

Fixation of Penile Prosthesis in Phalloplasty

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ABSTRACT

Background: Proximal fixation of penile prosthesis in phalloplasty cases is challenging due to lack of normal corporeal bodies and its tough tunical covering, proximal and distal migration may occur and patients may suffer from lack of rigidity.

Patients and Methods: This study included 14 cases in which 16 penile prostheses (12 semirigid and 4 inflatable) were inserted and fixed in totally reconstructed phallus during the period between 2002 and 2013 in Plastic Surgery Unit, Tanta University.

Twelve cases suffered from disorder of sex development or differentiation (46 XY) and four cases were presented by post traumatic penile amputation. Anterolateral thigh flap and tubed abdominal flap were used each in a single case, groin flaps were used in two cases that were reoperated again due to fracture of the prosthesis, while free radial forearm flaps were used in the remaining ten cases. Time of prosthesis insertion was not less than one year after phalloplasty and follow-up included regular physical examination and interviews over at least three years.

Plates and screws were used for fixation of prostheses to the pubic bone in four cases (all of them were semirigid). Construction of a polypropylene mesh jacket over the prostheses and its fixation by polypropylene sutures to the periosteum of the pubic bone was used in the remaining twelve cases, ten of them were new and two of them were redo cases. The prosthesis was semirigid in eight of them and inflatable in four.

Results: In plates and screws technique, early infection of the prosthesis occurred in one case, the plate was broken in the second case, while the metallic core of the prosthesis was broken in the remaining two cases within one year. In polypropylene mesh and sutures technique, tip necrosis with extrusion occurred only in one case due to insertion of over lengthened semirigid prosthesis, while all other cases were successful throughout the whole period of follow-up.

Conclusion: Adequate fixation of penile prosthesis in phalloplasty is an essential step to provide support and better performance. Fashioning a polypropylene mesh over the prosthesis with its fixation by polypropylene sutures to the periosteum of the pubic bone is one of the best options to achieve this goal.

INTRODUCTION

One of the goals of total phallic construction is the achievement of rigidity that allows penetrative sexual intercourse [1]. The main limiting factor is that there is no good substitute for the unique erectile tissue of the penis [2,3].

A number of entities have been used to achieve rigidity in phallic reconstruction. In 1993 Hage provided an overview [4]. He concluded that there exists no excellent device to obtain rigidity in a neophallus. For decades rib cartilage and bone transplants were the most popular entities. These techniques have been reported with high rates of failure. Rib cartilage has variable rigidity and there are no reports of patient satisfaction. Bone with periosteum tends to resorb with time [5].

Penile prosthetic surgery represents a valid option in phalloplasty for sex reassignment or demolition surgery. There are several types of prosthesis available and they showed remarkable developments since their commercialization in the 1970s. Penile prostheses can be semi-rigid or inflatable. Both devices enhance penile rigidity, but inflatable prostheses enable penile flaccidity achieving a better cosmetic result while in semi-rigid prostheses the penis is always erected although they are easier to use and they need simpler surgical procedure compared to inflatable prostheses [6].

There are minimal available data on penile prosthesis in phalloplasty, however, there are some important differences compared to prosthesis implantation in normal penis. First, there is no serviceable crus penis or corpora cavernosa. This may contribute to a higher risk of distal erosion or proximal migration. Second, the tissue of the constructed neophallus is totally different from the tissue in a normal male penis. This may cause a higher risk of prosthesis protrusion, erosion and

infection. Third, the prosthesis is implanted in an area that was previously operated on extensively, causing a lot of scar tissue, which is less vascularised and, thus, probably may cause a higher infection rate. Finally, most cases of phalloplasty are young so one may presume that they are sexually more active than older males who usually show marked decline in sexual desire. This may lead to more mechanical failure of prostheses [7].

PATIENTS AND METHODS

This study included 14 new and two redo cases in which 16 penile prostheses were inserted and fixed in totally reconstructed phallus during the period between 2002 and 2013 in Plastic Surgery Unit, Tanta University.

Plates and screws were used for proximal fixation of the prosthesis in the first four cases while polypropylene mesh and sutures were used in the following twelve cases.

Twelve cases suffered from disorder of sex development or differentiation (46 XY) and four cases were presented by post traumatic penile amputation without any corporeal remnants. Flaps used were the anterolateral thigh flap and tubed abdominal flap each in one case, groin flap in two cases that were operated twice, and the free radial forearm flap in the remaining ten cases. The operation was postponed for at least one year after phalloplasty for sufficient tactile sensitivity that was measured by pressure stimuli and vibratory sense.

In free radial forearm phalloplasty, Duplex study was mandatory to identify and mark the vascular pedicle to avoid its injury during the procedure.

Incision used was usually a vertical suprapubic incision from 5 to 7cm in length ending just above the new phallus; it was occasionally designed to be a part of a suprapubic V-Y advancement flap to lengthen the penis. The wound was deepened vertically down to the pubic bone preserving soft tissue with good blood supply as much as possible over the prosthesis. Pocket for penile implant was created by blunt dissection using Hegar dilator of increasing width, this dissection was carried out to just one cm below the tip of the new phallus to decrease the risk of perforation (Fig. 1), then the pocket was extended proximally to the symphysis pubis (Fig. 2). In two cases a longitudinal incision was made along the neophallus to facilitate easy insertion of the prosthesis (Fig. 3).

In plate and screws technique (Fig. 4), one cylinder of 11mm girth semirigid penile prosthesis was inserted into the neophallus that usually accommodates 12 to 14cm length. The proximal part was placed over the pubic bone and its length was adjusted (Fig. 5a,b). Seven holes stainless steel plate was placed over the single cylinder providing 3 holes on each side; electric drill was used to fix three screws on each side of the prosthesis leaving an empty hole over the cylinder, so that the in the erected neophallus the distal two thirds of the prosthesis bend over the lower edge of the plate (Fig. 6). 2/0 Vicryl sutures were used to approximate the subcutaneous tissues over the prosthesis and finally the skin was closed.

In polypropylene mesh and sutures technique (Fig. 7), before the insertion of the single prosthesis cylinder, a tube of polypropylene mesh was fashioned over the prosthesis using continuous 4/0 polypropylene sutures (Fig. 8). The mesh tube was closed distally and inverted again over the prosthesis to make the sutured edge inside the tube while the smooth surface outside (Fig. 9). The prosthesis with its polypropylene mesh envelop were then inserted into its prepared pocket inside the new phallus. Two 2/0 polypropylene sutures were passed through the polypropylene mesh and the periosteum of the pubic bone; these were tied after insertion, ensuring proper orientation of the erected neophallus (Figs. 10,11a-d).

Throughout either procedure, the prosthesis was frequently immersed in 100ml solution of 160mg of gentamycin preventing bacterial contamination. Antibiotic prophylaxis was started at induction and was continued for 10 days. After the operation, a supporting foam structure was applied to keep the neophallus in the semierect position, enhancing venous outflow. A catheter was inserted for two weeks because of the anticipated neophallic oedema and subsequent temporary collapse of the urethra. Patients were instructed how to inflate their prostheses in case of using inflatable type and how to manipulate the semirigid type. Sexual intercourse was allowed after three months allowing for complete healing and fixation when plates and screws were used and for optimal encapsulation and tissue ingrowth into the polypropylene mesh if used.

RESULTS

This study included 14 new and two redo cases in which 16 penile prostheses were inserted and fixed in totally reconstructed phallus during the period between 2002 and 2013 in Plastic Surgery Unit, Tanta University.

Time of prosthesis insertion was not less than one year after phalloplasty and follow-up included regular physical examination and interviews over one to nine years.

Plates and screws were used for proximal fixation of the prosthesis in the first four cases (Table 1) while polypropylene mesh and sutures were used in the following twelve cases (Table 2).

The prostheses used in all cases of plates and screws were semirigid while the flaps used one tubed abdominal and one anterolateral thigh flap, and two groin flaps. Two of these cases were due to traumatic amputation while the other two were due to disorder of sex development or differentiation (46XY). The prosthesis in the first case showed early infection within two weeks. The plate in the second case was broken after six months due to excessive repeated pressure during sexual intercourse while the metallic core of the prosthesis was broken in the remaining two cases between 7 and 12 months mainly due to bending of the prosthesis over the sharp edge of the plate, therefore the technique was abandoned.

Polypropylene mesh and sutures was used for fixation of the prosthesis for the last twelve cases, two of them were redo after fracture of the metallic core of previously fixed semirigid prostheses by plates and screws. The prostheses were semirigid in eight cases and inflatable in four cases while flaps used were two groin redo cases and free radial forearm flap in 10 cases. Ten cases were disorder of sex differentiation or development (46XY) and two cases were traumatic amputation.

In polypropylene mesh and sutures technique, tip necrosis with extrusion occurred in only one case with groin flap and inflatable prosthesis after 3 months; this case was operated before using plates and screws technique and its metallic core was broken after 7 months. However, the main cause in our opinion was the over length of the prosthesis (Fig. 12). All other cases (one groin and ten free radial forearm flaps) using 8 semirigid and 3 inflatable prostheses were successful throughout the whole period of follow-up between one and nine years with a mean of three years (Figs. 13a-b,14-16).

Table (1): Cases in which plates and screws were used for proximal fixation of the prosthesis.

Case	Flap used	Indication	Prosthesis	Fate
Case 1	Tubed abdominal flap	Traumatic penile amputation	Semirigid prosthesis	Infected and necessitated removal within two weeks
Case 2	Anterolateral thigh flap	Disorder of sex development or differentiation (46XY)	Semirigid prosthesis	Plate was broken after 6 months
Case 3	Groin flap	Traumatic penile amputation	Semirigid prosthesis	Prosthesis was broken after 7 months
Case 4	Groin flap	Disorder of sex development or differentiation (46XY)	Semirigid prosthesis	Prosthesis was broken after 12 months

Table (2): Cases in which polypropylene mesh and sutures were used for proximal fixation of the prosthesis.

Case	Flap used	Indication	Prosthesis	Fate
Case 5	Free radial forearm flap	Traumatic penile amputation	Semirigid prosthesis	Successful
Case 6	Groin flap redo	Traumatic penile amputation	Inflatable prosthesis	Tip necrosis with extrusion
Cases 7-12	Free radial forearm flap	Disorder of sex development or differentiation (46XY)	Semirigid prosthesis	Successful
Case 13	Groin flap redo	disorder of sex development or differentiation (46XY)	Semirigid prosthesis	Successful
Cases 14-16	Free radial forearm flap	disorder of sex development or differentiation (46XY)	Inflatable prosthesis	Successful



Fig. (1): Pocket for penile implant was created by blunt dissection distally.

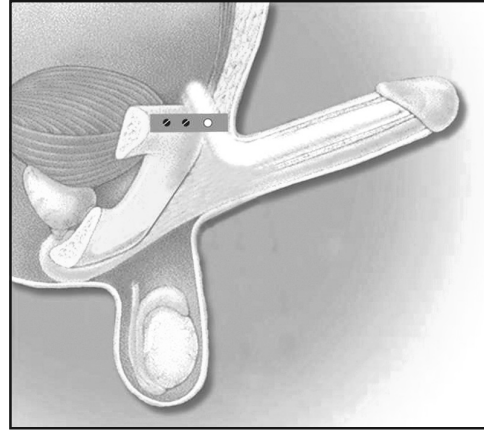


Fig. (4): Plate and screws technique.



Fig. (2): The pocket was extended proximally to the symphysis pubis.



Fig. (5A): Semirigid penile prosthesis inserted into the neophallus.



Fig. (3): In two cases a longitudinal incision was made along the neophallus to facilitate easy insertion of the prosthesis.



Fig. (5B): The proximal part was placed over the pubic bone and its length was adjusted.



Fig. (6): Stainless steel plate was placed over the cylinder and an electric drill was used to fix three screws on each side.

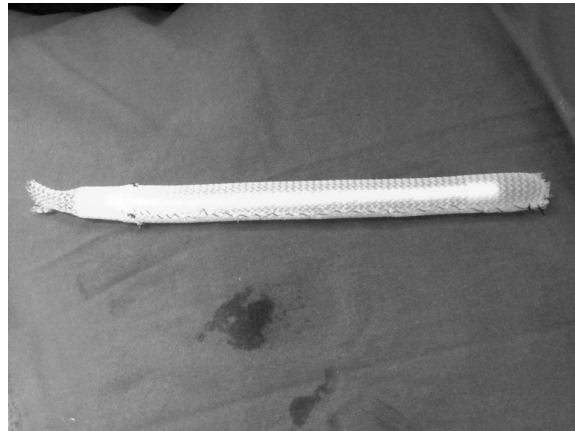


Fig. (9): The mesh tube was inverted over the prosthesis to make the sutured edge inside the tube while the smooth surface outside.

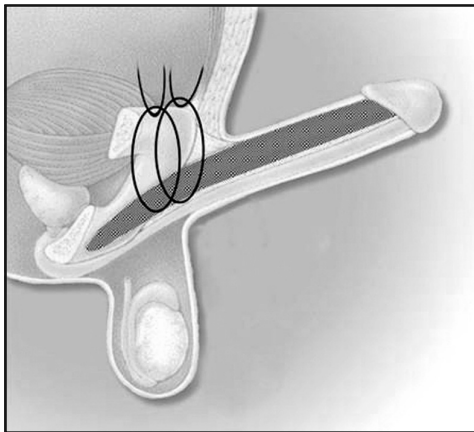


Fig. (7): Polypropylene mesh and sutures technique.



Fig. (10)

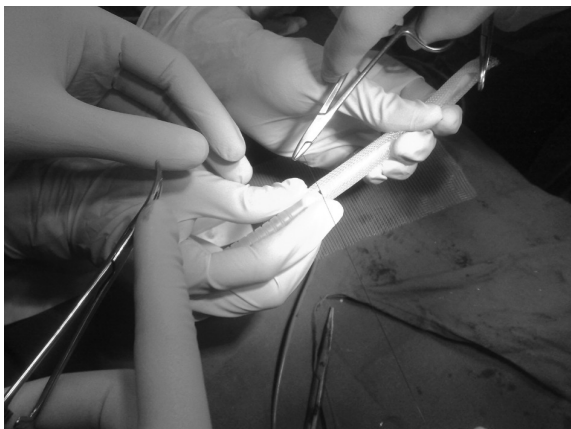


Fig. (8): A tube of polypropylene mesh was fashioned over the prosthesis using continuous 4/0 polypropylene sutures.



Fig. (11-A)

Figs. (10, 11-A): Two 2/0 polypropylene sutures were passed through the polypropylene mesh and the periosteum of the pubic bone.



Fig. (11-B): Sutures were tied after insertion and proper orientation of the prosthesis.



Fig. (12): Early tip necrosis due to over length of the inserted prosthesis using the polypropylene mesh and sutures technique.



Fig. (11-C)



Fig. (11-D)

Figs. (11-C,D): Closure of the neophallus over the fixed prosthesis.



Fig. (13-A): Free radial forearm phalloplasty before insertion of the prosthesis.



Fig. (13-B): Postoperative results after insertion of the prosthesis using the polypropylene mesh and sutures technique.



Fig. (14): Free radial forearm phalloplasty after insertion of the prosthesis using the polypropylene mesh and sutures technique.



Fig. (15): Free radial forearm phalloplasty after insertion of the prosthesis using the polypropylene mesh and sutures technique.



Fig. (16): Free radial forearm phalloplasty after insertion of the prosthesis using the polypropylene mesh and sutures technique.

DISCUSSION

The surgical construction of a penis is one of the most difficult surgical procedures in the reconstruction of the genital tract. It is indicated in men where the penis is missing for congenital or acquired reasons, or in women with gender dysphoria (but not in our community).

Once phalloplasty has been performed it is necessary to guarantee penile rigidity if the patient requires it [8]. Different techniques have been used to obtain this rigidity, but often they resulted in complications and failure [4].

Autologous cartilage and bone transplants tend to resorb, curve or fracture. Implants have a tendency to erode and extrude [9], due to the absence of the tough tunica albuginea, which constitutes a protective envelope for the prosthesis, anchoring it to the pubic bone and minimizing the risk of migration during mechanical friction of sexual intercourse [1]. Covering the implant with a prosthetic graft may help prevent this [8]. However, reports in the literature are poor, with only few studies and small number of patients published.

Gerald et al used 14mm vascular stretch polytetrafluoroethylene for corporeal reconstruction in 8 patients. The distal end was closed to enclose the rod/cylinder while the proximal seating of the implant and the proximal polytetrafluoroethylene sleeve was designed depending on the anatomy of the patient. In the genetic male patient with corporeal remnants the proximal corpora were used as the base for the stiffeners and a circular cuff of polytetrafluoroethylene at the proximal neotunica was sutured to the residual tunica albuginea. In the transsexual or patients without corporeal remnants the proximal polytetrafluoroethylene tunica was closed and the base of the sleeve was attached to the bone and periosteum of the ischium with polytetrafluoroethylene sutures to create firm anchor or base for the rod or cylinder. In 4 of these patients infection necessitated removal of the prosthesis [10].

Laurence et al used successfully in 4 patients 12mm polytetrafluoroethylene arterial graft. The sleeve was trimmed in a manner providing a sock into which the prosthetic cylinder was inserted and then secured to the pubic symphysis with braided polyester [11].

Polytetrafluoroethylene (PTFE) is a synthetic fluoropolymer of tetrafluoroethylene. It has one of the lowest coefficients of friction against any

solid, therefore it is used for applications where sliding action of parts is needed and commonly used as a graft material in surgical interventions. It does not incorporate into human tissues and becomes encapsulated and it is micro porous, which allows bacteria passage but prevents macrophage passage; therefore the body cannot clear the infection and an infected PTFE mesh must be explanted [12].

Hage recommended coverage by Dacron prosthesis to ensure optimal encapsulation and collagen ingrowth, he advocated the fixation of the cylinder to the pubic symphysis using two Mersilene 1 sutures passing through the redundant proximal Dacron sock [9]. Bettocchi et al., implanted malleable and inflatable prostheses in 17 patients who had undergone phalloplasty in female to male transsexualism using Dacron graft. Six prostheses were removed secondary to erosion [13]. Hoebcke et al., reported the largest series of 129 patients using hydraulic erectile prosthesis. He also covered the penile prosthesis by a Dacron vascular graft which was fixed to the pubic bone. Fifty-three patients (41.1%) needed to undergo either removal or revision of the prosthesis due to infection, erosion, dysfunction, or leak [7].

Dacron is a trademark for a polyester fiber. It is a condensation polymer obtained from ethylene glycol and terephthalic acid. Its properties include high tensile strength, high resistance to stretching, both wet and dry, and good resistance to degradation by chemicals and abrasions. In 1952, Dr. DeBakey made the first Dacron tube graft for aortic reconstruction. Currently, Dacron is used most commonly for aortic replacement and large-diameter lower-extremity bypass surgery [14].

In this study we started by the plate and screws technique to obtain good fixation with high mechanical stability during sexual intercourse and to prevent migration and erosion. The first prosthesis was infected and necessitated removal within two weeks. In the following three cases, the neophallus took a downward direction that was unsatisfactory during sexual intercourse, then the plate was broken within six months in one case due to excessive repeated pressure, while the metallic core of the implant was broken within one year in remaining two cases. This was explained by the extreme flexion and pressure against the hard edge of the plate that exceeded the resistance of the metallic core of the implant. Accordingly we abandoned this technique.

The polypropylene mesh was used to mimic the natural tough tunica albuginea of the normal penis. It's a very strong material that induces extensive tissue ingrowth and fibrosis. permanent polypropylene sutures between the mesh and the pubic bone helped to fix the implant and prevent its protrusion or malposition.

Among 14 cases using polypropylene mesh and sutures technique and along the follow-up period ranging from one to nine years with a mean of three years, no reported cases of infection and only one case showed tip necrosis and extrusion of the prosthesis after two months. This was a redo case after failure of plate and screws technique and the main reason in our opinion was the over lengthened prosthesis that encroached over the distal end of groin flap leaving less than 1cm of soft tissues.

Infection rate in ordinary cases of penile prosthesis can reach 3% while in phalloplasty cases the percentage is ten times higher [15,16]. Polypropylene mesh is a hydrophobic polymer of carbon atoms with alternating methyl moieties. This material is flexible, readily integrated by surrounding tissues and resists infection. The monofilament nature provides large pores facilitating fibrovascular ingrowth, infection resistance and improved compliance [17,18].

Conclusion:

Adequate fixation of penile prosthesis in phalloplasty is an essential step to provide support and better performance. We believe that polypropylene mesh and sutures resist infection and are very strong materials that are able to induce extensive fibrosis leading to prosthetic movement restriction. Fashioning a polypropylene mesh over the prosthesis with its fixation by polypropylene sutures to the periosteum of the pubic bone should be considered as one of the best options for fixation of prosthesis in phalloplasty.

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