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Primary reinforcement with rectus abdominis muscle flap—a salvage technique for a tenuous post traumatic duodenal perforation— a case report

R.D.R. Somasekar^{a,*}, A. Siva Sankar^b, P. Sai Krishna^c

^a Department of Surgical Gastroenterology, GMKMCH, BRS Residency, Vidyalaya Road, Salem, 636007, India

^b Department of Surgical Gastroenterology, GMKMCH, Nitesh Hospitals, Sewapet, Salem, 636002, India

^c Department of Surgical Gastroenterology, GMKMCH, Room No 210, PG Hostel, Salem, 636002, India

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ABSTRACT

INTRODUCTION: The conventional techniques for management of complex duodenal injuries are duodenal diverticularisation, pyloric exclusion or triple tube decompression. We here present a salvage technique of primary reinforcement with pedicled rectus abdominis muscle flap (RAMF) for a tenuous post traumatic duodenal perforation (PTDP). The majority of the studies in the literature are on the use RAMF for the secondary repair of peptic duodenal perforations.

PRESENTATION OF CASE: A 38 year old male presented with an acute abdomen, three days after sustaining a blunt abdominal trauma. The clinical and radiological findings in the abdomen were subtle and not contributory. An emergency laparotomy with a high index of suspicion revealed a large perforation in the anterolateral wall of the second portion of the duodenum with a friable unhealthy wall and shearing of the serosa around the perforation site. The entire omentum was unhealthy, contused with areas of gangrene and omentectomy done. The perforation site was closed using 3.0 vicryl and reinforced with a pedicled right RAMF based on the superior epigastric artery. The patient recovered uneventfully and was discharged.

DISCUSSION: The addition of conventional diversion techniques to primary duodenorrhaphy is sophisticated, time consuming and adds morbidity.

CONCLUSION: RAMF is a good tissue substitute to buttress tenuous duodenal injuries presenting late with inflamed, friable perforation sites and associated tissue loss, where duodenorrhaphy alone may not be successful. RAMF is a valuable salvage technique when the omentum is not available and the local tissue condition negates the effectiveness of other simpler techniques.

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1. Introduction

Isolated duodenal trauma (DT) is rare, occurring in 0.6% of patients with duodenal injuries following abdominal trauma and pose diagnostic challenges because of its retroperitoneal location [1]. In case of isolated DT the location, injury grade, time to development of symptoms and the delay in diagnosis are major determinants of the outcome. An early diagnosis is associated with less derangements in the milieu interior and hence lowers morbidity. The duodenum with its marginal shared vascular supply with the pancreas, high intraluminal pressure and the ingress of corrosive pancreatic biliary secretions are inherent detrimental factors in the repair of duodenal defects, especially of the second part [2].

Moreover, the progressive inflammatory reaction and auto digestion in the injured duodenal wall associated with diagnostic and treatment delay makes a simple injury more complex.

The addition of diversion procedures to primary duodenorrhaphy in complex duodenal injuries has always been a point of contention and controversy. The conventional diversion techniques are duodenal diverticularisation [3], pyloric exclusion or triple tube decompression [4,5]. These adjunctive procedures are time consuming and not without morbidity [6]. We here present a salvage technique of primary reinforcement with pedicled RAMF as a viable alternative (when other simpler techniques are not feasible) for a tenuous PTDP, from a GI surgery unit in an academic institution. The available studies in the literature are mainly on the use of RAMF for the secondary repair of duodenal defects [7].

2. Case report

The case is reported in accordance with the SCARE criteria [8].

* Corresponding author.

E-mail addresses: hpblap@gmail.com (R.D.R. Somasekar), drsvivasankar2004@gmail.com (A.S. Sankar), skrishna801@gmail.com (P.S. Krishna).



Fig. 1. Plain CT abdomen showing free fluid (arrow) in the Morrison's pouch.

A 38 year old male carpenter, walked into the emergency room in an academic institution with progressively increasing abdominal pain and abdominal distention for three days duration. He had sustained an upper abdominal blow by kicking, in an altercation prior to the onset of symptoms. He had no co-morbidities or pertinent history. He was dehydrated, afebrile and normotensive but was having tachycardia. The abdomen was diffusely distended, tender with no signs of peritonitis. The basic blood investigations were normal except for leukocytosis (14,500 cells/cumm) and elevated renal parameters (blood urea = 69 mg/dl, serum creatinine = 2.1 mg/dl). Plain skiagrams of the chest and abdomen were not productive. An ultrasound and a plain abdominal CT scan showed only free fluid in the abdomen (Fig. 1). The above findings along with a clinical suspicion of retroperitoneal DT, we proceeded with surgical exploration after optimizing the patient.

An emergency midline exploratory laparotomy by an experienced GI surgeon revealed around 750 mL of turbid reactive free fluid in the abdomen. The entire omentum was unhealthy, rolled up, with areas of clots and gangrene. There was bile staining in the retroperitoneum near the second part of the duodenum (Fig. 2). After duodenal Kocherisation, a large (1 × 1 cm) perforation in the anterolateral wall of the second portion of the duodenum was identified. The duodenal wall around the perforation was friable, unhealthy with shearing of the serosal layer (Fig. 3). The adjacent and rest of the viscera had escaped the brunt of the attack except for scattered mesenteric contusions in the jejunal mesentery.

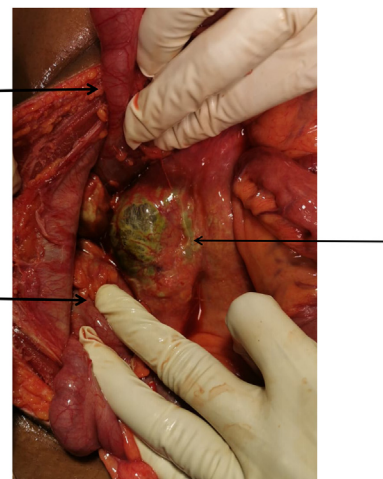


Fig. 2. Bile staining (arrow) noted near the 2nd part of duodenum in the infracolic compartment.

The entire greater omentum had to be removed. It was a “difficult to manage duodenum” as the patient presented to us late (>72 h after symptom onset). The edges of the perforation site were freshened and closed using 3.0 vicryl intermittent sutures. The local tissue condition was not conducive for a secure tube duodenostomy without a peritubal leak. The proximal jejunal loops were edematous and will not hold stitches well for a secure serosal patch repair. So, we decided to reinforce the repair with a superiorly based right RAMF. The RAM was freed from the anterior rectus sheath by dividing the tendinous intersections up to just below the umbilicus. The superior epigastric artery was ligated and divided just beyond the point of transection of the rectus muscle below the umbilicus. The RAMF was secured using 3.0 vicryl sutures to the duodenum as shown in the Figs. 4 and 5. A feeding jejunostomy (FJ) was done. A wide bore drain was placed near the repair site. The operating time was 120 min.

The patient was managed post operatively by mechanical ventilation in a surgical intensive care unit. He was managed with higher antibiotics and rigorous chest physiotherapy. Enteral feeds started through the FJ and per orally on the 4th and 7th postoperative days respectively. He recovered uneventfully except for minor surgical site infection. He got discharged joyously on the 12th postoperative

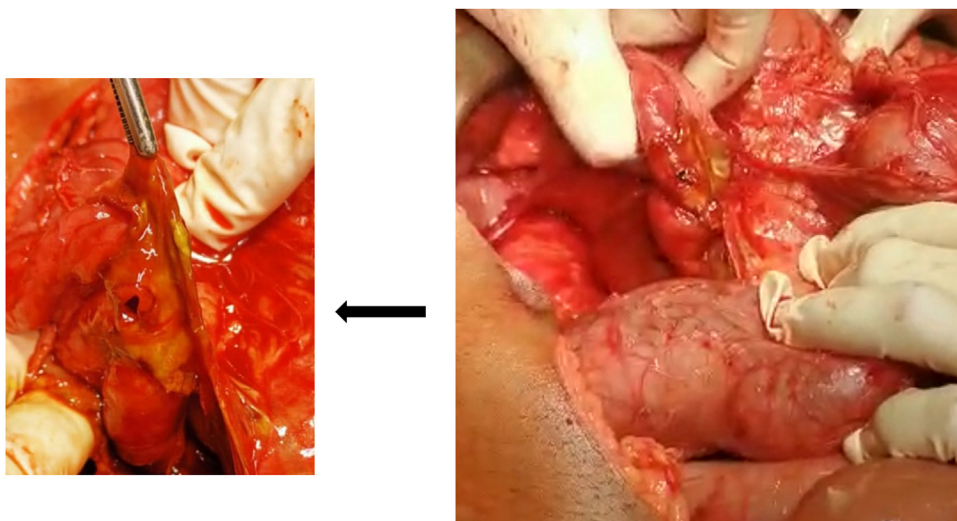


Fig. 3. 1 × 1 cm perforation in the anterolateral wall of 2nd part of duodenum with sheared off serosa.

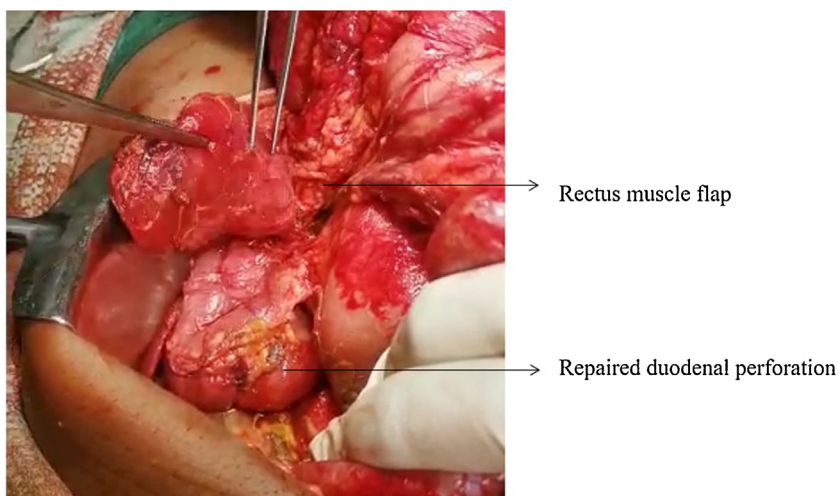


Fig. 4. Mobilisation of rectus muscle flap based on superior epigastric artery.



Fig. 5. RAMF secured to trauma site of duodenum using vicryl13.0.

Table 1
AAST Grading of Duodenal Trauma.

Grade	Injury Description	
I	Hematoma	Involving single portion of duodenum
	Laceration	Partial thickness, no perforation
II	Hematoma	Involving more than one portion
	Laceration	Disruption <50% circumference
III	Laceration	Disruption 50–75% circumference of D2
	Laceration	Disruption 50–100% circumference of D1, D3, D4
IV	Laceration	Disruption >75% circumference of D2
V	Laceration	Involving ampulla or distal common bile duct
	Vascular	Massive disruption of duodeno-pancreatic complex Devascularization of duodenum

day. A follow up at 3 months revealed no incisional hernia at the surgical scar.

3. Discussion

DT occurs in 1–4.7% and 2–10% of all cases of abdominal trauma in adults and children respectively [9]. There is associated organ injury in 68–86.5%, with major vascular injuries occurring in 23–46% [9]. Blunt injury is more common in children and penetrating injury in adults. There are three proposed mechanisms of blunt DT. Crushing injuries occur due to direct

compression of the duodenum over the lumbar vertebra [10]. Bursting (blow out) injuries happen when an impact occurs on a distended duodenum i.e. when the pylorus is contracted and the duodenojejunal flexure closed forming a closed loop [10]. Shearing injuries occur at the junction of fixed and mobile portions of the duodenum [10]. There can be a combination of mechanisms (bursting & shearing) as in our case.

The American Association for the Surgery of Trauma (AAST) grading system is widely accepted for the grading of DT (Table 1) [11]. AAST grade I injuries usually are asymptomatic and identified during abdominal exploration for other associated injuries. Grade III and above are complex injuries. There can be a combination of grade I and II injuries as in the current case scenario (partial mural disruption for 50% of the circumference with a perforation).

From our perspective, transmural duodenal injuries can be classified as either simple or complex from management viewpoint. A simple injury can be defined as one where a primary closure alone may be sufficient to accomplish a successful repair. A complex duodenal injury can be defined as AAST grade III and above or a grade II disruption where primary closure alone may not be sufficient to accomplish a successful repair.

The travails in the management of complex DT is further complicated by diagnostic delay. Mostly the clinical and radiological findings are subtle and not pathognomonic. CT scan of the abdomen can reveal retroperitoneal air pockets around the duodenum.

The physiology of the patient is the common denominator in deciding the line of surgical management. In unstable patients, damage control principles with emphasis on hemostasis and containment of enteric contamination is the strategy. Tube duodenostomy alone [12] or triple tube decompression [13] are viable damage control procedures. In a stable patient with a complex DT, diversion procedures like pyloric exclusion and Berne’s duodenal diverticularisation [14] are used. There is accumulating evidence that these procedures do not decrease morbidity, increases the duration of hospital stay [15,16] and the gastrojejunostomy predisposes to long term risk of gastric malignancy. Hence these diversion procedures must be used selectively. In an irreparably damaged duodenum, either a pancreas sparing duodenectomy [17] or a trauma Whipple must be considered with caution in a relatively stable patient.

The golden time period for primary duodenorrhaphy alone to be successful is yet to be defined. Moreover in late presentations, the milieu interior becomes analogous to a failed primary repair because of the ongoing inflammatory reaction and autodigestion caused by uncontained leak of the succus entericus.

A healthy vascularized tissue must be incorporated in the repair of any tissue defect with friable edges and tissue loss. Pedicled omentum is our first choice when available. RAMF is an alternative [18]. RAMF is much resistant to the activity of digestive enzymes and promotes wound healing by induction and promotion of fibroblast proliferation [19]. RAMF also induces faster re-epithelialisation [19]. The inflammatory adhesion between the

flap and the duodenum helps to contain the leak. RAMF has a constant, reliable vascular pedicle and by virtue of its proximity to the duodenum must be the flap of choice. An inferiorly based flap can be technically cumbersome and forms a potential site for twisting of small bowel around it. Moreover the superiorly based flap is easy to harvest and less time consuming. As the rectus sheath is left intact it allows for a secure abdominal closure. We routinely prefer to add a feeding jejunostomy in such cases as a precautionary measure. This technique requires further validation using larger samples to assess its pros and cons in comparison to other time tested techniques.

4. Conclusion

A high index of clinical suspicion with a low threshold for surgical exploration is necessary for successful management of DT. RAMF is a valuable salvage technique to buttress tenuous duodenal injuries (AAST grade II presenting late with inflamed, friable perforation sites and/or associated tissue loss) where duodenorrhaphy alone is questionable. RAMF is a good tissue substitute when the omentum is not available and the local tissue condition negates the effectiveness of other simpler techniques like tube duodenostomy or jejunal serosal patch in the primary repair setting (in a relatively stable patient).

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Nothing to declare.

Ethical approval

Exempt from ethical committee approval in our institution.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Anonymity of the patient is ensured at all stages.

Author contribution

Study concept and design - DR R.D.R Somasekar.

Data collection - DR R.D.R Somasekar.

Editing - DR A. Sivasankar.

Data analysis or interpretation - DR.P. Sai krishna.

Writing the paper - DR R.D.R Somasekar.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at <https://doi.org/10.1016/j.ijscr.2020.07.080>.

Declaration of Competing Interest

Nothing to declare.

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