SURGICAL PROCEDURES IN HIDRADENITIS SUPPURATIVA

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KEY POINTS

- At least in higher stages of HS, surgery should be introduced early after setting the diagnosis.
- Preoperatively, immunosuppressive and/or antibacterial medical treatment to calm active inflammation must be considered. Imaging (ultrasonography, MRI) may be helpful.
- Depending on the extent and severity of the disease local, tumescent, spinal and/or general anesthesia are used.
- Acute phase surgical treatment and treatment of the chronic continue intermediary phase should be distinguished. Incision and drainage can offer pain relief in a setting of a tense fluctuating acute abscess.
- After wide excision, different wound closure techniques can be chosen. Secondary intention healing ensures usually good functional and cosmetic results in defects up to 140 cm².

INTRODUCTION

Hidradenitis suppurativa (HS) is difficult to treat owing to its complex pathomechanism; beside the extensive inflammation with abscesses and inflammatory nodules, there is also sinus tract formation and in severe cases extensive scarring. Surgery should be introduced early in the management of HS. Unfortunately, surgical treatment is often performed many years after the initial symptoms of the disease, after numerous ineffective cycles of pharmacotherapy. Such delays are often caused by misdiagnosis, a doctor’s lack of knowledge about the disease, unjustified confidence in the efficacy of non-invasive therapies, anxiety about surgical treatment and the embarrassing location. The tolerance to and satisfaction with, sometimes debilitating, surgical procedures is surprisingly high and may result from the large psychosocial impact of HS. Because the magnitude of life impairment in HS is far greater than in other dermatoses, patients are highly willing to change the condition.

TREATMENT GOALS AND PLANNED OUTCOMES

The comparison of different operative methods of HS is difficult because of the many types of surgery, interindividual differences between patients and between operators, the shortage of randomized trials and the lack of consensus about the endpoints used. To be able to compare different surgical interventions, clear definitions of outcomes should be defined. We therefore suggest outcomes for future studies.

Relapse rates

Relapse (owing to non-radical surgery) is defined as inflammatory activity occurring within 0.5 cm of the surgical scar. The natural progression of HS can be defined as inflammation that develops outside this area but in the same anatomic region.
Time to wound closure
The time to wound closure is defined as the duration of the wound healing (complete healing) measured in days. For sutured lesions, complete healing may be considered achieved when the stitches have been removed.

Complications
Early complications include haemorrhage, infection, hypergranulation, necrosis of grafts or flaps, injury of brachial plexus or big axillary vessels and thrombosis of brachial veins. Late complications include wound dehiscence, retention of serum (seroma), cicatricial contracture, hypertrophic scars and keloids.

Patient reported outcomes
Patient satisfaction can be cosmetic or functional. The rate of either is measured on a numerical rating scale of 1 to 10 where 1 corresponds with very dissatisfied and 10 with excellent. If the satisfaction rate is measured for both functional and cosmetic results, the mean rate is shown. The recommendation of the treatment to other people and willingness to undergo further surgery are also important patient-reported outcomes.

PRE-OPERATIVE PLANNING AND PREPARATION
Medication to calm the inflammation
In moderate and severe HS, it is broadly recommended and accepted that surgery is combined with immunomodulating treatment. However, it remains unclear whether relapse rates after surgery with perioperative immunomodulation therapy are lower than surgical treatments without perioperative medication.

Imaging
Imaging is not routinely used in surgery of HS although it may be beneficial to management. Some studies with ultrasonography showed that the inflammation can be extended horizontally and vertically far over the visible borders of the inflammation on the skin surface. Moreover, differentiating between enterocutaneous fistula formation in Crohn’s disease remains challenging especially in the perianal region. Perianal lesions of Crohn’s disease usually present as wide fistulas, entering deeply through the perianal area to the colon and/or vagina, affecting the skin and subcutaneous tissue only to a small extent. Lesions of HS present as purulent, inflammatory infiltrates, frequently reaching the buttocks and perineum with numerous narrow, less visible shallow fistulas reaching the anus. Moreover, mixed clinical presentations can occur because of coexistence of HS and Crohn’s disease.

In ambiguous cases imaging with ultrasonography, MRI, CT and fistulography are helpful to assess the location and depth of fistulas and sinuses. Shallow lesions expressing the features of HS can be treated surgically by a (dermat)surgeon, independent from the established diagnosis of Crohn’s disease. If the diagnosis of Crohn’s disease with deep fistulas is confirmed, the surgical treatment should be carried out in cooperation with proctologic specialists. The diagnostic imaging, primarily fistulography, may be decisive.
PATIENT POSITIONING
Surgery involving the axillae and mons pubis is performed in supine position. Leg rests are used for operating inguinal and perineal lesions. The patient is placed in prone position during operations on perianal and gluteal HS.

PROCEDURAL APPROACH
Anaesthesia
Local anaesthesia
Local anaesthesia is performed in two steps. First, field block anaesthesia is performed with lidocaine 1% (10 mg/mL) plus adrenaline (5 µg/mL). Second, nodules and/or sinus tracts are injected with the same local anaesthetic. If patients have fear of needles or if they experience a lot of pain during local anaesthesia, lidocaine and prilocaine cream (EMLA) can be applied one hour before the injections.\(^6\)

Tumescent local anaesthesia
In tumescent local anaesthesia (TLA) large volumes (100+ ml) of highly diluted local anaesthetics (usually lidocaine buffered with sodium bicarbonate) are injected subdermally with mechanical assistance.\(^12\) In simple cases, it may be used as the sole method of anaesthesia, in more advanced cases, it can be combined with sedation, spinal or general anaesthesia. Because of the necessity of large skin incisions and difficulty in diffusion in indurated, fibrotic tissue, the concentration of lidocaine should be relatively high (0.1%), especially when TLA is used as sole form of anaesthesia. If TLA is used as a complementary agent, the concentration of lidocaine may be as low as 0.04-0.05%. Because the absorption of lidocaine is expected to be relatively high in lesional HS tissue, a maximal dose of 35 mg/kg lidocaine is recommended.\(^13\) The concentration of other components of TLA solution are as usual: adrenaline (1:1-2 millions) and sodium bicarbonate (10-20 ml in 1000 ml 0.9% NaCl). The tumescent solution is injected abundantly with use of a rotation pump, special tubing and long (spinal) needles. Owing to specific properties of TLA, intraoperative and postoperative bleeding is greatly reduced, assuring accurate and safe surgery and minimal blood loss, and the risk of infection is diminished due to antiseptic activity of bicarbonate and the wash away of infectious agents by copious discharge of fluid from the wound. Finally, the post-operative pain is reduced for many hours (Figure 1).\(^14\)
General and spinal anaesthesia

Under general and spinal anaesthesia, large areas can be operated without the limitation of the maximum allowed amount of local anaesthetics. In addition, some patients favour general anaesthesia above local anaesthesia which can be painful and hard to achieve in areas of active inflammation and fibrosis.

Lesion removal techniques

Incision and drainage

The purpose of incision and drainage is pain relief in case of a tense, fluctuating acute abscess. There is only a short term effect as lesions treated by incision and drainage tend to relapse. For drainage, 6- to 8-mm punch biopsies can be used. By digital pressure and rinsing with saline solution the remaining pus is removed.

Deroofing

The deroofing technique was first described by Mullins and colleagues in 1959. In the 1980s, the technique was modified by preservation of the exposed lesion floor. Presently, there is a tendency to remove keratinous debris and viable epithelial remnants on the floor because these substances could cause relapses when left present. Deroofing is the primary surgical therapy for persisting nodules or sinus tracts in HS Hurley stage I/II. The procedure starts with identification of the HS lesions to be deroofed by physical examination. Local anaesthesia is performed as described earlier. Next, a blunt probe is used to identify sinus-openings. After introduction, the probe is placed at different angels in search of connecting fistulas. The probe should be inserted into the fistula without resistance. If force is applied, false tracts can be created with the probe. The sinus roof is removed using electrosurgical dissection with a wire loop tip coupled to an electrosurgical generator (Figure 2). The probe is used as a guide, leaving the epithelial bottom of the sinus tract intact. The margins must be probed again for residual communicating sinus tracts. The jellylike material on the floor of the sinus tract needs to be removed superficially with the wire loop tip. The defects are left open for healing by secondary intention.
Skin-tissue-saving excision with electrosurgical peeling

This surgical technique for HS was described by Blok et al.: the ‘skin-tissue-saving excision with electrosurgical peeling’ (STEEP) procedure. STEEP seems to be a promising alternative to wide excision in extensive disease because it saves healthy tissue to a maximum and achieves complete removal of lesional tissue (Figure 3). The idea is that tissue sparing leads to quick wound healing, good cosmetic results and low risk of contractures. Recurrence rates seem similar to wide excision as both techniques are aimed at complete removal of lesional and fibrotic tissue. STEEP is performed mostly under general anaesthesia. Preoperatively, the operation field is palpated and sinus tracts are probed to get an impression about the extent of the disease. Next, the sinus roofs are incised electrosurgically with a wire loop tip coupled to an electrosurgical generator. Subsequently, successive tangential excisions are made until the epithelialised floor of the sinus tract is reached. Tangential peeling off affected tissue is continued until the area is clear of lesional tissue and fibrosis. Thereafter, the wound edges are checked with a probe for remaining sinus tracts. During and after the procedure, haemostasis is achieved by using the coagulation mode of the Erbotoom. Finally, the margins of the wound can be injected with triamcinolonacetonide 10-20 mg to prevent hypergranulation and bupivacaine 0.5% (10 ml) for postoperative analgesia. The defects are left open for healing by secondary intention (Figure 4).
Figure 3:

A. Wide excision: red dotted line represents the cutting plane. Healthy skin and subcutis are removed.

B. The STEEP procedure: nodules and scar tissue are identified by palpation, sinus tracts are localized by a probe. Diseased tissue is removed by means of tangential transections (red dashed lines). The defect is smaller compared to wide excision.


Figure 4: Cosmetic result of STEEP. 1 (a-c): axilla, 47-year-old male, Hurley stage II; 2 (a-c): groin, 46-year-old male, Hurley stage II; 3 (a-c): axilla, 49-year-old female, Hurley stage III
Excision

Excision is aimed at complete removal of lesions. The extent of pathologic lesions should be determined by observation in bright illumination and palpation showing the leakage of pus after compression. Furthermore symptoms reported by the patient should be taken into consideration, like localized pain and drainage.

Different surgical approaches are used with varying degrees of invasiveness. In limited local excision, each separate lesion is excised with a certain margin of healthy tissue. In wide excision, an area embracing all lesions is removed. In radical excision, an entire area of a body region in which the disease may presumable spread is excised. For all three techniques, often a lateral margin of 1 cm is proposed. However in small lesions, to ensure complete removal, a sparse margin may be sufficient. There is no consensus about whether partial or complete removal of the subcutaneous fat should be achieved. It is advised to adjust the excision to the extent and severity of the disease, as well as to the dynamics of its development. Particularly at depth, in proximity of big neurovascular bundles in axillary and inguinal regions, as well as around the rectum, overzealous excisions should be avoided.

The complications of such interventions may cause more morbidity than the disease itself (Figure 5). That is why recommendation for curettage of any remaining walls of sinuses is given, instead of thorough excision in these cases (Figure 6).

Figure 5: HS invading the deep tissues of the axillary area. Here during excision the weakened axillary artery was accidentally damaged, which required further suturing and coverage with skin-fascial flap.
Figure 6: Deep sinuses entering the perirectal space, accompanying advanced infiltrations of HS located on buttocks. These were opened and curetted, instead of thorough excision. This leaded to good healing, with no persistent discharge and fistulas.

Wound closure techniques

Primary closure

Sutures

Simple sutures may be recommended in small defects surrounded by loose skin. Undermining as well as suturing under high tension should be avoided, because of risk of healing disturbances. This option usually ensures fast healing with good cosmetic and functional results (Figure 7). It is advisable to close the wound rather loosely, what enables the outflow of exudate and limits risk of infection.

Figure 7: Small abscesses and fistulas of the axillary area, planned for spindle shaped excision (left). The defect after spindle excision was sutured loosely with subepidermal stitches (right).
Split-thickness skin grafts

Split-thickness skin grafts, usually meshed, are used typically in large wounds.\textsuperscript{23,24} Grafts of 0.6-0.8mm thickness are harvested from the thighs or buttocks with use of dermatomes, and then they are expanded in a ratio of 3:1 by multiple incisions in the mesh graft device. Grafts allow for closure of even the largest wounds with minimal risk of serious complications. Despite evident differences of colour and texture with surrounding skin, they ensure acceptable functional and aesthetic results, especially in armpits and buttocks (Figure 8). Traditionally, skin grafts were put on granulation tissue, after longer period of wound conditioning. Owing to good haemostatic properties, TLA grafting can also be performed in one procedure, directly after excision. Only on genital and inguinal regions is skin grafting made on previously granulated wound bed because of high risk of infection. Morgan and colleagues\textsuperscript{25} compared split skin grafting and secondary intention healing (SIH) in 10 patients undergoing bilateral excision for axillary HS. In each patient, one axilla was grafted and the other was allowed for SIH utilising Silastic foam dressing. Split skin grafting had a shorter time to wound closure than SIH. However, a majority of patients preferred SIH because of the comfort during healing, limb freedom and lack of a painful donor site. Additionally, SIH leads to good cosmetic results, whereas skin grafting often gives a patchwork appearance with a persistent depression at the site of excision.\textsuperscript{26}

![Figure 8: Wide infiltrations of HS in gluteal areas, planned for surgical treatment (left). Directly after excision of the pathologic lesions, wound was covered by meshed split thickness skin grafts (middle). The acceptable scars 1.5 months after the operation (the red-bluish color subsided later) (right).]

Flaps

Reconstruction with use of flaps may ensure the best quality of skin, owing to thick tissue coverage. Nevertheless, in larger wounds, flaps are difficult or impossible to use. In comparison with grafts, their harvesting is more difficult, more invasive and subject to risk of serious complications like flap necrosis and haemorrhage. In contrast, this approach is mandatory for coverage of important anatomic structures, like exposed neurovascular bundles. The many forms of flaps that are described in the treatment of HS by a number of authors are shown in Table 1. The genital area in women is specifically suitable for the use of flap techniques. The use of pubic-lower abdominal flaps (modified abdominoplasty), obtained during the procedure similar to abdominoplasty, results in accelerated healing and minimized deformations of
the vulva and groin (Figure 9).\textsuperscript{27,28} Because of the risk of ischemia of distant portion of those flaps, careful undermining and thinning of the tissues is advised. In inguinal areas the thigh advancement flaps, resembling the ‘medial thigh lift technique’ are successfully utilized (Figure 10).\textsuperscript{29} In axillary areas they were used exclusively for coverage of exposed big vessels (in the form of fascio-cutaneous random pattern transposition flaps). Apart from that, the use of flaps in HS operations should be limited. Flaps are definitive by their nature and therefore may be not appropriate to this medical condition with significant risk of progression. In addition, in HS there is often an underestimating of the defect size preoperatively. Therefore, the proposed flap can be too small.

<table>
<thead>
<tr>
<th>Lipocutaneous</th>
<th>Fasciocutaneous</th>
<th>Musculocutaneous</th>
<th>Free</th>
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<tr>
<td>Axillary</td>
<td>Transposition flap of Limberg\textsuperscript{30}</td>
<td>Double opposing V-Y perforated based flap\textsuperscript{31} Transpositional flap\textsuperscript{32} Lateral thoracic island flap\textsuperscript{33} Limberg transposition flap\textsuperscript{34} Thoracodorsal artery perforator V-Ymusculocutaneous advancement flap\textsuperscript{35}</td>
<td>Latissimus dorsi island flap\textsuperscript{36}</td>
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<tr>
<td>Groin, perineal, perianal</td>
<td>Modified Abdominoplasty\textsuperscript{27} Medial thigh lift\textsuperscript{29}</td>
<td>Bilateral pedicled anterolateral thigh (ALT) flap\textsuperscript{38}</td>
<td>Pedicled gracilis myocutaneous flap\textsuperscript{39}</td>
</tr>
<tr>
<td>Gluteal</td>
<td>Island V-Y advancement flap, rotation V-Y advancement flap and bilobed flap\textsuperscript{40}. Superior and inferior gluteal artery perforator flaps\textsuperscript{41}</td>
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Table 1: Overview of different types of flaps used in HS surgery

Figure 9: HS of the genital regions (pubic mound, labia majora, inguinal regions), planned for excision and subsequent coverage with ‘pubic- lower abdominal’ flaps (left). The defect directly after coverage with lower abdominal advancement flaps (right).
Figure 10: HS of the genital regions (inguinal and labia majora), planned for excision and coverage with ‘medial thigh lift’ flaps (left). The defect was covered with skin-subcutaneous ‘medial thigh advancement flaps’ (right).

Healing by secondary intention
Secondary intention healing (SIH) may be successful in defects up to 140 cm² (Figure 4, 11).²⁻⁴² SIH occurs along with the natural processes of granulation, wound shrinkage and epithelisation. This approach is typically utilized in the anogenital region, trunk and axillary area.²⁸ SIH ensures usually good functional and cosmetic results (Figure 4, 11). Moreover, the final scar has considerably reduced dimensions in comparison with the initial defect.²⁵ This approach is usually well-tolerated by patients owing to the minimal number of wounds (absence of donor sites) and amazingly unproblematic course of healing (except for the first difficult days).²⁵,²⁸,⁴³ Its major drawbacks are long healing duration (mean 6 - 12 weeks), the risk of unsightly scars in extensive defects, and the development of contractures over flexion areas. Of note, the most important factor responsible for healing period is the size of the wound. The localization was not of relevant.⁴³

Figure 11: HS of axillary area, planned for surgical treatment (left). The scar 3 months after completing secondary intention healing (SIH). Its size is much smaller than the primary defect (right).
**Combined reconstructions**

By using different techniques simultaneously, the benefits of the individual techniques can be combined. For example, wounds can be partially sutured while leaving its remaining portion for secondary healing. Such an approach was used many times in a closure technique called ‘star-like technique’: the pathological areas of axillary area are excised, five equilateral triangles adjacent to the defect are cut off and resulting defects are sutured (Figure 12). The wound area is hereby diminished by 50-80% and resulting in accelerated healing assessed as 6-8 weeks. Sutures in combination with skin grafting or partial flap reconstructions with SIH can also give good results.

![Figure 12: HS of the axillary area planned for excision with 5 adjacent triangles, according to 'starlike technique' (left). The wound was considerably reduced by approximating the edges of the triangles (middle). The final aesthetic scar 1 year after the operation (right).](image)

**COMPLICATIONS AFTER SURGERY**

Brachial plexus damage and thrombosis are the earliest complications, occurring instantly. Surgical repair of brachial plexus nerves should take place within three to six months after the injury. The treatment of thrombosis of brachial veins comprises anticoagulant therapy and compression. In case of haemorrhage, another early complication, the wound should be pressed for 30 minutes. If bleeding continues after 30 min, the haemorrhage site must be located. Small bleeders can be coagulated, whereas large vessels require ligation. If a wound infection occurs, usually after a few days, a choice should be made between prescribing local or systemic antibiotics.

Late complications can also occur. In major dehiscence, the wounds require resuturing. However, most dehiscence can be treated conservatively by allowing the wound to heal by granulation and contraction. Here, it is important to ensure the prevention of infections. Small seromas do not require therapy, whereas large collections should be drained. Debridement may be necessary for necrosis of grafts or flaps. Hypergranulation can be treated with a potent steroid twice daily for five days or just can be removed by curettage. Triamcinoloneacetonide 10 mg/mL can be injected three to five times with intervals of four weeks in hypertrophic scars or keloid. Serious therapeutic problems may arise from the presence of severe contractures,
accompanying axillary HS. In such interventions, despite the usual excision of affected tissue, it is necessary to release the cicatricial contractures (Figure 13). This release is usually done by transection of fibrotic strands adjacent to walls of fistulas and sinuses, with concomitant redression of the shoulder joint. If contracture persists for a long time, the complete correction is very difficult. The contractures can also be corrected using a ‘Z’ plasty or skin grafts. The comorbidities and complications of HS are discussed in another paper of this issue.44

Figure 13: Chronic HS in axillary location causing significant contracture. The hardened, fibrotic strands must be transected, and contracture released.

POST PROCEDURAL CARE
In deroofing and STEEP postoperative care consists of twice daily irrigation followed by alginate and silicone dressings.6,20 The large wounds left for SIH could be covered using thick absorbing dressings made of gauze soaked in mixture of petroleum jelly and liquid paraffin (1 : 1). They are usually removed after 48–72 hours and then replaced with new ones every two days during the first week and later on once a day. In the first week, wounds are managed in sterile conditions – rinsed with use of water disinfecting solution (e.g. povidone iodine, boric acid, octenidine, etc.). In the following weeks, wounds should be carefully washed with tap water and disinfectant liquid soap, rinsed with octenidine or 3% hydrogen peroxide, dried, smeared with petroleum jelly, and covered with absorbing gauze. Oral antibiotics should be not administered routinely. In the first post-operative week, it is usually necessary to administer oral pain medications to HS sufferers.43

After skin grafting, negative pressure dressings can be used. These dressing can increase oxygen levels in the wound, decrease the growth of bacteria, improve granulation and keep the graft in place in curved areas. A 95% of graft take was seen after using negative pressure dressings.45,46
REHABILITATION AND RECOVERY

In many cases multistaged, prolonged surgical treatment is needed. That is why optimal therapy requires the participation of family physician and public health nurses, as well as assistance and acceptance from the family. Lifestyle measures include losing weight in case of obesity and discontinuing smoking. To prevent cicatricial contractures, it is advisable to introduce physical therapy and physiotherapy subsequent to surgery. Depending on the size of the operation, the time until full recovery to pre-operative activity ranges between 4 and 10 weeks.\textsuperscript{42,47}

OUTCOMES AND CLINICAL RESULTS IN THE LITERATURE

The results of important outcomes of deroofing, STEEP and excision are summarized in Table 2.

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<tr>
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<th>Deroofing</th>
<th>STEEP</th>
<th>Excision</th>
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<tr>
<td>Indication</td>
<td>Hurley I/II</td>
<td>Hurley II/III</td>
<td>Hurley II/III</td>
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<tr>
<td>Relapse*</td>
<td>4-17%</td>
<td>3.7%-29%</td>
<td>27-42.8%</td>
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<td><strong>Patient reported outcomes</strong></td>
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<tr>
<td>Satisfaction rate</td>
<td>8</td>
<td>8</td>
<td>-</td>
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<tr>
<td>Recommendation of the treatment to other people</td>
<td>90%</td>
<td>100%</td>
<td>89.5%</td>
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<tr>
<td>Willingness to undergo further surgery</td>
<td>-</td>
<td>-</td>
<td>84%</td>
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<tr>
<td><strong>Complications</strong></td>
<td>Postoperative bleeding (1.1%)</td>
<td>Hypergranulation (mild) (62.4 %)</td>
<td>Wound dehiscence (3.5%)</td>
</tr>
<tr>
<td></td>
<td>Postoperative bleeding (1.9%)</td>
<td>Postoperative bleeding (7%)</td>
<td></td>
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<tr>
<td></td>
<td>Infections (1.9%)</td>
<td>Infections (10.9%)</td>
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<tr>
<td></td>
<td>Contractures (0.6%)</td>
<td>Contractures (7%)</td>
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<tr>
<td></td>
<td>Excessive pain (1%)</td>
<td>Excessive pain (32.7%)</td>
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<td></td>
<td>Nerve irritation (1%)</td>
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Table 2: Overview of outcomes of different type of techniques used in HS surgery; *: % of total operations. **: % of patients.

Deroofing

From 2003-2007, van der Zee et al.\textsuperscript{6} treated 44 Hurley I and II HS patients with the deroofing technique. The mean time to wound closure was 14 days at a mean defect length of 3 cm. 15 (17%) experienced a relapse after a median of 4.6 months.\textsuperscript{6} A lower relapse rate of 4% during a follow-up period of ten years was reported by Boer et al.\textsuperscript{48} Van der Zee et al.\textsuperscript{6} described one complication in the form of postoperative bleeding, no infections or impairment of movement caused by postoperative scarring were seen. The median satisfaction rate was eight, and 90% of the patients would recommend the technique to other patients.
STEEP
In a prospective case series the mean time to complete wound healing was 53 days with a median defect size of 15 cm². The size of the wound and the Hurley stage were independent predictors for wound healing. A retrospective analysis on 363 deroofings and STEEPs under general anesthesia showed 34% natural progression and 29% relapses due to irradical surgery. The relapse rate was much lower in the prospective case series in which only one of the 27 operations sites relapsed. Hypergranulation is the most common complication. The hypergranulation is usually mild with good reaction to topical treatment with superpotent topical steroids. Wound infections, nerve irritation, post operative bleeding and stricture formation are seen very rarely. With a functional outcome of 8.7, a cosmetic outcome of 7.2 and 100% of the patients that would recommend STEEP to others, patients are generally satisfied with the STEEP procedure (Figure 4).

Excision
The relapse rate depends on the margin of the excision. After limited excision, the relapse rate is 42.8% with a disease free interval of 11 months. Wide excision has a relapse of 27% after 20 months. The time to wound closure after excision is 6.6 weeks (range 2–12 weeks) with a mean size of the wounds of 40.6 cm². Bieniek et al. performed 229 operations among 182 patients. During the one-year follow-up period complete recovery was observed in 60% of the patients. 31.5% had new but less severe lesions in an adjacent area or at the site of the surgical intervention and 8.5% of the patients showed no improvement. The nature and frequency of complications were similar to those described by others with 7% postoperative bleeding, 10.9% infections, 7% contractures, 32.7% excessive pain and 3.5% wound dehiscence. Overall, 84-89.5% of patients declared willingness to undergo further surgery in case of disease recurrence, and to recommend it to other patients, whereas about 9% would not choose the surgery again.

Wound closure techniques
It is believed that the relapse rate is primarily determined by the radicality of the excision and not by the wound closure technique. Conversely, the relapse rate after primary closure was found to be much higher (54%) than the rates of split-thickness skin grafting (13%) or local flaps (19%). In SIH the relapse rate is low. SIH is preferred by patients over skin grafting because of shorter hospital stay and sick leave, less limitation of mobility after surgery, and better cosmetic results.

Other factors influencing the risk of relapse
Women are at higher risk of relapses than men. Also, the location of HS influences the relapse rates. Inguinal, genital and submammary HS relapses more frequently than axillary and perianal HS.
CONCLUSIONS
Surgical treatment in HS should be carried out by dermatosurgeons who have thorough knowledge on the pathology of the disease and excellent surgical skills. At least in more severe stages of HS, surgery should be introduced early after setting the diagnosis. Because the great impairment of quality of life in HS, patients are often highly motivated to change their condition by means of surgery. Preoperatively, medical treatment to calm active inflammation and imaging must be considered. Depending on the extent and severity of the disease local, tumescent, spinal and/or general anaesthesia are used. Incision and drainage can relieve pain in a setting of a tense, acute abscess. Deroofing is the primary surgical therapy for Hurley stage I/II. Until recently, wide excision was regarded as the preferred surgical method for Hurley stage II/III. The STEEP procedure seems to be a promising alternative to wide excision because it saves healthy tissue to a maximum and achieves complete removal of lesional tissue. After wide excision, different wound closure techniques can be chosen. Simple sutures can be used in small defects surrounded by loose skin. Split thickness skin grafts are employed typically in large wounds. Especially in genital and inguinal areas, flaps can be used successfully. However, the use of flap reconstruction, which is definitive by its nature, may not be appropriate to this disease with significant risk of progression. SIH ensures usually good functional and cosmetic results in defects up to 140 cm². By using different techniques simultaneously, the benefits of the individual techniques can be combined.
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