

Penile Replantation, Science or Myth? A Systematic Review

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Introduction: Penile amputation is a rare urologic condition for which immediate surgical replantation is warranted. The surgical technique used for repair has been modified and refined. Our aim was to assess the effects of several interventions and management for amputated penis after replantation.

Materials and Methods: We searched the MEDLINE (January 1966 to May 2007), EMBASE (January 1988 to January 2007), CINAHL (January 1982 to January 2007), PsycLIT (January 1984 to January 2007), ERIC (January 1984 to January 2007), and the bibliographic data of relevant articles; hand-searched conference proceedings; and contacted investigators to locate studies. All reported cases of penile replantation were studied. We assessed all titles, abstracts, and extracted data from the articles identified for inclusion. Outcome measures included cosmetic outcomes, acceptability, operative time, restoration of erectile function, sensibility of the glans, and long-term outcomes.

Results: Eighty patients had undergone penile replantation. There was considerable variation in the interventions, patients, and outcome measures. The majority of the reported cases in this area continue to be of moderate quality, although more recent cases have been of higher quality in terms of both patients' demographics and surgical techniques. Data were not available in all of the cases for many of the outcomes expected to be reported. There were several important variations in the cases studied.

Conclusion: The value of the various microsurgical techniques for replantation of the penis remains uncertain. Meticulous microsurgical techniques by experienced surgeons can reduce skin, urethra, and graft loss complications and produce a functional organ; nonetheless, such complications are still highly prevalent.

Keywords: amputation, penile replantation, microvascular surgery, penis

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INTRODUCTION

Penile amputation is a rare condition. It has been reported in both adult and pediatric groups,^(1,2) but the majority are in adult patients. They can occur as a result of self-mutilation of psychiatric patients, accidents, circumcision, and workplace injury,^(3,4) or can be caused by other people's actions such as violence, envy, and crime. Self-mutilations of the external genitals are also known as *Klingsor syndrome*.⁽⁵⁾ Stepwise complete self-

emasculatation and self-castration has also been reported.⁽⁶⁾ At least 4 patients with self-amputation have been reported who died of hemorrhage.⁽⁷⁾

Penile replantation was first described in the medical literature in 1929.⁽⁸⁾ In the last decade, numerous successful operative techniques have been described for penile replantation with microsurgical methods. The current standard of care for this rare entity is replantation with approximation

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of the urethra, corporal bodies, and microsurgical dorsal vein anastomosis. In 1977, the first successful replantation of an amputated penis using microsurgical techniques was reported.⁽⁹⁾ Due to the rarity of penile amputation, the number of reports dealing with this procedure and the postoperative patient care is limited. Evaluation of the relative effectiveness, safety, restoration of functional penis, and sensibility of the glans of different methods for penile replantation is crucial for surgeons who make decision.

A review of the published data and future methods of increasing success of microsurgical procedures is provided. Additionally, a systematic approach to dealing with this devastating injury is presented. The studied outcome measures were return of penile sensation, acceptable sexual function, and normal urination.

MATERIALS AND METHODS

A comprehensive search and review protocol was designed and processed all by the authors.

Sources

All reports that have described penile replantation were obtained. The MEDLINE (January 1966 to May 2007), EMBASE (January 1988 to January 2007), CINAHL (January 1982 to January 2007), PsycLIT (January 1984 to January 2007), and ERIC (January 1984 to January 2007), were searched. The following keywords were used for the search as text words or subject headings without language restriction using OVID software: amputation, autoamputation, penile replantation, microvascular surgery, and penis. In addition, hand searching of the bibliographies and citation lists of all relevant reviews and primary studies was performed to identify articles not captured by electronic searches as well as the proceedings of the urological associations in the past 2 decades.

Study Selection

All case reports and articles were selected. The authors selected the articles for inclusion after using the search strategy described previously.

Description of Studies

After evaluation of the abstracts, we excluded articles

that were clearly not on penile replantation or had not focused on interventions or outcome measures considered in this review. Ultimately, we retrieved copies of 46 potentially relevant reports.

Data Abstraction and Quality Assessment

All assessments and data extraction were performed independently by the 2 authors of the review. Data on characteristics of the study participants including age, medical illnesses, type of injury, time since amputation, measures to preserve the amputated organ, type of surgical interventions, follow-up period, and methods used to measure success and adverse events were extracted. When possible, we described the method used by the investigators to assess objective outcomes.

Preoperative Adjunctive Measures

For organ preserving and preparing the amputated part of the penis, various preoperative adjunctive measures have been used.⁽¹⁰⁻¹³⁾ These measures are as follows: (1) thoroughly washing the amputated penis with 0.9% saline and placing it in a pressurized hypothermic container at 4°C; (2) wrapping the amputated penis in moist gauze inside a plastic bag sealed within a second plastic bag containing iced slush; (3) placing the amputation part of penis in an ice container; (4) sterilization of the amputated penis and preparing it for anastomosis with 1% chlorhexidine solution, and immersing it in a 1% sodium heparin-saline solution; and (5) irrigation of the amputated penis with normal saline and antibiotics.

Postoperative Adjunctive Measures

For protection of anastomoses sites and the phallus, and for preserving the amputated part of the penis, various wound care methods have been used postoperatively,⁽¹⁰⁻¹³⁾ including (1) administration of broad-spectrum antibiotics and heparin or low-molecular-weight heparin; (2) treatment with hyperbaric oxygen; and (3) immobilization and protection of the penis by bulky dressing, frames, cages, removal of the penile skin with subsequent burying of the penis in the scrotum, and a subcutaneous tunnel created in the suprapubic area.

Surgical Methods

Before replantation, a suprapubic cystostomy

was being performed, routinely. Debridement of nonviable tissue was being done to allow clear identification of the veins, nerves, and arteries. In all of the cases, end-to-end anastomosis of the urethra and corpus spongiosum was also done using interrupted synthetic absorbable suture. Then, reapproximation of the tunica albuginea of the corpora cavernosa was being performed. As a last step, the Buck's and Colles' fasciae were being reapproximated, and the skin was being closed.

In dealing with arteries, veins, and nerves, one of the following methods were being employed: (1) realignment of the penile structures (urethra, corpus spongiosum, and corpus cavernosum) without anatomizing the blood vessels or nerves; (2) microsurgical end-to-end anastomosis of the dorsal penile artery; (3) creating a spongioavernosal shunt distally to provide venous drainage, in patients whose dorsal vein was severely injured, thus preventing primary reanastomosis with a microsurgical technique; (4) anastomosing 2 dorsal veins using nylon nonabsorbable sutures; (5) microvascular anastomosis of the deep dorsal vein and 1 artery; (6) microvascular anastomosis of the deep dorsal vein and the dorsal arteries; (7) anastomosing 2 dorsal veins, the dorsal artery, and 1 dorsal nerve using microsurgical technique; and (8) anastomosing 2 dorsal veins, the dorsal artery, and 2 dorsal nerves using microsurgical technique.

Heretofore, microsurgical anastomosis of the dorsal veins, dorsal artery, and dorsal nerve has been accomplished in about 27 cases.

RESULTS

Fifty cases of replantation using nonmicrosurgical technique, and at least 30 cases of replantation by microsurgical technique were reported. Varying degrees of reanastomosis of the dorsal vein, arteries, and nerves have been reported using microsurgical technique. Even after microsurgical replantation, spontaneous erections and the ability to intromit during sexual intercourse with full sensation in the glans are very rare. Of amputations that were microsurgically replanted, at least 27 cases were successful. Replantation of the penis without microsurgery techniques was associated with a high rate of fistula formation, urethral stenosis, skin necrosis, loss of sensation, and erectile dysfunction.

Venous outflow was a critical factor for the success of replantation. By reviewing and compiling case reports of microsurgical replantation, we concluded that microsurgical reanastomosing of the dorsal penile vein, penile arteries, and dorsal nerves can be identified as the "standard" method for penile replantation.

Microsurgical repair was associated with greater graft survival, decreased amount of skin loss, better erectile function, and better cosmetic results. Various patient variables play an important role in the success of replantation.

DISCUSSION

The first documented case of penile replantation was reported in 1929 by Ehrlich⁽⁸⁾ who realigned the penile structures without anatomizing the blood vessels or nerves. The first microvascular replantation was reported by Cohen and colleagues in 1977.⁽⁹⁾ Because of the paucity of penile amputation, management of this entity has evolved on the basis of only a few case reports and small series. Many factors contribute to positive final results: the degree of injury, type of injury (crushed, lacerated, or incised), duration of warm ischemia, the equipment used, and experience of the operative team.^(14,15) Graft survival without microvascular anastomosis depends on corporal sinusoidal blood flow. In this instance, glans and distal penile amputations are created as composite grafts by anastomosing the urethra and the corpora. Nonmicrovascular anastomosis has been associated with multiple complications such as fistula formation, skin necrosis, urethral stricture, absent sensation, and erectile dysfunction. In a series from Thailand, 14 of 18 replantations were done with a nonmicrosurgical technique. Skin loss was reported in 12 of 14 and graft loss in 6 of 14 patients.⁽¹⁶⁾ Treatment of penile amputation has been greatly improved by microvascular techniques. Early restoration of blood flow provides the best prospect for graft survival and normal erectile functional. The literature shows at least 27 cases of penile autoamputation with successful microsurgical replantation since 1970.

Penile amputation is seen most frequently in psychotic individuals with an acutely decompensated schizophrenia. In the early postoperative course, the risk of self-mutilation of the replanted penis is high. Harris and coworkers recommended the use

of a subcutaneous tunnel created in the suprapubic area to protect the penis from re-injury.⁽¹⁷⁾ All nonviable tissues must be debrided to allow clear identification of the veins, arteries, and nerves. At the completion of replantation, revascularization must be checked. Color of the distal penis is a good predictor of revascularization. Gradual increase in redness and size of the distal penis demonstrates good blood supply. Presence of the arterial pulse and appearance of superficial penile veins are other signs of revascularization. Doppler ultrasonography is a good modality for monitoring of vascularity. Venous outflow is a critical factor for the success of replantation. In cases that restoration of venous drainage is impossible, Leech therapy can be successful.^(11,12) Leech therapy is a well documented means of relieving venous congestion in both plastic and reconstructive surgery literature.⁽¹⁸⁻²⁰⁾ The current concept is that microsurgical reapproximation of the penile shaft structures provides the optimal benefit owing to having the fewest complications.

CONCLUSION

For penile amputation, microvascular replantation is the treatment of choice. Microsurgical anastomoses of the vessels and nerves provide preservation of sensation, physiologic micturition, and normal erectile function.

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CONFLICT OF INTEREST

None declared.

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