

INTRODUCTION

Severe or major trauma is a worldwide pandemic and one of the leading causes of death and disability. Its distribution at global, national and local level differs, however. Trauma is very heterogeneous in terms of its underlying causes, the types of injuries and their severity, and is characterized by considerable prognostic uncertainty. The risk factors of trauma are related to human behavior and to sociosanitary, occupational, economic, political and cultural variables. Its management in turn depends on a broad range of structures, organizations and clinical and surgical specialties (*Baker et al., 1998*).

Polytrauma always involves young, productive individuals and represents a substantial burden on the society, from both financial view and human perspectives. The presence of multiple injuries leading to significant disability with decreased chance of a return to work and thus significant effect on economic state (*Soreide, 2009*).

The two leading causes of mortality in polytrauma patients are neurological injuries and bleeding. Specifically, hemorrhage is responsible for 80% of all deaths that occur within the first few hours (*Kauvar et al., 2005*).

In a study that included 151,609 individuals. Participants reported whether they experienced injuries within the past 12 months that limited normal activities. Overall, 5979 participants

(3.9% of study population) reported at least one non-fatal injury. Total number of non-fatal injuries was 6300: 1428 were caused by RTAs (22.7%), 1948 by falls (30.9%) and 2924 by other causes (46.4%) (**Raina et al., 2015**).

Polytrauma patients may be saved with good triage system and focused trauma specialist and well-trained team care in dedicated institutions. Polytrauma care is needed more resources for intensive massive resuscitation treatment, high imaging, many operations, available intensive care unit (ICU) bed and stays with complex rehabilitation programs (World Health Organisation. Global status report on road safety, time for action (**Population, 2008**)).

The recent guidelines on management of traumatized patients due to either road traffic accidents or any other cause of trauma, generally emphasizes the importance of identifying and prioritizing the most serious life-threatening injuries and managing them. Management consists of a rapid primary survey, resuscitation of vital functions, a more detailed secondary survey, and, finally, the initiation of definitive care.

A quick primary survey on the body's most vital functions should be carried out at first and accordingly, the proper resuscitative measures should be taken. The primary survey should be repeatedly performed to detect and treat any deterioration in vital functions.

Thorough head to toe examination should be done afterwards with re-assessment of vital signs. Secondary survey is important as it can point to missed injuries that may be potentially life threatening. Full neurological and orthopedic assessment is done. Radiological imaging and laboratory tests are done at this stage for further diagnosis and preparation for definitive treatment (*American College of Surgeons, 2012*).

AIM OF THE WORK

Aim is to detect the incidence and the pattern of intra-abdominal injuries in polytraumatized patients admitted to the general surgery department at El-Demerdash Hospital and to estimate the trauma burden in General Surgery Department Ain Shams University.

Chapter 1

ANATOMY OF ABDOMINAL ORGANS

Liver

The liver is the largest organ in the body, weighing approximately 1500 g. It resides in the right upper abdominal cavity beneath the diaphragm and is protected by the rib cage. It is reddish brown and is surrounded by a fibrous sheath known as Glisson's capsule. The liver is held in place by several ligaments (**Fig. 1**). The round ligament is the remnant of the obliterated umbilical vein and enters the left liver hilum at the front edge of the falciform ligament. The falciform ligament separates the left lateral and left medial segments along the umbilical fissure and anchors the liver to the anterior abdominal wall.

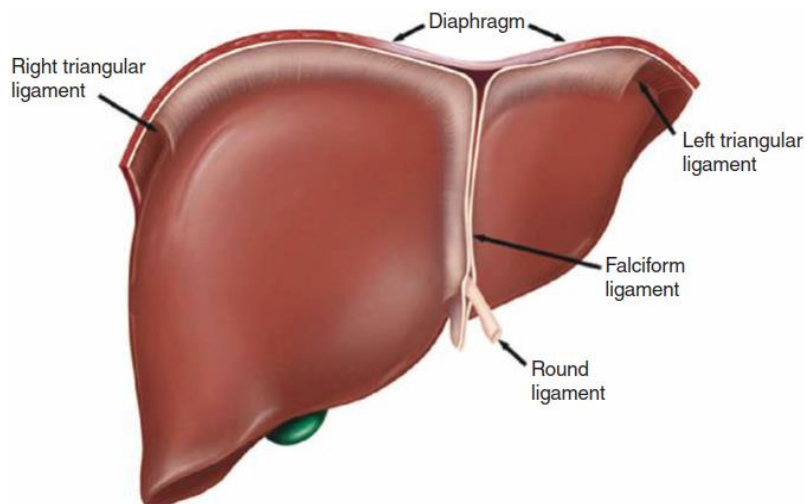


Figure (1): Hepatic ligaments suspending the liver to the diaphragm and anterior abdominal wall. (Charles et al., 2015)

Deep in the plane between the caudate lobe and the left lateral segment is the fibrous ligamentum venosum (Arantius' ligament), which is the obliterated ductus venosus and is covered by the plate of Arantius. The left and right triangular ligaments secure the two sides of the liver to the diaphragm. Extending from the triangular ligaments anteriorly on the liver are the coronary ligaments. The right coronary ligament also extends from the right undersurface of the liver to the peritoneum overlying the right kidney, thereby anchoring the liver to the right retroperitoneum. These ligaments (round, falciform, triangular, and coronary) can be divided in a bloodless plane to fully mobilize the liver to facilitate hepatic resection. Centrally and just to the left of the gallbladder fossa, the liver attaches via the hepatoduodenal and the gastrohepatic ligaments **(Fig. 2) (Abdalla et al., 2002).**

The hepatoduodenal ligament is known as the porta hepatis and contains the common bile duct, the hepatic artery, and the portal vein. From the right side and deep (dorsal) to the porta hepatis is the foramen of Winslow, also known as the epiploic foramen. This passage connects directly to the lesser sac and allows complete vascular inflow control to the liver when the hepatoduodenal ligament is clamped using the Pringle maneuver **(Bismuth et al., 1982).**

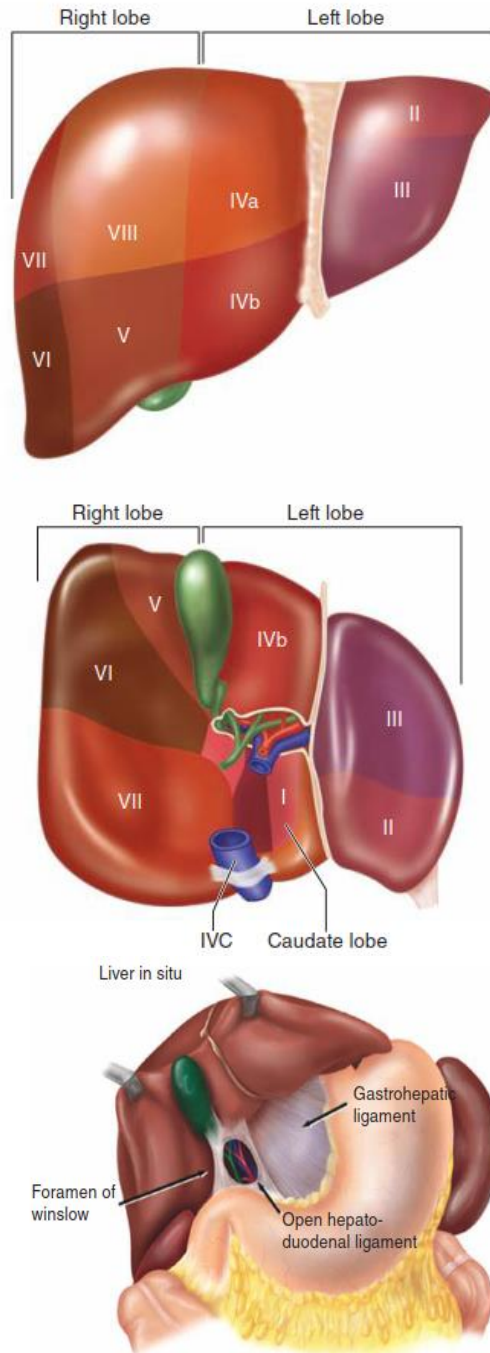


Figure (2): Couinaud's liver segments (I through VIII) numbered in a clockwise manner. The left lobe includes segments II to IV, the right lobe includes segments V to VIII, and the caudate lobe is segment I. IVC = inferior vena cava. (Abdalla et al., 2002)

Spleen

The abdominal surface of the diaphragm separates the spleen from the lower left lung and pleura and the ninth to eleventh ribs. The visceral surface faces the abdominal cavity and contains gastric, colic, renal, and pancreatic impressions.

Spleen size and weight vary with age, with both diminishing in the elderly and in those with underlying pathologic conditions. The average adult spleen is 7 to 11 cm in length and weighs 150 g (range, 70 to 250 g).

The spleen's superior border separates the diaphragmatic surface from the gastric impression of the visceral surface and often contains one or two notches, which are particularly pronounced when the spleen is greatly enlarged.

Of particular clinical relevance, the spleen is suspended in position by several ligaments and peritoneal folds to the colon (splenocolic ligament), the stomach (gastrosplenic ligament), the diaphragm (phrenosplenic ligament), and the kidney, adrenal gland, and tail of the pancreas (splenorenal ligament). The gastrosplenic ligament contains the short gastric vessels; the remaining ligaments are avascular, with rare exceptions, such as in patients with portal hypertension. The relationship of the pancreas to the spleen also has important clinical implications (*McClusky et al., 1999*).

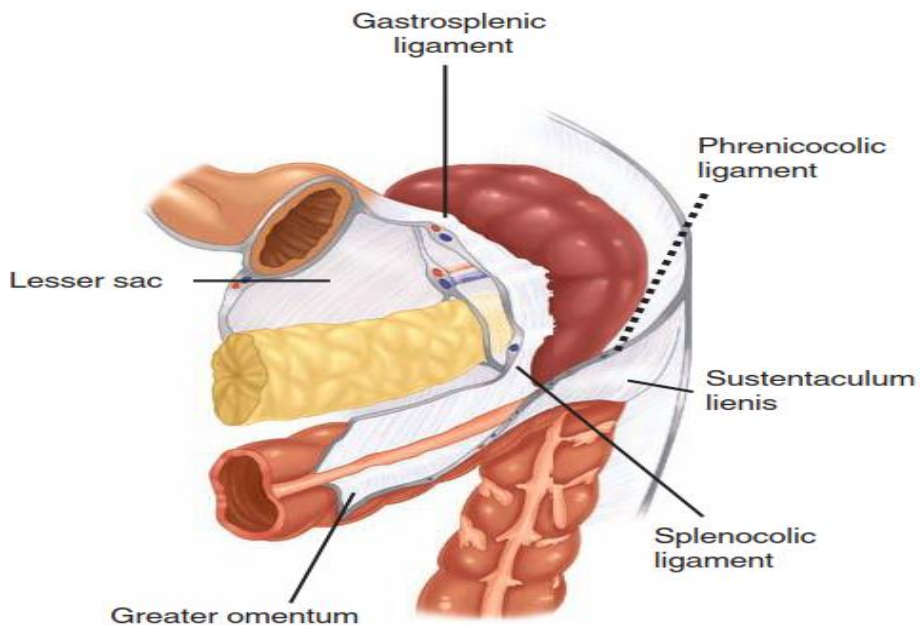


Figure (3): Small & large bowel (Charles et al., 2015)

The small intestine is a tubular structure that extends from the pylorus to the cecum. The estimated length of this structure varies depending on whether radiologic, surgical, or autopsy measurements are made. In the living, it is thought to measure 4 to 6 m. The small intestine consists of three segments lying in series: the duodenum, the jejunum, and the ileum.

The duodenum, the most proximal segment, lies in the retroperitoneum immediately adjacent to the head and inferior border of the body of the pancreas. The duodenum is demarcated from the stomach by the pylorus and from the jejunum by the ligament of Treitz. The jejunum and ileum lie within the peritoneal cavity and are tethered to the retroperitoneum by a broad-based mesentery. No distinct anatomic landmark

demarcates the jejunum from the ileum; the proximal 40% of the jejunoileal segment is arbitrarily defined as the jejunum and the distal 60% as the ileum. The ileum is demarcated from the cecum by the ileocecal valve.

The small intestine contains internal mucosal folds known as plicae circulares or valvulae conniventes that are visible upon gross inspection. These folds are also visible radiographically and help in the distinction between small intestine and colon, which does not contain them, on abdominal radiographs. These folds are more prominent in the proximal intestine than in the distal small intestine. Other features evident on gross inspection that are more characteristic of the proximal than distal small intestine include larger circumference, thicker wall, less fatty mesentery, and longer vasa recta (Fig. 28-1). Gross examination of the small-intestinal mucosa also reveals aggregates of lymphoid follicles. Those follicles, located in the ileum, are the most prominent and are designated Peyer's patches (*McMinn et al., 1994*).

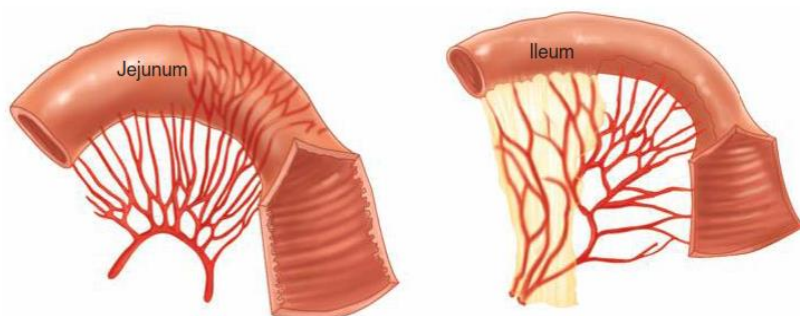


Figure (4): Gross features of jejunum contrasted with those of ileum. Relative to the ileum, the jejunum has a larger diameter, a thicker wall, more prominent plicae circulares, a less fatty mesentery, and longer vasa recta. (*Tran et al., 2007*)

Most of the duodenum derives its arterial blood from branches of both the celiac and the superior mesenteric arteries. The distal duodenum, the jejunum, and the ileum derive their arterial blood from the superior mesenteric artery. Their venous drainage occurs via the superior mesenteric vein. Lymph drainage occurs through lymphatic vessels coursing parallel to corresponding arteries. This lymph drains through mesenteric lymph nodes to the cisterna chyli, then through the thoracic duct, and ultimately into the left subclavian vein. The parasympathetic and sympathetic innervation of the small intestine is derived from the vagus and splanchnic nerves, respectively.

The large intestine extends from the ileocecal valve to the anus. It is divided anatomically and functionally into the colon, rectum and anal canal. The wall of the colon and rectum comprise five distinct layers: mucosa, submucosa, inner circular muscle, outer longitudinal muscle, and serosa. In the colon, the outer longitudinal muscle is separated into three teniae coli, which converge proximally at the appendix and distally at the rectum, where the outer longitudinal muscle layer is circumferential. In the distal rectum, the inner smooth muscle layer coalesces to form the internal anal sphincter. The intraperitoneal colon and proximal one-third of the rectum are covered by serosa; the mid and lower rectum lack serosa.

Colon Landmarks. The colon begins at the junction of the terminal ileum and cecum and extends 3 to 5 feet to the rectum. The rectosigmoid junction is found at approximately the level of

the sacral promontory and is arbitrarily described as the point at which the three teniae coli coalesce to form the outer longitudinal smooth muscle layer of the rectum. The cecum is the widest diameter portion of the colon (normally 7.5–8.5 cm) and has the thinnest muscular wall. As a result, the cecum is most vulnerable to perforation and least vulnerable to obstruction.

The ascending colon is usually fixed to the retroperitoneum. The hepatic flexure marks the transition to the transverse colon. The intraperitoneal transverse colon is relatively mobile, but is tethered by the gastrocolic ligament and colonic mesentery. The greater omentum is attached to the anterior/superior edge of the transverse colon. These attachments explain the characteristic triangular appearance of the transverse colon observed during colonoscopy. The splenic flexure marks the transition from the transverse colon to the descending colon. The attachments between the splenic flexure and the spleen (the lienocolic ligament) can be short and dense, making mobilization of this flexure during colectomy challenging. The descending colon is relatively fixed to the retroperitoneum. The sigmoid colon is the narrowest part of the large intestine and is extremely mobile. Although the sigmoid colon is usually located in the left lower quadrant, redundancy and mobility can result in a portion of the sigmoid colon residing in the right lower quadrant. This mobility explains why volvulus is most common in the sigmoid colon and why diseases affecting the sigmoid colon, such as diverticulitis, may occasionally present as right-sided abdominal pain.

The narrow caliber of the sigmoid colon makes this segment of the large intestine the most vulnerable to obstruction (*Tran et al., 2007*).

Chapter 2

EPIDEMIOLOGY OF ABDOMINAL TRAUMA

Traumas are the third most frequent cause of death in the general population, after cardiovascular disease and cancer. In the subgroup of adult patients under 40 years of age, traumas are the main cause of death (*Tentillier and Masson, 2000*).

A trimodal distribution of death is noted: 50% of deaths are estimated to occur at the scene of the accident, mainly due to severe vessel lesions and cerebral injuries. Approximately 30% of deaths take place within the first 24 h, secondary to hemorrhagic shock or severe cranial trauma. Finally, 20% of deaths occur in the following days or weeks, due to infections or multiple organ failure (MOF) (*Trunkey 1991; ATLS, 1994*).

Although hemorrhagic shock constitutes the major therapeutic challenge in the management of the patient during the first hours following an abdominal trauma, mortality may vary owing to a variety of factors:

- The cause of the abdominal lesion, with a mortality rate estimated to range from 10 to 30% for abdominal contusions, from 5 to 15% for injuries caused by firearms, and from 1 to 2% for cold-weapon injuries (*Cayten, 1984*).
- The type of organ involved, the severity of the lesion, and the number of intra-abdominal organs affected, with

mortality rates estimated at 6% for isolated liver traumas, 15% for three-organ involvement, and 50 and 70% for four- and five-organ involvement, respectively (**Carretier et al., 1991**).

- The coexistence of extra-abdominal lesions. The most commonly accepted definition of a polytraumatized patient is that of a severely injured patient presenting with two or more traumatic lesions, with at least one being life-threatening. This concept of polytraumatism is an independent prognostic factor of mortality.
- The patient's age and medical history.
- The rapidity and the quality of the patient's diagnostic and therapeutic management. Several studies have investigated the causes of death in the field of traumatology, with a subgroup analysis of evitable deaths. A study performed a chronological analysis of 623 cases of trauma-induced death to determine whether death could have been avoided by an optimal environment. This evaluation was based on the severity of lesions, the moment of death, the principal cause of death, and factors contributing to death. The evaluation was carried out according to the chronology of events: accident prevention, discovery of the injured person, prehospital management, occurrence of secondary lesions, and medical and paramedical errors. From the study results, it appears that three quarters of all deaths could have been prevented, which, in North America,