

Length of Inferior Division of Splenic Artery in Different Age & Sex

*Shumi MS¹, Paul P², Moin S³, Jeba JT⁴

Abstract

Background: Splenic arterial interventions are being used more frequently to manage a range of medical conditions. When appropriate, these procedures can serve as an alternative to surgery. For instance, embolization is commonly used in cases of splenic injury following trauma and to enhance hematological parameters, such as in patients with pancytopenia, thrombocytopenia, leukopenia, or anemia. This is particularly beneficial for individuals with hypersplenism, as well as for those who need high-dose chemotherapy or immunosuppressive therapy but would otherwise be unable to receive it. Additionally, these interventions can be performed to isolate splenic artery aneurysms from the parent vessel to prevent rupture, and to lower portal pressure, thereby reducing complications associated with portal hypertension. **Objectives:** Knowledge of intraparenchymal division of splenic artery is of great importance in surgical practice. It is for the branches of its terminal division or for its polar branches that the surgeon will turn when making a particular area for devascularization in order to perform a partial splenectomy. **Materials and Method:** This cross sectional descriptive study was done to measure length of inferior division of splenic artery in different age & sex group. Using a purposive sampling technique, 80 human spleen samples were collected from autopsy laboratory of the department of Forensic Medicine and later allocated into three separate groups. **Results:** The mean ($\pm$ SD) length of inferior division of splenic artery was 1.45 ± 0.54 cm in Group A, 2.08 ± 0.68 cm in Group B and 2.18 ± 0.69 cm in Group C. **Conclusion:** The mean length of inferior division of splenic artery was increased with age.

Keywords: Spleen, Age, Sex, Splenic artery, Bangladeshi cadaver.

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Introduction

The spleen is a large, encapsulated, complex mass of vascular and lymphoid tissues situated in the upper left quadrant of the abdominal cavity between the fundus of the stomach and the diaphragm. The size of the spleen roughly corresponds to the cupped hand or fist of the subject. Including the diaphragmatic and visceral surfaces, it has 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 fibers, trabecular dense connective tissue rich in collagen and elastic fibers. These with the reticular framework, support the cells of the spleen and surround the vessels in the

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splenic pulp. Spleen is an elastic, controllable reservoir that is important in adjusting the volume of the circulating blood. In life the spleen undergoes both rhythmic and passive contractions. In part this activity is attributed to the smooth muscle in its framework.^{2,3} The spleen filters blood and reacts immunologically to blood-borne antigens. It has both morphologic and immunologic filtering functions. Aged, damaged, or abnormal red blood cells are trapped by macrophages associated with unusual vascular sinuses in the red pulp. These macrophages break down the red cells, begin the metabolic breakdown of hemoglobin and retrieve and store the iron from the heme for reutilization in the formation of new red blood cells in the bone marrow.⁴ The spleen is supplied exclusively from the splenic artery. This is the largest branches of the celiac trunk and its course is among the most tortuous in the body. It vascularizes the spleen, a unique organ from the others in this region of the body given its hematopoietic function. Its blood flow is abundant and variable. It is a spongy organ with considerable capacity of retention and

1. Professor Dr. Mahmuda Sultana Shumi, Professore, Department of Anatomy, Ad-din Sakina Women's Medical College, Jashore.

2. Dr. Prohelika Paul, Associate Professor (CC), Department of Anatomy, Jashore Medical College, Jashore.

3. Dr. Shorna Moin, Associate professor, Department of Anatomy, Army Medical College, Jashore.

4. Dr. Jannatut Tahera Jeba, Lecturer, Department of Anatomy, Ad-din Sakina Women's Medical College, Jashore.

*Correspondence: E-mail: drsultanashumi@gmail.com

excretion of blood where the splenic artery possesses a wall which may respond at any time to the needs of the organ. Thus, this artery undergoes strong fluctuations in blood flow and its arterial wall is constantly being reorganized.⁵ Near the splenic hilum, the artery usually divides into terminal and polar arteries. The superior terminal branches are usually longer than the inferior terminal branches and provide the major splenic arterial supply. As these branches enter the hilum they divide further into four or five segmental arteries that each supplies a segmental vessel often leads to infarction of part of the spleen.^{6,7} 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. Knowing these variable distributions is necessary when performing resections, specially a spleen preserving procedure. Because of the variable nature of the splenic artery, one must be cautious when operating near this vessel and its tributaries.⁸ Splenic sinuses are filled with blood instead of lymph. It is the most vascular organ in the human body, which is involved in the regulation of circulating blood volume. Approximately 350 L of blood passes through it per day. The spleen receives approximately 5% of the cardiac output, and 40% source of the blood in the portal circulation. The spleen contains about one unit of blood at a given time, 25% of total lymphocytes in the body, 30 to 40 ml of mature RBC and one-fourth of the circulating platelets.^{9,10} Therefore, it is necessary to know the vascular distribution, as well as its probable location for increasing the knowledge about the gross anatomy and histology of the spleen in Bangladeshi people of different age and sex group. Moreover, to establish a normal standard which is basic and essential for reliable understanding of any disorders of spleen in Bangladeshi people.

Materials and Methods

The study was conducted in the department of

Anatomy at Mymensingh Medical College. It took place over a period from June 2013 to July 2014. The study protocol was approved by Ethical Review Committee of Mymensingh Medical College. A total of 80 human spleens were collected using a purposive sampling technique from October 2013 to April 2014. Among the samples, 47 were from males and 33 were from females. All specimens were obtained from Bangladeshi cadavers in the autopsy laboratory of the Department of Forensic Medicine at Mymensingh Medical College. Samples were collected from individuals who had died within the previous 12 hours. After collection, the specimens were kept to get fixed for 48-72 hours and preserved in 10% formol-saline solution. To facilitate the comparison of the length of inferior division of splenic artery in relation to age and sex, the samples were categorized into three groups: Group A (upto 20 years), Group B (21 to 40 years) & Group C (41 to 60 years). Each of these groups was further subdivided into male & female categories. For statistical analysis, differences among age groups were assessed using a one-way ANOVA test, while difference between sexes were evaluated using an unpaired 't' test. All data were recorded in a pre-designed data sheet, analyzed using the SPSS program, and compared with findings from national and international studies as well as standard text books. The aim of this study was to determine variations in the length of inferior division of splenic artery in Bangladeshi population and to compare the results with those reported by various established researchers in this field.

Results

From the Table I (a) and I (b) it was evident that the maximum length of inferior division of splenic artery was 2.50, 4.00 and 4.00 cm in Group A, B and C respectively. The minimum length of inferior division of splenic artery was 0.50 cm in group A, 0.80 cm in group B and 0.50 cm in group C. The mean length of inferior division of splenic artery

was maximum in group B, 2.21 cm in male and in group C 2.26 cm in female and minimum in group A, 1.47 cm in male and 1.42 cm in female. The mean ($\pm$ SD) length of inferior division of splenic artery was 1.45 ± 0.54 cm in Group A, 2.08 ± 0.68 cm in Group B and 2.18 ± 0.69 cm in Group C. It was evident from figure A that the mean length of inferior division of splenic artery increased with age.

Table I (a): Mean Length of Inferior Division of Splenic Artery in Different Age Groups		
Age Group	Number of specimen	Length of Inferior Division of Splenic Artery (cm) Mean $\pm$ SD (Minimum – Maximum)
A (0-20 years)	28	1.45 ± 0.54 (0.50- 2.50)
B (21 – 40 years)	31	2.08 ± 0.68 (0.80- 4.00)
C (41 to 60 years)	21	2.18 ± 0.69 (0.50- 4.00)

Table I (b): Comparison of Length of Inferior Division of Splenic Artery among the Age Groups					
Comparison Between Variables		Mean Difference	Std. Error	p	Level of significance
A	B	0.43	0.26	0.114	NS
B	C	1.19	0.49	0.043	S
C	A	0.76	0.42	0.1	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 difference of length of inferior division of splenic artery between group A & B and C & A was statistically not significant ($p > 0.05$) and B & C was statistically significant ($p < 0.05$).

Table II (a): Mean Length of Inferior Division of Splenic Artery in Different Sex Groups				
Age Group	Sex of the person	Number of specimen	Mean Length of Inferior Division of Splenic Artery in cm	$\pm$ SD
A (0-20 years)	Male	18	1.47	0.54
	Female	10	1.42	0.58
B (21 – 40 years)	Male	13	2.21	0.75
	Female	18	1.99	0.63
C (41 to 60 years)	Male	16	2.16	0.75
	Female	5	2.26	0.51

Table II (b): Comparison of Length of Inferior Division of Splenic Artery between Sexes					
Age group	Mean Difference between sex	Std. Error Difference	t	p	Level of significance
A	0.34	0.498	0.683	0.525	NS
B	0.175	0.327	0.535	0.61	NS
C	1.25	0.907	1.299	0.521	NS
Comparison between sexes of 3 groups were done by ANOVA test. p value > 0.05, not-significant at 5% confidence interval (CI) level. NS; not significant. S; significant					

Table- II (a) depicts that the mean ($\pm$ SD) length of inferior division of splenic artery was higher in male (1.47 ± 0.54) cm in Group A and (2.21 ± 0.75) cm in group B than that of female (1.42 ± 0.58) cm and (1.99 ± 0.63) cm in Group A and B respectively, but lower in Group C (2.16 ± 0.75) cm where mean length of inferior division of female splenic artery was (2.26 ± 0.51) cm in Group C. Variance analysis shows that there was no significant difference among sexes of the age groups ($p > 0.05$).

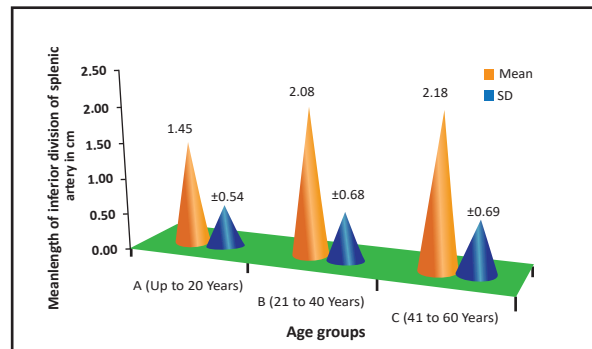


Figure A: Bar diagram representing the mean length of inferior division of splenic artery in different age groups.

Discussion

In our study, the maximum length of inferior division of splenic artery were 2.50, 4.00 and 4.00 cm in Group A, B and C respectively. The minimum length of inferior division of splenic artery was 0.50 cm in group A, 0.80 cm in group B and 0.50 cm in group C. The mean length of inferior division of splenic artery was maximum in group B, 2.21 cm in male and in group C 2.26 cm in female and minimum in group A, 1.47cm in male and 1.42 cm in female. The mean ($\pm$ SD) length of inferior division

of splenic artery was 1.45 ± 0.54 cm in Group A, 2.08 ± 0.68 cm in Group B and 2.18 ± 0.69 cm in Group C. Moreover, it was evident that the mean length of inferior division of splenic artery was increased with age. The mean difference of length of inferior division of splenic artery between group A & B and C & A was statistically not significant but B & C was statistically significant. The mean ($\pm$ SD) length of inferior division of splenic artery was higher in male (1.47 ± 0.54 cm) in Group A and (2.21 ± 0.75 cm) in group B than that of female (1.42 ± 0.58 cm) and (1.99 ± 0.63 cm) in Group A and B respectively, but lower in Group C (2.16 ± 0.75 cm) where mean length of inferior division of female splenic artery was (2.26 ± 0.51 cm) in Group C. Variance analysis shows that there was no significant difference between male and female among the age groups

In 2008 Chawdhury studied 120 spleens of Bangladeshi cadaver and found the maximum mean length of inferior divisional artery was in above 60 years age group (male was 2.21 cm and 2.30 cm of female). The minimum length was in up to 15 years age group (male 1.40 cm and 1.45 cm of female). The maximum and minimum mean length of present study in relation to different age and sex group was similar to the findings of Chawdhury (2008).¹⁰

The mean length of inferior divisional artery described by Rayhan (2006) was maximum 3.45 cm in 40-48 years age group and minimum 2.99 cm in 0-19 year's age group. The mean length of present study was lower than Rayhan because most of the values were close to the lower limit but the range was similar to the 0.50- 4.00 cm of present study.¹¹ In the present study the length of inferior divisional artery was 0.50- 4.00 cm which was within the range described by Michel's as 1-12cm in 1942 and common length 4 cm.¹² The terminal splitting pattern is bifurcated in 95.47% of individuals, and the presence of an inferior polar artery is directly correlated with a shorter distance to the hilum.¹³ Different authors have different inclusion

criteria and the results are stated in different ways, e.g. different age grouping, mean length or ranges, making it difficult to comparison with each other.

Conflict of Interest: The authors declare no conflict of interest.

Conclusion

From the present study, it was concluded that the mean length of inferior division of splenic artery was maximum in group B, 2.21cm in male and in group C 2.26cm in female and minimum in group A, 1.47cm in male and 1.42cm in female. The mean ($\pm$ SD) length of inferior division of splenic artery was 1.45 ± 0.54 cm in Group A, 2.08 ± 0.68 cm in Group B and 2.18 ± 0.69 cm in Group C. It was evident from the findings that mean length of inferior division of splenic artery was increased with age. It was also observed that the mean difference in length of inferior divisional artery was insignificant in between sexes of different age groups.

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