

## Scrotal and Perineal Reconstruction by Gracilis Myocutaneous Flap

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### ABSTRACT

Genital and perineal skin loss may be caused by variety of reasons. Reconstruction of scrotum is required not only for cosmetic reason but also for functional and psychological reasons as well. Numerous techniques have been described for scrotal reconstruction reflecting the challenge and complexity of defects. This suggests that no single method is satisfactory for all types and varying degrees of skin loss. In this article, the author presents his experience in scrotal and perineal reconstruction by gracilis myocutaneous flap.

*Objectives:* The aim of this article is to review published anatomy of gracilis muscle and myocutaneous flap and to present the author's experience in using this flap for reconstruction of perineal and scrotal defects.

*Methods:* From June 2013 to January 2015, 6 cases of scrotal and perineal defects reconstructed by gracilis myocutaneous flap in Shebin Elkom Teaching Hospital. Five were males and one was female. Four cases were due Fournier gangrene, one case was traumatic and one case was ischeal pressure sore. Age ranged from seven to sixty eight years with mean age 43.3 years. After debridement and dressing, operation was done under general or spinal anesthesia. All flaps survived except partial skin necrosis in one case. There was some wound dehiscence in most of the cases. All healed conservatively. Follow-up for at least 2 months and all patients were satisfied by the result.

*Results:* All flaps survived with good results and acceptable cosmetic appearance. Most of cases developed some wound dehiscence which healed conservatively.

*Conclusion:* Gracilis musculocutaneous pedicled flap is a good option for scrotal and perineal reconstruction especially in Fournier gangrene and ischeal pressure sore.

**Key Words:** Perineal reconstruction – scrotal reconstruction.

### INTRODUCTION

Genital and perineal skin loss may be caused by variety of reasons. It may be caused by avulsion injuries, assaults, self-mutilation, burns, animal attacks, gangrene of the male genitalia, pressure ulcers and surgical excision. Scrotal construction may also be required for congenital agenesis, tumor excision and female to male intersex surgical intervention. Reconstruction of scrotum is required not only for cosmetic reason but also for functional and psychological reasons as well [1].

Numerous techniques have been described for scrotal reconstruction reflecting the challenge and complexity, these defects present. This suggests that no single method is satisfactory for all types and varying degrees of skin loss [2].

The choice of reconstructive procedure is based on the size, location, nature of the defects, the availability of local tissue, the patients' age, predisposing factors and defect size and location [3].

The options of reconstruction of the genital area wound includes direct closure [4,5], skin grafting [6,7], random skin flaps [8,9], axial fasciocutaneous pedicled flaps e.g. medial thigh flap [10], anteromedial thigh flap [11,12], Superomedial thigh flap [13-18], inner thigh lift flap [19,20], pudendal thigh (Singapore) flap [21,22], V Y pudendal thigh flap [23], Anterolateral thigh flap [24], groin flap [25,26], musculocutaneous flaps eg gracilis musculocutaneous flap [27-31] and recuts abdominis flap [32].

#### Anatomy:

The gracilis muscle is a type II muscle according to the scheme of Mathes and Nahai [33]. Usually two or three vascular pedicles, accompanied by paired venae comitantes, enter the muscle on its deep surface.

The proximal pedicle is generally the dominant blood supply to the muscle. Its origin is directly from the profunda femoris or medial circumflex femoral artery [34-37], and passing between the adductor longus and adductor brevis before reaching the gracilis muscle. The dominant vascular supply to the gracilis supplies approximately 70% of the bulk of the muscle [38]. It is accompanied by two venae comitantes of similar size [38,39] and enters the gracilis 10±2cm distal to its attachment at the pubic tubercle [38,40].

The dominant pedicle divides upon entering the gracilis muscle, passing proximally and distally parallel to the longitudinal muscle fibers before

anastomosing with branches of the second (minor) pedicle [38,41,42]. The distal vascular pedicles arise from the superficial femoral vessels.

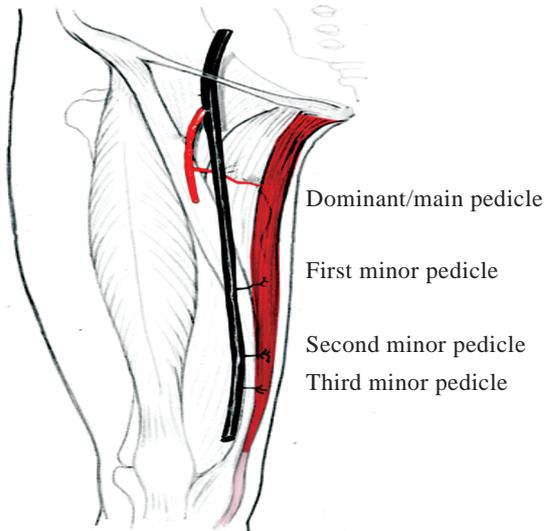


Fig. (1): Blood supply to the gracilis flap clarifying the nomenclature to be used in this article, and showing the dominant and minor pedicles (43).

*Flap design and flap markings:*

*Anatomic landmarks:* Adductor longus, pubic tubercle (or tuberosity), and medial tibial condyle. Palpate the tight adductor longus muscle first when the patient lies on the table and the medial thigh is abducted. The gracilis origin is located just superficially behind the adductor longus origin. The medial tibial condyle is then identified. The distal gracilis tendon passing behind the medial femoral condyle is inset at the upper medial tibia below the medial tibial condyle.

*Then the shape of the gracilis is outlined:* The upper two-thirds of the outline is muscle component and the lower one-third is the tendon. If a skin flap is going to be harvested, the skin paddle can be outlined over the muscle or over the posterior edge of the adductor longus muscle where the intermuscular septum is located that carries perforator vessels to supply the overlying skin.



Fig. (2): Design of gracilis myocutaneous flap.



(3-A): Preoperative.



(3-B): Design.



(3-C): Early postoperative.



(3-D): Late postoperative.

Fig. (3): Exposed both testis (Case No. 1).



(4-A): Preoperative.



(4-B): Design.



(4-C): Early postoperative.



(4-D): Late postoperative.

Fig. (4): Ischeal pressure sore (Case No. 2).



(5-A): Preoperative.



(5-B): Early postoperative.



(5-C): Late postoperative.

Fig. (5): Exposed both testis (Case No. 3).

Table (1): Summary of cases.

No.	Age	Sex	Etiology	Site & size	Procedure	Follow-up	Result
1	37	M	Fournier gangrene	Both testis	Gracilis myocutaneous flap	6 M	Wound infection healed conservatively
2	48	M	Fournier gangrene	Both testis & anterior abdominal wall	Gracilis myocutaneous flap + STSG	4 M	Some wound dehiscence healed conservatively
3	7	F	Ischeal pressure sore	7x8 cm	Gracilis myocutaneous flap	8 M	Some wound dehiscence healed conservatively
4	45	M	Trauma	Both testis	Gracilis myocutaneous flap	3 M	Good
5	68	M	Fournier gangrene	Both testis and perineum	Gracilis myocutaneous flap	8 M	Some wound dehiscence healed conservatively
6	55	M	Fournier gangrene	Both testis	Gracilis myocutaneous flap	5 M	Wound infection healed conservatively

## MATERIAL AND METHODS

From June 2013 to January 2015 we did 6 cases of scrotal and perineal reconstruction by gracilis myocutaneous flap in Shebin El-Kom Teaching Hospital. Five were males and one was female. Four cases were due Fournier gangrene, one case was traumatic and one case was ischeal pressure sore. Age was ranged from seven to sixty eight years with mean age 43.3 years.

## RESULTS and DISCUSSION

Partial scrotal loss is seldom a problem, and closure of the defect with the remaining scrotal skin can usually be accomplished due to viscoelastic properties of the scrotum. When scrotal remnants are available, the results are optimal as far as size, cosmesis and function measured by sperm count, are concerned [5].

Primary skin grafting for scrotal avulsion injuries was first advocated by Millard and subsequently updated by Maguiña [6,7].

In cases of complete loss of penile and scrotal skin, skin graft may be successful and the simplest option in closure of these defects. However, the split skin grafting may have certain disadvantages as take of graft may not be satisfactory, hair growth, contraction and distortion and lack of protection of testis.

Thigh pouch offers the simplest temporary coverage for the exposed testicles. However, the psychological and functional implications of absent scrotum may warrant eventual scrotal reconstruction [1].

Although some investigators have recommended that local random flaps can easily be used for scrotal defects, [8,9] but in these flaps the arterial

supply to the regions close to the defect may be compromised especially in Fournier's gangrene [8,45].

Pedicled fasciocutaneous flaps from the medial thigh and the groin area [8,9,46] offer the advantages of avoiding skin-graft problems, preserving adequate sensation, and covering a large defect [47].

The thigh region includes many fasciocutaneous flaps used in scrotal and perineal reconstruction. In the medial region of the thigh, there is a well-developed fascial plexus with marked axially aligned with sartorius [48]. The medial thigh fasciocutaneous flap can be harvested on them [9]. No specific vascular pedicle had to identified at the base of this longitudinally oriented flap, as it is nourished by the suprafascial plexus of the medial thigh that included septocutaneous branches from the superficial femoral artery and musculocutaneous branches through the adductor muscles [11].

The medial thigh flap of Hallock [9] is another one located along the medial aspect of the thigh, is based on a septocutaneous branch of the femoral artery at the apex of the femoral triangle. This medial thigh flap is a reliable fasciocutaneous for perineal reconstructions. The donor site is closed primarily and scar is hidden in the medial aspect of the thigh [11].

The anteromedial thigh flap of Koshima et al. [12], is an island cutaneous flap based on the septocutaneous perforator originating from the medial descending branch of lateral circumflex femoral vessels. Although this flap is thin, it requires tedious dissection of its vascular pedicle which is also liable to hazards of kinking, overstretching and compression.

Anteromedial thigh fasciocutaneous flap [2], has the following advantages over the medial thigh fasciocutaneous flap; (1) Flap dissection is easier, being more accessible, (2) Arc of rotation is less acute with less kink at the pedicle, (3) Dog ear deformity in the upper thigh is smaller, and (4) Scar of donor site closure is away from friction. One disadvantage of the described anteromedial thigh flap in fatty patients is its bulk which makes its rotation difficult and makes the neoscrotal bag very bulky. Also, it may affect spermatogenesis.

This flap is similar in principle and technique of elevation to the medial thigh fasciocutaneous flap of Hallock [9] described for scrotal reconstruction, but differs from it in being designed on the anteromedial thigh and thus it has more accessible dissection, less twisting at the pedicle and easier inset over the defect. Superomedial thigh flap [13,17,25].

This flap was described by Hirshowitz as a probable arterial flap with good vascular support from three main sources: (a) The deep external pudendal artery; b) anterior branch of the obturator artery and (c) The mid femoral circumflex artery [13]. Many authors [14-16] believe that the superomedial thigh flap is a good option for scrotal reconstruction in Fournier's gangrene with a better quality of transferred tissue (thin, pliable and above all sensate) [17].

Superomedial thigh fasciocutaneous flap of Hirshowitz & Pertz [8] is a horizontally oriented anteriorly based fasciocutaneous flap. One limit of this flap is its transverse dimension [14]. Inner thigh lift flap [19,20].

The fasciocutaneous flap of the inner thighs has excellent vascularization because of the presence of the branches of the femoral artery (internal and circumflex pudendal), making the flap very safe even in diabetic and vasculopathic patients. Loss of fertility is a complication of this technique. Impaired spermatogenesis is a result of the difficulty in maintaining a lower temperature in the testicles (35°C). However, this problem is also seen with other techniques, since none of them allow retraction and relaxation of the scrotum or mimic the function of the specialized vessels of the region.

Singapore flap [22] and V-Y fasciocutaneous pudendal thigh flap [23].

The pudendal thigh flap is a sensate fasciocutaneous flap based on the terminal branches of the superficial perineal artery. It has excellent vascu-

larization Loss of fertility is a complication of this technique. Impaired spermatogenesis is a result of the difficulty in maintaining a lower temperature in the testicles (35°C). However, this problem is also seen with other techniques, since none of them allow retraction and relaxation of the scrotum or mimic the function of the specialized vessels of the region 4.

The V-Y island fasciocutaneous flap, used to resurface the urogenital region after necrotizing fasciitis, is considered a new indication. The V-Y axial-pattern design of the flap is also considered a new modification, which enabled the flap to be advanced and tailored nicely in the midline. The idea of using the V-Y-plasty design is raised because the perineum has a pair of symmetrical anatomic structures. In addition, this procedure conserves tissue and the flap donor site is closed primarily without tension. Both aesthetic and functional results were satisfactory.

Anterolateral island thigh fasciocutaneous flap [49]. The anterolateral thigh perforator flap is based on either musculocutaneous or septocutaneous perforators of the descending branch of the lateral circumflex femoral artery. The technique is useful in the pedicled anterolateral thigh flap preparation, as it increases the arc of rotation, making it ideal for genitoperineal and abdominal wall reconstruction. However, the variable anatomy makes flap elevation challenging [50].

Groin flaps, supplied by the superior circumflex iliac artery, are sensitive island flaps, innervated by the lateral cutaneous femoral nerve. The groin flap is preferred by many because of thinness, especially on the lateral side [51,52]. We used the lateral portion of the groin flaps and had it expanded to obtain superthin flaps.

Gracilis, rectus abdominis muscle, or muscle-skin flaps have been used in this region [16,29,53]. Although these flaps are safe in terms of arterial supply, wasting a fully functional muscle that would add a great deal of bulk to the testes is a major disadvantage but it is good for infected areas.

From the above, we conclude that gracilis musculocutaneous flap in scrotal reconstruction have the following advantages:

- 1- Gives well vascularized tissue for reconstruction.
- 2- Better than fasciocutaneous flaps in microvascular impairment, infection or invasion of urethra or perianal area and immune compromised patient.

The disadvantages of this flap are that it is bulky and loss of gracilis function. However, gracilis muscle is expendable and the bulk is noted to be subsided in short time.

#### Conclusion:

Gracilis musculocutaneous pedicled flap is a good option for scrotal and perineal reconstruction especially in Fournier's gangrene and ischaemic pressure sore.

### REFERENCES

- 1- Pawan Agarwal: Scrotal Reconstruction; Our Experience. *Journal of Surgery Pakistan (International)*, 17 (1): P 32-35, 2012.
- 2- Abd El-Mageed M.: Evaluation of the Anteromedial Thigh Fasciocutaneous Flap for Scrotal Reconstruction Egypt, *J. Plast. Reconstr. Surg.*, Vol. 31, No. 2, July: 149-155, 2007.
- 3- Chen S.Y., Fu J.P., Chen T.M. and Chen S.G.: Reconstruction of scrotal and perineal defects in Fournier's gangrene. *Journal of Plastic, Reconstructive & Aesthetic Surgery*, Volume 64, Issue 4, April, Pages 528-534, 2011.
- 4- Mahesh Kumar, Abdul Razaque Shaikh\*, Abdul Razak Memon and Bilal Fazal Sheikh: Outcome of reconstructive procedures in Fournier's gangrene *Pakistan Journal of Surgery*, 121 Volume 24, Issue 2, 2008.
- 5- Gencosmanoglu R., Bilkay U. and Alper M.: Late Results of split grafted penoscrotal avulsion injuries. *J. Trauma*, 39: 1201-5, 1995.
- 6- Millard D.R. Jr.: Scrotal construction and reconstruction. *Plast. Reconstr. Surg.*, 38: 10-5, 1966.
- 7- Maguiña P., Tina L.P. and David GG.: Split thickness skin grafting for recreation of the scrotum following Fournier's gangrene. *Burns*, 29: 857-62, 2003.
- 8- Hirshowitz B. and Peretz B.A.: Bilateral superomedial thigh flaps for primary reconstruction of scrotum and vulva. *Ann. Plast. Surg.*, 8: 390-396, 1982.
- 9- Hallock G.G.: Scrotal reconstruction following Fournier's gangrene using the medial thigh fasciocutaneous flap. *Ann. Plast. Surg.*, 24: 86-90, 1990.
- 10- Hallock G.G.: Scrotal reconstruction following Fournier's gangrene using the medial circumflex artery flap. *Ann. Plast. Surg. Sep.*, 57 (3): 333, 2006.
- 11- Ahmad Al-Fadhli, Hisham Burezq, Nabeel Abdulfattah, Wael Ayad The Versatility of the Medial Thigh Flap for Coverage of Large Perineoscrotal Defects *Kuwait Medical Journal*, 40 (4): 293-296, 2008.
- 12- Koshima I., Soeda S., Yamasaki M. and Kyou J.: The free and pedicled anteromedial thigh flap. *Ann. Plast. Surg.*, 21: 480, 1988.
- 13- Hirshowitz B., Moscona R., Kaufman T. and Pnini A.: One-stage reconstruction of the scrotum following Fournier's syndrome using a probable arterial flap. *Plast. Reconstr. Surg.*, 66: 608-12, 1980.
- 14- Ferreira P.C., Reis J.C., Amarante J.M., Silva A.C., Pinho C.J., Oliveira I.C., et al.: Fournier's gangrene: A review of 43 reconstructive cases. *Plast. Reconstr. Surg.*, 119: 175-84, 2007.
- 15- Lee S.W., Bang C.Y. and Kim J.H.: Penoscrotal reconstruction using groin and bilateral superomedial thigh flaps: A case of penile vaselinoma causing Fournier's gangrene. *Yonsei Med. J.*, 48: 723-6, 2007.
- 16- Horta R., Cerqueira M., Marques M., Ferreira P., Reis J. and Amarante J.: Fournier's gangrene: From urological emergency to plastic surgery. *Actas. Urol. Esp.*, 33: 925-9, 2009.
- 17- Ayat Allah Oufkir, Mohammed Fadl Tazi2 and Mohammed Nouredine El Amine El Alami: The superomedial thigh flap in scrotal reconstruction: Technical steps to improve cosmetic results *Indian Journal of Urology*, Oct-Dec., Vol. 29, Issue 4, 2013.
- 18- Abdul Razaq A.: Whaib Evaluation of Superomedial Fasciocutaneous Thigh Flap in Replacement of Scrotal and Penile Skin *The Iraqi Postgraduate Medical Journal*, Vol. 10, No. 3, P 374-380, 2011.
- 19- Monteiro E., Carvalho P., Costa P. and Ferraro A.: Inner Thigh Lift Flap" for Fournier gangrene of the scrotum. *Plast. Reconstr. Surg.*, 110 (5): 1372-1373, 2002.
- 20- Victor Mauro1: Fasciocutaneous flap of the inner thigh for scrotal reconstruction in Fournier syndrome. *Rev. Bras. Cir. Plást.*, 26 (4): 707-9707, 2011
- 21- Monstrey S., Blondeel P., Van Landuyt K., et al.: The versatility of the pudendal thigh fasciocutaneous flap used as an island flap. *Plast. Reconstr. Surg.*, 107: 719-725, 2001.
- 22- Maharaj D., Naraynsingh V., Perry A. and Ramdass M.: The scrotal reconstruction using the "Singapore sling". *Plast. Reconstr. Surg.*, 110: 203-205, 2002.
- 23- El-Khatib H.A.: V-Y Fasciocutaneous Pudendal Thigh Flap for Repair of Perineum and Genital Region After Necrotizing Fasciitis: Modification and New Indication. *Annals of Plastic Surgery*, 48 (4): 370-375, 2002.
- 24- Heung Chan Oh, Seong Hwan Bae1, Jae Woo Lee1, Joo Hyoung Kim1 and Su Bong Nam1: Scrotal Reconstruction with Pedicled Anterolateral Thigh Perforator Flap in Fournier's Gangrene *Korean J. Urol.*, 8 (2): 114-20, 2013.
- 25- Cannistrac, Kirsch-Noir F., Delmasv, Marmus J.P. and Boccon-Gibod L.: Scrotal reconstruction by inguinal flap after Fournier's gangrene. *Prog. Urol.*, 13 (4): 703-6, 2003.
- 26- Atik B., Tan O., Ceylan K., Etlik O. and Demir C.: Reconstruction of wide scrotal defect using suprathigh groin flap. *Urology Aug.*, 68 (2): 419-22, 2006.
- 27- David W. Banks M.D., David P. O'Brien III M.D., J. Richard Amerson M.D. and T. Roderick Hester Jr.: Gracilis musculocutaneous flap scrotal reconstruction after Fournier's gangrene *Urology*, Volume 28, Issue 4, Pages 275-276, 1986.
- 28- Young Tae Lee and Jin Moo Lee: Gracilis myocutaneous flap for the coverage of an extensive scrotoperineal defect and protection of the ruptured urethra and testis *Yonsei Medical Journal*, Vol. 31 No. 2, P 187-191, 1990.
- 29- Kayikçioğlu A.: A new technique in scrotal reconstruction: Short gracilis flap. *Urology Jun.*, 61 (6): 1254-6, 2003.

- 30- Roberto Rudge Ramos, Jorge de Moura Andrews and Lydia Masako Ferreira: A gracilis myocutaneous flap for reconstruction of the scrotum. PRAS Volume 37, Issue 2, Pages 171-174 (April 1984).
- 31- Ioannovich J., Kepenekidis A., Stamatopoulos K. and Matar M.: [Use of gracilis musculocutaneous flap in tissue loss caused by Fournier's gangrene. Apropos of 4 cases]. *Ann. Chir. Plast. Esthet*, 43 (1): 58-63, 1998.
- 32- William A. Young Major, USAF, MC and Resident, James K. Wright LtCol, USAF, MC: Scrotal reconstruction with a rectus abdominis muscle flap *British Journal of Plastic Surgery*, Volume 41, Issue 2, Pages 190-193, 1988.
- 33- Mathes S.J. and Nahai F.: Classification of the vascular anatomy of muscles: Experimental and clinical correlation. *Plast. Reconstr. Surg.*, 67 (2): 177-187, 1981.
- 34- Orticochea M.: The musculo-cutaneous flap method: An immediate and heroic substitute for the method of delay. *Br. J. Plast. Surg.*, 25 (2): 106-110, 1972.
- 35- Harii K., Ohmori K. and Sekiguchi J.: The free musculocutaneous flap. *Plast. Reconstr. Surg.*, 57 (3): 294-303, 1976.
- 36- Erni D., Banic A. and Sigurdsson G.H.: A dynamic study of the circulation in the gracilis muscle in humans. *J. Reconstr. Microsurg.*, 12 (8): 515-519, 1996.
- 37- Giordano P. and Abbes M.: Gracilis blood supply: Anatomical and clinical re-evaluation. *Br. J. Plast. Surg.*, 43 (3): 266-72, 1990.
- 38- Morris S.F. and Yang D.: Gracilis muscle: Arterial and neural basis for subdivision. *Ann. Plast. Surg.*, 42 (6): 630-633, 1999.
- 39- Yousif N.J., Matloub H.S., Kolachalam R., Grunert B.K. and Sanger J.R.: The transverse gracilis musculocutaneous flap. *Ann. Plast. Surg.*, 29 (6): 482-490, 1992.
- 40- Juricic M., Vaysse P., Guitard J., Moscovici J., Becue J., et al.: Anatomic basis for use of a gracilis muscle flap. *Surg. Radiol. Anat.*, 15 (3): 163-8, 1993.
- 41- Taylor G.I., Cichowitz A., Ang S.G., Seneviratne S. and Ashton M.: Comparative anatomical study of the gracilis and coracobrachialis muscles: Implications for facial reanimation. *Plast. Reconstr. Surg.*, 112 (1): 20-30, 2003.
- 42- Cavadas P.C., Sanz-Giménez-Rico J.R., Landín L., Martínez-Soriano F.: Segmental gracilis free flap based on secondary pedicles: Anatomical study and clinical series. *Plast. Reconstr. Surg.*, 114 (3): 684-691. *Ann. Chir. Plast. Esthet*. 1998 Feb., 43 (1): 58-63, 2004.
- 43- Strauch B. and Han-Liang Yu: *Atlas of Microvascular Surgery*, 2<sup>nd</sup> Edition, Thieme, 2006.
- 44- David Chwei-Chin Chuang: *Gracilis flap In Wei and Mardini Flaps and Reconstructive Surgery* Saunders, P 390, 2009.
- 45- C.E. Horton J.F. and Stecker G.H.: *Jordan Genital reconstruction following trauma* J.G. McCarthy Plastic Surgery WB Saunders New York, 4226-4239, 1990.
- 46- Tiwari I.N., Seth H.P. and Mehdiratna K.S.: Reconstruction of the scrotum by thigh flaps. *Plast. Reconstr. Surg.*, 66: 605-606, 1980.
- 47- Kim K.S., Noh, B.K., Kim D.Y., Lee S.Y. and Cho B.H.: Thin Paraumbilical Perforator-Based Cutaneous Island Flap for Scrotal Resurfacing. *Plast. Reconstr. Surg.*, 108 (2): 447-451, 2001.
- 48- Cormack G.C. and Lamberty B.G.H.: *The Fasciocutaneous System of Vessels, the Blood Supply to the Skin by Regions-Thigh. In The Arterial Anatomy of Skin Flaps.* New York: Churchill-Livingstone, 1994.
- 49- Yu P., Sanger J.R., Matloub H.S., Gosain A. and Larson D.: Anterolateral Thigh Fasciocutaneous Island Flaps in Perineoscrotal Reconstruction. *Plast. Reconstr. Surg.*, 109 (2): 610-616, 2002.
- 50- Petros K. *Spyriounis Plastic and Reconstructive Surgery • March 2006 Volume 117, Number 3 • Anterolateral Thigh Perforator Flap.*
- 51- L.A. Sharzer: *Free flap transfer in the upper extremity* J.G. McCarthy Plastic Surgery WB Saunders New Yorkm 446, 1990.
- 52- I.A. McGregor and D. Soutar: *The groin skin flap* B. Strauch L.O. Vasconez E.J. Hall-Findlay Grabb's *Encyclopedia of Flaps Vol. 2* Little, Brown Boston, 1094-1100, 1990.
- 53- D. Banks and D.O'Brien J.: *Amerson Gracilis musculocutaneous flap scrotal reconstruction after Fournier Gangrene* *Urology*, 28: 275-276, 1986.