

PAIN RELIEF FOLLOWING THORACOSCOPIC
SYMPATHECTOMY FOR PALMAR
HYPERHIDROSIS: A PROSPECTIVE RANDOMISED
DOUBLE-BLIND STUDY

A EL-DAWLATLY¹, A AL-DOHAYAN², M ALMAJED³,
A TURKISTANI⁴, E MANAA⁵, M ELSAYED⁶
AND K MAZEN⁷

Abstract

Background: Acute pain management following thoracoscopic sympathectomy (TS) has been described in the literature. The combination of interpleural (IP) injection of bupivacaine and intramuscular injection. (I.M) NSAIDs has not been reported. Therefore we conducted this randomized controlled trial to compare this technique to other reported techniques described for postoperative analgesia following TS.

Methods: 40 patients scheduled to have TS under general anesthesia for the treatment of hyperhidrosis were randomly allocated into 4 groups. **Group 1** received 1.5 mg/kg b.w I.M pethidine at end of surgery. **Group 2** received ketoprofen 100 mg I.M at end of surgery. **Group 3** received 0.4 ml/kg b.w interpleural bupivacaine 0.5%. **Group 4** received a combination of I.M ketoprofen (100 mg) in addition to interpleural bupivacaine (0.4 ml/kg). Postoperative pain was assessed using the 11-

From College of Med., King Saud Univ., Riyadh, KSA.

Dept of Anesth.

1. MD, Prof. 3. FRCPC, Assist. Prof. 4. MD, FCCM, Assoc. Prof.
5. MD, Consultant Anesthetist. 7. MD, Senior Registrar.

Dept of Surg.

2. FRCS, Head Dept. of Surg 6. FRCS, Senior Registrar.

Address for correspondence: A.A El-Dawlatly, Associate Professor, Department of Anesthesia, College of Medicine, King Saud University, Riyadh 11461. P.O. Box: 2925, KSA.# E-mail: dawlatly@ksu.edu.sa.

point numeric rating score (NRS) at 7 different intervals. First, immediately on admission to PACU, every 2 hours for the next 8 hours then at 12 and at 24 hours. Pain was assessed at rest, during deep inspiration and while coughing. ANOVA was used for statistical analysis and Chi-square test for comparing of the data where P values <0.05 were considered significant.

Results: The NRS at rest was 3.2 (1.9), 2.4 (1.6), 3 (1.9) and 0.7 (0.9) at **Groups 1, 2, 3 and 4** respectively with significant difference in **Group 4** versus other Group (P<0.05) at 2 hours postoperatively and up to 24 hours postoperatively. The same trend was also found during maximal inspiration and while coughing. Opioid consumption in 24 hours was significantly reduced in **Group 4** compared to other Groups.

Conclusions: Combination of IP bupivacaine and I.M ketoprofen provided superior analgesia when compared to each modality alone and was better than intramuscular pethidine injection in terms of NRS and the consumption of rescue morphine postoperatively. Further studies are needed on large sample size to confirm our results.

Keywords: thoracoscopic sympathectomy; pain relief; interpleural analgesia.

Introduction

Thoracoscopic sympathectomy (TS) has become the standard method of surgical treatment of patients with hyperhidrosis. Postoperative pain following TS is underestimated. It is well known that although TS is minimally invasive procedure, however, patients can experience moderate to severe pain in the early hours postoperatively^{1,2}. In one study, the effect of continuous intra and postoperative paravertebral block after video-assisted thoracoscopic surgery (VATS) was evaluated and proved to be effective³. Vogt et al, have shown that single-shot paravertebral block was an effective procedure to improve pain treatment after thoracoscopic surgery⁴. In another study Asslia et al, have showed that interpleural analgesia was effective following TS for palmar hyperhidrosis (PH)⁵. In another study on the effect of single-dose, multilevel paravertebral nerve

blockage after thoracoscopic procedures, it was shown that the technique was effective only for 6 hours because of the limited duration with the currently available local anesthetic agents and the authors suggested that paravertebral technique is not indicated in the setting of thoracoscopic surgery⁶.

As previously described, acute pain management following thoracoscopic sympathectomy (TS) has been described in the literature. However, the combination of interpleural (IP) injection of bupivacaine and intramuscular injection (I.M) NSAIDs have not been reported. Therefore we conducted this randomized controlled trial to compare this technique to other reported techniques described for postoperative analgesia following TS.

Methods and Materials

After written informed consent was obtained and hospital Ethic Committee approval, 40 adult patients, ASA I or II (35 males) scheduled to undergo elective unilateral TS for treatment of PH were enrolled in the study. Patients with cardio-respiratory diseases were excluded from the study. A preoperative chest X-ray was taken for all patients to exclude any lung pathology.

Premedication for all patients was achieved with oral lorazepam 2mg. 2 hours preoperatively. Standard intraoperative monitoring was applied. Patients were randomly allocated into four groups (10 patients each) depending on the pain relief modality described. **Group 1** received I.M pethidine 1.5 mg/kg b.w, **Group 2** received I.M ketoprofen 100 mg, **Group 3** received 0.4 ml/kg b.w interpleural bupivacaine (5 mg/ml) and **Group 4** received combination of I.M ketoprofen (100 mg) and interpleural bupivacaine (0.4 ml/kg)^{7,8}. Interpleural bupivacaine was given by the surgeon at the end of the procedure through a silastic chest tube and before lung reinflation. Patients characteristics and duration of surgery of the four groups are given in Table 1.

Table 1
Patients characteristics & duration of surgery (mean \pm SD)

| | Group 1 | Group 2 | Group 3 | Group 4 |
|----------------------------------|-----------------|-----------------|-----------------|-----------------|
| Age (yr) | 22.5 \pm 3.1 | 26.6 \pm 2.1 | 25.1 \pm 4 | 30 \pm 8 |
| Weight (kg) | 67.8 \pm 11.4 | 65.3 \pm 11.6 | 68.8 \pm 12.9 | 74.3 \pm 7.7 |
| Height (cm) | 171.8 \pm 6.9 | 165.9 \pm 9.5 | 167.6 \pm 7.9 | 166.8 \pm 8.9 |
| Sex (M:F) | 9:1 | 9:1 | 8:2 | 9:1 |
| Duration of surgery (min) | 22 \pm 4.8 | 16 \pm 6.5 | 24.2 \pm 5.8 | 19.3 \pm 7.9 |

Induction of anesthesia was achieved with sufentanil 0.1 mcg/kg b.w and propofol 3 mg/kg b.w followed by atracurium 0.5 mg/kg b.w to facilitate endotracheal intubation with single lumen tube (SLT). The patients' lungs were ventilated with 50% O₂ in air and 1 MAC sevoflurane using anesthesia delivery unit (Datex Ohmeda type A_Elec, Promma, Sweden) with tidal volume of 10 ml/kg, rate of 10 breaths/min and inspiration time 33% of respiratory cycle time including a 10% end-inspiratory pause for both two-lung ventilation and one lung ventilation. Anesthesia was maintained with mixture of 50% O₂ in air and 1 MAC sevoflurane. Incremental dosage atracurium was given when required. Since the duration of surgery was relatively short no additional dosages of sufentanil was given to any patient in the four groups.

Surgery was performed in all patients by the same surgeon. Patients were positioned supine, with 30° higher tilt of the ipsilateral thorax. Verres needle was inserted into the pleural space through a small incision in the 3rd or 4th intercostal space of the operated side. Two ports technique was used, one for the camera and the other for the diathermy or staple⁹. Interpleural carbon dioxide gas was insufflated at a rate of 0.5-1 l/min and interpleural pressure (IP) of 10 mmHg to achieve one lung collapsed ventilation (OLCV). Then IP was reduced and maintained at 5 mmHg and later reduced to 2 mmHg throughout the rest of the procedure. At the end of surgery, a silastic chest tube was inserted, connected to an under-water seal system and the lung allowed to expand fully with positive pressure ventilation, then the tube was removed. Upon completion of surgery, atropine 1.2 mg and neostigmine 2.5 mg were given i.v and the trachea

was extubated. The patients then were sent to PACU.

In the PACU, NRS for pain assessment was used (0 = no pain, 10 = worst pain). Patients were asked to rate their pain at rest, deep inspiration and at coughing every hour in the recovery room and then 2, 4, 6, 8, 10, 12, 24 hours in the ward. Both the nurse and physician were unaware to which group the patient belongs while taking the NRS data. Inadequate analgesia was considered if the NRS at rest >3 where additional intravenous morphine was prescribed in this case.

Statistical analysis: Data were analyzed using a statistical software package (Graph Pad In Stat version 3.00 for Windows, Graph Pad Software Inc., San Diego, California, USA) and presented as mean (SD), number (Percentage), or ratio as appropriate. Groups were compared using analysis of variance (ANOVA) followed by Post-hoc analysis if significance was detected. Nominal data were compared using the Chi-square test. P values <0.05 were considered significant.

Results

Types of different surgical techniques are shown in Table 2. Intraoperative heart rate and systolic blood pressure and tissue oxygen saturation (SpO₂) showed non-significant differences between all the groups ($P>0.05$).

Table 2
Number of patients and types of surgical procedure in each group

| | Group 1 | Group 2 | Group 3 | Group 4 | Total % |
|--------------------|---------|---------|---------|---------|---------|
| Cutting | 0 | 0 | 0 | 5 | 12.5% |
| Coagulation | 9 | 4 | 5 | 5 | 47.5% |
| Clipping | 1 | 6 | 5 | 0 | 30% |

The NRS in the immediate admission to PACU showed non-significant differences among all four groups at rest ($P>0.05$). However, in the subsequent times NRS showed significant low values in **Group 4** compared to other groups (Table 3).

Table 3
Numeric rating score (NRS) at rest (mean \pm SD)

| | Group 1 | Group 2 | Group 3 | Group 4 | P value |
|--------|---------------|---------------|---------------|---------------|---------|
| 0 time | 2.8 \pm 1.5 | 2.7 \pm 3.2 | 2.9 \pm 2.9 | 1.4 \pm 1.2 | 0.456 |
| 2 hr | 3.2 \pm 1.9 | 2.4 \pm 1.6 | 3 \pm 1.9 | 0.7 \pm 0.9 | 0.006* |
| 4 hr | 3.5 \pm 1.8 | 2.7 \pm 1.7 | 2.7 \pm 1.8 | 1 \pm 1.1 | 0.012* |
| 6 hr | 3.2 \pm 1.8 | 3 \pm 1.8 | 3.1 \pm 1.9 | 0.9 \pm 1.4 | 0.014* |
| 8 hr | 1 \pm 1.6 | 3.2 \pm 2.3 | 3.4 \pm 1.6 | 1 \pm 1.6 | 0.003* |
| 12 hr | 0.9 \pm 1.2 | 2.6 \pm 1.9 | 3.1 \pm 1.8 | 1 \pm 1.5 | 0.007* |
| 24 hr | 1.1 \pm 1.4 | 1.8 \pm 1.3 | 2.1 \pm 1.5 | 0.1 \pm 0.3 | 0.004* |

* P<0.05 considered significant.

NRS at maximal inspiration showed significantly lower scores compared to other groups and continued as such up to the first postoperative day (Table 4).

Table 4
Numeric rating score (NRS) at maximal inspiration (mean \pm SD)

| | Group 1 | Group 2 | Group 3 | Group 4 | P value |
|--------|---------------|---------------|----------------|---------------|---------|
| 0 time | 3.4 \pm 1.5 | 3.3 \pm 3.7 | 3.8 \pm 3 | 2.4 \pm 1.1 | 0.7 |
| 2 hr | 3.8 \pm 1.2 | 2.8 \pm 1.8 | 4.2 \pm 2.7 | 1.5 \pm 1.6 | 0.015* |
| 4 hr | 4.1 \pm 1.6 | 2.9 \pm 1.9 | 3.6 \pm 1.8 | 0.9 \pm 1.4 | 0.0008* |
| 6 hr | 4 \pm 2.2 | 3.2 \pm 2.2 | 3.8 \pm 21.3 | 1.1 \pm 1.7 | 0.006* |
| 8 hr | 2.4 \pm 2.1 | 3.9 \pm 2.7 | 3.9 \pm 1.4 | 1.1 \pm 1.7 | 0.009* |
| 12 hr | 1.7 \pm 1.6 | 2.9 \pm 2.3 | 3.7 \pm 1.8 | 1.3 \pm 1.8 | 0.03* |
| 24 hr | 1.8 \pm 1.3 | 2 \pm 1.6 | 2.7 \pm 0.6 | 0.2 \pm 0.6 | 0.002* |

* P<0.05 significant.

The same trend of NRS changes continued while coughing (Table 5). Supplemental analgesic requirement with intravenous morphine in the first 24 hours were 4 \pm 1.2, 5 \pm 0.8, 4.5 \pm 0.76 and 1.2 \pm 0.6 mg for **Groups 1, 2, 3 and 4** respectively with significant lower mean value in **Group 4** compared to other groups (P<0.05).

Table 5
 Numeric rating score (NRS) while coughing (mean \pm SD)

| | Group 1 | Group 2 | Group 3 | Group 4 | P value |
|--------|---------------|---------------|---------------|---------------|---------|
| 0 time | 3.1 \pm 1.3 | 3.7 \pm 4 | 4 \pm 3.4 | 3.1 \pm 1.4 | 0.854 |
| 2 hr | 4 \pm 1.5 | 3 \pm 2 | 4.5 \pm 2.9 | 1.9 \pm 2.2 | 0.059 |
| 4 hr | 4.5 \pm 1.9 | 3.3 \pm 2.5 | 3.7 \pm 1.6 | 1.4 \pm 1.8 | 0.009* |
| 6 hr | 4.7 \pm 2.9 | 3.4 \pm 2.5 | 3.9 \pm 1.5 | 1.4 \pm 2.3 | 0.023* |
| 8 hr | 2.7 \pm 2.5 | 4.1 \pm 3.1 | 4.1 \pm 1.4 | 1.3 \pm 2.2 | 0.036* |
| 12 hr | 2.2 \pm 1.8 | 2.6 \pm 2.1 | 4 \pm 1.6 | 1.4 \pm 2.4 | 0.045* |
| 24 hr | 2 \pm 1.3 | 1.9 \pm 1.6 | 3.2 \pm 1.5 | 0.4 \pm 1.3 | 0.001* |

* P<0.05 significant.

Discussion

General anesthesia is commonly used for video-assisted thoracoscopic surgery. Thoracoscopy allows surgical procedures, previously done through thoracotomy incision, to be done through much smaller incisions, with less postoperative pain, and less risk of narcotic induced respiratory depression, atelectasis due to splinting, hypoxemia and retained secretions, permitting faster recovery and discharge from the hospital¹⁰.

Thoracoscopic sympathectomy has become a standard surgical procedure for treatment of PH. Anesthesia for TS is challenging. We have published several articles on anesthetic management of TS^{10,11,12}.

There are scattered reports in the literature on postoperative pain management following TS. Moreover, the ideal postoperative analgesic regimen following TS has not been established. Pain after thoracoscopic surgery is significant and extends till the first postoperative day. Transcutaneous electrical nerve stimulation has been reported as effective in reducing analgesic requirement after VATS^{13,14}. Diclofenac and ketorolac both were reported effective in treating postthoracoscopy pain². Local anesthetics have been used either paravertebrally or intrapleurally effectively in reducing pain after thoracoscopic surgery^{4,5,6}. Ben-David et al, suggested the use of continuous paravertebral block for treating post-thoracoscopic pain¹⁵. Their approach includes preoperative placement of

single paravertebral catheter at a level of T5 with minimum side effects. Also intercostals blockade has reported to provide effective pain relief and a dramatic reduction in morphine requirements following VATS¹⁶. Recently infusion of local anesthetic into an extrapleural pocket results in excellent postoperative pain relief following thoracoscopic resection through a multilevel intercostals nerve blockade¹⁷.

In this prospective, randomized, double-blinded study of postoperative pain relief following TS, a significant decrease of NRS in patients receiving combination of interpleural local anesthetic and I.M ketoprofen was reported up to 24 hours postoperatively. The present study is limited due to the small sample size studied. Therefore, future study on pain relief modalities on large number of patients following TS is indicated. Currently and after completion of this study and based on the results obtained, our practice has been changed to combine I.M ketoprofen and interpleural bupivacaine for postoperative analgesia following TS.

In conclusion, compared to interpleural local anesthetic alone or I.M ketoprofen alone, the combination of both provided better analgesia with a reduction in rescue morphine consumption following TS. Further studies on large sample size are required to confirm our results.

Acknowledgement

The authors would like to thank colleagues from the Anesthesia and Surgery Departments for their cooperation during the study period. Also, special thanks and appreciation go to anesthesia technicians at King Khalid University Hospital for their assistance.

References

1. NAGHIRO I, ANDOU A, AOE M, ET AL: Pulmonary function, postoperative pain, and serum cytokine level after lobectomy: a comparison of VATS and conventional procedure. *Ann Thorac Surg*; 72:362-5, 2001.
2. PERTTUNEN K, NILSON EKALSO E: I.V. diclofenac and ketorolac for pain after Thoracoscopic surgery. *Br J Anaesth*; 82:221-7, 1999.
3. RICHARDSON J AND SABANTHAN S: Pain management in video assisted thoracic Surgery: evaluation of localized partial rib resection. A new technique. *J Cardiovasc Surg (Torino)*; 36:505-9, 1995.
4. VOGT A, STIEGER DS, THEURILLAT C, ET AL: Single-injection thoracic paravertebral block for postoperative pain treatment after thoracoscopic surgery. *Br J Anaesth*; 95:816-21, 2005.
5. ASSALIA A, KOPELMAN D, MARKOVITS R. ET AL: Intrapleural analgesia following Thoracoscopic sympathectomy for palmar hyperhidrosis: a prospective, randomized trial. *Surg Endosc*; 17:921-2, 2003.
6. Hill SE, Keller RA, Stafford-Smith M, et al: Efficacy of single-dose, multilevel paravertebral nerve blockade for analgesia after thoracoscopic procedures. *Anesthesiol*; 104:1047-53, 2006.
7. EL-DAWLATLY A, SERAJ M, CHANNA A AND EL-BAKRY A: Interpleural analgesia in post-cholecystectomy patients. *Middle East J Anesthesiol*; 12:91-9, 1993.
8. AL-DOHAYAN A: Tansaxillary thoracoscopic sympathectomy experience in a hot climate: management of the dominant hand. *Surg Laparosc Endosc Percutan Tech*; 9:317-21, 1999.
9. BRODSKY JB AND COHEN E: Video-assisted thoracoscopic surgery. *Curr Opin Anesthesiol*; 13:41-45, 2000.
10. EL-DAWLATLY A, AL-DOHAYAN A, SAMARKANDI A, ET AL: Right vs left side thoracoscopic sympathectomy: Effects of CO₂ insufflation on hemodynamics. *Annales Chirurgie Gynecologie*; 90(3):206-208, 2001.
11. EL-DAWLATLY A, AL-DOHAYAN A, ABDEL-MEGUI M, ET AL: Variations in dynamic lung compliance during endoscopic thoracic sympathectomy with CO₂ insufflation. *Clin Auton Res*; 13 (Suppl 1): 1/94-1/97, 2003.
12. EL-DAWLATLY A: Impedance cardiography: noninvasive measurement of hemodynamics and thoracic fluid content during endoscopic thoracic sympathectomy. *Surg Laparosc Endosc Percut Tech*; 15:328-331, 2005.
13. BENEDETTI F, AMANZANIO M, CASADIO C, ET AL: Control of postoperative pain by transcutaneous electrical nerve stimulation. *Ann Thorac Surg*; 63:773-776, 1997.
14. BRODSKY JB AND MARK JBD: Postthoracoscopy pain: is TENS the answer? *Ann Thorac Surg*; 64:890-891, 1997.
15. BEN-DAVID B, MERMEN R AND CHELLY J: Paravertebral blocks in Thoracoscopy: single No, continuous Yes. *Anesthesiol*; 106:398, 2007.
16. TAYLOR R, MASSEY S, STUART-SMITH K: Postoperative analgesia in video-assisted thoracoscopy: the role of intercostals blockade. *J Cardiothorac Vasc Anesth*; 18:317-21, 2004.
17. DETTERBECK FC: Subpleural catheter placement for pain relief after thoracoscopic resection. *Ann thorac Surg*; 81:1522-3, 2006.

