



UPDATE IN INTENSIVE CARE MEDICINE

Are the paradigms in trauma disease changing?☆



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Abstract Despite an annual trauma mortality of 5 million people worldwide, resulting in countless physical disabilities and enormous expenses, there are no standardized guidelines on trauma organization and management.

Over the last few decades there have been very notorious improvements in severe trauma care, though organizational and economical aspects such as research funding still need to be better engineered. Indeed, trauma lags behind other serious diseases in terms of research and organization.

The rapid developments in trauma care have produced original models available for research projects, initial resuscitation protocols and radiological procedures such as CT for the initial management of trauma patients, among other advances. This progress underscores the need for a multidisciplinary approach to the initial management and follow-up of this complicated patient population, where intensivists play a major role in both the patient admission and subsequent care at the trauma unit.

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PALABRAS CLAVE

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Investigación en trauma;
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Equipo de Atención al Trauma;
Control de daños

¿Están cambiando nuestros paradigmas en la enfermedad traumática?

Resumen Aunque la mortalidad por trauma supera los 5 millones al año en todo el mundo, con innumerables incapacidades y enormes costes, faltan estándares globales y uniformes para su organización y manejo.

Los cambios en el conocimiento y los cuidados del paciente con trauma grave han sido espectaculares en las últimas décadas, pero los recursos en investigación, organización y cuidados no han crecido de forma paralela. En nuestro medio, la enfermedad traumática se sitúa muy por debajo de la investigación y organización de otras enfermedades graves.

En los últimos años hemos cambiado nuestros modelos en investigación en trauma, organización, cambios en la reanimación inicial, la presencia de la TC como pieza clave en el manejo inicial, etc. Estos cambios actuales y de futuro del manejo del paciente traumatizado generan una valoración y tratamiento multidisciplinarios, siendo necesaria la presencia del especialista en Medicina Intensiva como parte fundamental en el equipo de atención al trauma grave y su posterior cuidado en la unidad de críticos.

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Introduction

Severe trauma is the leading cause of death in individuals under 44 years of age in the western world, and is the main cause of infant mortality in children over one year of age. Over 5 million people die each year worldwide as a result of trauma disease—hemorrhagic shock being the underlying cause in 35–40% of the cases. Despite a global increase in trauma disease (except in some high-income geographical settings where the traffic accident-related mortality figures have decreased) and the great volume of surgeries it generates, trauma is usually little represented in regional, national and international programs. The lack of global and uniform standards for the collection, reporting and auditing of data referred to trauma is in clear contrast to the situation in other public health areas such as cancer or cardiovascular disease.^{1,2}

Although there have been spectacular changes in the knowledge and care of severe trauma in the last two decades, unfortunately there has been no parallel dedication of resources to organization and research in this field.

Trauma disease has been rather neglected in the context of serious acute disease. In our setting, care organization referred to trauma disease is far behind that found in relation to time-dependent disorders such as infarction or stroke.

There is still no clear definition of the regional systems of trauma care or of trauma centers, and in- and out-hospital trauma committees are moreover lacking. Indeed, even management standards for guaranteeing equity within the health system, commonly mediated by political structures, are lacking.³

In recent years there has been a change in paradigms, with the rerouting of our models toward new and sometimes even opposite positions. The most relevant changes experienced in the last two decades can be summarized as follows:

1. Changes in trauma care organization.
2. Importance of the multidisciplinary team in initial trauma care.
3. Need for multidisciplinary training and assessment.⁴
4. Physiopathological changes (injury mechanisms, initial inflammation, early coagulation disorders, alarmins, etc.).^{5–9}
5. Genetically determined evolutive differences of different phenotypes.
6. Advanced and sophisticated prehospital care.
7. Definition of trauma centers, high complexity centers and useful centers.¹⁰
8. Patient triage.
9. Implantation of resuscitation techniques with damage control and surgical damage control.
10. Incorporation of full-body computed tomography in the initial assessment of stable patients and patients with hemodynamic instability, except exanguination.¹¹
11. Radiological interventionism as an initial option.
12. Analysis of variables other than mortality, such as level of complexity, complications, sequelae, quality of life, return to work, etc.
13. Standardized regional, national and international registries.

14. Individualized treatment, supported by points of care, provided at the patient bedside.¹²

Peculiarities of research in trauma

According to Brohi, “research in trauma is disorderly, fragmented and often of low quality. It is slow and insufficient.”¹³ Few centers place priority on research in trauma, and there are possibly no such centers in our setting. Policies centered on global trauma research strategies are needed, extending from laboratory to patient care. Such initiatives should include research in prevention, biomechanics, physiology, clinical aspects, etc. Obviously, such efforts require infrastructures and support and funding mechanisms at least in proportion to the impact which trauma disease has in society today.¹⁴

Research in trauma is difficult, and its limitations include the heterogeneity of trauma disease. Different mechanisms produce different injuries, with dynamic and sometimes opposite responses secondary to time-dependent physiopathological changes. There are problems related to the critical condition of the patients, requiring the application of emergency techniques to save the life of the individual, and which make it difficult to simultaneously conduct research activities. Such activities could be carried out in the post-injury period by personnel not directly involved in the care of the patient. On the other hand, adequate patient selection is complicated. Informed consent requires some special formula, since in the first moments there are often no legal representatives present. Specific injuries may occur exceptionally and in an unpredictable manner, and randomized studies become impossible. However, even the existing case series are short, protracted in time, and limited to centers with a large volume of trauma patients.

Another problem is the difficulty of patient follow-up, since trauma patients suffer multiple disease conditions that result in different complications. Acute interventions are difficult to measure and quantify.

Traumatism sometimes occur while the patient is traveling, and so may have his or her place of residency in some other city or country—thus further complicating follow-up.

There are few standardized and structured trauma registries, and bias is common. Registries with high methodological quality are needed, capturing all the data referred to clinical evolution, from injury to rehabilitation and social reinsertion. The comparison of results is typically made with variables such as mortality or hospital stay, and not with complications, disabilities, the complexity of care, the need for specific resources, global costs, etc.

Large-scale cohort studies are needed to investigate the mechanisms of injury, along with randomized and controlled studies in order to apply homogeneous therapies and evaluate interventions. Such efforts must be characterized by high methodological quality, adopting a practical and ethical system for the selection of individuals for clinical studies, and with personnel experienced in final outcome assessments. There must be personnel from the clinical committees, though obviously not the directly implicated individuals.

Research in trauma remains fragmented, and is often an activity resulting from individual interest or comprising

single-center studies. There are few networked trials, in contrast to the situation found in other areas of Medicine.¹⁵ Collaborative studies are needed to disseminate research within clinical practice.

Different phenotypes condition different responses and prognostic variations. This makes it necessary to obtain greater knowledge of the genome and to develop more individualized treatments in accordance to the proteomic studies made.

There are enormous difficulties in simulating real life situations, and animal research is quite foreign to clinical reality. A further complication is the fact that some injuries are infrequent, with a lack of large series, and the few series that might exist moreover cover large time periods—a fact that limits the teachings that can be gained from them.

It is very difficult to design clinical trials, and these are often not ethically acceptable. However, the commercial interest associated to trauma disease has varied in recent years, with the introduction of new drugs possessing a probable health care impact and which have been studied by the drug industry in the context of clinical trials. In this regard, there is a need to establish ties between the industry and the institutions. Similar interest has developed in reference to certain biotechnological products applied to trauma.

There is a great need to investigate trauma disease from different perspectives, ideally within the setting of research centers, in order to increase the transference opportunities. It is important to encourage interest in basic research in trauma, with the development of research programs centered on cells, organs and the body as a whole.¹³

Definition of trauma disease

The severe trauma patient does not respond in a stereotyped manner as in other diseases; rather, patient response is conditioned by a complex physiopathological situation, with differences in response depending on the mechanism that has caused the injury, the patient comorbidities and age, and even the healthcare organization itself, the attending team and the local care protocols. Trauma disease seems to be a catchall, comprising injury mechanisms, different host responses, and sometimes even the need for opposite treatment strategies. An example of this is the frequent association of hemorrhagic shock to severe traumatic brain injury (TBI). In shock patients we would recommend permissive hypotension, while in TBI we would advocate adequate perfusion pressure, with the maintenance of at least normal blood pressure values. For these reasons it is very difficult to establish a clear and concise definition of severe trauma disease. There are a number of definitions habitually based on anatomical lesions, measured by severity scores that are related to mortality but not exactly to the need for complex and specific patient care, as might occur for example in cases of severe maxillofacial injuries.

The most widely used definition is that of Dressing, based on the anatomical Injury Severity Score, which defines severe trauma as corresponding to a score of over 15. The score is easy to establish on an a posteriori basis, but is of little help for initial management. No assessment is made of the complexity, physiological responses, resources, etc.

The mentioned definition is useful for comparing series and for conducting epidemiological studies, but not for initial patient triage. In effect, the precise score is not known in the early stages, and can only be established hours later and with the support of data from the imaging techniques. The Injury Severity Score offers an anatomical definition, but other variables must also be included within the concept of severe trauma, such as the physiological alterations represented by diminished consciousness, altered respiratory frequency or oxygen saturation, and hemodynamic impairment.

Some authors consider that any patient requiring hospital care because of a risk to life or organ function secondary to trauma should be classified as presenting severe trauma.

It seems useful to establish definitions by extension or based on standardized triage in trauma that assess the initial anatomical damage, the physiological alterations and, occasionally, the mechanism of injury and the patient comorbidities.

Attempts have been made to standardize the concept of severe trauma in order to establish the need for transfer to the useful center, as well as define activation of the resources required for correct patient care. In this line, Lerner et al. established a series of criteria based on the opinion of experts, though they need to be validated.¹⁶

It must be stressed that the term "polytraumatism" is increasingly little used because of its scant value in reference to the severity of damage and the resources to be used.

Trauma disease, like other emergency conditions, is characterized by very dynamic behavior—the data obtained being closely conditioned to the point in time in which they are obtained. Trauma disease is dependent upon time in that increased mortality is observed if time is needlessly wasted; however, time moreover causes variations in data and in the care objectives, and this further complicates the application of physiological criteria.

Fortunately, severe trauma mortality has decreased significantly. Many injuries have a low probability of death, though there is a high probability of complex injuries causing often permanent disabilities. This makes it necessary to evaluate the final outcome not only in terms of mortality but also in terms of complexity, resources and disabilities—and these new variables should be taken into account in future definitions.

Perspectives from passing time

Emerging areas in trauma disease range from epidemiology to epigenetics, with the constant introduction of changes in long-standing principles—often without the necessary supporting evidence.

Lessons learned in military conflicts have been transferred to civilian life, to the care of trauma patients, with changes in some of the paradigms referred to individualized patient management.

At the same time, there has been a revolution in the organization of the Departments of Traumatology and in the role of the teams that initially deal with these patients.

New role players have emerged in the management of severe trauma, including particularly the physical-presence

trauma radiologist and the incorporation of multidetector computed tomography (MDCT) in initial injury assessment, as well as deviation of part of the emergency surgery activity toward radiological interventionism—representing a spectacular shift in the management of bleeding wounds in hemodynamically stable patients toward nonsurgical management. This inversion in the specific contribution of each technique is also beginning to be seen in the hemodynamically unstable patient.¹¹ For these reasons, it is essential in trauma care systems to incorporate 24-h a day, 7-days a week radiological interventional units.¹⁷ In this context, another new role player in the initial management of patients with severe trauma is the hematologist—not only in representation of the blood bank, but also to detect and provide support in relation to coagulopathy in trauma and the activation of massive transfusion protocols.

Severe trauma care systems

Severe trauma care systems are young systems that developed from the civilian life experiences of West et al. and the learnings gained from military conflicts.¹⁸ Despite the years that have gone by, the United States—the country with the greatest healthcare expenditure—these systems remain imperfect, with a lack of the necessary equity. It has been estimated that 46 million American citizens would not have access to a trauma center within the first hour following injury—this implying the loss of rights to correct treatment in an adequate center and within an optimum time window.¹⁹ Severe trauma care systems should be organized and structured at regional level, with collaboration of the community. The systems should comprise the entire care chain, starting with prevention, pre-hospital management, in-hospital care and rehabilitation, and ending with social and occupational reinsertion of the patient, and secondary prevention of the possible risk factors.^{3,20}

The key element for optimizing the care of these patients is the creation of trauma care systems.¹⁸ These systems are based on two fundamental supports: the pre-hospital structure and the hospital center, as a definition of the trauma center concept. There are two large models at both pre- and in-hospital level, and adscription to one model or the other is conditioned to socioeconomic and cultural factors rather than to final outcomes.

Two pre-hospital systems have been developed: that introduced in the United States/Australia, and the system implemented in Europe. In the United States, the pre-hospital systems are incorporated within other units, and are fundamentally staffed by paramedics with direct control, and a medical supervisor. Depending on their level, they are authorized or not to perform certain maneuvers. In Europe, the pre-hospital systems may or may not depend upon the hospital, but are not ascribed to other organisms—and their more advanced versions are staffed by a physician in each mobile unit, trained and authorized to apply advanced life support techniques, administer drugs, perform laboratory tests, and use focused abdominal sonography for trauma extended in thorax (e-FAST), etc. The most effective systems are the inclusive kind, where all hospitals form part of the system, with different levels of certification depending on the capacity of each center.²¹

Two in-hospital systems have been developed: that introduced in the United States, and the system implemented in Europe. In the United States, the key element is the trauma center, defined by levels and subjected to periodic evaluation. In this regard, such centers are required to meet a series of requirements or conditions ranging from a minimum volume of attended patients a year to teaching and research programs and specific initiatives such as gender-based violence or motivational secondary prevention interventions in trauma patients (alcohol, drugs of abuse, violence). Periodic recertification is required, and external audits can be performed. In Europe it is more common for patients with severe trauma to be attended in high complexity centers, though these are often not of a monographic nature. Nevertheless, the study published by Haider et al., comparing the results between France and the United States for similar trauma severity levels, detected no significant differences in ultimate outcome.²² MacKenzie et al. demonstrated a decrease in mortality risk for one same injury level depending on whether the patient was treated in a trauma center or general hospital (7.6 versus 9.5 intrahospital) and even on the year of the lesion (10.4 versus 13.8)—fundamentally in young patients with serious injuries.²³ Other studies have confirmed these data.³ In this same line, MacKenzie et al. a few years later analyzed the costs generated in saving a disability-free life in trauma centers and in centers of other kinds. In this regard, these centers were not only found to be efficient but also cost-effective, thereby contributing to minimize the high costs involved.²⁴ In our setting, characterized by excellent pre-hospital systems and high complexity hospitals, there are no clear regional trauma care systems.³ As a result, and despite adequate triage, the critical patient is typically taken to the nearest center, not to the most appropriate center. Patient safety programs, conducting daily audits of the items that have an impact upon mortality, have been shown to reduce the patient mortality risk.²⁵

Advanced trauma life support programs systematize and homogenize initial patient management and have a positive impact upon the final outcome. For this reason, strong adherence to these programs is required in order to improve the results obtained.^{15,26}

Importance of the Trauma Care Team (TCT) in initial patient management

The Trauma Care Team (TCT) is an extremely useful concept, since it has a strong impact upon final outcomes referred to mortality, complications and costs.²⁷ These teams must be of a multidisciplinary nature, with emergency care physicians, surgeons, intensivists, nursing personnel, radiodiagnostic technicians, radiologists and hematologists. The team is to be coordinated by a leader with strong knowledge of trauma care, resuscitation techniques and circulatory and respiratory management in critical situations. The leader moreover must have training in communication, decision making, the management of human resources, etc. Each member of the team must know his or her role, and all must have multidisciplinary training. In reference to the TCT, each local program must respond to the following questions: Who? Where? and

When? The TCT is to be activated from the pre-hospital team according to consensus-based local protocols.⁴

Important changes in the last decade and lessons learned from the latest military conflicts have modified the conceptual framework of individual patient management. At the same time, there has been a revolution in the organization of trauma patient care, and in this regard the severe TCT has been shown to exert a positive impact upon the outcomes.^{28,29}

Military experience and resources: impact in the last decade

The developments in military casualty care have been spectacular, ranging from the concepts of Holcomb et al. referred to transfusion,³⁰ to principles in application to whole blood transfusion, early coagulopathy, the application of tourniquets, tactical evacuation with different levels of care, triage, war zone data registries, military blood banks, the management of chest injuries, the use of MDCT in war zones, and systematic training courses referred to the characteristics inherent to combat, e.g., Tactical Combat Casualty Care. These initiatives have made an important contribution to our change in model. Unfortunately, however, all of them are supported by very low levels of evidence, and are fundamentally based on retrospective studies.^{31,32}

Changes in initial resuscitation

One of the most spectacular changes in the model refers to initial resuscitation management, with two key references: the treatment of early coagulopathy as initial objective in place of perfusion with volume replacement, and the limitation of crystalloids in favor of blood products.³³ This subject has been extensively addressed in previous articles.³⁴ The early use of MDCT in the initial stage has resulted in a change in patient management—particularly the use of whole-body MDCT, which has allowed crucial time gains in patient management, with incorporation of the radiologist to initial trauma resuscitation, and affording improved outcomes.³⁵

Even relatively recent concepts, such as the use of crystalloids in the first moments of resuscitation, have lost much of their specific relevance. However, according to Sharpe et al., there is not enough evidence to discard the use of crystalloids in initial resuscitation,³⁶ or the existence of hyperfibrinolysis in the early phases.³⁷

As mentioned above, the creation of a TCT is crucial in all hospitals. The success of patient care relies on a series of adequate interventions within the necessary timelines, in each step of the chain of survival.⁶

Attempts are being made to move the means for patient resuscitation as close as possible in both time and space to the trauma scene. This strategy can help minimize avoidable mortality, life years lost and disabilities, provided the required measures are applied by trained personnel. In this context, predetermined criteria can be used to activate hospital protocols from the pre-hospital setting, such as massive transfusion protocols or unstable pelvis protocols in hemodynamically unstable patients. Likewise, in the immediate

future the targets of resuscitation can be taken to the injury site¹² with the support of telemedicine.³⁸

In the emergency service, the guidelines of the scientific societies referred to the recommended approach when serious injuries are suspected have also evolved—emphasis being placed on the use of new imaging techniques and the adoption of nonsurgical interventional measures. An example of this is provided by the current guides of the American Eastern and Western Trauma Associations regarding blunt aortic trauma,^{39,40} or the current concepts on polycompartmental syndrome.⁴¹

Changes in the management of closed (blunt) bleeding abdominal trauma

Over the last decade, the paradigm referred to the conservative management of stable abdominal trauma patients has shifted from surgery toward a nonsurgical management strategy. Nonsurgical treatment in patients with solid organ damage who are hemodynamically stable as evidenced by MDCT is currently regarded as standard management.⁴²

As regards conservative management in a subgroup of unstable patients, it seems that MDCT with contrast injection might be useful, except in those in which emergency laparotomy is clearly indicated. This approach would allow individualized assessment of the patient regarding the best management choice. The subject is currently the subject of intense debate, and it is suspected that changes will be introduced in the near future.¹¹

In cases of exsanguination, some techniques described over 50 years ago might be useful, including the use of catheters to temporarily occlude the aortic circulation, as in resuscitative endovascular balloon occlusion of the aorta.⁴³ This technique involves the insertion of a Foley-type inflatable balloon catheter into the aorta to interrupt the blood flow and temporarily control the hemodynamic instability. This procedure would be indicated in refractory hemorrhagic shock of abdominal origin. Obviously, the occlusion time must be very short, with recommended deflation of the balloon every 20 min. This strategy is a bridge toward definitive hemostasis; it is technically complex and requires adequate operator training. Radiological or ultrasound control is usually used to assess the position of the balloon.⁴⁴

Ogura et al. published a series of 35 patients with a 46% mortality rate in which 7 subjects were selected for this technique, followed by vascular embolization instead of surgery. The authors used the technique as a bridging procedure prior to angioembolization in solid organ bleeding.⁴⁵ At experimental level other forms of mechanical compression are also being investigated, with the use of coagulants or foam, and even ultrasound needles to induce local coagulation.⁴⁶

In very unstable patients MDCT might not be able to evidence bleeding until perfusion has been improved. This gives rise to doubts as to the usefulness of this technique in cases of exsanguination.

In any case, the role of surgery should not be neglected. When several bleeding sites are detected, it should be remembered that surgery usually offers a faster solution than interventional radiology.

The concept of damage control in the management of life-threatening situations in trauma disease and its evolution

Damage control is a technique that had its origins in naval warfare, where in the event of serious damage to the ship during combat, specific teams were activated to control the damage without repairing it. Rather, the aim was to isolate the damage (e.g., fire or flooding) from the rest of the structure with the purpose of allowing the vessel to reach harbor for definitive repair.

This concept was initially introduced in medical practice as "surgical damage control" (SDC) in cases of laparotomy with exsanguination, large anatomical injuries and severe physiological repercussions suggesting that the physiological reserves of the patient would not suffice to survive surgery. This strategy was introduced in the 1980s, with publication of the first series by Lucas and Ledgerwood (3 patients in 1976) and Feliciano (10 cases with a 90% survival rate, in 1981). In 1983, Rotondo coined the term by which the technique is known today. The idea is to postpone definitive surgery, performing only abbreviated surgery of the life-threatening injuries through temporary bleeding control (using packing techniques) and temporary control of the vascular damage (using ligation or tubes). Gastrointestinal leakage is controlled to avoid contamination, and the laparotomy is temporarily closed. This represents the first phase of the technique. The patient is then sent to the Intensive Care Unit (ICU), where the lethal triad of hypothermia, acidosis and coagulopathy is controlled or minimized, and the patient is hemodynamically stabilized. This constitutes the second phase of the technique. In a third phase the patient is returned to the operating room (after 48–72 h) for definitive repair of the lesions and definitive closing of the fascial layers. The strategy was initially used in cases of exsanguination detected at laparotomy, but was subsequently spread not only to other surgical fields such as chest, vascular or orthopedic surgery, but also to the initial stages of resuscitation (so-called resuscitation with damage control), which starts at pre-hospital level as close as possible to the trauma scene. This concept of damage control continues in the ICU until definitive reparative surgery is performed. Thus, there appears to be an extended concept of damage control from the trauma scene to definitive resuscitation in the ICU. This strategy has improved patient survival, and in recent years has experienced spectacular growth—despite the fact that there are no clinical trials that warrant its use, possibly due to ethical problems associated with the conduction of such studies.⁴⁷

The indications of SDC are established when it is seen that the patient is physiologically unable to withstand prolonged surgery accompanied by coagulopathy, hypothermia, etc. In some cases important damage is detected in the emergency room, as in patients with hemorrhagic shock and serious abdominal injuries, limb amputations, the need for more than one emergency surgical intervention, early coagulopathy, penetrating wounds with exsanguination, a need for massive transfusion, acidosis, hypothermia and severe coagulopathy before or during surgery, early bowel loop edema, etc.

It is important to remember that most patients do not require techniques of this kind: indeed, only 15% stand to benefit from such strategies. Despite this fact, in the last decade SDC has been overused, and the technique is not without complications in the form of abscesses, intestinal fistulas, eversions, or the need for repeat laparotomy—causing patient quality of life problems and increasing the healthcare costs. Primary closure of the fascial layers, early initial repeat laparotomy and continuous aspiration systems can contribute to minimize the complications. Unfortunately, resuscitation practices with massive volume replacement (fundamentally administering crystalloids) and failure to secure early hemostasis have contributed to the persistence of coagulopathy and the appearance of bowel loop edema with abdominal compartment syndrome, and have increased the use of SDC. However, the new resuscitation strategies have improved bleeding control. The limitation of crystalloid use and the control of early coagulopathy, as well as massive transfusion protocols and permissive hypotension (even during surgery) are reverting the tendency toward increased SDC use seen in recent years.⁴⁸ Although we currently do not conceive SDC without resuscitation with damage control, there is an inverse relationship between them. In effect, a positive response to resuscitation with damage control, even in the pre-hospital setting through the adoption of external bleeding control measures, early control of coagulopathy, limited administration of crystalloids, temperature control, early administration of tranexamic acid, permissive hypotension, etc., contributes to improved patient resuscitation—and this in turn minimizes the need for SDC. As a result, definitive surgery (including primary closing of the fascial layers) can be performed on an initial basis in more patients.⁴⁹ On the other hand, the concept of damage control is maintained in the ICU for as long as adequate patient resuscitation remains pending. However, apart from the control of temperature, coagulopathy, acidosis and the hemodynamic condition, there are a number of other strategies that reduce the risk of abdominal compartmental syndrome—a frequent cause of laparotomy over the last decade. Protective ventilation is optimized, the use of vasopressors is reduced as far as possible, the type and velocity of the infused fluids is controlled, transfusion strategies different from those used in the first few hours are adopted, and the patient is monitored (including intraabdominal pressure, etc.).

Conclusions

Management of the severe trauma patient is not the task of an individual professional. Rather, it is characterized by teamwork, though at different points in time there may be leading role players. Management must be organized to ensure that time is not wasted. In effect, time consumption is associated to poorer outcomes (time lost at pre-hospital level, during transfer, due to choice of an inadequate hospital center considering the type of patient injuries, time lost in the emergency room, in transfer for MDCT scans, etc.). Rapid evaluation but also critical interventions are needed. Efficacy in small actions taken in the context of

initial patient care can help avoid great monitoring and treatment needs in the ICU in later stages.

In the coming years, although we will continue to see severe trauma cases (presumably involving different causal mechanisms), prevention of trauma disease will probably improve. We will be able to define subgroups of patients with proprietary characteristics different from those of other subgroups, avoiding the “catchall” situation we have today. Research will become more robust and precise, and not fragmented but global. We will be open to new technological advances and new monitoring modalities, we will again change our models, ensuring individualized treatments, but will have to continue assuming the responsibility of decision making. We will know that the ultimate outcome in severe trauma patients is largely conditioned by the initial care provided by a multidisciplinary team in which professionals such as radiologists are new key role players. However, intensivists will remain key contributors due to their training, knowledge and technical and non-technical skills.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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