Case report

Ladd's procedure as an adjunct to treating combined traumatic duodenal and spinal injuries

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A R T I C L E   I N F O

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1. Introduction

Traumatic duodenal injuries are a rare and complex challenge. The surgeon facing such an injury has several options to repair this injury: primary repair with or without a serosal patch, performing a pyloric exclusion, adding a gastrostomy and/or feeding jejunostomy, and performing a gastro-enterostomy in order to bypass the duodenum.1,3,4,12,9 All of these options have a significant failure rate with persisting duodenal leakage and long-term morbidity.2 An often overlooked insult is concomitant spinal injury that may lead to a distal duodenal obstruction due to compression by the superior mesenteric artery (SMAS). This combined injury is noted when the mechanism is a high velocity blunt trauma such as seat belt injury during a motor vehicle accident. The contribution of this obstruction to the failure rate of the duodenal repair has not been addressed yet. We describe a case in which this event was foreseen and a Ladd's procedure was added to the duodenal repair. It is our impression that avoiding SMAS may enhance the chances of a successful duodenal repair.

2. Case description

A thirteen-year-old boy was transferred to our hospital 6 weeks after suffering from a blunt abdominal trauma caused by a seat belt injury during a high speed motor vehicle accident. At the primary hospital a right diaphragmatic, hepatic and duodenal injury was noted and treated via a right thoraco-abdominal approach. The duodenum was repaired primarily. Two weeks after the operation, a profuse duodenal leak was noted and the patient was transferred to a secondary hospital where a median laparotomy with a tube duodenostomy, periduodenal drainage and gastro-jejunosotomy were performed. Following this intervention, there was still about 1500–2500 ml of duodenal content per day flowing from the duodenostomy and drainage tubes. Feeding attempt via a trans-anastomotic jejunal tube was unsuccessful. He was transferred to our paediatric surgical centre where a fracture in the second lumbar vertebra was noted as well as a compression of the distal duodenum with a leak from the proximal part of the duodenum (Fig. 1). Parenteral nutrition was initiated and spine stabilizing procedure was performed. After recovery, a repeat upper gastrointestinal contrast film (UGI) showed an aggravation of the duodenal compression, with a persistent leak from the injury site (Fig. 2). A re-laparotomy was performed, undoing the gastro-jejunal anastomosis, performing pyloric exclusion with absorbable sutures, gastrostomy, feeding jejunostomy, and primary repair of the duodenum buttressed by a jejunal serosal patch. A Ladd's procedure was performed prior to duodenal repair in order to release the duodenum from the vascular compression caused by the superior mesenteric artery. The patient recovered uneventfully and 3 weeks later a repeated UGI confirmed free and intact passage through the duodenum (Fig. 3A and B). Oral feeding was introduced gradually and the boy was discharged 4 weeks after the third operation.

3. Discussion

Isolated blunt duodenal injuries are very rare. Duodenal injuries are commonly associated with injuries to other abdominal or thoracic organs, including spine injuries. They are usually due to motor vehicle accidents, especially with improper use of lap belt restraints. Examining the epidemiologic characteristics of seatbelt-associated injuries, Anderson et al.1 found that 10 of 16 patients (62%) with Chance fractures also had hollow-viscous injury. Most duodenal injuries may be safely primarily repaired, whilst the remaining usually require more complex procedures, such as pyloric exclusion, duodenoduodenostomy, and duoden-jejunosotomy.1,3,4,12,9

The most serious complication following the treatment of duodenal injury is the development of a duodenal fistula from suture line dehiscence. In a collective review of 15 series with 1408 patients with duodenal injuries, Asensio et al.2 noted a 0–17% incidence of duodenal fistula, with an average rate of 6.6%. In
complicated cases such as fistula formation, many methods for diversion of gastric flow have been suggested such as duodenal diverticulisation, antrectomy, vagotomy and end-to-side gastro-jejunostomy. When dealing with large duodenal defects, repairing solutions include a serosal patch of a loop of jejunum to buttress the duodenal repair, or resection and end-to-end duodenoduodenostomy. In the second part of duodenum such resections may be difficult. Therefore, alternative options might be necessary, such as either side-to-end or end-to-end Roux-en-Y duodenojejunostomy, or a side-to-side duodenojejunostomy. These complex procedures are seldom used in large series of duodenal injuries. Of course, any distal obstruction to the repair may be deleterious and should be avoided.

Fig. 1. An anteroposterior projections of an upper GI series performed after the second operation, showing passage of contrast from the stomach (St) to the duodenum (D) with a leak from the proximal duodenum along the surgical drain (arrows), and a distal duodenal linear obstruction (arrowhead), typical to superior mesenteric artery syndrome.

Fig. 2. An anteroposterior projections of an upper GI series performed after spine fusion and oral feeding renewal, showing persistence of leak (arrow) from the duodenum (D) and severe superior mesenteric artery compression (arrowhead). St, stomach.

Fig. 3. (a) Follow-up UGI after primary repair of proximal duodenum (D) with jejunal serosal patch and Ladd’s procedure, contrast flows freely from stomach (St) through the repaired duodenum (D), surrounded with the serosal patch (*), to the jejunum (J), with no obstruction or external compression. b. Scheme of the follow-up UGI. FJ, feeding jejunostomy.
Whether a distal compression to the duodenum compromises a duodenal injury repair is not yet clear. It seems logical to assume that it does, and in our case we considered it to be a contribution to the previous operative failures. The obstruction due to SMAS observed in this case could be a result of the spinal injury, its repair, concomitant weight loss or a combination of all these reasons. SMAS usually can be treated by weight gain alone, but at times surgery may be required.10 A duodeno-jejunostomy, the most common operation in this setting, may be unwise when a proximal duodenal injury is involved, and a gastro-jejunostomy may be counter-productive if the distal duodenum is obstructed, as a fistula will not close in the presence of distal obstruction. A Ladd’s procedure is not common in general surgery but is part of the armamentarium of the paediatric surgeon, performed mostly for intestinal malrotation and midgut volvulus. It consists of derotating the duodenum so that it will pass straight down to the right iliac fossa whilst rotating the cecum to the left upper quadrant. In order to do so, the ligament of Treitz must be divided and the SMA mesentery rotated 180°. Following this procedure, the duodenum no longer passes between the aorta and the SMA artery, and a posterior compression by the aorta (or an injured spine) no longer causes duodenal obstruction. Thus, utilising Ladd’s procedure in such a case of proximal duodenal injury ensures free flow of luminal secretions distally, and minimises the risk of fistula formation or of a leak at the anastomosis site. Performing the procedure in a normal rotated position is slightly more complex than in the malrotated bowel, but it is feasible with very low risk involved.11,5,6 It is our opinion that adding this procedure to the treatment of combined duodenal and spinal injury should always be considered, as it may enhance the chances of successful recovery in these complex cases.

References