A Randomized Comparison of Patient's Ventilation at Induction of Anaesthesia Between Tulip GT® Airway and Guedel Airway-Face Mask by Anaesthesia Residents.

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ABSTRACT

Background: The Tulip® airway is a recently introduced single sized ventilating oropharyngeal airway. **Methods:** We performed a randomized, controlled study of lung ventilation by anaesthesia residents using either Tulip GT® airway or face mask with Guedel airway in 100 anaesthetised patients, where the ease of insertion, intracuff pressure and volume were measured, as were the end-tidal carbon dioxide levels, airway pressures and tidal volumes over first three breaths. **Results:** Successful ventilation was observed with Tulip airway which provided a patent airway in comparison to facemask with a Guedel airway but 15 patients required additional cuff volume in Tulip airway. **Conclusion:** We conclude Tulip® airway can be used as an adjunct for airway management even by inexperienced users.

Keywords: Tulip® airway, Face mask ,Guedel airway.

INTRODUCTION

The Tulip GT® airway is a single-sized disposable oropharyngeal airway. It can directly be connected to the breathing circuit and thus helps in initial ventilation of the anesthetized patients. The Tulip airway is one size for all adults, designed to be as useful as Guedel airway with facemask. It is easy to insert and secures the airway following cuff inflation asit provides an oropharyngeal seal. It is sterilized by ethylene oxide and has a central circular breathing tube of 10 mm internal diameter made of di-2-ethylhexy phthalate free poly-vinyl chloride with an external diameter of 14 mm. The 15 mm (diameter) proximal end connects to anaesthesia breathing circuit directly [Figure 1]. The different colour markings on the proximal convex surface of the airway provide a guide to appropriate length of the airway to be inserted and also correspond to equivalent length of Guedel airway. The green, orange and red markings correspond to the sizes of the small (size 2), medium (size 3) and large (size 4) Guedel airways. The distal end is surrounded by a low pressure, high volume, polyhedral cuff that is anatomically shaped.Itmay be inflated to a maximum recommended volume of 60 ml (range 40–60 ml) or optimal of 50 cmH2O intracuff pressure (range 40–80 cmH2O) according to the patient's size. This hands free airway is 'insert to fit and inflate to fit' for adults.

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Figure 1: Inflated view of a Tulip airway showing the tri-coloured markings (left) and size-2,3,4 (green, yellow, red) Guedel airway (right).

In the past few years the airway is in use for clinical practice. Manikin studies have shown its ease of insertion by inexperienced users and have a steep learning curve.[1-3] Tulip airway is an improved version of Guedel airway, which requires a face mask with two-handed technique, selection of different sizes of airway, is cumbersome and difficult for inexperienced non-anaesthetic personnel to use and cannot be directly connected to an anaesthetic breathing circuit.[4-8]

This prospective randomised study was aimed at comparing the Tulip airway and Guedel airway with facemask for ventilation of patients following induction of anaesthesia by anaesthesia residents. We aimed at studying the ventilatory parameters like three breath EtCO2, airway pressure and tidal volume also comparing the ease of insertion, ventilating leak and complications associated with use of either airways.

MATERIALS AND METHODS

After approval from ethical committee and informed consent from patient, 100 adult patients of both sexes aged 18–70 years with ASA status I–II scheduled for elective maxillofacial, burns and plastic surgery, orthopaedic and general surgery under general anesthesia with neuromuscular blockade, were randomly selected. Patients at risk of bronchospasm, regurgitation or aspiration were excluded. Routine investigations like complete hemogram, blood sugar, blood urea, serum creatinine, chest x-ray, ECG were done.

The patients were randomaly assigned into two groups of 50 each by computerized block randomization. Group A was ventilated by Tulip airway (n=50) and Group B was ventilated by Guedel airway with facemask (n=50).General anaesthesia was standardized for all patients. Patients are pre-oxygenated for 3minutes after administering Inj. Midazolam 1mg and Injection Fentanyl 2mcg/kg and anaesthesia was induced with 2-2.5mg/kg propofol. An inhalational combination of 50% nitrous oxide in oxygen along with 1–2% isoflurane was delivered. After induction of anaesthesia, the patients underwent face mask ventilation until sufficient depth of anaesthesia for jaw relaxation to allow insertion of a Tulip/Guedel airway.All the anesthesia residents were shown how to use the Tulip airway in a manikin. Post this single event training, the residents were asked to insert either Guedel airway with facemask or the Tulip airway in a randomized manner in an anesthetized patient. The lubricated Tulip airway was inserted in a semi-inflated manner with ~40 ml air in midline and passed behind the tongue until a 'give' was felt as it passed into the oropharynx to obtain a seal.

The ease of insertion of the airway with 40 ml air in situ (semi-inflated) was assessed on a 10-point scale (1 easy; 10 difficult) and the initial intracuff pressure was measured after airway placement. In case of audible leak further air will be added (upto 60ml), intracuff volume and pressures were noted. Use of airway maneuvers such as jaw thrust or lift, head turn, head extension or others like change of hands or mask , inflation or deflation of cuff to achieve a patent airway were recorded. Further ventilatory parameters like three controlled breaths of EtCO2, peak inspiratory pressure, inspired and expired tidal volume were recorded. Injection Vecuronium 0.1mg/kg, was given after checking for ventilation. Immediate airway complications (bronchospasm, regurgitation, vomiting) were noted.

If anaesthesia resident failed to achieve ventilation of patient within 60 seconds, if SpO2 dropped to ≤ 94% or if there was any clinical /physiological indication of failure of patient wellbeing, the experienced anaesthetist overrode. After collecting the data, anaesthesia continued as per the dictates of anticipated surgery with a definitive airway.

RESULTS

Table 1: Patient's demographic profile shown as mean (SD) or number (proportion).

	Group A	Group B
Age (yrs)	34.62 ± 14.8	34.12 ± 14.35
Sex		
Male	33 (66.00%)	29 (58.00%)
Female	17 (34.00%)	21 (42.00%)
ASA physical status		
I	40 (80.00%)	49 (98.00%)
II	10 (20.00%)	1 (2.00%)
Mallampatti Classification		
1	31 (62.00%)	27 (54.00%)
2	9 (18.00%)	15 (30.00%)
3	10 (20.00%)	8 (16.00%)
4	0	0
Body mass index	23.5 ± 1.8	24 ± 1.36

Table 2: Ventilatory Parameters.

Ventilator Parameters	Tulip air way	Mask/Guedel ai rway	P value
ETCO2 mmHg Br eath 1	35.66 ± 4.74	32.62 ± 5.84	0.007
ETCO2 mmHg Breath 2	34.82 ± 4.74	31.96 ± 5.26	0.01
ETCO2 mmHg Br eath 3	34.42 ± 4.65	32.2 ± 4.98	0.039
PIPcmH2O Breath 1	18.28 ± 5.73	15.52 ± 4.4	0.008
PIPcmH2O Breath 2	17.48 ± 4.79	15.14 ± 3.93	0.009
PIPcmH2O Breath 3	17.24 ± 4.62	15.16 ± 3.68	0.01
Inspired Tidal Vol ume-ml Breath 1	528 ± 56.39	494.6 ± 63.12	0.005
Inspired Tidal Volume-ml Breath 2	527 ± 57.33	495.1 ± 62.24	0.007
Inspired Tidal Volume-ml Breath 3	527 ± 57.33	496.1 ± 61.07	0.007
Expired Tidal Volu me-ml Breath 1	470.58 ± 79.53	400.62 ± 99.75	<0.00 01
Expired Tidal Volu me-ml Breath 2	481.74 ± 73.85	418.3 ± 82.21	<0.00 01
Expired Tidal Volu me-ml Breath 3	482.26 ± 74.36	442.2 ± 68.87	0.002

The patient's demographic profile is shown in [Table 1] The airway was successfully placed in almost all patients to maintain a patent airway mostly size 2 Guedel airway(n=37) or till green mark of Tulip airway(n=38).The Tulip airway was difficult to insert in 5 patients compared to Group B where all patients showed easy insertion. The mean (SD) initial intracuff pressure of Tulip airway was 15.04 ± 5.88cmH2O with 40 ml air, the cuff pressure at seal with additional air was 44.46 ± 33.73cmH2O.The volume of the Tulip cuff at seal was such that 35 patients had a seal at insertion (40 ml air) while remaining 15 patients required the addition of between 7 to 15 ml (cuff volume 47.9 ± 8.21) to obliterate audible leak in 5 patients with Tulip airway while 4 patients had leak with Guedel airway. In Group A, 17 patients required additional maneuvers like deflated cuff (7), partial deflated (30ml) (10). A significant difference was seen in Group B where, 25 patients required intervention like change of hands (1) or mask (1) only ,requiring assistance only (12), requiring maneuver only (8), change of hands along with assistance(1) and change of mask along with assistance (2), ($p<0.0001$).The ventilator parameters, three controlled breaths EtCO2 , peak inspiratory pressure, inspired and expired tidal volume were significant with Tulip airway compared to Guedel airway and face mask [Table 2]. None of the patients experienced obstruction of airway, vomiting, regurgitation or bronchospasm. There was blood staining on the Tulip airway on two occasions (4%).

DISCUSSION

The Tulip is directly connectable to breathing circuit, hands-free airway and does not stimulate the patient on insertion. The Tulip GT is designed to work effectively in operating theatres and can replace the Guedel airway in the wards, Emergency Room, ambulances and in resuscitation kits. The Tulip airway is an adult 'one size fits all' airway where cuff volume can be adjusted to obtain a seal.[9]

In this study, using inexperienced users Tulip airway was easy to insert in 90% patients in compared to Guedel airway (100%) but overall success rate of insertion in both groups was 100 %.Patients who required adjunct maneuvers to maintain a patent airwayrevealed under-inflation of the cuff,which lead to inadequate anatomical displacement of the pharyngeal tissuesand was the cause of poor ventilation. As the accepted mucosal perfusion pressure within the oropharyngeal mucosa is 40 mmHg,[10,11] a desired intracuff pressure < 50 cmH2O (36 mmHg) was considered appropriate to allow anatomical displacement and maintain mucosal perfusion.

Our study showed Tulip airway produced higher tidal volume in comparison to Guedel airway and face mask under anaesthesia. Successful ventilation was achieved if the provider produced an end-tidal CO2>30mmhg and a tidal volume > 450 ml in first three breaths. Comparing the Tulip GT and facemask with Guedel airway at first breath, the mean (SD) end-tidal CO2 was 35.66 ± 4.74 mmHg vs 32.62 ± 5.84mmHg, inspired tidal volume was 528 ± 56.39ml vs 494.6 ± 63.12 ml, expired tidal volume 470.58 ± 79.53ml vs 400.62 ± 99.75ml and peak inspiratory pressure was 18.28 ± 5.73 cmH2O vs 15.52 ± 4.4 cmH2O respectively (all $p < 0.005$). Most users favoured the Tulip GT airway. In comparison to Guedel airway with facemask, supraglottic airway devices are reported to lead to a higher incidence of regurgitation.[20-25]

CONCLUSION

To conclude, we found that the Tulip GT provides significant advantages over the facemask with Guedel for airway management by inexperienced users. Also it was found useful especially in patients with facial burns and facial trauma where placement of mask was very painful and cumbersome.

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