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UPDATE IN INTENSIVE CARE

Innovation and new trends in critical trauma disease☆

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Abstract The management of critical trauma disease (CTD) has always trends the trends in military war experiences. These conflicts have historically revolutionized clinical concepts, clinical practice guidelines and medical devices, and have marked future lines of research and aspects of training and learning in severe trauma care. Moreover, in the civil setting, the development of intensive care, technological advances and the testing of our healthcare systems in the management of multiple victims, have also led to a need for innovation in our trauma care systems.

PALABRAS CLAVE
Trauma;
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Innovación y nuevas tendencias en patología traumática crítica

Resumen La atención a la patología traumática crítica (PTC) siempre ha recogido las tendencias del manejo de los traumas generados por conflictos bélicos. Estos conflictos han revolucionado históricamente los conceptos clínicos, las guías de práctica clínica, los equipos, han marcado las líneas de investigación venideras e incluso han servido para definir nuevosaspectos curriculares y de formación para la atención al trauma grave. Por otra parte en elámbito civil la evolución de los cuidados intensivos, el avance tecnológico, así como la puestaa prueba de nuestros sistemas sanitarios a la atención de múltiples víctimas, también hanprovocado la necesidad de innovación en nuestros sistemas de atención al trauma.

Introduction

The management of critical trauma disease (CTD) has always contemplated the trends in military war experiences.[1] These conflicts historically have revolutionized clinical concepts, clinical practice guidelines and medical devices (in terms of both invention and applications), and have marked future lines of research and aspects of training

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and learning in severe trauma care.[2] Clearly, extrapolating these experiences is not without problems and bias (the ultimate objectives of military medicine, the characteristics of research, the hostile environment in which it takes place, the types of trauma, the underlying mechanisms involved, etc.). However, even in this setting there have been advances through the establishment of registries, international collaboration, and relations between the civil and military contexts. After over a decade of military conflicts in different settings, a review is required of the most innovating aspects of the management of CTD.[3]

On the other hand, in the civil setting, the development of intensive care, technological advances (largely referred to imaging techniques) and the testing of our healthcare systems in the management of multiple victims, have also led to a need for innovation in our trauma care systems. Furthermore, from the start, the management of CTD has been tied to the field of Intensive Care Medicine, and has always had an enormous influence upon its progression (management of bleeding, nutrition, training, etc.).[4]

For all the above reasons, these developments in CTD require a review of those aspects referred to innovation–the latter being understood according to Rye as: ''any material, artifact or practice representing an important deviation from the currently assumed body of knowledge, as determined by the collective judgment of people with expertise in the field in the moment in which it appears for the first time in the context of practice''.[5]

The present study offers a review of the main research lines, novel aspects related to patient resuscitation, new devices, modifications in the care of cardiorespiratory arrest (CRA) in trauma, and the training and structure of trauma care teams–attempting to establish a difficult inference regarding the future of these topics in such a changing type of disease. The interpretation of these innovating subjects always must be made within context (stock of knowledge on the subject, the institutional and social environment, and the efforts of our organization).[6]

Research lines in critical trauma disease

Research in trauma disease, particularly referred to initial patient care, has a series of special characteristics and challenges that are different from those found in research in other areas, including Intensive Care Medicine referred to other types of diseases. The intense and necessary collaboration with the pre-hospital setting, the difficult differentiation between research and innovation in this field, the need for informed consent or substitutes thereof (consent from an independent physician), the scant time available for patient inclusion, and the influence of trauma care system maturity upon the outcomes, all complicate the conduction of clinical trials in this type of disease. Despite such difficulties, however, in recent years we have witnessed advances in methodological aspects and in the conduction of pragmatic trials, with high external validity, which have produced a genuine revolution in this field–resulting in levels of evidence which previously had only been possible in other types of diseases.[7–9]

The main lines of research in CTD focus on the new strategies referred to resuscitation with damage control. This concept is defined in the glossary of terms of the Spanish Society of Intensive and Critical Care Medicine and Coronary Units (*Sociedad Española de Medicina Intensiva, Crítica y Unidades Coronarias*, SEMICYUC), and encompasses the use of permissive hypotension in patients, adequate settings and types of trauma, the restrictive use of crystalloids, measures against hypothermia and acidosis, the use of prohemostatic drugs adjusted to the published evidence, and hemostatic resuscitation practices involving the balanced use of blood products in patients with traumatic hemorrhagic shock.[10]

The main research lines that have given rise to clinical trials are summarized in the following tables. The data have been obtained through a search in: clinical trials.gov (US National Institutes of Health), Current Controlled Trials, COCHRANE central register of controlled trials, using the following terms: trauma patients, severe trauma/coagulopathy, trauma/fibrinogen, trauma/tranexamic acid, trauma/antifibrinolytics, trauma/activated recombinant human factor VII, trauma/rFVIIa, trauma/hypotensive resuscitation, trauma/transfusion, trauma/thromboelastography, trauma/hemostatic resuscitation.

These studies fundamentally deal with the pharmacology of hemostasis, permissive deferred hypotension and the type of fluids used in trauma care, hemostatic resuscitation, point of care guided resuscitation versus predetermined resuscitation, with the use mainly of viscoelastic techniques (thromboelastogram or rotational thromboelastometry) or evolutions of these techniques, and attempting to consider all the systemic factors implicated in coagulation (platelets, endothelium, whole blood, etc.). Almost all of the publications are related to the change in paradigm in resuscitation (Table 1).

New devices

In recent years there has been an increase in the development of new devices applied to initial patient care and to the posterior management of trauma. In this regard, the advances have fundamentally consisted of improvements of different already existing techniques, with a view to expanding their use.

Tourniquets

Tourniquets are devices that had been regarded as a last resort in limb injuries causing hemorrhagic shock, or had even been discarded at the start of recent military conflicts and had to be reintroduced as specific protocols (combat application tourniquet) because of the large number of casualties due to exsanguination in vascular trauma. Different designs have attempted to minimize the side effects of tourniquet use, though rather than using one device or other, the important factor is probably recognition that the control of limb exsanguination is one of the most important aspects of pre-hospital care, both for saving the life of the patient and for limiting unnecessary resuscitation measures.[11]

New tourniquet versions, such as pneumatic devices, may prove to be essential for the management of injuries in the pre-hospital setting or until definitive bleeding control is achieved. However, the insufflation pressure of these devices has not been established, and there have been a