Role of Pyloric Exclusion in Duodenal Trauma – Historical Perspective

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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 same1. 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 Laborde. 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 19044. 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 percent5. 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 Ochsner. It remained dormant till around 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)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
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<tbody>
<tr>
<td>I</td>
<td>Haematoma</td>
</tr>
<tr>
<td>II</td>
<td>Haematoma &gt;1 portion</td>
</tr>
<tr>
<td></td>
<td>&lt;50% Circumference lacerated</td>
</tr>
<tr>
<td>III</td>
<td>50-70% Circumference of D2 disrupted</td>
</tr>
<tr>
<td></td>
<td>50-100% of D1, 3, 4</td>
</tr>
<tr>
<td>IV</td>
<td>&gt;75% Circumference D2</td>
</tr>
<tr>
<td></td>
<td>Ampulla/distal CBD</td>
</tr>
<tr>
<td>V</td>
<td>Massive disruption</td>
</tr>
<tr>
<td></td>
<td>Duodenal devascularization</td>
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</tbody>
</table>

The victims of duodenal injuries tend to be young males. Penetrating injuries are more common12,4,11. 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 (1909) found six patients who had injuries missed at primary laparotomy at peripheral hospitals out of a total of eight7. 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.

Grade III$^5$ as well as late injuries involving 50% or more of the duodenal circumference$^{6,7}$. It is designed to defunction the duodenal repair. Through a calculated gastrostomy, the pylorus is delivered into the wound. It is then closed with a purse-string or a linear suture. The gastrostomy 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)$^{13}$ 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$^{15}$. Prophylactic vagotomy has been recommended for the former$^{8,9}$. For intractable marginal ulcers, the GJ may have to be taken down$^9$. 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$^9$. 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%$^{2,3,4,5,8,10,16,17,18}$ and, quite possibly, is underreported. 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.

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