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Hand/Peripheral Nerve

Ulnar Nerve Entrapment in Diabetes: Patient-reported Outcome after Surgery in National Quality Registries

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Background: Ulnar nerve entrapment at the elbow (UNE) is overrepresented in patients with diabetes, but the outcome of surgery is unknown. We aimed to evaluate patient-reported outcome in patients with and without diabetes, and to assess potential sex differences and compare surgical treatment methods.
Methods: Data on patients operated for UNE (2010–2016, n = 1354) from the Swedish National Registry for Hand Surgery were linked to the Swedish National Diabetes Register. Symptoms were assessed preoperatively (n = 389), and 3 (n = 283), and at 12 months postoperatively (n = 267) by QuickDASH and HQ-8 (specific hand surgery questionnaire—8 questions). Only simple decompressions were included when comparing groups.
Results: Men with diabetes reported higher postoperative QuickDASH scores than men without diabetes. Women scored their disability higher than men on all time-points in QuickDASH, but showed larger improvement between preoperative and 12 months postoperative values. Patients operated with transposition scored 10.8 points higher on QuickDASH than patients who had simple decompression at 12 months (95% confidence interval 1.98–19.6).
Conclusions: Women with diabetes benefit from simple decompression for UNE to the same extent as women without diabetes. Men with diabetes risk not to benefit from simple decompression as much as women do. Ulnar nerve transposition had a higher risk of residual symptoms compared to simple decompression. *(Plast Reconstr Surg Glob Open 2020;8:e2740; doi: 10.1097/GOX.0000000000002740; Published online 24 April 2020.)*

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INTRODUCTION

Ulnar nerve entrapment at the elbow (UNE) is the second most common nerve entrapment in the upper extremity, with incidence rates ranging between 21 and 30 per 100,000 person-years.[1,2] Conservative treatment is usually the initial treatment. Surgical methods include simple decompression of the ulnar nerve in the cubital tunnel,

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as well as subcutaneous, intramuscular or submuscular anterior ulnar nerve transposition and medial epicondylectomy.[3] However, simple decompression is considered easier to perform, less invasive, more cost-effective and associated with fewer complications, compared to ulnar nerve transposition, and is therefore often preferred,[4,5] but outcome using patient-reported outcome (PRO) have not been reported in larger study populations.

Diabetes is a risk factor for carpal tunnel syndrome, and may be a risk factor for UNE.[6] Diabetes has been associated with higher revision rates following surgery for UNE,[7] but whether diabetes adversely affects PRO after surgery is not known; thus, it is not known if it is worthwhile to perform surgery for UNE in patients with diabetes. Interestingly, UNE is more common in men[1,2] and diabetic neuropathy seems to affect men earlier and more extensively than women.[8] It is however unknown if sex affects surgery outcome in UNE, although a small study indicated it does not.[9]

We aimed to evaluate PRO in patients with and without diabetes, as well as to assess potential sex differences, and potential differences between simple decompression and transposition, after surgical treatment for UNE.

METHODS

Cohort

In this register-based cohort study, we used prospectively collected data from the Swedish National Registry for Hand Surgery (HAKIR) and the Swedish National Diabetes Register (NDR) to investigate PRO. Patients were included from HAKIR (www.hakir.se)[10] between February 2010 and December 2016. All 7 specialized hand surgery departments in Sweden as well as 2 private units report to the registry. Patients were identified by the ICD-10 code G562 and primary surgical codes (KKÅ97) ACC53, ACC43 or NCK19. Registration included operated side (left/right/bilateral). Data regarding whether the diagnosis was supported or confirmed by electrophysiological examination are not available through the national quality registry, but in previous Swedish studies, 81%–91% of patients had preoperative electrophysiological evaluations.[9,11] For patients, who were re-operated during the study period, only the primary surgery was included in the analysis. If the only surgery registered during the study period was a re-operation, the patient was excluded.

Data Sources

Patients above 16 years old in the HAKIR registry receive 2 PRO measures (PROM) to fill out preoperatively and 3 and 12 months postoperatively. Patients who were re-operated within 1 year received no postoperative questionnaires. The first questionnaire is the Swedish version of the QuickDASH[12] (shortened version of the DASH; Disability of Arm, Shoulder and Hand questionnaire). The QuickDASH is a disability score evaluating the upper limb, with 11 items. Each question is scored 1-5, 1 representing no difficulty/not at all, and 5 representing unable/extremely difficult. A total score of 0–100 (higher score indicating more disability) was calculated.

The second questionnaire is specific to the HAKIR registry (HQ-8). HQ-8 includes 7 questions on perceived symptoms in the affected hand (pain on load, pain on motion without load, pain at rest, stiffness, weakness, numbness, and cold sensitivity), and one question on the ability to perform activities of daily living. The HQ-8 questions are reported on a Likert scale (0–100) supported with numerical descriptors (0, 10, 20 … 100) upon the box, where zero represents no problem and 100 represents the worst problem imaginable. All HQ-8 questions were studied independently.[13]

Data from HAKIR were linked to data from NDR (www.ndr.nu) using personal identification numbers. The majority (approximately 95%) of patients with diabetes above 18 years of age in Sweden are included in the registry that started in 1996 and contains data on diabetes treatment, complications, and associated risk factors.[14] The following variables were extracted from NDR: diabetes diagnosis, type of diabetes, diabetes duration, BMI, smoking, retinopathy status, and HbA1c levels.

The STROBE (ie, STrengthening the Reporting of OBservational studies in Epidemiology) guidelines were implemented in the writing of this manuscript.

Ethical Approval

The study was approved by the Regional Ethical Review Boards in Lund, Sweden, Dnr 2016/931. Patient consent was obtained when patients accepted inclusion in HAKIR and NDR.

Statistical Analysis

Data are presented as median (interquartile range; Q25–Q75). Non-parametric Mann-Whitney test was used to compare differences between groups for continuous data. Nominal data are presented as numbers (percentages). For nominal data, a Chi-square test was used to compare differences between groups. Linear regression analysis was performed to calculate the possible influence of diabetes and surgical technique on postoperative QuickDASH scores, adjusted for age and sex. Linear regression analysis was also used to calculate the effect of diabetes and sex on postoperative QuickDASH scores and men without diabetes was used as the reference category (adjusted for age). Data from the linear regressions are presented as unstandardized b-coefficients [95% confidence interval (CI)]. In the analyses comparing QuickDASH and HQ-8 from 2 perspectives; (1) between patients with and without diabetes, and (2) between men and women, only cases operated on with simple decompression were included, since it is more accurate to compare patients who were operated with the same method, and there were too few transpositions in the diabetes group to allow for detailed analysis. Medial epicondylectomies and endoscopic decompressions were few and therefore not included in further analyzes. When calculating response rate, patients who were operated within a year or within 3 months before data extraction were not included since they had not yet been invited to the follow-up. A P-value <0.05 was considered statistically significant. SPSS Statistics, version 25 (SPSS Inc., Chicago, Ill.) was used for all calculations. Each treated arm was analyzed as a separate statistical entity.

RESULTS

During the study period, we identified 1,550 primary surgical treatments for ulnar nerve pathology. Of these, surgeries at Guyon's canal, inconclusively coded surgeries, surgeries due to trauma, and revision surgeries were excluded (Fig. 1). Bilateral procedures were performed in 76/1,278 patients (5%). In all, 1,354 primary cases (arms) from 1,278 patients were included (Table 1). In 116/1,354 (9%) cases, surgery for other nerve entrapments had been performed simultaneously (Table 1). Of these, there were 85/116 (73%) carpal tunnel releases, 6/116 (5%) radial nerve decompression, 9/116 (8%) carpal tunnel release and UNE release at Guyon's canal, 1/116 (1%) carpal tunnel release and radial nerve decompression, and in 1/116 (1%) data were missing.

In 88/1,354 (6%) cases, another hand surgical procedure had been performed at the same time (Table 1). Of these, there were 15/88 (17%) trigger fingers, 12/88 (14%) ganglions, 12/88 (14%) related to arthritis, 6/88 (7%) epicondylitis, 2/88 (2%) de Quervain's tenosynovitis, 9/88 (10%) synovectomies, 2/88 (2%) Dupuytren's disease, and 29/88 (33%) other or multiple procedures.

Response rates overall were 452/1,354 (33%) preoperatively, 311/1285 (24%) at three months postoperative and 294/1089 (27%) at 12 months postoperative.

Non-responders

Preoperative

There were no differences in age, sex distribution, proportion with diabetes, or diabetes duration between responders and non-responders. HbA1c levels in responding patients with diabetes were 52 mmol/mol (42–76), compared to 57 (44–71) in non-responding patients with diabetes (P-value 0.58).

Twelve Months Postoperative

There were more women amongst the responders (160/294, 54%) than amongst non-responders (370/795, 47%; P-value 0.012). Responders were older [56 (44–64) years] than non-responders [51 (41–60) years; $P < 0.0001$]. HbA1c levels and diabetes duration did not differ between responders and non-responders.

Diabetes

Diabetes was present in 160/1354 cases (12%). Of these, there were 111 cases (76%) with type 2 diabetes (including Maturity Onset Diabetes in Young) and 33 cases (23%) with type 1 diabetes (including Latent Autoimmune Diabetes in the Adult). One case had secondary diabetes, 1 case was classified as unknown and in 14 cases data were missing. Twenty cases (1.5%) got their diabetes diagnosis during the study period, but after surgery. Of these, 1 case was classified as type 1 diabetes and the other 19 as type 2 diabetes. Characteristics are presented in Table 1. Simple decompression was performed more often in the patients with diabetes. More patients with diabetes were operated simultaneously for another nerve compression (Table 1).

There were no differences in total QuickDASH scores between patients with or without diabetes, neither pre- nor postoperatively. The total score change between the preoperative QuickDASH and the 12 months postoperative QuickDASH was lower in the cases with diabetes (Table 2). No improvement in the QuickDASH scores

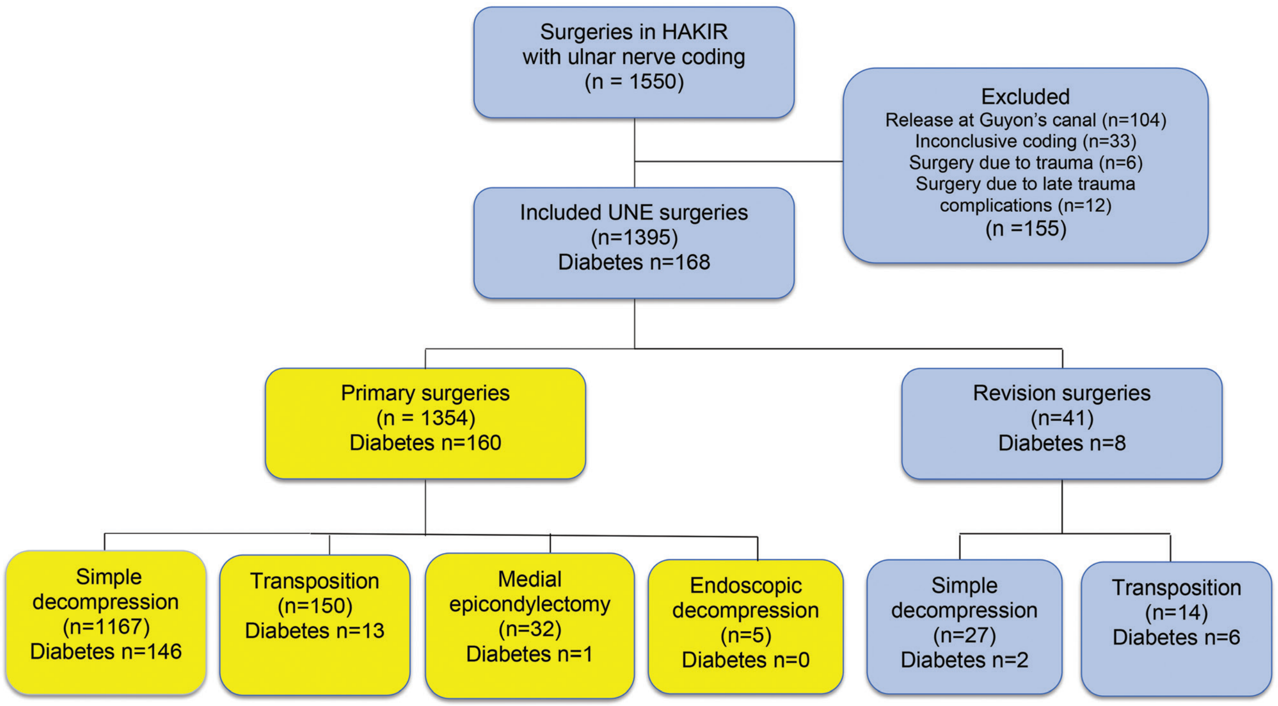

Fig. 1. Flowchart describing the inclusion process.

Table 1. Baseline Characteristics of Cases with and without Diabetes and Surgery Methods in Cases Operated on for UNE

	No Diabetes (n = 1194)	Diabetes (n = 160)	*P*	All Cases (n = 1354)
Sex (female), n (%)	581 (50)	63 (39)	**0.018**	652 (48)
Age (y), median [IQR]	51 (41 to 60)	61 [54 to 67]	**<0.0001**	52 [42 to 62]
BMI (kg/m^2), median [IQR]	N/A	2926 to 33	-	N/A
HbA1c (mmol/mol), median [IQR]	N/A	56 [44 to 71]	-	N/A
Duration of diabetes (y), median [IQR]	N/A	9 [3 to 20]	-	N/A
Re-operations, n (%)	32 (3)	2 (1)	0.29	34 (3)
Simple decompression, n (%)	1021 (86)	146 (91)	**0.048**	1167 (86)
Transposition, n (%)	137 (12)	13 (8)	0.21	150 (11)
Medial epicondylectomy, n (%)	31 (3)	1 (1)	0.12	32 (2)
Endoscopic decompression, n (%)	5 (0)	0 (0)	0.41	5 (0)
Concomitant other nerve decompression surgery, n (%)	92 (8)	24 (15)	**0.002**	116 (9)
Concomitant hand surgery procedure, n (%)	74 (6)	14 (9)	0.22	88 (6)

Diabetes includes both type 1 and type 2 diabetes. Numbers presented as number (percent) or as median (interquartile range (IQR)].
BMI, body mass index; HbA1c, glycosylated hemoglobin A; N/A, not available.
Boldface *p*-values <0.05 are considered statistically significant.

Table 2. QuickDASH Scores in Cases with and without Diabetes Treated with Simple Decompression for Ulnar Nerve Entrapment

QuickDASH Score	No Diabetes (n = 1021)	Diabetes (n = 146)	*P*	All Cases (n = 1167)
Preoperative	50 (27 to 66) (n = 346)	48 (39 to 64) (n = 43)	0.95	50 (30 to 66) (n = 389)
Postoperative at 3 months	27 (11 to 55) (n = 247)	41 (15 to 57) (n = 36)	0.10	30 (11 to 55) (n = 283)
Postoperative at 12 months	34 (14 to 55) (n = 229)	37 (11 to 58) (n = 38)	0.70	34 (14 to 55) (n = 267)
Change 0–3 months	16 (5 to 36) (n = 114)	24 (−9 to 55) (n = 10)	0.83	17 (5 to 37) (n = 124)
Change 3–12 months	0 (−10 to 12) (n = 126)	0 (−8 to 8) (n = 21)	0.86	0 (−9 to 11) (n = 147)
Change 0–12 months	14 (0 to 25) (n = 88)	3 (−8 to 9) (n = 12)	**0.046**	11 (0 to 23) (n = 100)

Diabetes includes both type 1 and type 2 diabetes. Numbers presented as median [interquartile range (IQR)].
Boldface *p*-values <0.05 are considered statistically significant.

Table 3. HQ-8 Questions

	HQ-1 Pain on Load	HQ-2 Pain on Motion without Load	HQ-3 Pain at Rest	HQ-4 Stiffness	HQ-5 Weakness	HQ-6 Numbness/ Tingling in Fingers	HQ-7 Cold Sensitivity	HQ-8 Ability to Perform Daily Activities
Preoperative								
No diabetes (n = 313)	50 (19 to 70)	30 (8 to 57)	31 (9 to 60)	30 (4 to 60)	52 (30 to 80)	80 (60 to 90)	53 (20 to 80)	50 (21 to 75)
Diabetes (n = 39)	46 (15 to 69)	30 (10 to 55)	30 (10 to 60)	37 (10 to 59)	50 (22 to 81)	80 (56 to 90)	73 (36 to 91)	50 (30 to 80)
P-value	0.47	0.96	0.83	0.15	0.86	0.89	**0.035**	0.95
All (n = 352)	50 (17 to 70)	30 (8 to 56)	30 (10 to 60)	30 (5 to 60)	52 (30 to 80)	80 (60 to 90)	59 (20 to 80)	50 (23 to 75)
3 months postoperative								
No diabetes (n = 232)	24 (10 to 50)	10 (0 to 32)	10 (0 to 30)	10 (0 to 38)	30 (10 to 60)	31 (10 to 70)	20 (1 to 55)	20 (2 to 50)
Diabetes (n = 34)	35 (10 to 60)	30 (3 to 60)	15 (4 to 60)	19 (4 to 44)	50 (23 to 70)	59 (20 to 80)	25 (4 to 59)	35 (10 to 59)
P-value	0.34	**0.043**	0.13	0.41	0.12	0.13	0.48	0.25
All (n = 266)	25 (10 to 50)	10 (0 to 40)	10 (0 to 30)	10 (0 to 40)	30 (10 to 60)	38 (10 to 70)	20 (1 to 57)	20 (2 to 50)
12 months postoperative								
No diabetes (n = 220)	30 (10 to 60)	10 (0 to 40)	10 (0 to 40)	20 (0 to 40)	34 (11 to 60)	40 (12 to 73)	30 (3 to 66)	27 (3 to 58)
Diabetes (n = 37)	30 (1 to 70)	10 (0 to 50)	10 (1–35)	10 (1 to 50)	40 (10 to 70)	50 (15 to 80)	40 (1 to 70)	30 (10 to 61)
P-value	0.93	0.98	0.90	0.69	0.54	0.93	0.76	0.36
All (n = 257) (n = 257)	30 (6 to 61)	10 (0 to 40)	10 (0 to 40)	20 (0 to 40)	35 (10 to 60)	40 (12 to 74)	30 (3 to 68)	29 (3 to 59)
Change 0–12 months								
No diabetes (n = 88)	8 (−5 to 31)	4 (−7 to 30)	2 (0 to 29)	5 (0 to 22)	10 (−9 to 35)	20 (0 to 50)	2 (−9 to 36)	10 (−1 to 31)
Diabetes (n = 12)	to 6 (−30 to 19)	4 (−23 to 15)	to 10 (−20 to 21)	to 5 (−19 to 38)	4 (−12 to 16)	10 (−10 to 60)	16 (−14 to 52)	10 (−14 to 31)
P-value	0.087	0.58	0.17	0.22	0.45	0.70	0.65	0.98
All (n = 100)	5 (−10 to 30)	4 (−10 to 28)	2 (−7 to 25)	4 (−2 to 22)	10 (−10 to 31)	20 (0 to 50)	6 (−9 to 36)	10 (−6 to 31)

Comparison between cases with and without diabetes treated with simple decompression for UNE.
Numbers presented as median [interquartile range (IQR)].
Boldface *p*-values <0.05 are considered statistically significant.

occurred between 3 and 12 months, regardless of diabetes status.

In the HQ-8 questions, patients with diabetes reported higher preoperative levels of cold sensitivity than patients without diabetes (Table 3).

QuickDASH scores did not differ between patients with and without diabetic retinopathy (**see Table, Supplemental Digital Content 1**, which displays cases with diabetes and retinopathy compared to cases with diabetes but without retinopathy operated for ulnar nerve entrapment, http://links.lww.com/PRSGO/B358). No differences were found in total QuickDASH scores between patients with type 1 and type 2 diabetes (**see Table, Supplemental Digital Content 2**, which displays the comparison between cases with type 1 and type 2 diabetes operated for ulnar nerve entrapment, http://links.lww.com/PRSGO/B359).

In the linear regression analyses, diabetes did not predict a higher postoperative QuickDASH score at 12 months (unstandardized B-coefficient 2.24, 95% CI −6.22 to 10.7; $P = 0.60$). Diabetes did not predict the change in QuickDASH score from 0 to 12 months (unstandardized B-coefficient −7.82, 95% CI −20.9 to 5.22; $P = 0.24$).

Smoking

In the group with diabetes, there were 40 patients who actively smoked, 71 patients who had never smoked and data were missing in 35 patients. Smoking habits did not differ between men and women with diabetes. There were no differences in preoperative PROMs between smokers and nonsmokers. At 3 months postoperative, patients with diabetes who smoked, scored lower on the item regarding pain at rest than those who did not smoke [1 (0–10) vs. 15 (5–40); $P = 0.031$]. No differences were found at 12 months postoperative.

Sex

In the whole population, there were 652/1,354 (48%) women. Women scored their symptoms higher in the QuickDASH at all occasions (Table 4), however, the relative improvement from preoperative to 12 months postoperative was larger in women. In the HQ-8 items, women scored higher on all items except stiffness preoperatively (Table 5). Women also scored higher on items regarding pain and numbness postoperatively (**see Figure, Supplemental Digital Content 3**, which displays sex differences in HQ-8 items in patients operated with simple decompression for UNE. Values are median. (a) Preoperative HQ-8; (b) postoperative HQ-8 at 3 months; (c) postoperative HQ-8 at 12 months, http://links.lww.com/PRSGO/B360). In the linear regression analysis, women reported 9.3 points higher postoperative QuickDASH scores at 12 months (95% CI 3.7–14.8; $P = 0.001$).

Diabetes and Sex

Men with diabetes reported higher postoperative QuickDASH scores than men without diabetes (Table 6). No such difference was found in women. There were no differences in HbA1c levels between men and women (data not shown). In the linear regression analysis, men with diabetes reported 11 points higher QuickDASH score at 12 months postoperative compared to men without diabetes, although not statistically significant (95% CI −0.2 to 22; $P = 0.054$). Women without diabetes reported 12 points higher in QuickDASH at 12 months postoperative than men without diabetes (95% CI 6–18; $P < 0.0001$).

Surgical Methods

There was no statistically significant difference in QuickDASH scores preoperatively between ulnar nerve transpositions [median 58 (IQR 38–73)] and simple decompressions [50 (30–66); $P = 0.066$]. At 12 months postoperatively, transpositions scored higher [45 (33–64)] than simple decompressions [34 (14–55); $P = 0.013$]. For ulnar nerve transpositions, the postoperative QuickDASH score at 12 months in the linear regression analysis was 10.8 points higher (95% CI 1.98–19.6; $P = 0.017$) than for simple decompressions.

DISCUSSION

In this national cohort study, no general differences were found in PRO between patients with and without diabetes after surgery for UNE in routine clinical practice. However, patients with diabetes reported a smaller improvement in the QuickDASH total score, but not in HQ-8, than patients without diabetes. Men with diabetes scored higher postoperatively in the QuickDASH than men without diabetes. Women generally scored higher than men. Patients operated with ulnar nerve transpositions reported higher postoperative QuickDASH scores than patients operated with simple decompression.

Diabetes

Diabetic neuropathy ranges from the typical symmetric, length-dependent polyneuropathy, to mononeuropathies such as nerve entrapments. Unfortunately, presence of diabetic neuropathy is not registered in HAKIR and NDR, but retinopathy was used as a proxy for neuropathy. Metabolic alterations in diabetes are believed to induce structural changes in the nerves, leading to increased risk of compression at narrow sites, such as the carpal and the cubital tunnel, the first common among patients with diabetes.[15] The present study includes PRO from many patients with and without diabetes undergoing surgery for UNE. Similar studies analyzing comparable or smaller patient numbers have found no impact of diabetes on UNE surgery outcome.[16–20] These studies contained few patients with diabetes and did not report on PRO. One large study including 25,977 patients with UNE indicated that diabetes is related to an increased risk of revision surgery.[7] However, the present study found that patients with diabetes do not report worse symptoms, nor have an increased risk of revision surgery. The patients with diabetes in the present study were generally well treated, as indicated by the HbA1c levels. Outcomes may be worse in populations with less controlled diabetes.

Patients with diabetes were to a higher degree simultaneously operated for other nerve compressions. This might be explained by that the most common other nerve entrapment operated was carpal tunnel syndrome, for which diabetes is a known risk factor.[21] Patients with diabetes experienced more cold sensitivity before surgery than patients without diabetes. Similarly, Thomsen et al.[22] reported a higher number of patients with diabetes and cold sensitivity after carpal tunnel release at 1 year, but not at 5 years after surgery. One possible explanation is that thermal sensation is mediated by small fibers that are damaged first in the course of diabetic neuropathy.[23]

We found no differences between patients with type 1 and type 2 diabetes, but the comparable groups were small and this finding must be interpreted with caution. However, the fraction of patients with type 1 diabetes was

Table 4. Sex Differences in QuickDASH Results in Cases Operated on with Simple Decompression for Ulnar Nerve Entrapment

	Men (n = 602)	Women (n = 565)	*P*	All Cases (n = 1167)
Age, years	54 (44 to 63)	51 (40 to 61)	**0.001**	52 (42 to 62)
QuickDASH scores				
Preoperative	43 (25 to 59) (n = 203)	57 (41 to 70) (n = 186)	**<0.0001**	50 (30 to 66) (n = 389)
Postoperative at 3 months	25 (10 to 45) (n = 133)	34 (14 to 60) (n = 150)	**0.012**	30 (11 to 55) (n = 283)
Postoperative at 12 months	25 (9 to 50) (n = 123)	40 (18 to 61) (n = 144)	**0.002**	34 (14 to 55) (n = 267)
Change 0–3 months	13 (5 to 35) (n = 56)	20 (6 to 43) (n = 68)	0.24	17 (5 to 37) (n = 124)
Change 3–12 months	2 (−9 to 11) (n = 74)	0 (−11 to 12) (n = 73)	0.65	0 (−9 to 11) (n = 147)
Change 0–12 months	7 (−4 to 21) (n = 49)	15 (5 to 27) (n = 51)	**0.039**	11 (0 to 23) (n = 100)

Numbers presented as median [interquartile range (IQR)].
Boldface *p*-values <0.05 are considered statistically significant.

Table 5. Sex Differences in HQ-8 Questions in Cases Operated on for Ulnar Nerve Entrapment with Simple Decompression

	HQ-1 Pain on Load	HQ-2 Pain on Motion without Load	HQ-3 Pain at Rest	HQ-4 Stiffness	HQ-5 Weakness	HQ-6 Numbness/ Tingling in Fingers	HQ-7 Cold Sensitivity	HQ-8 Ability to Perform Daily Activities
Preoperative								
Men (n = 180)	39 (10 to 61)	20 (2 to 50)	30 (3 to 50)	30 (6 to 57)	49 (21 to 71)	75 (50 to 90)	50 (11 to 76)	41 (15 to 70)
Women (n = 172)	60 (30 to 77)	40 (10 to 60)	45 (10 to 70)	40 (4 to 60)	60 (30 to 80)	80 (67 to 90)	68 (30 to 81)	60 (40 to 80)
P-value	**<0.0001**	**<0.0001**	**<0.0001**	0.21	**0.003**	**0.009**	**0.003**	**<0.0001**
All (n = 352)	50 (17 to 70)	30 (8 to 56)	30 (10 to 60)	30 (5 to 60)	52 (30 to 80)	80 (60 to 90)	59 (20 to 80)	50 (23 to 75)
3 months postoperative								
Men (n = 126)	20 (2 to 40)	10 (0 to 30)	10 (0 to 30)	10 (0 to 40)	30 (10 to 60)	30 (10 to 64)	20 (1 to 50)	20 (0 to 50)
Women (n = 140)	30 (10 to 60)	11 (1 to 41)	10 (1 to 39)	11 (0 to 38)	37 (14 to 60)	41 (10 to 80)	20 (1 to 62)	27 (4 to 57)
P-value	**0.011**	**0.037**	0.71	0.79	0.19	0.17	0.56	0.11
All (n = 266)	25 (10 to 50)	10 (0 to 40)	10 (0 to 30)	10 (0 to 40)	30 (10 to 60)	38 (10 to 70)	20 (1 to 57)	20 (2 to 50)
12 months postoperative								
Men (n = 121)	20 (0 to 51)	10 (0 to 40)	10 (0 to 28)	20 (0 to 50)	30 (10 to 60)	30 (10 to 70)	20 (1 to 60)	28 (1 to 60)
Women (n = 136)	38 (10 to 70)	20 (3 to 50)	20 (3 to 50)	20 (0 to 40)	40 (20 to 67)	50 (23 to 80)	40 (4 to 70)	30 (10 to 57)
P-value	**0.001**	**0.004**	**0.003**	0.65	0.10	**0.001**	0.12	0.60
All (n = 257)	30 (6 to 61)	10 (0 to 40)	10 (0 to 40)	20 (0 to 40)	35 (10 to 60)	40 (12 to 74)	30 (3 to 68)	29 (3 to 59)

Numbers presented as median [interquartile range, IQR].
Boldface *p*-values <0.05 are considered statistically significant.

Table 6. QuickDASH Results in Patients with and without Diabetes Divided by Sex and Operated on with Simple Decompression for Ulnar Nerve Entrapment

QuickDASH Score	Men without Diabetes (n = 513)	Men with Diabetes (n = 89)	*P*	Women without Diabetes (n = 508)	Women with Diabetes (n = 57)	*P*
Preoperative	41 (25 to 59) (n = 179)	50 (27 to 66) (n = 24)	0.36	57 (43 to 70) (n = 167)	64 (32 to 68) (n = 19)	0.92
Postoperative at 3 months	23 (9 to 41) (n = 116)	41 (19 to 55) (n = 17)	**0.03**	34 (14 to 59) (n = 131)	43 (11 to 61) (n = 19)	0.67
Postoperative at 12 months	41 (18 to 61) (n = 100)	43 (25 to 61) (n = 23)	**0.03**	41 (18 to 61) (n = 129)	27 (9 to 53) (n = 15)	0.18
Change 0–12 months	8.5 (−3 to 21) (n = 42)	−2 (−11 to 9) (n = 7)	0.089	16 (5 to 27) (n = 46)	5 (1 to 31) (n = 5)	0.38

Diabetes includes both type 1 and type 2 diabetes. Numbers presented as median [interquartile range (IQR)].
Boldface *p*-values <0.05 are considered statistically significant.

higher (23%) than it is in the total general total population (about 10%).[24]

Diabetes and Sex

There appears to be a difference in PRO between men with and without diabetes. Although in need of confirmation in future studies, these findings indicate that men, but not women, with diabetes may have worse outcome following simple decompression of UNE. A male predominance in UNE incidence has been reported in some studies.[1,2] Recent studies suggest that men with diabetes develop neuropathy earlier and to a greater extent than women.[8,25] Men have lower intraepidermal nerve fiber density than women in biopsied skin at wrist level.[26] This might indicate less spare capacity in men. As male sex alone has not been reported to negatively affect outcome after UNE surgery, a lower intraepidermal nerve fiber density in men cannot exclusively explain the potentially worse outcomes seen in men with diabetes in the present study. However, explanation might lie in the addition of neuropathic changes induced by diabetes, to an already damaged and especially vulnerable peripheral nerve system in men with UNE.

Surgical Method

Patients undergoing ulnar nerve transposition reported higher postoperative QuickDASH scores than simple decompressions. Transposition is often chosen in more complicated cases, such as when there is subluxation of the nerve. Transposition may also be chosen if a previous simple decompression has failed. It is possible patients, who were operated with a transposition during the study period, previously had been operated with a simple decompression before registration in HAKIR started. In the group with diabetes, simple decompression was chosen more often than in the group without diabetes. It is possible that the surgeon is more prone to avoid larger surgery in a patient with diabetes, to minimize the risk of complications, and that the pathophysiology of UNE in diabetes involves diabetic neuropathy, while subluxation may be a more common cause of surgery in the patients without diabetes.

QuickDASH

Postoperative QuickDASH scores were still high 1 year after surgery in the whole study group. Comparable populations of carpal tunnel syndrome report a postoperative score of 18 on average.[27] Possible explanations include patients being operated on too late, wrong diagnosis and presence of another diagnosis affecting the arm and hand. Also, there was minimal improvement between 3 and 12 months postoperatively, indicating that improvement after surgery occurs early, and evaluation can be done already at 3 months.

Strengths and Limitations

The use of 2 registries enabled detailed studies of a nationwide population. The use of an additional PROM provides more detailed data on surgery outcome. A limitation of the HAKIR registry is that no information is provided if the diagnosis of UNE is supported by a electrophysiological evaluation. We cannot exclude that patients with diabetes may have a worse grading on the preoperative electrophysiology; which may influence outcome of surgery for primary UNE.[9,11] Furthermore, patients may have had a previous elbow trauma or any involved occupational factor, which were not possible to detect in the registry, but in a previous study up to 63% of the patients with a primary UNE described repetitive work load and 26% had a history of a preceding trauma.[11]

No other questionnaires are available for the national quality registry, since such a large registry only uses 2 general questionnaires (ie, Quick DASH and HQ-8), which are sufficient for a variety of hand conditions.[28]

The response rate in the present study is a limitation. However, it corresponds well to other large online surveys[29] and the risk of selection bias is probably not high. Since the data extraction from HAKIR included the years 2010–2016, follow-up data on patients operated on during 2016 were lacking in some cases since it would have been introduced in the registry in 2017. We had no data regarding whether simultaneous surgery was performed on the ipsilateral or contralateral side.

The healthcare in Sweden is publicly funded, regardless of if the department is public or private. In the Swedish system, patients are referred to private units if the waiting time is too long at the public units (>3 months), but most probably this number of patients are of a lower number. Only a minority of patients have private health insurance. In 2017, there were 100 doctors with a specialist license in hand surgery in public care in Sweden, and 35 practicing in private care, according to the National Board of Health and Welfare. UNE surgery is also performed at the orthopedic department, especially in areas with a long distance to the closest specialized hand surgery department. Taken together, we think that the patient population in HAKIR is representative of the Swedish UNE population.

When comparing patients with diabetes type 1 with patients with diabetes type 2, and when comparing patients with and without retinopathy, as well as when comparing the change in PRO over time, the groups were small and the risk of a type 2 statistical error was high. These results should hence be interpreted with caution.

Due to the coding system, we did not have data on which type of transposition was performed.

Patients who were re-operated within 1 year were not sent postoperative questionnaires, which could result in under-reporting of treatment failures. We have chosen not to include any reoperations in this study (**see Figure, Supplemental Digital Content 4**, which displays a visual abstract of the article, http://links.lww.com/PRSGO/B361) (**see Video 1 [online]**, which displays the summary of the study in video format.)

CONCLUSIONS

Women with diabetes benefit from simple decompression for UNE to the same extent as women without diabetes. Men with diabetes risk not to benefit from simple decompression as much as women do. Ulnar nerve transposition had a higher risk of residual symptoms compared to simple decompression. No further improvement can be expected between 3 and 12 months postoperatively.

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