Korkeavirtausviikset leikkaussalissa

el Tapani Heikkilä, Tays

Sidonnaisuudet

- Koulutusmatka Fisher & Paykel:n kustantamana
- Fisher & Paykel maksaa luentopalkkion

Ajatus

- Korkeavirtausjärjestelmällä ajetaan kostutettua ja lämmitettyä happea nenän kautta hengitysteihin ja keuhkoihin, virtaus 20-70l/min
- Aiheuttaa AVMF (aventilatory mass flow) ilmiön
- Korkea kaasuvirtaus edesauttaa hiilidioksidin poistumista keuhkoista
- Aiheuttaa keuhkoissa maltillisen PEEP:n 2-5cmH2O
- Vähentää kuollutta tilaa
- Vähentää ylempien hengitysteiden vastusta
- Järjestelmää pystytään käyttämään koko induktion ajan esihapetuksesta intubaatioon asti
- Relaksoidun potilaan kaasujen vaihto onnistuu tietyin rajoituksin
- Sedatoitujen potilaiden kaasujenvaihdosta pystytään huolehtimaan paremmin
- Järjestelmä on nopea ja helppokäyttöinen

- Jo 1908 todettu, että jo yllättävän pieni määrä vapaasti virtaavaa happea riittää ylläpitämään veren happipitoisuuden

- Ongelmaksi muodostuu hiilidioksiditason nopea nousu toksiselle tasolle, josta seuraa metabolinen asidoosi ja kuolema

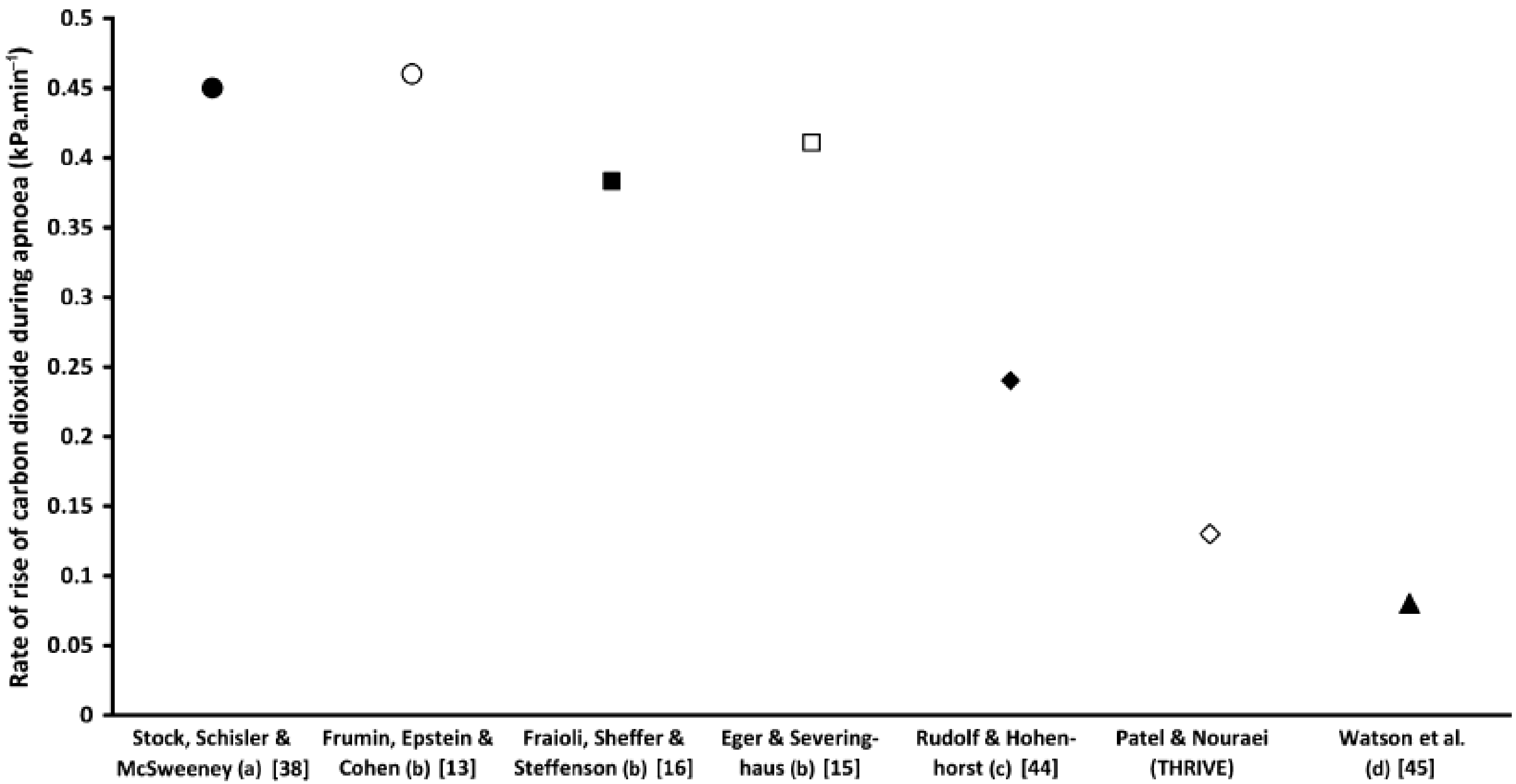
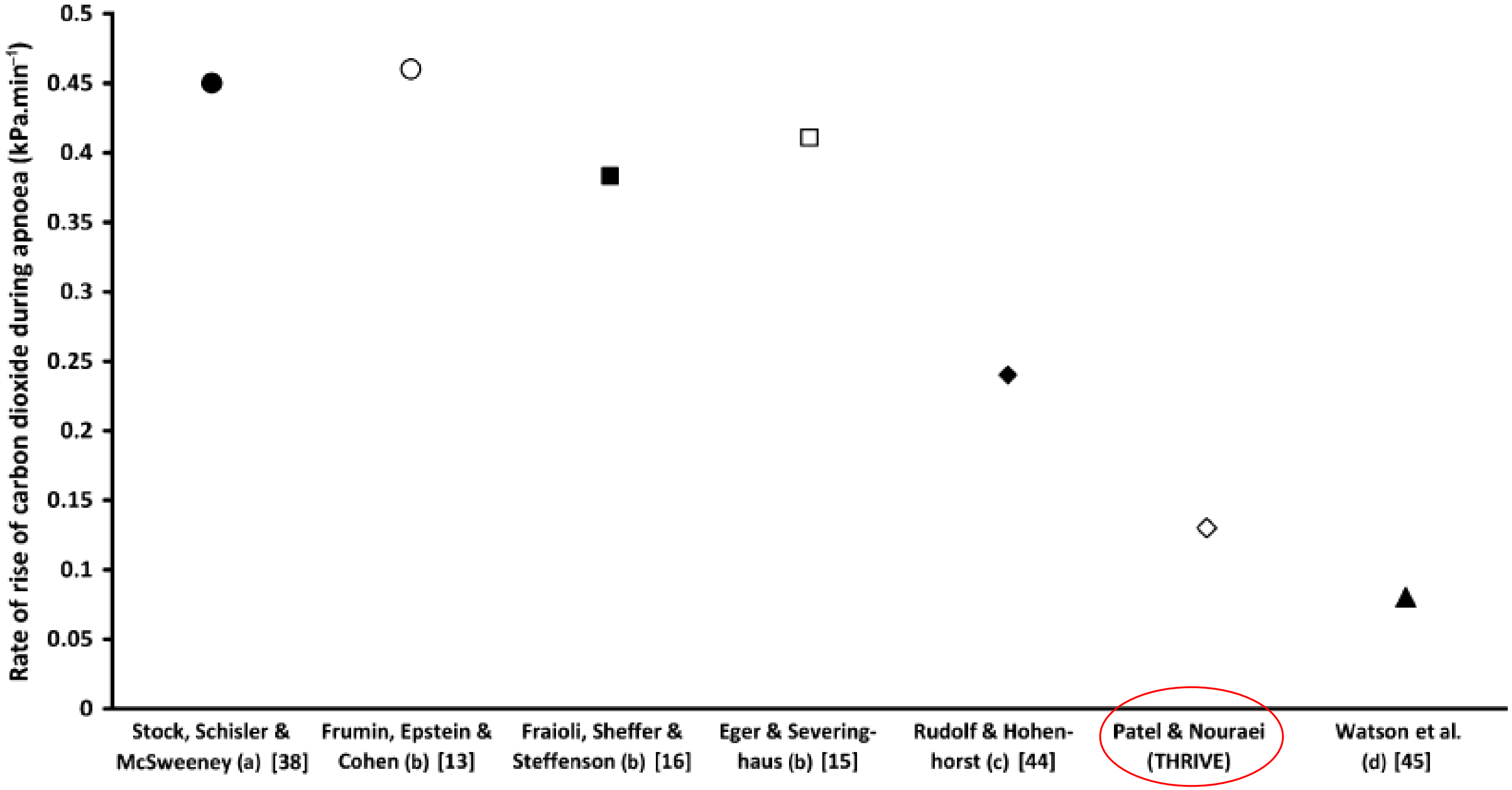


Figure 4 Rate of rise of carbon dioxide levels under different apnoea conditions undertaken within the study referred to: (a) airway obstruction; (b) classical apnoeic oxygenation; (c) low-flow intra-tracheal cannula and (d) high-flow intratracheal cannula.



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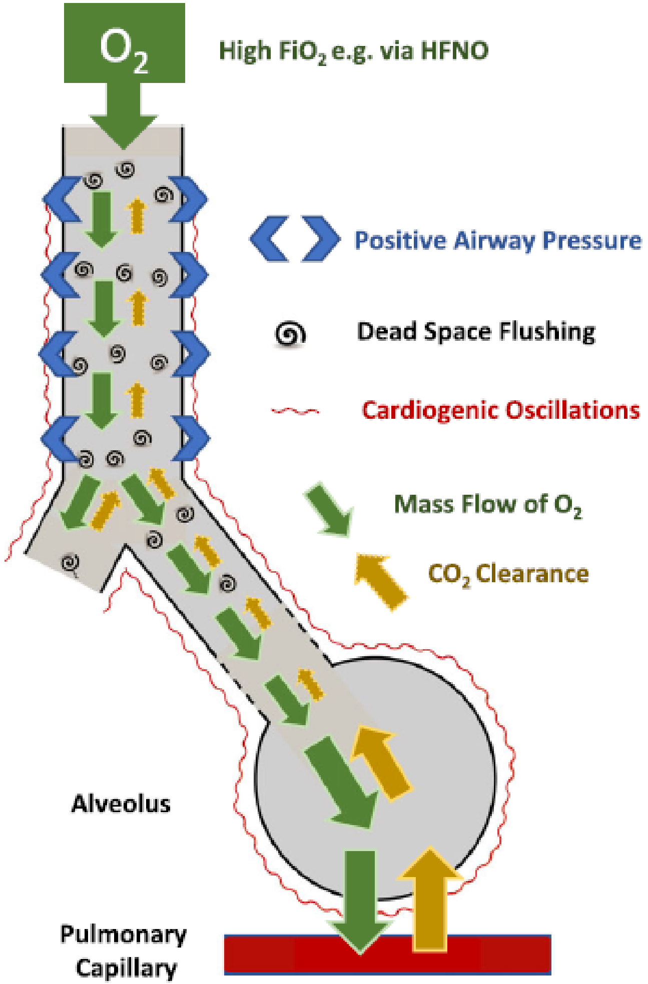

Figure 1 Apnoeic oxygenation involves the mass flow of a high fraction of inspired oxygen, aided by flushing of dead space, generation of positive airway pressure and cardiogenic oscillations. Higher flow rates can enable clearance of carbon dioxide.

Kontraindikaatiot

- Kallonpohjan murtuma
- Nenästä ei reittiä keuhkoihin
- Laserin käyttö toimenpiteessä jos järjestelmässä ei ole happiprosentin säätöä

Käyttöperiaate

- Esihapetus aloitetaan 20-30l/min
- Kun potilas on tottunut turbulenssiin voidaan virtausta nostaa ad 50l/min
- Kun potilas on sedatoitu/induktio annettu nostetaan virtaus 70l/min
- Kun potilaan tajunta on alentunut pidetään ilmatie auki alaleukaa työntämällä eteen/nostamalla (jaw thrust)
- Kun potilas on intuboitu laitteisto laitetaan pois päältä
- Potilaan kannattaa olla ylävartalo 30 asteeseen kohotettuna jos mahdollista
- Suu kannattaa pitää kiinni jos mahdollista mahdollisimman korkean PEEPn aikaan saamiseksi

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Original Article

Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE): a physiological method of increasing apnoea time in patients with difficult airways

A. Patel[1,2] and S. A. R. Nouraei[3]

1 Consultant Anaesthetist, The Royal National Throat Nose and Ear Hospital, London, UK
2 Consultant Anaesthetist, 3 Specialist Registrar in Academic Otolaryngology, University College Hospital NHS Foundation Trust, London, UK

Summary

Emergency and difficult tracheal intubations are hazardous undertakings where successive laryngoscopy–hypoxaemia–re-oxygenation cycles can escalate to airway loss and the 'can't intubate, can't ventilate' scenario. Between 2013 and 2014, we extended the apnoea times of 25 patients with difficult airways who were undergoing general anaesthesia for hypopharyngeal or laryngotracheal surgery. This was achieved through continuous delivery of transnasal high-flow humidified oxygen, initially to provide pre-oxygenation, and continuing as post-oxygenation during intravenous induction of anaesthesia and neuromuscular blockade until a definitive airway was secured. Apnoea time commenced at administration of neuromuscular blockade and ended with commencement of jet ventilation, positive-pressure ventilation or recommencement of spontaneous ventilation. During this time, upper airway patency was maintained with jaw-thrust. Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE) was used in 15 males and 10

- Tiedossa ollut vaikea ilmatie tai sen epäily
- Laryngotrakeaalinen stenoosi, äänihuuli/äänipoimu patologia, uniapnean korjausleikkaus, benigni/maligni hypopharyngsin ahtauma
- tiva-anestesia
- 4 benignia muutosta, 2 uniapnea leikkausta, 4 kaulan benignia/malignia muutosta, 9 potilaalla akuutti hengitysvaikeutta aiheuttava stridor
- 14 jet-ventilaatio, 4 intuboitiin, 4 laryngsmaski, 1 trakeostomia, 2 pelkkä THRIVE

females. Mean (SD [range]) age at treatment was 49 (15 [25–81]) years. The median (IQR [range]) Mallampati grade was 3 (2–3 [2–4]) and direct laryngoscopy grade was 3 (3–3 [2–4]). There were 12 obese patients and nine patients were stridulous. The median (IQR [range]) apnoea time was 14 (9–19 [5–65]) min. No patient experienced arterial desaturation $< 90\%$. Mean (SD [range]) post-apnoea end-tidal (and in four patients, arterial) carbon dioxide level was 7.8 (2.4 [4.9–15.3]) kPa. The rate of increase in end-tidal carbon dioxide was 0.15 $kPa.min^{-1}$. We conclude that THRIVE combines the benefits of 'classical' apnoeic oxygenation with continuous positive airway pressure and gaseous exchange

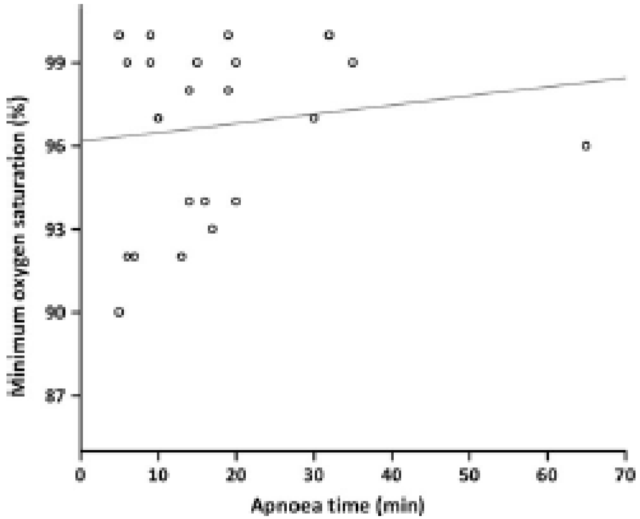

Figure 2 The relationship between apnoea time and oxygen saturation levels (n = 25). The line represents linear regression with r = 0.136 and p = 0.51.

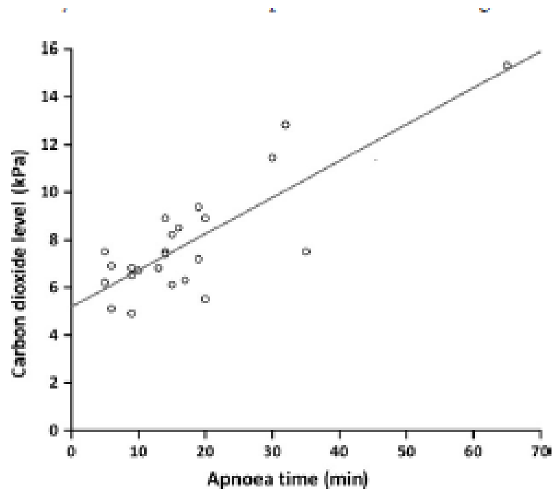

Figure 3 The relationship between apnoea time and end-tidal (and in four patients, arterial) carbon dioxide levels (n = 24). The line represents linear regression with r = 0.82 and $p < 0.0001$. The regression equation was $CO_2 = (5.2 \pm 0.5) + (0.15 \pm 0.02) \times$ apnoea time.

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Respiration and the Airway

RESPIRATION AND THE AIRWAY

Optimizing oxygenation and intubation conditions during awake fibre-optic intubation using a high-flow nasal oxygen-delivery system

S. Badiger, M. John, R. A. Fearnley and I. Ahmad*

Department of Anaesthesia, Guy's and St Thomas' NHS Foundation Trust, Great Maze Pond, London SE9 3RT, UK

*Corresponding author: E-mail: drimranahmad1@gmail.com

Abstract

Background: Awake fibre-optic intubation is a widely practised technique for anticipated difficult airway management. Despite the administration of supplemental oxygen during the procedure, patients are still at risk of hypoxia because of the effects of sedation, local anaesthesia, procedural complications, and the presence of co-morbidities. Traditionally used oxygen-delivery devices are low flow, and most do not have a sufficient reservoir or allow adequate fresh gas flow to meet the patient's peak inspiratory flow rate, nor provide an adequate fractional inspired oxygen concentration to prevent desaturation should complications arise.

Methods: A prospective observational study was conducted using a high-flow humidified transnasal oxygen-delivery system during awake fibre-optic intubation in 50 patients with anticipated difficult airways.

Results: There were no episodes of desaturation or hypercapnia using the high-flow system, and in all patients the oxygen saturation improved above baseline values, despite one instance of apnoea resulting from over-sedation. All patients reported a comfortable experience using the device.

Conclusions: The high-flow nasal oxygen-delivery system improves oxygenation saturation, decreases the risk of desaturation during the procedure, and potentially, optimizes conditions for awake fibre-optic intubation. The soft nasal cannulae uniquely allow continuous oxygenation and simultaneous passage of the fibrescope and tracheal tube. The safety of the procedure may be increased, because any obstruction, hypoventilation, or periods of apnoea that may arise may be tolerated for longer, allowing more time to achieve ventilation in an optimally oxygenated patient.

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ORIGINAL ARTICLE

Retrospective Study

High-flow nasal oxygen availability for sedation decreases the use of general anesthesia during endoscopic retrograde cholangiopancreatography and endoscopic ultrasound

Table 2 Utilization of deep sedation *vs* general anesthesia and oxygenation during deep sedation between eras

Anesthesia type	Era 1	Era 2	Era 3	*P* value
DS, *n* (%)	41 (65.1)	73 (83.0)	61 (70.1)	0.033
GA, *n* (%)	22 (34.9)	15 (17.0)	26 (29.9)	0.033
DS only SpO_2 nadir,	4.5 (98.0)	3.0 (99.0)[a]	4.0 (96.0)	< 0.001

There was a significantly lower utilization of GA in era 2 compared to era 1 (P = 0.012) that persisted as a trend only between eras 2 and 3 after Bonferroni correction (P = 0.045). There was a significantly lower median SpO_2 nadir in era 3 compared to era 2 ([a]P < 0.001) that was a trend between eras 1 and 2 after Bonferroni correction (P = 0.028). DS: Deep sedation; GA: General anesthesia.

Table 4 Anesthesia-only times between and within eras

Anesthesia time	Era 1	Era 2	Era 3	*P* value
ERCP/EUS combined	26.0, 37.5	23.5, 20.5[1]	30.0, 28.0	0.006
ERCP	52.5, 48.2	31.0, 27.5	43.5, 32.0	0.080
EUS	20.0, 12.0	17.5, 10.2[2]	23.0, 11.2	0.005
DS	21.0, 12.5	21.0, 13.0	24.0, 13.0	≤ 0.001
GA	68.0, 34.7	56.0, 13.0	59.0, 24.5	(time comparison within each era)

Käyttökohteita

- Crush-induktio
- Endoskooppinen yksikkö
- Tiedossa oleva vaikea ilmatie
- Saliin tuleva tukkoon menossa oleva ilmatie
- Obeesien potilaiden induktio
- Jne.

Käytössä huomioitavia seikkoja

- Ylipainoisen potilaan rajoittunutta vitaalikapasiteettia tämä ei lisää
- Potilailla joilla on akuutti hengitysvajaus järjestelmä ei ylläpidä saturaatiota

Omia ajatuksia

- Vähentää stressiä
- Antaa lisää aikaa
- Vapauttaa kädet
- Nopea ottaa käyttöön
- Sujuvoittaa potilasflowta endoskooppisessa toiminnassa
- Paljon tutkimuksia tulossa ja käyttökohteet tulevat selkiytymään ja mahdollisesti laajenemaan