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INTESTINAL TRAUMA

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ABSTRACT

Introduction: *intestinal injuries, mainly in the small bowel, occur due to blunt or penetrating trauma, with greater severity in the latter. Rapid assessment is crucial to improve prognosis due to the physical and ischemic damage that compromises intestinal viability.*

Objective: *to detail current information related to intestinal trauma, etiology, pathophysiology, epidemiology, evaluation, treatment, complications and care.*

Methodology: *a total of 32 articles were analyzed in this review, including review and original articles, as well as clinical cases, of which 21 bibliographies were used because the other articles were not relevant to this study. The sources of information were PubMed, Google Scholar and Cochrane; the terms used to search for information in Spanish, Portuguese and English were: intestinal trauma, abdominal trauma, penetrating abdominal trauma, abdominal contusion, surgical emergencies.*

Results: *the diagnosis of intestinal injuries follows a protocol that includes anamnesis, physical examination and studies such as radiography, FAST ultrasound, tomography and laparoscopy, the latter useful to avoid unnecessary laparotomies. Management depends on hemodynamic stability: stable patients with closed trauma are observed, while unstable patients require laparotomy; in penetrating injuries, surgery is urgent in unstable patients and conservative management is an option in stable patients. Primary repair is used in minor injuries, and early postoperative enteral nutrition improves recovery and reduces complications.*

Conclusions: *Traumatic bowel injuries present a diagnostic and therapeutic challenge because of their clinical variety and complications. Rapid assessment with studies and protocols guide management, where surgery is key in unstable patients, and early enteral nutrition improves postoperative outcomes, with hemodynamic stability and timely diagnosis being fundamental for prognosis.*

KEY WORDS: *trauma, bowel, evaluation, surgery, nutrition.*

INTRODUCTION

Intestinal injuries can originate from blunt or penetrating trauma, with the small bowel being the most common location affected in both types. Although blunt abdominal trauma is more frequent, only a small percentage causes intestinal damage, while penetrating trauma, although less frequent, presents a greater probability of injury. These injuries represent an important cause of morbidity and mortality, especially in men under 44 years of age. Early and accurate assessment is essential to improve outcomes, since the pathophysiology involves both direct physical damage and ischemic and inflammatory phenomena that affect intestinal viability.

METHODOLOGY

A total of 32 articles were analyzed in this review, including review and original articles, as well as cases and clinical trials, of which 21 bibliographies were used because the information collected was not important enough to be included in this study. The sources of information were Cochrane, PubMed and Google Scholar; the terms used to search for information in Spanish, Portuguese and English were: intestinal trauma, abdominal trauma, penetrating abdominal trauma, abdominal contusion, surgical emergencies.

The choice of the bibliography exposes elements related to intestinal trauma; in addition to this factor, etiology,

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pathophysiology, epidemiology, evaluation, treatment, complications and care of the pathology are presented.

DEVELOPMENT

Etiology

Intestinal injuries can be caused by blunt or penetrating trauma. Most blunt abdominal trauma does not cause intestinal damage, with injuries occurring in approximately 3% of these cases, the small intestine being the most common location. On the other hand, although penetrating traumas are less frequent than closed ones, they are more likely to cause intestinal injuries. These penetrating injuries are classified into two main types: high energy (projectile) and low energy (sharp)(1).

Epidemiology

Injuries constitute one of the main causes of mortality in people under 44 years of age. As in most trauma, the incidence is higher in men, who account for approximately 80% of cases. Bowel injury is the third most frequent injury associated with blunt abdominal trauma, behind the spleen and liver[^2]. In penetrating injuries, the small bowel is the most commonly affected organ, followed by the colon[^3]. In stab wounds, the incidence of intestinal injury varies between 30% and 83%, depending on the patient's body mass index (BMI); a high BMI has a protective effect, being associated with a lower incidence of severe injury and less need for surgical intervention(3).

Pathophysiology

The pathophysiology of intestinal trauma is diverse and involves physical mechanisms, ischemia and reperfusion phenomena, as well as processes mediated by cellular signals. Physical injuries can be direct, as in penetrating trauma that tears the bowel, or indirect, as in blunt trauma involving compression or deceleration forces. The latter tend to damage fixed areas such as the junction between the duodenum and jejunum, and can cause loss of blood supply, resulting in tissue death. This risk is higher in patients with a history of abdominal surgery due to the presence of adhesions.

In addition, decreased perfusion due to shock or hemorrhage can trigger intestinal damage, as evidenced by increased proteins such as I-FABP, associated with indices of traumatic severity. The acute inflammatory response also increases the permeability of capillary vessels, and replacement with large volumes of crystalloid solutions reduces oncotic pressure and raises hydrostatic pressure, favoring fluid leakage and intestinal edema. For this reason, early and balanced replenishment with blood components such as red blood cells, plasma and platelets is recommended(1,4).

History and Physical Examination

All trauma patients should be evaluated using a standardized protocol, beginning with the primary assessment. Subsequently, in the secondary evaluation, additional signs of injury are identified, supported by complementary studies as appropriate. At this stage, the abdomen is examined for visible signs and pain in patients with preserved neurological function.

In blunt abdominal trauma, the presence of the seat belt sign is associated with a significantly increased risk of small bowel perforation. In penetrating trauma, the number and location of wounds provide guidance on the extent and penetration of injuries.

Simultaneously, vital signs are monitored and information is collected on the mechanism of injury, which is essential to anticipate the type of injury. When the patient is conscious, relevant medical, surgical, social and allergic history is obtained(1,5).

Evaluation

The evaluation of abdominal trauma includes anamnesis, physical examination and complementary methods such as radiographs, FAST ultrasound, diagnostic peritoneal lavage (DPL), computed tomography (CT) and diagnostic laparoscopy (DL).

Radiographs detect signs such as subdiaphragmatic free air and pelvic fractures, useful for evaluating penetrating injuries. FAST ultrasound identifies fluid in key cavities, although with low sensitivity for bowel injuries. LPD helps to decide the need for laparotomy based on peritoneal fluid analysis.

CT is the most accurate technique for bowel injury, but can be false negative. LD is effective in stable patients with penetrating trauma to avoid unnecessary surgery, showing high sensitivity and specificity(6,7).

Treatment

Treatment of intestinal trauma varies according to the hemodynamic stability of the patient.

Blunt Injuries in Stable Patients

In cases of blunt abdominal trauma with reliable physical examination, no additional imaging studies are required, and the patient should be monitored with serial abdominal examinations for 24 hours. If the physical examination is not reliable - due to factors such as brain injury, intoxication or sedation - computed tomography (CT) is indicated. If the CT scan is negative, hospital observation is maintained. The detection of intestinal lesion in the CT scan warrants exploratory laparotomy.

Penetrating Injuries in Stable Patients

Hemodynamically stable patients with reliable physical examination may receive conservative treatment, provided they do not present exclusion criteria for surgery. Serial examinations over 24 hours are recommended. CT is essential for all patients with penetrating trauma, showing high sensitivity and specificity.

The trend towards conservative management responds to the high rate of non-therapeutic laparotomies and associated morbidity. Diagnostic laparoscopy can avoid unnecessary laparotomies, being especially useful for detecting and treating occult diaphragmatic lesions in the left upper quadrant, although its usefulness for bowel injuries is limited due to the high frequency of non-therapeutic laparotomies after its use(1,8-10).

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Unstable Blunt Injury
Unstable patients with blunt abdominal trauma should undergo DPL or FAST. If either is positive, exploratory laparotomy is performed; if both are negative or inconclusive, complementary studies such as CT scan and evaluation of other injuries are performed.

Unstable Penetrating Injury
In unstable patients with suspected gastrointestinal injury, exploratory laparotomy is immediate.

Surgical Management
Perioperative antibiotics are administered, preferably specific or broad-spectrum if the exact injury is unknown. Prophylaxis should last 24 hours, and in established infections it is recommended to prolong it to four days.

Exploratory Laparotomy Follows an order
Hemorrhage control, contamination control, complete diagnosis and reconstruction. The entire small bowel, colon, rectum and stomach, including the duodenum, are systematically inspected.

Repair Options
Primary Repair: For lesions smaller than 3 cm or affecting less than 50% of the intestinal circumference.

Resection with Anastomosis: For larger or multiple lesions.

Bypass: Reserved for high-risk cases or when intestinal continuity cannot be restored within 36 hours.

Damage Control: In patients with acidosis, hypothermia or coagulopathy, initial control is performed and definitive repair is deferred until stabilization. This method still generates controversy and is under study(11-14).

Special considerations.
Duodenum
Duodenal lesions require specific attention due to their location and anatomical relationships. The exploration should include opening of the lesser sac and Kocher maneuver to expose the duodenum. It can be complemented with right medial visceral rotation (Cattell-Braasch) and mobilization of the ligament of Treitz to completely visualize the fourth portion.

Isolated duodenal hematomas can be managed conservatively with nasogastric decompression, provided there are no signs of perforation. If obstruction persists beyond two weeks, surgical exploration is indicated.

Lesions smaller than 3 cm and away from the ampulla can be repaired primarily; larger lesions require resection with anastomosis. If a tension-free repair cannot be achieved, a Roux-en-Y duodenojejunostomy is considered. If there is a concomitant pancreatic lesion involving the second duodenal portion, wide drainage and deferring definitive reconstruction is recommended. In case of distal pancreatic duct injury, distal pancreatectomy may be performed.

Extraperitoneal Rectum
These lesions differ from intraperitoneal lesions in their location and management. The EAST guidelines recommend proximal bypass (colostomy) for lesions involving less than 25% of the circumference, without the need for rectal lavage or pre-sacral drainage. Some authors propose transanal repair without bypass if the lesion is accessible. If bypass is performed, early reversal (at 10 days) may be considered if the contrast enema shows no complications. In lesions affecting more than 25% of the rectum, bypass is always indicated(1,15).

Differential Diagnosis
The differential diagnosis of abdominal lesions should consider a wide range of possibilities, including lesions of hollow viscera such as the esophagus, stomach, small intestine, colon and rectum. Intra-abdominal vascular lesions should also be considered, which may manifest as acute blood loss anemia or intestinal ischemia. In addition, it is important to include in the diagnosis mesenteric or intestinal wall hematomas. Among solid organ lesions, liver, spleen and bladder lesions stand out. Finally, the differential diagnosis should consider retroperitoneal lesions, such as retroperitoneal hematomas and damage to the pancreas or kidneys.

Prognosis
The prognosis of the patient with traumatic bowel injury depends on his or her general condition and comorbidities. Those who refuse surgery or who present multiple chronic diseases have a less favorable outcome. The mortality rate ranges from 8% to 87%, with an average of 25%, hemodynamic instability being the main factor associated with a higher risk.

Complications
Undetected bowel injury represents a major challenge, as late diagnosis - between 60 and 90 minutes - increases mortality. Delayed presentation is common in patients initially treated conservatively, who may develop symptoms later that reveal bowel injury, although the safety of nonsurgical management remains debated. Bleeding associated with bowel trauma complicates repair and is linked to an increased risk of anastomotic leakage; in hemodynamically unstable patients with a need for transfusions, it may be necessary to opt for a shunt or leave the bowel in discontinuity for later definitive repair. Leakage after bowel repair occurs in approximately 5-8% of cases and is associated with increased severity of injury, fluid volume and intraoperative transfusions, with no significant differences between manual or stapled anastomosis(16-17).

Postoperative Care and Rehabilitation
Although the return of bowel function has traditionally been awaited before initiating enteral feeding, recent studies show that early nutrition is safe and effective. Prophylactic use of nasogastric (NG) tube has not been shown to reduce the incidence of leakage or ileus after bowel repair. A current review suggests that initiating enteral nutrition 24 to 48 hours postoperatively is safe and promotes early resolution of ileus; furthermore, there is no evidence to support the routine use of metoclopramide or erythromycin after bowel surgery. Therefore, feeding should be initiated early with close

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monitoring for symptoms such as bloating, nausea and vomiting.

The Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines, although not specific for intestinal trauma, recommend enteral nutrition in critically ill and surgical patients, including those with mechanical ventilation and stable doses of vasopressors. However, if mean arterial pressure is less than 50 mmHg or increasing doses of vasopressors are required, enteral feeding should be suspended until the patient is stabilized, watching for signs of intestinal ischemia.

ASPEN favors enteral nutrition in critically ill patients who tolerate it, highlighting that bolus feeding presents fewer interruptions than continuous feeding, without affecting mortality. To reduce the risk of aspiration pneumonia, it is recommended to keep the head of the bed elevated to 30-45 degrees and to perform twice daily chlorhexidine mouth rinses in intubated patients.

The debate over trophic feeding versus achieving complete goals persists, especially in intestinal trauma. However, patients with severe malnutrition do better when exceeding 80% of the nutritional goal. It is not recommended to monitor residual gastric volumes, as they are not associated with aspiration events; it is suggested to assess clinical and radiological distension, and not to discontinue enteral nutrition if residuals are less than 500 ml unless clinical signs are present.

If enteral feeding is not tolerated, it is recommended to start parenteral nutrition after approximately seven days, with daily reevaluation to restart enteral feeding when possible.

The management of patients with intestinal trauma and hypotension is complex. Vasopressors and large resuscitation volumes are associated with increased risk of anastomotic leak. A systematic review found increased mortality with vasopressors, but with limited evidence. It is suggested that fluid resuscitation should be preferred to vasopressors, although more research is needed.

The Foley catheter should be removed early if there is no urogenital injury, ideally on the first postoperative day except when the surgery involves the middle or lower rectum, where its removal is recommended between the third and sixth day to reduce the risk of urinary retention(18-21).

RESULTS

The diagnosis of intestinal injuries is based on a structured protocol that includes anamnesis, physical examination and complementary techniques such as radiography, FAST ultrasound, computed tomography and diagnostic laparoscopy, the latter being useful to avoid unnecessary laparotomies in stable patients. Management varies according to the hemodynamic stability of the patient: stable patients with blunt trauma can be observed with serial examinations, while unstable patients require immediate exploratory laparotomy. In penetrating injuries, surgery is a priority in unstable patients and conservative treatment is considered in stable patients under strict monitoring. Primary repair is adequate for minor injuries, while extensive injuries require resection or bypass. Early enteral nutrition after surgery has been shown to be safe and beneficial, favoring intestinal recovery and reducing complications such as ileus.

CONCLUSIONS

Traumatic bowel injuries constitute a diagnostic and therapeutic challenge due to the diversity of mechanisms, clinical manifestations and potential complications. Rapid and accurate evaluation, supported by imaging studies and standardized protocols, is key to deciding on appropriate management. Surgery remains the mainstay in unstable patients or with evidence of significant injury, while conservative management can be safely applied in certain stable patients. Early enteral nutrition is an essential component of postoperative care, contributing to better outcomes and lower morbidity. Finally, prognosis is conditioned by hemodynamic stability and timely detection of lesions, highlighting the importance of a multidisciplinary approach to optimize care.

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