Variations in Origin of Gastroduodenal Artery: A Cadaveric Study

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Abstract

Background: Gastroduodenal artery (GDA) is usually the first branch of the common hepatic artery from celiac trunk. In patients with chronic pancreatitis visceral artery aneurysms, incidence of up to 10% has been reported. The aneurysms occur most frequently in the splenic artery (10.4%); the common hepatic, gastroduodenal (1.5%), and pancreaticoduodenal arteries are affected.

Material and Methods: It was a cross-sectional study conducted in the Department of General Surgery and Forensic Medicine, N.S.C.B. Medical College, Jabalpur during the period from August 2012 to August 2013. Abdomen of the cadaver will be accessed by the standard postmortem midline incision (sternum to pubes). Vascular anatomy of the GDA and vein will be dissected out in-situ using standard surgical instruments. The distance from the pylorus to the GDA will be measured by measuring tape.

Results: In our study, out of total 31 cadavers, 19 (61.2%) were of male and 12 (38.8%) were of females. In all the cases, the site of origin of GDA is from the celiac axis of the common hepatic artery. Out of total 19 male cadavers, 17 (89%) showed a distance of 2.5-3 cm between pylorus and GDA and remaining 2 (11%) showed a distance of 3-3.5 cm.

Conclusion: In our study, GDA has been seen arising from common hepatic artery from the celiac axis in 100% of cases. Previous studies have also given very less percentage of rare sites of origin but with the advent of newer modalities of investigations such as Doppler studies and computed tomography angiograms this very less percentage of rare variations can be diagnosed if there are knowledge and suspicion. This will help a lot to prevent major catastrophe during surgeries and radiological interventions.

Keywords: Arterial steal syndrome, Cadaver, Common hepatic artery, Gastroduodenal artery, Superior pancreaticoduodenal artery

INTRODUCTION

Gastroduodenal artery (GDA) is usually the first branch of the common hepatic artery from celiac trunk. Arising posterior and superior to the first part of the duodenum, it is short and wide. At the lower border of the first part of the duodenum, it divides into the right gastroepiploic and superior pancreaticoduodenal arteries.1

The anatomical variations of the celiac trunk are due to the unusual embryological development of the ventral splanchnic branches of the aorta.2

In patients with chronic pancreatitis visceral artery aneurysms, incidence of up to 10% has been reported. The aneurysms occur most frequently in the splenic artery (10.4%); the common hepatic, gastroduodenal (1.5%), and pancreaticoduodenal arteries are affected.3,4

The superior pancreaticoduodenal artery descends between the contiguous margins of the duodenum and pancreas. It supplies both these organs. Its first branch is posterior superior pancreaticoduodenal artery originating at approximately the superior border of the duodenum which courses along the concavity of the duodenum posteriorly and anastomoses with the posterior inferior
pancreaticoduodenal artery. Just caudal to the origin of superior pancreaticoduodenal artery three to five branches arise from GDA which supplies posterior wall of the duodenum to the anterior surface of the head of the pancreas; this is the beginning area of fixation of the superior surface of the duodenum. A lateral arcade, the anterior superior pancreaticoduodenal artery turns abruptly lateral to descend along the anterior concave border of the duodenum and anastomoses with the anterior inferior pancreaticoduodenal artery.

Because of this typical location and anatomical relation of GDA, it’s good anatomical knowledge will be helpful in dealing with cases of bleeding peptic ulcer which requires gastroduodenal ligation. Peptic perforation occurring at the bifurcation creates a three-vessel operative problem.

Anatomical arrangement characteristic of the GDA complex consists of the right angled anastomosis of the transverse pancreatic artery with the GDA or either of its two branches. Perforation at this junction creates a second three-vessel situation.

To avoid early rebleeding, operative control of these open-ended arteries requires separate circumferential ligation. Such circumferential ligation is establishing the presence of a T or three-vessel complex. The consequent bleeding must be then controlled by tying the third ligature (the “U” stitch) proving that the ligatures have been properly placed.

The arteries involved in gastrointestinal (GI) hemorrhage in order of frequency include the splenic (40%), gastroduodenal (30%), pancreaticoduodenal (20%), gastric (5%), and hepatic arteries (2%).

GDA aneurysm may present clinically with abdominal pain, massive bleeding in the upper GI tract, jaundice, or hemorrhage. Rarely is it discovered at laparotomy performed for a different condition. In patients with chronic pancreatitis presenting with acute upper GI bleeding apart from common causes of bleeding, a rare possibility of GDA aneurysm should be suspected. In patients with chronic pancreatitis, any unexplained bleeding in this location particularly if associated with the sudden appearance of an abdominal mass with a bruit should alert for the possibility of GDA aneurysm.

The GDA steal syndrome during liver transplantation was reported by Nishida et al. GDA is cannulated in the procedure of hepatic arterial infusion pumps in hepatic arterial chemotherapy and for liver and/or colon resection. If the cannulated GDA is arising directly from the celiac axis, the chemotherapeutic agents may reach the left gastric or splenic arteries.

Arterial steal syndrome (ASS) after liver transplantation has been reported. ASS causes arterial hypo-perfusion of the graft liver and devastating consequences. However, the diagnosis tends to be delayed. Most of the cases are related to the splenic artery (lienalis steal syndrome). However, some cases of GDA steal syndrome have also been reported.

Keeping in view the clinical significance and applied importance of gastroduodenal anatomy and to add some more knowledge to the existing ones, the present study was undertaken, to know in detail the site of origin and variations in the course.

**MATERIALS AND METHODS**

**Type of Study**
Cross-sectional study.

**Place of Study**
Department of General Surgery and Forensic Medicine, N.S.C.B. Medical College, Jabalpur.

**Ethical Clearance**
Clearance will be obtained from the Institutional Ethics Committee.

**Duration of Study**
August 2012 to August 2013.

**Number of Cases**
31 cadavers.

**Inclusion Criteria**
All fresh cadavers ≥18 years of age.

**Exclusion Criteria**
Cadavers of patients who had suffered blunt abdominal trauma wherein presence of hematomas may mask the vascular pattern.

**Technique**
Abdomen of the cadaver will be accessed by the standard postmortem midline incision (sternum to pubes). Vascular anatomy of the GDA and vein will be dissected out in-situ using standard surgical instruments. The distance from the pylorus to the GDA will be measured by measuring tape.

**RESULTS**
In our study, out of total 31 cadavers, 19 (61.2%) were of male and 12 (38.8%) were of females. In all the cases, the site of origin of the GDA is from the celiac axis of the common hepatic artery. Distribution of the origin of the GDA is given in Table 1.
Table 1: Site of origin of GDA

<table>
<thead>
<tr>
<th>Site of origin</th>
<th>Male cadavers</th>
<th>Female cadavers</th>
<th>Total (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common hepatic artery</td>
<td>19</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td>Celiac axis</td>
<td>19</td>
<td>12</td>
<td>31</td>
</tr>
</tbody>
</table>

GDA: Gastroduodenal artery

Table 2: Distance from the pylorus to the GDA

<table>
<thead>
<tr>
<th>Distance</th>
<th>2.5-3 cm</th>
<th>3-3.5 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

GDA: Gastroduodenal artery

In our study, out of total 19 male cadavers, 17 (89%) showed a distance of 2.5-3 cm between pylorus and GDA and remaining 2 (11%) showed a distance of 3-3.5 cm between pylorus and GDA. Distribution of the origin of the GDA is given in Table 2.

**DISCUSSION**

In our study, the most common site of origin of the GDA in both sex was from the common hepatic artery from the celiac axis.

Lipshutz reported that the GDA was originated from the common hepatic artery in 92.3% of cases. He observed the origin of the GDA as the celiac trunk in 3 (3.61%) out of the 83 cadavers.

The superior pancreaticoduodenal artery descends between the contiguous margins of the duodenum and pancreas. It supplies both these organs; it’s first branch is posterior superior pancreaticoduodenal artery originating at approximately the superior border of the duodenum which courses along the concavity of the duodenum posteriorly and anastomoses with the posterior inferior pancreaticoduodenal artery. Just caudal to the origin of superior pancreaticoduodenal artery three to five branches arise from GDA, which supplies posterior wall of the duodenum to the anterior surface of the head of the pancreas, our study is in concordance with the above findings.

Michels reported five cases (2.5%) in 200 dissections with the GDA originating from the celiac trunk or the superior mesenteric artery, without specifying the number of origins from each artery.

In the cadaveric study of Petrella et al., a higher incidence of 6.74% was reported. Daseler et al., observed a single case of GDA from the celiac trunk in 500 dissections. GDA arising from superior mesenteric artery has been reported by Hsu et al. GDA arising from right or left hepatic artery has been reported in a study of 125 computed tomography (CT) angiograms by Rawat. Peschaud et al., reported a retroportal common hepatic artery.

**CONCLUSION**

In our study, The GDA has been seen arising from common hepatic artery from the celiac axis in 100% of cases. Previous studies have also given very less percentage of rare sites of origin but with the advent of newer modalities of investigations such as Doppler studies and CT angiograms this very less percentage of rare variations can be diagnosed if there are knowledge and suspicion. This will help a lot to prevent major catastrophe during surgeries and radiological interventions.

**REFERENCES**

13. Michels NA. Collateral arterial pathways to the liver after...
ligation of the hepatic artery and removal of the celiac axis.


Source of Support: Nil, Conflict of Interest: None declared.