

## CLINICO-ANATOMICAL STUDY OF VARIATIONS IN ARTERIAL SUPPLY OF ADULT HUMAN STOMACH

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### ABSTRACT

Anatomical variations in the arterial supply of adult human stomach have long baffled even the most experienced surgeons during surgical manipulation of the stomach. The stomach develops from the foregut hence its arterial supply is derived from the coeliac trunk. The present study is aimed at observing the anatomical variations of the arteries supplying the stomach. This study has been conducted on fifty cadavers during routine dissections. The aberrant arteries observed have both embryological and clinical significance. A comprehensive knowledge of the arteries nourishing the stomach along with their anomalies is vital for the surgeons to avoid iatrogenic complications during surgical manipulation involving the organ.

**KEYWORDS:** Arterial, Foregut, Stomach, Anomalies, Complications.

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DOI: 10.16965/ijar.2014.499

**Web site:** International Journal of Anatomy and Research  
ISSN 2321-4287  
[www.ijmhr.org/ijar.htm](http://www.ijmhr.org/ijar.htm)

Received: 01 Sep 2014

Peer Review: 01 Sep 2014 Published (O): 31 Jan 2015

Accepted: 13 Jan 2015 Published (P): 31 Mar 2015

### INTRODUCTION

The stomach is a sac-like dilatation of the alimentary canal [1]. In cadavers, the stomach is sickle shaped, the wider end being directed upwards and to the left [2]. From clinical experience the arterial supply of the stomach has long been postulated to be exceptionally rich [3]. In conventional textbooks the arterial supply of stomach is by the coeliac trunk directly or indirectly and the arteries reach the organ along its curvatures. The arteries are left gastric artery branch of coeliac trunk and is the principal artery of the stomach; right gastric artery branch of common hepatic artery; short gastric branches of splenic artery; left gastroepiploic artery branch of splenic artery; right

gastroepiploic artery branch of gastroduodenal artery and posterior gastric artery occasional branch of splenic artery. Known to Walther [4] since 1740 and termed by Haller [5] in 1745 as the posterior gastric branch, this artery and its surgical importance have been at best ignored and at worst neglected [6] in spite of several publications on variations of arterial supply of the stomach.

### MATERIALS AND METHODS

Conventional cadaveric dissections for academic teaching of first year MBBS students were performed on 50 embalmed male cadavers aged between 25 to 65 years. After exposing the abdominal cavity and removing the peritoneal fat, the coeliac trunk was located and each of

its three branches was individually examined. Emphasis was laid on arteries supplying the stomach with particular focus on occurrence of posterior gastric branch of splenic artery.

## OBSERVATIONS

In all cases the coeliac trunk was given off as the first anterior branch of abdominal aorta just inferior to the aortic hiatus of the thoraco-abdominal diaphragm and was found to lie at the level of lower border of body twelfth thoracic vertebra. The coeliac trunk was trifurcated in all cases. In thirty eight cases (76%) it gave the "tripus halleri" or classical trifurcation of common hepatic, left gastric and splenic arteries having a common point of origin and in twelve cases (24%) showed non classical trifurcation in which the left gastric artery demonstrated a variable pattern of origin. Variations in level of the coeliac trunk were not observed. In forty six cases (92%) a single left gastric artery branching from the coeliac trunk was observed and out of the remaining four cases in three cases (6%) the artery branched from the common hepatic artery and in one case (2%) the artery revealed an accessory left gastric artery branching directly and independently from the abdominal aorta. In forty nine cases (98%) the right gastric artery branched from the common hepatic artery and only in one case (2%) an accessory right gastric artery was observed to be branching directly from the coeliac trunk. In all cases short gastric arteries branching classically from the splenic artery were observed. None of the cases revealed any anomalies in the right and left gastroepiploic arteries respectively. Posterior gastric artery originated from the splenic artery in twelve cases (24%).

**Fig. 1:** Showing the Coeliac Trunk.



**Fig. 2:** Showing Branches of the Coeliac Trunk.



## DISCUSSION

Until coeliac and mesenteric angiography confirmed that previously noted pronounced variations in arterial supply to the stomach and duodenum occur, these variations have not always been adequately considered by the operating surgeons. Arterial supply to the stomach comes predominantly from the coeliac axis although intramural anastomoses exist with vessels of other origins at the two ends of the stomach. The coeliac trunk supplies the abdominal part of oesophagus, stomach, duodenum upto major duodenal papilla, liver, pancreas, gall bladder and spleen. The common hepatic, splenic and left gastric arteries are considered as the "main classic" branches of the coeliac trunk [7]. The coeliac trunk is the chief artery of the foregut. It supplies all the derivatives of the foregut that lie in the abdominal cavity. The anatomical variations of the coeliac trunk are due to unusual embryological development of the ventral splanchnic branches of the aorta [8]. The formation of the aorta begins during the third week of embryological development. Many segmental arteries arise from the primitive dorsal aorta. As the embryo continues to develop, most segmental arteries regress, except for the precursor of the segmental arteries to the three major mesenteric vessels. The tenth segmental artery gives rise to the coeliac trunk [9]. The left gastric artery is the smallest branch of the coeliac axis [10]. The left gastric artery may arise from the common hepatic artery or its branches. The most common variant is an origin from the left hepatic artery.



Other variants include a common origin with the common hepatic artery. Identification of an aberrant origin may be of importance during surgical mobilization of the upper stomach [10]. In our study variations in origin of the left gastric artery was observed in four cases (8%) out of which in one case an accessory left gastric artery was also observed. Ishiqami K et al studied 118 patients with conventional angiography for detection of an accessory left gastric artery [11]. Result of this study revealed an accessory left gastric artery in 25 out of 118 cases. According to Hollinshead W.H. [12] an accessory left gastric artery is present in about 11.5% of the population. It arises from the aorta independently in about 4.5% of the population. The right gastric artery arises from the common hepatic artery and its origin is often variant. The most common alternative origins are from the left hepatic, gastroduodenal or supraduodenal arteries [13]. An accessory right gastric artery is present in about 1.45% of the population [7]. In our study in only one case (2%) we observed the presence of an accessory right gastric artery. We did not observe any variations in right and left gastroepiploic arteries. They were seen to branch from gastroduodenal and splenic arteries respectively. The splenic artery is the largest branch of the coeliac trunk. The splenic artery gives off five to six short gastric branches and the left gastroepiploic artery. From the middle part of its course the splenic artery may give off a posterior gastric artery (PGA) to the stomach [14]. The high incidence and the wide distribution of the PGA to the stomach are in sharp contrast with the absence of description in most modern textbooks of anatomy. DiDio et al [15] found the PGA in 46% of their subjects. According to DiDio, the surgical importance of the posterior gastric arteries attributed to its relatively high incidence and the fact that it augments the blood supply to the superior part of the posterior surface and to the fundus. The artery has a deep and almost hidden origin from the splenic artery. Overlooking this vessel in particular may cause postsurgical haemorrhage if this vessel is inadvertently transected during surgery [6]. In our study we observed PGA in twelve cases (24%) and all were observed to originate from the splenic artery. This artery may

be an important channel in cases where major gastric arterial supply has been compromised. According to Loukas et al [16] the most common origin of PGA was from the left gastric artery in 41.8% cases, from splenic artery in 25.2% cases, double PGA in 22.4% cases and from coeliac trunk in 10.2% cases. A coeliacographic study reported PGA in 55.7% cases [17]. Each artery supplying the stomach has its own importance regarding variations. The gastroepiploic arteries observed in our study were least notorious.

## CONCLUSION

As anatomists and surgeons we state that in our opinion gastric arterial variations should not be overlooked during abdominal surgeries involving the stomach. Many complications can be avoided with precise knowledge of these aberrant arteries. While vascular anomalies are usually asymptomatic, they may become important in patients undergoing diagnostic angiography for gastrointestinal bleeding or coeliac axis compression syndrome. Knowledge of such variations can aid in the interpretation of angiographic studies.

**Acknowledgement:** The authors wish to acknowledge the guidance and supervision received from Dr. Vakil Ahmed, Professor of Anatomy, Katihar Medical College.

**Conflicts of Interests: None**

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#### How to cite this article:

Saif Omar, Md. Shakeb Ahmad, Nafees Fatima, Md. Arif Ansari. CLINICO-ANATOMICAL STUDY OF VARIATIONS IN ARTERIAL SUPPLY OF ADULT HUMAN STOMACH. *Int J Anat Res* 2015;3(1):821-824. **DOI:** 10.16965/ijar.2014.499