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Original Research Article

A Hospital Based Observational Study to Evaluate Branching Pattern of The Splenic Artery in the Human Cadaveric Spleen

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to see the branching pattern of the splenic artery in the human cadaveric spleen.

Material & Methods: This observational study was carried out in the Department of Anatomy, NMCH, Patna, Bihar, India for one year. The present study was conducted on 50 Human cadaver spleens, irrespective of their age and sex, fixed in 10% formalin solution, collected from the department of Anatomy department. The gross dissection was done by following the guidelines of Cunningham's Manual.

Results: Two primary segmental branches were seen in 35 (70%) specimens, three primary segmental branches were seen in 13 (26%) specimens and four primary segmental branches were seen in 2 (4%) specimens. The mean distance between the termination of splenic artery and the hilum of the spleen was 2.4 cm. The range was extending from 0.5 cm to 6.4 cm. The extra-parenchymal anastomosis of primary segmental branches was seen in 4 (8%) specimens. The intra-parenchymal anastomosis was seen in 2 (4%) and sub-capsular type of anastomosis was seen in 2 (4%) specimens.

Conclusion: The spleen is a highly vascular and friable organ. It is the largest of secondary lymphoid organ, which contains 25% of the body's lymphoid tissue and has both haematological and immunological functions. Total splenectomy is commonly done after a splenic injury, which leads to decrease in the immunity and predisposes the normal host to overwhelming life-threatening infections and also creates an altered haematological picture. To overcome this, partial splenectomy can be done by ligating a particular segmental branch of splenic artery.

Keywords: Splenectomy, Segmental Branches, Splenic Artery.

Introduction

The spleen is a highly vascular and friable organ. It is the largest secondary lymphoid organ, which contains 25% of the body lymphoid tissue and has both haematological and immunological functions.[1] Arterial blood supply correlates with the functional capability of the human spleen [2]. The spleen receives

a generous blood supply. Approximately 350 litres of blood per day pass through the spleen.[3] The spleen is structured in such a way that most of the blood flow passes through the marginal zone and directly along the white pulp leads to efficient monitoring of the blood by the immune system [4,5] – a s functional capacity correlates vascularity in the vicinity.

Spleen is supplied by splenic artery which is the largest branch of coeliac trunk.1 Jáuregui [6] found that the average length of splenic artery is 10.6 cm. The most striking feature of the splenic artery is its tortuosity. It traverses through the lienorenal ligament to reach near the hilum of the spleen, where it divides into two or three primary branches, each of which is subdivided mostly into two or four secondary branches. Moreover, a superior polar arteries and inferior polar arteries are given from splenic trunk or from one of its primary branches, which goes to the poles of the spleen, without entering the hilum. It is called as superior and inferior polar branches. The human spleen is divided accordingly into two or three main segments. Each main segment is also divided usually into two to four less constant secondary segments. The segments of spleen are separated by a definite avascular plane.

The partial removal of the spleen is possible, as the spleen is divided into segments, separated by fibrous septa and each segment is supplied by its own main artery.[7] The presence of splenic segmentation could be attributed to its development or to the terminal division of the artery. Better anatomical knowledge about segmental distribution of splenic artery and its variations are important for the partial removal of the organ. So, keeping the applied aspect and clinical significance of segmental branches of splenic artery and to add more knowledge to the existing one, the present study was undertaken to study the segmental branches of splenic artery which divide the spleen into various segments, its pattern of distribution and also to find out any inter-segmental arterial anastomosis by dissection method.

Sound knowledge of the variational anatomy of the splenic artery and its branches is indispensable to the surgeons in splenectomy, resection of any tumours, extirpation of cysts, because highly vascular spleen is prone to excessive bleeding which often occurs with resultant to unnecessary death.

The aim of the present study was to see the branching pattern of the splenic artery in the human cadaveric spleen.

Material & Methods

This descriptive observational type of study was done in the Department of Anatomy, NMCH, Patna, Bihar, India for one year and 50 human spleens were collected from the unclaimed dead bodies that were under examination in the Department of Forensic Medicine of NMCH, Patna, Bihar, India The samples were brought to the Department of Anatomy and divided into three age groups including group A (15-29 years), group B (30-49 years) & group C (50-69 years), for convenience of the study procedure, according to Rayhan et al.[8]

The splenic artery supplying the spleen and its branching pattern was observed by meticulous dissection on each specimen. The distance from the point of primary division of the splenic artery to the point of hilum was measured with the help of a measuring tape. Observed the number of lobar branches as most of the terminal division of the splenic artery occurs before entering into the hilum of the spleen. So was observed for lobar branches of the splenic artery by blunt macroscopic dissection. Its secondary branches were also observed. However, some of the lobar branches divided after entering into the hilum within the substance of splenic tissue. For this reason, 16 samples were

transferred into the caustic soda solution for 24-48 hours (100 ml water + 25 gm caustic soda) after removal of splenic capsule from the surface of the spleen. The spleen was removed from the solution and washed thoroughly with running tap water. After that, the splenic tissue was removed by application of gentle pressure over it and washed with running tap water (according to Rayhan et al.[8])

Angiography of spleen was done to see the vasculature especially for observing the number of the lobar branches and number of the secondary branches of the splenic artery. At first the tail of the pancreas was identified and the splenic artery was cut 5 cm proximal to the hilum of the spleen in 6 cases. The collected spleens were washed thoroughly with normal saline or acetone till the splenic vein showed the clear fluid coming out of it. Then solution of barium sulphate was injected into splenic artery with the help of a 50cc syringe and polythene cannula, but in few cases a branch of the splenic artery before entering to the hilum was ligated with silk to prevent the dye entering through that branch. The splenic artery was ligated after injecting the dye. The dye-injected spleens were radiographed immediately in more than two planes (according to Chakravarthi et al.[5])

Statistical Analysis

The collected data were analyzed by using SPSS version 11.0. Comparison between groups was done by One-way ANOVA (PostHoc).

Results

Table 1: Number of primary segmental branches of splenic artery

Primary segmental branches	Number of specimens	Percentage
One	Nil	0
Two	35	70
Three	13	26
Four	2	4
Total	50	100

Two primary segmental branches were seen in 35 (70%) specimens, three primary segmental branches were seen in 13 (26%) specimens and four primary segmental branches were seen in 2 (4%) specimens.

Table 2: Distance between the termination of splenic artery and the hilum of the spleen in cm

Mean	2.4
SD	1.5
Min	0.5
Max	6.4
Median	1.5

The mean distance between the termination of splenic artery and the hilum of the spleen was 2.4 cm. The range was extending from 0.5 cm to 6.4 cm.

Table 3: Types of anastomosis

Types of anastomosis	Number of specimens	Percentage (%)
None	42	84
Extra-parenchymal	4	8
Intra-parenchymal	2	4
Sub-capsular	2	4
Total	50	100

The extra-parenchymal anastomosis of primary segmental branches was seen in 4 (8%) specimens. The intra-parenchymal anastomosis was seen in 2 (4%) and sub-capsular type of anastomosis was seen in 2 (4%) specimens.

Discussion

Spleen is supplied by splenic artery, which terminates at the hilum by dividing into 2 or 3 terminal branches. These are named as superior, middle and inferior primary branches. These branches supply a particular part of the spleen which is separated by an avascular plane. Thus, these branches divide the spleen into definite arterial segments. So, these arteries can be considered as the primary segmental branches.[9]

Two primary segmental branches were seen in 35 (70%) specimens, three primary segmental branches were seen in 13 (26%) specimens and four primary segmental branches were seen in 2 (4%) specimens. The mean distance between the termination of splenic artery and the hilum of the spleen was 2.4 cm. The range was extending from 0.5 cm to 6.4 cm. The branches of spleen are named as superior, middle and inferior primary branches. These branches supply a particular part of the spleen which is separated by an avascular plane. Thus, these branches divide the spleen into definite arterial segments. So these arteries can be considered as the primary segmental branches.[9]

In some spleens, a branch arising from splenic artery itself or one of its primary branch which does not pierce the hilum, but goes to the poles of spleen. These are known as superior and inferior polar arteries. These arteries also supply a particular segment of spleen, which can be considered as the polar segments.[10] Silva LFA et al[11] observed 16% arising from main trunk and 20% arising from terminal branches. Swamy VL et al[12] noted all polar arteries arising from main trunk only.

Gupta et al.[2] studied 42 specimens where they found in 34 (84%) specimens, the splenic artery divided into two primary branches and in 8 specimens (16%) into three primary branches. Machálek et al.[13] observed that the splenic artery in 79% of cases branches into superior and inferior splenic branch. Trifurcation was noticed in 18% cases. Rayhan et al.[9] studied 70 cadaveric spleen and found two lobar arteries in 42 (60%) and three lobar arteries in 28 (40%) cases. Katritsis et al.[9] stated that splenic artery is divided into two primary splenic branches in 85.7 % of the specimens, and into three primary splenic branches in 14.3 % of the specimens.

The human spleen is divided accordingly into two or three main arterial segments, separated by a definite avascular plane. Each main segment is also subdivided, usually into two to four less constant secondary segments, the architecture of which and the avascular planes between them are very variable.

Conclusion

The spleen is a highly vascular and friable organ. It is the largest of secondary lymphoid organ, which contains 25% of the body's lymphoid tissue and has both haematological and immunological functions. Total splenectomy is commonly done after a splenic injury, which leads to decrease in the immunity and predisposes the normal host to overwhelming life threatening infections and also creates an altered haematological picture. To overcome this, partial splenectomy can be done by ligating a particular segmental branch of splenic artery.

The partial removal of the spleen is possible, as the spleen is divided into segments, separated by fibrous septa and each segment is supplied by its own main artery. The presence of splenic

segmentation could be attributed to its development or to the terminal division of the artery. Better anatomical knowledge about segmental distribution of splenic artery and its variations are important for the partial removal of the organ.

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