

# Endoscopic thoracic sympathectomy for Morbus Raynaud's phenomenon (Mansoura University Hospital experience)

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## Background

Endoscopic thoracic sympathectomy (ETS) is used for the treatment of a wide range of upper limb disorders. The aim of this study was to represent our experience with ETS as a minimally invasive procedure in the treatment of Morbus Raynaud's phenomenon (RP).

## Patients and methods

From January 2012 to March 2015, 29 patients complaining of Morbus RP underwent ETS in the Vascular Surgery Department, Mansoura University Hospital. Eleven patients (38%) presented with digital ulceration despite intensive medical therapy, and 18 patients (62%) presented with severe ischemia without ulceration.

## Results

Twenty-nine patients were subjected to 58 ETS. There were eight male (27.55%) and 21 female patients (72.5%) with a mean age of 38 years (range 21–67 years). The mean operative time was  $30 \pm 6$  min (range 22–45 min). There were no deaths or major intraoperative complications. Initial improvement of symptoms with ulcer healing was achieved in 28 of 29 patients (96.5%). Recurrence of the symptoms occurred in 15 patients (52%); however, the symptoms were less severe compared with preoperative symptoms. There was no recurrence of digital ulceration.

## Conclusion

ETS for RP has good initial effect despite a high rate of recurrence. However, the symptoms were less severe compared with preoperative symptoms and without recurrence of digital ulceration. ETS is a preferred treatment modality for Morbus RP.

## Keywords:

Raynaud's phenomenon, sympathectomy, upper limb ischemia, vasospastic diseases

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## Introduction

Thoracic sympathectomy (TS) is a procedure to interrupt the adrenergic effect of the central nervous system on the upper extremity. The major effects of sympathectomy are diminution in vasomotor tone and reduction in peripheral vascular resistance [1].

TS is indicated for the treatment of some upper limb disorders, mainly hyperhidrosis, Raynaud's phenomenon (RP), and complex regional pain syndrome [2].

Management of RP by means of open cervicothoracic sympathectomy was first reported by Adson and Broser [3]. Thoracic endoscopic sympathectomy was first described by Kux [4], and it had the advantage of being a minimally invasive procedure.

Maurice Raynaud, in 1862, was the first to describe the phenomenon of acral vasospasm presented with pallor, cyanosis, and hyperemic phase, sometimes accompanied by pain. Subsequent authors in the next decades have termed this condition as Raynaud's disease, which may be primary RP or secondary RP caused by an underlying definite pathology, mainly

connective tissue autoimmune disorders such as systemic sclerosis, systemic lupus erythematosus, and Sjogren's syndrome [5,6].

RP is characterized by episodic digital ischemia provoked by cold [7]: clinically manifested as classical a color triad sequence of pallor due to vasospasm, cyanosis due to venous stasis, and redness caused by reactive hyperemia following the return of blood flow [8].

In primary RP, treatment is mostly prophylactic by avoiding cold exposure or the use of vasospastic drugs, whereas secondary RP is seen in connective tissue disorders and treatment is directed to the underlying cause [9].

Medical treatment for RP includes vasodilators, anticoagulants, and more specific drugs such as endothelin-1 receptor antagonists, calcium channel

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blockers, angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers, prostacyclin analogs,  $\alpha$ -adrenergic blockers, and phosphodiesterase-5 inhibitors [10].

In either type of RP the symptoms may progress and digital ulcerations develop despite conservative treatment. TS may relieve symptoms in these patients [11].

Different methods of surgical sympathectomy have been reported, including resection, electrocauterization, transection, and clipping of various levels from T2, T3, T4, and sympathetic rami communicants [12].

Immediately after endoscopic thoracic sympathectomy (ETS) all the patients were completely cured with warm and dry hands, however, after 6–8 months recurrence usually occurs but to a lesser extent than the pre-intervention. This is not due to nerve regeneration but due to hypersensitivity of the noradrenergic receptors, which regulate the precapillary sphincters lowering the threshold of their stimulation [11,13].

This study aimed to represent our experience in managing Morbus Raynaud's by means of endoscopic transthoracic sympathectomy in Mansoura University Hospitals.

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## Patients and methods

From January 2012 to March 2015, 29 patients complaining of Morbus RP were subjected to ETS in the Vascular Surgery Department, Mansoura University Hospital. After approval of our institution review board (IRB)

After explanation of the nature of the disease and possible treatment, informed consent was obtained from the patients included in the study.

All patients were subjected to thorough history taking with emphasis on previous treatment modalities.

Patients who presented with ulceration or severe ischemia without ulceration despite intense medical treatment were included in the study, whereas patients with no previous medical treatment were excluded.

## Operative technique

Surgical technique: patients were positioned in supine semisitting position with arms abducted. General anesthesia was induced with a single-lumen endotracheal tube. Pneumothorax was achieved with a Verses needle using carbon dioxide insufflation with about 2 l at a pressure of 8 mmHg. Thereafter, two ports

were introduced (sixth intercostal space midaxillary line and fourth intercostal space anterior axillary line). In addition, a third port may be used for adhesiolysis, in case of extensive adhesions. The first port is used for the endoscope and the second for dissection and diathermy [14].

After collapse of the lung, the sympathetic chain is identified under the parietal pleura, running vertically over the necks of the ribs in the upper costovertebral region. If the sympathetic chain is difficult to visualize, it can be identified by rolling it under the grasping forceps, and then sympathectomy will be performed (T2–T4).

Thereafter, the anesthetist reinflates the lung until it reaches the intercostal muscles, with positive pressure until closure of the wound was performed.

The pain visual analog scale is a single-item scale for pain intensity; the scale is most commonly anchored by 'no pain' (score of 0) and 'pain as bad as it could be' or 'worst imaginable pain' (score of 100). The following points on the pain visual analog scale have been recommended: no pain (0–4 mm), mild pain (5–44 mm), moderate pain (45–74 mm), and severe pain (75–100 mm) [15].

The patients were asked to point to the site on the line that represents their pain intensity. Using a ruler, the score is determined by measuring the distance (mm) on the 10 cm line between the 'no pain' anchor and the patient's mark, providing a range of scores from 0 to 100 [16].

## Follow-up

All patients were followed up postoperatively with radiograph and discharged 24 h later unless complications occurred. Two weeks after discharge, the patients were followed up at the outpatient clinic, and the stitches were removed. Thereafter, the patients were followed up every 3 months for relief of symptoms, recurrence of symptoms or healing of ulcers, or both.

## Statistical analysis

The statistical analysis of data was carried out using Excel program and SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

Data were presented as mean  $\pm$  SD for quantitative data and as frequency and proportion for qualitative data.

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## Results

Between January 2012 and March 2015, 29 patients underwent 58 ETS; all patients underwent the operation after failure of conservative treatment.

Eight patients (27.5%) were male and 21 patients (72.5%) were female.

The mean age was 38 years (range 21–67 years).

The mean operative time was  $30 \pm 6$  min (range 22–45 min) (Table 1).

There was no death or major intraoperative complication (Tables 2 and 3).

Initial improvement of symptoms with ulcer healing was achieved in 28 of 29 patients (96.5%).

Recurrence of the symptoms was observed in 15 patients (52%) during the follow-up period, but symptoms were less severe compared with preoperative symptoms (Table 4).

#### No recurrence of digital ulceration

There were no intraoperative complications but postoperative complications occurred in two patients. One patient had pneumothorax discovered by means of postoperative radiography and managed with intercostal tube, which was removed after 3 days from the insertion. Another patient developed segmental

**Table 1 Demographic data and operative time**

Age (years) (mean (range))	38 (21-67)
Sex (female, male)	21, 8
Primary Raynaud's	23
Secondary	6
Operative time (min) (mean (range))	30±6 (22-45)

**Table 2 Hospital stay, complications, and follow-up**

Mean hospital stay (days)	1±0.4
Number of postoperative complications	2
Mean follow-up period (months)	25±6.2

**Table 3 Postoperative outcome**

	Primary Raynaud's	Secondary Raynaud's
Initial improvement of the symptoms		
Symptom-free patients (28 of 29)	23/23	5/6
Ulcer healing (10 of 11)	8/8	2/3
Long-term results (mean 25±6 months)		
Recurrence of symptoms but better than that preoperatively (15 patients)	11/23	4/6
Recurrence of digital ulcer	0	0

**Table 4 Visual analog scale for pain**

	VAS (mean±SD)	P value
Preoperative	91.1±0.3	
Early postoperative	15.8±0.7	0.01*
3 months postoperatively	37.7±0.4	0.03*
6 months postoperatively	72.2±0.2	0.08
12 months postoperatively	81.1±0.06	0.2

VAS, visual analog scale.

atelectasis that improved during follow-up with physiotherapy.

#### Discussion

RP is classified into primary Raynaud's and secondary Raynaud's. Primary Raynaud's is idiopathic, and secondary Raynaud's is related to an underlying disease [17]. Later, it was described in 1826 as an episodic syndrome of emotionally triggered digital cyanosis, rubor, and pallor [14].

Earlier, an abnormal vasospastic response was considered as a cause of this syndrome. Therefore, cervicothoracic sympathectomy was adopted as a treatment option for RP [3,18]. Later, with the introduction of endoscopic surgery, TS, being a less invasive surgical technique, was considered the preferred treatment option for patients with severe RP with no response to conservative treatment [18].

In our study, recurrence of the symptoms was observed in 52% of patients during follow-up period; however, the symptoms were less severe compared with preoperative symptoms. These findings are in contrast to previous reports of a high recurrence rate by Claes [11], who found that the recurrence rate was 100%. However, Matsumoto reported a recurrence rate of 82% and Nicholson *et al.* [19] reported a recurrence rate 50%.

The exact mechanism of recurrence of symptoms is unknown, but recurrence may be caused by technical error (incomplete sympathectomy) [20], sympathetic reinnervation, hypersensitivity of the digital vessels to circulating catecholamines [21], or progression of the underlying disease (e.g., vasculitis or connective tissue disorder).

As for digital ulceration of the Raynaud's, healing occurred in 10 of 11 patients (91%) after only 1 month after surgery. There was no recurrence or new ulcer formation during the follow-up period (range 6–44 months). This is nearly similar to the results reported by Khan *et al.* [22], who reported that healing of the ulcer occurred in 91% of the patients. However, Thune *et al.* [8] and Matsumoto *et al.* [2] found that ulcer healing occurred in 100% of patients.

It is unclear as why ETS produces healing of digital ulcer despite the high recurrence rate of RP. However, we think that RP with digital ulcer has both functional and organic (microvessel obstruction because of vasculitis) problems, and ETS improves the microvascular circulation of the

finger and promotes long-term healing of ulcer, and its preventive effect for abnormal, vasospastic response lasts for a few months [2]. However, if the patient had complete obstruction, there will be less chance for healing, similar to the patient in our study.

The mean hospital stay in our study was an average of 1 day, which is similar to the average hospital stay in the study by Claes [23].

This study represents our experience in Mansoura University Hospital on ETS for Morbus RP during a follow up of  $25 \pm 6.2$  months, which was similar to that reported in studies by Thune *et al.* [8] and Coveliers *et al.* [17].

## Conclusion

ETS for RP has a good initial effect despite a high rate of recurrence. However, the severity of the symptoms recurring is much less compared with the presenting symptoms, without recurrence of digital ulceration. ETS can be used as a last option for the management of Morbus RP when conservative management fails.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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