and upper and lower extremities, with sparing of the torso.
Awareness and implementation of preventive measures are expected to reduce the incidence of this type of injury.

Keywords
unexploded ordnance - trauma - prevention - military training areas - explosion - deaths - mines

Rhabdomyolysis: risk factors and incidence in polytrauma patients in the absence of major disasters.

Sousa A, Paiva J A, Fonseca S, Raposo F, Valente L, Vyas D, Ribeiro O, Pinto R.

Eur J Trauma Emerg S. 2013;39(2):131-137.
10.1007/s00068-012-0233-7

Rhabdomyolysis is a syndrome caused by musculoskeletal tissue damage that leads to the release of large amounts of intracellular elements, which particularly affect renal function. The most common causes are severe trauma, ischemia, surgical procedures, and drug abuse. We aimed to determine the incidence of rhabdomyolysis by measuring muscle injury markers (CK, myoglobin), to identify pre/post-admission as well as iatrogenic risk factors for rhabdomyolysis in severe polytrauma, to clarify the relevance of orthopedic injuries and surgical treatment in the onset/worsening of rhabdomyolysis, and to correlate risk factors with its main complication-acute renal failure (ARF).
Prospective study of severe polytrauma patients (Injury Severity Score (ISS) > 15), with CK and myoglobin values measured at admission and after 24, 48, and 72 h. Peak values, variations between admission and peak, and variations between admission and day 3 were all determined. The correlations of those values with the onset of ARF and other negative outcomes were assessed.
A total of 57 consecutive patients with a median ISS of 29 were included. ARF was present in 20 patients (38 %). CK-0 level was correlated with male gender ($p < 0.027$) and ISS (0.014); Mb-0 level was correlated with hypovolemic shock (0.003) and skeletal fracture ($p < 0.043$). CK-max was correlated with surgery ($p < 0.038$) and surgery duration ($p < 0.014$); Mb-max was correlated with surgery ($p < 0.002$) and anesthesia duration ($p < 0.005$). Delta-CK was correlated with surgery ($p < 0.01$) and surgery duration ($p < 0.017$), and Delta 0-3-CK was correlated with surgery ($p < 0.042$). Logistic regression analysis found relationships between Delta 0-3-CK and both ICU admission ($p < 0.003$) and MODS ($p < 0.012$), and between Mb-max and ARF ($p < 0.034$).
We found that a large number of factors are implicated in CK and Mb variations. Rhabdomyolysis is a very frequent complication, but increase in CK marker alone does not seem to be correlated with the incidence of ARF. Therefore, Mb level should be considered in this group of patients.

Keywords
polytrauma - emergency surgery - soft tissue injuries - surgical critical care - trauma systems - crush compartment syndrome - hanshin-awaji earthquake - acute-renal-failure - skeletal-muscle - exertional rhabdomyolysis - surgical-patients - creatine-kinase - free-radicals - injury - ischemia

Ultrasonographic diagnosis of abdominal free fluid: accuracy comparison of emergency physicians and radiologists.

Tajoddini S, Vahdati S S.

Eur J Trauma Emerg S. 2013;39(1):9-13.
10.1007/s00068-012-0219-5

Objective
Blunt abdominal trauma is a diagnostic challenge for emergency physicians and ultrasonography is one of the diagnostic tools used in this type of injuries. The aim of this study was to evaluate the diagnostic value of ultrasonographies performed by emergency physicians and radiologists.

Methods
This prospective diagnostic study was performed in the emergency departments of two trauma centers in Iran during a period of 12 months. The subjects were all patients with blunt abdominal trauma that were candidated for abdominopelvic computed tomography (CT) scanning in our emergency departments. The results of focused assessment with sonography for trauma (FAST) performed by emergency physicians and radiologists were compared blindly with the results of CT scans performed by radiologists. The sensitivity, specificity, and predictive values of diagnosis for different abdominal anatomic areas were calculated.

Results
In total, 450 patients undergoing FAST and CT scanning were studied. The sensitivity of radiologists' diagnoses for Morison's, splenorenal, perivesical, and pleural effusion areas were, respectively, 88.0, 70.0, 38.0, and 30.0 %. The corresponding values for emergency physicians' diagnoses were, respectively, 82.0, 60.0, 28.0, and 30.0 %. The specificity of radiologists' diagnoses in the mentioned areas were, respectively, 98.9, 100, 93.1, and 100 %, and for emergency physicians, they were, respectively, 98.9, 100, 96.0, and 100 %.

Conclusion
Emergency physicians showed a promising performance in applying FAST in blunt abdominal trauma. The specificity of ultrasonographic diagnosis in the emergency physicians group and the radiologists group were comparable, while radiologists showed a higher performance regarding the sensitivity of the ultrasonographic diagnosis.

Keywords
blunt abdominal injury - emergency medicine - ultrasound - fast - focused assessment with sonography for trauma - trauma patients - sonography - ultrasound

The European trauma course: trauma teaching goes European.

Thies K C, Deakin C D, Rommens P M, Voiglio E J, Sabbe M B, Arafat R, Brattebo G, Lippert F K, Lott C, Robinson D.

Eur J Trauma Emerg S. 2013;39(5):441-442.
10.1007/s00068-013-0317-z, team,

Influence of vagal injury on acute traumatic reaction after blast injury.

Wang Y, Pan L, Fan W, Zhou Z, Zhu L, Wang Y, Hu R.

Eur J Trauma Emerg S. 2013;39(4):385-392.
10.1007/s00068-013-0277-3

A prospectively randomised, controlled animal study was conducted to analyse the influence of vagal injury on acute cardio-respiratory responses to blast injury.
We used a previously described model of blast-fragment combined injuries to divide dogs randomly into three groups: normal control, blast injury with fragment shot at the masseter and blast injury with fragment shot at the neck. The vagal histomorphologic changes were investigated by haematoxylin-eosin staining and immunocytochemical analysis of neuron-specific enolase and glial fibrillary acidic protein. The indices of respiration, heart rate, blood pressure and body temperature were recorded continuously before and after blast exposure.
The vagal injury was more severe in the neck-injured than in the face-injured group. However, bradycardia, hypotension and absence of compensatory peripheral vasoconstriction, which are typically seen in animals subjected to blast injury without vagal nerve injuries, were partly inhibited when the vagal nerve was injured.
A vagally mediated reflex, such as a cardio-respiratory system defensive reflex that caused shock, was observed immediately after blast pressure wave injury. These observations may have important implications for the emergency management of blast injury cases.

Keywords
vagal injury - vagal reflex - blast injury - breathing rate - heart rate - blood pressure and body temperature - traumatic shock nse - gfap - brain-injury - nerve-stimulation - anesthetized rat - shock - hemorrhage - model - wave - war - resuscitation - morbidity

Management of chronic traumatic arteriovenous fistula of the lower extremities.

Yousuf K M, Bhagwani A R, Bilal N.

Eur J Trauma Emerg S. 2013;39(4):393-396.
10.1007/s00068-013-0284-4

Introduction
Vascular injuries secondary to blunt or penetrating trauma are a significant cause of morbidity and mortality, especially in war-afflicted areas. Due to the violent situations of Pakistan and the unavailability of vascular services in remote areas, we are witnessing an increase in the number of delayed/chronic post-traumatic arteriovenous fistulas (AVFs) of the extremities in our institution. The purpose of this study is to share our experience of post-traumatic AVF and the incidence, presentation, and outcomes of these patients.

Methods
A 10-year retrospective study between January 2002 and May 2012 was conducted. We studied 30 patients with post-traumatic AVF of the lower limbs.

Results
All 30 cases were due to penetrating injuries, either by gun shots or bomb blasts. All of the patients were treated surgically, except for one patient who was treated with a covered stent. The interval between surgery and presentation ranged from 6 months to 20 years. All patients had complete obliteration of the fistulous tract and there was no recurrence and no post-operative mortality.

Conclusion
Long-standing traumatic AVF is becoming common in Pakistan. Surgery remains the standard treatment.

Keywords
trauma - arteriovenous fistula - chronic – injuries

The falling bullets: post-Libyan revolution celebratory stray bullet injuries.

Al-Tarshihi M, Al-Basheer M.

Eur J Trauma Emerg S. 2014;40(1):83-85.
10.1007/s00068-013-0323-1

To report our experience with the post-Libyan revolution celebratory stray bullet injuries by falling bullets.
This descriptive study was carried out during the period from November 2011 to February 2012 at the military Jordanian field hospital in Benghazi-Libya. Twenty-three patients who were injured by falling bullets were enrolled in this study. Intentional and direct bullet injuries due to conflicts were excluded. Demographic data, injured body part, place of injury, timing of intervention, hospital stay, and fatality were described and analyzed.
Children less than 14 years of age constituted 65.2 % (n = 15) of the falling bullets victims. Injured body parts were upper and lower limbs (12, 52.2 %), chest (8, 34.8 %), head and neck (2, 8.7 %), and abdomen (1, 4.3 %). Three (13.0 %) patients were diagnosed to have stray bullet injury by radiological investigations without a clinical suspicion. Two (8.7 %) fatalities were reported.
Celebratory stray bullet injuries are an unusual form of injury not infrequently seen in some parts of the world. Lower limb and chest injuries especially among children are most commonly reported. Focus on prevention through education and weapon use regulations carries the best chance of reducing these injuries.

Keywords
stray - bullet - injuries - libya - shootings

33rd Meeting of the Pediatric Section of the German Society of Trauma Surgeons (DGU) Abstracts.

Anonymous.

Eur J Trauma Emerg S. 2014;40(3):406-417.
10.1007/s00068-014-0410-y

Pitfalls to avoid in the medical management of mass casualty incidents following terrorist bombings: the hospital perspective.

Ashkenazi I, Turegano-Fuentes F, Einav S, Kessel B, Alfici R, Olsha O.

Eur J Trauma Emerg S. 2014;40(4):445-450.
10.1007/s00068-014-0403-x

The unique patterns of injury following explosions together with the involvement of numerous physicians, most of whom are not experienced in trauma, may create problems in the medical management of mass casualty incidents.
Four hundred patient files admitted in 19 mass casualty events following bombing incidents were reviewed and possible areas which could impact survival were defined.
Forty-nine (9.3 %) patients had an Injury Severity Score a parts per thousand yen16. Of 205 patients in whom triage decisions were available, 5 of 25 severely injured patients were undertriaged by the triage officers at the door of the hospital. Following primary evaluation inside the emergency department critical injuries in two patients were missed due to distracting, less serious injuries. Of 68 (16.1 %) patients who were operated, 28 were in need of either immediate, urgent or high-priority operations. Except for neurosurgical cases which needed to be transferred to other hospitals, there was no delay in surgery. One patient underwent negative laparotomy. There were 15 in-hospital deaths, 6 of which were deemed as either anticipated or unanticipated mortality with possibility for improvement.
Medical management should be evaluated following MCIs as this may illustrate possible problems which many need to be addressed in contingency planning.

Keywords
mass casualty incidents - terror bombings - attacks - london

Endovascular therapy in trauma.

Brenner M, Hoehn M, Rasmussen T E.

Eur J Trauma Emerg S. 2014;40(6):671-678.
10.1007/s00068-014-0474-8

The practice of medicine has experienced a revolution in the use of catheter-based or endovascular techniques to manage age-related vascular disease over the past 15 years. In many scenarios the less invasive, endovascular method is associated with reduced morbidity and mortality than the traditional open surgical approach. Although somewhat delayed, the use of endovascular approaches in the management of certain trauma scenarios has also increased dramatically. With improvements in catheter-based and imaging technologies and a broader acceptance of the value of the endovascular approach, this trend is likely to continue to the benefit of patients. The use of endovascular techniques in trauma can be considered in three broad categories: (1) large-vessel repair (e.g. covered stent repair), (2) mid- to small-vessel hemostasis (e.g. coils, plugs, and hemostatic agents), and (3) large-vessel balloon occlusion for resuscitation (e.g. resuscitative endovascular balloon occlusion of the aorta). While not exclusive, these categories provide a framework from which to consider establishing a trauma-specific endovascular inventory and performance of these techniques in the setting of severe injury. The aim of this review is to use this framework to provide a current appraisal of endovascular techniques to manage various forms: vascular injury, bleeding, and shock; including injury patterns in which an endovascular approach is established and scenarios in which it is nascent and evolving.

Keywords
vascular trauma - endovascular repair - catheter-based approach - endovascular balloon occlusion - resuscitation - thoracic aortic injuries - occlusion balloon catheter - surgery-of-trauma - hemorrhagic-shock - prospective trial - abdominal-trauma - liver-injuries - data-bank - repair - embolization

Proper coding of the Abbreviated Injury Scale: can clinical parameters help as surrogates in estimating blood loss?

Burkhardt M, Holstein J H, Moersdorf P, Kristen A, Lefering R, Pohlemann T, Pizanis A, DGU T.

Eur J Trauma Emerg S. 2014;40(4):473-479.
10.1007/s00068-013-0335-x

The Abbreviated Injury Scale (AIS) requires the estimation of the lost blood volume for some severity assignments. This study aimed to develop a rule of thumb for facilitating AIS coding by using objective clinical parameters as surrogate markers of blood loss.
Using the example of pelvic ring fractures, a retrospective analysis of TraumaRegister DGU(A (R)) data from 2002 to 2011 was performed. As potential surrogate markers of blood loss, we recorded the hemoglobin (Hb) level, systolic blood pressure (SBP), base excess (BE), Quick's value, units of packed red blood cells (PRBCs) transfused before intensive care unit (ICU) admission, and mortality within 24 h.
We identified 11,574 patients with pelvic ring fractures (Tile/OTA classification: 39 % type A, 40 % type B, 21 % type C). Type C fractures were 73.1 % AIS(pelvis) 4 and 26.9 % AIS(pelvis) 5. Type B fractures were 47 % AIS(pelvis) 3, 47 % AIS(pelvis) 4, and 6 % AIS(pelvis) 5. In type C fractures, cut-off values of < 7 g/dL Hb, < 90 mmHg SBP, <-9 mmol/L BE, < 35 % Quick's value, > 15 units PRBCs, and death within 24 h had a positive predictive value of 47 % and a sensitivity of 62 % for AIS(pelvis) 5. In type B fractures, these cut-off values had poor sensitivity (48 %) and positive predictive value (11 %) for AIS(pelvis) 5.
We failed to develop a rule of thumb for facilitating a proper future AIS coding using the example of pelvic ring fractures. The estimation of blood loss for severity assignment still remains a noteworthy weakness in the AIS coding of traumatic injuries.

Keywords
abbreviated injury scale (ais) - coding - pelvic ring fracture - estimated blood loss - rule of thumb - life-threatening hemorrhage - multiple trauma - probability - transfusion - predictors - mortality

Update on the definition of polytrauma.

Butcher N E, Balogh Z J.

Eur J Trauma Emerg S. 2014;40(2):107-111.
10.1007/s00068-014-0391-x

Purpose
The definition and use of the term "polytrauma'' is inconsistent and lacks validation. This article describes the historical evolution of the term and geographical differences in its meaning, examines the challenges faced in defining it adequately in the current context, and summarizes where the international consensus process is heading, in order to provide the trauma community with a validated and universally agreed upon definition of polytrauma.

Conclusion
A lack of consensus in the definition of "polytrauma'' was apparent. According to the international consensus opinion, both anatomical and physiological parameters should be included in the definition of polytrauma. An Abbreviated Injury Scale (AIS) based anatomical definition is the most practical and feasible given the ubiquitous use of the system. Convincing preliminary data show that two body regions with AIS >2 is a good marker of polytrauma-better than other ISS cutoffs, which could also indicate monotrauma. The selection of the most accurate physiological parameters is still under-way, but they will most likely be descriptors of tissue hypoxia and coagulopathy.

Keywords
polytrauma - definition - inflammatory response syndrome - nosocomial infection - multiple injuries - trauma patients - pathophysiology - patient - care - severity - system - level

Should prehospital resuscitative thoracotomy be incorporated in advanced life support after traumatic cardiac arrest?

Chalkias A, Xanthos T.

Eur J Trauma Emerg S. 2014;40(3):395-397.
10.1007/s00068-013-0356-5

The survival of traumatic cardiac arrest patients poses a challenge for Emergency Medical Services initiating advanced life support on-scene, especially with regard to having to decide immediately whether to initiate prehospital emergency thoracotomy. Although the necessity for carrying out the procedure remains a cause for debate, it can be life-saving when performed with the correct indications and approaches.

Keywords
traumatic cardiac arrest - prehospital - thoracotomy - algorithm - on-scene thoracotomy - emergency thoracotomy - guidelines - survival - injuries

Innovation in trauma care: 2nd World Trauma Congress and 15th European Congress of Trauma and Emergency Surgery.

Coimbra R, Leenen L P H, Marzi I.

Eur J Trauma Emerg S. 2014;40(2):105-106.
10.1007/s00068-014-0393-8

New solutions for complex bleeding in trauma.

Coimbra R, Leppaniemi A.

Eur J Trauma Emerg S. 2014;40(6):639-639.
10.1007/s00068-014-0475-7

A randomized trial comparing two intraosseous access devices in intrahospital healthcare providers with a focus on retention of knowledge, skill, and self-efficacy.

Derikx H J G M, Gerritse B M, Gans R, van der Meer N J M.

Eur J Trauma Emerg S. 2014;40(5):581-586.
10.1007/s00068-014-0385-8

Introduction
Intraosseous access is recommended in vitally compromised patients if an intravenous access cannot be easily obtained. Intraosseous infusion can be initiated by various healthcare providers. Currently, there are two mechanical intraosseous devices approved by the U. S. Food and Drug Administration (FDA) for use in adults and children. A comparison is made in this study of the theoretical and practical performance by anesthesiologists and registered nurses of anesthesia (RNAs) in the use of the battery-powered device (device A) versus the spring-loaded needle device (device B). This study entailed a 12-month follow-up of knowledge, skill retention, and self-efficacy measured by standardized testing.

Methods
A prospective randomized trial was performed, initially comparing 15 anesthesiologists and 15 RNAs, both on using the two types of intraosseous devices. A structured lecture and skill station was given with the educational aids provided by the respective manufacturers. Individual knowledge and practical skills were tested at 0, 3, and 12 months after the initial course.

Results
There was no statistical significant difference in the retention of theoretical knowledge between RNAs and anesthesiologists on all testing occasions. However, the self-efficacy of the anesthesiologists is significantly higher ($p < 0.01$) than the self-efficacy of the RNAs for both devices, on any testing occasion. Insufficient skills were local disinfection (both groups, both devices) and attachment of the needle to the intravenous line (RNAs with both devices). In 33 % of all device B handlings, unsafe practice occurred.

Conclusion
The use of device A is safer in handling in comparison to device B at 12 months follow-up. The hypothesis that doctors are more qualified in obtaining intraosseous access has been disproven, as anesthesiologists were as successful as RNAs. However, the low self-efficacy of RNAs in the use of intraosseous devices could diminish the chance of them actually using one.

Keywords
intraosseous access - cardiopulmonary resuscitation - in-hospital resuscitation - self-efficacy - hospital staff training - resuscitation-council guidelines - emergency cardiovascular care - bone-injection-gun - life-support - cardiopulmonary-resuscitation - vascular access - infusion - experience - children - adults

Refining the trauma triage algorithm at an Australian major trauma centre: derivation and internal validation of a triage risk score.

Dinh M M, Bein K J, Oliver M, Veillard A S, Ivers R.

Eur J Trauma Emerg S. 2014;40(1):67-74.
10.1007/s00068-013-0315-1

To derive and internally validate a clinical prediction rule for trauma triage.
Ambulance presentations requiring trauma team activation between 2007 and 2011 at a single inner city major trauma centre were analysed. The primary outcome was major trauma, defined as Injury Severity Score > 15, intensive care unit admission or in-hospital death. Demographic details, vital signs on arrival at hospital, mechanism of injury and injured body regions were used in the modelling process. Multivariable logistic regression was used on a randomly selected derivation sample. Receiver operating characteristic (ROC) analysis and Hosmer-Lemeshow tests were used to assess the discrimination and calibration of the derived model. The model was further tested using bootstrapping cross-validation.
A total of 3027 patients were identified. Predictors selected for the prediction model were age a parts per thousand yen65 years (OR 1.58, 95 %CI 1.08-2.32, p = 0.02), abnormal vital signs (OR 3.72, 95 %CI 2.64-5.25), Glasgow Coma Scale score a parts per thousand currency sign13 (OR 14, 95 %CI 9.23-23.34 p < 0.001), penetrating injury (OR 5.13, 95 %CI 2.76-9.54, p < 0.001), multiregion injury (OR 4.72 95 %CI 3.45-6.46, p < 0.001), falls (OR 1.51 95 %CI 1.06-2.15, p = 0.02) and motor vehicle crashes (OR 0.56, 95 %CI 0.35-0.90, p = 0.02). The ROC area under the curve (AUC) for the final model was 0.85 (95 %CI 0.83-0.87) with a Hosmer-Lemeshow test statistic p = 0.83. Bootstrapping cross-validation demonstrated an identical AUC.
We have derived and internally validated a trauma risk prediction rule using trauma registry data. This may assist with the formulation of revised local and regional trauma triage protocols. External validation is required before implementation.

Keywords
major trauma - triage - risk score - new-south-wales - field triage - prehospital index - american-college - mortality - victims - injury - care - prediction - protocol

Polytrauma at the Emergency Department; can we relate arterial blood gas analysis to a shock classification?

Evers M J, Vaneker M, Biert J.

Eur J Trauma Emerg S. 2014;40(2):169-173.
10.1007/s00068-013-0325-z

Objective
Shock is defined as a change of circulation which results in hypoxia at the tissue level. Lactate and base deficit (BD) are associated with a high risk of multiple organ dysfunction in trauma patients. In this study we evaluated the influence of early recognition of shock in trauma patients.

Methods
In a retrospective study, relevant data were collected from the Radboud University Nijmegen Medical Centre (RUNMC) database between January 2009 and December 2010. Vital parameters were taken at the accident scene, and patients were divided into four shock classes. Arterial blood gas analysis was performed on arrival in the emergency department. Statistical analysis was performed with SPSS version 17.0. Statistical significance was assumed at $p <= 0.05$.

Results
A total of 255 patients were included. Patients who suffered from prehospital shock, and those who were intubated prior to hospital admittance showed a bad outcome, presenting with a more severe metabolic acidosis, higher ISS and higher mortality. There was a significant difference for bicarbonate and BD between shockclass I + II and shockclass III + IV, respectively 22.7 vs. 19.7 and -3.4 vs. -6.9. Intubated patients had a decreased bicarbonate and BD compared to not intubated patients, respectively 21.81 vs. 23.24 and -5.08 vs. -2.38. Mortality and ISS were higher in patients in shock class III and IV. Significant differences in serum lactate levels were not found.

Conclusions
Prehospital shock influences patient outcome; outcome of patients is related to initial shock classification. Further validation of our shock classification, however, is necessary.

Keywords
trauma patients - early arterial blood gas analysis - intubation - metabolic acidosis - shock classification - trauma patients - base deficit - prehospital hypotension - mm hg - injury

Autotransfusion in emergent operative trauma resuscitation.

Caliste X A, McArthur K A, Sava J A.

Eur J Trauma Emerg S. 2014;40(5):541-545.
10.1007/s00068-013-0328-9

Purpose
Autotransfusion of red cells is common in many surgical specialties. However, this technique is not uniformly used in abdominal trauma. The purpose of this paper is to study the outcomes of patients who were autotransfused during emergency trauma operations in which they sustained full-thickness hollow viscus injury (HVI).

Methods
A total of 179 patients in period 1999-2008 with penetrating and blunt abdominal trauma requiring intraoperative blood transfusion were evaluated. Recipients of autotransfusion and banked blood (autotransfused group) were compared with recipients of banked blood products only (control group). The t-test, Chi-squared, and Fisher's exact test were used to evaluate the data. Multivariate regression analysis evaluated the primary outcomes, survival and bloodstream infection (BSI).

Results
Of the 179 patients, 108 controls and 71 autotransfused patients were evaluated. The results showed no statistically significant difference between the control and autotransfusion groups regarding age, injury pattern/severity [Injury Severity Score (ISS)], length of stay, postoperative international normalized ratio (INR), and volume of banked blood products. Both groups were also proportional with colon injury. The estimated operative blood loss (EBL) was 2,472 +/- 3,261 for controls and 4,056 +/- 3,825 for the autotransfused group ($p = 0.0001$). The total volume of blood transfused was 2,792 and 5,513 for controls and patients in the autotransfusion group, respectively ($p = 0.002$). Ninety controls (84 %) and 53 autotransfused patients (76 %) survived to discharge ($p = 0.21$). Twenty controls (49 %) and 17 autotransfused patients (45 %) developed BSI ($p = 0.72$). Logistic regression analysis revealed that an ISS > 25, systolic blood pressure <90, and EBL >2 L predicted mortality. There was also a trend towards decreased survival with age >50 years.

Conclusion
We found no evidence that emergent autotransfusion worsens clinical outcomes in the setting of concomitant HVI.

Keywords
abdominal trauma - emergency surgery - shock - trauma systems - infection - autotransfusion - intraoperative blood salvage - auto-transfusion - abdominal-trauma

Challenges in the training of military surgeons: experiences from Dutch combat operations in southern Afghanistan.

Hoencamp R, Tan E C T H, Idenburg F, Ramasamy A, van Egmond T, Leenen L P H, Hamming J F.

Eur J Trauma Emerg S. 2014;40(4):421-428.
10.1007/s00068-014-0401-z

To improve care for battle casualties, we analyzed the surgical workload during the Dutch deployment to Uruzgan, Afghanistan. This surgical workload was compared with the resident surgical training and the pre-deployment medical specialist program.
Patient data from the trauma registry (2006-2010) at the Dutch Role 2 Medical Treatment Facility (MTF) were analyzed. The case logs of chief residents (n = 15) from the general surgery training program in the Netherlands were used for comparison.
The trauma registry query yielded 2,736 casualties, among whom 60 % (1,635/2,736) were classified as disease non-battle casualties and 40 % (1,101/2,736) as battle casualties. During the study period, 1,427 casualties (336 pediatric cases) required 2,319 surgical procedures. Each graduating chief resident handled an average of 1,444 cases, including 165 laparotomies, 19 major vessel repairs, 28 amputations, and 153 fracture stabilizations, during their residency. Residents had limited exposure to injuries requiring a thoracotomy, craniotomy, nephrectomy, IVC repair, or external genital trauma.
The injuries treated at the Dutch Role 2 MTF were often severe, and exposure to pediatric cases was much higher than reported for other combat hospitals in Iraq and in Afghanistan. The current civilian resident training does not equip the trainees with the minimally required competences of a fully trained military surgeon. The recognition in the Netherlands of military surgery as a subspecialty within general (trauma) surgery, with a formal training curriculum, should be considered. The introduction of a North Atlantic Treaty Organization Military (and Disaster) Surgery standard may facilitate the achievement of this aim.

Keywords
military - disaster - surgery - dutch armed forces - medical-treatment facility - lessons - competences - casualties - iraq - care

Pooled preventable death rates in trauma patients.

Kwon A M, Garbett N C, Kloecker G H.

Eur J Trauma Emerg S. 2014;40(3):279-285.
10.1007/s00068-013-0364-5

To estimate the pooled PDRs (preventable death rates) with articles being published since 1990, and compare the differences of PDRs over time and according to the evaluation approaches to determine preventable deaths.
Articles concerning preventable deaths of trauma patients published between 1990 and 2013 were systematically reviewed, and the pooled PDRs with 95 % confidence intervals were estimated using meta-analysis. It was also observed whether the PDRs differed over time and according to the evaluation approaches employed for determining preventable deaths.
Twenty seven articles were identified through bibliographic searches using PUBMED with the keywords of 'preventable deaths', 'the cause of deaths' and 'trauma'. Mean ages of the trauma patients in the selected articles ranged from 32.9 to 58 years old and 72 % were male on average. The pooled PDR was estimated as 0.20 with 95 % CI (0.16, 0.25) with a p-value of 0.0001, and the differences of PDRs over time and according to the employed approaches were not statistically significant with p-values of 0.06 and 0.99, respectively. However, PDRs determined by statistical approaches alone showed greater dispersion in comparison with the 'panel review approach'.
This article provided some insights about the trauma care system by computing the pooled estimate of PDRs over the past 23 years as an indicator. The pooled PDR was estimated as approximately 20 %, with no statistical significance of differences in PDRs over time or by the evaluation methods employed. That left us still room for improvement in trauma care system despite our efforts to reduce PDRs. In addition, when 'statistical approaches' are applied alone to estimate PDRs, we recommend that statistical methods should be applied with caution when the characteristics of trauma patients are heterogeneous. The optimal approach might be to combine both statistical and panel review approaches instead of employing a single approach.

Keywords
preventable - deaths - trauma - causes of deaths - injury severity - care - score - audit - probability - mortality - survival - outcomes - system - region

The coagulopathy of trauma.

Maegele M.

Eur J Trauma Emerg S. 2014;40(2):113-126.
10.1007/s00068-014-0389-4

Trauma is a leading cause of death, with uncontrolled hemorrhage and exsanguination being the primary causes of preventable deaths during the first 24 h following trauma. Death usually occurs quickly, typically within the first 6 h after injury. One out of four patients arriving at the Emergency Department after trauma is already in hemodynamic and hemostatic depletion. This early manifestation of hemostatic depletion is referred to as the coagulopathy of trauma, which may distinguished as: (i) acute traumatic coagulopathy (ATC) and (ii) iatrogenic coagulopathy (IC). The principle drivers of ATC have been characterized by tissue trauma, inflammation, hypoperfusion/shock, and the acute activation of the neurohumoral system. Hypoperfusion leads to an activation of protein C with cleavage of activated factors V and VIII and the inhibition of plasminogen activator inhibitor-1 (PAI-1), with subsequent fibrinolysis. Endothelial damage and activation results in Weibel-Palade body degradation and glycocalyx shedding associated with autoheparinization. In contrast, there is an IC which occurs secondary to uncritical volume therapy, leading to acidosis, hypothermia, and hemodilution. This coagulopathy may, then, be an integral part of the "vicious cycle'' when combined with acidosis and hypothermia. The awareness of the specific pathophysiology and of the principle drivers underlying the coagulopathy of trauma by the treating physician is paramount. It has been shown that early recognition prompted by appropriate and aggressive management can correct coagulopathy, control bleeding, reduce blood product use, and improve outcome in severely injured patients. This paper summarizes: (i) the current concepts of the pathogenesis of the coagulopathy of trauma, including ATC and IC, (ii) the current strategies available for the early identification of patients at risk for coagulopathy and ongoing life-threatening hemorrhage after trauma, and (iii) the current and updated European guidelines for the management of bleeding and coagulopathy following major trauma.

Keywords
trauma - hemorrhage - coagulopathy - mechanisms - diagnosis - predictors - treatment - guideline - endothelial glycocalyx degradation - life-threatening hemorrhage - activated protein-c - massive transfusion - brain-injury - platelet dysfunction - atls classification - blood-transfusion - hypovolemic shock - early prediction

Modern resuscitation of hemorrhagic shock: what is on the horizon?

Martin D T, Schreiber M A.

Eur J Trauma Emerg S. 2014;40(6):641-656.
10.1007/s00068-014-0416-5

Mortality rates among the severely injured remain high. The successful treatment of hemorrhagic shock relies on expeditious control of bleeding through surgical ligation, packing, or endovascular techniques. An important secondary concern in hemorrhaging patients is how to respond to the lost blood volume. A single method that is able to adequately address all needs of the exsanguinating patient has not yet been agreed upon, despite a large growth of knowledge regarding the causative factors of traumatic shock.
A review of relevent literature was performed.
Many different trials are currently underway to discriminate ways to improve outcomes in the severely injured and bleeding patient. This paper will review: (1) recent advances in our understanding of the effects hemorrhagic shock has on the coagulation cascade and vascular endothelium, (2) recent research findings that have changed resuscitation, and (3) resuscitation strategies that are not widely used but under active investigation.

Keywords
trauma - resuscitation - hemorrhagic shock - glycocalyx - trauma-induced coagulopathy - ffp - traumatic brain-injury - fresh-frozen plasma - histone deacetylase inhibition - randomized controlled-trial - disseminated intravascular coagulation - endothelial glycocalyx degradation - receiving massive transfusions - ischemia-reperfusion injury - activated factor-vii - freeze-dried plasma

The impact of body mass index and gender on the development of infectious complications in polytrauma patients.

Mica L, Keller C, Vomela J, Trentz O, Plecko M, Keel M J.

Eur J Trauma Emerg S. 2014;40(5):573-579.
10.1007/s00068-013-0300-8

Purpose
The aim was to test the impact of body mass index (BMI) and gender on infectious complications after polytrauma.

Methods
A total of 651 patients were included in this retrospective study, with an Injury Severity Score (ISS) >= 16 and age >= 16 years. The sample was subdivided into three groups: BMI <25 kg/m(2), BMI 25-30 kg/m(2), and BMI >30 kg/m(2), and a female and a male group. Infectious complications were observed for 31 days after admission. Data are given as mean +/- standard errors of the means. Analysis of variance, Kruskal-Wallis test, chi(2) tests, and Pearson's correlation were used for the analyses and the significance level was set at $P < 0.05$.

Results
The overall infection rates were 31.0 % in the BMI < 25 kg/m(2) group, 29.0 % in the BMI 25-30 kg/m(2) group, and 24.5 % in the BMI > 30 kg/m(2) group ($P = 0.519$). The female patients developed significantly fewer infectious complications than the male patients (26.8 vs. 73.2 %; $P < 0.001$). The incidence of death was significantly decreased according to the BMI group (8.8 vs. 7.2 vs. 1.5 %; $P < 0.0001$) and the female population had a significantly lower mortality rate (4.1 vs. 13.4 %; $P < 0.0001$). Pearson's correlations between the Abbreviated Injury Scale (AIS) score and the corresponding infectious foci were not significant.

Conclusion
Higher BMI seems to be protective against polytrauma-associated death but not polytrauma-associated infections, and female gender protects against both polytrauma-associated infections and death. Understanding gender-specific immunomodulation could improve the outcome of polytrauma patients.

Keywords
body mass index - gender - polytrauma - infection - iss - injury severity score - blunt trauma patients - immune-response - obesity - mortality - outcomes - care - disease - system - risk

Development and evaluation of a new simulation model for interactive training of the medical response to major incidents and disasters.

Montan K L, Hreckovski B, Dobson B, Ortenwall P, Montan C, Khorram-Manesh A, Lennquist S.

Eur J Trauma Emerg S. 2014;40(4):429-443.
10.1007/s00068-013-0350-y

The need for and benefit of simulation models for interactive training of the response to major incidents and disasters has been increasingly recognized during recent years. One of the advantages with such models is that all components of the chain of response can be trained simultaneously. This includes the important communication/coordination between different units, which has been reported as the most common cause of failure. Very few of the presently available simulation models have been suitable for the simultaneous training of decision-making on all levels of the response. In this study, a new simulation model, originally developed for the scientific evaluation of methodology, was adapted to and developed for the postgraduate courses in Medical Response to Major Incidents (MRMI) organized under the auspices of the European Society for Trauma and Emergency Surgery (ESTES). The aim of the present study was to describe this development process, the model it resulted in, and the evaluation of this model.
The simulation model was based on casualty cards giving all information normally available for the triage and primary management of traumatized patients. The condition of the patients could be changed by the instructor according to the time passed since the time of injury and treatments performed. Priority of the casualties as well as given treatments could be indicated on the cards by movable markers, which also gave the time required for every treatment. The exercises were run with real consumption of time and resources for all measures performed. The magnetized cards were moved by the trainees through the scene, through the transport lines, and through the hospitals where all functions were trained. For every patient was given the definitive diagnosis and the times within certain treatments had to be done to avoid preventable mortality and complications, which could be related to trauma-scores.
The methodology was tested in nine MRMI courses with a total of 470 participants. Based on continuous evaluations and accumulated experience, the setup of the simulation was step-wise adjusted to the present model, including also collaborating agencies such as fire and rescue services as well as the police, both on-scene and on superior command levels. The accuracy of the simulation cards for this purpose was evaluated as "very good" by 63 % of the trainees and as "good" by 33 %, the highest two of the six given alternatives. The participants' ranking of the extent that the course increased their competencies related to the given objectives on a 1-5 scale for prehospital staff had an average value of 4.25 +/- A 0.77 and that for hospital staff had an average value of 4.25 +/- A 0.72. The accuracy of the course for the training of major incident response on a 1-5 scale by prehospital staff was evaluated as 4.35 +/- A 0.73 and that by hospital staff as 4.30 +/- A 0.74.
The simulation system tested in this study could, with adjustments based on accumulated experience and evaluations, be developed into a tool for the training of major incident response

meeting the specific demands on such training based on recent experiences from major incidents and disasters. Experienced trainees in several courses evaluated the methodology to be accurate for this training, markedly increasing their perceived knowledge and skills in fields of importance for a successful outcome of the response to a major incident.

Keywords
simulation - training - major incident - disaster - mass-casualty - mrmi - macsim

Vascular injuries following blunt polytrauma.

Muckart D J J, Pillay B, Hardcastle T C, Skinner D L.

Eur J Trauma Emerg S. 2014;40(3):315-322.
10.1007/s00068-014-0382-y

Motor vehicle collisions account for the majority of blunt vascular trauma. Much of the literature describes the management of these injuries in isolation, and there is little information concerning the incidence and outcome in patients suffering multiple trauma. This study was undertaken to describe the spectrum of blunt vascular injuries in polytrauma patients.
All patients who had sustained blunt vascular trauma over a 6-year period (April 2007-March 2013) were identified from a prospectively gathered database at the Level I Trauma Unit, Inkosi Albert Luthuli Central Hospital, Durban, South Africa. The retrieved data consisted of age, sex, mechanism of injury, referral source, Injury Severity Score (ISS), New Injury Severity Score (NISS), time from injury to admission, surgical intervention and outcome. The initial investigation of choice for patients sustaining multiple injuries was computed tomography (CT) angiography if they were physiologically stable, followed by directed angiography if there was doubt concerning any vascular lesion. If technically feasible, endovascular stenting was the preferred option for both aortic and peripheral vascular injuries.
Of 1,033 patients who suffered blunt polytrauma, 61 (5.9 %) sustained a total of 67 blunt vascular injuries. Motor vehicle collisions accounted for 92 % of the injuries. The median ISS was 34 [interquartile range (IQR) 24-43]. The distribution of blunt vascular injuries was extremity (21), thorax (20), abdomen and pelvis (19), and head and neck (7). Endovascular repair was employed in 12 patients (ten blunt aortic injury, one carotid-cavernous sinus fistula, one external iliac artery). Of the extremity injuries, primary amputation was undertaken in 8 (38.1 %) and secondary amputation in 2 (9.5 %). The total amputation rate was 48 %. There were 17 (28.3 %) deaths, of which 11 (64.7 %) were directly attributable to the vascular injury and 6 (35.3 %) of these occurred on the operating table from exsanguination, the majority from injuries to the abdominal vena cava.
Blunt vascular injury is uncommon in the patient with multiple trauma but confers substantial morbidity and mortality. In those cases with peripheral injuries, delays in referral to definitive care frequently exceed the ischaemic time, resulting in a high rate of amputations. Central injuries, especially those of the vena cava, account for the majority of directly attributable deaths.

Keywords
polytrauma - vascular injury - artery injuries - multidetector ct - trauma - management - experience - fistulas - database - outcomes - repair

Wounds of war in the civilian sector: principles of treatment and pitfalls to avoid.

Riddez L.

Eur J Trauma Emerg S. 2014;40(4):461-468.
10.1007/s00068-014-0395-6

Terror attacks with explosive devices or mass shootings have introduced a new pattern of injuries into the civilian sector. The aim of this short review on the treatment principles for so-called penetrating war wounds is to remind surgeons who are not normally confronted with them of some basic rules to follow and pitfalls to avoid.
This review article is based on literature research of the National Library of Medicine and the National Institutes of Health MEDLINE database using PubMed, as well as updated books on war surgery and the author's own experience of war zones.
Principles of treatment of penetrating war injuries to the head, neck, and torso are all based on damage control surgery focusing on hemorrhage and contamination control and early restoration of the deranged physiology. For injuries to the extremities, differences in treatment principles between low- and high-energy wounds are more important, although initial treatment is also focused on hemorrhage control. The surgical treatment should be based on thorough wound examination and debridement as well as fracture stabilization when required.
Certain knowledge of the treatment of war wounds is necessary in all civilian hospitals that receive patients injured in terror attacks.

Keywords
war wounds - terror attacks - terror bombings - wound debridement - ballistics - terrorist bombing attacks - operation iraqi freedom - gunshot wounds - extremity injuries - colon injuries - management - experience - infections - trauma - anastomosis

Damage control strategies in the management of acute injury.

Savage S A, Fabian T C.

Eur J Trauma Emerg S. 2014;40(2):143-150.
10.1007/s00068-014-0386-7

Traumatic injury is the leading cause of death worldwide. The rapid evaluation and correction of injuries in these patients is paramount to preventing uncontrolled decompensation and death. Damage control strategies are a compendium of techniques refined over decades of surgical care that focus on the rapid correction of deranged physiology, control of contamination and blood loss, and resuscitation of critical patients. Damage control resuscitation (DCR) focuses on the replacement of lost blood volume in a manner mimicking whole blood, control of crystalloid administration, and permissive hypotension. Damage control laparotomy controls gastrointestinal contamination and bleeding in the operative suite, allowing rapid egress to the intensive care unit for ongoing resuscitation. Pelvic packing, an adjunct to DCR, provides a means to control hemorrhage from severe pelvic fractures. Temporary vascular shunts restore perfusion, while resuscitation and reconstruction are ongoing. Taken together, these strategies provide the trauma surgeon with a powerful arsenal to preserve life in the transition from injury to the shock trauma room to the intensive care unit.

Keywords
damage control - hemorrhage - resuscitation - temporary vascular shunts - i trauma center - endovascular balloon occlusion - unstable pelvic fractures - fresh-frozen plasma - hemorrhagic-shock - control resuscitation - open abdomen - massive transfusion - follow-up

Introduction to the 5th focus-on issue devoted to disaster and military surgery.

Turegano F, Lennquist S.

Eur J Trauma Emerg S. 2014;40(4):419-420.
10.1007/s00068-014-0428-1

The exponential function transforms the Abbreviated Injury Scale, which both improves accuracy and simplifies scoring.

Wang M D, Fan W H, Qiu W S, Zhang Z L, Mo Y N, Qiu F.

Eur J Trauma Emerg S. 2014;40(3):287-294.
10.1007/s00068-013-0331-1

We present here the exponential function which transforms the Abbreviated Injury Scale (AIS). It is called the Exponential Injury Severity Score (EISS), and significantly outperforms the venerable but dated New Injury Severity Score (NISS) and Injury Severity Score (ISS) as a predictor of mortality.
The EISS is defined as a change of AIS values by raising each AIS severity score (1-6) by 3 taking a power of AIS minus 2 and then summing the three most severe injuries (i.e., highest AIS), regardless of body regions. EISS values were calculated for every patient in two large independent data sets: 3,911 and 4,129 patients treated during a 6-year period at the Class A tertiary hospitals in China. The power of the EISS to predict mortality was then compared with previously calculated NISS values for the same patients in each of the two data sets.
We found that the EISS is more predictive of survival [Zhejiang: area under the receiver operating characteristic curve (AUC): NISS = 0.932, EISS = 0.949, P = 0.0115; Liaoning: AUC: NISS = 0.924, EISS = 0.942, P = 0.0139]. Moreover, the EISS provides a better fit throughout its entire range of prediction (Hosmer-Lemeshow statistic for Zhejiang: NISS = 21.86, P = 0.0027, EISS = 13.52, P = 0.0604; Liaoning: NISS = 23.27, P = 0.0015, EISS = 15.55, P = 0.0164).
The EISS may be used as the standard summary measure of human trauma.

Keywords
abbreviated injury scale - exponential injury severity score - injury severity score - new injury severity score - prediction of mortality - severity score - mortality - care