Introduction

Duodenal injury is one of the uncommon but serious surgical emergencies due to its deep and retroperitoneal relatively protected anatomical site which is surrounded by many nearby organs so; duodenal injury is rarely an isolated injury. Duodenal injuries from three to five percent of all abdominal injuries but nowadays seen more and more frequently due to the increased road traffic accidents. Literature focuses on the exact management of various cases of duodenal injuries which may lead to high mortality rate. **(Chen and Yang., 2011).**

Duodenal injuries may be due to traumatic or non-traumatic causes. in traumatic causes significant force must be applied to the area to result in injury. Forces resulting in compression of the duodenum between the spinal column and a fixed object such as a seatbelt, is well documented to cause injury to the duodenum. Perhaps less widely recognized, mechanism of duodenal injury is the result of a sudden blow to the epigastrium. These injuries are frequently the result of a direct assault such as a punch or a kick. In young children, child abuse or non-accidental trauma is the most common type of assault. therefore, non-accidental trauma is a frequent, potentially underrecognized, cause of duodenal trauma in young children. Traumatic injuries include also penetrating injury:

gunshot, knife, iatrogenic injury e.g. during ERCP, open or labroscopic operations. Non traumatic (pathological)injuries may be due to perforated peptic ulcer, duodenal divertculum and its complications**. (Barbara et al.,2004).**

The anatomical site of the duodenum as a retroperitoneal organ and its relation to many vital structure such as inferior vena cava(IVC), portal vein, common bile duct(CBD), hepatic artery and pancreas with the passage of bile and pancreatic juice into the duodenum consider the main obstacle for the management of duodenal injuries with the increase of its complicated death rate. **(Rathore et al., 2007).**

In the last decade management has shifted toward a more selective approaches even some authors advocate non-surgical management to some cases, others advocate mandatory surgical exploration. Non operative treatment is feasible for patients in good general condition and in good local circumstances without evolved peritonitis with a high success rate but many precautions must be thought of and close observation is highly important.in patients with low grade duodenal injuries or injuries that are detected early, simple closure is the standard method, patients with sever duodenal injuries may require more sophisticated repair if suture wound dehiscence is expected especially if combined with pancreatic injury. Laparoscopy is a

safe and feasible method for patient with duodenal injuries less than 24hours and without associated complications with a high success rate but it should be used selectively, reversing the traditional open approach for patients presenting with shock and symptoms more than 24hours.**(Mouly et al., 2013)**

AIM OF THE WORK

The aim of this work is to clarify the different options availableformanagementof different cases of duodenal injuries in the hope to decrease the rate of morbidity and improve the outcome.

Review of literature

Embryology of the duodenum:

The duodenum develops from the terminal part of foregut and the cephalic part of midgut. The junction of the two parts is directly distal to the origin of the liver bud.**(sadler 2006)**.

As the stomach rotates, the duodenum takes on the form of a C -shaped loop and rotates to the right. This rotation, together with rapid growth of the head of the pancreas, swings the duodenum from its initial midline position to the left side of the abdominal cavity.**(sadler 2006)**.

The duodenum and the head of the pancreas press against the dorsal body wall, and the right surface of the dorsal mesoduodenum fuses with the adjacent peritoneum. Both layers subsequently disappear, and the duodenum and the head of the pancreas become fixed in a retroperitoneal position.**(sadler 2006)**.

The dorsal mesoduodenum disappears entirely except in the region of the pylorus of the stomach, where a small portion of the duodenum retains its mesentery and remains intraperitoneal. **(sadler 2006)**.

During the 2nd month, the lumen of the duodenum becomes obliterated by the cells in its walls. However, the lumen is recanalizecl shortly thereafter.**(Sadler 2006)**.

Since the foregut is supplied by the **cephalic artery** and the midgut is supplied by the **superior mesenteric artery,** the duodenum is supplied by branches of both arteries. **(Sadler 2006)**

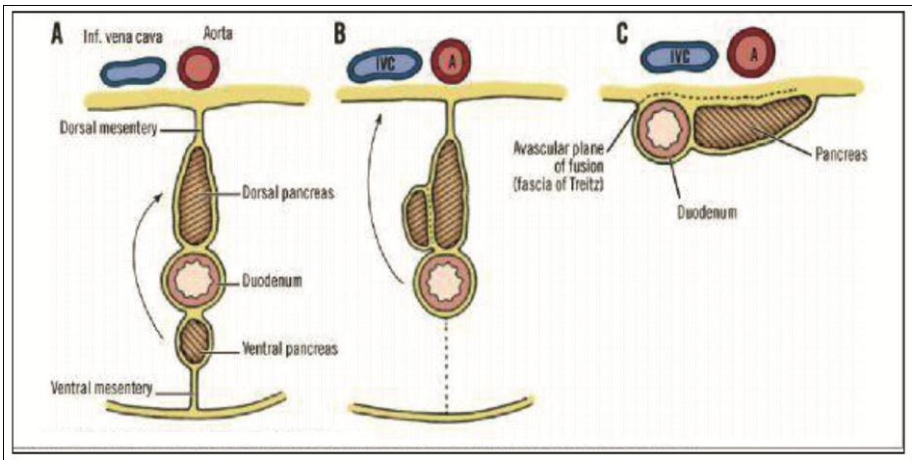

Fig.(1): Embryology of duodenum (rotation of the duodenum)(skandalakis et al.,1989)

Anatomy of the Duodenum

The duodenum curves in a C around the head of the pancreas and is 10 inches (25 cm) long. At its origin from the pylorus it is completely covered with peritoneum for about 1inch (2.5 cm), but then becomes a retroperitoneal organ, only partially covered by serous membrane.(**Standring .,2004)**

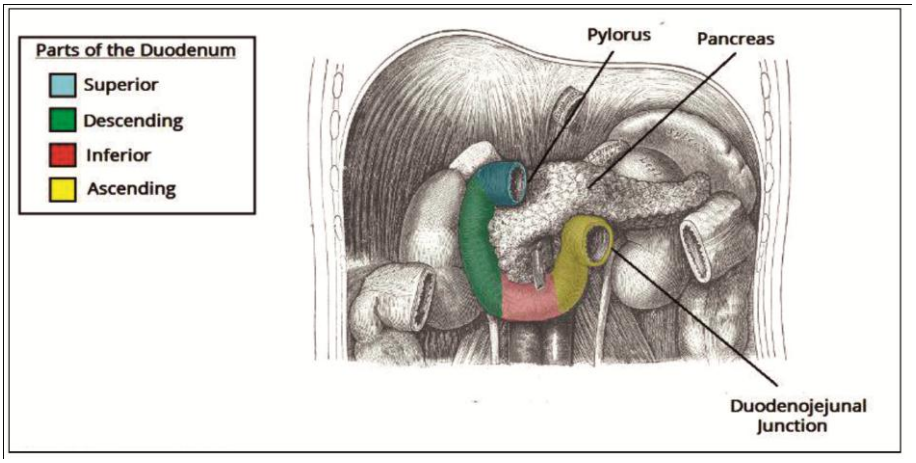

Fig.(2) : Parts of the duodenum. (skandalakis et al.,1989)

Relations:

For descriptive purposes, the duodenum is divided into four sections. The first part (2 inches (5 cm)) ascends from the gastroduodenal junction, overlapped by the liver and gallbladder. Immediately posterior to it lie the portal vein, common bile duct and gastroduodenal artery which separateit from the inferior vena cava.(**Standring .,2004).**

The second part [3 inches (7.5 cm)] descends in a curve around the head of the pancreas. It is crossed by the transverse colon and lies on the right kidney and ureter. Halfway along, its posteromedial aspect enters the common opening of the bile duct and main pancreatic duct (ofWirsung) on to an eminence called the duodenal papilla. Thiscommon opening is guarded by the sphincter of Oddi. (**Standring .,2004).**

The subsidiary pancreatic duct (of Santorini) opens into the duodenum a little above the papilla.(**Standring .,2004)**.

The third part (4 inches (10 cm)) runs transversely to the left, crossing the inferior vena cava, the aorta and the third lumbar vertebra. It is itself crossed anteriorly by the root of the mesentery and the superior mesenteric vessels. Its upper border hugs the pancreatic head.(**Standring .,2004)**.

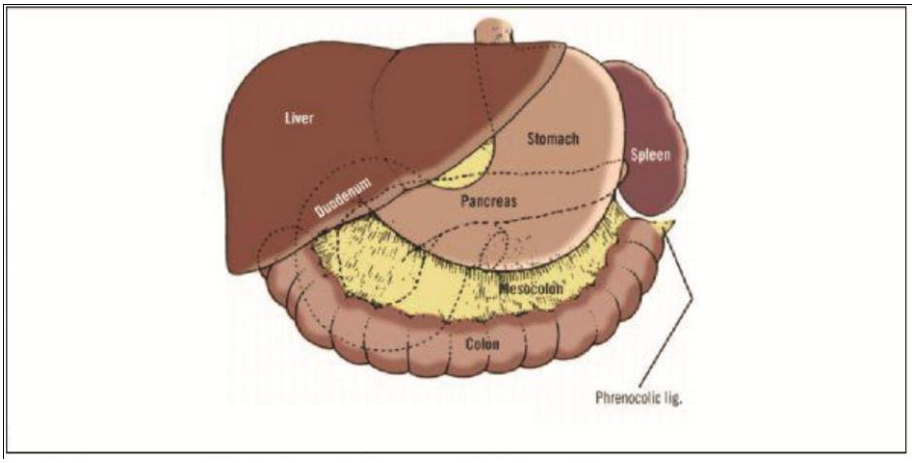

Fig. (3): The relations of the duodenum (Skandalakis et al., 1989)

The fourth part (1 inch (2.5 cm)) ascends upwards and to the left to end at the duodenojejunal junction. It is surprisingly easy for the surgeon to confuse this with the ileocaecal junction. He confirms the identity of the duodenal termination by the presence of the suspensory ligament of Treitz, which is a well-marked peritoneal fold descending from the right crus of the diaphragm to the duodenal termination, and by visualizing

the inferior mesenteric vein which descends from behind the pancreas immediately to the left of the duodenojejunal junction.(**Standring .,2004)**

Vascular supply:

Arteries:

The main vessels supplying the duodenum are the superior and inferior pancreaticoduodenal arteries. The first and second parts also receive contributions from several sources including the right gastric artery, the supraduodenal artery, the right gastroepiploic artery, the hepatic artery and the gastroduodenalartery. Branches of the superior pancreaticoduodenal artery may contribute to the supply of the pyloric canal, with some anastomosis in the muscular layer across the pyloroduodenal junction. **(Standring 2004).**

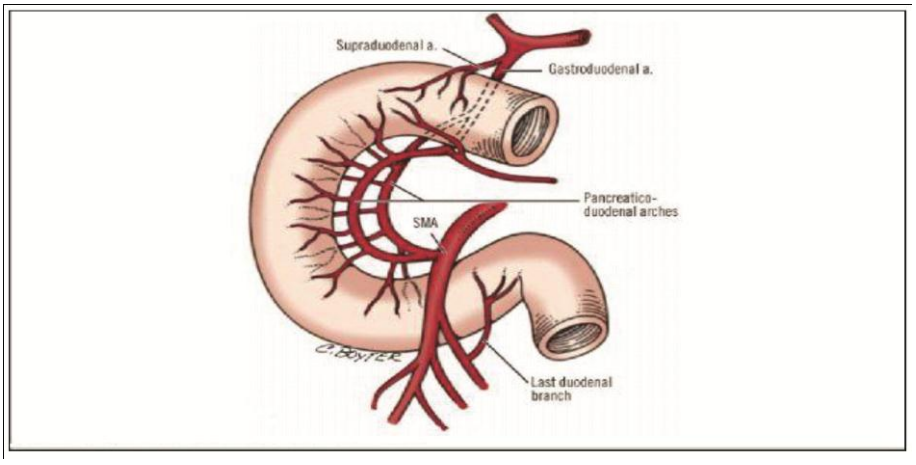

Fig. (4):Majorarterial blood supply of duodenum (Skandalakis et al., 1989).

Gastroduodenal artery:

The gastroduodenal artery arises from the common hepatic artery behind, or sometimes above, the first part of the duodenum. It is of moderately large caliber and descends between the first part of the duodenum and the neck of the pancreas, immediately to the right of the peritoneal reflection from the posterior surface of the first part. It usually lies to the left of the common bile duct but is occasionally anterior. At the lower border of the first part of the duodenum it divides into the right gastroepiploic and superior pancreaticoduodenal arteries. Before its division the lowest part of the artery gives rise to small branches that supply the pyloric end of the stomach and the pancreas, and retroduodenal branches that supply the first part and the proximal portion of the second part of the duodenum directly. The supraduodenal artery often arises from the gastroduodenal artery behind the upper border of the first part of the duodenum andsupplies the superior aspect of the first part. Although the gastroduodenalartery usually branches from the common hepatic artery it may also arise as a trifurcation with the right and left hepatic arteries. Occasionally the origin is from the superior mesenteric artery or the left hepatic artery, and rarely it may arise from the coeliac axis and right hepatic artery.

The supraduodenal artery occasionally arises from the common hepatic artery or right gastric artery. **(Standring2004).**

Superior pancreaticoduodenal artery:

The superior pancreaticoduodenal artery is usually double. The anterior artery is a terminal branch of the gastroduodenal artery and descends in the anterior groove between the second part of the duodenum and the head of the pancreas. It supplies branches to the first and second parts of the duodenum and to the head of the pancreas, and anastomose with the anterior division of the inferior pancreaticoduodenal artery. The posterior artery is usually a separate branch of the gastroduodenal artery and is given off at the upper border of the first part of the duodenum. It descends to the right, anterior to the portal vein and common bile duct as the latter lies behind the first part of the duodenum. It then runs behindthe head of the pancreas, crosses posterior to the common bile duct (which is embedded in the head of the pancreas), enters the duodenal wall and anastomose with the posterior division of the inferior pancreaticoduodenal artery. The posterior artery supplies branches to the head of the pancreas, the first and second parts of the duodenum, and several branches to the lowest part of the common bile duct. **(Standring 2004)**

Inferior pancreaticoduodenal artery:

The inferior pancreaticoduodenal artery arises from the superior mesenteric artery or its first jejunal branch, near the superior border of the third part of the duodenum. It usually divides directly into anterior and posterior branches. The anterior branch passes to the right, anterior to the lower border of the head of the pancreas, and runs superiorly to anastomose with the anterior superior pancreaticoduodenal artery. The posterior branch runs posteriorly and superiorly to the right, lying posterior to the lower border of the head of the pancreas, and anastomosis with the posterior superior pancreaticoduodenal artery. Both branches supply the pancreatic head, its uncinate process and the second and third parts of the duodenum.**(Standring 2004)**

Jejunal artery branches:

The first jejunal branch of the superior mesenteric artery has branches that supply the fourth part of the duodenum. They frequently form anastomosis with the terminal branch of the anterior inferiorpancreaticoduodenal artery, which means that the fourth part of the duodenum has a potential collateral supply from the celiac axis and superior mesenteric artery and so is not commonly affected by ischemia. **(Standring 2004).**

Veins:

The duodenal veins drain ultimately into the portal vein. Submucosal and intramural veins give rise to pancreaticoduodenal veins that usually accompany the corresponding named arteries.Thesuperiorpancreaticoduodenal vein is formed medial to the mid point of the second part of the duodenum. It runs superomedially on the posterior surface of the head of the pancreas, passes posterior to the distal common bile duct and drains into the portal vein behind the neck of the pancreas. The inferior pancreaticoduodenal vein runs from the anteromedial aspect of the second part of the duodenum inferiorly in the groove between the second and third parts and the head of the pancreas. It usually drains into the superior mesenteric vein but may drain into the right gastroepiploic vein. Small veins from the first and upper second part of the duodenum may drain into the prepyloric vein whilst veins from the third and fourth parts may drain directly into the superior mesenteric vein. **(Standring 2004).**

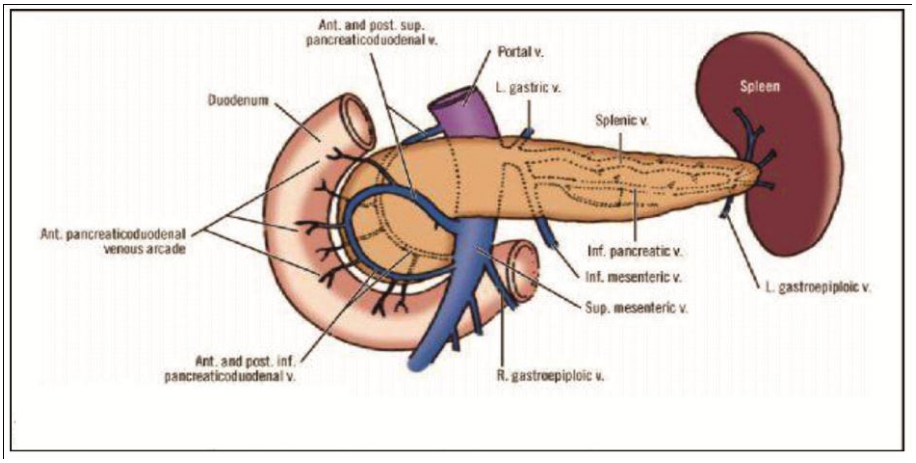

Fig. (5):Veinousdrainge ant view (Skandalakis et al., 1989)

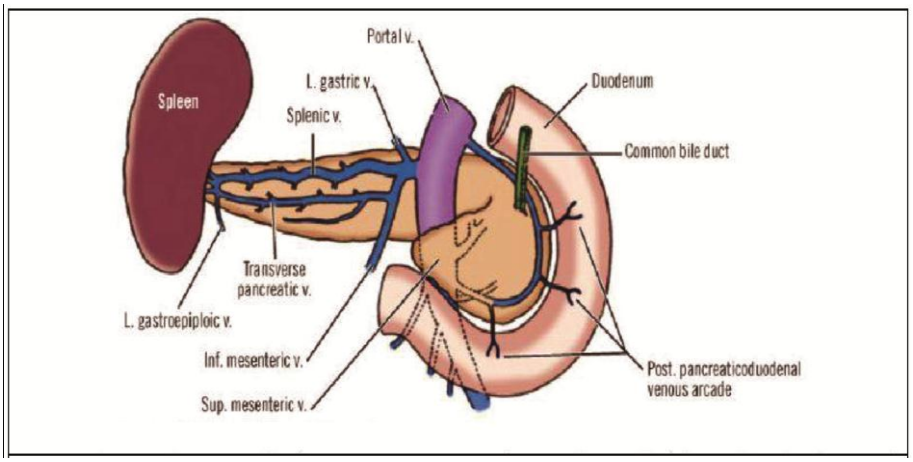

Fig. (6):Veinousdrainge post view (Skandalakis et al., 1989)

Lymphatics:

Duodenal lymphatics run to anterior and posterior pancreatic nodes that lie in the anterior and posterior grooves between the pancreatic head and the duodenum. These drain widely into the suprapyloric, infrapyloric, hepatoduodenal, common hepatic and superior mesenteric nodes. **(Standring 2004)**

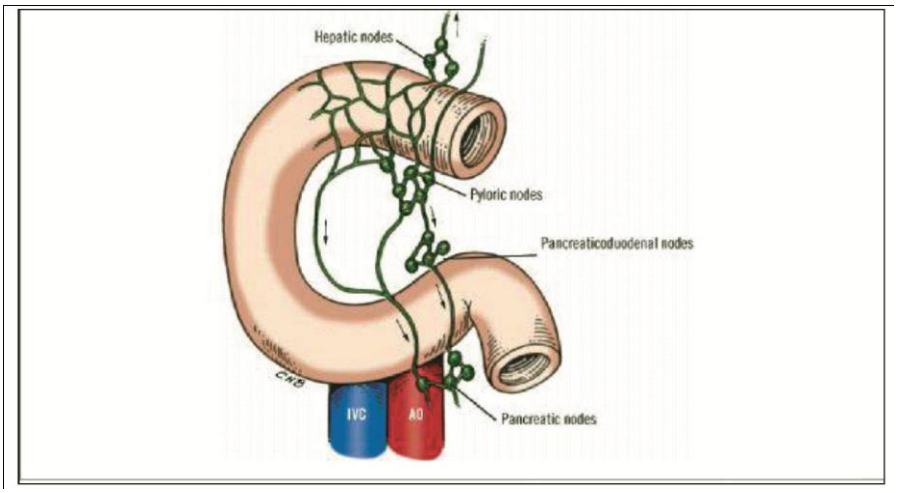

Fig. (7):Diagrammatedpresentation of lymph drain(Skandalakis et al., 1989)

Innervation:

The duodenum is innervated by the parasympathetic and sympathetic systems. Preganglionic sympathetic fibers originate from neurones in the fifth to the twelfth thoracic spinal segments and travel via the greater and lesser splanchnic nerves to the coeliac plexus where they synapse on neurones in the coeliac