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 en 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

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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 pancreaticoduodenal 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 duodenal 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 trial of events is likened to the pathogenesis of Boerhaave's syndrome [16], but in a prograde fashion.

The pathogenesis of Boerhaave's syndrome is attributed to a sudden rise in intragastric pressure, leading to perforation of the cardia and subsequent distension and rupture of the stomach (Figure 1A, 1B). This mechanism of injury is similar to the one proposed for the patient described in this case report, where the steering wheel caused compression of the upper abdomen, leading to distension and rupture of the duodenum (Figure 1C). The injury was managed with a standard Whipple's procedure, which preserved the blood supply to the pancreatic head and allowed for anastomosis of the bile and pancreatic ducts to the jejunum. The patient subsequently recovered without any complications.

The case presented here highlights the importance of considering the mechanism of injury in trauma patients with duodenal injuries. Although pancreaticoduodenectomy is the gold standard treatment for these injuries, preserving the blood supply to the pancreatic head and anastomosing the bile and pancreatic ducts to the jejunum can be an effective alternative. This approach allows for preservation of pancreatic function and can lead to successful outcomes in select cases.
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**