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ORIGINAL ARTICLE

Left Gastric Artery Variants: A Cadaveric, Postmortem and Radiological Investigation

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Abstract

Background/Aim: Anatomical variations of the gastric vessels during laparoscopic surgeries of the stomach and related viscera frequently impair the surgeon's judgment, extend the duration of surgery and sometimes can lead to accidental surgical injuries, rendering it not possible to assure the safety and effectiveness of the surgical treatment. This research paper aimed to examine the variations of the left gastric artery (LGA), which could have implications for surgical and interventional procedures of the gastrointestinal tract (GIT) and related organs.

Methods: Fifty specimens, of which 22 were dissected from cadavers and 28 were acquired from post-mortems among the Indian population, regardless of age or sex were examined for variant LGA. In addition, the variation of the celiac trunk was observed in 10 patients using 3D-CT images, which were created by reconstructing multiple-slice computed tomography (CT) using 3-dimensional CT simulation software (3D-CT).

Results: The classical pattern origin of LGA from the celiac trunk was observed in 96 % specimens. In 2 % gastrophrenic trunk emerged from the abdominal aorta (AA) slightly proximal to the celiac trunk, then it branched into LGA and left and right inferior phrenic arteries. In remaining 2 %, LGA was the branch of the splenic artery. In 10 individuals radiological examination was conducted and found no abnormal pattern of celiac trunk.

Conclusion: Observing and reporting the variation in the gastric vessels by different methods has certain clinical value in upper gastrointestinal surgeries and interventions. The duration can be prolonged and the intraoperative blood loss is increased with the vascular variations. Overall, this research paper provides important information on the prevalence of anatomical variations of the LGA, which could help improve the safety and efficacy of upper gastrointestinal procedures.

Key words: Left gastric artery; Stomach; Coeliac trunk; Anatomical variations; Gastrointestinal surgery.

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Introduction

Usually, the left gastric artery (LGA) is a branch of the coeliac trunk, it travels posterior to the lesser sac within the gastro-pancreatic ligament toward the left and upward direction being enclosed here in the gastropancreatic fold. Then it runs the dorsomedial aspect of the stomach, thence along the lesser curvature, followed by it splitting it into ventral and dorsal branches

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to supply the stomach. Posterior branch in the lesser curvature anastomoses with right gastric artery.[1] The LGA not only supplies to the stomach but also supplies to the terminal part of the oesophagus. In the surgeries of the stomach and terminal oesophagus, care must be taken to spot the arteries around the stomach, even during the removal of lymph nodes.[2] Any damage or occlusion of the LGA can lead to severe complications such as gastric ulcer and bleeding. During oesophageal reconstruction usually, LGA is cut, which leads to avascular hepatic necrosis in the individuals with left hepatic artery as the branch from the LGA.[3] The LGA does not always arise from the usual site, it may arise from the aorta with a higher prevalence from a superior mesenteric artery with a lower prevalence.[4] This may lead to technical issues in the procedures of transarterial chemoembolisation and infusion therapy for liver cancer patients.[5] If the existence of a posterior gastric artery behind the stomach is a branch from the splenic artery, the significance of the exact depiction of the posterior gastric artery is vital for gastric and pancreatic surgeries.[6]

The rationale of this investigation was to study the anatomical variations in the origin and path of LGA to provide preoperative knowledge of vascular variations that would facilitate surgeons to avoid extensive dissection and vascular damage.

Methods

Institutional Ethical Committee of Sri Venkateswara Medical College, Tirupati, India was granted permission (SVMC/Institutional Ethical Committee/Acad No: 305/12/2013). All the participants, relatives of the deceased and donors of the cadaver signed a written waiver of informed consent. The study included 50 human specimens, of which 22 were obtained from cadavers in the dissecting theatre and 28, regardless of age or sex, from post-mortem examinations among Indian residents. The investigation was conducted in Anatomy Department at Sri Venkateswara Medical College, Tirupati, Kurnool Medical College, Kurnool and AIMSR, Chittoor, India. Dissection was done based on the instructions of the second volume of Cunningham's Dissection Manual. The arteries which were supplied to the stomach were traced carefully. In each instance, a schema was drawn. The source of origin, course and relations of LGA were observed. Besides, the variation of the celiac artery was evaluated in 10 individuals using 3D-CT images, which were created by reconstructing multiple-slice CT using 3-dimensional CT simulation software (3D-CT).

Results

The classical pattern origin of LGA from the celiac trunk was observed in 48 specimens. In one sample gastrophrenic trunk emerged from the abdominal aorta (AA) slightly proximal to the celiac trunk, then it branched into LGA and left and right inferior phrenic arteries (Figure 1). In another sample, LGA was the branch of the splenic artery (Figure 2).

The LGA splatted into ventral and dorsal branches immediately after a little distance from its origin to supply the corresponding surfaces of the stomach (Figure 3).

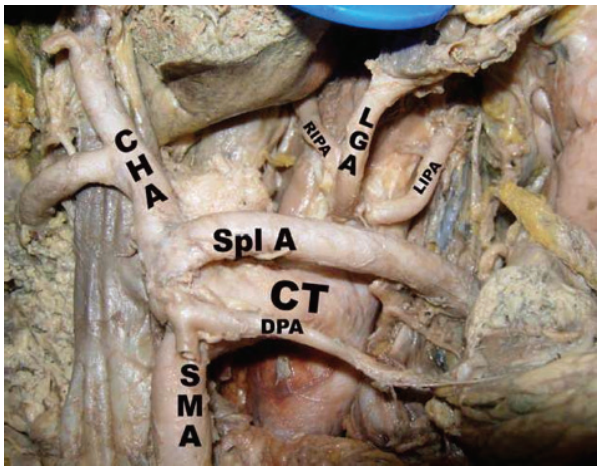

Figure 1: Hepatolienomesenteric trunk with dorsal pancreatic artery. Gastrophrenic trunk arose from the aorta

CT = Coeliac trunk; CHA = Common hepatic artery; Spl A = Splenic artery, RIPA = Right inferior phrenic artery; LGA = Left gastric artery; LIPA = Left inferior pancreatic artery; SMA = Superior mesenteric artery; DPA = Dorsal pancreatic artery;

The LGA had given branches to the oesophagus and stomach, in addition, it has given supplementary branches such as the inferior phrenic artery (IPA) and replaced left hepatic artery (LHA). The IPAs were a branch of the LGA in 2 cases. The left inferior pancreatic artery (LIPA) emerged from the LGA in another case (Figure 4). In one more specimen, the LGA was the branch of the abdom-

inal aorta and it divided into right and left IPA as the gastrophrenic trunk (Figure 1). In two instances, the LHA was substituted for the LGA (Figure 5).

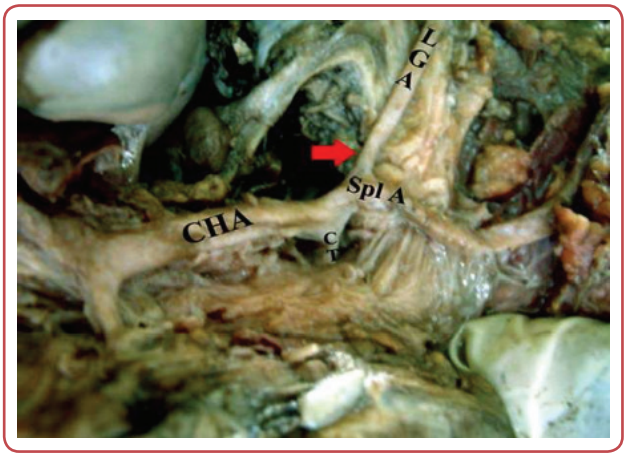

Figure 2: The coeliac trunk divided into the hepatic artery and splenic artery. The left gastric artery took origin from the splenic artery

LGA = Left gastric artery; Spl A = Splenic artery; CT = Coeliac trunk; CHA = Common hepatic artery;

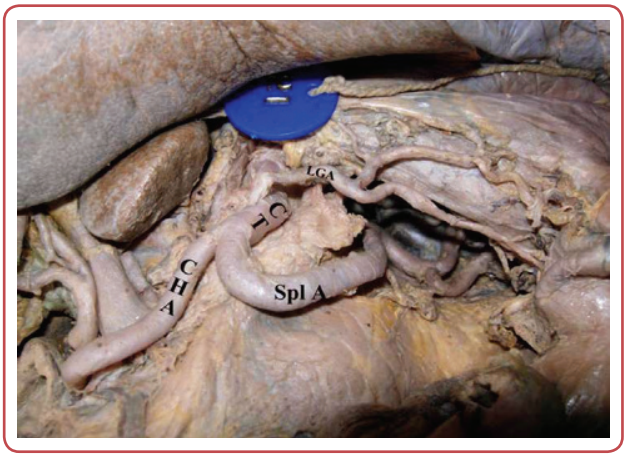

Figure 3: Left gastric artery (LGA) is divided into two branches that supply the anterior and posterior surfaces of the stomach

CT = Coeliac trunk; CHA = Common hepatic artery; Spl A = Splenic artery; LGA = Left gastric artery;

Figure 4: Left inferior phrenic artery emerged from the left gastric artery

CHA = Common hepatic artery; Spl A = Splenic artery; LGA= Left gastric artery; LIPA= Left inferior pancreatic artery;

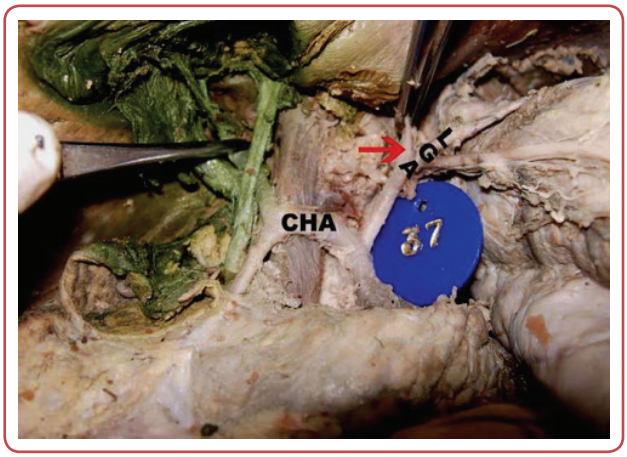

Figure 5: Replaced LHA arose from the left gastric artery. PHA continuing as RHA only

LHA = Left hepatic artery; PHA = Proper hepatic artery; RHA = Right hepatic artery; CHA = Common hepatic artery; LGA = Left gastric artery;

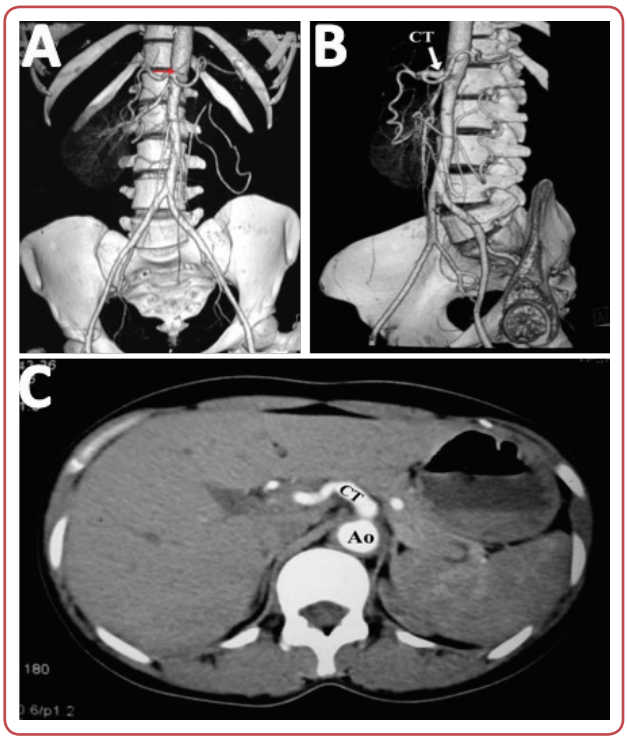

Figure 6: Representative images of reconstructed volumetric 3D rendered CT angiogram in A) AP projection B) sagittal projection showing the origin of the coeliac trunk and its branches. C) Axial section of CT angiogram showing the origin of coeliac trunk from the aorta

CT = Coeliac trunk; Ao = Aorta; AP = anterioposterior; CT = computed tomography;

To correlate cadaveric and autopsy investigation conducted CT angiogram and reconstructed volumetric 3D rendered angiogram to observe the celiac trunk anatomical variation but didn't find any variation from the classical pattern (Figure 6A, B, C).

Discussion

This study conducted a systematic investigation of cadaveric, postmortem dissections and CT angiography images to identify and report the LGA variations in comparison with normal classical patterns of the origin and course of these blood vessels. In healthy people, these anatomical differences are asymptomatic, but they will have crucial importance in individuals who have to undergo abdominal surgeries and investigation procedures.

Existing literature reported that in 94.4 % of cases, the LGA was the branch of the celiac trunk, in 2.7 % of cases it is a branch of the splenic artery (SA), in 2.1 % it arose from the aorta and in 0.3 % of cases from the common hepatic artery (CHA).[7] In this study, the LGA was the branch of celiac trunk in 96 %, the branch of SA in 2 % and the direct branch of AA and LGA as the branch of the CHA was not observed. The observations of this study are in line with earlier investigations such as LGA is the branch of AA was documented by Eaton in 4.5 %,[8] in 1.5 % by Lipshutz,[9] and in 0.5 to 1.5 % by Yildirim et al.[1] In the current investigation occurrence was 2 %, which is the same as that of Lipshutz research. The case study published in 2014 reported that the LGA emerged from the ventral aspect of AA just proximal to the hepatic trunk at the level of the first lumbar vertebra.[10] It is similar to existing literature[1] and current study. In other literature, the LGA emerged abnormally among 13 of the five hundred individuals, most commonly as a direct aortic branch.[11] The IPA and the LGA were the branches of the trunk called the gastro-phrenic trunk, which arose from the aorta.[12–14] This study also observed a similar pattern.

A recent study reported that the hepato-gastro-phrenic trunk (HGPT) is the branch of AA at the origin point of the celiac trunk. Its initial branch was the LIPA and it continued as the hepato-gastric trunk (HGT). During its course on the way to the diaphragm, the left IPA gives a branch to the left adrenal gland. HGT split into the LGA and a branch to the CHA at a length of 10.3 mm. No splenic artery (SA) emerged from the celiac trunk.[15] The CHA, SA, left IPA and LGA were all formed by the quadrification of the celiac trunk,[14] but in the current investigation, the gastrophrenic trunk was the branch of AA and it had given LGA, then it was divided into left and right IPAs. In previous research observations, the LGA had been divided into ventral and dorsal branches to supply corresponding aspects.[9, 16, 17] The findings of this study also revealed similar patterns in one individual (2 %).

The report of Piao et al revealed that in 2.9 % of cases, the IPA is a branch of LGA.[18] In a recent investigation, the LGA is given origin to the inferior RIPA and LIPA, while no celiac trunk was found.[19] In this study, the left IPA was the branch off LGA in 4 % of individuals as existing data. The hepatosplenic trunk, gastrophrenic trunk, splenic hypoplasia and auxiliary spleen were described by Yi et al,[20] whereas Shibamoto et al reported the concurrent existence of the LGA and CHA that courses retroportally called the hepatosplenomesenteric trunk and for both IPAs a common trunk in cancer stomach patient.[21] The LGA and right IPA arose from a common gastrophrenic trunk as a branch of AA.[22] This study results also demonstrated the same findings in 2 % of specimens. The previous research document that replaced LHA was the branch of LGA in 4 % of specimens[23, 24] and the LGA gave aberrant LHA.[25–28] Observations of the current study also revealed the same type of variants.

This study had some limitations since was mostly based on cadaveric and postmortem investigations, the analysis of CT images was few and further investigations are required in combination with classical and advanced methods to provide knowledge of vascular variations as they may be potential bleeding sites.

Conclusion

Considering these findings, it is assumed that the abdominal surgeons who are performing the procedures should have an idea about vascular variants and their branching pattern of LGA and also about aberrant arteries. It helps in the preoperative planning for radiological and surgical procedures to avoid possible induced damage and fatal complications and to reduce intra- and post-operative risk factors.

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Conflict of interest

None.

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