An Unusual Case of Devastating Isolated Duodenal Injury treated by Emergency Whipple’s Procedure: Possible Explanation

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Abstract
Pancreatic duodenal injuries have high mortality and morbidity rates, owing to the unforgiving nature of the involved organs, particularly the pancreas, and the difficult procedures required for repair. In this report we describe the clinical course of a patient who sustained a devastating injury to the duodenum with separation of the pancreatic head, following a car accident. He was managed by emergent Whipple’s procedure with a successful outcome. This is one of a few published reports on emergency pancreatoduodenectomy in the setting of trauma. Additionally, we question the mechanism of such injury, which spared the contagious pancreatic head.

Introduction
Blunt duodenal injuries are rare with an estimated incidence of 0.2% of trauma cases, and are usually associated with injuries to neighbouring structures. Out of 30 cases of traumatic rupture of the duodenum, isolated injury was found in only three [1]. Lying in the concavity of the duodenum, the pancreatic head is most likely involved in such cases.

Case Report
A 22-year-old non restrained male driver was brought to the emergency room after involvement in a vehicular accident. On examination, he was fully conscious and haemodynamically stable, but in severe pain. There was a superficial wound in the forehead and the chest and heart examinations were normal. Abdominal examination showed severe tenderness with board like rigidity, especially in the right upper quadrant.

His haemoglobin was 12.8 gm/dl, and the blood biochemistry including urea, creatinine and electrolytes were normal.

A supine chest X ray was normal and CT scan showed a full stomach with air anterior to the right kidney, aorta and inferior vena cava (Figures 1 and 2).

A presumptive diagnosis of duodenal rupture was made and the patient was prepared for an exploratory laparotomy.

On entering the abdomen, a big amount of frothy bile-stained fluid was found in the right upper quadrant below the liver, and the duodenum appeared severely damaged with a bursting injury, especially in the second part. Additionally, after Kocherization, the head of the pancreas appeared few mm apart from the C loop of the duodenum (Figure 3), and bile continued to pour in the area, apparently from a severed retroduodenal common bile duct. The whole retroperitoneum in the area was bathed in frothy bile.

After considering the extent of the injury, a decision to perform an emergency pancreatoduodenectomy, seemed most appropriate. After resection, continuity was restored in a Roux Y fashion (Figure 4) and the procedure was concluded with the construction of a feeding jejunostomy and drains were inserted.

Postoperatively, somatostain was started in a dose of 200 µg subcutaneously every 8 hours. Apart from bile leak which started on the first post operative day, the patient showed steady recovery. On the third postoperative day, feeding through the feeding jejunostomy was started and gradually oral feeding was introduced. MRCP, US scan and a gastro
Figure 3: Diagrammatic representation. Burst type of injury involving the duodenum and causing separation of the head of the pancreas from the C loop (green zone).

Figure 4: Diagrammatic representation. Restoration of the bowel continuity in Roux en Y fashion with hepaticojejunostomy, gastrojejunostomy and pancreaticojejunostomy.

graftin study showed no free intraperitoneal collection and no bile leak could be demonstrated. After two weeks, bile leak ceased, when the drain was removed and the patient was discharged in good condition for outpatient follow up. Four years later, he presented with diffuse colicky abdominal pain and X ray showed dilated small bowel loops, suggestive of adhesive bowel obstruction. As the condition failed to respond to conservative treatment, exploration was performed. At laparotomy, a band was found strangling a loop of the terminal ileum. The band was divided and the gangrenous loop was excised with primary anastomosis. Thereafter, the patent was discharged in good condition and remains well.

Discussion

Although the extent of pancreatic duodenal injuries may mandate a Whipple's procedure [2], this is a rare encounter and lesser techniques should be considered first. For duodenal injuries, debridement and suture repair [3-6] with or without pyloric exclusion have been utilized with success [7]. Cases with substance loss have been managed by pedicled ileal loop to bridges duodenal defects [8]. Additionally, duodenal diverticulization and triple tube technique have proved useful tools in the surgeon's armamentarium. As for pancreatic injuries, the choice of the procedure depends on the location of the injury, the integrity of the pancreatic duct, the stability of the patient and the presence of associated injuries. The range of procedures includes drainage alone, insertion of pancreatic duct stent through ERCP, distal pancreatectomy with or without splenectomy, pancreatectojejunostomy and at the end of the scale, pancreateoduodenectomy [9]. Although the diagnosis may be difficult, the presence of retroperitoneal haemtoma [8] or air [5] in the region of the duodenum on CT scan, is highly suggestive of duodenal injury, as was seen in our patient.

Whipple's procedure is a major undertake when performed for selected patients in the elective setting. The task becomes even more formidable when performed for trauma, where patient selection is not an option.

In this regard, the procedure has been rarely performed for injuries resulting from vehicular accidents. In their report on 301 consecutive patients who underwent Whipple's procedure, Standop et al. found only 6 cases done as an emergency procedure and none was performed for a vehicular injury [10]. In another report on 48 cases with blunt major pancreatic injury, only two underwent pancreatectoduodenectomy, with one (50%) mortality rate [9].

Although rarely performed, pancreaticoduodenectomy for combined pancreatic and duodenal injuries is a well established tool in the surgeon's armamentarium [11]. However, with better understanding of the anatomy of the pancreatectoduodenal region, pancreas sparing duodenectomy could be performed for a variety of causes, including isolated devastating duodenal injury [12]. In this technique, the duodenum is first separated from the pancreas and resected, with careful preservation of the blood supply. Bowel continuity is then restored by gastrojejunostomy and the pancreatic and bile ducts are anastomosed to the jejunum. This may be accomplished by a variety of ways. If the portion of the duodenal wall containing the papilla remains intact, it could be anastomosed to the jejunum. Alternatively, the isolated papilla with a fringe of the surrounding douodenal wall could be reimplanted into the jejunum or, as the third option, the bile and pancreatic ducts could be separately anastomosed to the jejunum [12]. In the case presented here, a standard Whipple's procedure was performed for two reasons. Firstly, despite the apparently intact pancreatic head, possible ischaemic injury, resulting from its separation from the duodenum, could not be absolutely excluded. Secondly, the author is more comfortable with a standard procedure than a pancreatic preserving duodenectomy.

The mechanism of injury in the patient presented here deserves a special note. Generally, the mechanism of duodenal injury in trauma patients is largely speculative. Anteroposterior compression of the duodenum against the spine is the preferred explanation. Another proposed mechanism is that deceleration generated by the impact, creates inertial stresses between the moving duodenum and related structures with shearing effects [5]. In our patient with a devastating injury to the duodenum, there were no concomitant injuries to the neighbouring structures, notably the pancreatic head, which only parted from the duodenum. This happening could not be explained by the aforementioned mechanisms.

In the search for an explanation, the author of this paper speculated the following: compression of the full stomach (Figure 1) by the steering wheel caused sudden passage of a large amount of gastric contents into the duodenum through the patent pylorus, as by coincidence, the cardia was closed. This led to a sudden distension and rapid rise of the duodenal intraluminal pressure. This sudden distension lead to a burst type of injury to the duodenum, distilling the pancreatic head medially and avulsing the ampulla of Vater (Figures 5A-5C), an injury which has been rarely reported [13-15]. This trail of events is likened to the pathogenesis of Boerhaave's syndrome [16], but in a prograde fashion.
Although difficult to prove, this mechanism may be the reason behind some cases of duodenal injuries which occur without simultaneous injuries to other contagious organs.

Conclusion

Although formidable, emergent Whipple's procedure could be safely done for duodenopancreatic injuries, when less extensive procedures seem unsafe. Some cases of isolated duodenal injuries, in the setting of blunt trauma, may result from sudden distension of the duodenum upon anteroposterior compression of the stomach.

References