

## Anatomical Observation on Draining Patterns of Saphenous Tributaries in Korean Adults

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*This study was done to identify the normal and variants of saphenous tributaries in Korean adults. The pattern of confluence of saphenous tributaries, medial accessory saphenous, lateral accessory saphenous, superficial epigastric, superficial circumflex iliac and superficial external pudendal veins, was carefully examined in 249 lower limbs (right, 129; left, 120) of embalmed Korean cadavers (73 males & 56 females). The medial accessory saphenous vein drained into the great saphenous vein directly (in 82.3%) or by a common trunk (in 17.7%) with the superficial epigastric or superficial external pudendal vein. The lateral accessory saphenous vein entered the great saphenous (in 67.1%) or the femoral vein (in 32.9%) directly or, forming a common trunk with other saphenous tributaries. The superficial epigastric vein joined the great saphenous (in 77.1%) or the femoral vein (in 22.9%) directly or, by a common trunk with other saphenous tributaries. The superficial circumflex iliac vein reached the great saphenous (in 83.1%) or the femoral vein (in 16.9%) directly or, by a common trunk with other saphenous tributaries. The superficial external pudendal vein opened into the great saphenous (in 95.2%) or the femoral vein (in 4.8%) directly or by a common trunk with other saphenous tributaries. In Koreans, the incidence of the normal pattern of saphenous tributaries was 23.7% and in 76.3% any one of variant saphenous tributaries entered the femoral or the great saphenous vein by a common trunk with other saphenous tributaries.*

**Key Words:** Saphenous tributaries, medial accessory saphenous vein, lateral accessory saphenous vein, superficial epigastric vein, superficial circumflex iliac vein, superficial external pudendal vein, Koreans

### INTRODUCTION

The great saphenous vein, the longest vein in the body, begins in the medial marginal vein in the dorsum of the foot and ascends along the medial side of the leg through the thigh, perforates the cribriform fascia and the femoral sheath at the saphenous opening, and ends in the femoral vein. It plays a significant role in the venous return of the lower limb, since it communi-

cates with deep veins and receives numerous tributaries in its course through the thigh (Anson, 1966; Hamilton, 1976; Romanes, 1981; Clemente, 1985; William et al., 1989). In the treatment of venous varicosities, a technique of high ligation of the great saphenous vein and its tributaries in the upper thigh is established. In addition, the saphenous vein is usually chosen when obstructive coronary heart disease is surgically treated with grafts of autogenous veins anastomosed between the aorta and the coronary arteries (Ludbrook, 1972). Therefore, it is important to understand the normal and variants of the saphenous

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vein and its tributaries.

Many investigations of the course of the saphenous vein and the pattern of confluence of tributaries to the saphenous vein are reported especially intended for Americans (Glasser, 1943; Daseler *et al.*, 1946). But, anatomical studies on Koreans have not been performed.

This study was done to identify the normal and variants of the great saphenous vein and its tributaries, with special regards to the pattern of confluence of the medial accessory saphenous, lateral accessory saphenous, superficial epigastric, superficial circumflex iliac and superficial external pudendal veins in the upper thigh of adult Koreans.

## MATERIALS AND METHODS

Materials used for this analysis were obtained from embalmed Korean cadavers used for dissection at Anatomy Departments of Catholic University Medical College, Seoul National University College of Medicine, Soonchunhyang University College of Medicine, Yonsei University College of Medicine, Chungbuk National University College of Medicine, Chonbuk National University Medical School, Yonsei University Wonju College of Medicine and Chonnam National University Medical School over three years from 1989 to 1991. Materials of 249 lower limbs (right, 129; left, 120), 73 males and 56 females, age ranging from 25 to 85 years, showing no macroscopic evidence of vascular lesions were used. The patterns of confluence of saphenous vein and its tributaries at the saphenous opening were carefully examined *in situ* and a drawing of the pattern was made.

Materials were grouped into two main classes; normal and variant pattern. The normal pattern applied to anatomical features in which each of the saphenous tributaries emptied separately into the great saphenous vein as described in textbooks of anatomy (Anson, 1966; Hamilton, 1976; Romanes, 1981; Clemente, 1985; William *et al.*, 1989). The saphenous tributaries, *i.e.*, medial accessory saphenous, lateral accessory saphenous, superficial epigastric, superficial circumflex iliac and superficial external pudendal veins emptied separately into the great saphenous vein, which in turn empties into the femoral vein. The term variant was applied to the cases in which two or more of the saphenous tributaries fused into a common trunk before entering either the great saphenous or the femoral vein, or the cases in which any of the saphenous tributaries emptied into the femoral vein instead of the great saphenous vein.

## RESULTS AND DISCUSSION

In the present study, five major saphenous tributaries, *i.e.*, the medial accessory saphenous, lateral accessory saphenous, superficial epigastric, superficial circumflex iliac and superficial external pudendal veins were observed in all cases, and they drained into either the great saphenous vein or the femoral vein directly or by common trunks. The patterns of joining of each saphenous tributary to either the great saphenous or the femoral vein were tabulated (Tables 1—5). Most of the saphenous tributaries drained into the great saphenous vein, and a few saphenous tributaries entered the femoral vein. In Americans, Daseler *et al.* (1946) reported all saphenous tributaries drained into the great saphenous vein, and Glasser (1943) observed some of the saphenous tributaries entering the femoral vein.

### Medial accessory saphenous vein (Table 1)

The medial accessory saphenous vein drained the posteromedial surface of the thigh and was directly anterosuperiorly to terminate in the great saphenous vein. In 249 limbs (right, 129; left, 120), most (82.3%) of the medial accessory saphenous veins drained directly into the great saphenous vein. In the rest of the cases the medial accessory saphenous vein joined to form a common trunk with the superficial external pudendal vein at an incidence of 14.1%, or with the superficial epigastric and superficial external pudendal veins in a 3.6% incidence before entering the great saphenous vein.

In Americans all cases of the medial accessory saphenous vein joined the great saphenous vein directly (in 92.0% of 100 lower limbs) or by a common trunk with the superficial external pudendal vein, and cases entering the femoral vein were not observed (Glasser, 1943; Daseler *et al.*, 1946).

### Lateral accessory saphenous vein (Table 2)

The lateral accessory saphenous vein originated in a suprapatellar network, gathering branches from the anterior and lateral surfaces of the thigh. It inclined medially in ascending to the saphenous opening, where it emptied into the great saphenous or the femoral vein.

In our observations, the lateral accessory saphenous vein drained into the great saphenous vein directly in a 38.6% incidence. This pattern occurred at an incidence of 36.0% (Daseler *et al.*, 1946) or 74.0% (Glasser, 1943) in Americans.

**Table 1.** Medial accessory saphenous vein draining into the great saphenous vein

	right	left	bilateral*	total	%
directly	104	101	32	205	82.3
common trunk with SEP	20	15	5	35	14.1
common trunk with SE & SEP	5	4	1	9	3.6
Total	129	120	38	249	100.0

\* The numbers of bilaterals are included in the numbers of the right and the left. Abbreviations in Tables 1-5: LAS, lateral accessory saphenous vein; MAS, medial accessory saphenous vein; SCI, superficial circumflex iliac vein; SE, superficial epigastric vein; SEP, superficial external pudendal vein.

**Table 2.** Lateral accessory saphenous vein draining into the great saphenous or the femoral vein

	right	left	bilateral	total	%
<b>Great saphenous vein</b>					
directly	48	48	18	96	38.6
common trunk with SCI	18	15	7	33	13.3
common trunk with SE	10	13	1	23	9.2
common trunk with SCI, SE & SEP	4	4	0	8	3.3
common trunk with SCI & SE	4	3	1	7	2.8
Subtotal	84	83	27	167	67.1
<b>Femoral vein</b>					
directly	30	25	8	55	22.1
common trunk with SCI	11	8	3	19	7.6
common trunk with SCI, SE & SEP	2	3	0	5	2.0
common trunk with SCI & SE	2	1	0	3	1.2
Subtotal	45	37	11	82	32.9
Total	129	120	38	249	100.0

Eight variant types of the lateral accessory saphenous vein which emptied into the femoral vein directly or by a common trunk with other saphenous tributaries before entering the great saphenous or the femoral vein could be identified in Koreans. Out of these 8 variant types, the most frequent (22.1%) was the type which emptied directly into the femoral vein, and the incidence of cases forming a common trunk with the superficial circumflex iliac vein before entering the great saphenous vein was 13.3%. In Americans the cases directly entering the femoral vein were observed in a 1.0% incidence (Glasser, 1943).

### Superficial epigastric vein (Table 3)

The superficial epigastric vein arose in the umbilical region, sometimes through anastomosis with the thoracoepigastric vein and coursed inferolaterally, over the medial half of the inguinal ligament, to the saphenous opening. The superficial epigastric vein entered the great saphenous or the femoral vein.

In the present study, the incidence of the cases in which the superficial epigastric vein drained into the great saphenous vein directly or by a common trunk with other saphenous tributaries was 77.1%. The incidence of the superficial epigastric vein directly entering the great saphenous vein was 45.0%. This pattern occurred in Americans at an incidence of 36.0% (Daseler et al., 1946) or 62.0% (Glasser, 1943).

There were twelve types of the superficial epigastric vein which formed a common trunk with other saphenous tributaries or emptied directly into the femoral vein in Koreans. Of these variant types, the most frequent (12.5%) was the type which formed a common trunk with the superficial external pudendal vein. In Americans the superficial epigastric vein formed a common trunk with lateral accessory saphenous and superficial circumflex iliac veins at an incidence of 9.0 (Glasser, 1943) or 33.0% (Daseler et al., 1946), with the superficial circumflex iliac vein 8.0% (Glasser, 1943), with the superficial external pudendal vein 2.0%

**Table 3.** Superficial epigastric vein draining into the great saphenous or the femoral vein

	right	left	bilateral	total	%
Great saphenous vein					
directly	57	55	26	112	45.0
common trunk with SEP	18	13	4	31	12.5
common trunk with LAS & SCI	10	13	1	23	9.2
common trunk with SEP & MAS	5	4	1	9	3.6
common trunk with LAS, SCI & SEP	4	4	0	8	3.2
common trunk with LAS	4	3	1	7	2.8
common trunk with SCI	2	0	0	2	0.8
Subtotal	100	92	33	192	77.1
Femoral vein					
directly	7	8	2	15	6.0
common trunk with LAS & SCI	11	8	3	19	7.6
common trunk with SCI	7	7	0	14	5.6
common trunk with LAS, SCI & SEP	2	3	0	5	2.0
common trunk with SEP	2	1	0	3	1.2
common trunk with SCI & SEP	0	1	0	1	0.4
Subtotal	29	28	5	57	22.9
Total	129	120	38	249	100.0

**Table 4.** Superficial circumflex iliac vein draining into the great saphenous or the femoral vein

	right	left	bilateral	total	%
Great saphenous vein					
directly	73	68	27	141	56.6
common trunk with LAS	18	15	7	33	13.3
common trunk with LAS & SE	10	13	1	23	9.2
common trunk with LAS, SE & SE	4	4	0	8	3.2
common trunk with SE	2	0	0	2	0.8
Subtotal	107	100	35	207	83.1
Femoral vein					
common trunk with LAS & SE	10	8	3	18	7.2
common trunk with SE	7	7	0	14	5.6
common trunk with LAS, SE & SE	2	3	0	5	2.0
common trunk with LAS	2	1	0	3	1.2
common trunk with SE & SEP	0	1	0	1	0.4
common trunk with LAS & SE	1	0	0	1	0.4
Subtotal	22	20	3	42	16.9
Total	129	120	38	249	100.0

(Glasser, 1943) or 14.0% (Daseler *et al.*, 1946) and with the lateral accessory saphenous vein 2.0% (Daseler *et al.*, 1946).

#### Superficial circumflex iliac vein (Table 4)

The superficial circumflex iliac vein drained the area superior to the lateral half of the inguinal ligament and

as far lateralward as the anterior superior iliac spine, and coursed inferomedially, crossing the inguinal ligament obliquely, to the saphenous opening. It terminated in the great saphenous or the femoral vein.

The cases draining into the great saphenous vein directly or forming common trunks with other saphenous tributaries were observed in 83.1%. In 56.6% of all cases, the superficial circumflex iliac vein drained directly into the great saphenous vein in Koreans. This pattern was reported in Americans at an incidence of 31.0% (Daseler et al., 1946) or 54.0% (Glasser, 1943).

In our observation, ten variant types of the superficial circumflex iliac vein which formed a common trunk with other saphenous tributaries and emptied into the great saphenous or the femoral vein. The most frequent (13.3%) was a common trunk formed together with the lateral accessory saphenous vein. In Americans the incidence of the cases forming a common trunk with the lateral accessory saphenous and superficial epigastric veins was 33.0% (Daseler et al., 1946), and with the superficial epigastric vein 8.0% (Glasser, 1943) or 15.0% (Daseler et al., 1946), with the lateral accessory saphenous vein 10.0% (Glasser, 1943) or 21.0% (Daseler et al., 1946). According to Glasser (1943) the superficial circumflex iliac vein drained into the femoral vein directly in a 1.0% incidence or formed a common trunk with the superficial epigastric and superficial external pudendal veins at a 6.0% incidence in Americans.

### Superficial external pudendal vein (Table 5)

The superficial external pudendal vein was a continuation of the anterior scrotal or labial veins, and drained into the great saphenous or the femoral vein, directly or by forming a common trunk with any of the medical accessory saphenous, superficial epigastric and superficial circumflex iliac veins at the saphenous opening.

In Koreans, most (61.9%) of the superficial external pudendal veins drained directly into the great saphenous vein. The pattern of this type occurred at an incidence of 78.0% (Daseler et al., 1946) or 81.0% (Glasser, 1943) in Americans.

Out of eight variant types of the superficial external pudendal vein in Koreans, the type forming a common trunk with the medial accessory and superficial epigastric veins was frequent. In Americans the incidence of cases directly entering the femoral vein was 2.0%, and that of cases forming a common trunk with the superficial epigastric and superficial circumflex iliac veins, 6.0% (Glasser, 1943).

Table 6 shows that the patterns of confluence formed by five major tributaries could be divided into normal and variant types (Figs. 1, 2 & 3).

The normal pattern was the case in which each saphenous tributary drained separately into the great saphenous vein, and the incidence of this vascular pattern was 23.7%. The normal pattern was reported

**Table 5.** Superficial external pudendal vein draining into the great saphenous or the femoral vein

	right	left	bilateral	total	%
Great saphenous vein					
directly	77	77	27	154	61.9
common trunk with MAS	20	15	5	35	14.1
common trunk with SE	18	13	4	31	12.5
common trunk with MAS & SE	5	4	1	9	3.6
common trunk with LAS, SE & SCI	4	4	0	8	3.2
Subtotal	124	113	37	237	95.2
Femoral vein					
directly	1	2	1	3	1.2
common trunk with LAS, SE & SCI	2	3	0	5	2.0
common trunk with SE	2	1	0	3	1.2
common trunk with SE & SCI	0	1	0	1	0.4
Subtotal	5	7	1	12	4.8
Total	129	120	38	249	100.0

**Table 6.** The incidence of normal and variant types of the saphenous tributaries in adult Koreans.

Type	Right	Left	Bilateral	Total	%
Normal	31	28	16	59	23.7
Anomalous					
I	9	13	1	22	8.8
II	11	11	3	22	8.8
III	8	9	5	17	6.8
IV	8	6	3	14	5.6
V	7	4	1	11	4.4
VI	5	5	0	10	4.0
VII	5	5	1	10	4.0
VIII	6	4	2	10	4.0
IX	3	6	0	9	3.6
X	4	4	0	8	3.2
XI	4	2	1	6	2.4
XII	2	3	1	5	2.0
XIII	4	1	0	5	2.0
XIV	1	4	1	5	2.0
XV	2	3	0	5	2.0
XVI	3	2	0	5	2.0
XVII	2	2	1	4	1.6
XVIII	2	1	0	3	1.2
XIX	2	1	0	3	1.2
XX	2	1	0	3	1.2
XXI	2	1	0	3	1.2
XXII	1	1	1	2	0.8
XXIII	1	1	1	2	0.8
XXIV	2	0	0	2	0.8
XXV	1	0	0	1	0.4
XXVI	0	1	0	1	0.4
XXVII	1	0	0	1	0.4
XXVIII	0	1	0	1	0.4
	129	120	38	249	99.7

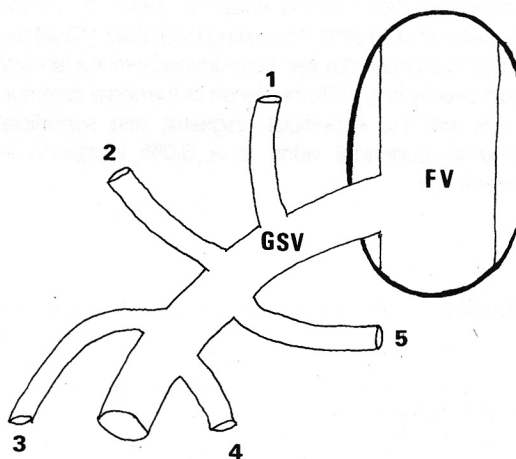
to occur at a variable incidence in Americans. Daseler *et al.* (1946) reported a 15.1% incidence in 550 lower limbs, and Glasser (1943) reported that this pattern occurred in 37.0% of 100 cases.

Those cases in which any of the saphenous tributaries form a common trunk before entering into the

great saphenous vein or the femoral vein were regarded as variant types, and they were subdivided into 28 types according to the patterns of confluence of the saphenous tributaries

The most numerous were types I and II. In type I, the superficial circumflex iliac, lateral accessory saphenous and superficial epigastric veins joined to form a common trunk emptying into the great saphenous vein, and this type occurred in an 8.8% incidence. Type II included those cases in which the lateral accessory saphenous vein drained into the femoral vein and the rest of the saphenous tributaries emptied separately into the great saphenous vein. The incidence of this vascular pattern was 8.8%.

In conclusion, our results suggest that the patterns of the saphenous tributaries are generally inconstant. It might be different between individuals or races, and the anatomy of the saphenous tributaries should be carefully considered in order to obtain successful results in the surgical treatment of venous varicosities of the lower limbs.



**Fig. 1.** Schematic drawing of normal pattern of saphenous tributaries entering the great saphenous vein (GSV) in Korean adults. Abbreviations in Figs. 1-3: FV, femoral vein; 1, superficial epigastric vein; 2, superficial circumflex iliac vein; 3, lateral accessory saphenous vein; 4, medial accessory saphenous vein; 5, superficial external pudendal vein.

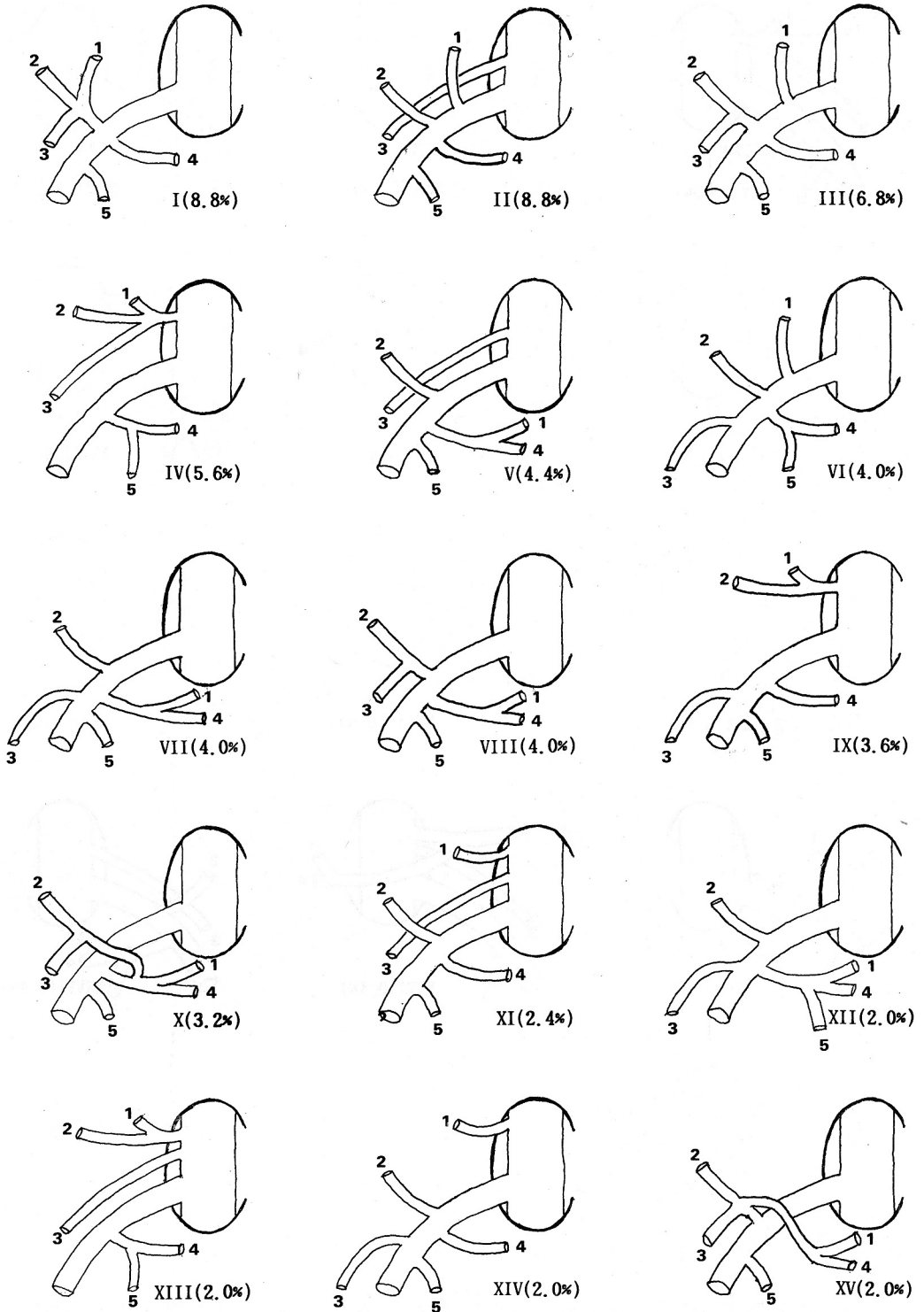
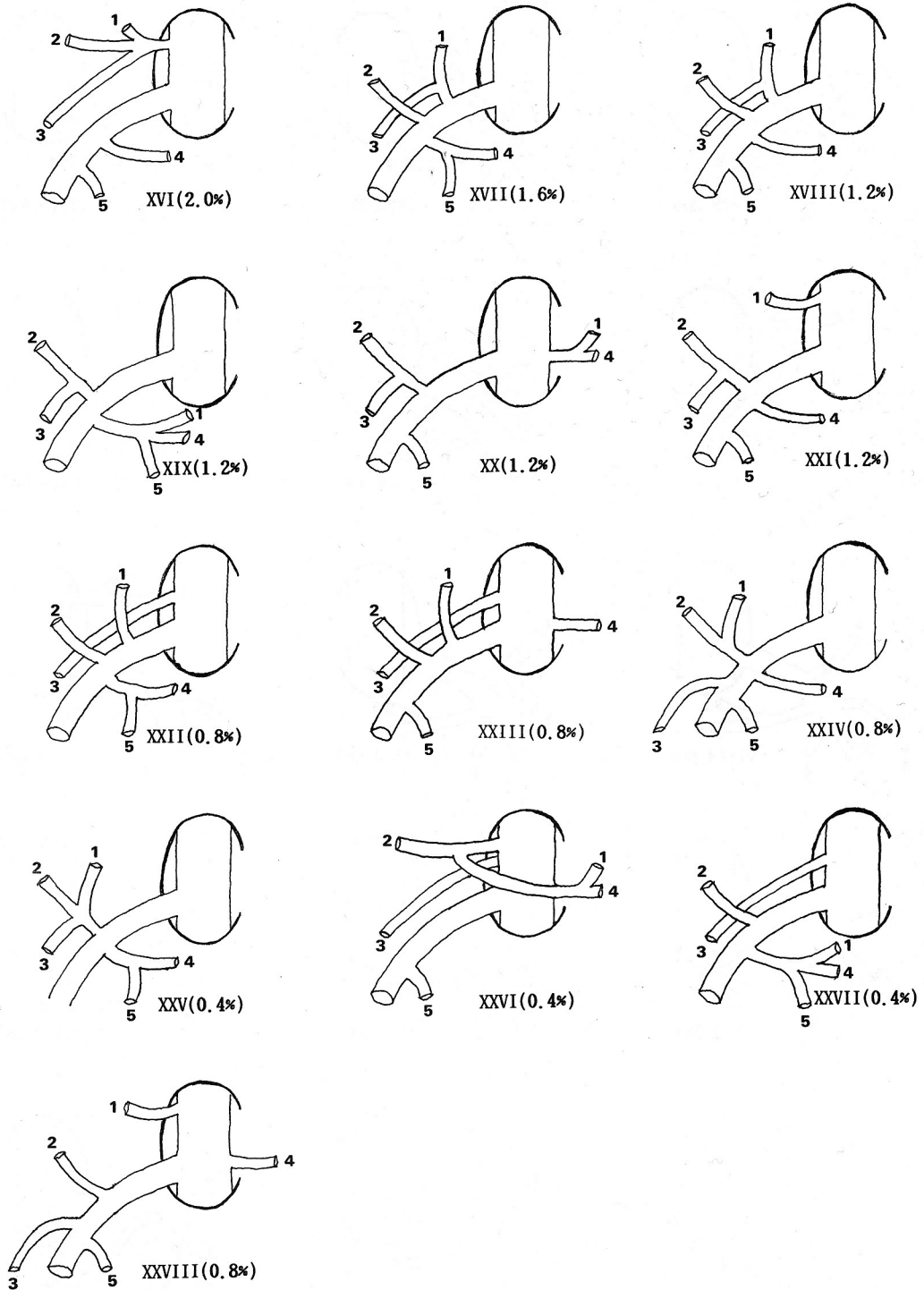


Fig. 2. Schematic drawings of variant draining patterns (type I–XV) of saphenous tributaries in Korean adults.



**Fig. 3.** Schematic drawings of variant draining patterns (type XVI-XXIII) of saphenous tributaries in Korean adults.



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