

Short Communication

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Traumatic Colon Injury with Emphasis on the Diagnosis

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Abstract

The diagnosis of injury to the retroperitoneal colon (ascending and descending) is challenging and may be delayed due to its retroperitoneal location. Delay in the diagnosis of the retroperitoneal colon carries a high morbidity and mortality. The diagnosis involves understanding the mechanism of injury, clinical presentation, and using an appropriate diagnostic modality. This short communication describes epidemiology, embryology, applied anatomy, physiology, clinical, and radiological diagnoses. A brief description of the management as well as the complications is also given.

Keywords: Colon; Retroperitoneum; Penetrating and Blunt Trauma; CT Scan; Management; Complications

Introduction

Epidemiology

The colon is involved in about 27% of abdominal trauma and constitutes the 2nd most frequently injured organ, after the small bowel [1]. Injury to the colon includes blunt as well as penetrating trauma. Blunt injury constitutes about 13% of injuries, is less common than penetrating trauma [2] and results from motor vehicle accidents, assault, falls, and pedestrian trauma. Direct blow to the colon and seat belt injuries are also seen. The deceleration impact from these injuries leads to mesenteric tears and ischemic injury to the colon. In rare instances, contusion to the colonic wall may lead to a delayed colonic perforation several days following injury [3]. Penetrating trauma is caused by stab, high velocity or low velocity gunshot wounds and involves the right colon in 49% of cases, the left colon in 39% of cases, and both sides in 12% of the cases [4]. Iatrogenic perforating injury occurs following diagnostic and therapeutic endoscopic procedures in less than 1% of cases. Blunt injury is associated with injury to other abdominal organs such as the small gut, liver, spleen, and other regions of the body such as the head and the chest [5]. In blunt injury, the right or the ascending colon is commonly injured followed by the transverse colon or the sigmoid colon, and the left or the descending colon [6]. The injury to the colon is further classified as either partial or full thickness. Many of the injuries are partial thickness in nature [1].

Embryology

The primitive gut tube is produced from the endodermal roof of the yolk sac. In the third week of gestation the gut tube divides into the foregut, the midgut comprising of the right colon (the ascending colon), the cranial half of the transverse colon, and the hindgut, consisting of the caudal half of the transverse colon, and the left (the descending) colon. The midgut herniates out of the abdominal cavity transiently which is an important phase in the growth for acquiring length and correct positioning of its structures. The stages in the development of the midgut include physiologic herniation, the return to the abdomen of the herniated portion, and fixation.

Applied Anatomy

The large gut, including the anal canal, is 150 cm in length (59 inches). The ascending colon or the right colon originates at the ileo-cecal junction and ends at the hepatic flexure and is roughly about 15 cm in length. The anterior and lateral positions are covered by the peritoneum. The posterior part is fixed to the retroperitoneum by the fascia of Toldt. The descending or the left colon starts at the splenic flexure and is about 25 cm in length before it changes into the sigmoid colon. The diameter of the descending colon is smaller than the ascending colon. The peritoneal covering of the descending colon is like that of the ascending colon.

Blood Supply of the Colon

Arterial Supply

The colon receives its arterial blood supply from the superior and inferior mesenteric arteries (SMA & IMA); both of which arise from the anterior part of the aorta. The marginal artery of Drummond provides the collateral blood supply to the colon. The meandering mesenteric artery or arc of Riolan connects the SMA to the IMA. The presence of a large arc of Riolan suggests the obstruction to one of the main mesenteric arteries.

Venous Drainage

Venous drainage is into the superior and the inferior mesenteric veins which go on to form the portal vein.

Lymphatic Drainage

The wall of the large intestine is supplied by numerous lymphatic vessels that drain into groups of lymph nodes, matching arterial supply. There is communication between groups of lymph nodes at the level of the paracolic groups near the marginal arteries. In addition, dual drainage from distal transverse and splenic flexure ensues into the superior and the inferior mesenteric lymph nodes.

Innervation

The innervation follows the blood supply from both sympathetic and parasympathetic nervous system [7].

Physiology of the Large Gut

The large gut is accountable for handling chyme (indigestible material) after most nutrients are absorbed by the small gut. In addition, the large intestine absorbs water by osmosis (300-400 cc), electrolytes such as sodium via sodium channels, potassium is either secreted or absorbed via a concentration gradient induced by sodium, and chloride is exchanged for bicarbonate via an electrochemical gradient; creating and absorbing vitamins such as K and B with the help of a multitude of commensal organisms that live in the gut; and thrusting waste material forwards into the rectum for elimination. The ascending colon absorbs the left-over water and nutrients solidifying waste material and the descending colon stores the waste material eventually emptying it into the sigmoid colon. The large gut consists of serosal, muscular, submucosa, and mucosa. The muscle layer, in turn, consists of an outer longitudinal and an inner circular layer. The colon is endowed with two types of peristalses, namely, haustral and mass. Haustra are pouches that give the colon a segmented appearance and help to move material slowly forwards, which helps to absorb the remaining water and mass peristalsis which helps to move the left-over residue faster into the distal part of the gut [8].

Clinical Manifestation

Delay in the diagnosis of injury, especially to the retroperitoneal colon, results in an increase in morbidity and mortality. Therefore, it is imperative to pay attention to the mechanism of injury, elicit precise history, and perform good clinical examination.

Injury to the colon must be suspected following penetrating trauma to the chest, flank, abdomen, back, and below the nipple line (underneath the fourth intercostal space). Blunt trauma from a deceleration process may present as trauma to other internal organs as described above. Injured individuals may present with abdominal pain, abdominal distension form ileus, an entry wound in penetrating trauma, or bruising

in the case of blunt abdominal trauma, generalized abdominal tenderness, and rebound tenderness due to peritonitis, and absent bowel sounds when accompanied by ileus. Rectal examination may reveal blood [9].

Radiological Diagnosis

Plain Abdominal x-ray

An upright abdominal x-ray may show free air under the diaphragm, which indicates the perforation of a hollow viscus, and is not specific for injury to the colon [1].

Focused Assessment with Sonography in Trauma (FAST)

FAST is restricted to finding non-specific free intra-peritoneal fluid and is not helpful in diagnosing either injury to the hollow viscus or the extent of such an injury. Other limitations include the body habitus of the patient, the presence of free air, and bowel gas as well as the experience of the operator [10].

Diagnostic Peritoneal Lavage (DPL)

DPL may show elevated white blood cell count, increased alkaline phosphatase, bile, or fecal matter. It can also give false negative results especially in those with retroperitoneal perforation of the gut. The same limitations that are observed in FAST also apply to DPL.

Computerized Tomography (CT) Scan

It is the diagnostic procedure of choice in stable patients with blunt abdominal injury and for patients with penetrating injury to the back and flank undergoing nonoperative management. The most important CT findings in colon injury includes an injury track leading up to the injured bowel, free fluid, air outside the lumen of the gut, extravasation of the contrast, thick colon wall, mesenteric hematoma, mesenteric infiltrates, and discontinuity of the gut [11].

Laparoscopy

Advantage

Diagnosing penetration to the peritoneum when imaging study is equivocal, difficulty in diagnosing other injuries such as injury to the diaphragm on laparotomy.

Disadvantage

Retroperitoneal injuries can be missed with grave consequences.

Management

The management of colonic injury involves resuscitation using an adequate amount of crystalloid solutions to establish a perfusing blood pressure, whereas over aggressive use of such fluids leads to bowel edema, an increase in intraabdominal pressure, decreased mesenteric blood flow, and wound dehiscence [11]. The colon injury scale as shown in table 1 is used to quantify the risk of outcome after an injury including complications and is limited in use for optimal treatment [12].

Table 1: The colon injury scale

Grade (a)	Type of Injury	Description of Injury
I	Hematoma	Contusion or hematoma without devascularization
	Laceration	Partial thickness, no perforation
II	Laceration	Laceration < 50% of circumference
III	Laceration	Laceration ≥ 50% circumference without transection
IV	Laceration	Transection of the colon
V	Laceration	Transection of the colon with segmental tissue loss
	Vascular	Devascularized segment

a: Advanced grade I for multiple injuries up to grade III.

Surgical Options are as Follows

Penetrating Trauma

Non-destructive penetrating colon injury (wounds that involve less than 50% of the colon wall circumference without devascularization): Primary repair is suggested,

For destructive penetrating colon injury (wounds that involve 50% or greater of the colon wall circumference or occur with segmental devascularization): For those that do not have significant comorbidities and receive less than 6 units of blood, segmental resection with primary anastomosis is suggested.

For those who have significant comorbidities and have received more than 6 units of blood, a diversion procedure is suggested to prevent anastomotic leak [13].

Blunt Injuries

The clinical pathway is same as what is followed for penetrating trauma.

Complications

Complications following colonic trauma include anastomotic leaks, intraabdominal abscess, and wound infection. Antibiotic prophylaxis against aerobes and anaerobes is suggested to prevent septic complications following destructive colon injuries [4].

Conclusion

The colon is involved in blunt as well as penetrating trauma. Delay in the diagnosis to the retroperitoneal colon carries a high morbidity and mortality. Therefore, early diagnosis is needed for a good outcome. The CT scan is the diagnosis of choice in stable patients. The principles of management are

the same for blunt as well as penetrating colon injuries.

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References

1. Wolff BG, Pemberton JH, Wexner SD, et al. (2007) The ASCRS Textbook of Colon and Rectal Surgery. New York: Springer; 322-34.
2. Williams MD, Watts D, Fakhry S (2003) Colon injury after blunt abdominal trauma: results of the EAST multi-institutional hollow viscous injury study. *J Trauma*, 55: 906-12.
3. Ross SE, Cobean RA, Hoyt DB et al. (1992) Blunt colonic injury-a multicenter review. *J Trauma*, 33: 379-84.
4. Demetriades D, Murray JA, Chan L et al. (2001) Committee on Multicenter Clinical Trials. American Association for Surgery of Trauma. Penetrating colon injuries requiring resection: diversion or primary anastomosis? An ASST prospective multicenter study, *J Trauma*, 50: 765-75.
5. Cleary RK, Pomerantz RA, Lampman RM (2006) Colon and rectal injuries. *Dis Colon Rectum*, 49: 1203-22.
6. Sharpe JP, Magnotti LJ, Weinberg JA et al. (2013) Applicability of an established management algorithm for colon injuries following blunt trauma, *J Trauma Acute Care Surg*, 74: 419-24.
7. Galandiuk S, Netz U, Morpurgo E et al. (2021) colon and rectum. *Sabiston Textbook of Surgery*, Chapter 52: 1320-400.e1.
8. Azzouz LL, Sharma S (2023) Physiology, Large Intestine. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK507857/>
9. Croce MA, Fabian TC (2020) Colon and Rectum. In: Feliciano DV, Mattox KL, Moore EE. eds. *Trauma*, 9e. McGraw Hill.
10. Mohammadi A, Ghasmi-rad M (2012) Evaluation of the gastrointestinal injury in blunt abdominal trauma 'FAST is not reliable': the role of repeated ultrasonography. *World J Emerg Surg*, 7: 2.
11. Stafford RE, McGonigal MD, Weigel JA, et al. (1999) Oral contrast solution and computed tomography for blunt abdominal trauma: a randomized study. *Arch Surg*, 134: 662-6.
12. Moore EE, Cogbill TH, Malangoni MA, et al. (1990) Organ injury scaling, II: Pancreas, duodenum, small bowel, colon, and rectum. *J Trauma*, 30: 1427-9.
13. Sharpe JP, Magnotti LJ, Weinberg JA, et al. (2012) Adherence to a simplified management algorithm reduces morbidity and mortality after penetrating colon injuries: a 15-year experience. *J Am Coll Surg*, 214: 591-7.

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