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Techniques for Control of Abdominal Bleeding: Review of the Literature

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ABSTRACT

Abdominal traumatism (AT) produces lesions in the wall or in the content (viscera, mesos, vascular ducts, biliopancreatic, urinary tract). The abdomen can be injured in isolation, although about a third of pediatric polytraumatisms are associated with AT. AT implies a high vital risk due to two circumstances: hemorrhage due to injury to solid organs or blood vessels and peritonitis due to perforation of hollow viscera. The global mortality varies between 5 and 15% and reaches 50% in the lesion of the great vessels. Management of these injuries is key to patient survival.

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INTRODUCTION

Massive hemorrhage is a vital emergency and an important cause of death in polytraumatized patients or in patients with intraoperative or postoperative complications. Control of hemorrhage is a substantial objective of the surgeon to avoid exsanguination and death of the patient. Appropriate management of the bleeding patient includes stabilization of the patient, identification, repair of the injury, and recovery of tissue perfusion. Uncontrolled post-traumatic bleeding is the leading cause of potentially preventable death in trauma patients. Given the high rate of volume loss, early surgical intervention offers the best chance of survival for the patient. Therefore, resuscitative maneuvers are of utmost importance, with rapid replacement of lost circulatory volume, immediate identification of bleeding sources, and control of hemorrhage to minimize blood loss, restore tissue perfusion, and achieve recovery. hemodynamic stability

Recommendations on resuscitation and volume resuscitation of the patient in hemorrhagic shock are constantly changing. The amount of sera, plasma derivatives and blood components that must be administered is not precisely established, but it is assumed that in these patients early control of the cause of shock is much more important to avoid fatal outcome or other sequelae of hemorrhage, two. Hemostasis must be performed quickly before the appearance of the lethal triad consisting of hypothermia, metabolic acidosis and coagulopathy.

At admission, approximately one-third of all polytrauma patients show signs of coagulopathy and a significant increase in the occurrence of multiple organ failure with essential worsening of prognosis and a high risk of death compared with patients with similar patterns but in the absence of coagulopathy. Regardless of whether it is a patient with massive blood loss as a result of trauma or as a complication of a surgical intervention, the identification and repair of the bleeding lesion may require the performance of specific maneuvers that may be temporary or permanent. Depending on the patient's condition, personal history, the cause of the bleeding and concomitant injuries, the patient may require a one-time intervention, or a surgical strategy called "damage control surgery" that consists of patient management in three consecutive phases.

The strategy of damage control surgery is recommended especially in unstable patients, in hypothermia, with metabolic acidosis, severe coagulopathy, a lesion in a site that is difficult to anatomically accessible. Asensio establishes a protocol to define even more precise indications, the requirement of more than 4 liters of packed red blood cells, or if a combination of red blood cells and whole blood of more than 5 liters is used, or the total volume of fluid therapy administered exceeds 10-12 liters; or when the patient has a pH less than 7.2, a temperature less than 34°C, or an estimated blood loss greater than 5,000 mL; an inaccessible major venous injury or concomitant major injury outside the abdomen; the need for prolonged surgical procedures in a

patient with suboptimal response to resuscitation or inability to achieve hemostasis due to recalcitrant coagulopathy, whereas primary definitive surgical treatment is indicated in the hemodynamically stable patient and in the absence of any of the above . In the first phase, the initial and rapid control of bleeding, repair or local control of other injuries and provisional closure of the wound (for example of the abdominal or thoracic cavity, of the skull or wounds on the extremities) are carried out.

Hemorrhage control can be achieved using different techniques such as packing for moderate venous or arterial bleeding and parenchymal injuries, primary repair by means of raffia of the injured organ or vessel, temporary repair of the vessels with devices or by means of a bypass, the use of local hemostatics, embolization by arteriography or a combination of all the aforementioned techniques. Control of other associated injuries must be rapid and may be provisional to avoid contamination of the surgical field, which is a trigger for sepsis and systemic inflammatory response syndrome. To achieve this may require closure of hollow viscus perforations or resection of perforated or non-viable segments of the hollow viscus with mechanical sutures and adequate drainage of the pancreas when it is injured. In the second phase, the patient is stabilized in the Intensive Care or Postoperative Care Unit.

Long times in the operating room are detrimental to critically ill patients, and the ICU is where metabolic acidosis, coagulopathy, hypothermia, and hypoperfusion can be corrected. In this period, embolization of bleeding vessels can also be performed. In some situations, after the first intervention, the patient may require transfer to another higher level center (of reference), which would be indicated in very complex cases or that require evacuation from hospitals in areas of armed conflict or natural disasters. . Subsequently, the third phase is carried out, which consists of definitive surgery with final repair of the injuries and closure of the surgical wound. The removal of the packing and the performance of the second intervention should be postponed for 24-72 hours, preferably up to 48 hours according to the different authors.

It is recommended to second early laparotomy (at 24 hours) called "the second look" in the case of suspected persistence of bleeding or the appearance of abdominal compartment syndrome. The concept of damage control has also been described for hemorrhages that require thoracic, trauma and/or neurosurgical intervention.

ABDOMINAL HEMORRHAGE

Jover et al. define the fundamental principles of intra-abdominal hemorrhage control following the instructions of the DSTC manual. In the case of a complex scheduled intervention, it recommends correct identification and dissection of the large veins and arteries of the surgical bed in order to clamp them in the event of an iatrogenic injury. The next principle is a wide exposure of the field that in the case of abdominal surgery encompasses the chest and groin area. In most urgent interventions, opening through a midline laparotomy is recommended. In scheduled or urgent cases, it may be necessary to enlarge the incision regardless of the initial technique chosen. Accessing the cavity, the clots and blood are extracted, always requiring two aspirators. Subsequently, compresses are placed in the four quadrants and an exhaustive exploration of the cavity is carried out.

At this time we have several options that depend on the origin of the bleeding and the patient's condition. In some cases, bleeding can be controlled by manual compression, in other situations packing with compresses is required with temporary closure of the cavity with or without embolization and subsequent review in 24-72 hours after patient stabilization and correction of other physiological parameters. . In other cases it is necessary to resort to complex bleeding control techniques. The liver is the second most frequently injured organ in both blunt and penetrating trauma. In the event of bleeding from the liver, it is advisable to avoid placing too many compresses, which can enhance bleeding due to compression of the vena cava.

Not recommended either maintain the packing for more than 48-72 hours due to the increased risk of bile leak and the appearance of intra-abdominal abscesses. Current indications for the use of liver packing include those hemorrhages that are not controllable with other measures and liver injuries in which the hemorrhage is considered to be secondary to the vicious circle of acidosis, hypothermia, and coagulopathy. The appearance of late complications such as abdominal compartment syndrome, secondary to the rapid development of a third space, should be monitored, so intra-abdominal pressure should be monitored with a bladder catheter in the ICU. It is essential to mobilize the liver by sectioning the ligaments for proper exposure of all sides, since in blunt trauma injuries to the posterior side can go unnoticed. Bleeding from deep wounds can be controlled by means of a Foley catheter inserted in its path, and in superficial wounds, local hemostatics or even a simple suture can be used. One of the complex maneuvers used is the Pringle maneuver, which is based on the occlusion of the hepatic pedicle at the level of Winslow's hiatus to control bleeding from the hepatic artery and some of its branches and from the portal vein.

One of the problems arising from the technique is the ischemia caused by prolonged clamping, for which the authors recommend using it intermittently, maintaining it for 10-15 minutes and unclamping for the next five minutes. Some authors mention that in a normotensive and normothermic patient, the liver can withstand up to 90 minutes of ischemia. For the maneuver, a vascular clamp or a tape through a tourniquet can be used. In case of persistence of bleeding despite the correct performance of the Pringle maneuver, it is necessary to suspect that the hemorrhage comes from the vena cava, the suprahepatic veins or an aberrant hepatic artery. In these cases, total venous exclusion is performed, which consists of clamping the vena cava that

can be performed at different intrahepatic, supra, and infradiaphragmatic levels. The most experienced surgeons can resort to other techniques of hepatic venous exclusion such as a veno-venous bypass (between the femoral and portal veins and the external jugular or axillary vein) or aorto-caval shunt.

The use of a shunt between the right atrium and the cava may be useful in the treatment of exsanguinating liver injuries that affect the retrohepatic cava, the portal vein, or both. This technique was described by Schrock in 1968 after extensive studies on cadavers, which showed that few vessels drain into the suprarenal vena cava and therefore it is possible to divert their flow. The shunt placement technique is complex and time consuming. Its use should be considered in those cases in which the Pringle maneuver fails to control hepatic hemorrhage. It is generally used in less than 5% of cases of all serious liver injuries, and mortality is 55% to 81%. Many trauma surgeons prefer the direct approach to the retrohepatic vena cava and suprahepatic veins.

This approach begins with rapid digital dissection of the hepatic parenchyma through Cantlie's line, creating an intrahepatic fissure that separates the right and left lobes through a plane free of important vascular structures. Rapid splenectomy without any attempt at preservation or nephrectomy is recommended in case of injury to these organs or their vascular bundles. If they could not be practiced, Vascular clamps should be used to clamp the vascular pedicles that can be left temporarily safely in the abdominal cavity. Access to the large abdominal arteries such as the aorta with its bifurcation, the celiac trunk, the mesenteric arteries, and the left renal artery is achieved by performing the Mattox maneuver, which consists of sectioning the peritoneum in the left paracolic with mobilization and rotation of the organs located in this area - the spleen, the splenic flexure of the colon, the transverse colon, the tail and the body of the pancreas and, depending on the need, the left kidney.

On the right side, the Cattel Braasch maneuver is performed to expose the aorta with its bifurcation, the infrahepatic vena cava, the presacral artery, and the vascular bundle of the right kidney. It consists, like the maneuver described above, in the mobilization and rotation of the ascending colon with the hepatic flexure and the mesentery. For a better presentation of the vena cava, the pancreas, and the right kidney, the Kocher maneuver is also performed, which consists of mobilizing the duodenum and the pancreatic head. Control of bleeding from the aorta requires exposure of its lesion.

The abdominal aorta can be shown using the maneuvers described above, but at the level of the diaphragmatic hiatus, it may require mobilization of the left hepatic lobe, downwards from the stomach (after section of the gastrohepatic ligament) and the esophagus. Most venous vascular injuries can be ligated without too many complications, when this is not the case, their primary repair or the use of intravascular shunts or extra-anatomic bypasses should be assessed. Aortic cross-clamping through an emergent left anterolateral thoracotomy is a controversial issue due to the technical difficulty, the consequences of performing the maneuver, and the low survival rates.

Some authors accept its performance in patients with hemorrhagic shock secondary to penetrating trauma but with vital signs present. The principle of performing aortic occlusion by thoracotomy prior to laparotomy is temporary control of bleeding. Multiple studies have been published describing the adverse effects of this technique, including: decreased renal blood flow, hypoperfusion of other intra-abdominal organs and the spinal cord, induction of anaerobic metabolism with lactic acidosis due to hypoxia, increased intrathoracic bleeding in case of coexistence of an injury at this level, and the notable increase in afterload in a left ventricle with compromised function. According to the publications, the aorta can be kept clamped for more than 15 min.

CONCLUSIONS

Thanks to the development of endovascular techniques, it has been possible to implement the same strategies for vascular trauma and emergency surgery. Endovascular procedures reduce operative time, significantly reduce blood loss, and avoid iatrogenic injury to neighboring organs. The disadvantages are the cost and the non-availability of these techniques in all hospitals that receive polytraumatized patients. The indications for the use of these techniques are a low-velocity vascular injury (white weapon or small-caliber firearm), located in an anatomical region that is difficult to access, requiring prolonged intervention and that can worsen ischemia or hemorrhage, or a region where the risk of iatrogenic injury. Hemodynamic instability is a relative contraindication to endovascular therapy. In some cases, the open approach is preferred, for example if there is a bone compromise that requires exposure and fixation with osteosynthesis material, extensive soft tissue injuries or in case of associated intra-abdominal or intrathoracic injuries or in the case of some superficial arteries such as the superficial femoral artery. Arteries such as the iliac, popliteal, axillary or subclavian arteries benefit from endovascular repair due to their location

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