REVIEW ARTICLE

Lichen Sclerosus—Presentation, Diagnosis and Management

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SUMMARY

Background: Lichen sclerosus is a chronic inflammatory skin disease. It is thought to be underdiagnosed and undertreated. If it is not treated, lichen sclerosus is associated with a greater degree of scarring and an elevated risk of cancer in the genital area.

Methods: This review is based on pertinent articles published up to October 2015 that were retrieved by a selective search in PubMed, Embase, and the Cochrane Library and on the European S3 guideline for lichen sclerosus.

Results: Lichen sclerosus is mainly found in the anogenital area but can also be generalized. Extragenital involvement is reportedly present in 6% to 20% of patients. Neighboring mucous membranes, such as the vaginal or oral mucosa, are not typically affected. The disease is more common in women than in men, and occurs more often in adults than in children. About 10% of patients have other family members with the same condition. Anogenital lichen sclerosus often causes itching and pain. Functional impairment due to fissures and scars can arise over the course of the condition. The treatment of first choice is the local application of high-potency corticosteroids as early as possible (1/A). For boys and men in whom the condition does not remit after steroid treatment, circumcision is indicated (3/D).

Conclusion: Anogenital itching and clinical features such as erythema, white skin changes (such as hyperkeratosis and sclerosis), and fissures should arouse suspicion of lichen sclerosus. The diagnosis should be confirmed with a skin biopsy, and early, thorough treatment should be initiated. In this way, a mutilating disease course can be averted, and the risk of cancer can be lessened.

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It is unclear whether patients with anogenital complaints in Germany consult their family physician first or go directly to a specialist, e.g., a gynecologist, a urologist or a dermatologist. AOK data (Allgemeine Ortskrankenkassen, a large general statutory health insurance company) from Baden–Württemberg (AOK-BW) illustrate that in 2014 gynecologists encoded 69% of diagnosed lichen sclerosus (ICD-10 code L90.0) cases, dermatologists 14%, general practitioners 12%, and urologists 5% (AOK-BW data upon request). Little is reported about lichen sclerosus in primary care; referring to general practitioners in particular. Occasionally it is mentioned as a differential diagnosis of itch (1). This suggests that little attention is paid to lichen sclerosus in primary care. AOK-BW data indicate furthermore that the disease is underdiagnosed and hence probably undertreated in Germany. Consequences thereof could not yet be evaluated. It is unclear, for example, whether treatment only mitigates symptoms or influences the course of the disease decisively. A recently published study shows that early, consistent treatment ameliorates the course of lichen sclerosus and significantly reduces the known risk of malignant evolution in the genital area.

Epidemiology

Lichen sclerosus occurs at all ages and in both sexes. The male-to-female ratio varies between 1:3 and 1:10. Only rarely is an equal distribution observed (3). Lichen sclerosus is predominantly diagnosed in older (postmenopausal) women (2–4), though the disease already occurs in about 50% of affected women prior to menopause. The delay in diagnosis is reported to be around 5 years (e1, e2). The exact prevalence is unknown. It is estimated at 0.1% for children and 3% for women over 80 years old (nursing home population) (3–6, e2–e4). 88% of these women were immobile and 86% incontinent. According to the WiDO (Research Institute of the AOK; Wissenschaftliches Institut der AOK) database of AOK in Baden–Württemberg, approximately 0.15% of policyholders were diagnosed with lichen sclerosus (L90.0) in 2014 and, by comparison, 1.9% were diagnosed with psoriasis (prevalence according to literature around 2.5%). AOK-BW records a prevalence of lichen sclerosus of 0.29% in women over 80 years of age. These data on lichen sclerosus are thereby lower than prevalence data cited in other publications and suggest that the disease is undertreated.

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BOX 1

Clinical characteristics and symptoms of lichen sclerosis

- **Clinical characteristics**
 - Pale, ivory colored lesions, partially atrophic skin (crinkling or cellophane paper-type appearance)
 - "Figure-of-eight" distribution around vulva and anus
 - Purpura/ecchymosis (localized hemorrhage of the skin)
 - Hyperkeratosis (whitish, thickened lesions)
 - Sclerosis (whitish-yellowish indurated skin)
 - Fissures (lacerations)
 - Ulcerations/erosions
 - Blisters (rare)
 - Varying degree of scarring
 - Follicular plugging in the case of extragenital lichen sclerosis (follicular keratin clots)
- **Symptoms of anogenital lichen sclerosis**
 - Itch (primarily in the female anogenital area)
 - Pain/sensation of soreness
 - Fragility of skin
 - Dyspareunia/apareunia
 - Impeded urinary flow
 - Obstipation (often with children)

Etiology/pathogenesis

The cause of lichen sclerosis is unknown. Presumably there is a genetic predisposition. Approximately 10% of patients with lichen sclerosis have relatives with the same disease (7), potentially the percentage is much higher (8). Immunological changes on the level of T and B cells have been described. Thus an autoimmune phenotype has been observed in the case of vulvar lichen sclerosis involving increased levels of Th1-specific cytokines, dense T cell infiltration and enhanced BIC/miR-155 expression as well as autoantibodies against extracellular matrix protein 1 and BP180 antigen (e5–e7). The pathogenetic relevance of these observations is unclear. Oxidative DNA damage and TP53 mutations (tumor suppressor gene) have also been described. This could indicate an autoimmune background of lichen sclerosis and play a role in the slightly increased risk of vulval carcinoma (9).

Reasons for counselling

The typical lichen sclerosis patient is a woman of roughly 50 years of age with external genital itch (1, 10). The urge to scratch is very strong. When asked explicitly, pain during sexual intercourse is often described. Men are affected less frequently by lichen sclerosis. When affected they complain less of pruritus, but more of erectile dysfunction due to increasing phimosis and pain (11). Lichen sclerosis is less common in children. Boys typically complain of a

narrowing of the foreskin, possibly accompanied by sclerosis. This phenomenon has to be differentiated from physiological phimosis that generally regresses by puberty (12, 13). Girls typically suffer from anogenital itching and possibly from constipation and painful defecation (14).

Clinical features and symptoms

Whitish patches and nodules (hyperkeratosis and sclerosis) that can coalesce into bigger areas (plaques) are typically found in the anogenital region (*Box 1, Figure a*) (3, 4, e8, e9). Extragenital lichen sclerosis is less common—data vary between 6 to 20% (4, e10, e11)—and can be found often on the torso, e.g., in the submammary area. Extragenital lichen sclerosis is usually asymptomatic and is not associated with an increased risk of malignant transformation.

In the anogenital area, at first only a slight redness may be seen. White hyperkeratosis, atrophic skin, lacerations and ecchymosis typically occur later in the course of disease. Scarring in the area of the clitoris and the labia minora may develop and possibly lead to complete burying of the clitoris (*Figure b*), a narrow vaginal introitus resulting in dyspareunia (pain during sexual intercourse) or also perianal stenosis and painful defecation. Men may develop sclerosis and narrowing of the foreskin resulting in erectile dysfunction. Lichen sclerosis may be limited to the glans penis and prepuce or affect the penile shaft and scrotum. As a complication the meatus and urethra can also be affected potentially leading to urethral stenosis. Especially in children lichen sclerosis may manifest itself initially as slight redness followed by depigmentation of the skin. Sometimes it is difficult to distinguish this feature from vitiligo or eczema. Accompanying fissures, itch, and constipation in cases of perianal involvement are key diagnostic features. Itching and pain are frequently described, whereby asymptomatic courses of disease exist (minimally 10%) (2, 4, e3, e8). If an itch persists, at the latest when whitish discolorations of the skin appears, lichen sclerosis has to be considered.

The development of indurated plaques or nodes and ulcers that do not heal indicate malignant transformation. Prompt clarification by means of a biopsy is imperative (2, 4).

Histological characteristics

A typical whitish alteration of healthy-appearing skin should be biopsied, not ulcerations or fissures (5 mm punch biopsy). Only older lesions usually exhibit typical characteristics of lichen sclerosis, early lesions may be unspecific (15).

Diagnostic procedures

For the experienced examiner the clinical picture is often diagnostic and histological evidence is not mandatory. Whitish alterations of the skin in the anogenital area paired with itching point to lichen sclerosis. When the clinical picture is unclear or the physician is not familiar with the disease, a biopsy from a typical lesion

Figure

a) White nodules and plaques (hyperkeratosis or sclerosis) in the interlabial sulcus (1), labia minora (2), perineal (3) and perianal (4)

b) Atrophy and sclerosis of the skin in the interlabial sulcus (1), adhesion of the labia minora above the clitoris (partially buried) (2), ecchymosis of the right labium minus (3)

should be performed. This should be done prior to treatment with topical corticosteroids or if necessary after four weeks of therapy interruption. Some specialists postulate that a biopsy should be taken in each case to confirm the clinical diagnosis (2).

A biopsy is usually taken under local anesthesia and is generally well tolerated. Children are an exception. A biopsy is usually not performed, because in the anogenital area this can be a very traumatic experience. In cases of uncertainty an expert who is familiar with the disease (dermatologist, gynecologist, urologist, pediatric surgeon) should be consulted.

When the clinical and histological findings differ, repeated examinations must be performed: e.g., a repeat biopsy to ensure the diagnosis.

The *Table* describes differential diagnoses of lichen sclerosus. Prolonged, unspecific treatment, e.g., for supposed candidiasis ought to be avoided. Vitiligo can exist parallel to lichen sclerosus, but can also initially represent a differential diagnosis—especially in children.

Risk factors

Hormones

The higher incidence of lichen sclerosus in postmenopausal women suggests that the hormonal status may be of pathogenetic relevance. In case-control studies, free testosterone and androstenediones were decreased in women with lichen sclerosus. A loss of androgen receptors in lesions caused by lichen sclerosus was demonstrated (16, 17). It is assumed that androgen dependent functions of the vulva are altered under the influence of lichen sclerosus. These functions are also influenced by oral contraceptives with antiandrogenetic properties. A case-control study (questionnaire survey) showed that contraception with progesterone alone (odds ratio [OR] = 0.19; $p = 0.045$) is negatively correlated with lichen sclerosus. The same applies to estrogen substitution therapy (OR = 0.209; $p = 0.025$) (7).

Trauma

It is assumed that trauma plays a significant role as trigger in the development of lichen sclerosus. Such traumas include scratching, friction (e.g., caused by tight clothing), occlusion, surgical procedures or sexual abuse during childhood (7, 11, 19–22). The Köbner phenomenon describes the development of disease specific skin alterations at the site of trauma. This is described, for example, in psoriasis and also extragenital lichen sclerosus (18, 19).

Infections

There is no compelling indication of an infectious trigger of lichen sclerosus. There is in particular no indication of an association of *Borrelia burgdorferi* or HPV (human papilloma virus) infections with lichen sclerosus. Sporadically there are reports about hepatitis C or local infections (vulvitis/urethritis) that may be pathogenetically relevant (3).

Drugs

There are occasional reports that associate lichen sclerosus with medication intake (23–25).

Associated diseases

A number of diseases are described to occur more frequently in patients with lichen sclerosus. Some study results diverge, which may be due to different study cohorts (3, 4, 26–29). Twenty to thirty percent of women with lichen sclerosus are reported to have autoimmune diseases (*Box 2*).

Treatment

Specific treatment

The recommended initial treatment of lichen sclerosus is a three-month application of potent to ultrapotent topical corticosteroids (level of evidence 1+grade of recommendation A) (3, e12) (*eTable 1*, *eTable 2*).

TABLE

Differential diagnoses of lichen sclerosis

Differential diagnosis	Clinical features	Main symptoms	Diagnostics
Lichen planus, erosive/mucosal form	– Erosions of the vaginal introitus – Reticulated hyperkeratosis at the edge of the lesion (Wickham striae)	Pain > itch	– Biopsy – Indications of lichen planus on/in other areas of the body (mouth, scalp, vagina)?
Vitiligo	– Clearly defined depigmentation – No alteration of skin texture	No symptoms	– Black light – Indications of vitiligo on/in other parts of the body? – Biopsy
Eczema	– Erythema +/- scaling – Lichenification	Itch	– Medical history – Biopsy
Psoriasis	– Erythema +/- scaling – Fissures	Mild itch	– Indications of psoriasis on/in other parts of the body? – Family history – Biopsy
Autoimmune blistering dermatosis	– Erosions or blisters	Pain	– Biopsy/immunofluorescence – Indications of blisters on/in other parts of the body?
Candida infection	– Reddening	Itch	– Mycological examination

Randomized studies show that application of potent to ultrapotent topical corticosteroids significantly improves lichen sclerosis in 75 to 90% of patients, compared to roughly 10% in placebo groups (3, e12). Generally, a fingertip-unit (0.5 g) of ointment is applied once a day, see Box 3. The current S3 guideline describes in detail the different treatment options for women, men and children with genital and extragenital lichen sclerosis (3).

If the initial three-month treatment with topical steroids does not lead to the desired full remission in male patients with genital lichen sclerosis, a complete circumcision should be recommended, especially in uncomplicated cases in early stages (without involvement of meatus and urethra) (level of evidence 3/grade of recommendation D) (10). This procedure is reported to lead to permanent, lifelong remission (recovery) in 90 to 100% of cases.

For many patients, especially for women and girls, a long-term treatment lasting for years or even decades is reasonable (often necessary), even if there are few complaints. It has been shown that individually adapted long-term treatment with corticosteroid applications, e.g. twice a week, resulted in the suppression of symptoms in 93.3% of compliant patients versus 58% of partially compliant patients and prevention of scarring (adhesions/scarring occurred in 3.4% of compliant patients versus 40% of partially compliant patients) in female patients evaluated after an average follow-up time of 4.7 years (range, 2.0 to 6.8 years) (women: level of evidence 1+/grade of recommendation A; men and girls 3/D; boys 2+ to 1+/B) (2, 30). In other words, once lichen sclerosis is in remission after initial treatment, individually adjusted long-term treatment with a potent corticosteroid ointment is indicated. An application once or twice a week is often sufficient to suppress symptoms and signs permanently. The frequency of application may even be reduced

further in some patients. Others by contrast need more frequent steroid applications. One has to pay more attention to steroid side effects (such as thinning of the skin, an initial reddening is indicative) in children than in adults due to their thinner skin. 30 g of an ultrapotent steroid ointment (e.g., clobetasol propionate 0.05%) is usually sufficient to treat genital lichen sclerosis in adults for at least three months. For children this has not been investigated, though the dosage ought to be considerably lower. Because of its lower potential for side effects, mometasone furoate is possibly more appropriate for children than clobetasol propionate, whereby hardly any side effects are to be expected with the latter when administered twice a week on two successive days (31).

Calcineurin inhibitors (tacrolimus and pimecrolimus) are second choice treatment options. The effects are inferior to those of topical corticosteroids (women: level of evidence 1+/grade of recommendation B–A; men 2+/C; boys and girls 3/D) (3).

A follow-up is generally advisable three months after initial treatment; after that, follow-up intervals should be dependent on severity of disease and individual circumstances. Independent of complaints, a follow-up should be made for years every six to twelve months. In case of any alterations or an indication of malignant transformation (patients should be informed and instructed!), follow-ups need to be made in shorter intervals (2).

Treatment with sex hormones—especially with testosterone—is obsolete because it is not more but rather less effective than corticosteroids and has more side effects (women: level of evidence 1+/grade of recommendation A) (3, e12).

Systemic treatment is occasionally indicated in refractory cases. Successful treatment with etretinate (0.5–1 mg/kg body weight [BW]/day) given for 14 to 18 weeks followed by a maintenance dose of 0.26 mg/

BOX 2

Associated diseases

- **In females**
 - Thyroid diseases, 12–16%
 - Vitiligo
 - Inflammatory bowel diseases
 - Alopecia areata
 - Rheumatoid arthritis
 - Pernicious anemia
 - Morphea or localized scleroderma
 - Psoriasis
- **In males**
 - Atopic dermatitis (boys)
 - Diabetes mellitus (men)

kg BW/day was described in two small randomized studies (women/men: level of evidence 1+/grade of recommendation B). Retinoids, such as etretinate, are teratogenic (30% risk) as well as toxic for liver and kidneys. In some cases ciclosporin 3–4 mg/kg[BW]/day was administered for three months or methotrexate 10–15 mg/week for six to eight months (women: level of evidence 3/grade of recommendation D). The spectrum of side effects of ciclosporin, including nephrotoxicity (10–15%) and the increase of blood pressure (15–40%), limits long-term treatment.

Non-specific measures

In addition to therapy with pharmaceuticals, application of emollients several times per day (before/after contact with water or urine), e.g. ointments without fragrances, such as paraffin and Vaseline in equal parts, should be recommended (women: level of evidence 2+ to 3/grade of recommendation D) (30, 32, 33). When cleansing the genital area it is important to use little soap and not to harm the skin by over-washing or using abrasive towels. Special intimate care products for vaginal and vulval care are not recommended. Moist toilet paper should also not be used. It should be pointed out that tight clothing and sports activities that stress the anogenital skin may function as a trigger. Soft bicycle saddles should be recommended.

Course of disease and prognosis

Lichen sclerosis is usually chronic, especially in women and girls. The incidence of spontaneous remission is unknown, in girls it is estimated at 25% (14, e13). Lichen sclerosis is typically a lifelong disease. When lichen sclerosis begins in childhood, permanent remission in puberty cannot be expected with certainty (14, 34). Disease activity appears to be reduced in puberty. However, lichen sclerosis rarely goes into complete remission, but usually causes new complaints in adulthood.

BOX 3

Treatment of lichen sclerosis in short

- **Treatment strategies for genital lichen sclerosis**
 - Initial treatment with potent to ultrapotent corticosteroids for 12 weeks
 - Usually 0.5 g (fingertip) once a day
 - Ointment is preferable to cream
 - Topical calcineurin inhibitors as second line treatment, effective and probably low-risk
- **Surgery for male patients**
 - Circumcision in uncomplicated cases of lichen sclerosis (without involvement of the meatus or urethra) is very effective for men and boys (there are no high quality long-term studies) (level of evidence 3/grade of recommendation D)
 - Surgical intervention in complicated cases of lichen sclerosis (e.g., with urethral involvement) requires the consultation of an experienced surgeon
- **Long-term therapy for genital lichen sclerosis**
 - Skin care products (women: level of evidence 2–3/grade of recommendation D)
 - Silk underwear alleviates discomfort more than cotton underwear (women: level of evidence 2 +/grade of recommendation C)
 - General measures like the avoidance of mechanical irritation (e.g., by using rough paper towels, moistened toilet tissues or hard bicycle saddles)
 - Application of a potent to ultrapotent steroid twice a week leads to permanent remission in many women (women: level of evidence 1 +/grade of recommendation A)
- **Extragenital lichen sclerosis**
 - UVA1 phototherapy for ten weeks (level of evidence 1 +/grade of recommendation B)
 - Potent to ultrapotent topical steroids (level of evidence 3/grade of recommendation D)
 - Tacrolimus ointment 0.1% (level of evidence 3/grade of recommendation D)
 - Systemic steroids/methotrexate (level of evidence 3/grade of recommendation D)

Treatment with potent topical corticosteroids suppresses symptoms such as itching and pain in 75–90% of female patients. Scarring is irreversible. A cohort study on vulvar lichen sclerosis indicates, however, that early and consistent long-term treatment decreases scarring by 36.6% and the development of carcinoma by 4.7% after an observation period of 4.7 years (range, 2.0 to 6.8 years) (2).

In men treatment seems to be more successful (3, 12). After initial steroid treatment for three months or complete circumcision, permanent remission or cure, especially for uncomplicated forms in early stages, may be expected in 90–100% of affected men. Conclusive evidence, however, is lacking. High quality prospective studies to fill in this gap have not yet been conducted (3).

Risk of cancer

Squamous cell carcinomas develop in connection with genital, not extragenital lichen sclerosis. In patients with lichen sclerosis the risk of developing a squamous cell carcinoma in the genital area is slightly increased and is defined with an estimated lifetime risk of approximately 4 to 5% (2–4, e8). This risk seems to be significantly decreased by consistent long-term treatment (2). The pathomechanism of malignant evolution is unknown. Unlike squamous cell carcinoma in the genital area that is associated with human papilloma virus (HPV), oncogenic HPV can typically not be detected in carcinomas associated with lichen sclerosis (35–37). It is assumed that p53 oncogenes, chronic inflammation and oxidative DNA damage are responsible for malignant transformation (7, 38).

Psychosocial effects

Quality of life is decisively affected by lichen sclerosis (11, 39). In daily life anogenital itching is distressing. Patients suffer from embarrassment when they want to speak about the disease or satisfy the insatiable itch. Their social activities are limited since their clothing must be suitably selected (it must not be too tight). Some sports (horseback riding, bicycling) are only feasible to a limited extent because they strain the genital area too much. Pain during sexual intercourse can significantly impact patients' sex lives leading to drastic restriction or complete refrainment from sex (apareunia) (39). Fear of developing a carcinoma is often named. This fear can be allayed by information, proper treatment and follow-ups. Since the frequency of carcinomas is reduced by consistent treatment, regular follow-ups should be made to achieve the highest possible therapy compliance (2).

Early detection of lichen sclerosis, followed by prompt and lasting treatment, as well as patient support and timely intervention when a carcinoma is suspected has to be the aim. It is assumed that lichen sclerosis is underdiagnosed. On the other hand, however, it also happens that harmless diseases such as eczemas in the anogenital area are misdiagnosed as lichen sclerosis—with far-reaching implications.

Conflict of interest statement

Dr. Kirtschig received a fee for a lecture on lichen sclerosis from Dr. August Wolff GmbH & Co.

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KEY MESSAGES

- Lichen sclerosis is a common dermatosis of the anogenital area.
- In 6–20% of patients extragenital areas of the body are also affected.
- The estimated prevalence lies between 0.1% for children and 3% for women over 80 years of age.
- Lichen sclerosis predominantly occurs in adult women, but also in children and men.
- The male-to-female ratio varies between 1:3 and 1:10.
- Familial predisposition has been described. At least 10% of patients with lichen sclerosis have another family member with the same disease.
- The cause of lichen sclerosis is unknown. Local trauma is an important trigger. Hormonal influences such as estrogen deficit seem to play a role.
- Early and consistent treatment with potent topical corticosteroids may decrease complications such as scarring and malignant transformation.

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Supplementary material:
eReferences:

www.aerzteblatt-international.de/ref1916

eTables:

www.aerzteblatt-international.de/16m0337

Supplementary material to:

Lichen Sclerosus—Presentation, Diagnosis and Management

by Gudula Kirtschig

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eTABLE 1

Level of evidence and grade of recommendation (Evaluation of articles according to GRADE: www.gradeworkinggroup.org)

Level of evidence	Type of evidence
1++	– High-quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1+	– Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias
1–	– Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias *
2++	– High-quality systematic reviews of case-control or cohort studies – High-quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal
2+	– Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal
2–	– Case-control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal *
3	– Non-analytical studies (for example, case reports, case series)
4	– Expert opinion, formal consensus
Grade of recommendation	Evidence
A	– At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population, <i>or</i> – A systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results
B	– A body of evidence including studies rated as 2++, directly applicable to the target population and demonstrating overall consistency of results, <i>or</i> – Extrapolated evidence from studies rated as 1++ or 1+
C	– A body of evidence including studies rated as 2+ , directly applicable to the target population and demonstrating overall consistency of results, <i>or</i> – Extrapolated evidence from studies rated as 2++
D	– Evidence level 3 or 4, <i>or</i> – Extrapolated evidence from studies rated as 2+ , <i>or</i> – Formal consensus
D (GPP)	– A good practice point (GPP) is a recommendation for best practice based on the experience of the guideline development group

* Studies with a level of evidence ‘–’ should not be used as a basis for making a recommendation
RCT, randomized controlled trial; NICE, National Institute for Health and Clinical Excellence

eTABLE 2

Therapy recommendations for lichen sclerosus (LS). These are described in more detail in the S3-guideline (3). Studies were evaluated on the basis of the GRADE criteria; notes on levels of evidence and recommendations may be found in eTable 1

Treatment	Women	Girls	Men	Boys
Local treatment/measures				
Steroids	Clobetasol propionate (1+/A): improvement in 75% of patients after 3 months	Clobetasol propionate (3/ D): improvement in 65-100% of patients	Clobetasol propionate (3/D): cure expected in 50% of patients after 3 months	Mometason furoate (1+/2+ B): improvement in 41% of patients after 5 weeks
Steroid injections (intralesional)	In refractory LS: improvement in 80% of patients after Ø 4 injections (1+/B)			Preputioplasty combined with injection (3/D)
Tacrolimus 0.1% or 0.03 %	Remission in 34% of patients after 12 weeks (2+/C)	Tacrolimus 0.03% (3/D): remission in 79% of patients after 10 months	Remission in 36% of patients (2+/C)	After surgery: recurrence in 10% of patients (2/20) (3/D)
Pimecrolimus 1%	Complete remission of symptoms (pruritus) in 70% patients after 3 months (1+/B)	Decrease of itching in the majority of cases; no effect on sclerosis (3/D)	No reports	No reports
Skin care products	Improvement in 10% of patients (2+/3/D)	No reports	No reports	No improvement (3/D)
Silk underwear	Less complaints compared to cotton underwear (2+/C)	No reports	No reports	No reports
UVA1 phototherapy	Partially effective	No reports	No reports	No reports
Systemic treatment				
Retinoids	Effective in 35–85% of patients (1+/B)	No reports	Effective in 35–85% of patients (1+/B)	No reports
Cyclosporine	Effective in individual cases (3/D)	No reports	No reports	No reports
Methotrexate	Effective in individual cases (3/D)	No reports	No reports	No reports
Surgery				
	Only for treatment of complications (carcinoma, dysfunctions) (3/D)	No reports	90–100% cure* after circumcision; Ø follow-up after 5 years, retrospective studies (3/D)	Nearly 100% cure* after complete circumcision between the ages of 1 and 5 in prospective long-term study (3/D)

*Cure = no signs or symptoms of LS after treatment; Ø, on an average