

SHORT THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PhD)

**Reconstruction of deformities resulting from benign and
malignant lesions of the penile skin**

by Mihály Murányi, MD

Supervisor: Tibor Flaskó, MD, PhD, habil.



UNIVERSITY OF DEBRECEN
DOCTORAL SCHOOL OF MEDICAL SCIENCES

DEBRECEN, 2026

Reconstruction of deformities resulting from benign and malignant lesions of the penile skin

By Mihály Murányi, MD

Supervisor: Tibor Flaskó, MD, PhD, habil

Doctoral School of Medical Sciences, University of Debrecen

Head of the Defense Committee:	Árpád Illés, MD, PhD, DSc
Reviewers:	Gergely Bánfi, MD, PhD
	István Előd Király, MD, PhD
Members of the Defense Committee:	Péter József Molnár, MD, PhD
	Lóránt Székvölgyi, PhD, DSc

The PhD Defense takes place at the Lecture Hall of Bldg. A, Department of Internal Medicine, Faculty of Medicine, University of Debrecen at 1 p.m., on 16 of June 2026.

1. Introduction

The penis occupies a central role in the lives of men, due to its physiological function and its role in gender identity. From the perspective of maintaining the body's normal functioning, the most significant function of the penis is urination. However, in addition to its role in urination, the penis also performs an additional function. This is the ability to urinate while standing, which is a defining part of male identity. Another physiological function of the penis is sexual function. The significance of this is well demonstrated by the fact that sexuality is located at the bottom of Maslow's pyramid, which organizes the hierarchy of human needs, that is to say it is a fundamental, indispensable part of physical comfort. The third physiological function of the penis is fertility. The penis is the organ that most determines a man's sexual identity, and its appearance and function are closely related to the experience of self-identity and masculinity. From a psychosocial perspective, the penis can be regarded as a symbolic manifestation of male sexual competence, self-esteem, and social effectiveness. Within a broader socio-cultural context, the phallus has become a symbol of masculinity, power, and sexual potential.

Diseases that result in penile deformity can have a significant impact on patients' urinary and sexual function, fertility, and sense of masculinity. It is important to note that there are a number of diseases that can affect the skin of the penis, with the result that deformity may occur. The most prevalent form of malignant neoplasm is squamous cell carcinoma, which originates in the skin of the penis. Benign lesions include sclerosing lipogranuloma, which is caused by the introduction of fatty material under the skin of the penis; genital lymphoedema; hydradenitis suppurativa, which affects the skin of the genitals; hidden penis; Fournier's gangrene; and other conditions that cause penile skin deficiency (burns, trauma). In the thesis, a detailed analysis is provided of two topics related to penile skin reconstruction. First, we present the possibilities for reconstructing penile deformities caused by sclerosing lipogranuloma and then by penile cancer.

2. Literature review

2.1 Sclerosing lipogranuloma

Sclerosing lipogranuloma of the penis is not a naturally occurring condition. The development of this condition is attributed to the injection of fatty substances, most commonly paraffin, under the skin of the penis. The objective of subcutaneous injection of paraffin is to induce penile thickening.

Robert Gersuny was the first to report on the injection of paraffin, a fatty substance, into the genitals in 1900. Paraffin was injected into the scrotum of a male patient who had undergone a bilateral orchiectomy to replace his testicles. Subsequently, the procedure was also tried in the context of breast replacement and the treatment of facial deformities. However, subsequent to the initial favourable outcomes, it became evident that the injection of paraffin under the penile skin had serious consequences. The skin of the penis undergoes oedema, accompanied by the development of dense, painful lumps and sclerosing lipogranuloma beneath the skin. It is not uncommon for the skin of the penis to exhibit yellow discolouration, however, this can result in ulceration or even necrosis. It is important to note that significant sexual dysfunction, including the complete inability to engage in sexual intercourse, may develop. The latter also impairs the fertility of the affected men. This is an important consideration, as these patients are young, with an average age of 30-35 years.

Due to these serious complications, the subcutaneous injection of fatty substances under the skin of the penis has been completely eliminated from medical practice. Nevertheless, the procedure continues to be utilised extensively in non-medical contexts. The patient or a partner with greater experience in the procedure is responsible for administering the heated, and therefore liquefied, paraffin into the penis in the form of a subcutaneous injection. Complications arising from sclerosing lipogranuloma have been known to occur even in the context of injections performed under conditions of complete sterility. However, it is non-medical settings, often characterised by the use of contaminated instruments, that are a primary source of further complications. This method of penis thickening is prevalent in Central and Eastern Europe, as well as in certain Southeast Asian countries. We do not have accurate epidemiological data, but

based on scientific publications on sclerosing lipogranuloma, we can see that the highest number of cases reported worldwide so far have been from Korea, Bulgaria, and Hungary.

Injecting paraffin into the skin of the penis is considered self-mutilation in Hungary and is illegal. Consequently, a considerable proportion of patients do not seek medical attention even when symptoms manifest. It is therefore difficult to estimate the exact number of patients and the rate and severity of complications. In Hungary, the procedure is mostly popular among people with low socioeconomic status and prisoners.

An important characteristic of the substance injected into the subcutaneous tissue is that it is fatty. This is of significance as the human body is incapable of breaking down or eliminating fat that has been injected into the tissue. The substance remains at the injection site, which is consistent with the patient's expectation of achieving permanent thickening of the penis. Nevertheless, despite the immune system's inability to break down the foreign substance injected, it does respond to it. This process leads to a foreign body reaction accompanied by chronic granuloma formation. The ultimate outcome of this process is the development of palpable lumps under the skin.

The treatment of penile sclerosing lipogranuloma is surgical. Previous attempts at conservative treatment have been unsuccessful and unable to effectively resolve the problem. The tissue affected by granulomatous inflammation must be excised. It is insufficient to solely excise the subcutaneous nodules, as this would result in the interruption of the blood supply to the overlying skin, leading to its subsequent necrosis. Consequently, it is imperative to remove the skin from the affected area of the penis. The removal of the damaged tissue is followed by reconstruction of the area where skin is missing. The reconstruction of the penile skin can be achieved through the utilisation of the remaining skin from the penis itself, skin flaps, or skin grafts.

Following the excision of the lipogranuloma nodule, primary closure of the penile skin is a viable option in cases where the penile skin is only partially affected. Utilisation of flaps or grafts are indicated if the entire length of the penile skin is deformed.

After removal of sclerosing lipogranuloma, the most prevalent technique employed for the coverage of the denuded penis is the utilisation of a local skin flap derived from the scrotum. There are several surgical techniques that use scrotal skin flaps. In Hungary,

one of the most common techniques for treating penile paraffinoma is the Cecil type two-stage scrotalization procedure (Cecil procedure). This surgical technique was introduced and popularized in Hungary by Professor Zsolt Kelemen, MD and his colleagues. During the first session of the procedure, the tissues affected by sclerosing lipogranuloma are excised, and subsequently, the denuded penis is implanted into a channel that has been formed under the anterior scrotal skin. The second session of the surgery, the release of the penis, takes place 3-6 months later. During this procedure, the penis is separated from the scrotum in such a way that the skin of the ventral surface of the scrotum covers the penis. This procedure has been performed at our clinic on a regular basis in the past. Based on our own experience and patient feedback, we encountered the following problems: A considerable proportion of patients, nearly half, did not return for the second session. We do not know the exact reason for this, but in their cases, the reconstruction of the penile skin was interrupted. The issue of the penis being in an abnormal position between two surgical procedures is a serious problem for patients. A penis implanted in the scrotum is not only aesthetically disadvantageous, but also hinders sexual intercourse. For this reason, many people reject the surgery and want a one-session solution that provides a permanent solution. A further disadvantage of the two-stage surgery is that, due to its nature, it necessitates two separate surgical procedures. This results in a twofold increase in the surgical risk for the patient. The two surgeries are also disadvantageous for the healthcare system, as the patient requires admission to the hospital and the use of the operating room twice.

There are several single session surgical techniques that use scrotal skin flaps. In the procedure known as bilateral anterior scrotal skin flap (bilateral flap), two skin flaps are formed from the anterior surface of both scrotal halves. The medial edges of the flaps are closed on the dorsal surface of the penis, while the lateral edges are closed on the ventral surface of the penis in the midline. The distal edges of the flaps are attached to the subcoronal skin edge of the penis.

In the surgical procedure known as the bipedicle anterior scrotal skin flap (bipedicle flap), a rectangular bipedicle skin flap is formed from the anterior surface of the scrotum. The two pedicles of the flap fall over the part of the scrotum above the spermatic cord. The skin of the two halves of the flap remains connected along the raphe scroti. The denuded

penis is covered with a flap of the same width as circumference of the penis, and then the lateral edges of the flaps are closed along the ventral side of the penis.

When using the modified bilateral skin flap (Shin flap), a longitudinal median incision is made on the anterior surface of the scrotum, starting from the cranial part of the circular scrotal skin edge formed at the base of the penis, thus forming the medial edges of the bilateral scrotal skin flaps. The proximal part of the medial edges of the flaps is closed in the midline on the dorsal side of the penis, and the distal part is anastomosed to the subcoronal skin edge. Subsequently, an inverted V-shaped incision is made on the ventral side of the penis, 1 cm proximal to the subcoronal anastomosis. The skin edges of the inverted V-shaped incision are closed in an inverted Y shape.

Damaged penile skin can also be reconstructed with grafts. Full-thickness or partial-thickness skin grafting is indicated when there is insufficient quantity or quality of scrotal skin available for penile skin reconstruction. The optimal donor site for partial-thickness skin grafting is the anterior surface of the thigh. The harvesting of the graft can be accomplished using either a Humby knife or pneumatic dermatome. The harvested graft is then placed over the penis and secured with absorbable sutures.

2.2 Penile cancer

Penile cancer is a malignant tumor affecting older men, typically those over the age of 50, and most commonly those over the age of 60. In 95% of cases, the tumour is squamous cell carcinoma, most often originating in the foreskin or glans penis. The incidence of the condition varies significantly between different geographic regions. It is a rare disease in the Western world, but is significantly more common in South Africa, Southeast Asia, and South America. In 2020, the age-adjusted incidence of penile cancer worldwide was 0.8/100,000 men. The same figure is 0.94 in Europe, 0.5 in the USA, and 0.86 in Hungary per 100,000 people. Almost half of penile cancer cases are associated with human papillomavirus (HPV) infection, so penile cancer is more common in areas where HPV prevalence is higher. Circumcision in infancy has a protective effect against invasive penile cancer. Therefore, in countries where boys are circumcised at birth, the incidence of penile cancer is lower. There is no evidence that circumcision performed after puberty has a similar protective effect.

The standard treatment for primary penile cancer is surgical intervention. The primary objective of surgical intervention is the complete extirpation of the tumour. Radical surgery and organ-preserving surgery are the two main types of surgery. Radical surgery is indicated for cases of locally advanced tumours, when the tumour has spread to the cavernous bodies (pT3) or surrounding tissues (pT4). In these surgeries, we traditionally aim for a wide, 2 cm surgical margin. A wide tumor-free surgical margin ensures a low local recurrence rate. However, these surgical procedures are known to result in significant mutilation and substantial impairment of the penile function. Radical surgeries include radical penectomy and penile amputation. During radical penectomy, the entire penis is removed along with the crus penis. Urine drainage is achieved by creating a perineal urethrostomy. During penile amputation, the distal part of the penis is removed, proceeding proximally from the tumor in intact tissue. Following spatulation, the urethra is sutured to the penile skin at the top of the remaining penile stump. After penile amputation, the penis is significantly shortened, but the ability to achieve erection and urinate while standing is usually preserved. In the event of a substantial decrease in penile size during the procedure, making it impossible to urinate while standing, the creation of a perineal urethrostomy is recommended. This facilitates the hygienic micturition of the patient.

Radical penile surgery, with a 2 cm tumour-free surgical margin, has the potential to result in significant loss of function and a substantial deterioration in quality of life. This has led to a heightened emphasis on the demand for organ-preserving interventions among patients. This demand is reflected in the efforts of the urology profession. The European Association of Urology (EAU) guidelines on penile cancer, which are also accepted and applied in Hungary, have for years recommended the principle that in cases of primary penile cancer, complete removal of the tumour must be ensured, while at the same time striving to preserve as much of the penis as possible. All this must be done in a way that is oncologically safe.

The most important argument against organ-preserving treatment of the penis is that the local recurrence rate is significantly higher after such interventions than after radical surgery. This is true, but several studies have shown that there is no difference between the two types of surgery in terms of overall and disease-specific survival. Survival is not

influenced by the appearance of local recurrences, but by the development of lymph node or distant metastases. For this reason, the proportion of organ-preserving treatments in clinical practice has increased in recent decades. However, subsequent studies have provided additional evidence that has led to a refinement of the overall picture. They have shown that overall and disease-specific survival is significantly worse after local recurrence. Nevertheless, based on this knowledge, the EAU guidelines for penile cancer continue to strongly recommend organ-preserving surgery for penile intraepithelial neoplasia (PeIN) affecting the glans or foreskin, as well as for pTa-pT2 stage penile cancer. However, patients should be informed of the risk of local recurrence and its possible consequences prior to surgery.

In light of the evidence detailed in the previous paragraphs, it is possible to perform organ-preserving treatments for the penis, even if the local recurrence rate is higher. However, this approach is not applicable in all cases. The procedure can be performed following careful examination and patient selection.

If organ-preserving treatment is being considered, an MRI scan of the penis is necessary during the examination. This is important because, prior to organ-preserving treatment, it must be established whether or not the tumour extends to the cavernous bodies ($\geq$ cT3). MRI has an 80% sensitivity and 96% specificity for detecting tumour involvement of the cavernous bodies.

A biopsy is necessary before treating the primary tumor. This is to rule out non-tumour lesions (such as syphilis) that may arise during differential diagnosis. On the other hand, it is to determine the tumour's grade, as this influences the width of the surgical margin required to remove the tumour. If non-surgical organ-preserving treatment is planned, a biopsy is essential as this type of treatment does not produce a specimen that can be used for a definitive histological examination.

During organ-preserving surgery, a sample can be taken from the base of the resection for an intraoperative frozen section analysis. However, the necessity of this procedure is controversial. The EAU guidelines do not recommend routine intraoperative histological examination, but suggest it if there is uncertainty regarding the tumour-free surgical margin.

As with all tumour diseases, regular follow-up examinations are necessary after treatment for penile cancer. These are required more frequently after organ-preserving treatment than after penile amputation. Physical examinations should be performed every three months for the first two years, and every six months for years three to five, to check for local recurrence.

It is difficult to determine the minimum width of an oncologically safe, tumour-free surgical margin because there is no clear scientific evidence based on comparative studies. The current EAU guidelines do not specify the minimum required thickness of a tumour-free surgical margin. They state that, in basic cases, the surgical specimen should contain an area of clinically normal-looking skin around the tumour and the surrounding erythema. However, a wider surgical margin is recommended for large or higher-grade tumours. There is no scientific evidence to support the historically required 2 cm negative surgical margin in penile amputation. Scientific publications suggest that a thinner surgical margin is sufficient to maintain oncological safety. If histological examination does not confirm lymphovascular invasion or involvement of the corpus cavernosum, a surgical margin thicker than 1 mm may be sufficient.

Non-surgical treatments for primary penile cancer fall into three main categories: topical therapies (chemotherapy and immunotherapy), various forms of radiation therapy and laser tumour ablation.

Topical chemotherapy with 5-fluorouracil can be used to treat PeIN. One disadvantage of this method is that it causes inflammation and erosion at the treatment site, often leading to treatment being interrupted. The recurrence rate after treatment is 11%. Topical immunotherapy is often used as a second-line treatment following unsuccessful 5-fluorouracil treatment for PeIN. Treatment with imiquimod cream activates the immune system and triggers an inflammatory response. Side effects may include redness, swelling and erosion of the glans penis. The risk of recurrence is 20%. The inaccuracy of the biopsy prior to treatment may contribute to this high recurrence rate. In addition to PeIN, invasive squamous cell carcinoma may be present in 8.7–20% of cases.

Squamous cell carcinoma is a radiation-sensitive tumour type. Therefore, primary penile squamous cell carcinoma in stages T1 and T2 can be treated with radiation therapy. This

can involve external radiotherapy, brachytherapy, or a combination of the two. However, radiation therapy has a high complication rate, often leading to treatment discontinuation, therapy modification, or surgery. The most common side effects are glans necrosis, urethral stricture and scarring of the cavernous bodies.

Laser ablation can be used to treat both superficial (PeIN and Ta) and invasive (T1–2) tumours. Carbon dioxide or Neodymium yttrium Aluminium Garnet (Nd:YAG) lasers are suitable for this procedure. The oncological results are more favourable for superficial and T1 tumours, and less so for T2 tumours. For this reason, lasers are ideal for T1 and lower stages, and the EAU guidelines also recommend their use for these indications.

There is a wide range of indications for organ-preserving surgery of the penis. It can be performed on stages PeIN, Ta and T1-2. The advantage of surgery is that tumourous tissue is removed from the body. Another advantage over non-surgical organ-preserving treatments is that a detailed histological examination can be performed on the tissue removed during surgery, enabling accurate grading and staging. Histological examination of the entire tumour provides more accurate findings than a biopsy taken from the tumour, as histological heterogeneity within the tumour can be accurately mapped.

For small tumours located on the glans, wide local excision is considered. Due to the tumour's small size, a biopsy is usually not performed beforehand. In practice, the entire lesion is excised during the biopsy with an incision in the normal-looking skin adjacent to the tumour, after which the wound is closed. Wide local excision is recommended for stage T1a and grade G1-2 tumours.

Radical circumcision is only possible for tumours affecting the foreskin. The tumour is removed alongside the foreskin with a tumour-free surgical margin. This is indicated for PeIN or pT1 tumours.

During glans resurfacing, the epithelial layer is removed from the glans in such a way that the spongy tissue remains intact. This procedure is suitable for treating PeIN and pTa-pT1a penile cancer. The denuded glans is then covered with partial-thickness skin graft.

If the tumour is located on the glans and wide excision or glans resurfacing is insufficient to achieve tumour-free status, then glansectomy is considered. This is less radical than penile amputation, since the corporal bodies remain intact and the length of the penis is reduced less. Glansectomy is indicated for stage T1-2 penile cancer.

Following glansectomy glans reconstruction with partial-thickness skin graft (balanoplasty or glanduloplasty) is possible to increase patient satisfaction. Reconstruction can also be performed using buccal mucosa graft.

3. Objectives

1. Patients prefer single-session surgical solutions to the Cecil procedure, which is widely used in Hungary for sclerosing lipogranuloma of the penis. The main reason for this preference is that, during the period between the two surgical sessions, the penis is in an abnormal position. Patients also want to avoid the double burden of two surgeries. Single-session techniques are also more advantageous from a professional point of view, as they require less time within the healthcare system.

However, the disadvantage of the single-session scrotal skin flap surgical techniques mentioned in the literature review is that they all result in T-shaped skin anastomoses. In the case of bilateral flaps, this occurs on both the ventral and dorsal sides of the subcoronal skin anastomosis; in the case of bipedicle flaps, it occurs on the ventral side; and in the case of Shin flaps, it occurs on the dorsal side.

For these reasons, we aimed to develop a reconstructive surgical technique for treating penile deformity caused by sclerosing lipogranuloma that could be performed in one session, would eliminate the problem caused by T-shaped skin anastomoses and would result in patient satisfaction and few complications. We also aimed to evaluate the results of the surgeries after developing the surgical technique, paying particular attention to surgical time and hospital stay, complication rates, penetration ability and patient satisfaction.

2. To increase patient satisfaction, it is important that we implement international examples of organ-preserving penile surgery for penile cancer in Hungarian practice. Glans reconstruction has a history in Hungary. The Urology Clinic

working group at the University of Szeged has published several papers on creating a neoglans from buccal mucosa graft following glansectomy. Buccal mucosa grafts are ideal for reconstruction following surgery for penile cancer, and our working group has tested and is currently using this technique. One disadvantage of this surgical technique is that the size of the graft that can be obtained from the oral cavity is limited. A larger graft is required for the complete aesthetic reconstruction of the glans. We therefore consider partial-thickness skin graft to be optimal in this regard.

Therefore, we aimed to implement glans reconstruction using split-thickness skin graft after glansectomy for penile cancer in Hungary. Our aim was to evaluate the oncological and functional outcomes of our surgeries and compare them with those of glansectomy alone and penile amputation. We hypothesised that reconstructive glansectomy would achieve better functional results than standard glansectomy or penile amputation while maintaining oncological efficacy.

4. Patients and methods

4.1 Sclerosing lipogranuloma

Before developing our new surgical technique to repair penile skin damaged by sclerosing lipogranuloma, we routinely performed the Cecil procedure. We then began using the Shin flap. Subsequently, based on our experience with the two-stage procedure, we modified the Shin flap. The key feature of the new reconstruction technique (modified bipedicle flap) is that the denuded penis is covered with a skin flap formed from scrotum. This flap is bipedicle, meaning that we create it from the skin on the right and left sides of the ventral side of the scrotum. The connection between the two side of the flap along the raphe scroti in the middle is preserved. This is an axial flap and is supplied with blood by the deep external pudendal artery, which is preserved on both sides. During reconstruction, the lateral edges of the flap are placed on the ventral side of the penis and are formed using the inverted V-shaped incision known from the Shin flap.

The modified bipedicle flap was first used in September 2017. A retrospective study was conducted among men who underwent surgery using this method between September 2017 and March 2020. In all cases, surgery was indicated for sclerosing lipogranuloma

caused by Vaseline being inserted under the skin of the penis in non-medical circumstances. All surgeries were performed by the author.

The following parameters were recorded from the electronic medical record system of our clinic during our study: age; time elapsed between paraffin administration and surgery; type of anaesthesia; hospital stay; duration of surgery; complications, classified according to the Clavien-Dindo classification system; and follow-up time. The functional outcomes of the surgery and patient satisfaction were assessed using a questionnaire. The questionnaire included the following questions: 1. Are you able to achieve an erection? (answer: yes/no) 2. Are you able to engage in sexual intercourse? (answer: yes/no) 3. Do you experience any tension or pain during erection? (answer: yes/no) 4. Overall, how satisfied are you with the results of the surgery? (answers: 1. very dissatisfied, 2. dissatisfied, 3. unsure, 4. satisfied, 5. very satisfied). The surgery was considered successful if respondents answered question 4 with 'satisfied' or 'very satisfied'.

4.2 Penile cancer

Although we had experience of radical and organ-preserving surgeries, including glansectomy, we did not have experience of glans reconstruction. We opted for Bracka's technique to introduce glans reconstruction in Hungary. During the surgery, the glans and foreskin are removed, and a neoglans is then created at the tip of the corporal bodies. In order to create the neoglans, partial-thickness skin graft has to be harvested. To perform this, we asked a dermatologist with experience in dermatological surgery at our partner clinic. We performed our first such surgery in 2017. We later learnt how to harvest partial-thickness skin graft from our dermatologist colleague, and have been performing this step ourselves since the fourth surgery.

A retrospective study was conducted among all men who underwent penile surgery at our clinic between 1 January 2017 and 31 December 2022 due to PeIN or penile cancer, as confirmed by penile biopsy. The study aimed to assess and compare the oncological and functional outcomes of patients who underwent glansectomy and glans reconstruction with those who underwent glansectomy without reconstruction (standard glansectomy) or penile amputation.

The selection criterion was that the tumour was located on the glans. Patients who underwent radical circumcision due to a tumour on the foreskin, or radical penectomy, were excluded. The patients were divided into three groups. Group A comprised patients who underwent partial or total glansectomy followed by neoglans formation using partial-thickness skin grafts. Group B included patients who underwent partial or total glansectomy without neoglans formation. Group C included patients who underwent penile amputation.

The following parameters were recorded from the electronic medical record system of our clinic: age; Charlson Comorbidity Index (CCI); American Society of Anesthesiologists (ASA) score; Body Mass Index (BMI); penile biopsy histology results; clinical staging results; length of surgery; hospital stay; tumour involvement of surgical margins; local recurrence; disease-specific survival; overall survival; and complications. Complications were assessed using the Clavien-Dindo classification system.

Functional outcomes were assessed using a questionnaire. The questionnaire included the following questions: 1. Are you able to urinate while standing up? (answer: yes/no) 2. Are you able to engage in sexual intercourse? (answer: yes/no) 3) How satisfied are you with the appearance of your penis? (answers: 1. very dissatisfied, 2. dissatisfied, 3. uncertain, 4. satisfied, 5. very satisfied). We considered the surgery to be successful if respondents answered question 3 with 'satisfied' or 'very satisfied'. Erectile function was assessed using the International Index of Erectile Function – 5 (IIEF-5) questionnaire.

Patients who were originally classified as group A or B, but who later underwent salvage penile amputation due to a positive surgical margin, were reclassified as group C when oncological and functional outcomes were assessed.

5. Results

5.1 Sclerosing lipogranuloma

Between 2017 and 2020, a total of 49 surgeries were performed at our clinic using the modified bipedicle flap. The patients had an average age of 33.7 ± 9.4 years. The median time between paraffin injection into the penis and surgery was six years (range: 0.5–12) years. Forty-four patients underwent surgery under spinal anaesthesia and five under general anaesthesia. The average surgical time was 125.4 ± 27.7 minutes. The average

length of hospital stay was 2.4 ± 1.1 days. Eight of the 49 patients did not attend the postoperative follow-up examinations, resulting in a dropout rate of 16.3%. The average follow-up time for the 41 patients who attended was 20.0 ± 13.9 months.

No complications were observed during surgery. The total complication rate within 30 days of surgery was 26.5%. According to the Clavien-Dindo classification, there were five grade 1, eight grade 3a and one grade 3b complications. One reoperation was performed during the postoperative hospital stay due to a scrotal haematoma. Under general anaesthesia, the haematoma was removed and the haemostasis was achieved. After discharge, no complications of sufficient severity to require readmission were observed. All complications could be treated on an outpatient basis. Necrosis was observed at the edges of the skin flap in eight cases, and this was treated with necrectomy and local wound care. In two cases, wound dehiscence and an difficult-to-heal wound were observed. These were treated with local wound care. One patient presented with a painful, tension-causing haematoma in the mons pubis, which was managed with medications.

The questionnaire survey was completed by 61.2% of patients, a total of 30 patients responding to our questions. Of these respondents, two (7%) reported the onset of erectile dysfunction following surgery. Three patients (10%) experienced pain or tension during erection. All respondents were able to engage in sexual intercourse after surgery. When asked how satisfied they were with the outcome of the surgery, 16 respondents (53%) said they were very satisfied, while 11 respondents (37%) said they were satisfied. According to our definition, 90% rated the outcome of the surgery as positive. Of the remaining patients, two (7%) said they were uncertain and one (3%) was dissatisfied. The average score was 4.4 points.

5.2 Penile cancer

A total of 21 patients were included in the study. Six patients were assigned to group A, eight to group B and seven to group C. The median age of the patients was 65 years (range: 23–77) in group A, 71 years (range: 59–79) in group B and 66 years (range: 42–77) in group C. The median CCI score was 2 (range: 0–3), 4.5 (range: 1–5) and 2 (range: 0–5); the median ASA score was 2 (range: 1–3), 3 (range: 2–4) and 2 (range: 2–3); and the median

BMI was 25.4 (range: 24.0–26.5), 25.1 (range: 23.0–50.9) and 29.8 (range: 21.3–35.8) in groups A, B and C, respectively. Patients in groups B and C did not differ significantly from those in group A in terms of age, ASA score and BMI. However, patients in group B had significantly higher CCI scores than those in group A ($p=0.036$), while there was no significant difference between groups A and C ($p=0.508$).

Penile biopsy, which formed the basis for the surgical indication, revealed squamous cell carcinoma in 14 cases (67%), verrucous carcinoma in two cases (10%), and PeIN in five cases (24%). The grade was not determined in 5 (24%) cases, grade 1 was confirmed in 7 (33%) cases, grade 2 in 7 (33%) cases, and grade 3 in 2 (10%) cases. The clinical T stage was Tis in five (24%) patients, Ta in two (10%) patients, T1 in seven (33%) patients, T2 in two (10%) patients and T3 in five (24%) patients. Clinical staging showed lymph node metastasis in five (24%) patients, with no distant metastasis confirmed.

The surgery was performed under general anaesthesia in five (24%) cases and under spinal anaesthesia in 14 (67%) cases. Due to the general condition and comorbidities of the patients, two (10%) cases were performed under local anaesthesia. The median surgical times were 136 (IQR: 132–142) minutes in group A, 51.5 (37.5–91) minutes in group B, and 80 (65–148) minutes in group C. Surgeries in group A were significantly longer than those in group B ($p = 0.011$), though no such difference was observed between groups A and C ($p = 0.169$). The median number of days of hospitalisation was 7 (IQR: 7–7), 1.5 (1–5) and 4 (1–11) days in groups A, B and C, respectively. Patients in group A stayed in the clinic significantly longer than those in group B ($p = 0.004$), though there was no significant difference between groups A and C ($p = 0.304$).

No complications were observed in group A, where the graft adhered in all cases and there was no shrinkage of the graft or meatal stenosis. Two complications (25%) were observed in group B: one was a grade I complication according to the Clavien-Dindo classification, for which local wound treatment was applied due to wound dehiscence. The other was a grade III/a complication: a stitch was inserted under local anaesthesia due to wound bleeding. Two grade I complications also developed in group C. Local wound treatment was used for wound dehiscence and a compression bandage was applied for moderate wound bleeding.

Based on the final histopathological examination, the median maximum diameter of the removed tumour was 30 (interquartile range [IQR]: 13.5–39.5) mm, with no significant difference between the groups in this respect. Histopathological examination revealed squamous cell carcinoma in 14 cases (67%), verrucous carcinoma in three cases (14%), and PeIN in one case (5%). Three cases (14%) were confirmed as pT0 stage, meaning there was no residual tumour tissue in the sample. There was one such patient in each group. In patients with pT0 in groups A and B, surgery was justified by positive surgical margins for PeIN, as confirmed by histological examination of penile biopsy samples. Penile biopsy in the pT0 patient in group C confirmed squamous cell carcinoma G2 with positive surgical margins. Pathological T stage classification revealed Tis in one case (5%), pT1a in six cases (29%), pT1b in five cases (24%), pT2 in three cases (14%), and pT3 in three cases (14%). The tumour grade was G1 in six (29%) patients, G2 in nine (43%) patients and G3 in two (10%) patients.

The final histological examination revealed positive surgical margins in two cases: one in group A and one in group B. The histological examination of the patient in group A confirmed G1 verrucous carcinoma. This resulted in salvage penile amputation one month after surgery, which confirmed pT3 verrucous carcinoma with a tumour-free surgical margin. Five years after surgery, the patient is alive and tumour-free. Upon analysing the oncological and functional results, the patient was categorised as group C. Histological examination of the patient in group B revealed G2 squamous cell carcinoma with positive surgical margins. This resulted in a recommendation for salvage penile amputation; however, the patient declined due to his poor general health and multiple comorbidities. His CCI score was 5 and his ASA score was 4, and he lived for another 33 months without tumour recurrence.

Six patients underwent bilateral inguinal lymphadenectomy: two from group B and four from group C. Modified inguinal lymphadenectomy was performed in three cases, which showed no metastasis. Three patients underwent radical inguinal lymphadenectomy; one of these patients later underwent bilateral pelvic lymphadenectomy after histological examination of the inguinal lymph nodes revealed pN2 stage. Three patients received chemotherapy. One patient received neoadjuvant treatment, while two received adjuvant treatment comprising four cycles of paclitaxel, ifosfamide and cisplatin (TIP).

During a median follow-up period of 27 months (IQR: 13–51), one local recurrence was observed in Group C. Local recurrence was confirmed six months after surgery in a patient who underwent penile amputation. Imaging studies also revealed inguinal lymph node, lung and adrenal metastases at that time. The patient received four cycles of TIP chemotherapy. The patient died 13 months after penile amputation. No local recurrence was observed in Groups A and B, and disease-specific survival was 100% in these groups compared to 88% in Group C. No deaths were observed in Group A. In Group B, two patients died from non-tumour causes 27 and 33 months after surgery. This resulted in an overall survival rate of 75%. In group C, one non-tumour-related death occurred 57 months after penile amputation, resulting in an overall survival rate of 75% in this group as well.

Due to the retrospective nature of our clinical study, it was not possible to assess the functional outcomes of patients who died during the follow-up period. A total of 17 patients completed the questionnaire: five from group A, and six each from groups B and C. 100% (5/5) of patients in group A, 83% (5/6) of patients in group B, and 67% (4/6) of patients in group C were able to urinate while standing after surgery. The penetration rate was 100% (5/5), 50% (3/6) and 17% (1/6) in groups A, B and C, respectively. Regarding the appearance of the penis, 80% (4/5), 67% (4/6) and 33% (2/6) of respondents in groups A, B and C were satisfied or very satisfied after surgery, respectively. The median IIEF-5 score after surgery was 21 (IQR: 19–25), 7.5 (5–17) and 5 (5–9) in groups A, B and C, respectively.

Multiple binary logistic regression analysis was performed to identify factors influencing penile appearance and erectile function, showing that a positive assessment of penile appearance after surgery was significantly influenced by belonging to group A rather than group C ($p = 0.030$). Postoperative erectile function was also significantly improved if the patient was in group A rather than group C ($p = 0.007$). A more favourable CCI score ($p = 0.035$), ASA score ($p = 0.021$) and BMI value ($p = 0.027$) were also found to significantly improve erectile function. When comparing groups A and B, we were unable to demonstrate any significant impact on the appearance of the penis or erectile function.

6. Discussion

6.1 Sclerosing lipogranuloma

The literature on sclerosing lipogranuloma is dominated by case reports and case series involving fewer than 10 patients. These small clinical studies often present multiple surgical techniques and their results on a heterogeneous patient group. Few publications present an analysis of a given surgical procedure or compare two specific procedures in a larger patient group. Our clinical study, which presents the results of surgery on 49 patients, is the largest study on this topic. We will compare our results with those of clinical studies presenting well-defined reconstruction techniques with more than ten patients. These articles are suitable for comparison because, like our data, they analyse the initial cases of a novel surgical procedure performed by a particular working group.

On average, the modified bipedicle flap procedure took 125.4 ± 27.7 minutes less than the Cecil procedure when the duration of the first and second sessions were combined. Between 2008 and 2020, the average surgical time for the first and second Cecil procedure sessions performed at our clinic was 116.6 ± 38.6 and 75.3 ± 14.1 minutes, respectively. This adds up to more than three hours of surgical time. Between 2020 and 2024, the median surgical time for partial-thickness skin grafts performed at our clinic for sclerosing lipogranuloma was 170 minutes (range 135–250). Mendel et al. reported a median operating time of 128 minutes (IQR: 99–169) using bilateral flaps, while Fakin et al. reported an average operating time of 152 minutes (converted from 2.53 ± 0.46 hours) for bilateral flaps. These data all show that surgery using the modified bipedicle flap technique is significantly shorter than Cecil surgery and partial-thickness skin grafting, and similar to or shorter than other single stage scrotal skin flap techniques.

Compared to an average of 2.4 ± 1.1 days observed with the modified bipedicle flap, our Cecil surgeries required an average of 3.8 ± 1.4 days of hospitalisation after the first session and 2.9 ± 0.8 days after the second. Therefore, the hospital stay was longer after both sessions than after the modified bipedicle flap surgery. Adding up the length of the hospital stay after the two sessions reveals a difference of almost threefold. For partial-thickness skin grafting performed at our clinic, the median number of hospitalisation days is 5 (range: 1-5), which is double that for our modified bipedicle flap surgeries.

Mendel et al. reported a median of 4 (IQR: 3–5) days after bilateral flap use, while Fakin et al. reported an average of 4.63 ± 1.75 days of hospitalisation for bipedicle flap procedures. Based on these data, the number of days of hospitalisation after our modified bipedicle flap procedures is clearly lower than that reported in the international literature for other single stage scrotal skin flap procedures, as well as for our own procedures using different techniques.

Following our operations involving modified bipedicle flap, the overall complication rate was 26.5%. For Cecil surgeries, the figure was 17.6% after the first session and 11.1% after the second. Examining the complication rate per patient revealed a complication rate of 23.5%. We observed a total complication rate of 36.4% in cases of partial-thickness skin grafting. Bajory et al. observed skin edge necrosis in 25% of cases following the second Cecil surgery session. The same working group observed skin edge necrosis in 25% of cases involving their single-session surgeries with bilateral flaps. Mendel et al. reported a total complication rate of 45.5% in connection with bilateral flaps. Jeong et al. achieved a complication rate of 23.5% using the same surgical technique. However, Shin et al. experienced a 100% complication rate with this surgical technique. Fakin et al. experienced a 39.5% complication rate with a bipedicle flap procedure. Shin et al. experienced complications in 28.6% of cases after performing the Shin flap procedure. Excluding the outlier reported by Shin et al. for bilateral flaps, the overall complication rate following various penile skin reconstruction techniques for sclerosing lipogranuloma of the penis ranges from 23.5% to 45.5%. Our new surgical technique is at the lower end of this spectrum.

Similar to the 100% penetration rate observed after our modified bipedicle flap surgeries, Bajory et al. reported 100% penetration after Cecil surgeries. Bajory et al. and Jeong et al. also reported 100% penetration after bilateral flap surgeries. Fakin et al. reported 100% penetration after surgeries involving a bipedicle flap, as did Shin et al. after surgeries using the Shin flap.

The method used to assess overall patient satisfaction varies between reports, which makes direct comparison difficult. Fakin et al. reported an 88% success rate based on a 5-point Likert scale questionnaire, with an average patient satisfaction score of 4.37. In contrast, our study confirmed a success rate of 90%, with respondents giving an average

score of 4.4 points on the patient satisfaction question. Based on our own study, which used the same method as Fakin et al., the success rate after partial-thickness skin grafting was 89%, with patients giving an average score of 4.3 points on the patient satisfaction question. Bajory et al. assessed patient satisfaction with the surgery during follow-up examinations one and three months after surgery. Of those who underwent Cecil surgery and bilateral flap surgery, 81.2% were satisfied with the procedure. After Cecil surgeries performed at our clinic, 77.8% of patients were satisfied with the surgical results when assessed using a similar method after the second session. Overall, patient satisfaction after penile skin reconstruction surgery is typically high, ranging from 80% to 90%. Patient satisfaction following the surgical technique presented in our paper is particularly favourable.

One limitation of our study is that it is based on the retrospective findings of a single surgeon. This could be mitigated in future by involving other institutions and a larger patient sample. The dropout rate among our patients was high. A prospective study would enable us to increase the response rate.

The effectiveness of the new surgical technique is demonstrated by the fact that Cecil surgery has been eliminated from our clinic's repertoire and we have not performed two-stage penile skin reconstruction since 2021. With single-stage surgery, patients do not experience the double burden of surgery or hospital stays, nor do they need to keep their penis in an abnormal position for months, which can impair their sexual life.

At our institute, the primary reconstructive technique used for sclerosing lipogranuloma affecting the entire length of the penile skin is currently the modified bipedicle flap. We only perform partial-thickness skin grafting if the scrotum is not suitable for flap formation. Compared to partial-thickness skin grafting, the scrotal skin flap has several advantages. It is located close to the penis and is easily accessible. Unlike partial-thickness skin grafting, where the donor site is visible on the thigh, the surgical area is hidden by underwear. The scrotal flap has a rich blood supply and does not require a good blood supply at the recipient site (the denuded penis). The colour and elasticity of scrotal skin are similar to those of penile skin, and erogenous sensation remains after surgery. This is in contrast to partial-thickness skin, which is lighter and less elastic than genital skin. Flap surgery does not require specialised instruments, such as the Humby knife.

However, the disadvantages of scrotal skin flaps should not be overlooked. Unlike partial-thickness skin, hair growth can be expected on the penis.

We consider the major advantage of the modified bipedicle flap, compared to bilateral flaps, bipedicle flaps and Shin flaps, to be that three non-intersecting suture lines are formed on the penis at the end of the operation. This reduces the risk of wound healing disorders, as no T-shaped skin anastomosis is created. With the bilateral flap, bipedicle flap and Shin flap, a longitudinal suture line is created on at least one side of the penis under the coronal sulcus. During erection, this can cause significant tension, exacerbated by the shrinkage of these suture lines during wound healing and the formation of less elastic scar tissue in their place. With the modified bipedicle flap technique, however, there is free skin between the longitudinal suture lines running along the ventral and dorsal sides of the penis and the circular suture line below the coronal sulcus. The elasticity of this circular skin area promotes the stretching of the reconstructed skin during erection. We believe this explains why the complication rate and overall patient satisfaction were so favourable after modified bipedicle flap surgeries.

6.2 Penile cancer

When performed with the appropriate indication, glansectomy and glans reconstruction is an optimal solution for treating penile cancer. The tumour is completely removed, allowing for an accurate histological examination. The procedure is oncologically safe, has a high adhesion rate for partial-thickness skin graft, and can be performed with few complications and favourable patient satisfaction.

Following the introduction of this surgical technique in Hungary, we considered it important to examine whether the procedure could be performed safely from an oncological perspective and to patients' satisfaction. No randomised controlled clinical trials or observational comparative studies comparing glansectomy and glans reconstruction with standard glansectomy or penile amputation have been published in the international literature. Therefore, we conducted a comparative study of these surgeries among patients at our clinic.

In the case of glansectomy and glans reconstruction, both the surgical time and hospital stay were significantly longer than for standard glansectomy. This is due to the time-consuming nature of harvesting and securing the partial-thickness skin graft. Patients remain in the clinic for at least five days until the bandage fixed to the graft are removed. There was no significant difference in surgical time and days of hospitalisation between groups A and C. Most articles reporting the results of glansectomy and glans reconstruction do not report surgical time and duration of hospital stay. However, Falcone et al. and Pérez et al. assessed these parameters in their papers, reporting median surgical times of 150 (IQR: 105–180) and 218 (165–345) minutes, respectively, and median hospitalisation times of 2 (1–3) and 3 (2–5) days, respectively.

Complications rarely occur following glans reconstruction. Similar to our own results, several clinical studies of this procedure have found no complications during the postoperative period. In our study, we observed fewer complications after glansectomy and glans resection than after standard glansectomy or penile amputation. However, the complications observed in these procedures were mild.

Following glans reconstruction, our examination revealed complete graft adhesion in all cases. Similar results were reported by Beech et al. and O'Kane et al., whereas Moreli et al. observed partial graft damage in 13% of cases. Falcone et al. found the same complication in 17.6% of cases. Parnham et al. found partial graft damage in 20% of cases and complete graft necrosis in 3.4% of cases when evaluating data from 177 surgeries. We did not experience any cases of meatal stenosis following our surgeries. In the literature, meatal stenosis rates range from 0 to 14%.

We expect to see more positive surgical margins in organ-preserving surgeries performed with a thinner safety margin free of tumour than in radical penile surgeries. Our study supported this hypothesis. We observed no positive surgical margins after penile amputation. However, one patient in each of our glansectomy groups had tumour-positive surgical margins based on the final histological examination. Therefore, the combined data for groups A and B showed a surgical margin positivity rate of 14% (2/14). When we calculated the data for groups A and B separately, the respective figures were 17% (1/6) and 13% (1/8). This is a similar result to that found in the international literature (3–21%).

Examining several observational studies dealing with glansectomy and glans reconstruction reveals that local recurrence data varies widely (0–17.6%). In our study, we did not observe any local recurrence following this type of surgery.

Our study found that disease-specific and overall survival rates were 100% after glansectomy and glans reconstruction. This clearly demonstrates that the introduction of glansectomy and glans reconstruction with partial-thickness skin graft in Hungary took place within a safe framework from an oncological perspective and did not reduce patients' life expectancy. It is also evident that the reconstruction did not impact the oncological outcome of the glansectomy, which is unsurprising given that the radical nature of glansectomy is not diminished by subsequent glanduloplasty. Similar good survival data can be found in the international literature on glansectomy and glans reconstruction: Disease-specific survival ranges from 89 to 100%, and overall survival ranges from 83 to 100%.

In our clinical study, excellent functional results were observed following reconstructive glansectomy. All patients were able to urinate while standing and engage in sexual intercourse. 80% were satisfied with the appearance of their penis, achieving a median IIEF-5 score of 21 after surgery. However, no statistically significant difference was found in terms of functional parameters when compared with standard glansectomy. These favourable functional results after glansectomy and reconstruction are consistent with those reported in the relevant international literature.

Despite the importance of urinating while standing, this is rarely mentioned in scientific publications examining the results of glansectomy and glans reconstruction. In their analysis of 12 surgeries, Beech et al. similarly found that all patients were able to urinate while standing after surgery. Croghan et al. reported an 85% success rate after examining 35 patients. We have more data on penetration ability, but most publications do not detail the method used to assess it. Studies have found the penetration ability rate after surgery to be 81–100%.

We expected the greatest difference in the evaluation of the appearance of the penis when comparing the functional results of glansectomy with reconstruction and standard glansectomy. After glansectomy and glans reconstruction, 80% of patients were

satisfied, compared to 67% after standard glansectomy, which is not a significant difference. Multiple analyses were performed to reduce the impact of confounding factors. However, even this did not demonstrate that greater satisfaction should be expected with glans reconstruction than with standard glansectomy. One possible explanation for this result is that, even after standard glansectomy, the penis does not look unnatural. It most closely matches the appearance of an uncircumcised penis. In contrast, the penis after glansectomy and glans reconstruction looks as if it had previously been circumcised. In Hungary, only a small proportion of men are circumcised, so an uncircumcised penis is considered the natural state. Therefore, it is not surprising that patients are satisfied with the appearance of their penis after a standard glansectomy. However, it is possible that the results would be different in other countries where male circumcision is much more common for traditional or cultural reasons.

The cosmetic results of glans reconstruction are not consistently evaluated in international literature. Different working groups use different methods to evaluate the appearance of the penis or do not disclose their methodology. Similar to our study, Croghan and Scarberry used a 5-point Likert scale to measure cosmetic results. 78% and 100%, respectively, responding that they were satisfied or very satisfied. Falcone et al. used a dichotomous scale to assess patient satisfaction in articles published in 2022 and 2025. Patient satisfaction was 88% in 2022 and 82% in 2025. Beech, Palminteri and Håkansson did not detail their assessment methodology in their publications, but all three studies reported 100% satisfaction.

Following glans reconstruction, favourable results were obtained in terms of erectile function based on the IIEF-5 questionnaire. Our results are also considered favourable in comparison to those of other authors. Studies using the IIEF-5 questionnaire reported results ranging from 16 to 18 points.

The most significant limitation of our study was the small number of patients. One reason for this is that penile cancer is rare. According to the GLOBOCAN (Global Cancer Registries) database, the age-adjusted incidence rate in Hungary in 2020 was 0.86 per 100,000 people. According to data from the Hungarian National Cancer Registry, the number of new cases ranged from 68 to 116 per year between 2010 and 2020.

Unfortunately, we were unable to increase the number of patients by involving other Hungarian institutions, as our study examined a new type of surgery that was not performed elsewhere. This limiting factor could be mitigated in future studies by extending the study period and involving patients from other institutions. Another limiting factor is the heterogeneity of our patients and data. One reason for this is that it is difficult to create a homogeneous sample with a small number of patients; another reason is that the surgical treatment of primary penile cancer is mostly personalised and less standardisable. A third significant limiting factor is the retrospective nature of the study, meaning that some data was incomplete, preventing us from assessing the functional outcomes of patients who died after surgery. This could be mitigated by conducting a prospective study.

We consider the introduction of glansectomy and glans reconstruction with partial-thickness skin graft to be a success. This procedure is now part of our surgical repertoire and we perform it independently. During glanduloplasty, the partial-thickness skin grafted onto the penis has adhered well in all cases. Based on our experience to date, partial-thickness skin graft is an excellent option for glans reconstruction. We consider it to be a better choice than buccal mucosa for complete glans replacement due to the size limitations of the latter. However, we do not rule out the use of buccal mucosa, considering it to be more suitable for replacing small areas of glans skin.

Glansectomy and glans reconstruction takes longer than the standard procedure and requires a longer hospitalisation period. Based on our examination, this did not cause any additional complications, even: no complications were observed after the surgeries. In assessing functional outcomes, we found that all examined parameters showed better results after glans reconstruction than after standard glansectomy; however, the differences were not significant. For this reason, we do not reject the surgery, as we believe that different results may be obtained in a larger number of cases. Furthermore, we are proud that our clinic can offer patients undergoing surgery for penile cancer the option of glans reconstruction alongside standard glansectomy.

During the initial glans reconstructions, a dermatologist harvested the partial-thickness skin graft. We later learned this surgical technique ourselves, and since then, urologists

have performed the entire surgery. We consider this model advantageous for several reasons. It facilitates scheduling and preparation of the surgery, especially in the event of delays or postponements. Since we have our own dermatome, there is no need to transport specialised equipment between institutions before or after each procedure. As with most reconstructive surgeries, situations may arise during the operation that require modifications to the planned reconstruction technique. In such cases, patients find it very reassuring if their surgeon is confidently proficient in several alternative reconstructive techniques.

7. New observations

1. We have pioneered a reconstructive surgical technique for treating penile deformities caused by sclerosing lipogranuloma. This technique restores the penile skin in a single stage using scrotal skin flaps. The design of these flaps eliminates the need for T-shaped skin anastomosis.
2. Our modified bipedicle flap surgery involves a shorter operating and hospitalisation time than previously used surgical techniques. The surgery is safe, with a complication rate similar to that reported in the literature for other types of reconstruction.
3. Based on our questionnaire survey, all respondents were able to engage in sexual intercourse after the surgery and 90% were satisfied or very satisfied with the outcome.
4. We have introduced glansectomy and glans reconstruction with partial-thickness skin graft as a treatment for penile cancer originating in the glans in Hungary.
5. Our study has shown that this surgery has few complications and is oncologically safe.
6. Following glans reconstruction, we observed a 100% success rate in terms of both urination while standing and penetration ability. Eighty percent of patients were satisfied or very satisfied with the appearance of their penis after surgery. The median IIEF-5 score after surgery was 21.
7. Our observational study compared the oncological and functional outcomes of glansectomy and glans reconstruction, standard glansectomy and penile amputation for the first time. All three types of surgery were found to be

oncologically safe. No significant difference was found between glans reconstruction and standard glans reconstruction in terms of postoperative erectile function or the appearance of the penis after surgery, but a significant difference was found between glans reconstruction and penile amputation.

8. Summary

In addition to its role as the primary attribute of masculinity, the penis performs a number of significant physiological functions, including those related to urination, sexual activity, and fertility. Consequently, in the treatment of penile deformities resulting from benign and malignant lesions of the penile skin, it is imperative to employ a reconstruction technique that preserves the function of the penis to the greatest extent possible, in addition to the removal of the affected tissue.

Our goal was to develop new techniques for penile skin reconstruction and to introduce some of these techniques in Hungary. A novel single-stage reconstruction technique was developed for the treatment of penile deformities caused by sclerosing lipogranuloma, utilising a bipedicle scrotal skin flap. The novel technique avoids one of the two-stage surgeries previously popular in Hungary and eliminates the T-shaped skin anastomosis characteristic of previously described single-stage scrotal skin reconstruction surgeries, which increases the risk of wound healing disorders and skin necrosis. The findings of this study demonstrate that this surgical intervention can be performed safely, with reduced operating times and hospital stays, and a 90% patient satisfaction rate.

We have introduced glans reconstruction and glans reconstruction with partial-thickness skin grafting for the treatment of penile cancer affecting the glans in Hungary. The present study found that the procedure has few complications and is oncologically safe, with a 100% disease-specific survival rate after surgery. Excellent results were achieved in terms of urinating while standing, penetration ability, and erectile function, with 80% of patients satisfied with the appearance of their penis after surgery. When comparing glans reconstruction and standard glans reconstruction, we found no significant difference in erectile function and cosmetic results. However, we found a significant

difference between glansectomy with reconstruction and penile amputation in the above functions in favor of reconstructive glansectomy.

We are confident that we have enriched the surgical repertoire of Hungarian reconstructive urology for the treatment of penile deformities with valuable methods.

9. Acknowledgements

I would like to express my gratitude to my supervisor, Dr. Tibor Flaskó, for his invaluable professional guidance and assistance throughout the development and implementation of the novel surgical techniques. He pioneered the implementation of experimental surgical procedures at the clinic, a role that demanded both trust and responsibility from him. He acted as my professional mentor throughout my seventeen years of employment at the Dept. of Urology, and the success of the surgeries described in this thesis is attributable to the school of surgery he created. I would like to extend my gratitude to the entire staff at the Dept. of Urology, including my fellow doctors, scrub nurses, operating room assistants, and nurses, who have provided unwavering support and assistance throughout my 17 years of service at the Department. It is through their guidance and expertise that I have acquired the knowledge and skills essential to my practice in the field of urology. I would like to express my gratitude to Professor István Juhász for his invaluable assistance in mastering the technique of partial-thickness skin grafting. I would like to express my gratitude to my family and friends who have provided me with support throughout the years.



Registry number: DEENK/117/2026.PL
Subject: PhD Publication List

Candidate: Mihály Murányi

Doctoral School: Doctoral School of Medical Sciences

List of publications related to the dissertation

1. **Murányi, M.**, Domoszlai, A., Nagy, A. C., Flaskó, T.: Comparing functional outcomes of glansectomy with or without glans reconstruction.
Can J. Urol. 32 (2), 119-127, 2025.
DOI: <http://dx.doi.org/10.32604/cju.2025.063821>
IF: 0.9 (2024)
2. **Murányi, M.**, Varga, D., Kiss, Z., Flaskó, T.: A New Modified Bipedicle Scrotal Skin Flap Technique for the Reconstruction of Penile Skin in Patients with Paraffin-Induced Sclerosing Lipogranuloma of the Penis.
J. Urol. 208 (1), 171-178, 2022.
DOI: <http://dx.doi.org/10.1097/JU.0000000000002480>
IF: 6.6

List of other publications

3. Bakos-Kádár, K., Domoszlai, A., **Murányi, M.**, Flaskó, T.: A nemi szervek lymphoedemája okozta deformitás műtétes kezelése.
Magy. urol. 37 (3), 104-108, 2025.
DOI: <http://dx.doi.org/10.22591/magyuro.2025.3.bakoskadark.104>
4. Kiss, Z., **Murányi, M.**, Nagy, A. C., Flaskó, T.: Effectiveness of the mushroom technique versus morcellation in en bloc bipolar prostate enucleation for prostates over 80 mL.
PLoS One. 20 (9), 1-11, 2025.
DOI: <http://dx.doi.org/10.1371/journal.pone.0331142>
IF: 2.6 (2024)





5. Kiss, Z., **Murányi, M.**, Barkóczi, A., Drabik, G., Nagy, A. C., Flaskó, T.: En Bloc Bipolar Prostate Enucleation Using the Mushroom Technique with Early Apical Release: Short-Term Outcomes.
Medicina (Kaunas). 61 (10), 1-15, 2025.
DOI: <http://dx.doi.org/10.3390/medicina61101859>
IF: 2.4 (2024)
6. Kiss, Z., Drabik, G., **Murányi, M.**, Nagy, A. C., Goumas, I. K., Flaskó, T.: Single session removal of encrusted double J stent using a simultaneous endourological approach: a case series.
Medicine, Balt. 104 (49), 1-6, 2025.
DOI: <http://dx.doi.org/10.1097/MD.00000000000046323>
IF: 1.4 (2024)
7. Kiss, Z., Drabik, G., **Murányi, M.**, Nagy, A. C., Goumas, I. K., Flaskó, T.: Tubeless Percutaneous Nephrolithotomy in the Barts 'Flank-Free' Modified Supine Position with 24-Hour Discharge: a Single-Center Experience.
Medicina (Kaunas). 61 (4), 1-10, 2025.
DOI: <http://dx.doi.org/10.3390/medicina61040748>
IF: 2.4 (2024)
8. **Murányi, M.**, Chang Chien, Y. C., Benyó, M., Flaskó, T.: A hímvessző epithelioid haemangioma.
Orv. hetil. 164 (21), 836-840, 2023.
DOI: <http://dx.doi.org/10.1556/650.2023.32777>
IF: 0.8
9. Schnémann, B., **Murányi, M.**, Drabik, G., Flaskó, T.: A péniszfraktúra hatása a szexuális funkcióra.
Magy. urol. 35 (3), 135-139, 2023.
DOI: <http://dx.doi.org/10.22591/magyuro.2023.3.schnemannb.133>
10. **Murányi, M.**, Varga, D., Drabik, G., Flaskó, T.: Merevedési funkció hosszan tartó ischaemiás priapismus után.
Magyar Androl. 27 (1), 28-34, 2022.
11. **Murányi, M.**, Farkas, A., Kiss, Z., Drabik, G., Flaskó, T.: A hímvessző bőrének helyreállítása szklerotizáló lipogranuloma okozta deformitás miatt.
Orv. hetil. 162 (35), 1413-1417, 2021.
DOI: <http://dx.doi.org/10.1556/650.2021.32180>
IF: 0.707
12. Benyó, M., Kopa, Z., Jakab, A., Nagy, A. C., **Murányi, M.**, Flaskó, T., Molnár, Z.: Correlation between serum markers of testicular cancer and classic semen parameters.
Magyar Androl. 25 (2), 57-63, 2020.
13. Flaskó, T., **Murányi, M.**: A húgyhólyag, húgycső, here, mellékhere gyulladásai.
In: Urológia. Szerk.: Nyirády Péter, Bajory Zoltán, Flaskó Tibor, Szántó Árpád, Semmelweis Kiadó, Budapest, 129-136, 2019.





14. Varga, D., **Murányi, M.**, Flaskó, T.: Prostatatabiopszia után kialakult kétoldali psoas tályog esete.
Magy. urol. 31 (4), 137-141, 2019.
DOI: <http://dx.doi.org/10.22591/magyuro.2019.4.vargad.137>
15. Kiss, Z., **Murányi, M.**, Flaskó, T.: Recidív húgycsőszűkület és prosztatatarák terápiás dilemmája.
Magy. urol. 30 (3), 105-109, 2018.
16. Kiss, Z., Benyó, M., Lőrincz, L., **Murányi, M.**, Flaskó, T.: A pénisz strangulációs sérülései az urológiai gyakorlatban.
Magyar Androl. 22 (2), 51-54, 2017.
17. Norheim, E. H., Molnár, Z., **Murányi, M.**, Benyó, M.: Female ejaculation; fact or fiction? = Női ejakuláció: fikció vagy valóság?
Magyar Androl. 22 (2), 31-36, 2017.
18. **Murányi, M.**, Farkas, A., Kiss, Z., Flaskó, T.: Húgycsődivertikulum radikális prostatectomia után.
Magyar Urol. 29 (1), 9-12, 2017.
DOI: <http://dx.doi.org/10.22591/magyuro.2017.1.muranyim.9>
19. **Murányi, M.**, Kiss, Z., Farkas, A., Flaskó, T.: A nagy imitátor.
Orvosi Hetilap. 157 (9), 350-356, 2016.
DOI: <http://dx.doi.org/10.1556/650.2016.30384>
IF: 0.349
20. **Murányi, M.**, Benyó, M., Farkas, A., Redl, P., Szabó, A., Flaskó, T.: Egy ülés húgycsőplasztika szájnyálkahártya átültetéssel.
Magyar Urol. 28 (3), 127-131, 2016.
21. **Murányi, M.**, Benyó, M., Kiss, Z., Flaskó, T.: Successful laparoscopic radical prostatectomy in a patient with factor XI deficiency.
IJCRI. 7 (6), 374-377, 2016.
DOI: <http://dx.doi.org/10.5348/ijcri-201667-CR-10655>
22. **Murányi, M.**, Benyó, M., Kiss, Z., Flaskó, T.: Veleszületett hímvesszőgörbület kezelése Yachia-féle corporoplastikával.
Magyar Urol. 28 (2), 79-83, 2016.
23. Benyó, M., Hársfalvi, J., Pfliegler, G., Molnár, Z., **Murányi, M.**, Józsa, T., Flaskó, T.: Present practice of thrombosis prophylaxis of radical prostatectomy in a European country: a Hungarian multicenter study.
Urol. Int. 92 (3), 289-293, 2014.
DOI: <http://dx.doi.org/10.1159/000353918>
IF: 1.426
24. Benyó, M., Hársfalvi, J., Pfliegler, G., Kiss, Z., **Murányi, M.**, Berczi, C., Varga, A., Flaskó, T.: Trombózis profilaxis gyakorlat a magyar urológiai osztályokon.
Magyar Urol. 26 (1), 2014.





25. Benyó, M., **Murányi, M.**, Berczi, C., Matolcsi, M., Salah, M. A., Varga, A., Flaskó, T.: Heretumort utánzó krónikus granulomatosus orchitis esete.
Magyar Urol. 24 (2), 82-85, 2012.
26. **Murányi, M.**, Tóth, S. Á., Farkas, A., Flaskó, T., Varga, A.: Hólyagtumor fiatal korban.
Magyar Urol. 24 (1), 7-12, 2012.
27. **Murányi, M.**, Salah, M. A., Benyó, M., Tóth, C., Flaskó, T.: Kimutathatatlan prosztaták radikális prostatectomiás szövetmintákban.
Orv. Hetil. 153 (3), 113-117, 2012.
DOI: <http://dx.doi.org/10.1556/OH.2012.29285>
28. **Murányi, M.**, Józsa, T., Benyó, M., Salah, M. A., Flaskó, T.: Laparoscopic Removal of a Paracaval Air Gun Bullet in a Child.
Urol.Int. 89 (2), 246-248, 2012.
DOI: <http://dx.doi.org/10.1159/000337693>
IF: 1.065
29. **Murányi, M.**, Salah, M. A., Benyó, M., Flaskó, T.: Serious contracted bladder and vesicoureteral reflux after intravesical Mitomycin-C treatment.
IJCRI. 3 (3), 27-29, 2012.
DOI: <http://dx.doi.org/10.5348/ijcri-2012-03-103-CR-8>
30. **Murányi, M.**, Salah, M. A., Tállai, B., Benyó, M., Flaskó, T.: Very Late Relapse of Testicular Tumour in Combination with Renal Cancer and Their Retroperitoneoscopic Removal.
Case Reports in Medicine. 2011, Article ID 164070, 2011.
DOI: <http://dx.doi.org/10.1155/2011/164070>

Total IF of journals (all publications): 20,647

Total IF of journals (publications related to the dissertation): 7,5

The Candidate's publication data submitted to the Tudóstér have been validated by DEENK on the basis of the Journal Citation Report (Impact Factor) database.

18 March, 2026

