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Original Article

The Splenic Artery and Segmental Branches Morphometric Study in Humanoid Cadaver Spleens by Method of Dissection

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ABSTRACT

Human spleen has various functions including immune system regulation and haematopoisis. The spleen is an extremely vascularized and fragile organ. It is the second major lymphatic organ, containing 25% of lymphoid tissue in the body, and has haematologic and immunologic roles. **Objective:** To understand the segmental branches morphometry of the polar and splenic arteries. **Methods:** The analysis was performed on 86 spleens collected from adult human cadavers of not known gender, stored in 10% formalin solution. In the Department of Anatomy, Mohi-ud-Din Islamic Medical College (MIMC), Mirpur, Azad Jammu & Kashmir and Women Medical and Dental College Hospitals, Abbottabad for six- months duration from July-December 2021 **Results:** In 59(68.6%) spleen samples; there were 2 primary branches, 23(26.7%) samples had three primary branches, and 4 (4.7%) specimens had four primary branches. 20 (23.3%) samples had superior polar arteries, 34(39.5%) had inferior polar arteries, and both inferior and superior polar arteries in 7(8.1%) samples. The inferior polar artery length ranged from 0.9-5.90 cm, with 3.17 cm of average length and 3.30 cm median length. The superior PB diameter ranged from 0.8-4.12 mm, with 2.20 mm average length and 2.4 mm median length. The mean diameter of middle PB ranged from 0.8 mm to 3.6 mm, with an average of 2.10 mm and 2.4 mm median length. The superior polar artery diameter ranged from 0.5-3.1 mm, with 1.40 mm average length and 1.4 mm of median. The inferior polar artery diameter varies from 0.5-2.9 mm, with 1.3 mm of an average diameter with 1.4 mm median. **Conclusions:** As various splenic sparing surgeries depend on a better information of the vascular anatomy of the spleen, this analysis enhances the current information about the segmental branches' morphometry of the splenic artery.

INTRODUCTION

In the human body; the major lymphatic organ is spleen supplied by the splenic artery, the main division of the celiac trunk [1,2]. It crosses the lienorenal ligament and approaches the spleen hilum where it splits into 2-3 main branches, each of which divides mainly into 2-4 secondary branches [3,4]. Also, inferior and superior polar arteries arise from the primary branches or splenic trunk and pass into the spleen pole without entrance in the hilum [5,6]. The spleen partial elimination is probable because its division into sections parted by a fibrous septum, and every section has its individual major artery blood supply. The occurrence of spleen segmentation can be accredited to its progression or final artery division [7,8]. Improved structural information of segmental distribution and lesions of the splenic artery is important for partial organ removal [9]. Since various spleen-sparing surgeries depend on improved knowledge of the spleen vascular anatomy, this study complements the current understanding of the segmental branches' morphometry of the splenic artery [10]. To learn about the splenic artery and its segmental branches. Examine the polar arteries and assess the dimension of the segmented and main pole branches. Evaluate the diameter of the polar branches and primary segmental branches.

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METHODS

The analysis was performed on 86 spleens collected from adult human cadavers of not known gender and age, stored in 10% formalin solution. The gross dissection was performed according to the instructions in the Cunningham Manual. The identification of the spleen was done and released from the stomach and posterior wall of abdomen by dissecting the lienorenal and gastrosplenic ligament. About 10cm proximal to the spleen hilum; splenic artery was cut, after which the it was removed. The fat and fascia near the hilum were removed to reveal segmental splenic artery branches. First, major segmental branches of the polar and splenic arteries, if present, were recognized and recorded, and after that the lengths of polar arteries and segmental branches were evaluated directly by means of a digital Vernier caliper. The outer diameter of the polar arteries and segmental branches were assessed directly 1 cm distal from their origin by means of a digital Vernier caliper. During the measurement, care was taken not to press the artery against the edge of the caliper.

RESULTS

In 59 (68.6%) spleen samples; there were 2 primary branches, 23 (26.7%) samples had three primary branches, and 4 (4.7%) specimens had four primary branches (Table 1). 20 (23.3%) samples had superior polar arteries, 34 (39.5%) had inferior polar arteries, and both inferior and superior polar arteries in 7 (8.1%) samples (Table 2). The inferior polar artery length ranged from 0.9-5.90 cm, with 3.17 cm of average length and 3.30 cm median length. The superior PB diameter ranged from 0.8-4.12 mm, with 2.20 mm average length and 2.4 mm median length. The mean diameter of middle PB ranged from 0.8 mm to 3.6 mm, with an average of 2.10 mm and 2.4 mm median length. The superior polar artery diameter ranged from 0.5-3.1 mm, with 1.40 mm average length and 1.4 mm of median. The inferior polar artery diameter varies from 0.5-2.9 mm, with 1.3 mm of an average diameter with 1.4 mm median (Table 3,4).

Primary segmental branches	Numeral of specimens (86)	%age
One	Nil	0
Two	59	68.6
Three	23	26.7
Four	4	4.7

Table 1: Numeral of splenic artery with its primary segmental branches

Polar artery	Numeral of specimens (79)	%age
Inferior Polar Artery	Nil	0
Superior Polar Artery	59	68.6
None (no polar artery)	23	26.7
Superior & Inferior Polar Artery (Both)	4	4.7

Table 2: Distribution of Polar artery

Length	Superior primary segmental	Middle primary segmental branch	Inferior primary Segmental	Extra primary segmental branch	Superior Polar artery	Inferior polar artery
No	86	49	86	5	20	34
SD	0.740	0.670	0.990	0.8	1.210	1.34
Mean	1.70	1.13	1.92	1.4	2.80	3.17
Maximum	4.3	2.1	5.1	1.7	5.51	5.9
Minimum	0.4	0.3	0.30	0.4	0.8	0.9
Median	1.2	1.1	1.6	1.59	2.4	3.30

Table 3: Dimension of polar artery and primary segmental branches

Length	Superior primary segmental	Middle primary segmental branch	Inferior primary Segmental	Extra primary segmental branch	Superior Polar artery	Inferior polar artery
No	86	49	86	5	20	34
SD	0.821	0.690	0.820	0.5	0.660	0.570
Mean	2.20	2.10	2.13	2.3	1.400	1.310
Maximum	4.12	3.6	4.4	3.9	3.1	2.9
Minimum	0.8	0.8	0.6	1.9	0.5	0.5
Median	2.4	2.4	2.10	1.2	1.4	1.4

Table 4: The polar artery and primary segmental branches diameter

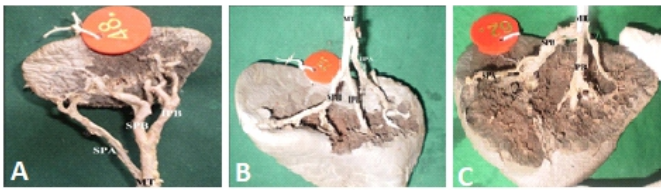

Figure 1A: Superior Polar artery B: Inferior polar artery C: both inferior and superior polar artery

DISCUSSION

The splenic artery supplies the spleen, which divides into 2 or 3 terminal branches and ends at the hilum. These are the so-called superior, middle and inferior main branches [11,12]. The specific part of the spleen is supplied by these branches divided by avascular plane. Therefore, these arteries split the spleen into different arterial sections [13,14]. We observed 2-4 major branches in this study. In few spleens, branch that arises from the splenic artery itself or from its main branches, do not penetrate the hilum, but enter the spleen poles and called as the inferior and superior polar arteries. These similarly supply the spleen specific segment, which are regarded as the polar segments [15,16]. The dimension of the superior PB ranged from 0.4-4.3 cm, with 1.70 cm average length and 1.2 cm of median. The mean dimensions of middle PB vacillated from 0.3-2.1 cm, with 1.13 cm average length and 1.1 cm median

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length. The dimension of the inferior PB vacillated from 0.30-5.1 cm, with 1.92 cm average length and 1.6 cm median length. The extra length of PB varies from 0.4-1.7 cm, with 1.4 cm of average length and 1.59 cm median length. In our study, 18 (22.8%) samples had superior polar arteries, 32 (40.5%) have inferior polar arteries, and both inferior and superior polar arteries in 6 (5.2%) samples. A detailed information of the anatomy of the individual segmental branches is vital for accessing and ligating the arteries during surgical procedures. In this analysis, the superior polar artery length varies from 0.8-5.49 cm, with an average of 2.76 cm and 2.8 cm median length. The superior polar artery length varies from 0.8-5.51 cm, with 2.80 cm of average length and 2.4 cm median length [17,18]. The inferior polar artery length ranged from 0.9-5.90 cm, with 3.17 cm of average length and 3.30 cm median length. The superior PB diameter ranged from 0.8-4.12 mm, with 2.20 mm average length and 2.4 mm median length [19]. The mean diameter of middle PB ranged from 0.8 mm to 3.6 mm, with an average of 2.10 mm and 2.4 mm median length [20]. The PB inferior diameter ranged from 0.6 mm to 4.4 mm, with an average of 2.13 mm and 2.10 mm median length.

CONCLUSION

Complete splenectomy is usually performed following spleen injury, predisposing to immunosuppression and predisposing the normal host to life-endangering contaminations and infections, and generates a different haematologic depiction. To remedy this, a partial splenectomy can be performed by ligation of the specific splenic artery segmental branch. As various sparing of spleen surgeries depends on a better information of the spleen vascular anatomy, this analysis enhances the current information about the segmental branches' morphometry of the splenic artery.

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