Bilateral Scrotal Flap: Pedicle and Dimension of Flap in Cadaveric Dissections

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Penile paraffinoma is not uncommon among Thai males. The definite treatment involves the complete removal of skin and subcutaneous tissue infiltrated by the foreign material and resurfacing in the penile shaft with skin graft or scrotal flap in severe cases. In the present study the authors undertook an anatomical investigation of external pudendal vessels and scrotal skin in 5 soft cadavers. The authors found that the anterior scrotal artery branching from the external pudendal artery at the point 2-2.7 cms. from midline at pubic symphysis level and running in the internal spermatic plane. Anterior scrotal artery supplied scrotal skin 62.5-100% (mean 75.9%) in anteroposterior dimension and 66-100% (mean 88%) in superoinferior dimension. The authors recommended that this flap must elevate deep to the internal spermatic plane, just close to tunica vaginalis and the dimension of flap should not be more than 62.5% in anteroposterior and 66% in superoinferior dimension.

Keywords: *Scrotal flap, Penile paraffinoma, Penile reconstruction*

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Many kinds of alloplastic material have been injected into penile skin aiming to increase the circumference of the penis, such as paraffin, Vaseline and oil. This practice is usually performed by non-medical personnel or the patient himself. Most of them were followed by foreign body granuloma and fibrosis which are the main pathology that leads to all other problems. The complications involve penile deformity, skin necrosis, limited erectile function and painful intercourse.

The definite treatment involves the complete removal of skin and subcutaneous tissue infiltrated by the foreign material and resurfacing the penile shaft with skin graft[1-5]. However, complete removal of foreign material is often impossible and some of them remain in Buck's fascia. In these cases skin grafting, a simple and effective method to cover the denuded penile shaft, cannot achieve its goal as a stable coverage. The alternative scrotal skin flaps such as bipedical scrotal flap or bilateral scrotal flap are better methods for achieving stable coverage[6,7].

The bilateral scrotal flaps as described by the authors and Jeong et al are frequently used to resurface the penile shaft in severe cases. The main vascular supply to this flap is the anterior scrotal artery which is the terminal branch of deep external pudendal artery from the femoral artery[8,9]. However, vascular anatomy and angiosome of the vessel is still lacking. In the present study the authors have demonstrated a series of human dissection of the scrotal skin and its vascular supply from the external pudendal artery. The exact anatomical landmark and angiosome of the anterior scrotal artery within the scrotal skin has been demonstrated.

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Material and Method

Anatomical dissection was performed on 5 adult male human soft cadavers in the department of anatomy, faculty of medicine, Chulalongkorn University, Thailand. External examination of all cadavers revealed neither scar nor anomalies in the

perineum, genital and inguinal regions. By meticulous dissection, the external pudendal arteries were all identified and cannulated with no. 24 silastic catheter. Ten cc of methylene blue was injected through the catheter then the stained, cutaneous territory was photographed and measured. The scrotal skin was dissected from anterior to posterior and then vertically inferior to superior, the vascular pedicle in each side was identified. At the pubis symphysis level, the distance between vascular pedicle and midline was measured. In the present study, the rugae presented area in the scrotal skin had been considered as the whole scrotal skin. The total scrotal skin width and the stained area in anteroposterior dimension were measured as well as the total scrotal length and the stained area in superoinferior dimension (Fig. 1, 2). Four scrotal skins were removed from cadavers, fixed in 10% formalin, processed, sliced and stained with H&E. Light microscope was used to identify the vascular plane in these scrotal skins.

Results

All of the anatomical dissection, the unvarying presentation of the anterior scrotal artery from the deep external pudenda artery was found. The anterior scrotal artery runs downward parallel to the midline with its origin 2-2.7 cm (mean 2.45 cm) lateral to the midline at pubic symphysis level (Table 1). This artery runs in the deep plane just close to the spermatic cord. It supplies 62.5-100% (mean 75.9%) of the scrotal skin in antero-posterior dimension and 66-100% (mean 88%) in supero-inferior dimension (Table 2, 3). None of the artery crosses the median raphe to supply contralateral scrotal skin.

Table 1. Distance between the origin of anterior scrotal artery and midline of pubic symphysis

Flap	Distance (cm)
Flap 1	2.5
Flap 2	2.0
Flap 3	2.0
Flap 4	2.5
Flap 5	2.3
Flap 6	2.6
Flap 7	2.5
Flap 8	2.7
Flap 9	2.6
Flap 10	2.7
Mean	2.45

Fig. 1 Stained area from right external superoinferior pudendal artery

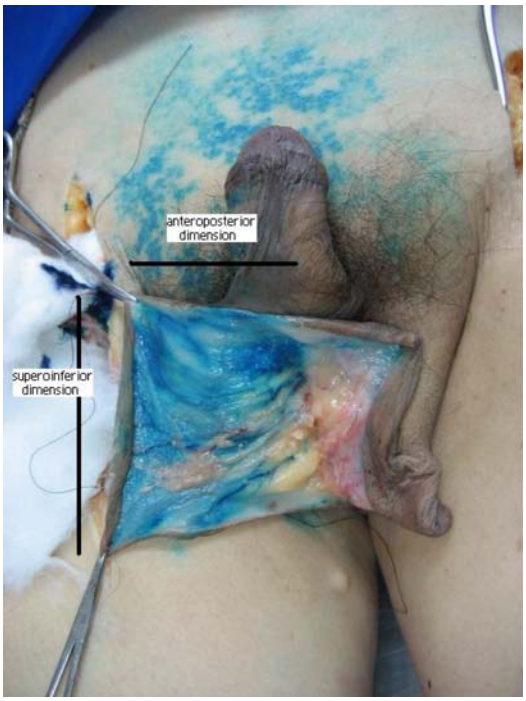

Fig. 2 Anteroposterior and dimension of flap

Table 2. The diffusion of methylene blue in anteroposterior dimension

Flap	Total skin in anteroposterior dimension (cm)	Stained skin in anteroposterior dimension (cm)	Stained skin in anteroposterior dimension (%)
Flap 1	9	6	66
Flap 2	8	5	62.5
Flap 3	14	10	71.4
Flap 4	12	8	66
Flap 5	9	7	77
Flap 6	10	9	90
Flap 7	9	9	100
Flap 8	12	8	66
Flap 9	13	10	76.9
Flap10	12	10	83
Mean	10.8	8.2	75.9

Table 3. The diffusion of methylene blue in superoinferior dimension

Flap	Total skin in superoinferior dimension (cm)	Stained skin in superoinferior dimension (cm)	Stained skin in superoinferior dimension (%)
Flap 1	8	8	100
Flap 2	6	4	66
Flap 3	12	12	100
Flap 4	10	7	70
Flap 5	9	9	100
Flap 6	8	8	100
Flap 7	10	9	90
Flap 8	10	8	80
Flap 9	12	10	83
Flap10	10	9	90
Mean	9.5	8.4	88

The histological study in four specimens had shown that the main vessel runs within the internal spermatic fascial plane, deep to cremasteric muscle. The main vessel sends off small vessels to supply the scrotal skin while it runs downward parallel to the median raphe.

Discussion

The anatomy of scrotal skin and vascular network has been described in classic treatises. However, there has been no study that emphasizes the exact anatomy of anterior scrotal artery and the area of the scrotal skin supplied by this vessel.

The scrotal skin and soft tissue is composed of the following layers, skin, dartos muscle, external spermatic fascia, cremasteric muscle, internal spermatic fascia and tunica vaginalis[8,9]. Three main efferent vessels to scrotum are anterior scrotal artery which is the terminal branch of deep external pudendal artery from femoral artery, posterior scrotal artery which is the terminal branch of superficial perineal artery from the internal iliac artery and funicular artery which is the proximal branch of the deep inferior epigastric artery. The deep external pudendal artery gives off internal and external anterior scrotal artery when it runs close to the spermatic cord.

Francisco[10] studied the vascular supplies of the anterior perineal region which involved the anatomy of deep external pudendal artery, superficial perineal artery, funicular artery and their angiosome by

methylene blue staining technique. However, no exact angiosome of scrotal skin has been published. Fernandez[11] had dissected scrotal skin in fresh specimens in order to examine the scrotal circulation by transillumination test. He found an extremely rich vascular in both the dartos muscle and skin which made it safe to be raised as a musculo-cutaneous flap regardless of the pedicle location. JH Jeong[6] designed a flap as shown in Fig. 3. His flap, including dartos fascia, was elevated from the underlying tunica vaginalis. There wasn't any flap necrosis in his patients. Jindarak[7] used the bilateral scrotal flap technique to resurface the penile shaft in the different design from JH Jeong (Fig. 4). There was only one distal flap necrosis.

In the present study the authors have shown that the anterior scrotal artery runs downward close to the spermatic cord and parallel within 2- 2.7 cm (mean 2.45 cm) to the midline. It runs deep to the cremasteric muscle within the internal spermatic fascia and sends off branches to supply superficial scrotal skin. When raising the scrotal skin as a flap, it is recommended to dissect close to the tunica vaginalis in order to protect the main vessel. The pedicle must be wider than 2.5 cm from the midline. According to the present study, this artery supplies 62.5-100% (mean 75.9%) of the scrotal skin in anteroposterior dimension and 66-100% (mean 88%) in superoinferior dimension.

The present study presents the anatomy of anterior scrotal artery and its angiosome. It reveals the pathway of the main arterial supply of the scrotal skin. When this artery is included in the pedicle, the various techniques of raising the scrotal skin flap can be performed.

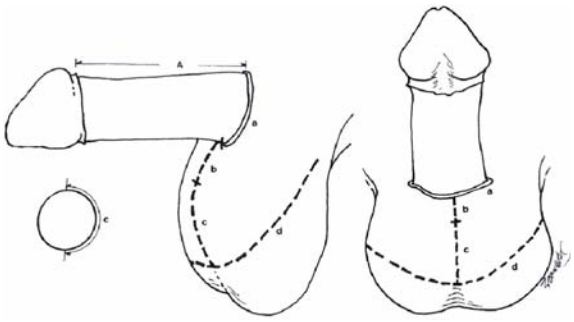

Fig. 3 Bilateral scrotal flaps by JH Jeong

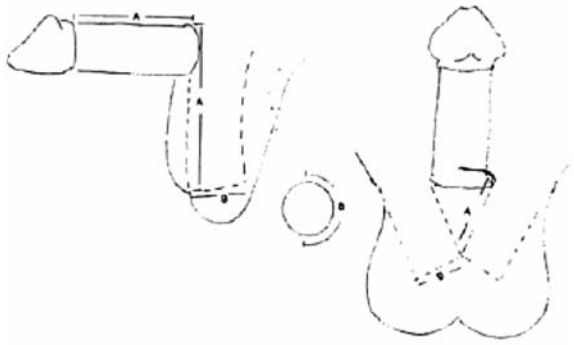

Fig. 4 Bilateral scrotal flaps by Jindarak

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การศึกษาทางกายวิภาคของหลอดเลือดและขนาดของ bilateral scrotal flap

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การฉีดสารต่าง ๆ รวมทั้งพาราฟินเข้าที่อวัยวะเพศชาย ด้วยจุดประสงค์เพื่อต้องการเพิ่มขนาดของอวัยวะเพศ โดยรู้เท่าไม่ถึงการณ์พบได้เสมอในผู้ชายไทย การรักษามักจะต้องลอกเอาผิวหนัง และเนื้อเยื่อโดยรอบอวัยวะเพศออกทั้งหมด บ่อยครั้งที่ไม่สามารถทำการปลูกถ่ายผิวหนังได้ต้องทำการปิดแผลโดยใช้ scrotal flap ผู้นิพนธ์ได้ทำการศึกษากายวิภาคของหลอดเลือด external pudendal และผิวหนังบริเวณที่จะยก flap ในศพอาจารย์ใหญ่ 5 ท่าน พบว่าหลอดเลือด anterior scrotal ซึ่งเป็นหลอดเลือดหลักแยกออกจากหลอดเลือด external pudendal ในตำแหน่งตั้งแต่ 2 ถึง 2.7 เซนติเมตร จากแนวกลางบริเวณกระดูกหัวหน่าว หลอดเลือดอยู่ในชั้น internal spermatic plane และหลอดเลือดเลี้ยงผิวหนังของลูกอัณฑะในแนวจากหน้าไปหลัง 62.5-100% (เฉลี่ย75.9%) และในแนวจากบนไปล่าง 66-100% (เฉลี่ย 88%) ผู้นิพนธ์ได้แนะนำว่าการยก scrotal flap ต้องยกชั้น internal spermatic ซึ่งอยู่ชิดกับชั้น tunica vaginalis มาด้วยขนาดของ flap ไม่ควรเกิน 62.5% ในแนวจากหน้าไปหลัง และ 66% ในแนวจากบนไปล่าง