Review Article

Role of Pyloric Exclusion in Duodenal Trauma – Historical Perspective

MA RATHORE ZU CHAUDHRY AM CHAUDHRY
Correspondence to: *MA Rathore, Specialist Registrar in Gastro-intestinal Surgery, NI UK.* munirrathore@yahoo.com

Abstract
Background: Majority of duodenal injuries requires simple repair. Pyloric exclusion is recommended for injuries involving 50-70% of circumference. This adjunct procedure has specific complications. The benefit is uncertain. This review article assesses the benefit of the procedure
Methods: Published literature over the last two decades was reviewed. It was sourced from indexed journals and Medline.
Conclusion: The role remains equivocal. Perhaps some advantage in delayed or failed duodenal repair. The incidence of complications may be substantial.
Key words: Duodenum, injuries, repair, pylorus, pyloric, exclusion, gastrojejunostomy

Duodenal injuries are characterized by being uncommon, potentially catastrophic, prone to be missed and fraught with controversy regarding management of advanced injuries. They account for three to five percent of all abdominal injuries and blunt duodenal trauma forms 0.2% of the same[1]. Isolated duodenal injury is extremely rare. The anatomical risk of associated injuries to the main pancreatic duct, common bile duct, the portal vein, abdominal aorta, inferior vena cava and superior mesenteric vessels make the injury potentially fatal. The retroperitoneal location of the organ leaves even a severe injury prone to be missed.

Majority of injuries are simple and require simple repair. Beyond this point there is lack of consensus. A fraction requires adjunct procedures to protect the simple repair. The smallest group needs mandatory major operative procedures. The complex operations take time. They have definite morbidity specific to them. This review was carried out to assess the benefit of pyloric exclusion in the management of duodenal injuries as seen against the history of duodeno-pancreatic trauma.

Historical Background

Larrey in 1811, reported first successful outcome of duodenal injury. In 1827 first pancreatic injury was documented at autopsy (St Thomas Hospital records). First report of penetrating pancreatic injury in the literature came in 1856 from Laborderie. In 1881 President James Garfield was assassinated. He died through a mycotic aneurysm after conservative treatment. Debate on abdominal exploration in penetrating trauma then commenced. Summers performed the first pyloric exclusion in 1904[2]. In WWII, X-rays, NG tubes, penicillin and laparotomy became available. The resultant mortality was 42%. In World War I the mortality associated with duodenal trauma was 80%. It decreased to 41% in Korean War. In late 1940's Whipple (1888-1963), an Iranian born American surgeon described Whipple's operation. By the Vietnam War in 1970's improved triage, blood transfusion, anaesthesia & antibiotics decreased the general mortality from 42% in WWII to nine percent[3]. In subsequent decades various modes of duodenal repair have been practiced. It appears the revival of pyloric exclusion (after being first described by Summers in 1904 may be linked with the description of duodenal diverticulization by Berne in 1986.

Discussion

A comparison may be drawn against the changing concept of repair of colonic injuries (eight percent of all abdominal injuries). There is a move away from protecting the suture line (with a colostomy) in favour of primary repair. The idea was born around 1951 by Ocshner. It remained dormant till about a quarter of a century ago when more understanding was made about the behaviour of an anastomosis. Primary colonic repair has since become more popular with equivalent results.

Table 1: American Organ Injury Scale – by AAST (American Association of Surgery for Trauma)

Grade I	Haematoma, Partial thickness laceration - no perforation
Grade II	Haematoma >1 portion <50% Circumference lacerated
Grade III	50-70% Circumference of D2 disrupted 50-100% of D1, 3, 4
Grade IV	>75% Circumference D2 Ampulla /distal CBD
Grade V	Massive disruption Duodenal devascularization

The victims of duodenal injuries tend to be young males. Penetrating injuries are more common[1,2,4-11]. The diagnosis is prone to be missed especially in blunt trauma or in the rare event of isolated duodenal injury-even at a laparotomy. Carrel (1990) found six patients who had injuries missed at primary laparotomy at peripheral hospitals out of a total of eight[4]. Index of suspicion is extremely important. The role of serum amylase estimation and contrast duodenogram is not diagnostic. The CT has false negative of 4-22% - probably more.

Simple Repairs are ordinary closures and end-to-end anastomoses (without resection). One form of Complex

Repairs may involve the non-mandatory ones used to 'protect' the simple repairs. These include pyloric exclusion (P-Exc), 'covering' gastro-jejunostomy (GJ) and triple decompression involving tube gastrostomy, tube duodenostomy and feeding jejunostomy (GDJ). The other forms of complex procedures are mandatory and are resectional. They thus have definite procedure-related complications. They include duodenal diverticulization and the Whipple's operation or its modification. Due to lack of consensus, the operative procedure is guided by basic surgical principles, operative judgment and surgical expertise. Therefore the treatment of advanced injuries requires a tailored operation. One size does not fit all.

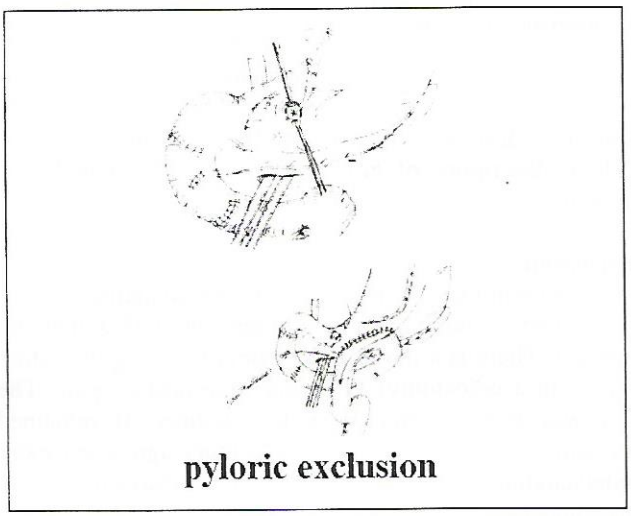

Fig. 1: Can be performed without GJ. All are known to open spontaneously. Controlled re-open suture may be applied

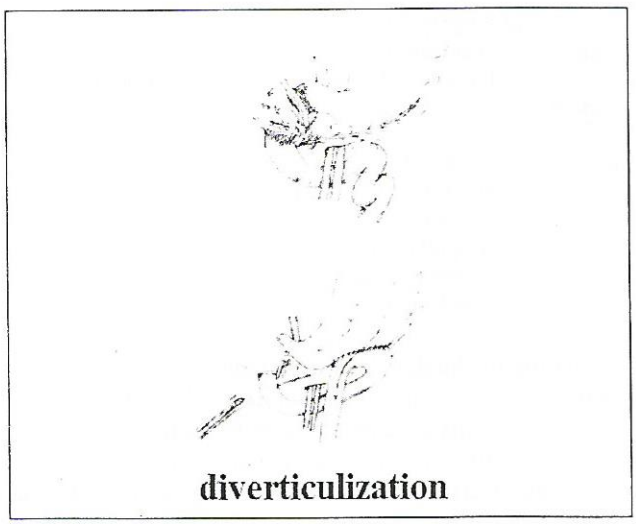

Fig. 2: For supra-papillary severe Grade III/IV injuries. Stump blow-out remains a potential complication. Few alternatives when indicated. Note the difference between pyloric exclusion and diverticulization.

Pyloric Exclusion (P-Exc) is an adjunct procedure (Fig. 1). It is recommended for severe Grade II and all Grade III[2] as well as late injuries involving 50% or more of the duodenal circumference[5,9]. It is designed to defunction the duodenal repair. Through a calculated gastrotomy, the pylorus is delivered into the wound. It is then closed with a purse-string or a linear suture. The gastrotomy is utilized as an isoperistaltic gastro-

Jejunostomy and maintains the chyme flow. P-Exc without GJ is also feasible. The pylorus is known to re-open spontaneously within weeks (reported 94-100%) [11]. It is regardless of the suture type used and whether or not the GJ was constructed. The procedure is relatively easy. It takes less time than diverticulization (Fig. 2). The risk of afferent loop syndrome does exist[10]. There is 11-12.5%[10,11,12] incidence of serious bleeding or perforation from a marginal ulcer often requiring re-operation. Fang (1998)[12] reported two out of eight patients with marginal ulceration and one with duodenal fistula. In further nine patients the GJ was not done. These complications were not seen. One mechanism is the acid contact with jejunal aspect of the gastrojejunostomy – similar to acid peptic disease. If the pyloric purse string is applied too proximal one can 'alienate' the antrum. This could lead to the retained antrum syndrome[13]. Prophylactic vagotomy has been recommended for the former[10]! For intractable marginal ulcers, the GJ may have to be taken down[18]. Gastro-jejunostomy alone may not be beneficial and may contribute to increased morbidity[19]. The evidence is limited. Degiannis treated Grade II & III injuries without and, later in the series, with P-Exc. The post-operative leak rate decreased from 43% to 12%[9]. From the literature P-Exc appears to have some role in treating delayed or failed duodenal repair[15].

On the other hand Kline (1994) found primary repair satisfactory for injury severity up to Grade III[6]. His team also successfully repaired some Grade IV injuries with primary repair alone. Our own experience suggests primary repair without adjunct procedures may suffice for injuries perhaps up to Grade IV.

Duodenum-related morbidity tends to be low to moderate. The most important is a duodenal fistula. It is a potentially fatal complication. The incidence varies from 2% to 12%[2,4,5,8-10,16,17,16-18]. The apparent reasons are the same as for other gastrointestinal anastomoses – physical tension and ischaemia remaining the ultimate causes. Coexisting pancreatic injury is associated with higher risk of duodenal leak. P-Exc is said to be beneficial in this scenario[18]. Having said that, Mullins (1995)[19] compared pyloric exclusion and octreotide. His team determined the resultant reduction of upper gastrointestinal secretions reaching the duodenum. The model involved artificial construction of duodenal fistula in dogs. Octreotide was found to be superior to P-Exc in reducing the volume. The combination of octreotide and P-Exc conferred no extra benefit.

Duodenum-Related Mortality (DRM) is zero to 9.5%. Most of the studies have reached the conclusion that the

leading cause of death is associated trauma leading to shock and multi-organ failure. Pancreatic, liver, splenic and colonic injuries have an adverse bearing[2,10,11].

Conclusion

The role of pyloric exclusion for the recommended injury severity (of GII & III) remains equivocal since simple repair without adjunct procedure may achieve the same result. It may have a role in delayed or failed duodenal repair. Procedure-related complications may be reduced by performing pyloric exclusion without gastrojejunostomy.

References

1. Allen GS, Moore FA, Cox CS Jr, Mehall JR, Duke JH. Delayed diagnosis of blunt duodenal injury: an avoidable complication. *J Am Coll of Surg* 1998 Oct; 187(4):393-9
2. Asensio JA, Gambaro E, Forno W, Tsai K-J. Duodenal and pancreatic injuries, complex and lethal injuries; *Trauma Grapevine* 2000 Jun; 2(6):1-3
3. Uppot RN, Willis JS, Gheyi VK. Bowel trauma. e-medicine 2001; 2(12) http://www.emedicine.com/radio/topic89.htm
4. Carrel T, Lerut J, Niederhauser U,. Diagnosis and treatment of traumatic injuries of the duodenum and pancreas: 21 cases. [French] *J de Chirurgie* 1990; 127(10): 438-44
5. Cogbill TH, Moore EE, Feliciano DV, Hoyt DB, Jurkovich GJ, Morris JA, Mucha P Jr, Ross SE, Strutt PJ, Moore FA. Conservative management of duodenal trauma: a multicentre perspective. *J Trauma* 1990 Dec; 30(12):1469
6. Kline G, Lucas CE, Ledgerwood AM, Saxe JM. Duodenal organ injury severity (OIS) and outcome. *American Surgeon* 1994 Jul; 60(7):500-4
7. Verma GR, Wig JD, Khanna SK: Management of duodenal trauma. *Tropical Gastroenterology* 1994; 15(1): 23-8.
8. Moncure M, Goins WA. Challenges in the management of pancreatic & duodenal injuries. *J National Medical Association* 1993 Oct; 85(10):767-72
9. Degiannis E, Krawczykowski D, Velmahos GC, Levy RD, Souter I, Saadia R. Pyloric exclusion in severe penetrating injuries of the duodenum. *World J Surg* 1993; 17(6):751-4
10. Buck JR, Sorensen VJ, Fath JJ, Horst HM, Obeid FN. Severe pancreatico-duodenal injuries: the effectiveness of pyloric exclusion with vagotomy. *Am Surgeon* 1992 Sept; 58(9):557-60 discussion 561
11. Ginzburg E, Carrillo EH, Sosa JL, Hertz J, Nir I, Martin LC. Pyloric exclusion in the management of duodenal trauma: is concomitant gastrojejunostomy necessary? *Am Surgeon* 1997 Nov; 63(11):964-6
12. Fang JF, Chan RJ, Lin BC. Controlled reopen suture technique for pyloric exclusion. *J Trauma* 1998 Sept; 45(3):593-6
13. Jansen M, Du Toit DF, Warren BL. Duodenal injuries: surgical management adapted to circumstances. *Injury* 2002 Sept; 33(7):611-5
14. Ivatury RR, Nallathambi M, Gaudino J, Rohman M, Stahl WM. Penetrating duodenal injuries. Analysis of 100 consecutive cases. *Ann of Surg* 1985 Aug; 202(2):153-8
15. Cone JB, Eidt JF. Delayed diagnosis of duodenal rupture. *Am J Surg* 1994 Dec; 168(6):676-8; discussion, 678-9
16. Nesbakken A, Buanes T, Gerner T, Naess F, Stadaas JO. Duodenal injuries due to blunt trauma. [Norwegian] *Tidsskrift for Den Norskey Laegeforening* 1989 Sept 109(26):2659-61
17. Wynn M, Hill DM, Miller DR, Waxman K, Eisner ME, Gazzaniga AB. Management of pancreatic and duodenal trauma. *Am J Surg* 1985 Sept; 159(3):327-32
18. McKenny MG, Nir I, Levi DM, Martin L. Evaluation of minor penetrating duodenal injuries. *Am Surgeon* 1996 Nov; 62(11):952-5
19. Mullins AP, Blumenthal SR, Hollenbeck JI, Messick WJ. Octreotide versus pyloric exclusion in reducing gastrointestinal secretions entering the duodenum in a canine model. *Am Surg* 1995 Feb; 61(2):182-4