Facing challenges in penile prosthesis implantation
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Chapter 1

Introduction And Outline Of The Thesis
Introduction

Classically, impotence was used to describe the persistent failure to develop and maintain erections of sufficient rigidity for penetrative sexual intercourse. To date, the general terminology used to describe this condition has been moving away from the highly emotive term impotence towards a more widely descriptive term ED (ED).

ED is a worldwide problem with considerable amplitude. A few large scale studies addressing the epidemiology of ED include the Massachusetts Male Aging Study (MMAS) and the National Health and Social Life Survey (NHSLS). MMAS, conducted from 1987 to 1989 in areas around Boston, was a cross-sectional random sample community-based survey of 1290 men in the age range of 40 to 70 years and reported an overall prevalence of 52% for various grades of ED. The NHSLS study surveyed 1410 men in the age range of 18 to 59 years, and reported a prevalence of 43%.

ED often is a multifactorial disorder, with medical, psychosocial, and sexological components described. The most important medical risk factor is the metabolic syndrome – describing a cluster of cardiovascular risk factors including diabetes, hypertension visceral obesity, dyslipidaemia. Recently, the metabolic syndrome has been associated with hypogonadism. Psychosocial factors include depressed mood, developmental factors such as childhood sexual trauma and widowers ED. Sexological factors include performance anxiety and interpersonal distress. Many treatment options are available for cases of ED, ranging from phosphodiesterase type 5 inhibitors (PDE5-i), intracorporal injection of vasoactive agents, vacuum therapy and surgery. Surgery is usually reserved for patients with ED refractory to medical treatment. The mainstay of surgical treatment is implantation of a penile prosthesis. The concept of implanting a penile prosthesis for management of ED is based on a natural anatomical component found in several species (e.g. dogs), the os penis or baculum, which supports and maintains the penis in erection. Accordingly, a rigidity conferring device is implanted in the corpora cavernosa. Insertion of a penile prosthesis has proven to be a satisfactory and effective treatment alternative.
The first detailed implantation attempt to correct ED was done in 1936 by Bogoras, who reconstructed an amputated penis, with an abdominal tube pedicle graft fortified by rib cartilage (cited in 7). The first artificial penile implants were made of acrylic, and placed beneath Buck's fascia, outside the corpora cavernosa 8. Beheri first documented success with intracavernosal placement of polyethylene rods in 700 patients 9. Ever since, the craft of penile prosthesis implantation has evolved. Several types of penile implants are currently in use. An ideal penile prosthesis should create a normal-looking erect and flaccid penis. The nearest to this ideal is the inflatable penile prosthesis (IPP), which was developed to mimic the natural hemodynamic event of the erection. Hydraulic prostheses are composed of two inflatable cylinders, a reservoir, and a pump. When an erection is desired, the pump is activated and fluid (saline) is transferred from the reservoir into the cylinders. By activating the deflation valve, detumescence is induced. Current IPPs come in one - two- or three-piece configurations 6. As an alternative for the IPP, mechanical, malleable, and soft semi-rigid penile implants play a significant role in the management of ED. Ease of insertion, low malfunction rate, low cost, and simplicity of the operation has made them a popular choice in many circumstances.

Satisfaction rates in the range of 70–80 % are consistently higher than those of other less invasive treatments. Rajpurkar and Dhabuwala demonstrated that penile implant surgery was associated with high satisfaction rates and erectile function among sildenafil non-responders compared to other modalities of treatment including oral and intracavernosal injection therapy 10. Carson reported a long-term multicentre study of the 700CX three-piece inflatable prosthesis, focusing on patient satisfaction with a median follow-up of almost 48 months; 79% of the patients with a device were using it at least twice monthly and 88% would recommend an implant to a friend 11. This is a rather high satisfaction rate considering that the study sample consisted of the difficult to treat Peyronie’s disease population. Psychosexual questionnaires used following implant surgery revealed that patients perceive an improvement of erection ability and sexual desire and less performance anxiety 12. The predictable and reliable results which these devices afford add to the patient’s confidence in his ability to perform sexually. His overall outlook on life, productivity, and body image are consequently enhanced 13.
Over several decades of penile prosthesis implantation surgery, implantation has become a straightforward widely applied procedure. Nevertheless, challenging cases remain; procedures may be complicated and the results may be disappointing. Amongst the challenging conditions are penile fibrosis and Peyronie’s disease the most challenging. Amongst the complications infection and distal perforation of the prosthesis are the most common. Loss of penile length and girth following implantation are the most frequent causes for disappointment.

In case of penile fibrosis and Peyronie’s disease the cavernous tissue is replaced by fibrous tissue causing penile shortening. Creating a space for implanting the cylinders inside the corpora cavernosa may be extremely difficult, involving blunt and sharp dilatation in the blind, with the risk of perforating the corpus spongiosum and creating a caverno-urethral fistula. Moreover, the corpora cavernosal may be perforated at the glans penis or in the crura. Several solutions have been developed to facilitate the excavation of the fibrous tissue and to simultaneously avoid perforation including full length corporotomies. However, the down-side of extended corporotomies is risk due to more tissue damage and longer operation time.

Males afflicted by medical therapy resistant ED together with Peyronie’s disease suffer from penile shortening and deformities, both issues that need to be addressed upon implantation. Methods available for correcting the deformity include 1) manual remodeling with the prosthesis in place that will reverse milder degrees of curvature but will not increase penile length, and 2) tunical incision with or without patch grafting. The latter will straighten the penis and - if performed prior to implantation – will restore length, but involves extended operative time and exposure.

Patients suffering from a lack of genital sensation which may be the case in diabetic neuropathy, or spinal cord injuries, or multiple sclerosis, are at risk of perforation of the implant through the glans, necessitating removal and re-implantation. Often re-perforation occurs. Several methods are available to avoid reperforation, including the re-routing procedure and the windsock technique. Rerouting involves seating the cylinder in a more medial and secure position under the glans penis by creating a new
cavity for the cylinder behind the back wall of the fibrotic sheath containing it. The windsock technique involves fashioning a Gortex mesh into a windsock that fits the extruded cylinder. Long sleeves are secured to the tunica albuginea proximally, in a trial to avoid recurrence of extrusion. Both techniques provide in securing the implant in place but do not provide in re-inforcement of the tip of the corpus cavernosum.

Finally, implantation is known to result in decreased penile length, and to a lesser extent; penile girth, with subsequent dissatisfaction. Among the methods proposed for increasing satisfaction are the incision the suspensory ligament \(^20\). Nevertheless, compromised length due to an excess of prepubic subcutaneous fat, loss of complementary erection and the cold glans syndrome remain unaddressed.
Outline Of The Thesis

In this thesis we investigated the utility of new surgical techniques with the aim to find easy solutions for the above mentioned problems. Firstly, in “Shaeer’s penoscopy” cavernous fibrous tissue is resected under endoscopic or ultrasonographic control or a combination of both (modified Shaeer’s technique)\(^1\),\(^2\),\(^3\),\(^4\). Furthermore, in Peyronie’s disease, penile shortening and deformity was corrected by penoscopic incision and resection of the plaques (trans-corporal incision (TCI))\(^5\). Furthermore, in case of distal corporeal perforation, the tip of the corpora are repaired endoscopically with a graft or double breasting\(^6\). Finally, a technique is described to augment penile length and girth following implantation: so called penile supersizing technique\(^7\).

Penile Fibrosis

Fibrosis of the corpora cavernosa may result from ischemic priapism, extensive Peyronie’s disease, repeated intra-corporal injection, irradiation, vascular insufficiency or from delayed re-implantation following extraction of an infected prosthesis. Implantation of a penile prosthesis into corpora cavernosa that have been affected by fibrosis is a difficult and risky procedure, often with a less than satisfactory outcome. The most difficult task for the implanter is to dilate the corpora cavernosa, while keeping the integrity of the tunica albuginea intact and protecting the urethra from injury. Considering that dilatation involves the use of blunt force against resistance in a blind fashion urethral injury, anterior and posterior perforation may be the result\(^8\). We therefore developed an alternative approach to facilitate safer and more successful dilatation: sharp resection under direct vision.

Visually monitored sharp resection of fibrous tissue has evolved through three stages: Initially, optical corporotomy and trans-corporal resection using the transurethral resection / transurethral incision unit\(^2\),\(^3\). This enabled the safe use of sharp cutting and diathermy resection to excavate fibrous tissue while monitoring incision and resection optically from within the corpora cavernosa (“Penoscopy”)\(^3\) (Chapters 2 and 3).
Next, intraoperative ultrasonography was used to guide safe resection of fibrous tissue by sharp instruments\(^\text{24}\) (Chapter 4). Finally, both techniques were combined. Ultrasonography was employed to insert a guidewire into the corpora cavernosa for the peniscope to follow. Then, ultrasound monitoring was used upon approaching the proximal and distal tips of the corpora cavernosa to avoid puncturing them\(^\text{21}\) (Chapter 5).

**Peyronie’s Disease**

Considering that deformity correction has a negative impact on erectile function,\(^\text{16, 29}\) patients with Peyronie’s disease (PD) and concomitant ED, should be considered candidates for implantation of a penile prosthesis rather than deformity correction alone\(^\text{29}\). These patients can achieve simultaneous correction of deformity and restoration of erectile function through the placement of a penile prosthesis followed by manual modeling\(^\text{16, 17}\) and/or, a tunical incision with or without patch grafting\(^\text{16}\).

Unfortunately, modeling will not always correct penile shortening notorious for PD. For example, in case of asymmetric shortening (i.e. in lateral curvatures) the length of both corpora may differ by 1-2 cm, dictating the use of a shorter prosthesis to maintain equality of both cylinders\(^\text{30}\). In addition, modelling on its own may not be sufficient for full correction of deformity. It may sometimes be necessary to perform a plaque incision and grafting procedure after the prosthesis has been implanted\(^\text{16}\), adding to operative time and infection-risk. Incision and grafting may require mobilization of the neurovascular bundle with consequent sensory deficit, or a secondary incision for dorsal access.

**Chapter 6** reports on Trans-Corporal Incision (TCI), a minimally invasive endoscopic approach for plaque incision from within the corpora cavernosa, restoring straightness and length to the penis, before calibration of the corpora cavernosa, allowing implantation of a longer prosthesis in a straight penis, with neither mobilizing the neurovascular bundle nor a secondary incision. Through a penoscrotal incision, the corpora are dilated, and TCI is performed to incise Peyronie’s plaques at the point of maximum deformity under optical monitoring by the fore mentioned “Penoscopy”. Artificial erection is re-induced and correction of curvature evaluated. Implantation then proceeded as usual after having
straightened the penis, and the length of the prosthesis is chosen according to the longer corrected length\textsuperscript{25}.

**Distal Perforation**

Distal erosion and perforation of penile prosthesis through the glans penis or urethra have been reported in association with spinal cord injuries, diabetes mellitus and following irradiation for prostatic cancer. Once perforation occurs, re-implantation carries a higher risk of re-perforation unless adequate preventive measures are taken. In some cases, re-perforation necessitates several revisions\textsuperscript{31}. **Chapter 7** describes a technique to expose and repair the point of perforation to restore distal support.

**Supersizing Following Penile Prosthesis Implantation**

It is common for penile length to be compromised following penile prosthesis implantation. Girth is also compromised though to a lesser extent, due to loss of complementary erection\textsuperscript{32}. This is more pronounced in semirigid in comparison to inflatable implants, and in cases with fibrosis such as Peyronie’s disease.\textsuperscript{33} **Chapter 8** describes a technique to enhance penile size following implantation.\textsuperscript{27}. 
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References


