

## CASE REPORT

# Replaced Gastroduodenal Artery - A Rare Anomaly and Its Importance in Pancreaticoduodenectomy

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### ABSTRACT

**Introduction** Recent data on borderline resectable pancreatic cancer have resulted in widening horizons of pancreatic surgery in terms of vascular resection. Gastroduodenal artery usually originates from common hepatic artery and traverses anterior to pancreas. It is ligated at its origin from the common hepatic artery during Pancreatoduodenectomy. **Case report** A middle-aged gentleman presented to us with history of jaundice. On evaluation with contrast enhanced computerised tomography scan was found to have a pancreatic head mass and anomalous GDA. **Discussion** He was planned for an infracolic superior mesenteric artery first approach and dissection of replaced artery from pancreatic head. A non-artery first approach would result in injury vessel at different parts of procedure and would go unrecognised intra-operatively. **Conclusion** Detailed study of contrast enhanced CT scan is mandatory to understand vascular anatomy, identify anomalous vessels and comprehend its importance prior to major hepato-pancreatobiliary surgery.

### INTRODUCTION

Pancreatoduodenectomy (PD) is a complex surgery. Vascular anomalies are a rule rather than exception during this surgery. As vascular anomalies are known to influence outcomes of surgery a thorough understanding of vascular anatomy and its anomalies is very important [1].

Encouraging results of recent data on borderline resectable pancreatic cancer have resulted in widening horizons of pancreatic surgery in terms of both venous and arterial resection [2].

Gastroduodenal artery (GDA) is ligated at its origin from the common hepatic artery (CHA) during PD. Also it is a common practice to do the clamp test before ligating the GDA and to look for pulsations of the hepatic artery [3]. It is usually done to rule out celiac artery stenosis where GDA may be the main retrograde pathway for arterial blood supply to the liver.

We present a case of replaced GDA and also reemphasize the importance of performing the clamp test before ligating and dividing GDA.

### CASE REPORT

Forty-seven-year-old gentleman presented to us with history of jaundice. He had undergone an exploratory

laparotomy and cholecystojejunostomy at another centre as a bypass procedure. On evaluation with contrast enhanced computerised tomography (CECT) scan he was found to have pancreatic head mass and anomalous GDA. A 3-D reconstruction was performed for better delineation of the vasculature. This anomalous artery originated from SMA just below neck of pancreas traversed anterior to pancreatic neck giving rise to superior pancreaticoduodenal and right gastroepiploic artery then coursing on superior order of pancreas and then divided into right and accessory left hepatic artery (**Figure 1**).

### DISCUSSION

Normal celiac artery and hepatic artery course is seen only in 55-70% of patients [4]. This is mainly due to complex embryological development.

The vessels in the wall of the yolk sac first differentiate to form arteries and veins of the vitelline system. As there is shrinkage in the yolk sac, the right and left vitelline plexus coalesce to form the major arteries that anastomose to form the median ventral branches of dorsal aorta which supplies the future gut. These arteries finally lose connection with the yolk sac, and become the artery which supplies the gastrointestinal tract [5].

Under the influence of the local haemodynamic factors and possibly by the genetic dictations, some of the capillaries dilate and coalesce with the adjacent one to direct the blood flow, whereas the other capillaries regress and finally disappear. The preferred channel thus formed persists as the definitive artery [6].

There are many classifications of celiac and hepatic artery anomalies. Most commonly used is Michels [4]. He has classified the anomalies into ten types. Song et al.

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has published largest series of celiac and hepatic artery variations in 5002 patients using CT scan and digital subtraction angiography [7].

The nomenclature “replaced GDA” (and not replaced common hepatic artery) is derived as it traverses anterior to the pancreas during its course, superior pancreaticoduodenal and right gastroepiploic artery arise from the artery (which normally arise from GDA). While the replaced CHA usually runs posterior or superior to pancreas (**Figure 2**).

The anomalous artery in our case has been probably formed by persistence of channels from superior mesenteric artery (SMA) to the hepatic artery via GDA and regression of segment of vessel connecting CHA to hepatic artery proper. A similar acquired situation is seen in celiac artery stenosis when the collaterals connecting GDA to inferior pancreaticoduodenal artery arise from SMA and the dominant blood supply to liver is from SMA via collateral reemphasising our theory of embryological origin [8].

Even in largest series by Song et al. they found 3% of common hepatic artery arising from SMA [7]. They found different courses of CHA i.e., suprapancreatic, infra pancreatic, trans-pancreatic, pre superior mesenteric vein or retro superior mesenteric vein. But none of their anomalies had prepancreatic course similar to ours.

Importance of this artery lies in mistaking it for GDA which arises from CHA and ligating it, which would result in compromised blood supply to liver and biliary tract. At this juncture performing a clamp test would at least forewarn us about some anomaly. Also as this artery arises from the SMA near the neck of pancreas and traverses anteriorly,

it would be at risk of damage during neck transection or during uncinate dissection.

Hence this case was planned for an infracolic SMA first approach and dissection of replaced artery from pancreatic head by ligating superior and inferior pancreatic vessels.

There are many artery first approaches to pancreaticoduodenectomy described in literature which can facilitate early decision making regarding resectability and also help in identification and dissection of aberrant/anomalous arteries [9] (**Figure 3**).

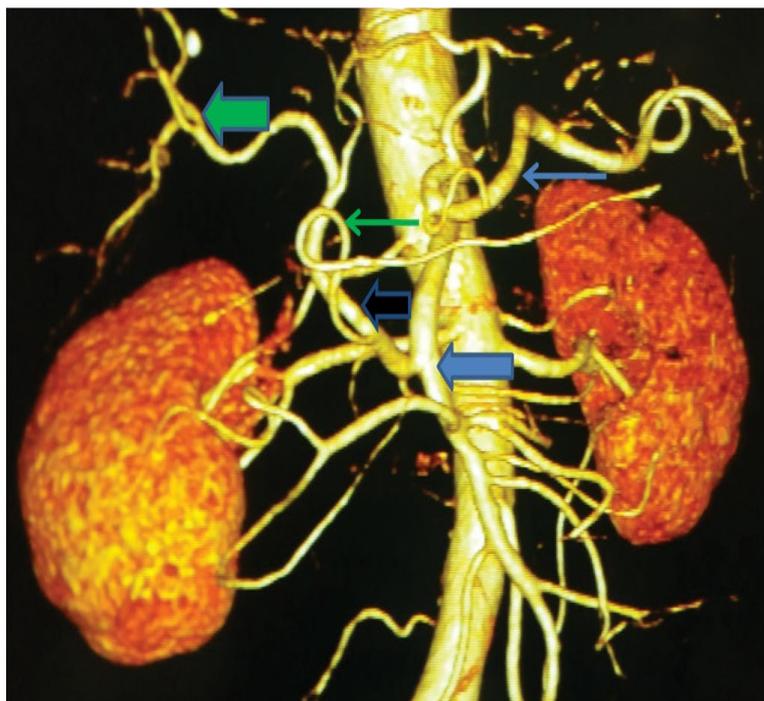
The infracolic SMA first approach involves lifting of transverse mesocolon, dissection and isolation of SMA and vein at the root of mesocolon over fourth part of the duodenum. It also entails partial division of nerve plexus over SMA and dissecting over the anterior wall up to its origin from the aorta. By using this approach replaced GDA originating from anterior surface of SMA would be clearly identified and preserved [10].

A non-artery first approach would result in injury vessel at different parts of procedure and would go unrecognised intra-operatively.

Preserving arterial supply to liver during PD is very important as arteries mainly supply the biliary tract. Damage to these will result in bile leak or biliomas which may be a cause of major morbidity in the post-operative period. Only one case of replaced GDA has been reported in literature and they too have used artery first approach [11] (**Figure 4**).

## CONCLUSION

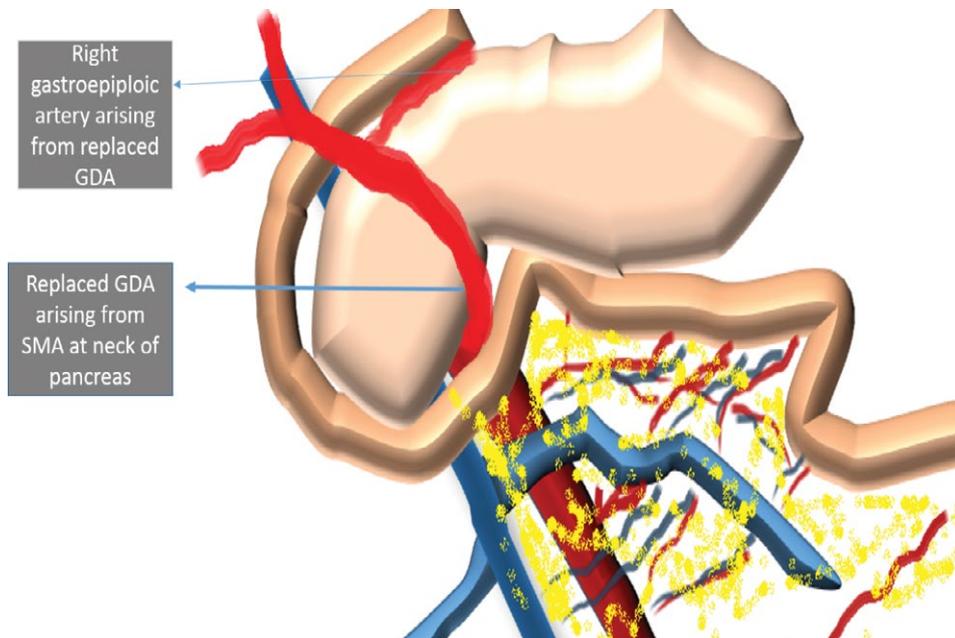
Detailed study of contrast enhanced CT scan is mandatory to understand vascular anatomy, identify anomalous vessels and comprehend its importance prior



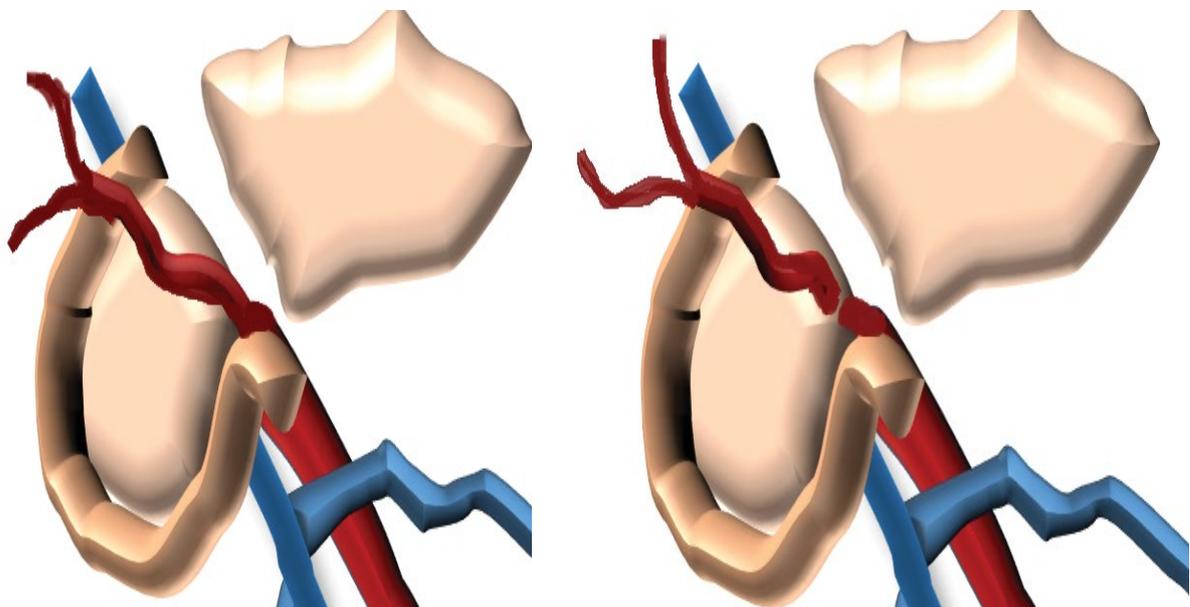
**Figure 1.** 3-D reconstruction CT angiography showing Celiac artery (blue thin arrow), Replaced GDA (black thick arrow) arising from Superior mesenteric artery (blue thick arrow) and giving rise to right gastro epiploic artery (green thin arrow) superior pancreaticoduodenal, right hepatic artery (green thick arrow) and left hepatic artery.



**Figure 2.** Replaced GDA traversing anterior to pancreas (possible site of injury) and giving rise to right gastroepiploic artery.



**Figure 3.** Pictorial representation of anomalous artery.



**Figure 4.** Orientation of the artery during pancreatic neck transection and potential site of injury during dissection.

to major hepato-pancreatobiliary surgery. Vascular anomaly may also dictate approach to surgery as in this case aninfracolic SMA first approach was mandatory. Rest all approaches would have resulted in injury to replaced GDA. Safety measures like clamp test are crucial and should be routinely performed in hepato-pancreatobiliary surgery even in this era of vascular resections.

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### Conflict of Interest

The authors declare that they have no conflict of interest.

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