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Use of cuffed oropharyngeal vs laryngeal mask airway in elderly patients

Purpose: This study was designed to compare the new cuffed oropharyngeal airway (COPA) to the laryngeal mask airway (LMA) in elderly patients.

Methods: In a randomized, controlled study, 80 patients, age ≥ 65 , ASA I-III, undergoing urology procedures, were managed with either COPA or LMA. Propofol requirements for insertion of the devices, ease of insertion and removal, airway manipulations, mean arterial pressure, heart rate, $P_{ET}CO_2$, SpO_2 , peak inspiratory pressure, selection of the appropriate size of the device and leaks, fiberoptic visualization of larynx and complications were studied.

Results: There were more airway manipulations in the COPA group than in the LMA group (40% and 5% respectively) whereas $P_{ET}CO_2$ was higher in the LMA group ($P < 0.05$). In 60% of COPA patients the vocal cords could not be visualized but ventilation was adequate in all but two cases.

Postoperative sore throat occurred in 20% of patients with LMA vs 10% with COPA). Bloody secretions on the device were present in two patients managed with LMA.

Conclusion: In elderly patients COPA required more airway manipulations than the LMA. Laryngeal mask airway caused more sore throats, but was better for fiberoptic visualisation of the larynx. Both are excellent options when intubation is not indicated/desired.

Objectif : La présente étude a été menée pour comparer deux appareils utilisés chez des patients âgés : la canule oropharyngée à ballonnet (COPB) et le masque laryngé (ML).

Méthode : Dans une étude randomisée et contrôlée, on a inséré une COPB ou un ML chez 80 patients, âgés de 65 ans, ASA I-III, devant subir une intervention urologique. Le propofol nécessaire pendant l'insertion du dispositif, la facilité de l'insertion et du retrait, les manipulations requises, la tension artérielle moyenne, la fréquence cardiaque, la $P_{ET}CO_2$, la SpO_2 , la pression inspiratoire de crête, l'appareil choisi selon la taille appropriée et les fuites, la visualisation fibroscopique du larynx et les complications ont été étudiés.

Résultats : L'insertion de la COPB a demandé plus de manipulations que celle du ML (40 % et 5 %, respectivement) tandis que la $P_{ET}CO_2$ était plus haute avec le ML ($P < 0,05$). Chez 60 % des patients qui ont reçu la COPB, on ne pouvait visualiser les cordes vocales, mais la ventilation était adéquate chez tous sauf chez deux patients. Des maux de gorge postopératoires sont survenus chez 20 % des patients avec le ML vs 10 % avec la COPB). Des sécrétions sanguinolentes étaient présentes sur l'appareil de deux patients portant le ML.

Conclusion : Chez les patients âgés, l'insertion de la COPB demande plus de manipulations que celle du ML. Le ML cause davantage de maux de gorge, mais permet une meilleure visualisation fibroscopique du larynx. Les deux dispositifs testés sont très utiles lorsque l'intubation n'est pas indiquée ou souhaitée.

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THE cuffed oropharyngeal airway (COPA) – Malinckrodt Medical, Athlone, Ireland, is a new airway device intended to improve the performance of the Guedel airway. In addition to the usual oral airway, the COPA has an inflatable cuff. The anterior cuff pushes the base of the tongue anteriorly, whereas the posterior cuff maintains the patency of the pharynx by pushing its posterior wall backward. It also has a 15-mm connector for a breathing circuit, which enables hands-free anesthesia. An elastic strap helps in maintaining COPA in the desired position.

Transurethral surgery is one of the most commonly performed procedures in men over 65 yr.¹ The aim of this study in these elderly patients was to compare anesthetic airway management with the COPA and the laryngeal mask airway (LMA) with regard to insertion parameters, effectiveness of ventilation, fiberoptic visualization of larynx and adverse effects.

Methods

After informed consent and Human Research Committee approval, 80 elderly (age ≥ 65 yr) male patients, ASA I-III were randomly allocated to two equal ($n = 40$) groups. Patients in group 1 were managed with COPA and those in group 2 with LMA. Patients underwent short transurethral procedures (internal urethrotomy, urethral stent placement, transurethral resection of bladder tumour - TURB) under general anesthesia.

Patients at risk of aspiration, obesity (grades II, III with a body mass index (BMI) > 29.9), patients with reactive airway, severe restrictive lung disease or ASA IV were excluded from the study. In each patient Mallampati score was determined preoperatively. Diazepam ($100 \mu\text{g}\cdot\text{kg}^{-1}$) *po* one hour before the procedure was used as premedication. Monitoring consisted of five lead ECG, non-invasive blood pressure, pulse oximetry and capnography.

After five minutes preoxygenation, anesthesia was induced with a sleep dose (disappearance of eyelash reflex) of propofol and maintained with isoflurane (end tidal concentrations maintained between 0.7 and 1.1%) and nitrous oxide 65% in oxygen. The initial dose of propofol was supplemented ($0.5 \text{ mg}\cdot\text{kg}^{-1}$) after 60 sec if the jaw was not relaxed or coughing or swallowing were encountered during insertion. Fentanyl, up to a total of $2 \mu\text{g}\cdot\text{kg}^{-1}$ was administered in small boluses at the discretion of the anesthesiologist.

Size #3, #4 or #5 LMA (according to patient's weight) was inserted using the insertion technique recommended by the manufacturer.² The COPA size (which is 1 cm longer than the corresponding Guedel

airway) was selected according to the following method: the distal tip of the COPA was placed at the angle of the jaw and the device held perpendicularly to the jaw. In the correct position the guard should be 1 cm above the lips of the patient. The fixation strap posts are centered over the corners of the mouth. The insertion technique for COPA was similar to that of the standard oropharyngeal airway with the patient's head placed in "sniffing" position.

Lidocaine jelly was used as a lubricant for both devices. Dentures (if present) were not removed before insertion of the airway device.

The cuffs of both COPA and LMA were inflated until no leak was detected while applying manual ventilation to a peak inspiratory pressure of $20 \text{ cmH}_2\text{O}$. The mean inflation cuff volumes necessary to maintain a leak free airway were also recorded. The COPA and LMA sizes were considered appropriate if there was no leak around the cuff, a CO_2 trace was obtained with normal breathing sounds on auscultation. For the short period of apnea, the lungs were mechanically ventilated with a tidal volume of $7 \text{ ml}\cdot\text{kg}^{-1}$ and a respiratory rate of $10 \text{ breath}\cdot\text{min}^{-1}$. After resumption of spontaneous breathing, ventilation was unsupported until the end of surgery.

In cases in which the airway was not open at first insertion manipulations aimed to improve airway seal and patency were done. These manipulations included jaw thrust, chin lift, head tilt to one side or a combination of these manoeuvres. If both cuff inflation and manipulations failed to maintain an appropriate airway, the device was replaced with a larger size. If this also failed, tracheal intubation was performed after using succinylcholine. Insertion was considered easy if no swallowing or coughing were encountered while the jaw was relaxed during insertion.

Heart rate and mean arterial pressure values were recorded prior to (baseline value) and two minutes after the insertion of the device. Peak inspiratory pressures was recorded during the short period of controlled ventilation while $\text{P}_{\text{ET}}\text{CO}_2$ and SpO_2 values were registered every five minutes.

After the airway was secured and the patient was breathing spontaneously, fiberoptic examination was performed through a bronchoscopic swivel connector (Portex, England). The Olympus bronchoscope (model LF-2) was inserted through the device's lumen. The laryngoscopic view was recorded according to the score proposed by Brimacombe and Berry³ (score 4: only cords seen; score 3: cords plus posterior epiglottis seen; score 2: cords plus anterior epiglottis seen; score 1: cords not seen, able to ventilate; score 0: cords not seen fiberoptically, unable to ventilate).

At the end of the procedure patients were allowed to wake up, the cuff was deflated and the device was removed. Removal was considered easy if performed without encountering any resistance.

Adverse events were classified as intraoperative (coughing, swallowing, patient movement, vomiting, wheezing, hypoxemia ($\text{SpO}_2 < 90\%$), hypotension ($> 30\%$ decrease from baseline), hypertension ($> 30\%$ increase from baseline) and postoperative: sore throat, blood on the device. Postoperative sore throat was assessed in the recovery room.

Data are expressed as means $\pm$ SD of the numerical values. Standard errors of means were calculated for the performance of an unpaired *t* test for the parametric values.

Results

There were no differences between the groups with regard to age, BMI, type of surgery, Mallampati score, associated diseases and ASA class (Table I).

The dose of propofol necessary to insert the devices did not differ nor did the supplemental propofol. Patients in the two groups received similar doses of fentanyl and the time of anesthesia was similar.

More airway manipulations were necessary with COPA (40%) than with the LMA (5%) (Table II). Chin support during anesthesia was necessary in 10% of the COPA patients.

Both devices were easy to insert and to remove (Table III). Failure to maintain adequate ventilation was present in two patients with COPA, in spite of the airway manipulations and replacing the device by a larger one. In both patients the larynx was easily visualized and the trachea easily intubated.

Cuffed oropharyngeal airway size #10 was used in 58% of the cases, and size #9 and #11 in 34% and 8% respectively. Laryngeal mask airway size #4 was used in 75% of cases, and size #5 and #3 in 17.5% and 7.5% respectively. In three cases with COPA and one with LMA, the device was replaced with a larger size to achieve a better seal (Table III). Mean inflation cuff volumes were similar to those recommended by the manufacturer.

The heart rate and mean arterial pressure values did not differ between baseline and two minutes after the insertion in each group, nor in between the groups (Table IV). Mean $\text{P}_{\text{ET}}\text{CO}_2$ was higher ($P < 0.05$) in the LMA group. There were no differences with respect to the other respiratory parameters. The period of apnea was short in both groups.

Fibreoptic visualization of the larynx (scores 4, 3 and 2) was possible in 87.5 % with LMA vs 35% of the patients with COPA (Table V). Sixty percent of the

STABLE I Demographic, surgical and anesthetic data

	COPA	LMA
Age (yr) mean $\pm$ SD	65 $\pm$ 5	66 $\pm$ 6
ASA class (%):		
- I	15%	10%
- II	45%	37.5%
- III	40%	52.5%
Body mass index (mean $\pm$ SD)	27 $\pm$ 3	27 $\pm$ 2
Associated diseases:		
- COPD	26 (65%)	20 (50%)
- Smoker	17 (42.5%)	19 (47.5%)
- Hypertension	12 (30%)	15 (37.5%)
- Coronary artery disease	23 (57.5%)	18 (45%)
- Congestive heart failure	7 (17.5%)	5 (12.5%)
- Chronic renal failure	3 (7.5%)	6 (15%)
- Diabetes mellitus	20 (50%)	16 (40%)
Mallampati score		
- 1	20 (50%)	19 (47.5%)
- 2	16 (40%)	18 (45%)
- 3	4 (10%)	3 (7.5%)
Transurethral procedures:		
- internal urethrotomy	6 (15%)	4 (10%)
- urethral stent placement	5 (12.5%)	6 (15%)
- ureteroscopy	3 (7.5%)	1 (2.5%)
- TURB	26 (65%)	29 (72.5%)
Anesthesia data:		
- time of anesthesia (min)	33.7 $\pm$ 9	33 $\pm$ 9
- propofol induction ($\text{mg}\cdot\text{kg}^{-1}$)	2.6 $\pm$ 0.48	2.6 $\pm$ 0.49
- propofol supplement ($\text{mg}\cdot\text{kg}^{-1}$)	0.2 $\pm$ 0.11	0.3 $\pm$ 0.32
- fentanyl ($\mu\text{g}\cdot\text{kg}^{-1}$)	1.3 $\pm$ 0.45	1.4 $\pm$ 0.52

TURB – transurethral resection of bladder tumors, COPD – chronic obstructive pulmonary disease.

COPA patients had scores of 1 compared with 12.5% in the LMA patients. In the two cases of COPA where insertion failed, no laryngeal structures were identified (score 0).

Intraoperatively there were no differences between the groups with regard to swallowing, coughing, movement, vomiting or wheezing (Table VI). Transient hypoxemia (SpO_2 88% and 89%) occurred in the two COPA patients where the insertion failed. There were no differences with respect to changes in blood pressure. Tachycardia (heart rate $> 20\%$ from baseline) was encountered in one COPA and respectively two LMA patients. The presence of dentures did not produce any difficulty in insertion of either device.

We found twice as high a rate of postoperative sore throat in the LMA group than in the COPA group. Bloody secretions on the device were present in two patients after removal of the LMAs.

Discussion

The disadvantage of using a face mask during anesthesia is the need for airway support, sometimes by two hands and in extreme cases, the inability to ventilate the lungs due to airway obstruction. Mask ventilation also leads to operating room air pollution.

The main disadvantage of the LMA is its basic and maintenance cost. Although the basic cost of the LMA (with 40 uses as recommended by the manufacturer) is about the same as for the COPA (about \$250 for 40

uses of LMA and \$6 for a single use of COPA), maintenance costs should be added for the LMA. In addition, many LMAs are wasted or thrown away by mistake.

The cuffed oropharyngeal airway is minimally invasive, easy-to-use, disposable and possesses the capability of the LMA to maintain a clear airway. It has been used in gynecological procedures,⁴ magnetic resonance imaging⁵ and ear and nose surgery.⁶ Our patients underwent short transurethral surgery not requiring muscle relaxation and protection of the airway with an endotracheal tube, features representing indication for use of LMA. Scsay *et al.*⁷ demonstrated that COPA size correlated well with the horizontal mandibular length. We chose the COPA size by measuring the lips-to-angle of jaw distance (as currently recommended by the manufacturer). Only in three cases a change for a larger size was required.

The performance of COPA was compared with the LMA in a recently published study.⁸ Most of the findings were similar with our results. Nevertheless, the differences found need further comment. Ten percent of our COPA patients and 30% in Greenberg *et al.*⁸ study, needed continuous support compared with no air support for the LMA patients. This difference could be explained by differences in selection of COPA size in our group of patients.

In our study, $P_{ET}CO_2$ was higher in the LMA than in the COPA patients. This difference cannot be explained by differences in the measured apparatus dead space of the devices. Furthermore, the concentration of anesthetic which might have influenced the alveolar ventilation were similar in both groups. Even though large, detectable leaks were not present, small,

TABLE II Airway device data

	COPA	LMA
Easy insertion	39 (97.5)	35 (87.5)
Easy removal	40 (100)	38 (95)
Failure	2 (5)	0
Appropriate size chosen	37 (92.5)	39 (97.5)
No of devices replaced	3 (7.5)	1 (2.5)
Inflation cuff volume (ml) (mean $\pm$ SD)	35.19 $\pm$ 1.97	29.68 $\pm$ 2.61
Airway supporting manoeuvres:		
- jaw thrust	3 (7.5)	0
- chin lift at insertion	5 (12.5)	2 (5)
- head tilt	5 (12.5)	0
- combined manoeuvres	3 (7.5)	0
- total No of manipulations	16 (40)	2 (5)
- chin support during anesthesia	4 (10)	0
Fibreoptic view score:		
- 4: only cords seen	2 (5)	15 (37.5)
- 3: cords plus posterior epiglottis seen	2 (5)	10 (25)
- 2: cords plus anterior epiglottis seen	10 (25)	10 (25)
- 1: cords not seen, function adequate	24 (60)	5 (12.5)
- 0: cord not seen, failure to function	2 (5)	0

Values are No. (%) of patients

TABLE III Respiratory, hemodynamic data

	Baseline		After insertion	
	COPA	LMA	COPA	LMA
Fi O ₂	0.21	0.21	0.35	0.30
SpO ₂ (%)	94 $\pm$ 1	95 $\pm$ 1	95 $\pm$ 1	95 $\pm$ 1
P _{ET} CO ₂ (mmHg)	-	-	39 $\pm$ 4	46 $\pm$ 5*
PIP (mmHg)	-	-	18 $\pm$ 3	18 $\pm$ 3
Effective ventilation	-	-	38(95%)	40(100%)
MAP (mmHg)	88 $\pm$ 15	93 $\pm$ 21	78 $\pm$ 25	73 $\pm$ 18
Heart rate (beats·min ⁻¹)	73 $\pm$ 12	71 $\pm$ 10	78 $\pm$ 17	76 $\pm$ 11

FiO₂ – fraction of inspired oxygen, P_{ET}CO₂ – end-tidal carbon dioxide pressure, SpO₂ – pulse oximetry oxygen saturation, MAP – mean arterial pressure, PIP – peak inspiratory pressure

* $P < 0.05$ in LMA group vs COPA group

TABLE IV Intraoperative and postoperative adverse effects

	COPA	LMA
Intraoperative:		
- Swallowing	2 (5)	0
- Coughing	3 (7.5)	2 (5)
- Patient movement	2 (5)	3 (7.5)
- Vomiting	0	0
- Wheezing	1 (2.5)	2 (5)
- SpO ₂ < 90%	2 (5)	0
- Hypotension (< 30% from baseline)	3 (7.5)	2 (5)
- Hypertension (>30% from baseline)	1 (2.5)	0
- Tachycardia (> 20% from baseline)	1 (2.5)	2 (5)
Postoperative:		
- Sore throat	4 (10)	8 (20)*
- Vomiting	2 (5)	1 (2.5)
- Blood on the device	0	2 (10)

Values are No. (%) of patients

* $P < 0.05$ in LMA group vs COPA group

undetectable leaks around the COPA might explain the differences.

Greenberg *et al.* found a relatively high incidence of hypoxemia ($\text{SpO}_2 < 90\%$) in both groups (9.6% in COPA vs 7.2% in LMA patients).⁸ Our results showed only a 5% incidence of hypoxemia in two COPA patients whereas no desaturation occurred in the LMA patients. These differences might be related to immediate mechanical ventilation in case of apnea after induction and to the use of isoflurane for maintenance rather than boluses of propofol, which may have caused additional periods of apnea in the study by Greenberg *et al.*⁸

Most of the reported adverse effects related to COPA were minor (coughing, bucking, postoperative nausea and vomiting). In our study postoperative sore throat and blood on the device were the main adverse effects and occurred more frequently with the LMA. Due to its closer proximity to the larynx, LMA may predispose to more serious complications related to laryngeal injury.^{9,10} No major complications (regurgitation, aspiration of gastric contents, laryngeal injury, laryngo- or bronchospasm) occurred in our patients.

Our study was performed in a unique group of patients: elderly patients scheduled for transurethral surgery. These patients have a high incidence of medical problems, although the mortality in the first postoperative month - 0.2% - is relatively low^{11,12} after either general or regional anesthesia. As these patients may have repeat surgeries with no need for muscle relaxation, general anesthesia with spontaneous breathing with either COPA or LMA seems to be a good choice. The hemodynamically detrimental effects of laryngoscopy and endotracheal intubation are avoided.¹³ The respiratory and hemodynamic parameters with both COPA and LMA did not change from before to after insertion of the device.

We found no relation between the fiberoptic view and the clinical quality of the airway. In the two cases where COPA failed, the larynx was not visualized at all. Kay and Greenberg used COPA as an adjunct to oral fiberoptic intubation by passing the fibroscope on the outer side of COPA. The device allowed undisturbed administration of anesthesia and effective ventilation.¹⁴

In conclusion, our study demonstrates that although more head/jaw manipulations were required to maintain a patent airway, COPA allowed a safe, hands-free anesthesia with good control in most of the patients. The fiberoptic view was better with the LMA, which may be a better choice, when fiberoptic intubation is required for difficult airway cases. Cuffed oropharyngeal airway was an equally effective airway device to the LMA in providing anesthesia for short transurethral procedures for this elderly patients group.

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