Original Article

Variaton of Distance between Sites of Division of Splenic Artery and the Hilum and Number of Branches of Splenic Artery

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Abstract

Background: *Spleen, the largest lymphoid organ in the human body is closely associated with the circulatory system. Splenic arterial interventions are increasingly used to treat various medical disorders and sometimes may be substituted for surgery. For example, embolization is often performed to treat post traumatic splenic injuries and in patients with hypersplenism and those who require high-dose chemotherapy or immunosuppressive therapy to improve their hematologic parameters. So, detailed anatomical knowledge on spleen is very much important.* ***Objectives:*** *Knowledge of division of splenic artery is of great importance in surgical practice.* ***Materials and Methods:*** *This cross sectional descriptive study was done to measure distance between sites of division of splenic artery and the hilum and number of branches of splenic artery. A total 80 human spleen were collected by purposive sampling technique. The specimens were collected, from autopsy laboratory of the Department of Forensic Medicine and divided into three groups according to age.* ***Results:*** *In the present study it was found that, maximum mean distance was 1.98cm in group C, and it was observed that the distance increased with age and no significant difference was found among the age groups. It was also found that, the maximum two branches were present in group B and three branches in group C.* ***Conclusion:*** *The distance between the site of division of splenic artery and hilum increased with age. The incidence of two branches of splenic artery is more in group B and maximum three branches present in group C.*

Keywords: Spleen, Splenic artery, Bangladeshi cadaver.

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Introduction

The spleen is a large haemolymphoid organ consisting of vascular and lymphoid tissue which is located in the left quadrant of the abdominal cavity opposite the left ninth to eleventh ribs. Due to its rich vascularity it has friable texture. It has two surfaces (diaphragmatic and visceral), the superior and inferior borders and anterior and posterior ends or poles.[1] Splenic parenchyma consists of white and red pulp that is surrounded by serosa and a collagenous capsule with smooth muscle fibres. This parenchyma also contains dense connective tissue, rich in collagen and elastic fibres (Trabeculae). These trabeculae along with reticular framework, support the cells and surround the vessels in the splenic pulp. Spleen is an elastic, controllable reservoir that is important in adjusting the volume of the circulating blood.[2,3] During fetal development the spleen has performed important hematopoietic functions, which includes erythropoiesis and granulopoiesis. It has a distinctive pattern of blood circulation and specialized vascular channels that facilitate the filtering of blood.[4] Spleen is a spongy organ with considerable capacity of retention and excretion of blood which get supply from the splenic artery.[5] Near the splenic hilum, the artery usually divides into terminal and polar arteries. The superior terminal branches are usually longer than the inferior branches and provide the major splenic arterial supply, then enter the hilum and divide further into four or five segmental arteries that each supplies a segmental vessel often leads to

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infarction of part of the spleen.[6] In case of diffuse type of spleen, the terminal branches are long and arise far away from the hilum. On the other hand, the compact type shows the short terminal branch, which is close to the hilum.[7] There is typically a superior polar artery, which sometimes communicates with the short gastric arteries; superior, middle, and inferior terminal arteries and an inferior polar artery. In a spleen preserving surgery, knowledge of these variable distributions of splenic artery is necessary.[8] Splenic artery aneurysm are estimated to occur at 0.04%-1% of post-mortem examinations. They are twice as common in the female and are usually situated in the main arterial trunk. Although there are usually single, but more than one aneurysm is found in a quarter of cases. They are more likely to be associated with arteriosclerosis in elderly patients. The treatment of choice is splenectomy and removal of the diseased artery. Splenic infarction commonly occurs in patients with a massively enlarged spleen from myeloproliferative syndrome, portal hypertension or vascular occlusion produced by pancreatic disease, splenic vein thrombosis or sickle cell disease. Treatment is conservative and splenectomy should be considered only when a septic infarcts cause an abscess.[2] Splenic arterial interventions also may be performed to exclude splenic artery aneurysms from the parent vessel lumen and prevent aneurysm rupture; to reduce and prevent sequelae in patients with portal hypertension.[9] Therefore, the application of conservative splenic surgery requires a detailed knowledge of vascular pattern of spleen in both sexes. In this present study, the distance between the site of division of splenic artery and hilum and the number of branches of splenic artery were studied and compared with the works of many eminent authors in this field.

Materials and Methods

The study was carried out in the department of Anatomy, Mymensingh Medical College, Mymensingh from June 2013 to July 2014. A total 80 human spleen were collected by purposive sampling technique from October 2013 to April 2014, among them 47 were male and 33 were female. The specimens were collected from Bangladeshi cadavers, from autopsy laboratory of the department of Forensic Medicine of Mymensingh medical college. Only fresh specimens from persons who died within the preceding 12 hours were chosen. After collecting, the specimen was allowed to get fixed for 48-72 hours and preserved in 10% formol-saline solution. For convenience of differentiating the number of splenic artery in relation to age and sex, the collected specimens were divided into three groups namely group A (0-20 years), group B (21-40 years) and group C (41-60 years). After removal of all fats and unwanted tissue, splenic artery was carefully preserved with its branches and the point of division of splenic artery was identified. The distance was first fixed with the help of a divider and measured with the help of a measuring scale. All data were recorded in the pre-designed data sheet, analyzed by SPSS program and compared with the findings of other national and international studies and standard text books. In statistical analysis, differences between age groups and sexes were calculated by using one way ANOVA test and unpaired Student's t test accordingly.

Results

From Table-I(a) and I(b) it was evident that the maximum distance between sites of division of splenic artery and the hilum in group A (0-20 years) was 3.00 cm, in group B (21-40 years) 4.00 cm and 5.00 cm in group C (41-60 years). The minimum distance from the hilum in group A was 0.50 cm, in group B 0.50 cm and 0.80 cm in group C. The mean distance was maximum in group B, 2.26 cm in male and in group C 2.06 cm in female and

minimum in group A, 1.49 cm in male and 1.56 cm in female. It was also observed that the mean distance from the hilum was gradually increased with age.

Table: I(a) Mean distance between sites of division of splenic artery and the hilum in different age groups

Age Group	Number of specimen	Distance between sites of division of splenic artery and the hilum in cm Mean ± SD (Minimum – Maximum)
A (0-20 years)	28	1.51±0.62 (0.50- 3.00)
B (21 – 40 years)	31	1.92±0.77 (0.50- 4.00)
C (41 to 60 years)	21	1.98±0.91 (0.80- 5.00)

Table: I(b) Comparison of distance between sites of division of splenic artery and the hilum among the age groups:

Comparison between Variables	Mean Difference in cm	Std. Error	*P*	Level of significance
Group A vs Group B	0.36	0.26	0.192	NS
Group B vs Group C	0.90	0.43	0.07	NS
Group C vs Group A	0.54	0.4	0.232	NS

Comparison between 3 groups were done by ANOVA test. *P* value > 0.05, not significant at 5% confidence interval (CI) level. NS; not significant.

The mean distance between group A & B, group B & C, group C & A was statistically not significant as *p*> .05.

Table- II(a), II(b) and figure 1 depicts that the mean (±SD) distance between sites of division of splenic artery and the hilum was higher in male (1.49±0.48) cm in Group A and (2.26±0.82) cm in group B than that of female (1.56±0.84) cm and (1.67±0.64) cm in Group A and B respectively, but lower in Group C (1.96±1.02) cm where mean distance was (2.06±0.44) cm in Group C.

Table: II(a) Mean distance between sites of division of splenic artery and the hilum in different sex groups

Age Group	Sex of the person	Number of specimen	Mean distance between sites of division of splenic artery and the hilum in cm ± SD
A (0-20 years)	Male	18	1.49±0.48
	Female	10	1.56±0.84
B (21 – 40 years)	Male	13	2.26±0.82
	Female	18	1.67±0.64
C (41to 60 years)	Male	16	1.96±1.02
	Female	5	2.06±0.44

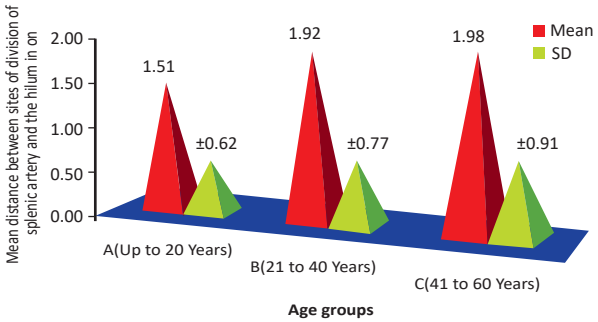
Table: II(b) Comparison of distance between sites of division of splenic artery and the hilum between sexes:

Age group	Mean Difference between sex	Std. Error Difference	t	*p*	Level of significance
A	0.74	0.297	2.488	0.055	NS
B	0.875	0.210	4.162	0.004	S
C	0.95	1.299	0.731	0.598	NS

Comparison between sex was done by variance analysis. *P* value > 0.05, not significant at 5% confidence interval (CI) level. NS; not significant. S; significant.

Variance analysis shows highly significant difference in between group B & C, where for Group B t= -4.162 and *p*=0.004.

Figure 1: Bar diagram representing the mean distance between sites of division of splenic artery and the hilum of spleen in different age groups.



From table III(a) and III(b) it was evident that, about 88.75% of cases the splenic artery divides into superior and inferior terminal branches and in 11.25% of cases the artery divides into superior, middle and inferior terminal branches. It was also found that, the maximum two branches present in group B, which was 90.32% and maximum three branches present in group C, which was 14.28%.

Table: III (a): Number of branches of splenic artery in different age groups

Age Group	Specimen number	Two branches	Three branches
A (0-20 years)	28	25 (89.28%)	3 (10.71%)
B (21-40 years)	31	28 (90.32%)	3 (9.67%)
C (41-60 years)	21	18 (85.71%)	3 (14.28%)
Total	80	88.75%	11.25%

Table: III (b): Comparison of number of branches of splenic artery among the age groups:

Comparison between Variables	Mean Difference in cm	Std. Error	*p*	Level of significance
Group A vs Group B	0.11	0.13	0.396	NS
Group B vs Group C	0.67	0.20	0.01	S
Group C vs Group A	0.56	0.26	0.061	NS

Comparison between 3 groups were done by ANOVA test. *P* value > 0.05, not significant at 5% confidence interval (CI) level. NS; not significant. S; Significant.

The mean values were not significant between group A & B, C & A at $p > .05$ level but statistically significant in group B & C at $p < .05$ level.

Discussion:

From the present study it was evident that, the maximum distance between sites of division of splenic artery and the hilum in group A was 3.00 cm, in group B 4.00 cm and 5.00 cm in group C. The minimum distance from the hilum in group A was 0.50 cm, in group B 0.50 cm and 0.80 cm in group C.

It was also observed that the mean distance was maximum 1.98 cm in Group C and minimum 1.51 cm in Group A. The mean distance between group A & B, group B & C, group C & A was statistically similar. In this study the mean value of the distance between sites of division of splenic artery and the hilum was higher in male than that of female in Group A and group B but lower in Group C. Variance analysis shows highly significant difference in between group B & C and no significant difference between other groups.

In 2008 Chawdhury studied 120 spleens of Bangladeshi cadaver and found that the average maxi-

mum distance from the hilum was 2.67 cm in male and 3.00 cm in female of above 60 years age group. The minimum distance from the hilum was 2.07 cm in male and 1.52 cm in female of upto 15 years age group, which supports the mean distance between sites of division of splenic artery and the hilum of present study.[10] The mean distance of present study in different age group was higher than Rayhan (2006), who studied 70 spleens and found, the maximum mean distance as 3.50 cm in above 60 years age group and minimum as 3.10 cm in 0-19 years age group.[11] The present study shows, splenic artery in group A divided into its terminal branches in group A 0.5- 3.00 cm, in group B 0.5-4.00 cm and in group C 0.8-5.00 cm away from the hilum, which was supported by another study who found that, splenic artery divided into its terminal branches 2-4 cm proximal to the hilum of the spleen.[12] Holivkova et al in 1998 observed that the splenic artery divides into its terminal branches approximately 2-12.2 cm from the hilus, which was higher than the findings of present study.[13]

In the present study it was found that, in 88.75% cases the splenic artery divided into superior and inferior terminal branches and in 11.25% cases splenic artery divided into superior, middle and inferior terminal branches.

Coetzee in his study observed that about 80% of cases the splenic artery divided into superior and inferior terminal branches and in 20% of cases in superior, middle and inferior terminal branches.[14] In other study stated that the splenic artery divided into two or three main branches before entering the hilum of the spleen.[6] In another study it showed that the main splenic artery generally divided into superior and inferior branches.[2] In different study it was found that two lobar arteries were present in 63.3% samples; three lobar arteries were present in 36.7% samples.[15] In the present study incidence of two branches of splenic artery was more and incidence of three branches was less than the findings of above mentioned authors.

Conclusion

From the present study, it was concluded that the splenic artery was divided nearer to hilum in early age group and distance between sites of division of splenic artery and the hilum increased with age. The maximum two branches of splenic artery are present in group B and three branches in group C.

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