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Thoracoscopic sympathectomy: endobronchial anesthesia vs endotracheal anesthesia with intrathoracic CO_2 insufflation

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Abstract

Purpose. To compare clinical advantages and hemodynamic and respiratory changes during one lung-collapsed ventilation (OLCV) using a double-lumen tube (DLT) or a single-lumen tube (SLT) with intrathoracic CO_2 insufflation, in patients undergoing thoracic sympathectomy (TS) under general anesthesia.

Methods. One hundred and twenty-five patients (94 men and 31 women) undergoing TS for the treatment of palmar hyperhidrosis (PH) were randomly allocated to two groups: group A (68 patients; age, 29 ± 6 years) in whom DLT was used, and group B (57 patients; age, 32 ± 3 years) in whom SLT with intrathoracic CO_2 insufflation at a rate of 0.5–1 $l \cdot min^{-1}$ and sustained intrathoracic pressure at 6 mmHg insufflation were used. Anesthesia was maintained with 1 minimum alveolar concentration (MAC) isoflurane in 50% nitrous oxide in oxygen with incremental doses of sufentanil and atracurium when required. Arterial blood gases were measured in 10 patients in group B. Hemodynamic and respiratory parameters were obtained perioperatively.

Results. There were no significant differences in hemodynamic and respiratory parameters between the two groups during the study phases, except for the arterial oxygen saturation (SpO_2). The times required for anesthesia and surgery were significantly shorter in the SLT group than in the DLT group. SpO_2 during OLCV was 95 ± 1% with DLT and 98 ± 1% with SLT, with a significant difference. Three patients had an SpO_2 of less than 90% in the recovery room, where the chest tube position was readjusted, with no further sequelae.

Conclusion. General anesthesia with SLT and intrathoracic CO_2 insufflation provides optimal operating conditions, adequate oxygenation, and perfect hemodynamic stability during TS.

Key words Thoracic surgery · Anesthetic techniques · Endotracheal intubation · Endobronchial

Introduction

Thoracoscopic sympathectomy (TS) for the treatment of palmar hyperhidrosis (PH) is gaining in popularity. In the past, surgical treatment of PH was invasive and had a high incidence of morbidity. Because TS provides detailed visualization of the surgical field with minimal postoperative complications, most surgeons now prefer the thoracoscopic approach for the treatment of PH [1]. Anesthesia for TS is challenging. Establishing one-lung anesthesia is an essential part of the anesthetic technique to facilitate adequate surgical exposure. One lung-collapsed ventilation (OLCV) can be achieved either by endobronchial anesthesia or by intrathoracic carbon dioxide (CO_2) insufflation combined with the use of an endotracheal tube [2]. In one report of 719 cases, single-lumen endotracheal tube (SLT) anesthesia was considered safe and economical for TS [3]. But in another report, the combination of balanced anesthesia and a double-lumen endobronchial tube (DLT) was considered an adequate technique for TS [4]. To evaluate the advantages and disadvantages of each technique, we conducted the present study. We investigated the hemodynamic and respiratory changes during general anesthesia for TS, using either DLT or SLT with an intrathoracic CO_2 insufflation technique.

Patients and methods

After written informed consent was obtained, 125 adult patients (94 men and 31 women) scheduled to undergo elective TS for the treatment of PH under general anesthesia were randomly enrolled in the study. Patients

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with cardiorespiratory disease were excluded from the study. The physical status of the patients was American Society of Anesthesiologists (ASA) I or II. A preoperative chest X-ray was taken in all patients. Premedication for all patients was achieved with oral diazepam $0.15\,mg\cdot kg^{-1}$ 2h preoperatively. The patients were randomly allocated to two groups: group A (n = 68) in whom DLT was used, and group B (n = 57) in whom the trachea was intubated with an SLT. Anesthesia in both groups was induced with sufentanil $0.1\,\mu g\cdot kg^{-1}$ and thiopentone $4\,mg\cdot kg^{-1}$, and intubation was accomplished with atracurium $0.5\,mg\cdot kg^{-1}$. Endobronchial intubation was achieved with a left-sided DLT (Mallinckrodt, Athlone, Ireland), size 37–39Fr. Correct placement was confirmed using a fiberoptic bronchoscope (FOB). Intraoperative monitoring consisted of electrocardiogram (ECG) lead II; heart rate; arterial oxygen saturation (SpO_2) determined by pulse oximeter; blood pressure, determined by a non-invasive automated method; end-tidal carbon dioxide ($EtCO_2$); and body temperature, determined by rectal temperature probe. Anesthesia was maintained with 1 minimum alveolar concentration (MAC) isoflurane in 50% nitrous oxide in oxygen during OLCV. Incremental doses of sufentanil and atracurium were given if required. A radial artery cannula was inserted for arterial blood gas analysis in ten patients from group B.

Surgery was performed in all patients by the same surgeon. Patients were positioned supine, with a 30° higher tilt of the ipsilateral thorax. Group B patients were not ventilated during insertion of the Verres needle. The needle was inserted into the pleural space through a small incision in the third or fourth intercostal space, and CO_2 was insufflated at a rate of $0.5–1\,l\cdot min^{-1}$. Intrathoracic pressure was sustained at 6mmHg. At the end of surgery, atropine 1.2mg and neostigmine 2.5mg were given intravenously and the trachea was extubated. All the patients were sent to the recovery room, where a chest X-ray was taken before they were transferred to the ward.

During the early phases of the study, a chest tube with a proper drainage system was routinely inserted in every patient and remained until the first postoperative day. Later during the study period, a chest tube was inserted and connected to an under-water seal system at the end of surgery, and was removed in the recovery room after chest X-ray examination. Hemodynamic and respiratory data were obtained before, during, and after OLCV every 3min and then averaged over the time of surgery in both groups A and B. The duration of anesthesia was defined as from the time of induction of anesthesia to extubation of the trachea, while the time of surgery was defined as from the time of skin incision until time of closure of the wound. The blood gas data for the ten patients in group B were also recorded before, during, and after OLCV.

The results were expressed as mean ± SD. The unpaired t-test was used for analysis of differences in the data between groups A and B, and one way analysis of variance (ANOVA) was used for analysis of differences in the data among group B patients before, during, and after OLCV. For all comparisons, $P < 0.05$ was considered statistically significant.

Results

There were no differences in the demographic data between groups A and B (Table 1). There were no significant differences in heart rate (HR) and mean blood pressure (mBP) before, during, and after OLCV in either of the groups (Table 2). In groups A and B, the mean $EtCO_2$ values were significantly higher during OLCV than before OLCV. In the ten patients in group B, orterial carbon dioxide pressure ($PaCO_2$) was significantly higher during OLCV than before OLCV. During OLCV, SpO_2 in group A was significantly lower than that in group B (Table 3). Times required for anesthesia and surgery in group B were both significantly shorter than those in group A (Table 4). In the recovery room, two patients from group A and one patient from group B were desaturated, with SpO_2 <90%. The SpO_2 was improved by adjusting the chest tube position, and there were no further episodes of desaturation.

Table 1. Demographic data

Group	A	B
n (M/F)	52/16	42/15
Age (years)	29 ± 6	32 ± 3
BW (kg)	69 ± 10	67 ± 12

Values are means ± SD
BW, Body weight

Table 2. Hemodynamic parameters

	HR		mBP	
Group	A	B	A	B
Before OLCV	75 ± 15	72 ± 12	80 ± 12	79 ± 10
During OLCV	78 ± 12	75 ± 13	85 ± 14	87 ± 12
After OLCV	70 ± 15	69 ± 12	75 ± 12	80 ± 10

See text for explanation of groups A and B
Values are means ± SD
OLCV, One-lung collapsed ventilation; HR, heart rate; mBP, mean blood pressure

Table 3. Respiratory parameters

	SpO_2		PaO_2		ETCO$_2$		$PaCO_2$	
Group	A	B	A	B	A	B	A	B
Before OLCV	98 ± 1	99 ± 1	—	120 ± 16	35 ± 2	32 ± 4	—	33 ± 4
During OLCV	95 ± 1	98 ± 1*	—	98 ± 12	38 ± 5**	37 ± 6**	—	40 ± 6**
After OLCV	99 ± 1	98 ± 2	—	115 ± 10	30 ± 6	33 ± 4	—	36 ± 5

* $P < 0.05$ vs group A; ** $P < 0.05$ vs before OLCV
Values are means ± SD
SpO_2, Arterial oxygen saturation; PaO_2, arterial oxygen pressure; $EtCO_2$, end-tidal carbon dioxide; $PaCO_2$, arterial carbor dioxide pressure

Table 4. Times required for anesthesia and surgery

	Group A	Group B
Anesthesia (min)	50 ± 18	36 ± 12*
Surgery (min)	36 ± 6	20 ± 4*

* $P < 0.05$ vs group A
Values are means ± SD

Discussion

Since the introduction of TS, the scope of treatment for PH has improved. The reported incidences of postoperative pneumothorax and hemothorax after TS were 0.4% and 0.15%, respectively. Minimal postoperative pain and a short period of hospital stay have been reported after TS [5]. Anesthesia for TS is technically demanding [6]. The use of a DLT provides excellent surgical conditions during TS and ensures OLCV if properly inserted [7]. However, placement of the DLT and confirmation of its correct position, using an FOB, needs clinical skill [8]. During endobronchial anesthesia, the use of intrathoracic CO_2 insufflation is rarely required for TS.

In contrast, anesthesia with SLT has certain advantages over DLT. Special skill is not required to confirm its correct position, and in the present study, there was a significantly shorter duration of anesthesia in the SLT group than in the DLT group. However, intrathoracic CO_2 insufflation is an essential prerequisite for SLT to ensure adequate one-lung collapse throughout the procedure. During TS and OLCV, hypoxemia is a major concern. In the present study, a comparison of SpO_2 values revealed that the tracheal anesthesia technique provided optimal oxygenation compared with oxygenation in the endobronchial technique. However, the lower SpO_2 value in the endobronchial group of patients during OLCV was of no clinical significance. It has been reported that the use of CO_2 insufflation in the closed chest cavity resembles tension pneumothorax, with a fall in the systolic blood pressure [9,10]. In one study, successful ipsilateral lung collapse was reported without unwanted adverse effects, using $1\,l\cdot min^{-1}$ CO_2 insufflation [11]. In another study, in 80 patients in whom intrathoracic CO_2 insufflation was used for TS for pH, postoperative complications included 1 with prolonged air leak, 1 with hemothorax, 2 with wound infections, and 15 cases of facial anhidrosis [12].

In the present study, we experienced three cases of transient postoperative desaturation; the chest tube position was readjusted in these patients, and there were no further problems.

In conclusion, we believe that the combination of balanced anesthesia and SLT with intrathoracic CO_2 insufflation (at a rate of 0.5–$1\,l\cdot min^{-1}$, with sustained intrathoracic pressure of 6 mmHg) provides optimal operating conditions, adequate oxygenation, and perfect hemodynamic stability during TS.

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References

1. Johnson JP, Obasi C, Hahn MS, Glatleider P (1999) Endoscopic thoracic sympathectomy. J Neurosurg 91:90–97
2. Fredman B, Olsfanger D, Jedeiken R (1997) Thoracoscopic sympathectomy in the treatment of palmar hyperhidrosis: anesthetic implications. Br J Anaesth 79:113–119
3. Lee LS, Ng SM, Lin CC (1994) Single-lumen endotracheal intubated anesthesia for thoracoscopic sympathectomy—experience of 719 cases. Eur J Surg 572[Suppl]:27–31
4. Deloggu G, Marano M, Ciccioli T, Lombardi A, Costantini D (1996) Thoracoscopic bilateral sympathectomy in Raynauds syndrome: anesthesiology problems. Ann Ital Chir 67:405–409
5. Gothberg G, Drott C, Claes G (1994) Thoracoscopic sympathectomy for hyperhidrosis—surgical technique, complications and side effects. Eur J Surg 572[Suppl]:51–53
6. Cunningham AJ (1993) Laparoscopic sympathectomy: anesthetic implications. Anesth Analg 76:1120–1130
7. Jedeikin R, Olsfanger D, Shachor D, Mansoor E (1993) Transthoracic endoscopic sympathectomy. Br J Anaesth 70:491–492

8. Benumof JL, Partridge B, Salvatier C, Gibbins J (1987) Margin of safety in positioning modern double-lumen tubes. Anesthesiology 67:729–738
9. Jedeikin R, Olsfanger D, Shachor D, Mansoor K (1992) Anesthesia for transthoracic endoscopic sympathectomy in the treatment of upper limb hyperhidrosis. Anaesthesia 69:349–351
10. Baraka A (1998) Hazards of carbon dioxide insufflation during thoracoscopy. Br J Anaesth 81:100–108
11. Olsfanger D, Jedeikin R, Fredman B, Shachor D (1995) Endotracheal anesthesia for transthoracic endoscopic sympathectomy. Br J Anaesth 74:141–146
12. Hsu CP, Chen CY, Lin CT, Wang JH, Chen CL, Wang PY (1994) Video assisted thoracoscopic T2 sympathectomy for hyperhidrosis palmaris. J Am Coll Surg 179:59–64