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Free Radial Forearm Flap for Phalloplasty

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ABSTRACT

From May 2003 to March 2006, 12 cases of free radial forearm flap were used for total phallic construction in intersexes patients in Plastic and Reconstructive Surgery Department, Tanta University Hospital. Their ages ranged from 17 to 28 years. Follow-up period ranged from 6 months to 15 months. No complete flap loss, 4 cases of fistulas were developed, 3 of them closed spontaneously and one required surgical intervention. Meatal stenosis in 2 cases which required regular dilatation. No functional disability of the donor site. The neophallus was insensate for the first month postoperatively. Most patients have recovered gross tactile sensation after 6 months. Penile prosthesis is considered only after protective sensation develops after 9 months. Sexually active patients described erogenous sensation. The radial forearm flap allows reconstruction of a neophallus that is aesthetically and psychologically satisfying. It is of appropriate size and shape, and allow for placement of a penile prosthesis and permit successful coitus.

INTRODUCTION

The penis is uniquely complex organ because it serves both functional and psycho-sexual purposes. Total reconstruction of the phallus may be indicated in cases of congenital anomalies such as penile agenesis, micropenis, intersexes condition. Borgoras **[1]**, first reported using tubed abdominal flap to build a penis. Gilles **[2]**, described staged abdominal pedicle. Orticochea **[3]**, reported the use of gracilis myocutaneous flap. In 1980, the forearm flap first described by Chang **[4]**. The radial forearm neurovascular fasciocutaneous free flap includes the volar forearm skin, its underlying adipose tissue, sensory medial and lateral ante-brachial cutaneous nerves, the basilic and cephalic veins and part of the deep fascia, all these are connected to the radial artery and its venae comitantes by a thin intermuscular septum that contains cutaneous perforating vessels. A set of four to five perforating vessels emerges from the proximal and distal thirds of the radial artery **[5]**. The radial forearm free flap is thin, potentially sensate, minimally hair bearing flap with enough flexibility that its design can incorporate a vascularized urethra. It is aesthetically and psychologically satisfying. It enables the patients to void in standing position through distal meatus. It provides a phallus that has protective and erogenous sensation and of suitable size and shape to allow for placement of a penile prosthesis and permits successful coitus **[4,6]**.

PATIENTS AND METHODS

From May 2003 to March 2006, 12 cases of free radial forearm flap were used for total phallic construction in intersexes patients. Their ages ranged from 17 to 28 years. In Tanta University Hospital. Follow-up period ranged from 6 months to 15 months. The patients were questioned about their subjective impressions of any change of grip power and pinch power, and range of motion of wrist in the donor forearm following operation, were evaluated with a dynamometer. In nine cases with regular sexual activities in whom prostheses were inserted, sexual performance was also subjectively assessed.

Surgical technique:

Flap design and dimensions: The flap is designed on the non dominant forearm with a centrally located neourethra in continuity with a neoglans. The dimensions of the flap depend on to some degree, on the patients need and desire as well as the size of the forearm and the amount of subcutaneous tissue present. Our flap dimensions are usually of 15x17cm. The non dominant forearm is chosen as the donor site. A preoperative Allen's test should be performed on all patients. The flap is designed on the volar aspect of the forearm. No shaving, this allows marking of neourethera on the portion of the forearm with the least amount of hair.

Operative technique: The forearm is moderately exsanguated with Esmarch bandage, a sterile tourniquet is inflated to 250mm Hg. Two strips of skin each 1cm wide, on either sides of the centrally

planned neourthera are deepithelialized. The radial artery and its venae comitantes are identified at the wrist and isolated with vessel loops. An incision is made along the radial border of the flap carried down through the deep fascia. The dissection then proceeds ulnarly beneath this layer and stops at the thin intermuscular septum, which carries the septocutaneous perforating vessels. Identify and preserve the cephalic vein, the medial and lateral antebrachial cutaneous nerves, they were dissected an additional 3 to 4cm proximal to the skin paddle, tagged with 7/0 prolene and divided. Next, the ulnar border of the flap is incised and elevated radially beneath the deep fascia. The cutaneous perforating vessels of the ulnar artery should be ligated and divided. This dissection is continued ulnarly till the intermuscular septum containing the septocutaneous perforators of the radial artery is encountered. The radial artery and its venae comitantes are elevated from their bed from distal to proximal. Muscular branches are ligated. The arterial dissection is continued proximally until the bifurcation of the brachial artery is encountered. Dissection of the proximal venae comitantes proceeds until the veins coalese into one. The tourniquet is released, the flap is perfused, and hemostasis is achieved. The flap is now attached by only the radial vascular bundle. Small vascular clamps are applied to the distal radial vascular bundle, and hand perfusion is examined. Only after adequate ulnar blood supply to the hand has been ensured, the distal radial vascular bundle clamped. If there is inadequate hand perfusion via the ulnar artery ,a saphenous vein interposition graft to reconstruct the radial artery must be done. The portion of the flap forming the central neourethra is then tubed over 10 French silastic urinary catheter by suturing the ulnar to the radial skin edge of the neourethra in several layers. The constructed phallus is left attached to its proximal pedicle until the recipient site has been prepared.

Recipient site preparation: During flap elevation a separate team prepares the pubic site and the recipient vessels and nerves. Approximately 20cm of saphenous vein is harvested from the thigh and left attached to the femoral vein. The divided end of the saphenous vein graft is then anastomosed to the femoral artery using microsurgical tech. and loupe magnification to create a temporary A.V. fistula. If no penile remnant is present, an incision is made over the symphysis pubis. If a portion of the native phallus exists, a degloving incision is designed. The dorsal penile branche of the pudendal nerve is isolated, or dissection of the pudendal nerve in the perineum. The fully constructed neophallus is detached from the forearm, transferred to the pubic area, and secured in place with tacking sutures. Primary urethral anastomosis using 4/0 vicryl end to end two layers anastomosis. The saphenous vein loop is divided, and the cephalic vein is anastomosed end to end to the venous limb of saphenous loop with 7/0 prolene. The radial artery is anastomosed end to end to the arterial limb of the saphenous loop with. 7/0 prolene. Epineural microneurorhaphies between branches of the pudenual nerve and the medial and lateral cutaneous nerves of the forearm using 8/0 prolene. Closure of the remaining wounds around the root of the neophallus and femoral vessels. Percutaneous suprapubic catheter is placed to ensure adequate drainage away from the healing neourethra.

Donor site: The forearm muscle in the bed of the donor site are approximated together and over any exposed tendons with absorbable sutures to minimize contour irregularities. A thick split-thickness skin graft is then applied to the muscular bed.

RESULTS

Neophallus complications: 12 cases of free radial forearm flap were used for total phallic construction in intersexes patients. Their ages ranged from 17 to 28 years. No complete forearm flap loss occurred. Urethrocutaneous fistula occurred in 4 cases (33.3%) postoperatively; 3 cases healed spontaneously within one month (25%), one case (8.3%) needed surgical intervention. All fistulae occurred at the junction of the neophallus and the neoscrotum. Meatal stenosis in 2 cases (16.6%) which required regular dilatation. The neophallus was insensate for the first month postoperatively. Most patients have recovered gross tactile sensation after 6 months. Penile prosthesis is considered only after protective sensation develops after 9 months.

Donor site complications:

In 11 cases no significant difference in the range of motion of donor forearm and hand after operation. As well as no 'significant' change or decrease in grip and pinch power after operation, though one case complained of minimal decrease of grip power.

Sexual function restoration:

All preserved native phallus or clitorises had erotic sensation. All the cases claimed that they had erotic sensation on the neophallus. In five cases that have regular sexual activities, all can achieve orgasm during intercourse and all are satisfied with the results. The remaining seven cases, can achieve orgasm by masturbation stimulating the neophallus only.

Fig. (1): The flap is designed on the volar aspect of the non dominant forearm.

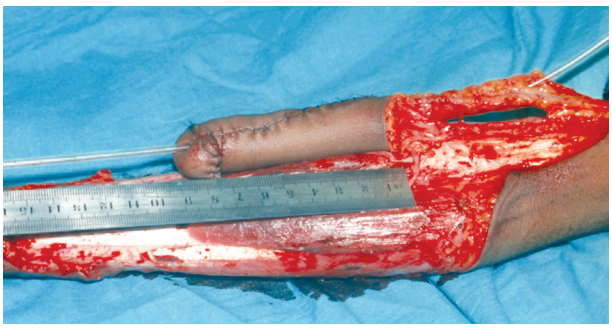

Fig. (2): The constructed phallus is left attached to its proximal pedicle until the recipient site has been prepared.

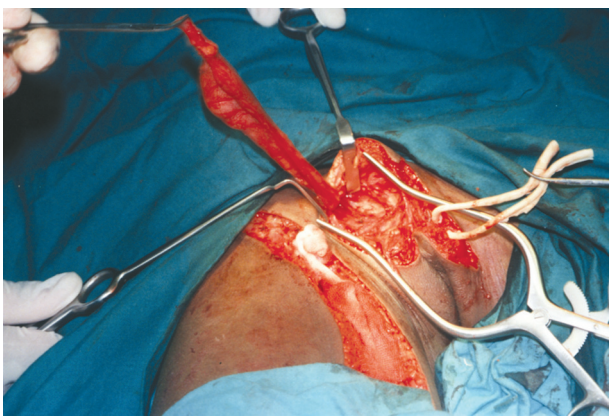

Fig. (3): Preparation of the recipient site.

Fig. (4): The fully constructed neophallus is detached from the forearm.

Fig. (5): Closure of the remaining wounds around the root of the neophallus and femoral vessels.

Fig. (6): Percutaneous suprapubic catheter is placed to ensure adequate drainage away from the healing neourethra.

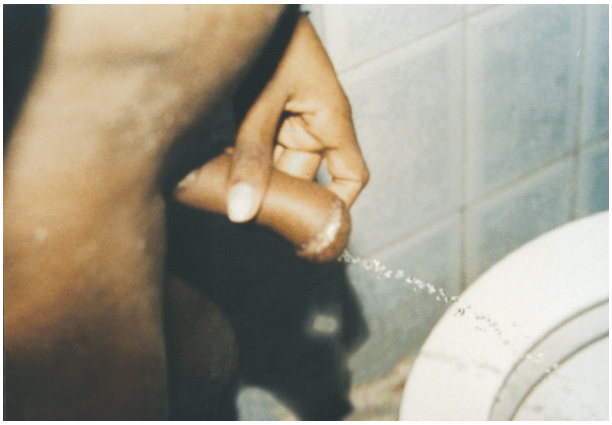

Fig. (7): Complete and perfect micturation through intact urethera and external urethral meatus.

Table (1): Complications in 12 of phalloplasty using free radial forearm phalloplasty.

	No. of cases
Complete flap loss	0
Fistula formation	4
Fistula repair	1
Meatal stricture	2
Donor forearm morbidity	1

DISCUSSION

Neophallic complications:

Urethrocutaneous fistula is a common complication in free flap phalloplasty. Chang and Hwang **[7]** designed 'a tube-in-a-tube' radial forearm fasciocutaneous flap in seven cases and one (14.8%) fistula formation. Chang et al., reported an amazing result with a fistula rate of only 5.1% (seven in 136 cases) with various flaps, and 3.2% (three in 93 cases) with free forearm flaps. In female-to-male transsexuals, Hage et al. **[8]** used the same method and fistula was noted in five of six cases. Later, Hage et al. **[9]** used the anterior vaginal flap to construct the fixed part of the neourethra. The fistula rate was 19.5% (nine in 46 cases). LeGaillard et al. **[10]**, presented 15 prefabricated phalli using radial forearm fasciocutaneous flaps and showed a fistula rate of 46.7% (seven in 15 cases). Fang et al. **[11]**, has used 'a-tube-in-a-tube' forearm osteocuta neous flaps in 14 cases of female-to-male transsexuals and nine cases were complicated by troublesome fisula. Byun et al. **[12]** reported two in five cases which, using the similar method, had problems of fistula. In our study all fistulae originated from anastomosis of the native urethra and neourethra. They were 4 in number 3 of them healed spontaneously and one required surgical intervention. Biemer **[6]** reported a stricture rate of 40% (four in 10 cases). Byun et al. **[12]** reported that one in five cases. In our study urethrocutaneous fistula occurred in 4 cases (33.3%) postoperatively; 3 cases healed spontaneouslyin within one month (25%), one case (8.3%) needed surgical intervention. All fistulae occurred at the junction of the neophallus and the neoscrotum. 2 cases (16.6%) of meatel stenosis which required regular dilatation.

Donor site complications: The donor forearm morbidity has been mentioned in the literature. Bardsley et al. **[13]** and Boorman et al. **[14]** had similar conclusions that both power and range of motion were uniformly normal. Richardson et al. **[15]** in their prospective study showed that decreased pinch and grip powers as well as restrictive wrist motion were noted in both groups of fasciocutaneous and osteocutaneous flaps. In our series one case complained of minimal decrease of grip power. Though in 11 cases no significant difference in the range of motion of donor forearm and hand after operation. As well as no 'significant' change or decrease in grip and pinch power.

Sexual function restoration: Levine et al. **[16]** reported successful implantation and long-term retention of penile prostheses in four patients after total phallic reconstruction. Alter et al. **[17]** used inflatable and semi-rigid penile prostheses with Gore-Tex struts in phalloplasty. They achieved a success rate of 65% in 13 patients. However, surgical revision rates of up to 43% have been reported in 'normal' males with inflat able penile prostheses after long-term follow-up **[18]**. The long-term results of penile prostheses implanted in female-to-male transsexuals after phalloplasty with fasciocutaneous flaps have yet to be evaluated. The incorporations of pudendal nerves to re-innervate the constructed phallus have been mentioned **[19]**. In our series, we coapted forearm cutaneous nerves to the dorsal penile branche of the pudendal nerve, or the pudendal nerve in the perineum. All the cases claimed that they had erotic sensation on the neophallus. In five cases that have regular sexual activities, all can achieve orgasm during intercourse and all are satisfied with the results. The remaining seven cases, can achieve orgasm by masturbation stimulating the neophallus only. Hage and de Graaf **[20]** put the clitoris directly below the phallic shaft. Gilbert et al. **[21]** as well as Defontaine et al. **[22]** placed the penile remnant or clitoris below the scrotum and inner thigh in all cases as its greater and easier stimulation can be gained during intromission. Dabernig et al. **[23]** used free prefabricated fibular flap as a good alternative to the free radial forearm flap in female-to-male sex reassignment surgery. They described a new technique of harvesting the flap without sacrificing the fibula. The neophallus is thinner, more elegant, less rigid and able to contain a hydraulic penile prosthesis. Rashid and Sarwar **[24]** underwent penile reconstruction for 36 men having avulsion injuries with radial forearm free flap there was one flap loss, eight developed fistula and six patients developed late stricture. Overall patient satisfaction with the reconstruction was very high.

Conclusion: The free radial forearm flap allows reconstruction of a neophallus that is aesthetically and psychologically satisfying. The flap allows

the patients to void in standing position through a distal meatus. It provides a neophallus that has protective and erogenous sensation. It is of appropriate size and shape, and allow for placement of a penile prosthesis and permit successful coitus.

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