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ARTERIAL BLOOD SUPPLY OF DOG STOMACH BEFORE AND AFTER PARTIAL GASTRECTOMY

(With 5 Figs.)

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المدد الدموي الشرياني للمعده في الكلب قبل وبعد استئصال جزء منها

كمال الدين هاشم ، ساميه سليم

أجري الجانب التشريحي لهذا البحث على عدد خمسة عشر كلباً وذلك لدراسة المدد الدموي الشرياني للمعده بعد حقن الشريان الجوفي بمادة المطاط السائل وكذلك بمادة غير نافذه للاشعه هي الباريوم . وقد وجد أن الشريان الجوفي ينقسم في معظم الحالات الى الشريان الكبدي وجذع قصير مشترك لكل من الشريان الطحالي والشريان المعدي الأيسر . الشريان المعدي الثربي الأيمن يتحد مع الشريان المعدي الثربي الأيسر على الانحناء الأكبر مقابل الثلمه الزاويه ولكن بعد استئصال نصف المعده لوحظ أنه لا يوجد اتحاد بين الشريانين السابقين في مكان الاستئصال . أما بعد استئصال ثلاثة أرباع المعده قد أوضح البحث أن التفرعات المعديه للشريان المعدي الأيسر أصبحت أكثر وضوحاً وتعرجاً لتعويض النقص في الدم الشرياني الناتج من الاستئصال الجزئي للشريان المعدي الثري الأيمن والاستئصال الكلي للشريان المعدي الثربي الأيسر .

SUMMARY

The celiac artery divides into hepatic artery and a short common trunk for the splenic and left gastric arteries. The righ gastric artery is weakly developed vessel anastomoses in most cases with one of the terminal branches of the visceral branch of the left gastric artery. After removal 50% of the stomach the anastomosis between the right and left gastroepiploic arteries at the site of

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operation is not demonstrated. But after removal 75% of the stomach the Rr.gastrici of the left gastric artery are clearly distended and become more flexous to compensate the deficiency of the arterial blood which results from the partial resection of the right gastroepiploic artery and complete resection of the left gastroepiploic artery.

INTRODUCTION

It has already been stated that the standard operation for partial gastrectomy, as performed at the present time in the treatment of peptic ulcer, implies the removal of two–third to three–quarters of the stomach. More radical (sub total) resections are now usually reserved for the treatment of gastric carcinomata (FARQUOHARSON, 1966 and GARLOCK, 1967).

The aim of the present work is to evaluate the influence of partial gastrectomy by studying the change which might occur in the rest of the stomach as well as by studying its arterial vasculature following surgery. Therefore it is necessary to describe the arteries of the stomach in the normal dogs to compare between them and those follow the gastrectomy.

MATERIAL and METHODS

The anatomical study of this work was carried out on 15 adult dogs of both sexes. The examined animals were anaesthetized and throughly bled through the common carotid artery. The stomach and the other viscera supplied by the celiac artery were removed in the fresh state and the esophageal as well as the pancreaticoduodenal arteries were ligated. Ten specimens were injected by radioopaque substance, barium sulphate 40%, through the celiac artery for the radiological investigation, while the rest of the speciments were injected by the coloured gum milk (latex). The Nomenclature used is that adopted by N.A.V. (1983).

The surgical study was carried out on 21 clinically native breed dogs varying in weight from 12–23 kg. and in age from 4–6 years. They were under clinical observation before and after operation. The animals were divided into three equal groups depending upon the percentage of the resected part from the stomach. In first group 25% from the stomach, while

in the second and third groups 50% & 75% from the stomach were removed respectively. All animals were subjected to preumblical laparotomy under the effect of intravenous general anaesthesia using thiopental sodium (Nesdonal, specia), ten minutes after intramuscular tranquelization with propyl promazine (combelen, Bayer), in a dose of 0.05 ml/kg body weight. The stomach is exposed and thoroughly isolated from the abdominal cavity. The vessels along the greater curvature have been divided and ligated using No. 0 chromic catgut. Secrure ligation before division of the vessels prevents the slipping of ligatures and the retraction of the retracted vessels with resulting of rapid hematoma formation. The stomach is then feed from the surrounding, carefully taking care not to injure either the duodenal side or the pancreatic substance. The stomach is then divided and evacuated from its contents. The estimated resected part was then divided by a scalpel. The gastric tissue was sutured using continuous connell suture of 2/0 chromic catgut. The abdominal incision was then closed as usual.

All dogs were fed on milk for the first seven days then fed on easily digested food for another week. A course of antibiotics were parentially injected for five successive days. Barium meal was performed before and weekly following surgery. Dogs were sacrificed 30 days post-operation. The stomach was dissected free and used to study the arterial vasculature of the remained stomach using barium sulphate and gun milk (latex).

I – Anatomical observation:

The stomach in dog (Fig. 1) receives its arterial blood supply from the celiac artery (Fig. 1/1) which arises from the abdominal aorta at the level of the first lumbar vertebra. The celiac artery is relatively short vessel measures about 1.5cm in length then divides mainly into two branches, A.hepatica (Fig. 1/2) and a short common trunk for A.lienalis (Fig. 1/3) and A.gastrica sinistra (Fig. 1/4). But in three out of fifteen examined cases the celiac artery trifurcated into A.lienalis, A.gastrica sinistra and A.hepatica.

A.lienalis:

After its origin the splenic artery (Fig. 1/3) descends on the visceral surface of the fundic region of the stomach and shortly before its greater curvature it sends a large vessel to the spleen then it continues as the A.gastroepiplocia sinistra. About 1cm after its origin the splenic artery detaches a long vessel which courses along the greater curvature of the left side of the stomach to terminate in the proximal half of the spleen. This vessel releases 4 gastric branches to the adjacent areas of the stomach. The

splenic artery supplies the stomach with 9–10 Aa.gastricae breves which run within the gastrosplenic ligament toward the greater curvature of the stomach to terminate within the gastric wall.

The left gastroepiploic artery (Fig. 1/5) which is the direct continuation of the splenic artery passes within the greater omentum along the greater curvature of the stomach and terminates by amastomosing with the right gastroepiploic artery opposite to the angular notch. The left gastroepiploic artery gives of 8–9 small gastric branches supplying the adjacent area of the gastric wall along which it passes, in addition it detaches several twigs to the greater omentum.

A.gastric sinistra:

The left gastric artery (Fig. 1/4) descends toward the left side of the lesser curvature where it divides into visceral and parietal branches. Shortly after its origin the left gastric artery detaches 1–2 small esophageal branches to the abdominal portion of the esophagus. Moreover, the parent vessel releases before its division a small vessel to the cardiac region and also a considerable branch which redivides into three smaller vessels vascularizing the visceral surface of the fundic region.

The visceral branch runs within the lesser omentum along the lesser curvature of the stomach to reach the angular notch where it terminates by dividing into 3–4 small vessels which terminate within the texture of the stomach. One of these vessels completes the course of the parent branch along the lesser curvature to anastomose with the right gastric artery.

In five examined cases the visceral branch itself anastomoses with the right gastric artery. Along its course the visceral branch gives off small Rr.gastrici to the fundus of the stomach and also it detaches several twigs to the lesser omentum.

The parietal branch of the left gastric artery descends toward the parietal surface of the stomach where it devides into several small gastric branches piercing the gastric wall to terminate within the texture of the stomach.

A.hepatica:

The hepatic artery (Fig. 1/2) shares in the vascularization of the stomach through the A.gastrica dextra (Fig. 1/6) and A.gastroepiplocia dextra (Fig. 1/7). The right gastric artery is a weakely developed vessel which orginates from the hepatic artery directly after detacheing the last hepatic branch. Only in two examined cases the right gastric artery arose from the

last hepatic branch of the hepatic artery. It passes along the lesser curvature of the stomach toward the angular notch where it terminates by anastomosing with a branch of the left gastric artery. The right gastric artery detaches 6–8 small gastric branches to the adjacent area of the stomach where it passes.

The right gastroepiploic artery arises from the gastroduodenal artery where the latter gains the dorsal aspect of the pyloric region. It passes in the greater omentum along the greater curvature of the stomach toward the right side where it terminates by anastomosing with the left gastroepiploic artery opposite to the angular notch. During its course, the right gastroepiploic artery detaches 5–7 small gastirc braches to the adjacent area of the greater curvature of the stomach. in addition, the pyloric region of the stomach recieves twigs fro the gastrodudodenal artery.

It is clear that the stomach is surrounded by what can be called an arterial circle resulting from the anastomosis between the right and left gastroepiploic arteries on the greater curvature as well as the right and left gastric arteries on the lesser curvature (Fig. 1). The arterial circle furnishes the stomach with Rr.gastrici. The weakest parts of this circle are found at the point of anastomosis which is located at the angular notch on the lesser curvature or opposite to this notch on the greater curvature.

The previously described normal arterial picture of the stomach is changed after the partial gastrectomy and the degree of the change depends upon the amount of the removal part of the stomach. After removal 50% of the stomach (Fig. 2) the anastomosis between the right and left gastroepiploic arteries is not demonstrated at the site of operation. Moreover, the area of operation was free from small gastric branches. But after removal 75% of the stomach (Fig. 3) the left gastroepiploic artery is completely resected and the right gastroepiploic artery is partially resected. The deficiency of the arterial blood supply due to the complete or partial absence of the aforementioned arteries is compensated by a clear distension in the gastric branches of the left gastric artery which become more flexous.

II – Surgical consideration (Fig. 4 & 5):

Animals of the first group had survived the whole time of experiment in good general condition and without any complications. One out of 7 dogs of the 2nd group died one week after surgery while two dogs from the third group were died 5 and 8 days post operatively. Living dogs of the second and third groups were gradually depressed and emaciated.

Stomach of three out of four dogs with half of the stomach became enlarged to a normal or greater than normal size. Dogs of the third group with only one quarter stomach, the latter is enlarged but not reach its normal size. Only one dog from the last group its stomach was enlarged greater than the normal size.

DISCUSSION

According to that recorded by SISSON and GROSSMAN (1967), the present work indicates that the celiac artery in dog divides into the hepatic artery and a short common stem from which the left gastric and splenic arteries arise. But corresponding to that mentioned in the same animal by MILLER, et al. (1964); GHOSHAL (1975); ADAMS (1986) and DYCE, et al. (1987) the celiac artery follows the commonest pattern of divisio in which it divides into three major vessels, splenic, left gastric adn hepatic arteries. This condition is observed only in 3 out of 15 examined cases. In this respect MILLER, et al. (1964); GHOSHAL (1975) and ADAMS (1986) pointed up that the left gastric and splenic arteries arise rarely by a short common trunk. While WILKENS and MUNSTER (1981) stated that in dog the left gastric artery originates usually from the splenic artery.

The celiac artery in the examined cases of dog is a relatively short vessel measures about 1.5cm in length. On the other hand, DYCE, et al. (1987) stated that the caliac artery divides directly after leaving the aorta. In all investigated cases the splenic artery arises from celiac artery either directly or indirectly. However, this artery arose from the cranial mesentric artery in exceptinal case as given by KENNEDY and SMITH (1930) and in 3.7% of the cases as recorded by GUPTA, et al. (1980). The current study shows that the left gastric artery divides into visceral and parietal branches. This division was recorded by GUPTA, et al. (1980) in 95.1% of the examined dogs. But after MILLER, et al. (1964), WILKENS and MUNSTER (1981) the left gastric artery may be double, however, PIASECKI (1975) described double left gastric artery in all his 6 cases. Perhaps the division of the left astric artery into two branches which were reported in the present study and by GUPTA, et al. (1980) might have made PIASECKIC (1975) to think that left gastric artery was double in each specimen.

In agreement to statement of the SISSON and GROSSMAN (1967) in dog and WARICK (1963) in human, the right gastric artery anastomoses in the

most cases with the terminal branches of the left gastric artery. But according to MILLER, et al. (1964); ADAMS (1986) and DYCE, et al. (1987) the right gaastric artery in dog anastomoses with the left gastric artery itself.

As mentioned by DYCE, et al. (1987) in dog the right and left gastroepiploic arteries anastomose on the greater curvature and the right and left gastric arteries anastomose on the lesser curvature of the stomach. They added that the arterial arcades that follow the curvatures supply a fair-sized branches to the adjacent part of both surfaces of the stomach. The same result was obtained in the present study in which the anastomosis between the allready described arteries forms what can be called an arterial circle which supplies the stomach with the Rr.gastrici. Thsi anastomosis is clinically important because if one of these arteries is closed due to affection or during operation the other arteries can compensate this defect. In this connection, BROWN and DERR (1952) in human stated that the rich intramural blood supply imply that one intact major artery is adequate to supply the stomach with the arterial blood even through all other arteries are ligated.

Accoring to this work the arterial picture of the stomach in dog is changed after partial gastrectomy, the anastomosis between the right and left gastroepiploic arteries is not demonstrated at site of operation after removal 50% of the stomach. But after removal 75% of the stomach the gastric branches of the left gastric artery were clearly distended and became more flexous to compensate the partial or complete absence of the right and left gastroepiploic arteries respectively.

Stomach, like other organs probably rarely function up to the limit of its capacity. Like the heart and other organs there is a reserve power rarely called into use. This excess in the stomach may perhaps, be measured by the resection of small portion, where the metabolic reaction is nil, but when the limit of this reserve is reached the diminished function involves the adaptive powers of remaindes of the stomach and a compensation for the loss is established in a hypertrophy of the remaindes. Moreover, compensation of the loss especially in the blood vasculature of the stomach will be calculate through the importance of the intramural anastomotic system in the supply of the stomach. In this manner BROWN and DERR (1952) concluded that one intact major artery of the intramural blood

supply is adequate to supply the stomach with arterial blood even through all other arteries are ligated.

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LEGENDS

Fig. (1): Radiograph of the normal arterial vasculature of stomach.

Fig. (2): Radiograph of the arterial vasculature of the stomach after removal 50%.

Fig. (3): Radiograph of the arterial vasculature of the stomach after removal 75%.

1– A.celiaca. 2– A.hepatica. 3– A.lienalis.

4– A.gastrica sinistra 5– A.gastroepiplocia sinistra.

6– A.gastrica dextra. 7– A.gastroepiplocia dextra:

A.Site of operation operation after removal 50% from the stomach.

B.Site of operation after removal 75% from the stomach.

Fig. (4): X–Ray reveals shape of the stomach one month following removal 25%.

Fig. (5): X–Ray reveals shape of the stomach one month following removal 75%.

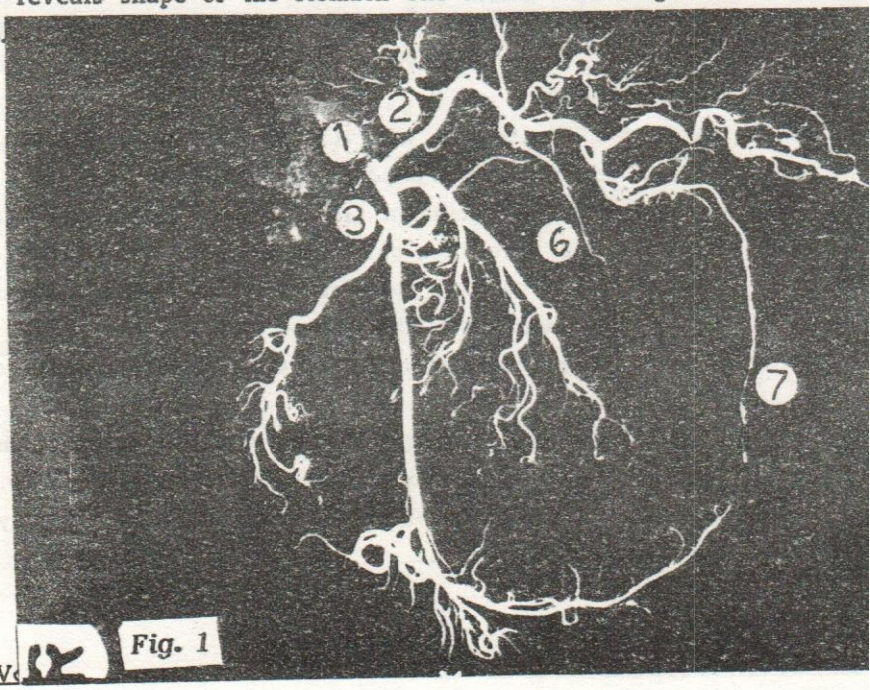

Fig. 1

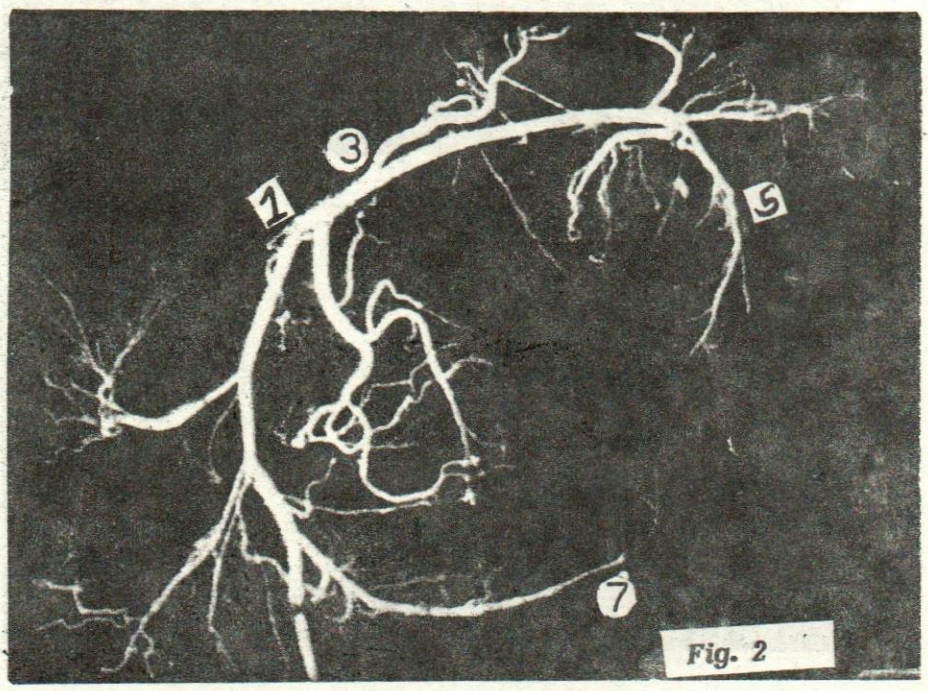

Fig. 2

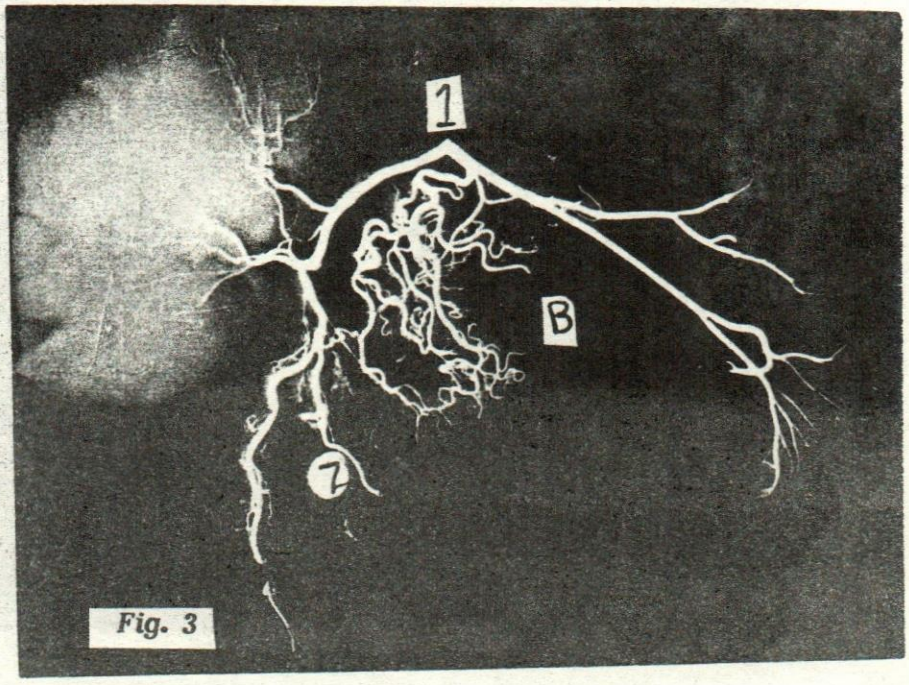

Fig. 3

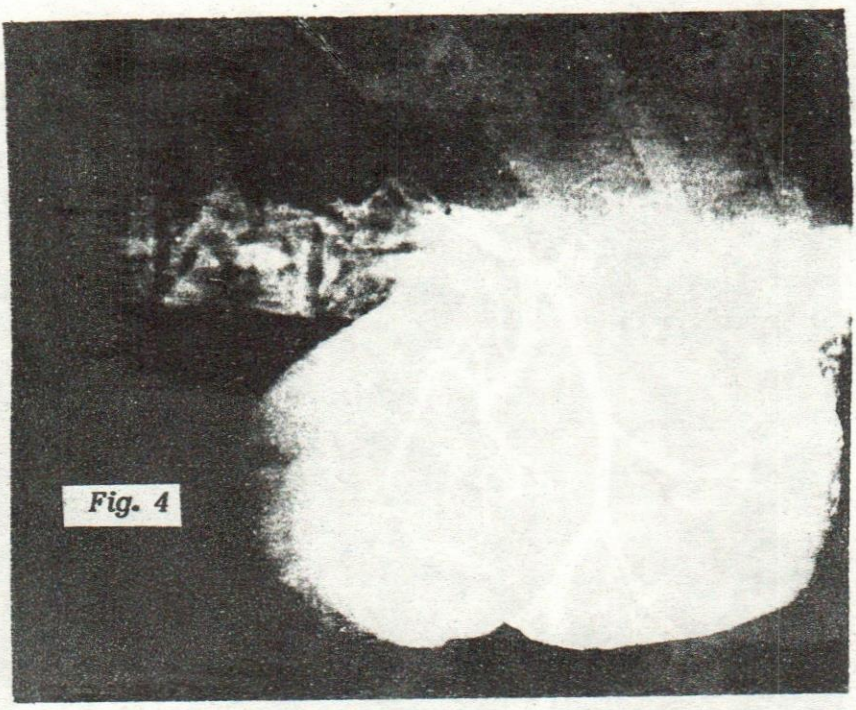

Fig. 4

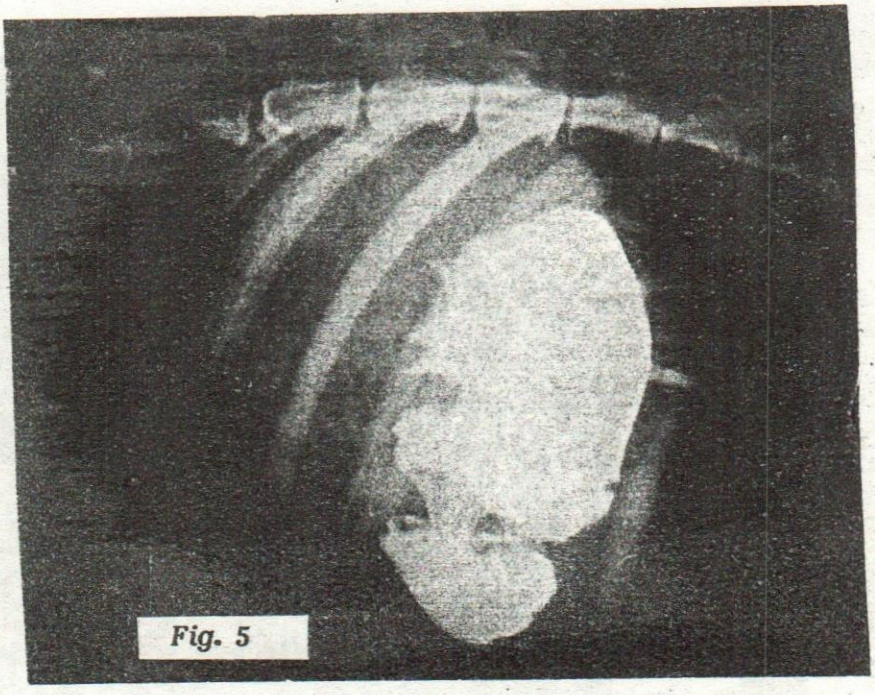

Fig. 5