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REVIEW

Extraperitoneal pelvic packing in trauma of the pelvis: A standard practice? A general review

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Abstract

Introduction: Pelvis fractures that associate bleeding with hemodynamic instability warrant immediate treatment. The therapeutic options in these cases vary from angioembolization to extraperitoneal pelvic packing.

Material and method: The P.I.C.O.S guidelines were used to structure the questions and the research topic as to attain clinical validity. The results of the research were filtered in accordance with the PRISMA checklist.

Results: 38 papers were identified. After screening, 27 papers were used to complete the analysis.

Discussion: Frequently, bleeding has a venous source in the pelvis. In the case of pelvic fractures with hemodynamic instability, extraperitoneal pelvic packing is one of the core treatments but not a stand-alone treatment, as it needs to be coupled with a pro-efficient trauma resuscitation protocol. Its intended use is as a bridge therapy until conclusive investigations regarding the place of bleeding can be obtained. Angiography is recommended if hemodynamic instability exists after pelvic packing and effective hemodynamic resuscitation.

Conclusion: Even with all these recent efforts, the wide-use of this therapy is precluded due to the absence of a standardized evaluation of these patients and large multicentric studies.

Keywords: pelvis fractures, extraperitoneal packing, trauma

Introduction

Mortality in severe pelvic lesions is a direct consequence of bleeding at this level that occurs within the first 24 hours of hospitalization [1,2].

Pelvic fractures with hemodynamic instability are still a challenge in the modern era for the trauma surgeon, as these lesions reflect a high energy impact that often associates other lesions from other anatomical compartments with life-threatening complications [3,4].

In these cases, mortality still accounts for nearly 50%, one-third of which is due to bleeding [5].

Bleeding from the pelvic fractures often derives from venous lesions or bone fracture lines and only up to 15% derive from arterial lesions, hence the utility of extraperitoneal packing that provides increased and constant pressure on a low debit, low-pressure venous

lesions [6].

From an anatomical point of view, although direct sources of bleeding are rarely identified we can mention the sacral venous plexus (most commonly), lesions of the branches which derive from the internal iliac artery [7]. Keeping this aspect in mind, a basic element in the treatment algorithm represents the confirmation that the pelvic fractures represent the starting point of the bleeding and hemodynamic instability [8].

Once this goal is met, it is possible to establish a protocol of damage control with volumetric resuscitation and selection of surgical procedures that allow the fastest approach towards the bleeding source [9]. It is crucial that the hemorrhages are stopped in an effective period of time as to avoid the triad, coagulopathy, acidosis, and hypothermia that generate a vicious circle that often leads to the patient's death [9].

Vascular lesions in this anatomical region are difficult to resolve due to the multitude of collateral vascular anastomoses. Several techniques have been described to address these hemorrhages that range from internal iliac artery ligation or internal iliac vein ligation to thermal or argon electrocoagulation [10,11].

The results of each technique are still questionable. Angiography is an attractive method that allows both the identification of the source of bleeding and treatment by embolization, but it is a costly technique that is not available in all hospitals, and when it is used, the transfusion needs increase [12].

Also, the duration of up to 1 hour and a half is a real problem for a hemodynamically unstable patient [13].

Pelvic packing has been rediscovered about 25 years ago when it was demonstrated that it was an effective/ simple and quick method to stop life-threatening bleeding that frequently results from low-pressure and low-volume venous lesions due pelvis fractures [13,14]. However, the first historical description of this technique was made by Logothetopulos in 1926 [15].

This technique was adopted by trauma centers relatively quickly due to the fact that it allowed the trauma surgeon to contain a non-identifiable life-threatening hemorrhage for which he had few therapeutical options and gave the trauma team time to resuscitate the patient [15, 16].

With the implementation of this technique, a reduction in the number of deaths and the need for transfusions was reported in the case of patients with significant bleeding from pelvic fractures and hemodynamic instability [17].

The purpose of this study was to conduct a general review of the literature regarding the extraperitoneal packing as a technique of damage control in the case of pelvic fractures with hemodynamic instability and to evaluate the indications and effectiveness.

Material and Method

The research was performed using the PubMed database. The P.I.C.O.S concept (patient, intervention, comparator, outcome, study type) was used to structure the questions and the research topic as to attain clinical validity. The results of the search were filtered in accordance with the PRISMA checklist (Preferred Reporting Items for Reviews and Meta-Analysis). We used the standard recommendation of two independent readers who performed the selection and subsequent extraction process.

Results

We identified 38 papers from one medical database. After exclusion of 6 papers (duplicates), the number was reduced to 32. Of these, 3 papers were not obtainable while the other 2 papers were not appropriate for the research subject. 27 papers were used to complete the analysis.

Discussion

Treatment techniques in a patient with pelvic trauma are dictated by the presence or absence of hemodynamic stability. In these situations, hemorrhage generally stops after pelvic stabilization and effective resuscitation. However, a percentage of these patients require additional treatment that may be completed by angiography and angioembolization if available and the patient's clinical status allows the extraperitoneal packing with the sole purpose of damage control.

In spite of all the technological advances in both pre-hospital and hospital systems, in the case of a trauma, still unstable hemodynamic patients with pelvic fractures have a hospital mortality rate up to 50%. The main cause is exsanguination [18].

It should be noted that before performing any maneuver on a patient with a pelvic fracture, the pelvis should be stabilized with an external C-Clamp or a temporary pelvis fixer. If this stage is skipped, one can increase the pelvis damage with the forced extraperitoneal packing and this will translate into more intense bleeding.

Osvaldo et al. proposed that extraperitoneal packing in trauma of the pelvis and hemodynamic instability should be used only as a bridging solution that ensures the survival of the patient until definitive treatment is available and allows the surgeon to complete the paraclinical investigations that can locate the source of the bleeding [19]. This concept has been also mentioned and confirmed by the group study of Nina et al. This technique has a real benefit in small hospitals, as it offers a window of time for the patient to be transferred to a larger trauma center [20]. His group found a better survival in the arm of patients with extraperitoneal packing when compared with the arm without extraperitoneal packing, with the mention that this procedure had to be accompanied by an effective resuscitation in the emergency room such as administration of blood components according to the European 1: 1: 1 protocol [19].

The sources of bleeding in these patients are difficult to identify clearly as they can be either arterial or venous. It is confirmed that in case of high energy trauma, in most cases the source of bleeding comes from both venous and arterial vessels, thus extraperitoneal packing after the patient is hemodynamically stable should be accompanied by angiography [21].

However, Cothren et al. believe that angiography is required only for a small segment of this subgroup of patients who fulfill strict criteria such as hemodynamic instability after packing [22].

Angiography remains an important resource in the trauma surgeon therapeutic arsenal. Studies which compare first-line angiography versus extraperitoneal packing are of low quality, while prospective randomized trials with a large number of patients are lacking, either due to ethics or due to the rarity of this type of pathology. Another aspect to be considered when one chooses angiography before packing is that the patient comes from a high energy impact, enough to produce a pelvic fracture and is often polytraumatized and may have other sources of bleeding (liver, spleen, mesentery) that require additional surgery in an emergency theater, therefore, his transportation directly to the angiography room for an investigation that can last even 90 minutes is not an optimal treatment.

The learning curve of extraperitoneal pelvic packing is short, and can be, in theory, done by any trauma surgeon. From the extraperitoneal approach, the blood loss is minimal and the duration varies between 8 and 20 minutes. In extreme situations, with minimal equipment, this procedure can also be performed in the emergency room [23].

The time window provided by the extraperitoneal packing is approximately 10 hours in the case of patients who require angioembolization [24].

Regarding the effectiveness of this

technique, when properly applied, it reduced both the transfusion requirement and the number of deaths by exsanguination data confirmed by Osvaldo et al. and Nina et al. [19, 20]. Reducing the need for transfusion is an important aspect that requires attention because it has been identified as an independent factor that causes multiple organ failure and death, so reducing the number of transfusions implies better survival after the first 24 hours [24].

As reported by Anna Totterman et al., the survival rate at 30 days in the group with pelvic packing was 72%, data similar to those given by Ertel et al. (71%).

Practically, this technique allows the anesthesiologist to ensure an effective resuscitation, prolonging the time he can administer a corresponding volume of blood products, thus stabilizing the patient until definitive hemostasis is achieved, due to the fact that it almost immediately increases the systolic blood pressure [21].

Taking into account that all these procedures are performed in emergency settings in a patient with hemodynamic shock, the complication rate is quite high. The main injured structures are the intestines and urinary bladder and may reach an incidence of 15% [24]. Neuropathy of the sciatic and obturator nerves has also been noted [25]. The rate of postoperative infection can reach up to 33% [21].

Regarding the moment swabs should be extracted, the time must be carefully selected as repacking increases the infection rate to 50% [25]. The optimal moment would be at 48 hours, but the coagulation status of the patient should be considered before undergoing a new surgical reintervention [22].

Conclusion

Extraperitoneal pelvic packing focuses on the primary bleeding source and should be viewed as a damage control procedure. Hemodynamically unstable patients with pelvic fractures require a multidisciplinary approach and although the exact place of extraperitoneal pelvic packing in the treatment algorithm is not exactly established, this procedure can offer the extra-time required for a patient to survive as he is moved from a small trauma center that is not properly equipped to ensure the definitive hemostasis. If bleeding persists, angioembolization should be the mainstay procedure. The clinician needs to be informed and recognize the weakness and strength of each procedure and tailor it for each patient.

Conflict of Interest statements

Authors state no conflict of interest

Authors' Contributions

Conception and design: Iulian Slavu, Adrian Tulin, Lucian Alecu.

Provision of study material or patients: Adrian Tulin, Lucian Alecu.

Collection and assembly of data: Iulian Slavu, Adrian Tulin, Lucian Alecu.

Data analysis and interpretation: Iulian Slavu, Lucian Alecu.

Manuscript writing: Iulian Slavu.

Final approval of manuscript: Lucian Alecu, Adrian Tulin.

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