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The impact of sensory deficits after harvesting hamstrings autograft for ACL reconstruction

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Abstract
Purpose The aim of this study was threefold: to investigate the incidence of sensory deficits after harvesting hamstrings autografts, to localise and measure the area of altered sensibility and to investigate the impact of any sensory deficit on the patients daily life.
Methods A consecutive series of sixty-one patients were examined for sensory deficits related to harvest of hamstrings tendons 10 years after having had an anterior cruciate ligament reconstruction. A neurological examination of the leg was performed to investigate for potential altered sensibility and to quantify the extent of the lesion. The patients answered the anterior knee symptoms (AKS) questionnaire and additional questions regarding impact on activities of daily life by any sensory deficit.
Results Eighty-five per cent of the examined patients had sensory deficits—experienced as numbness (78 %) and paraesthesia (16 %)—distal to the site of tendon harvesting. The mean affected area was 70 (SD 62) cm^2. No patients experienced sensory deficit symptoms to such a degree that it affected their activities of daily life, but the group with sensory deficit had significantly more AKS than patients without sensory deficit, as evaluated by the AKS score ($P = 0.02$). The most commonly reported complaints were related to strenuous activities and kneeling knee position.
Conclusions This long-term evaluation shows that sensory deficit after hamstring tendons harvesting affects a majority of patients and is probably permanent. Most patients reported this as being only mildly bothersome, but they have significantly more AKS as assessed by the AKS questionnaire. In clinical practice, patients should be counselled prior to tendon harvesting on the incidence and characteristic of the sensory deficit along with other possible peri- and postoperative complications.
Level of evidence Case series, Level IV.

Keywords Anterior cruciate ligament · Hamstrings graft · Sensory deficit · Complication

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Introduction

Patellar tendon (BPTB) autograft has traditionally been a popular choice for anterior cruciate ligament (ACL) reconstruction. Multiple studies have described donor site morbidity and anterior knee symptoms (AKS) as sequela from harvesting the central part of the BPTB [5, 6, 11]. In recent years, the trend has changed towards a dominant use of hamstring tendon autograft for ACL reconstruction. Compared to the BPTB, the hamstrings autograft has been shown to have less donor site pain [5, 7].

Reports have described several adverse effects of the hamstrings tendon harvesting. These include hamstring muscular weakness, scar site neuroma, hypertrophic scarring and distal altered sensibility [3, 20, 22, 23]. The latter is most commonly described in the area innervated by the infrapatellar branches of the saphenus nerve, but several other nerves can also be at risk [16, 18, 24]. The incidence rates of sensory deficits are highly variable and range from 50 to 88 % in recent reports [9, 10, 13, 15, 16, 21]. Most of

these are based on self-examination and could therefore be less sensitive as opposed to evaluation by an independent examiner. Although the postoperative altered sensibility is a relatively well-known adverse effect, few attempts have been made to quantify the impact of these changes on the daily activities of patients. In a study by Jameson et al. [9], it was suggested that the mere presence of sensory deficits affected the postoperative rehabilitation in 28 % and restricted the activity in 33 % of patients.

The aims of our study were to investigate the long-term effects of hamstring harvesting for use in ACL reconstruction. We hypothesised that the presence of sensory deficits would make a notable impact in the patients' activities of daily life.

Materials and methods

A consecutive series of patients reconstructed for ACL deficiency at our hospital from 1999 to 2001 were examined at minimum 10 years after the surgery. They all gave their written informed consent before participation.

Patient selection

Patients undergoing ACL reconstruction using double-stranded semitendinosus and gracilis autograft, using a uniform method for reconstruction, were eligible for the study. Two experienced knee surgeons performed 71 % of the surgeries, the remaining was performed by two residents supervised by a third experienced surgeon. Exclusion criteria were revision surgery and any former surgery to the same knee. Results from the same patient cohort have been reported in a former study [8].

Surgical procedure

The detailed surgical technique has been described in a former publication [8]. Briefly, an initial arthroscopy was made in all patients. Two small horizontal parapatellar incisions were made for the arthroscope and instrumentation. The semitendinosus and gracilis tendons were harvested from the same knee using a medial horizontal incision above and slightly proximal to the pes anserinus. If the tendons were not palpable, the incision was made approximately three finger breadths below the medial joint line. Sharp dissection was performed down to the fascia where a small horizontal incision was made just above the palpable tendons. The tendons were identified and levered by a curved retractor. Blunt dissection was undertaken to free each tendon one at a time. Tendons slips and crural fibres inserting onto gastrocnemius were cut by scissors. An open-ended tendon stripper was used to free the tendons from the proximal muscular belly, while the knee was supported in a flexed position.

Postoperative follow-up at 10 years

All patients completed the AKS score [19], first published by Shelbourne and Trumper as an evaluation of anterior knee pain on a scale from 0 (worst) to 100 (no symptoms). In addition, we asked (a) if the patient had been aware of any sensory deficit before the examination; (b) if so, what type of change the patient experienced (e.g. numbness, tickling or pain) and to what degree this (change) represented a discomfort to the patient; and finally (c) if the patient had been informed about the possibility of this complication before the surgery.

An independent examiner, not involved in surgery and postoperative rehabilitation, examined the patients. Examination of the distal sensory quality of the harvested leg and the contralateral leg was undertaken as described by Kjærgaard et al. [10]. By light touch, a non-affected reference area was established. Comparison between the operated knee and the opposite knee as well as between different parts of the same knee and leg was made. If a sensory deficit was found, a thorough mapping of this area was done and marked with a pen. A transparent foil was used to copy the size of the area, and an image scanner was used to digitise the drawing. The length of the scar was measured. The ImageJ software (NIH, Bethesda, Maryland) was used for measuring the size of the affected area with sensory deficit.

On application, the study was approved by the regional ethical (REK Helse Vest) committee (REK ID 3366).

Statistical analysis

Statistical processing was done in Statistical Package for Social Sciences (SPSS version 19.0) (SPSS Inc., Chicago IL, USA). The a priori significance level was set at 0.05. Means, standard deviations and frequency distributions were calculated. Since normality of data could not be presumed the Kruskal–Wallis test and Mann–Whitney U test were used to test for differences between groups, bootstrap sampling was used for calculation of the confidence interval in difference between groups. A post hoc power calculation was performed to determine the power of the results from the AKS score [1].

Results

Sixty-five patients were eligible for the study. Three of these had undergone revision surgery at the 10 year follow-up and were therefore excluded from follow-up

examinations. Another patient was excluded due to multiple scars from secondary surgery. Thus, 61 patients were examined, of these 36 were males. Age at surgery was median 29 years (range 15–66 years).

Sensory deficits

Eighty-five per cent ($n = 52$) of the patients had altered sensibility in the area of IBSN, distal and lateral to the site of tendon harvesting. The mean area of sensory deficit was 69.5 cm^2 (SD 62). The mean length of the scar was 5.3 cm (SD 0.9 cm). There was no difference in the distribution of sensory deficits when comparing scars up to 5 cm in length and scars from 5 cm and above (n.s.).

Forty-five patients were aware of the sensory deficit prior to the physical examination. All patients graded the symptoms as "only minimal/slight discomfort". No patients experienced sensory deficit symptoms to such a degree that it significantly affected their ADL (including work and sports). When asked to describe the altered sensibility, 78 % reported it as numbness while 16 % described it as a tickling or itching sensation.

When responding to the question "Were you informed about possible sensibility changes before the surgery?" 63 % of patients did not remember. Twenty per cent reported they were not informed, while 16 % reported they were informed about this preoperatively.

Subjective scores

The mean AKS score for all patients was 89 (SD 16). In the group with sensory deficits, there was significantly more ($P = 0.02$, 95 % CI 7.8–18.6) AKS than patients without sensory deficit, as evaluated by the AKS score—median scores were 85 (range 80–100) and 100 (range 29–100), respectively. A post hoc power calculation displayed a power of 68 % of the results of the AKS score.

Discussion

The main finding in the present study was hypoesthesia or dysesthesia in 85 % of patients at a minimum of 10 years after harvesting semitendinosus and gracilis tendons for ACL reconstruction. Although none of the patients considered the deficits more than mildly bothersome, there was a mean reduction of 15 points on the AKS score in the group with sensory nerve lesions.

In a study by Kjærgaard et al. [10], the incidence of sensory deficit was about unchanged from the first postoperative period to the 1-year follow-up evaluation. The size of the affected area did, however, decrease in 46 % of patients during the first postoperative year. Mirzatolooei and Pisoodeh [13] evaluated patients at 2 weeks and 6 months after the harvest of hamstrings tendons. In the population of 98, they found three patients where the sensory loss had disappeared at the latter follow-up evaluation. No further evaluation was carried out beyond the first 6 months. In an evaluation at 3, 6 and 12 months after tendon harvesting, Sanders et al. [18] found sensory deficits in 74 % of the participating patients. Twenty per cent of these reported a decrease in symptoms over time. Since only 62 of 164 patients responded to their questionnaire, an underreporting bias could likely be present.

Mochizuki et al. [15] both administered a questionnaire and did a clinical examination when evaluating sensory deficits in their group of patients. During three clinical visits, and a maximum of 32 months of follow-up, 13 % (six patients) experienced disappearance of symptoms. One of the patients regained the sensibility within a year after surgery, while the five other regained sensibility between 12 and 32 months after surgery. Only 60 of 252 patients responded to the questionnaire, 43 % reporting hypoesthesia at a mean of 32 months after graft harvesting. Even though there are some exceptions, the main regenerative window for the sensory deficits seems to be within the first postoperative year. Thereafter this complication will endure per se, but patients will to some extent habilitate to the problem. We therefore believe that the present finding of 85 % sensory deficits represents the permanent rate of this complication.

The reported incidence of altered sensibility after hamstrings harvesting spans from 50 to 88 % in the literature [9, 10, 13, 15, 16, 18, 21]. In addition to uncontrollable differences in surgical technique, the timing of the follow-up evaluations and the mode of examination is highly variable in different studies. The present use of thorough clinical examination might be one cause of a higher incidence than in other reports. The results are in line with the findings from Kjærgaard et al. [10] where a similar examination was performed. They assessed the loss of sensibility by light touch at 12 days and 1 year postoperatively and found incidences of 88 and 84 %, respectively. The finding of sensibility changes in patients that does not report this themselves emphasises why the sole use of patient completed questionnaires, as in several other publications, might underreport on such complications. Therefore, we believe that those higher incidence rates represent more likely estimates of this postoperative complication.

In the present study, the patients reported most complaints in the areas *strenuous activities* and *kneeling position* when assessed by the AKS score. The only other publication using the same questionnaire, on hamstrings harvested patients, reports the same pattern

of symptoms [21]. Even so, the present study has a remarkable higher percentage of patients reporting no complaints in these areas (*strenuous activities* and *kneeling position*)—69 and 54 %, respectively, as compared to 37 and 36 % in the study by Spicer et al. Except from the variability in surgical technique, we have no proposed explanation for this difference. Another interesting finding is the significant difference in median AKS score between patients with or without sensibility loss. One could theorise that surgical technique could have a common effect on nerve lesions and kneecap symptoms after surgery. Former studies have, however, not found any effect of meticulous dissection when examining for postoperative effects of tendon harvesting [4, 12, 13, 14, 15].

The AKS questionnaire was first used by Shelbourne et al. [19] and was intended as a measure of donor site pain after BPTB harvesting. In the original publication, the authors themselves criticised the score since it seemed to be more affected by postoperative loss of extension than the actual AKS. When examining for the same confounding effect in the present patient group, we found no such correlation. There was, however, very few patients with flexion contracture in this follow-up examination—also the present patient group is small compared to the one reported by Shelbourne et al. A more recent, self-administered questionnaire was developed by Aufwerber et al. [2] to examine for donor-related problems after tendon harvesting. This questionnaire can be used both in the case of patellar and hamstrings tendon harvesting. The questionnaire displayed good content validity and internal consistency and would therefore be a good alternative when examining for postoperative sensibility changes in ACL reconstructed patients. A comparison of the findings of this patient-administered questionnaire and clinical examination of the same patient group should, however, be performed.

There has been a recent interest in a mini-invasive posterior approach for harvesting the hamstrings tendons from the popliteal fossa [17]. This technique has been claimed to give less donor site problems and better cosmesis. Hopefully, future studies comparing this approach to an anterior approach will reveal if this change can affect incidence of nerve lesions and AKS.

The strengths of the present study include the use of an independent examiner and a clinical neurological examination to evaluate sensibility loss (as opposed to studies based solely on the patients own experience). Limitations are the retrospective inclusion of patients and the lack of a control group. Further, serial postoperative examinations would have given more insight in sensory changes over time.

Conclusions

The findings in the present study demonstrate a persisting high incidence of hypoesthesia after harvesting hamstrings grafts. Most patients found this only minimally bothersome and none experienced symptoms to such a degree that it significantly affected their ADL—activities of daily life. Patients with sensory deficits, however, reported significant more anterior knee pain as measured with the AKS score than those without sensory deficits. Preoperative counselling on incidence and distribution of the sensibility loss is recommended alongside other possible complications for patients undergoing hamstring tendon harvesting.

Conflict of interest None.

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