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ARTHROSCOPY AND SPORTS MEDICINE

Osteitis pubis and adductor tendinopathy in athletes: a novel arthroscopic pubic symphysis curettage and adductor reattachment

Sascha Jörg Hopp · Ulf Culemann · Jens Kelm · Tim Pohlemann · Antonius Pizanis

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Abstract
Introduction Various surgical treatment options have been described in athletes with degenerative osteitis pubis who fail to respond to conservative treatment modalities. Although adductor longus tendinopathy often represents an additional pain generator in chronic groin pain associated with osteitis pubis, this has not been acknowledged in the surgical literature, to our knowledge. We present the results of a novel surgical technique for combined degenerative lesions of the pubic symphysis joint and the adjacent adductor longus tendon in a series of athletes with osteitis pubis.
Methods During 2009 and 2010, five competitive non-professional soccer players with considerable groin and pubic pain were referred to our clinic, after conservative therapy over a period of at least 12 months had failed. According to our clinical protocol for patients with groin pain, physical examination, pelvic radiographs and arthrography of the pubic symphysis to detect microlesions of the adjacent adductor longus tendons were performed. The patients diagnosed with degenerative osteitis pubis and concomitant lesion of the adductor longus origin were indicated for surgery. Surgery consisted of resection of the degenerative soft and bone tissue and subsequent reattachment with suture anchors. With regard to stability of the symphysis pubis, a two-portal arthroscopic curettage of the degenerative fibrocartilaginous disc tissue was performed. The patients were followed prospectively at medium term with assessment of general pain level (VAS score) and sport activity with pain (NIPPS score) pre- and postoperatively.
Results All patients recovered to full activity sports after an average period of 14.4 weeks. VAS and NIPPS scores markedly improved and overall satisfaction with the postoperative result was high. One intraoperative bleeding occurred, needing revision surgery. None of the patients developed pubic instability due to pubic symphysis curettage in the sequel.
Conclusions This novel surgical technique combines successfully stability-preserving arthroscopic pubic symphysis curettage with adductor debridement and reattachment in well-selected cases of athletes suffering from degenerative osteitis pubis and concomitant adductor pathology, being refractory to conservative treatment. Diligent preoperative evaluation of the specific pathology will lead to successful outcome.

Keywords Arthroscopy · Pubic symphysis · Osteitis pubis · Curettage · Adductor tendinopathy · Athletes

S. J. Hopp (✉) · T. Pohlemann · A. Pizanis
Department of Trauma-, Hand- and Reconstructive Surgery, University of Saarland, Kirrbergerstrasse 1, 6421 Homburg/Saar, Germany
e-mail: sascha.hopp@uks.eu

U. Culemann
General Hospital AKH Celle, 29223 Celle, Germany

J. Kelm
Orthopedic Surgical Center, 66557 Illingen, Germany

Introduction

"Osteitis pubis" has been described as non-infectious, inflammatory damage to the pubic symphysis and its supporting structures [1, 2].

The incidence in the overall athletic population accounts for 2–5 % of all sports-related injuries [3], and more specifically in up to 18 % of all male soccer players every

year [4]. No reports were found dealing with female athletes involved with osteitis pubis and therefore should be scrutinised carefully. Although there are many non-traumatic causes of groin pain, e.g. urologic, gynaecologic and obstetric ailments [2, 5, 6], most of the authors conclude that in athletes, it is generally regarded as a result of a chronic mechanical overuse of the pelvic stabilising musculoskeletal system with subsequent degeneration of the fibrocartilaginous disc tissue, resulting in anterior pelvic instability in the end-stage [2, 3, 5]. Furthermore, recent radiologic investigations showed that pathologies of the adjacent adductor or rectus tendon enthesis are also implicated in the aetiology of this injury and often coexist [7, 8]. Osteitis pubis is mostly involved in sports associated with sudden changes in direction, stop and go movements or kicking, most frequently practiced in soccer, Australian rules football, rugby, ice hockey or American football and to a lesser degree also in distance running [1, 5, 9].

Though the majority of cases with "osteitis pubis" respond well to conservative programmes of rest, physiotherapy with core muscle strengthening, oral medication or local injection therapy with corticoids, they may often take a considerable period of time to heal [1, 2, 5, 6].

Nevertheless, up to 10 % of all patients do not respond to conservative measures and need surgical treatment [10]. A variety of surgical procedures have been reported in the literature with varying efficacies, such as endoscopic placement of extraperitoneal mesh [11], wedge resection [12], total resection [13], arthrodesis of the pubic symphysis [2] or pubis symphysis curettage as the least violating surgery [6, 14, 15].

To our knowledge, a simultaneous surgical management of concomitant adductor tendinopathy in conjunction with degenerative "osteitis pubis" has not yet been mentioned in literature. Therefore, we present the technique and outcome of a novel surgical treatment for arthroscopic curettage of the pubic symphysis in combination with adductor debridement and reattachment in a series of athletes.

Methods and patients

Clinical findings

Five non-professional competitive soccer players suffered from similar symptoms consisting of persistent pain in the groin and pubic region for a period of at least 12 months (16–24 months).

Before they were referred to our centre, all athletes underwent intensive conservative treatment, including rest, physiotherapy, ultrasound, anti-inflammatory non-steroidal drugs, oral corticosteroids or local injections and a pelvic belt due to suspected pubic instability in one case, but without any benefit to the patients.

At presentation in our clinic, the following diagnostics supported the presence of degenerative "osteitis pubis" and concomitant adductor tendinopathy: on physical examination, the patients indicated localised tenderness on palpation over the symphysis, the adjacent pubic bones and especially over the adductor longus origin, either uni- or bilaterally. Resisted adduction as well as passive abduction was painful in all cases for one or both adductors. There were no clinical signs of inguinal hernia or femoroacetabular impingement.

Plain pelvic radiographs showed typical degenerative signs with marginal irregularity, erosions and subchondral sclerosis of the pubic rami (Fig. 1). Additional alternating single-leg stance X-rays (flamingo-view X-rays) were performed preoperatively to rule out pubic vertical instability.

T2-weighted magnetic resonance imaging (MRI) showed typical features of "osteitis pubis" with pubic bone marrow oedema on one or both sides. Additional lesions most likely comprising a microlesion of the adductor longus tendon were detected in some of the cases (Fig. 2).

According to our institutional preoperative protocol, ambulatory diagnostic and therapeutic anaesthetic and corticoid injection under C-arm imaging guidance into the symphyseal joint was carried out in all athletes. Diagnostic arthrography of the pubic symphysis, as presented by Brennan et al. [16], showed degenerative changes of the joint and a contrast material effusion on the symptomatic side ("secondary cleft sign") either uni- or bilaterally, indicating an injury at the origin of the adductor longus tendon close to the aponeurosis and pubic bone (Fig. 3).

Complete disappearance of the symptoms immediately after the intervention in every one of the five patients was considered to be an appropriate indicator of a combined

Fig. 1 Standing pelvic X-ray of a 24-year-old male football player showing degenerative changes of the pubic symphysis with irregularity, mild sclerosis of the pubic margins and discrete widening of the symphyseal cleft

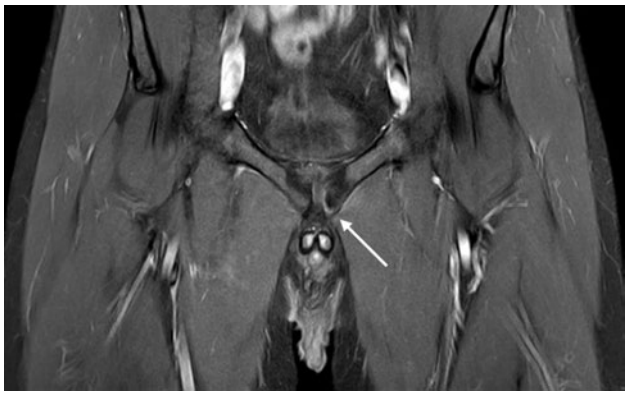

Fig. 2 T2-weighted coronal MRI scan of the pelvis shows typical "secondary cleft sign" on the left (*white arrow*), reflecting an avulsion injury of the adductor longus tendon

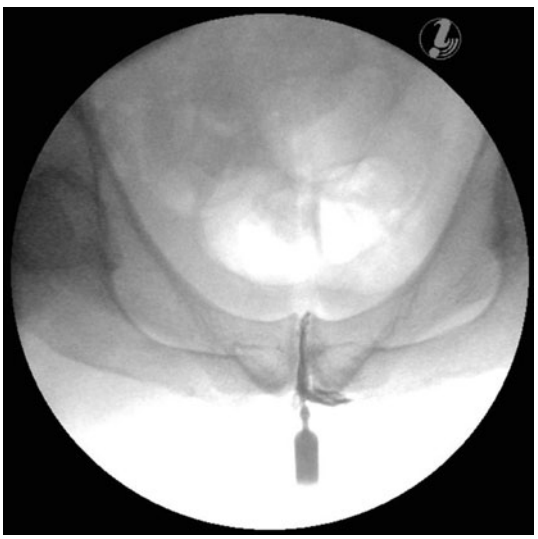

Fig. 3 Arthrography of the pubic symphysis with pathologic effusion of contrast material on the left side into the adductor compartment ("secondary cleft sign")

lesion of the pubic symphysis and a concomitant defect of the adductor longus tendon origin. The patients were indicated for surgery, when the symptoms reappeared in the course of further conservative treatment.

Surgical technique

After informed consent about the planned operative procedure and definitive agreement on the postoperative physiotherapy protocol was obtained, the patients underwent the following surgery.

The procedure was performed under general anaesthesia, a single shot antibiotic (3rd generation of cephalosporin) was administered and a Foley catheter for decompression of the urinary bladder was inserted. The patient was positioned supine in a low lithotomy position on the operating table with both hips slightly flexed, abducted and externally rotated to expose the groin (Fig. 4). The genitalia were covered with compresses and carefully retracted down between the legs. The symphyseal area and the groin on both sides were washed and covered in a sterile manner. Before the incision, the important landmarks, which are the symphyseal cleft and the superior ramus, the femoral artery and the easily palpable adductor longus tendon, were identified.

An oblique skin incision 6 cm in length in the fold of the groin, directly over the palpable adductor longus/gracilis tendon, was made and the adductor muscle group was identified by blunt dissection. Several crossing veins in the subcutaneous soft tissue were coagulated or ligated. The adductor fascia was split longitudinally and the preparation followed along the adductor longus tendon to its origin at the pubic bone, where its fibres merge with the anterior symphyseal capsule complex. Adherent tissue over the anterior pubic symphysis capsule was bluntly dissected and the spermatic cord protected by a retractor. Until then, neither discoloration of the tendon nor a swelling indicating an old partial rupture was found in any of the patients.

Therefore, precise intraoperative localisation of the adductor lesion by intraoperative arthrography of the symphysis (iopromide, Ultravist® 300, Bayer Healthcare) was performed under fluoroscopic control. The radiographic "secondary cleft sign", which has been already diagnosed during ambulatory visits, indicated the topography of the lesion during operation.

Exactly at this location, the adductor longus tendon was opened longitudinally and a complete 1 cm broad tendon flap detached from its bony origin Granulation and regenerative tissue were identified in the deep layer of the tendon and completely excised (Fig. 5); also, the anterior cortex of the pubic bone was carefully opened. Thereby, a small

Fig. 4 Intraoperative positioning of the patient in low lithotomy position

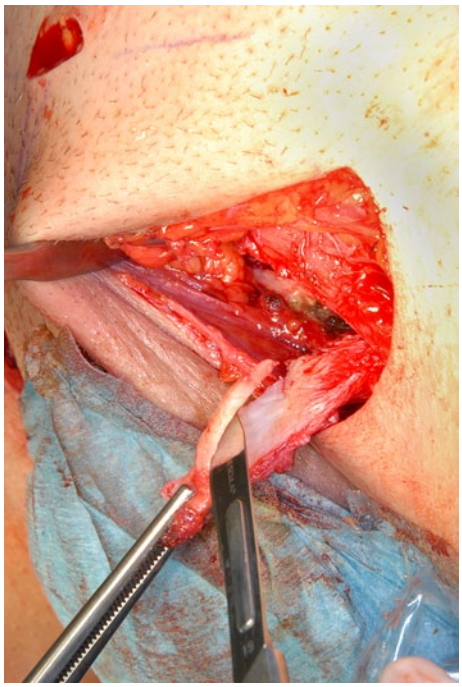

Fig. 5 Debridement of granulation tissue in the deep layer of the adductor tendon, which was detached from its bony origin

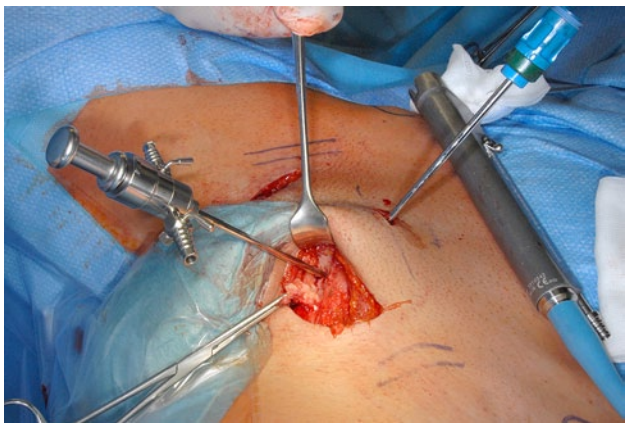

Fig. 6 Intraoperative situs with arthroscopic trocar in the opening of the anterior symphyseal capsule ("anterior portal") and the shaver placed in the superior ("suprapubic") portal. Spermatic cord structures are retracted with a blunt hook

opening to the symphyseal joint cleft was created, and through this "anterior portal" a 2.7 mm 30° arthroscopic optic (Karl Storz, Germany) was carefully introduced. Under simultaneous fluoroscopic guidance in standard pelvic inlet view and direct arthroscopic visualisation a, a 4.5 mm motorised shaver (Dyonics System, Smith and Nephew, Germany) was introduced using the Seldinger technique, with the aid of a cannula and a nitinol wire,

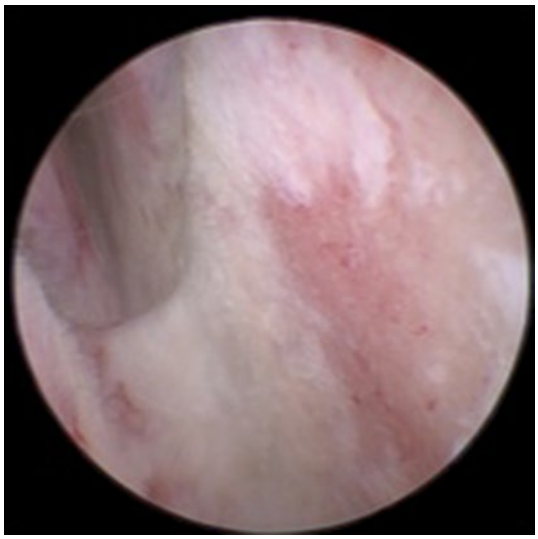

Fig. 7 Inferior view with cleared symphyseal cleft after debridement with visible punctual cancellous bleedings

Fig. 8 Reattached adductor longus tendon with suture anchors and some additional supporting sutures (Vicryl 0)

via a 2 cm suprapubic skin incision through the superior pubic ligament (Fig. 6). Now under sufficient visualisation of the symphyseal joint, complete resection of the ruptured fibrocartilaginous disc tissue and abrasion of the remaining degenerated hyaline cartilage were gradually performed, until the subchondral bone layer was opened and small cancellous bleedings were obtained (Fig. 7). After completed arthroscopic pubic symphysis debridement, subsequent reattachment of the debrided tendon to its original contact area was performed with the aid of two 2.8 mm suture anchors (Arthrex Fastak®, Naples, Florida) (Fig. 8) and their correct position verified with image intensifier control in pelvic inlet view. Additional supporting sutures protected the reattached tendon against traction forces. Wounds were

closed with non-absorbable skin sutures over the wound drainage.

The debrided material of the tendon and the fibrocartilaginous disc tissue was sent to histopathological and microbiological investigation.

Postoperative period and rehabilitation course

Our postoperative protocol included drainage removal on the second day; non-steroidal anti-inflammatory drugs were used for postoperative pain control on demand for a maximum of one week. Mobilisation with full weight-bearing was allowed immediately on the day of surgery, with limited abduction and adduction against resistance for 6 weeks postoperatively. Subsequently, increased mobility and muscle strengthening exercises as well as specific stabilising core exercises followed. After 3 months, sports-specific training exercises and, if pain-free, competitive sports activities were allowed.

The patients were followed prospectively on ambulatory visits 2 weeks (last wound inspection), 6 weeks for clinical and 12 weeks after surgery for clinical and radiological evaluation with additional standing pelvic and flamingo-view radiographs to rule out iatrogenic pubic instability. They were asked to fill an outcome protocol with assessment of pain (VAS score, 1–10) and level of pain during activity (NIPPS score, 0–7). At the latest follow-up contact via phone call, the patients were asked for residual symptoms, complications and their actual level of sporting activity.

Results

The average age of the athletes was 26 years (range 20–30 years) and the mean duration of symptoms was 20.4 months (range 16–24 months). All of the patients had symptoms at the adductor longus origins, four times unilaterally. One patient with bilateral groin symptoms had undergone bilateral hernia repair prior to our surgery. The arthrography of the pubic symphysis with the detection of a secondary cleft sign, either uni- or bilateral, corresponded directly to the side of the symptoms in all of the patients (Table 1).

All athletes returned to play after an average period of 14.4 weeks (14–18 weeks). VAS and NIPPS scores markedly improved and the overall satisfaction with the surgery was high. At the latest follow-up assessment after surgery, on average 18.2 months (range 14–24 months), all patients ranged between pain-free condition or only with mild symptoms before or during activity (NIPPS 3), without necessity for altering the activity (Table 2). No pubic instability on postoperative flamingo X-rays was detected in the controls after 12 weeks.

One patient had a complication with a hemodynamically relevant bleeding of the corona mortis after an intraoperative removal of a deeply positioned suture anchor, necessitating immediate surgery with successful ligation of the bleeding vessel. No further complication occurred during the postoperative course.

The histopathologic evaluation of the intraoperative samples revealed no signs of inflammation, but advanced degenerative changes of the fibrocartilaginous disc tissue and cartilage, as well as granulation and regeneration tissue of the tendon, respectively.

Discussion

Anatomically, the pubic symphysis is an amphiarthrodial joint composed of opposed hyaline cartilage covered pubic bones with an intervening fibrocartilaginous disc [5]. The stability of the pubic symphysis is maintained by four different ligaments, together with the adjacent tendons of the rectus and the adductor tendons, forming a stable ligamentous envelope [8, 17]. While the posterior pubic ligament is very thin and its contribution to the stability of the symphysis is almost negligible, the other three ligaments, especially the strong inferior (arcuate) pubic ligament, reinforce the anterior pelvis to resist the forces applied to the joint during physiologic gait [18].

The potential risk of performing surgery at the pubic symphysis is damage to one or even more of these “joint

Table 1 Patient characteristics

No	Age	Duration of symptoms	Symptomatic site	“Sec cleft sign”	Previous surgery
1. (K.K.)	24	18	Both adductors + symph.	Bilateral	Bilateral hernia repair
2. (O.M.)	28	16	Left adductor + symph.	Unilateral left	None
3. (S.S.)	28	22	Left adductor + symph.	Unilateral left	None
4. (K.C.)	30	24	Left adductor + lower abd.	Unilateral left	None
5. (R.D.)	20	22	Right adductor + symph.	Unilateral right	None

symph. pubic symphysis, *abd.* abdomen

Table 2 Results (after latest follow-up assessment)

No	VAS score		NIPPS score		Return to previous sports (weeks)	Satisfaction with surgery
	Pre	Post	Pre	Post		
1. (K.K.)	9	2	6	3	18	High
2. (O.M.)	7	0	5	0	14	High
3. (S.S.)	8	2	5	3	13	High
4. (K.C.)	9	0	5	0	13	High
5. (R.D.)	9	2	7	3	14	High

VAS visual analogue scale, *NIPPS* Nirschl Pain Phase Scale of Athletic Overuse Injuries

stabilisers", resulting in an increased pathologic magnitude of motion in the anterior pelvic ring, possibly leading to overall instability of the whole pelvis [12, 13, 19]. As a consequence, it is unlikely that abnormal motion in the symphysis joint and subsequently in the sacroiliac joints will occur, when an aggressive ligament and bone resection is avoided.

Several more or less invasive surgical procedures have been reported in literature to treat patients suffering from resistant osteitis pubis. Moore et al. reported on two cases with total resection of the pubic symphysis, in which both patients required arthrodesis of the pubic symphysis and both sacroiliac joints, because they developed debilitating posterior instability of the pelvis [13]. Also with the resection of a trapezoid-shaped wedge in a non-athletic population, first recommended by Schnute et al. in 1961 [19] and later by Grace et al. in 1989 [12], similar complications occurred and some patients had to be stabilised with bilateral sacroiliac arthrodesis for pain caused by posterior instability.

Williams et al. performed the opposite procedure and reported excellent results after arthrodesis, autogenous bone grafting and plate fixation in a series of seven professional rugby players with osteitis pubis and concomitant pubic instability. After restoration of the anterior pelvic ring, the symptoms in all athletes resolved and no serious complication occurred until follow-up evaluation [2]. However, return to professional sports was reported after 7 months.

Other authors limited surgery to disc curettage, without excessive bone and ligament resection [6, 14, 15].

Radic et al. presented a retrospective study of 23 athletes with "osteitis pubis" treated by open curettage. Although no significant complication occurred and the adjacent ligaments were not further harmed, at the latest follow-up, a total of 39 % of all patients did not return to their previous activity level or were still suffering pain [6]. It is hypothetic, but one must assume, that this could be a result of a non-rigorous patient selection. Interestingly, four patients in the study diagnosed with MRI scan had additional concurrent partial tears of the adductor tendon, which were not addressed with the sole curettage.

In a recent cases series, Hechtman et al. reported on a minimally invasive curettage successfully performed in four athletes suffering from isolated degenerative osteitis pubis without tendon involvement, which was ruled out by MRI diagnostics preoperatively [15].

In our series of patients, degenerative osteitis pubis as well as concomitant adductor longus tendinopathy could be verified by MRI scans, showing bilateral bone marrow oedema and a "secondary cleft sign" on the symptomatic side, indicating an adductor enthetic microtear [16]. Additional clinical provocation tests confirmed the diagnosis. Following our institutional radiological protocol, additional flamingo radiographs were performed routinely pre- and postoperatively to exclude pubic symphysis instability, which has also been attributed to be a possible cause for groin pain symptoms in athletes [2]. Furthermore, concerning preoperative planning of our surgery, in the clinical circumstance, a positive intraarticular injection test with a local anaesthetic to confirm the diagnosis should be a prerequisite.

Although the diagnostic "secondary cleft sign" is well described in literature on MRI and radiographic diagnostics [16, 20], its usable operative transfer, as performed in our department for the first time, has not been reported before, especially in combination with an arthroscopic procedure. The use of arthrographic diagnostics in the operative field necessitated an additional image intensifier C-arm unit, but it was helpful to precisely localise the distinct chronic lesion of the adductor longus tendon and limit thereby the magnitude of tendon detachment and debridement.

In contrast to other investigations reporting on sole tenotomies of the adductor tendons in athletes with chronic adductor tendinopathies remote from the pubic symphysis [21], in our patients the tendon pathology directly regarded the enthesis of the adductor longus tendon, which anatomically also contributes to the anterior symphyseal capsule and the fibrocartilaginous disc [17, 20], and therefore was addressed in a simultaneous procedure.

Concerning the arthroscopic procedure, proper installation of the portals, especially the suprapubic portal, depends on careful attention to the topographical anatomy of the pubic symphysis and the adequate image intensifier

adjustment during installation. Through this ligament-sparing arthroscopic surgery, the risk of iatrogenic instability was decreased to nil.

This procedure preserved the important capsular and ligamentous stability of the pubic symphysis and produced marked pain reduction or pain relief and excellent functional results. We found the proposed surgical to be technique safe and reliable. The preliminary results in our five patients were very promising.

The limitations of our study were the small series of patients, the lack of a control group and the medium follow-up time.

Conclusion

Usually, the treatment of choice for patients with osteitis pubis is primarily conservative and the course is mostly self-limiting with varying periods of time.

In select cases of patients with recurrent osteitis pubis and concomitant adductor tendinopathy, our surgical procedure with an arthroscopic curettage of the pubic symphysis in combination with restoration of the adductor tendon origin addresses both coexisting causes. Although this report describes the first five cases, our growing experience with this method on further cases is encouraging, because of similar good results. This therapeutic option has the benefit of being straightforward and first of all tailored to the specific lesions presented. However, diligent preoperative evaluation of the underlying pathology with the suggested diagnostic is of paramount importance.

In the near future, clinical investigations with larger sample sizes are warranted to confirm the usable transfer of this new surgical technique into daily routine.

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