



A STUDY ON THE POLAR ARTERIES IN HUMAN SPLEEN AND ITS CLINICAL SIGNIFICANCY.

Anatomy

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ABSTRACT

The aim of the present work was to study the branching pattern of polar arteries in human spleen. Polar arterial pattern was studied in 31 human spleens by piece-meal dissection. The splenic artery and its branches were cleaned and traced. The origin and numbers of polar branches of spleen was noted. Primary segmental arteries pass through hilum of spleen and polar arteries enter spleen at superior or inferior pole of spleen. There was inferior polar artery in 49.72%, superior polar artery in 27.92%, both superior & inferior polar arteries in 13.68% and absent polar artery in 8.68% of specimens. Various origin of polar arteries also noted such as from splenic trunk (19.34%), inferior terminal branch (29.03%), superior terminal branch (16.12%), left gastropiploic artery (9.68), both splenic trunk and superior terminal branch (6.45%), superior and inferior terminal branches (6.45%) & superior terminal and left gastropiploic artery (3.23%). We also get double polar arteries originating from splenic trunk (6.45%) and left gastropiploic artery (3.22%). These findings of our study will be helpful to the surgeons while they perform segmental resection of the spleen and splenic injury repair.

KEYWORDS

Spleen, Splenic Artery, Superior Polar Artery, Inferior Polar Artery.

INTRODUCTION

The spleen is supplied by splenic artery. The splenic artery is the largest branch of the celiac trunk. The splenic artery may also arise directly from the aorta, the superior mesenteric, the left gastric, the left hepatic, the right hepatic or the common hepatic artery. In rare instance, it is double, the upper splenic being much smaller^{1a}.

Terminal branches of splenic artery:

The splenic artery is divided into two or three primary terminal branches before entering the hilum of the spleen. The terminal branches are named as the superior, middle and inferior terminal branches which enter the spleen through its hilum. (Michels, 1955)^{1b}.

Polar arteries to the spleen:

In some spleens, the splenic artery itself or its primary branch gives an artery which does not pierce the hilum, but goes to one of the poles of the spleen. It can be named as the superior or the inferior polar branch. These branches supply a particular part of the spleen which is separated by an avascular area. Thus, these branches divide the spleen into definite arterial segments.

Michels defined polar artery as "A vessel is considered as a polar artery when it penetrates one of the splenic poles, not the hilum, independently of its origin."²

Partial splenectomy was tried by many surgeons in order to preserve the functions of the spleen, particularly in children as the spleen performs important immunological and haematological functions. Total splenectomy leads to a decrease in the immunity and altered haematological features. Terminal branches and polar branches of spleen make avascular segments which is the basis of partial splenectomy^{2,3}.

Identification and ligation of polar artery is immense importance along with main splenic trunk. However, the pattern of splenic segments, polar arteries and their number is poorly studied and needs further investigations^{4,5}.

Therefore, this present work was carried out with an aim directed to the study of the branching pattern of polar arteries and its variations of origin in human spleen.

MATERIALS & METHOD

The present study was conducted in the Department of Anatomy of Lakhimpur Medical college, Lakhimpur and Gauhati Medical College, Guwahati.

The 31 spleens were collected from the Department of Anatomy & Department of Forensic Medicine of Lakhimpur Medical College,

Lakhimpur & Gauhati Medical College, Guwahati. The polar arteries were studied by piece meal dissection method in 31 human spleen fixed in 10% formalin.

Inclusion criteria:

- Normal specimens of cadaveric/autopsies spleens with intact vessels.

Exclusion criteria:

- Injured or lacerated spleen.
- Congenital malformations of the spleen.
- Pathological abnormalities of the spleen.

RESULTS

Variations in the origin and number of polar branches of splenic artery are listed out. In our study we have found that the occurrence of inferior polar artery is highest i.e. 49.72 ± 5.833 in percentage whereas that of absent polar artery (no polar artery) is 8.68 ± 5.390 in percentage. This is very highly significant ($P < 0.001$). The occurrence of other two varieties i.e. superior polar artery is 27.92 ± 3.288 in percentage and both (superior and inferior) polar arteries is 13.68 ± 2.132 in percentage. Hence occurrence of inferior polar artery is significantly higher than superior polar artery ($P < 0.05$) with an R value of 0.453 (fig. no. 4, 5 & Table no. 1). These findings are shown by bar diagrams in figure no. 1.

Table no.1. Number and percentage of polar arteries

Polar branches	Superior polar artery	Inferior polar artery	Both (sup. & inf.) polar artery	Absent (no polar artery)
Frequency	9	15	4	3
Percentage	29.92	49.72	13.68	8.68

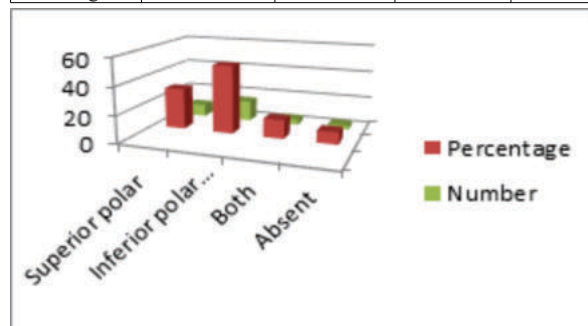


Fig. No. 1: Number and percentage of various pattern of polar artery of spleen.

Origins of various polar arteries are shown in table number 2 & figure no.2. In two specimens double inferior polar arteries arise from splenic trunk (figure no.4) and in another one specimen it arise from left gastroepiploic artery (figure no.5).

Table no.2. Origin of various polar arteries

From	Frequency	Percentage
Splenic trunk(S)	6	19.34
Inferior terminal branch(IT)	9	29.03
Superior terminal branch(IT)	5	16.12
Left gastroepiploic attrey(LGEA)	3	9.68
Splenic trunk & superior terminal br.	2	6.45
superior and inferior terminal branch	2	6.45
Splenic trunk and LGEA	1	3.23

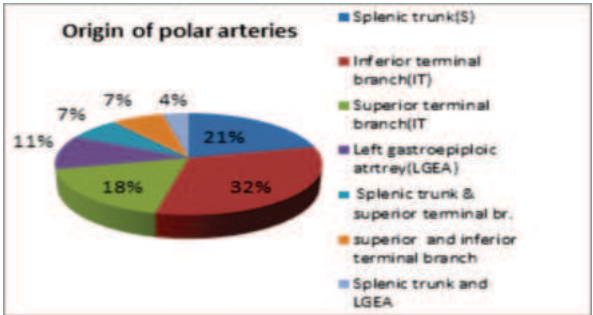


Fig.No.2: Percentage of origin of polar arteries.

Table no. 3. Table showing the level of significance of number of polar arteries of spleen.

Serial number	Comparison between	“t”	P
1	Number of 'superior polar artery' & 'inferior polar artery'	2.222	<0.05
2	Number of 'superior polar artery' & 'both (sup. & inf.) polar artery'	0.524	>0.05
3	Number of 'superior polar artery' & 'absent polar artery (no polar artery)'	2.22	<0.05
4	Number of 'both (sup. & inf.) polar artery' & 'absent polar artery (no polar artery)'	0.524	>0.05
5	Number of 'inferior polar artery' & 'absent polar artery (no polar artery)'	0.000	<0.001



Fig. no.3. Photograph showing superior polar artery arising from the splenic trunk (S).

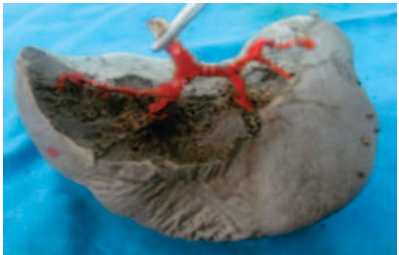


Fig no.4. Photograph showing two inferior polar arteries arising from inferior terminal (IT) and one superior polar arteries arising from superior terminal (ST) branch of splenic artery (S).



Fig. no.5. Photograph showing double inferior polar arteries (IPos) arising from the splenic trunk.



Fig. no.6. Photograph showing double inferior polar arteries arising from the left gastroepiploic artery (LGEA)



Fig. no.7. Photograph showing two terminal branches (bifurcation) and both superior and inferior polar branches arising from splenic artery. S = splenic artery, ST = superior terminal branch, IT = inferior terminal branch, SPo = superior polar artery, IPo = inferior polar artery

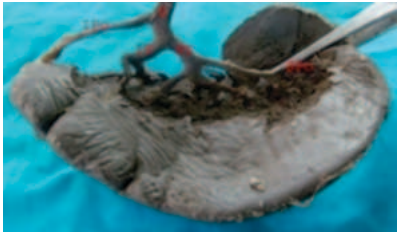


Fig no.8. Photograph showing inferior polar artery (IPo) arising from splenic trunk (S) and superior polar artery arising from superior terminal branch (ST) of splenic artery.

DISCUSSION

The polar arteries of spleen were studied and compared with established findings of other workers (table no. 4).

TABLE – 4 Polar branches of spleen observed by other authors

Workers	Year	Spleen Studied	SPo %	IPo %	Both SPo +IPo %	Absent %
Michels	1942	100	65	82	-	-
Michal <i>et al</i>	1979	25	12	50	12	26
Katritas <i>et al</i>	1982	70	60	80	-	-
Garcia and Lemes	1988	181	39.77	55.24	-	-
Liu <i>et al</i>	1996	-	31	38	-	-
Seok <i>et al</i>	1998	-	76	24	-	-
Hayara	2007	25	100	100	-	-
Ravikumar <i>et al</i>	2011	40	17.5	52.5	-	-
Chavare <i>et al</i>	2012	111	40.53	54.06	11.71	17.11
Londonhe	2013	50	32	56	24.4	-

In the present study, the superior polar branch was observed in 29.92%, the inferior polar branch was observed in 49.72%, both superior polar and inferior polar branches were observed in 13.68%, while absent polar branch was observed in 8.68% specimens. Mikhail et al (1979)⁶ found them in 12%, 50%, 12% and 26% specimens respectively while these were found in 40.53% specimens, in 54.06% specimens, in 11.71% specimens and in 17.11% specimens respectively, in the studies which were done by Chaware et al (2012)⁷. Thus, their findings were in accordance with those of the present study. The incidence of the superior and the inferior polar branches was 65% and 82% respectively in the study which was done by Michels (1942 & 1956)¹. It was 60% and 80% respectively in the study which was done by Katritsis et al (1982)⁹ while Garcia-Porrero & Lemes (1988)¹⁰ found them 37.77% and 55.24%. Thus, the incidence of the polar branches varied in the previous studies which were done by different authors.

Ravi Kumar *et al*¹¹ study about double inferior polar artery and found that double inferior polar arteries arise from inferior terminal branch, main trunk and left gastropiploic artery in 66.4%, 16.8%, 6.8% specimens respectively. They also found that superior polar artery originate from superior terminal branch in 15%, and from splenic trunk in 2.5% while inferior polar artery arising from inferior division in 35% and from splenic trunk in 2.5% of specimens. In the present study variable origin of polar arteries are found such as from splenic trunk (19.34%), inferior terminal branch (29.03%), Superior terminal branch (16.12%), left gastropiploic artery (9.68), both splenic trunk and superior terminal branch (6.45%), superior and inferior terminal branches (6.45%) & superior terminal and left gastropiploic artery (3.23%). We also get double polar arteries originating from splenic trunk (6.45%) and left gastropiploic artery (3.22%).

CONCLUSIONS

The incidence of the polar arteries of the spleen from highest to lowest may be summarized as 'inferior polar artery', 'superior polar artery', 'both (superior and inferior) polar artery' & 'absent (no polar artery)' and the occurrence of 'inferior polar artery' is significantly higher than the other varieties. Most of the spleens have polar branches with their variable origin and number. These variability gain importance in partial splenectomy as it offer protection in the pneumococcal sepsis. The splenic segments were separated from each other by an avascular plane. These findings of our study will be helpful to the surgeons while they perform segmental resection of the spleen and surgical repair of spleen injuries. This will also give reliable information to the anatomists for learning and also for teaching splenic anatomy.

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