Original article

Improved quality of life after sympathetic block for upper limb hyperhidrosis

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Background: **The aim of the study was to assess two disease-specific quality of life (QoL) instruments after limited endoscopic thoracic sympathetic block (TS) at T4 for upper limb hyperhidrosis.**

Methods: **Between 2001 and 2005, 112 patients underwent 223 TS procedures in a prospective study. Some 103 patients (92·0 per cent) had palmar, 87 (77·7 per cent) had axillary and 75 (67·0 per cent) had combined hyperhidrosis. QoL questionnaires devised by Keller *et al.* and Milanez de Campos *et al.* were employed before and after treatment. Mean(s.d.) follow-up was 21·9(10·1) months.**

Results: **A total of 106 patients (94·6 per cent) were evaluated. All patients with palmar hyperhidrosis were completely or almost dry after surgery. Side-effects of compensatory sweating and gustatory sweating were observed in 17·0 and 28·3 per cent of patients respectively. QoL improved after TS in 100 per cent (Keller) and 97·3 per cent (Milanez de Campos) of patients illustrated by ameliorated scores of 78·7 and 67·8 per cent, respectively (both $P < 0·001$). Both questionnaires showed that compensatory sweating resulted in reduced postoperative QoL ($P = 0·011$, Keller; $P = 0·032$, Milanez de Campos).**

Conclusion: **Endoscopic sympathetic block at T4 leads to improved QoL. Both current questionnaires fulfilled validation criteria for disease-specific QoL instruments in upper limb hyperhidrosis.**

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Introduction

Primary hyperhidrosis is a widespread problem in the Western world, with a prevalence of up to 2·8 per cent[1]. When conservative treatment fails, endoscopic thoracic sympathectomy (TS) has evolved as the treatment of choice[2].

Besides traditional outcome data, such as mortality, morbidity and complication rates, quality of life (QoL) analyses are being used increasingly in the evaluation of surgical procedures. QoL investigations are lacking in sympathetic surgery compared with other procedures[3], and those available lack quality, especially in terms of substantiated conclusions[4,5].

Generic QoL instruments, such as the Short Form (SF) 36 or SF-12, cover all relevant domains of a person's general health status and are used mostly for quality management[6–9]. They may not detect disease-specific changes in QoL[10–12]. Disease-specific instruments focus on important parts of the health state and measure changes in a distinct condition[11–15].

To date, there are two disease-specific QoL instruments that examine the physical and psychological condition of patients with hyperhidrosis after TS. In 2001, Keller *et al.*[6] described a 'hyperhidrosis scale' comprising 15 questions concerning daily life. The second disease-specific QoL instrument was introduced by Milanez de Campos *et al.*[14] and subdivided 20 questions in four domains.

The aim of this study was to evaluate QoL after thoracic endoscopic sympathetic block at T4. The two disease-specific questionnaires were applied before and after surgery, taking into account the effect of patient sex, major side-effects and recurrent hyperhidrosis.

Patients and methods

Between June 2001 and March 2005, 223 TS procedures were performed on 112 patients (80 women of mean(s.d.) age 30·3(9·9) years and 32 men aged 30·5(6·4) years). Some 103 patients (92·0 per cent) had palmar, 87 (77·7 per cent) had axillary and 96 (85·7 per cent) had plantar hyperhidrosis. Twenty-eight patients (25·0 per cent) had isolated palmar and 12 (10·7 per cent) had isolated axillary hyperhidrosis; 75 (67·0 per cent) had combined palmar and axillary sweating. All patients had received extensive conservative therapy before being referred for surgery.

Surgical procedure

The procedure has been described previously[16,17]. In brief, under general anaesthesia, two 5-mm trocars were inserted in the third and fifth intercostal spaces. Clips (5 mm) were used to block the sympathetic trunk above and below the fourth sympathetic ganglion. In 111 patients (99·1 per cent) bilateral TS was performed in a single operation. Usually, patients were discharged from the hospital on the first postoperative day.

Clinical outcome

All patient charts were reviewed for assessment of postoperative success and complications. Symptoms were scored before and after surgery by means of a standard questionnaire using a visual analogue scale (VAS) graded between zero (no symptoms) and ten (worst possible symptom). The major side-effects of sympathetic surgery, such as compensatory sweating, gustatory sweating and vasomotor rhinitis, were graded similarly. In addition, patient satisfaction was assessed[15–17]. Information was obtained by physical examination, personal interview and telephone call before operation and at follow-up.

Quality of life instruments

Two disease-specific questionnaires were used to assess changes in QoL after TS. Both reflect common physical symptoms and social stigmata associated with primary sweating[6,14].

The QoL instrument developed by Keller *et al.*[6] comprises 15 questions scored from zero (no symptoms) to ten (worst possible) subdivided into three domains according to the main sweating areas. The first domain addresses sweating of the hands, the second concerns the feet, and the third refers mainly to the armpits. The 'hyperhidrosis scale' has been described in detail elsewhere[3]. The second questionnaire, devised by Milanez de Campos *et al.*[14], consists of 22 questions scored as above in four domains: sweating symptoms, intimacy, emotional response and special circumstances.

Statistical analysis

Results were presented as median (interquartile range (i.q.r.)) scores. Percentages given for complication and success rates were related to the number of TS procedures. In contrast, side-effects, satisfaction rates and changes in QoL were recorded per patient.

Statistical evaluation was performed with the paired Wilcoxon signed rank test for comparison of preoperative and postoperative QoL using median rank scores[18]. Sum scores were created for each domain, as well as a total sum score. The Mann–Whitney *U* test was used to show any sex differences in QoL sum scores; therefore, the item 'wearing high-heeled shoes' from the Keller index was excluded. $P < 0{\cdot}050$ was considered statistically significant. The Bonferroni correction was employed to control for multiple errors. All analyses were performed with SPSS® version 10.0.7 for Windows® (SPSS, Chicago, Illinois, USA).

Results

Clinical outcome

Complete follow-up information was obtained from 106 patients (94·6 per cent) after a mean(s.d.) follow-up of 21·9(10·1) months. Some 199 procedures were performed for palmar hyperhidrosis; 154 palms (77·4 per cent) became completely dry, and the other 45 improved considerably (*Table 1*). Changes in the axillae and feet were less marked.

Seven patients (3·1 per cent) had postoperative complications. Three (1·3 per cent) had a unilateral pneumothorax after surgery that required chest tube drainage. One patient underwent thoracoscopic revision

Table 1 Clinical outcome after thoracoscopic sympathectomy in 106 patients

Treatment success	Palmar hyperhidrosis ($n = 199$)	Axillary hyperhidrosis ($n = 171$)	Plantar hyperhidrosis ($n = 186$)
Completely dry, no sweating	154 (77·4)	98 (57·3)	16 (8·6)
Improved sweating	45 (22·6)	53 (31·0)	62 (33·3)
Mild sweating*	0 (0)	8 (4·7)	2 (1·1)
Unchanged sweating	0 (0)	8 (4·7)	96 (51·6)
Worse sweating	0 (0)	4 (2·3)	10 (5·4)

Values in parentheses are percentages. *Unchanged or worse sweating, but not disturbing.

owing to intercostal artery bleeding after chest tube drainage of a pneumothorax. No patient developed Horner's syndrome. Two patients (0·9 per cent) had postoperative neuralgia and were treated with non-steroidal analgesics; both had settled after 2 weeks. One wound infection was treated with dressings and the patient did not need antibiotics.

Eighteen patients (17·0 per cent) developed compensatory sweating, mostly affecting the chest, back, abdominal and lumbar regions. Only one woman (0·9 per cent) considered this side-effect to be unbearable; she refused any further therapy. Ten patients (9·4 per cent) were disturbed by the extent of the compensatory sweating, whereas the others were not, or barely concerned. Thirty individuals (28·3 per cent) exhibited gustatory sweating, but none was disturbed by this. Vasomotor rhinitis was not observed.

One man (0·9 per cent) developed bilateral palmar, and less severe axillary, recurrence of hyperhidrosis 9 months after operation. He had repeat surgery and the T3 ganglion was blocked additionally. No reason for the recurrence was detected and his palms remained dry at follow-up. A woman with combined palmar and axillary hyperhidrosis complained of axillary recurrence 3 weeks after TS; however, her palms remained completely dry. Four patients (3·8 per cent) with palmar and seven (6·6 per cent) with axillary hyperhidrosis observed a mild increase in sweating 2–9 months after surgery, corresponding to an increase in the VAS score from two to four points. Palmar sweating was not affected in patients with combined palmoaxillary hyperhidrosis. One patient insisted on having his clips removed because of compensatory sweating, but this did not improve his complaints.

At follow-up, 92 patients (86·8 per cent) were fully satisfied, 11 (10·4 per cent) were partly satisfied, mostly because of compensatory sweating, and three patients (2·8 per cent) were dissatisfied. Two of the dissatisfied patients had recurrent hyperhidrosis as described above, and one gave postoperative pain and simultaneous compensatory sweating as reasons for his dissatisfaction.

Table 2 Preoperative and postoperative quality of life according to the hyperhidrosis scale of Keller *et al.*[6] after thoracoscopic sympathectomy in 106 patients

Question	Preop. score	Postop. score	*P**
Shake hands with others?	10 (8, 10)	0 (0, 0)	< 0·001
Hold hands with a boyfriend/girlfriend/spouse?	10 (8, 10)	0 (0, 0)	< 0·001
Writing (by hand) on paper?	9 (6, 10)	0 (0, 0)	< 0·001
Grasp heavy objects and/or tools?	6 (4, 10)	0 (0, 0)	< 0·001
Attempt to initiate intimate contact?	8 (4, 10)	0 (0, 0)	< 0·001
Turn knobs or taps?	7 (4, 10)	0 (0, 0)	< 0·001
Drive a car?	8 (5, 10)	0 (0, 0)	< 0·001
Eat with forks, knives or spoons?	5 (2, 10)	0 (0, 0)	< 0·001
Wear fabric, leather or rubber gloves?	9 (4, 10)	0 (0, 0)	< 0·001
Put on socks or stockings?	7 (4, 9)	4 (1, 7)	< 0·001
Walk barefoot?	6 (3, 8)	4 (0, 7)	< 0·001
Wear sandals?	8 (4, 10)	5 (1, 8)	< 0·001
Wear high-heeled shoes?	6 (2, 10)	3 (0, 7)	< 0·001
Sweat from axilla?	8 (2, 10)	0 (0, 2)	< 0·001
Sweat from parts of the body other than above?	0 (0, 0)	0 (0, 0)	0·719

Values are median (interquartile range). *Wilcoxon signed rank test with Bonferroni correction.

Quality of life assessment

Both questionnaires showed that QoL improved significantly after TS. One hundred per cent (Keller) and 97·3 per cent (Milanez de Campos) of patients achieved ameliorated scores by 78·7 and 67·8 per cent, respectively (both $P < 0·007$). The median sum score for the Keller questionnaire decreased from 95 (range 8–132) to 17 (0–62) ($P < 0·001$). The median sum scores of the domains

Table 3 Preoperative and postoperative quality of life according to the Milanez de Campos *et al.*[14] questionnaire after thoracoscopic sympathectomy in 106 patients

Question	Preop. score	Postop. score	*P**
How would you rate your QoL in general?	5 (4, 5)	1 (1, 2)	< 0·001
Writing	5 (3, 5)	1 (1, 1)	< 0·001
Manual work	5 (4, 5)	1 (1, 1)	< 0·001
Leisure	4 (3, 5)	1 (1, 1)	< 0·001
Sports	4 (3, 5)	1 (1, 2)	< 0·001
Hand shaking	5 (4, 5)	1 (1, 1)	< 0·001
Socializing (public places)	5 (4, 5)	1 (1, 1)	< 0·001
Grasping objects	3 (2, 5)	1 (1, 1)	< 0·001
Social dancing	5 (4, 5)	1 (1, 1)	< 0·001
Holding hands	5 (4, 5)	1 (1, 1)	< 0·001
Intimate touching	4 (2, 5)	1 (1, 1)	< 0·001
Intimate affairs	4 (2, 5)	1 (1, 1)	< 0·001
I always justified myself	3 (1, 5)	1 (1, 1)	< 0·001
People rejected me slightly	1 (1, 4)	1 (1, 1)	< 0·001
In a closed or hot environment	5 (4, 5)	1 (1, 2)	< 0·001
When tense or worried	5 (4, 5)	1 (1, 2)	< 0·001
Thinking about a problem	4 (2, 5)	1 (1, 1)	< 0·001
Before an examination /meeting/speaking in public	5 (5, 5)	1 (1, 2)	< 0·001
Wearing sandals/walking barefoot	4 (2, 5)	2 (1, 4)	< 0·001
Wearing coloured clothing	4 (2, 5)	1 (1, 1)	< 0·001
Having problems at school/work	5 (3, 5)	1 (1, 2)	< 0·001

Values are median (interquartile range). QoL, quality of life. *Wilcoxon signed rank test with Bonferroni correction.

dropped from 65 to 0 (palmar), from 21 to 12 (plantar) and from 8 to 0 (axillary) (*Table 2*).

The Milanez de Campos questionnaire[14] showed similar results: the median sum score dropped from 84 (range 47–105) to 22 (19–65) ($P < 0{\cdot}001$). There were similar reductions in each of the four domains ($P < 0{\cdot}001$) (*Table 3*). No patient graded their QoL as slightly or much worse.

Patients who developed compensatory sweating had a worse QoL than those who did not: median rank score 57·7 *versus* 39·9 ($P = 0{\cdot}011$) as evaluated by the Keller questionnaire and 51·2 *versus* 37·4 ($P = 0{\cdot}032$) by the Milanez de Campos questionnaire. Moreover, postoperative QoL scores in patients with compensatory sweating were worse than before surgery: median rank score 57·7 *versus* 48·0 ($P = 0{\cdot}001$) with the Keller questionnaire; 51·2 *versus* 41·8 ($P = 0{\cdot}001$) with the Milanez de Campos questionnaire. Gustatory sweating did not impair postoperative QoL.

QoL in women with hyperhidrosis was significantly worse than that in men when assessed with the Milanez de Campos questionnaire (median rank score 46·0 *versus* 34·2; $P = 0{\cdot}043$), but, in contrast, the Keller scale did not detect any sex-specific differences.

Discussion

Patients with upper limb hyperhidrosis experience a poor QoL, despite usually being young and not affected by comorbidity or pain. Hyperhidrosis is not life threatening or life limiting, yet, in terms of SF-36 scores, the general health status and social functioning of patients with hyperhidrosis is worse than that of patients with postmastectomy pain or those with unstable angina pectoris or myocardial infarction[19–21].

The major finding of this study is that QoL increased considerably after T4 TS. The low number of postoperative complications and the high success rate in patients with palmar hyperhidrosis may have contributed to these findings. Both disease-specific questionnaires showed comparable results, with improvements of 78·7 and 67·8 per cent, according to the Keller[6] and Milanez de Campos[14] questionnaires respectively. In contrast, Lau *et al.*[7] reported QoL improvement of only 8 per cent, using the SF-36 after T2–T4 sympathectomy. It seems unlikely that technical aspects of surgery accounted for this difference; Sayeed *et al.*[8] and Young *et al.*[9] admitted that the SF-36 is too general and lacks responsiveness.

The QoL questionnaire developed by Milanez de Campos *et al.*[14] evaluates hyperhidrosis in different situations. In the present study, dissatisfaction was most pronounced for the social domain, where hyperhidrosis is a major drawback[2,7,13,14]. The emotional domain yielded relatively low dissatisfaction rates, as most people hide their complaints to avoid social and emotional rejection.

Compensatory sweating, the most frequent and unwanted side-effect of sympathetic surgery, profoundly impairs postoperative QoL. Limited T4 TS was performed in an attempt to reduce the rate of compensatory sweating in comparison with that observed following T2–T4 sympathectomy[17,22]. In addition, the present study demonstrated that QoL in patients who developed compensatory sweating was even worse than before surgery. If risk factors could be identified for the development of compensatory sweating, these patients should be excluded from surgery. As such risk factors are not yet known, patients can be offered a reversal operation if severe compensatory sweating occurs after operation[23]. A large number of patients reported gustatory sweating, which did not influence QoL scores. There was no association between a renewed increase in sweating after TS and changes in QoL. All but one patient (with palmar recurrence) judged an increase in sweating as not disturbing.

The QoL of women with hyperhidrosis was significantly worse than that of men, according to the Milanez de Campos questionnaire. These results agree with data from a disease-specific questionnaire developed by Amir *et al.*[13]. As hyperhidrosis decreases sexual attraction, women might be impaired more than men. The focus of the Keller score is directed towards the areas of hyperhidrosis, whereas the Milanez de Campos questionnaire stresses the importance of disease-specific emotional and personal aspects. This fact might explain why the latter questionnaire was able to detect sex-specific differences.

This study validated both disease-specific QoL questionnaires studied. Preoperative and postoperative values of the Keller hyperhidrosis scale were within the range of data obtained in other studies[6,15,17]. Broadly, T4 TS yielded similar results to those of T2–T3 sympathectomy, although no definite comparisons can be drawn because postoperative data were reported only anecdotally by Keller *et al.*[6]. As the results of the present authors' previous short-term studies[15,17] were similar to data presented here after mid-term follow-up, the Keller questionnaire has shown reliability. Significant improvement in QoL was observed after TS in all reports, attesting to the responsiveness of this instrument[6,15,17]. Furthermore, the different questions adequately reflected the area of interest, fulfilling the third QoL criterion of validity[10–12].

The Milanez de Campos questionnaire gave excellent results after T4 TS, as 97·3 per cent of patients improved. Only 86·4 per cent graded their QoL as better in the original description[14]. Different surgical procedures

provide different results[17,22]; however, in the original description three different procedures (resection, and thermal ablation with electric and harmonic scalpels) were employed without differentiation between surgical procedures[14]. The low proportion of patients with compensatory sweating after T4 TS might also be responsible for the present results. In summary, this study has proved that both disease-specific QoL questionnaires fulfil the three essential requirements of reliability, responsiveness and validity[10–12].

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