

Permissive hypotension in trauma

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Abstract

Introduction: Hemorrhagic shock is one of the most common causes of death in trauma patients, because it sets in motion a vicious cycle of mechanisms, including hypothermia, acidosis, and coagulopathy. To mitigate these effects, damage control strategies have been proposed, including the controlled intake of fluids with permissive hypotension, contemplating goals in systolic blood pressure, and thus, maintaining adequate tissue perfusion.

Objective: The present research aimed to review the literature in search of updated information about the management of permissive hypotension in patients with trauma.

Methodology: Information was searched in the Web-of-Science and Scopus databases in the last five years. The result yielded a total of 118 articles, of which 30 were taken according to the inclusion and exclusion criteria.

Results: All the articles consider the use of permissive hypotension as a good option for the management of patients with trauma and hypotension, however, they differ when it is appropriate to use it and under what conditions it should be performed.

Conclusions: Although permissive hypotension has become one of the fundamental pillars in the prehospital management of the patient with trauma, research studies in humans are required to support when and how it should be used.

Keywords: Permissive hypotension, polytrauma, damage control.

Hipotensión permisiva en trauma

Resumen

Introducción: El shock hemorrágico es una de las causas más comunes de muerte en pacientes con trauma debido a que pone en marcha un círculo vicioso de mecanismos que incluyen hipotermia, acidosis y coagulopatía. Para mitigar estos efectos, se han propuesto estrategias de control de daños, incluido el aporte controlado de líquidos con hipotensión permisiva contemplando metas en la presión arterial sistólica para mantener una adecuada perfusión de los tejidos.

Objetivo: Conocer información actualizada acerca del manejo de la hipotensión permisiva en pacientes con trauma.

Metodología: Se buscó información en las bases de datos Web-of-Science y Scopus de los últimos cinco años. El resultado arrojó un total de 118 artículos de los cuales se tomaron 30, según los criterios de inclusión y exclusión.

Resultados: Todos los artículos consideran el uso de la hipotensión permisiva como una buena opción para el manejo de los pacientes con trauma e hipotensión, sin embargo, difieren en qué momento es adecuado utilizarlo y en qué condiciones se debe realizar.

Conclusiones: Si bien la hipotensión permisiva se ha convertido en uno de los pilares fundamentales en el manejo prehospitalario del paciente con trauma, se requieren estudios investigativos en humanos para soportar cuándo y cómo debe utilizarse.

Palabras claves: Hipotensión permisiva, politrauma, control de daños.

Introduction

Worldwide, trauma generates around 5 million deaths per year (1.2 million from traffic accidents), with a global burden of disease that makes it a major public health problem and one of the most frequent reasons for consultation in Latin American health systems (1). According to the Advanced Trauma Life Support (ATLS) manual (2), hemorrhage is the most common cause of shock in trauma patients. Hemorrhagic shock sets in motion a vicious cycle of outcomes, including hypothermia, acidosis, and coagulopathy; better known as the triad of death. Identifying its origin, controlling it and restoring the circulating volume are the main objectives in the treatment of this type of shock (2). To achieve this, strategies such as Damage Control Resuscitation (RCD) have been proposed, which aims to avoid disproportionate therapeutic measures that may cause secondary harm to patients, optimize tissue oxygenation, and ensure sufficient minimal blood flow to the vital organs (avoiding counteracting the coagulation mechanisms); For this, he proposes using a restricted fluid replacement generating permissive hypotension, emphasizing “balanced resuscitation”, with the aim of achieving adequate organ perfusion, avoiding circulatory overload and reducing the risk of rebleeding (3). However, studies have been contradictory or insufficient in determining this methodology as the most appropriate, so disagreements must be resolved under current evidence before deciding on the systematic management of the patient (4). Even so, the volume of data on hypotensive resuscitation continues to grow, so we will try to elucidate in the following pages the efficacy, strategies and data studied through the literature regarding hypotensive resuscitation in patients with traumatic hemorrhagic shock.

In recent years, research has been carried out regarding the most appropriate treatment that can be offered to patients with hemorrhagic shock due to trauma in order to reduce mortality from this type of injury. Historically, patients have been resuscitated with large amounts of fluids, but it has been observed that, despite the efforts made, there is a considerably high risk of death and complications have been evident (5).

For this reason, several current studies have sought to determine the appropriate treatment for these patients, thus introducing the concept of damage control resuscitation which in turn includes permissive hypotension, which consists of the supply of restricted fluids to a patient in order to partially increase blood pressure (without reaching normotension) so a sufficient minimum blood flow to vital organs is

guaranteed (6). In addition to permissive hypotension, there is also hemostatic resuscitation (use of blood and blood products) and damage control surgery (7). The effectiveness of this method has been demonstrated to reduce mortality in this type of trauma; However, there is no current consensus or research with sufficient statistical validity to support the use of this methodology, in turn, the goal (in terms of systolic blood pressure) of this permissive hypotension has not been defined (8). Many authors defend the previous strategy based on the fact that by correcting the lost volume with large amounts of fluids, the hemodynamic function will be restored and will allow a correct perfusion of the tissues and therefore the patient will have a better recovery (9).

Even so, the defenders of the recent damage control resuscitation strategy propose that this aggressive resuscitation could go against the physiological mechanisms of coagulation, which seek to reduce bleeding and therefore prevent further loss of blood volume. The proposed mechanism is that this increase in pressure (due to the amount of fluids supplied) displaces the clots that are forming at the bleeding sites; it worsens acidosis, dilutes clotting factors, decreases blood viscosity and causes hypothermia if these were not previously heated (10).

But in reality, does the use of resuscitation strategies based on permissive hypotension improve survival in patients with hemorrhagic trauma? In general, the results show evidence of a certain improvement in survival; however, due to the studies that do not demonstrate these benefits or even conclude that it is counterproductive, it is proposed in the following work to review the research that exists so far in the literature and draw the most appropriate conclusion.

This article is based on the scientific research that has been done on “permissive hypotension” in the last 5 years. The data obtained could allow us to elucidate how to provide optimal care for hemorrhagic trauma in the prehospital setting, benefiting both health personnel, showing updated strategies to achieve the most appropriate treatment, as well as patients.

Materials and methods

A systematic review of the scientific studies published in medical journals was carried out, these were identified through bibliographic searches in the Scopus and Web-of-Science databases for articles published between 2015 and before April 20, 2020. used the following search terms and the Boolean AND connector: “Damage control” AND “Permissive hypotension” AND “Trauma”. The

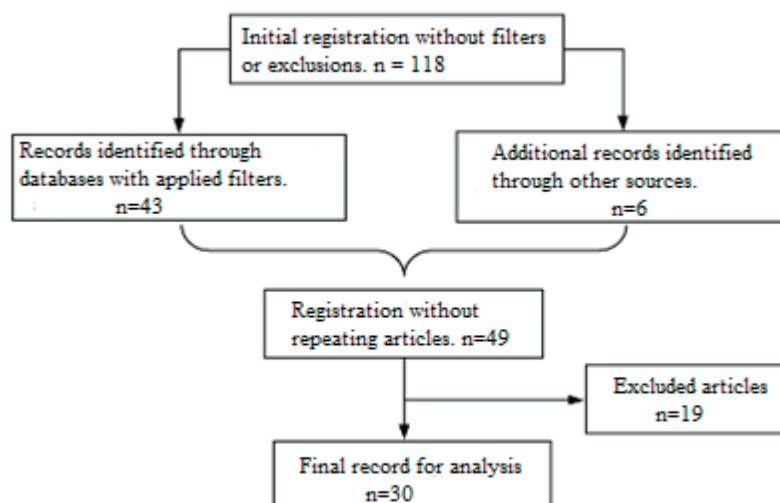
literature search included original integrative studies (systematic reviews and meta-analyzes), and primary articles (observational or clinical trials). The intervention evaluated was to identify the prehospital management for patients with hemorrhagic trauma using permissive hypotension and fluid restriction as treatment. The search equation obtained in the databases is illustrated in Table 1.

Table 1. Database search equation

Database	Search equation
Web of Science	TEMA: ("Damage control" AND "Permissive hypotension" AND "trauma") Refinado por: TIPOS DE DOCUMENTOS: (ARTICLE) AND AÑOS DE PUBLICACIÓN: (2020 OR 2019 OR 2018 OR 2017 OR 2016) Periodo de tiempo: Últimos 5 años. Índices: SCI-EXPANDED, SSCI, A&HCI, ESCI.
Scopus	TITLE-ABS-KEY ("Damage control" AND "Permissive hypotension" AND "trauma") AND PUBYEAR > 2015 AND (LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016)) AND (LIMIT-TO (LANGUAGE, "English"))

Initially, 118 articles were found, identified as eligible studies for inclusion in the search process (Fig. 1). After applying the filters for the search (last 5 years and document type “article”), 56 articles remained, of which 7 were duplicates and therefore, were eliminated from the list, leaving 49, later another 19 articles were excluded in view of the fact that their approach was different with respect to trauma management, and included aspects related to bleeding patients in non-emergency situations, articles focused on the in-hospital area, as well as articles aimed at a military environment. Finally, 30 articles were selected and used in this systematic review.

Figure 1. Analysis scheme of included articles.



Results

52% of the articles are based on European publications that are focused on trauma management and use values between 80-90 mmHg as goals for systolic blood pressure, arguing that it is the lower limit pressure accepted to maintain adequate perfusion at organs (11), while others state that it is better to use values greater than 100 mmHg but not exceeding 110 mmHg, since there is evidence that values below 90 and greater than 110 at the time of admission

increase the risk of mortality (12).

80% of the articles mention that the use of this treatment method is totally contraindicated in patients with traumatic brain injury, spinal cord injury and the elderly population; Due to the fact that an adequate cerebral perfusion pressure is crucial to ensure oxygenation of the tissues of the injured central nervous system and, with the parameters of permissive hypotension, these requirements are not met (13) (14).

In a systematic review of the literature conducted in 2018 with randomized trials Controlled and cohort studies, the mortality rate among post-traumatic patients managed with conservative resuscitation was found to be lower than standard aggressive resuscitation, indicating that permissive hypotensive resuscitation may create a better survival rate among trauma patients (15).

Two articles focus on the fact that this strategy should not be used while the source of bleeding is not controlled and only until the moment when definitive control of it is achieved, taking into account short transfer times (9) (16). Because the late times in the transfer of the patient from the scene of the events to arrival at the hospital increase the risk of mortality (17). The deterioration of the patient's condition, that is, the worsening of a condition such as coagulopathy in a patient who has lost a significant amount of blood volume, is related to poor management of the emergency, which includes an inappropriate and excessive administration of intravenous fluids without performing a resuscitation that includes the entire damage control component (18).

The risk of accelerating the coagulopathy process in the middle of aggressive fluid resuscitation has been mentioned, as well as causing complications such as secondary intra-abdominal hypertension or abdominal compartment syndrome, as they are closely related to aggressive fluid resuscitation (19), however after resuscitation with permissive hypotension or aggressive resuscitation, complications such as acute kidney injury could occur, documented in both cases (20) (21).

There is no agreement on the best solution for fluid replacement, while some support balanced resuscitation under the concept of damage control, using ratios of plasma, platelets, and red blood cells that approximate whole blood and restricted volumes of crystalloids (22) (23), others argue that the use of pre-hospital blood products is only available in some countries and, therefore, crystalloid fluids remain the solution of choice in the pre-hospital setting (12). The need to implement the administration of crystalloids at low volume in

the prehospital setting is recognized when the transfer time can be prolonged, otherwise, rapid referral to an adequate hospital center is preferable, where definitive treatment is provided to the patients (24). Regarding the amounts of fluids that should be administered to achieve an acceptable systolic blood pressure or generate a quality radial pulse, a volume of between 250 to 500 mL has been recommended (25). Randomized controlled trials regarding the use of aggressive fluid resuscitation compared to hypotensive resuscitation in the pre-hospital and in-hospital settings have supported changes in international guidelines for the management of hemorrhagic shock from trauma, suggesting low arterial pressures, allowed up to state that a definitive repair of the damage is possible, taking into account the characteristics of the patient and the injury (26).

There is currently no consensus on the guidelines to follow in resuscitation for optimal prehospital care, as there remains a considerable and ongoing debate about how to provide the best trauma care in the prehospital setting. The development of trauma systems and protocols is necessary, which can achieve improvements in outcomes, and although resuscitation strategies are evolving, more research evidence is required to support them (27) (28). Among the research results regarding the correct management of fluids in patients with hemorrhagic shock due to trauma, it is determined that a good fluid therapy is as significant as a surgical management of the injury (29), important emphasis is placed on a good evaluation of the patients after a trauma and likewise a review of their pathological antecedents that could put the patient at risk with the use of permissive hypotension (30).

Conclusions

Permissive hypotension has become one of the main management strategies for trauma patients, demonstrating its effectiveness in preventing dilutional coagulopathy and reducing bleeding. However, there is limited evidence to support when and how it should be used. Much of the practices in this regard are based on weak observational evidence or animal studies, requiring strong evidence from randomized controlled trials (RCTs) in humans. As knowledge of the pathophysiology of massive bleeding increases and technology advances, it is expected that rational treatment protocols will continue to be refined. To this end, the aim should be to carry out high-quality randomized controlled trials and coordinate research efforts aiming at the objective of bringing more and better information to pre-hospital and in-hospital health personnel, with which appropriate decisions could be made in the management of the disease. Hemorrhagic

shock and the applicability of permissive hypotension.

In-hospital personnel, mainly in the emergency department, must be attuned to the interdisciplinary management of the patient with hemorrhagic shock that requires surgical damage control, so that from their arrival to their disposition in the operating room they have been managed, not only in the injury repair process, but also in its postoperative process, as damage control resuscitation improves the recovery process.

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