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DEVELOPMENT OF ARTERIAL VESSELS OF THE STOMACH IN THE LATE FETAL PERIOD OF HUMAN ONTOGENESIS AND IN NEWBORNS

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During the 7-8th month of the fetal period, the left gastric artery in all cases was the first branch that arose from the abdominal trunk. At the level of the cardiac region of the stomach, it was divided into 2 branches – the anterior and posterior in 14 cases (out of 15 examined), and in 1 case into 3 branches – anterior, middle and posterior. The right gastric artery was a branch of the common hepatic artery in 5 cases, in 8 instances it was hepatic and in 2 – of the left side of the latter. In 11 cases, it is represented by one trunk and forms an anastomosis with the anterior branch of the left gastric artery by direct connection, or by means of lateral branches. The vessels of the stomach of the 9-10-month-old fetuses are studied on 10 objects. The left gastric artery in 9 cases is divided into the anterior and posterior branches, and in one case it is represented by one trunk. The right gastric artery in 6 cases is a branch of the hepatic artery, in 4 cases – of the common one. In 7 observations, the artery is divided into 2 branches (the anterior and posterior), which are anastomosed with the corresponding branches of the left gastric one. Stomach vessels of newborns have been studied on 5 objects. The left gastric artery in all cases is divided into the anterior and posterior branches. The right gastric artery arose from the hepatic one and in all cases is represented by one vessel, which, either directly or by secondary branches, is anastomosed with the anterior branch of the left gastric artery.

Key words: arteries, stomach, development, fetal period, newborn.

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Blood supply of the stomach in the postnatal period of human ontogenesis has been studied sufficiently completely and deeply [1, 2]. A large range of individual variability of arteries and veins has been revealed, which is of great importance for the needs of practical medicine, especially surgery. All of the above mentioned refers to the stomach, as to the organ of the abdominal cavity. Information about the anatomical and topographical structure of the blood vessels of the stomach [3, 4] have been accumulated, the classification of the branches of vessels of the internal organs has been formed, the peculiarities of the location of the vessels in different regions of the stomach have been determined [5] etc. At the same time, it is known that the roots as developmental patterns, and the emergence of individual variability are in the prenatal period of development [6].

The investigations dealing with the studies associated with the development of stomach vessels during the whole period of prenatal human ontogenesis have not been found in the available sources. Our publications [7, 8] are stipulated by the desire to reduce this gap.

The purpose of the work was to study the development of the stomach arterial vessels in the late fetal period of prenatal human ontogenesis and the status of the organ's arterial system in newborns.

Materials and methods. The study involved 25 corpses of fetuses aged 7-10 months of intrauterine development (231.0 – 375.0 mm of crown-rump length – CRL) and 5 corpses of newborns. The age of the fetuses was determined by the tables of B.M. Petten (1959), B.P. Khvatov, Yu.N. Shapovalov (1969). The methods of injection with stained mixtures, or X-ray contrast media, followed by macro-, microscopic preparation, visualization or radiography, microscopic examination of histological sections, and graphic reconstruction were used.

Results and their discussion. During the 7-8th month of the fetal period, the left gastric artery in all cases was the first branch arising from the abdominal trunk. The initial portion of the artery, the diameter of which increases from 0.6 to 0.8 mm, has an ascending direction, and is located in the thickness of the root of the dorsal mesenterium, reaches the stomach and at the level of its cardiac region in 14 cases (out of 15 examined) was divided into 2 branches – anterior and posterior, and in 1 case into 3 – anterior, middle and posterior. Before being divided in all cases ascending branch 0.35-0.48 mm in diameter arose in the direction of the esophagus and the fundus of the stomach, which in its turn branched out into the anterior and posterior branches. The anterior branch of the left gastric artery descends along the anterior edge of the lesser curvature (in some cases going onto the anterior wall), giving from 4 to 8 branches of the third order, the diameter of which ranges from 0.35 to 0.45 mm. In one case, there were only 2 arising branches. The number of branches of the third order, arising from the posterior branch, ranges from 3 to 7. The right gastric artery (0.35-0.5 mm in diameter) in 5 cases is a branch of the common hepatic artery, in 8 cases – of actually hepatic one and in 2 – of the left branch of the latter. Locating in the thickness of the hepatic-gastric ligament, it then goes along the superior edge of the pyloric portion of the stomach in the direction of its angle. In 11 cases, it is represented by one trunk and forms an anastomosis with the anterior branch of the left gastric artery by direct connection, or by means of lateral branches. In 4 observations the right

gastric artery is immediately divided into 2 branches – anterior and posterior. The posterior branch in 3 cases is anastomosed with the same branch of the left artery, in 1 case it is short, branching independently into a number of thin branches. The number of branches of the right gastric artery of the third order, passing along the anterior and posterior walls of the stomach ranges from 4 to 8, from 0.25 to 0.35 mm in diameter. The right gastroepiploic artery in all cases was one of the terminal branches of the gastro-duodenal artery, its diameter reaches 0.55-0.8 mm, represented by one trunk, located along the greater curvature in the area of the pylorus and caudal portion of the body of the stomach. The number of branches that go to the anterior and posterior walls is almost symmetrically ranging from 14 to 30. The left gastroepiploic artery in 9 samples arises from the inferior branch of the spleen artery, in 4 of them – directly from the trunk, and in 2 – from its middle branch. The diameter of the vessel in the place of arising varies from 0.35 to 0.54 mm. The number of branches going to the anterior and posterior walls of the stomach is 6-10. Anastomosis between the two gastroepiploic ones is directly observed in 5 cases, between lateral branches – in 6 cases, and in 4 cases visually detected anastomoses were not observed. The number of short stomach arteries (0.3-0.5 mm in diameter) varies from 3 to 6, each arising from the terminal branches of the spleen artery. They supply the posterior wall of the fundus and partly the body of the stomach, as well as the anterior wall of the body in the area of the greater curvature.

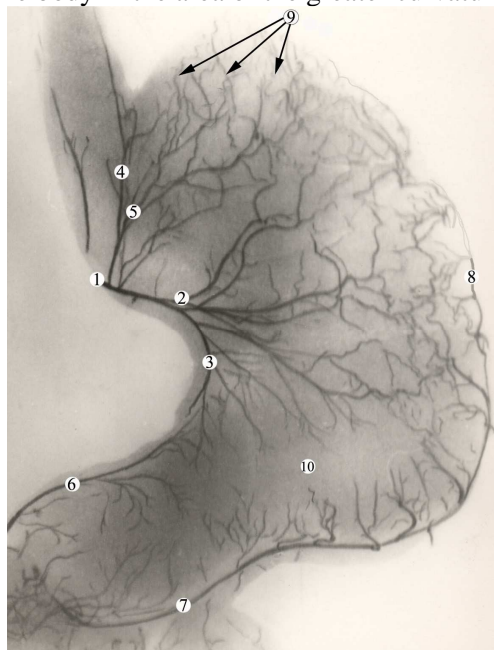


Fig.1 Roentgenogram of the arterial vessels of the stomach in the fetus, having 325 mm of crown-rump length. 1 – left gastric artery; 2 – anterior branch of the left gastric artery; 3 – posterior branch of the left gastric artery; 4 – branch to the esophagus; 5 – branches to the cardiac region; 6 – right gastric artery; 7 – right gastroepiploic artery; 8 – left gastroepiploic artery; 9 – short gastric arteries; 10 – low-vessel area of the body of the stomach.

The vessels of the stomach of the 9-10-month-old fetuses were studied on 10 objects. The left gastric artery (from 0.85 to 1.3 mm in diameter) in 9 cases is divided into the anterior and posterior branches (Fig. 1), in one case it is represented by one trunk. Diameter of the branches is 0.65-0.8 mm. The branches of the third order in the number from 3 to 9 are located and branched out in the subserous layer of the anterior and posterior walls of the stomach. Right gastric artery (up to 0.6 mm in diameter) in 6 cases is a branch of the hepatic artery, in 4 cases it is a branch of the common artery. In 7 observations, the artery is divided into 2 branches (the anterior and posterior), which are anastomosed with the corresponding branches of the left gastric one. In 3 cases, the artery is represented by a single trunk, located along the anterior edge of the lesser curvature of the stomach. The right gastroepiploic artery (from 0.7 to 1.0 mm in diameter) in all observations is a branch of gastro-duodenal artery. From 16 to 32 branches 0.45-0.55 mm in diameter arise from it in the direction of the anterior and posterior walls of the stomach.

The left gastroepiploic artery (0.5-0.65 mm in diameter) arises from the inferior (6) middle (3) branches of the spleen artery and only in one case from the main trunk. In one case, there was detected an additional vessel arising from the middle portion of the splenic artery, located on the posterior wall of the stomach, reaching the fundus. There were from 3 to 5 short gastric arteries, 0.45-0.55 mm in diameter.

Gastric vessels in newborns have been studied on 5 objects. The left gastric artery in all cases is divided into the anterior and posterior branches. The right gastric artery arising from the hepatic one was in all cases represented by one vessel, which, either directly or by secondary branches, forms anastomoses with the anterior branch of the left gastric artery. Up to 30 branches going to the walls of the stomach arise from the right gastroepiploic artery (the branch of the gastro-duodenal one), located along the greater curvature. Up to 10 branches going to the walls of the stomach arise from the left gastroepiploic artery. There was a direct anastomosis between the two arteries in all observations. There were from 3 to 5 short branches, the blood supply areas were similar to those in 9-10-month-old fetuses.

The described vessels and their first branches are initially located under the serous membrane of the stomach. Types of branches are diverse: bifurcation, trifurcation, arborescent; numerous anastomoses were detected between them. The smaller branches (of the IV, V orders) penetrate into the submucosal base, where they are located closer to the muscular membrane, forming a network (the diameter of the largest vessels is 0.42 mm, of the smallest – 0.044-0.048 mm). 2 types of vessels arise from this network: the first are directed deeply inside and form another (deep) plexus of the submucosal tissue (the diameter of the vessels is 0.036-0.040 mm) under the muscular layer of the mucosa; the others return to the subserous layer where they are divided in a T-like way and come into contact with the vessels of the subserous plexus.

Passing through the muscular membrane, these communicative vessels give a small number of lateral branches to supply the muscular membrane with blood. As shown in Fig. 1, the left gastric artery is the principle vessel supplying the stomach with blood in the late fetal period of development. The areas with visually less number of vessels at the final stage of the fetal period are significantly reduced.

Conclusions

1. In 7-10-month-old fetuses and newborns the bifurcation type of the branching of the left gastric artery (28 out of 30) prevails, while the right one in most cases is represented by one trunk (22 out of 30).
2. The left gastric artery and the right gastroepiploic artery are the gastric vessels with the largest diameter at the time of birth, while the distribution area of the branches of the left gastric artery is much larger.
3. Well-developed subserous and submucosal (superficial and deep) plexuses are determined in the wall of the stomach of fetuses and newborns, while in the muscular membrane the arterial vessels form single anastomoses.

Prospects for further research involve the generalization of the angioarchitectonics of the stomach arterial system in fetuses and newborns.

References

1. Akhtemiichuk YuT. Narysy embriotopohrafi. Chernivtsi: Bukrek; 2008. 200 s. [in Ukrainian]
2. Holovatskyi AS, Cherkasov VH, Sapin MR, Parakhin AI. Anatomiiia liudyny. V 3-kh t. Vydannia 2-e, doopratsyovane. Vinnytsia: Nova knyha; 2011. T. 2, 456 s. [in Ukrainian]
3. Kovalchuk LIa, Sukhynskiy KI, Sukhynskiy RK. Strukturna orhanizatsiia intraorhannoho krovonosnogo rusla stinok shlunka liudyny. Shpytalna khirurhiya. 1998; 4:55-9. [in Ukrainian]
4. Kurygin AA, Gajvoronskiy IV, Musinov IM. Lokalnye i individualnye osobennosti angioarhitektoniki zheludka i ikh znachenie v proyavlenii krovotocheniy. Vestnik hirurgii im. II. Grekova. 2004; 163(3):19-21. [in Russian]
5. Loytra AO, Shkrobanets AA, Boichuk OM. Rozvytok arterialnykh sudyn shlunka u plodiv 4 – 6-ho misiatsiv prenatalnogo periodu ontogenezu liudyny. Bukovynskiy medychnyi visnyk. 2017; 21(2 Ch 2):60-2. [in Ukrainian]
6. Nebaba NL. Strukturnaya organizatsiya podslizistogo krovenosnogo rusla zheludka. Tavricheskiy mediko-biologicheskiy vestnik. 2006; 9(3):120-3. [in Russian]
7. Snell RS. Clinical anatomy by regions. Philadelphia; 2008. 926 p.

Реферати

РОЗВИТОК АРТЕРІАЛЬНИХ СУДИН ШЛУНКУ У ПІЗЬНОМУ ПЛОДОВОМУ ПЕРІОДІ ОНТОГЕНЕЗУ ТА У НОВОНАРОДЖЕНИХ ЛЮДИНИ

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Впродовж 7-8-го місяців плодового періоду ліва шлункова артерія у всіх випадках була першою гілкою, яка відходила від червного стовбура. Вона на рівні кардіальної частини шлунка, у 14 випадках (з 15 досліджених) поділялася на 2 гілки – передню та задню, а 1 випадку на 3 – передню, середню та задню. Права шлункова артерія у 5-и випадках є гілкою спільної печінкової артерії, у 8-и – власне печінкової та у 2-х – лівої гілки останньої. У 11 випадках вона представлена одним стовбуром та анастомозує з передньою гілкою лівої шлункової артерії шляхом безпосереднього з'єднання, або за допомогою бічних гілок. Судини шлунка плодів 9-10-го місяців вивчені на 10 об'єктах. Ліва шлункова артерія у 9-и випадках поділяється на передню та задню гілки, в 1-му представлена одним стовбуром. Права шлункова артерія у 6-и випадках гілка власне печінкової артерії, у 4-х – спільної. У 7 спостереженнях артерія поділяється на 2 гілки (передню та задню), які анастомозують з відповідними гілками лівої шлункової. Судини шлунка новонароджених вивчені на 5 об'єктах. Ліва шлункова артерія у всіх випадках поділяється на передню та задню гілки. Права шлункова артерія відходила від власне печінкової і в усіх випадках представлена однією судиною, яка безпосередньо, або вторинними гілками анастомозує з передньою гілкою лівої шлункової.

Ключові слова: артерії, шлунок, розвиток, ембріональний період, новонароджений.

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РАЗВИТИЕ АРТЕРИАЛЬНЫХ СОСУДОВ ЖЕЛУДКА В ПОЗДНЕМ ПЛОДОВОМ ПЕРИОДЕ ОНТОГЕНЕЗА И У НОВОРОЖДЕННЫХ ЧЕЛОВЕКА

Лойтра А.А., Шкробанец А.А., Бойчук О.М., Лопушняк Л.Я., Дмитренко Р.Р., Руснак В.Ф., Галагдина А.А.

В течение 7-8-го месяцев плодного периода левая желудочная артерия во всех случаях была первой ветвью, которая отходила от червного ствола. На уровне кардиальной части желудка, в 14 случаях (из 15 исследованных) артерия разделялась на 2 ветви – переднюю и заднюю, а 1 случае на 3 – переднюю, среднюю и заднюю. Правая желудочная артерия в 5-и случаях является ветвью общей печеночной артерии, в 8-и – собственно печеночной и в 2-х – левой ветви последней. В 11 случаях она представлена одним стволом и анастомозирует с передней ветвью левой желудочной артерии путем непосредственного соединения или с помощью боковых ветвей. Сосуды желудка плодов 9-10-го месяцев изучены на 10 объектах. Левая желудочная артерия в 9-и случаях делится на переднюю и заднюю ветви, в 1-м представлена одним стволом. Права желудочная артерия в 6-и случаях – ветвь собственно печеночной артерии, в 4-х – общей. В 7 наблюдениях артерия делится на 2 ветви (переднюю и заднюю), которые анастомозируют с соответствующими ветвями левой желудочной. Сосуды желудка новорожденных изучены на 5 объектах. Левая желудочная артерия во всех случаях делится на переднюю и заднюю ветви. Права желудочная артерия отходила от собственно печеночной и во всех случаях представлена одним сосудом и непосредственно или вторичными ветвями анастомозировала с передней ветвью левой желудочной артерии.

Ключевые слова: артерии, желудок, развитие, эмбриональный период, новорожденный.

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