Determining the dose of remifentanil for adequate intubation conditions in children for day case surgery

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Introduction:

- The advantages of day case surgery are increasing its popularity.
- Paediatric patients are excellent candidates for day case surgery; they are generally healthy, commonly requiring anaesthesia for short procedures.
- Rapid emergence from anaesthesia, minimal delay in recovery and rapid readiness for discharge from the ward are paramount in day case surgery.
- Ideal anaesthetic agents should have rapid onset, short duration, minimal side effects and minimal residual effects.
- Although muscle relaxants provide exceptional intubation conditions, their duration of action often exceed that of the procedure.
- This risks residual paralysis during recovery, delayed discharge from the day unit which nullifies most of the advantages of day case surgery.
- The pharmacodynamics and -kinetics of propofol and remifentanil are well suited for day case surgery.
- Propofol dosing has been investigated previously.[1]
- The optimal remifentanil dosing schedule for intubation during day surgery, while maintaining haemodynamic stability, warranted further refinement.

Methods and materials:

- Ethics committee approved / patient consent obtained.
- Single-blind, randomised controlled trial.
- Calculated sample size: 60 patients (20 per group) to allow for a power of 81% to detect a difference between the groups
- Randomised into 3 groups according to remifentanil dose: 0.5, 0.75, and 1µg/kg.
- Standardised induction with sevoflurane (in 50% oxygen/nitrous oxide), placement of IV access followed by propofol 1,5mg/kg, then received remifentanil according to randomisation group.
- Adequate intubation conditions with least haemodynamic variation assessed by: i) ease of intubation (using Helbo-Hansen Intubation Score), and ii) blood pressure prior to induction, after propofol administration and after intubation.
- Total score of 10 or less were considered adequate intubation conditions.
- Score of 11 to 20 were considered inadequate intubation conditions.

Helbo-Hansen Intubating Score[2]				
Factors assessed	1	2	3	4
Laryngoscopy	Easy	Fair	Difficult	Impossible
Vocal Cords	Open	Moving	Closing	Closed
Coughing	None	Slight	Moderate	Severe
Jaw relaxation	Complete	Slight	Stiff	Rigid
Limb Movements	None	Slight	Moderate	Severe (jerky)

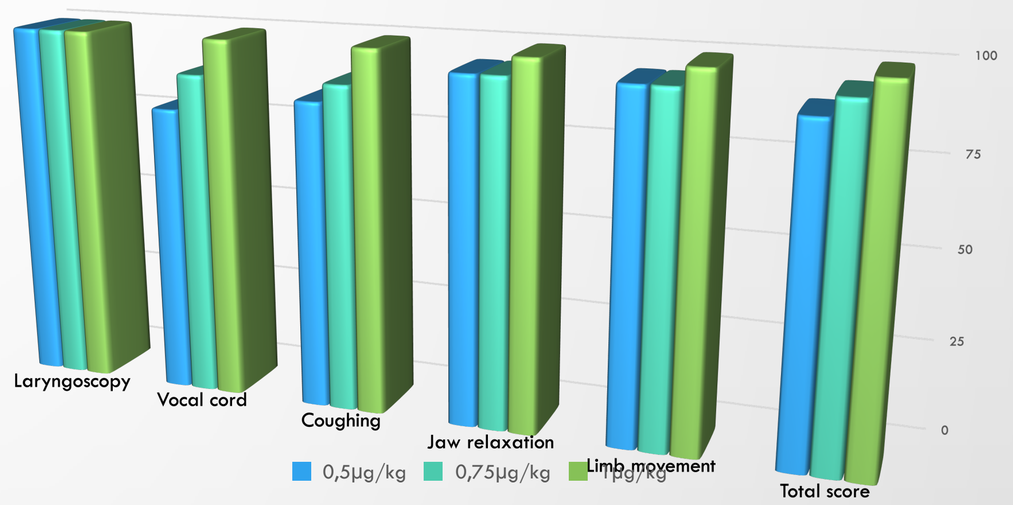
Results:

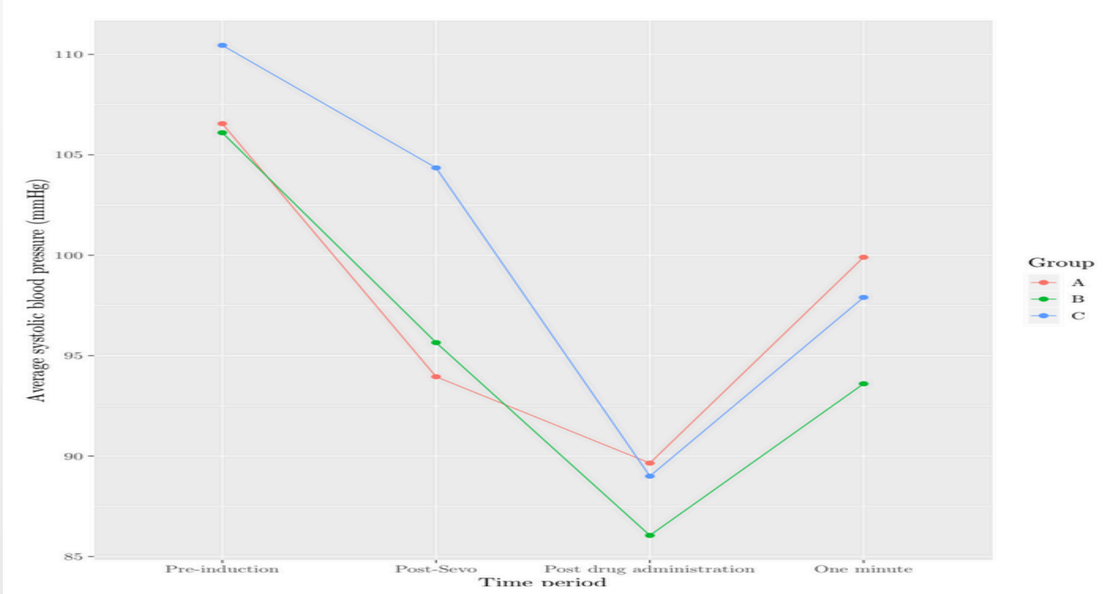
- Sixty children (aged 3-10 years) presenting for dental extractions recruited.
- Groups were comparable for age, sex, weight and duration of surgery.
- Significant decrease in vocal cord movement (p = 0.0395) was observed as dose of remifentanil increased.
- Ease of laryngoscopy (p = 0.277), coughing (p = 0.1017), jaw relaxation (p = 0.0518) and limb movement (p = 0.0518) did not improve significantly as propofol dose increased.
- Overall adequacy of intubating conditions (total score) did not improve as remifentanil dose increased (p = 0.0919).
- Blood pressure decrease as remifentanil dose increased was not statistically significant for systolic (p = 0.064) and mean arterial pressure (p = 0.059).
- Systolic blood pressure decrease was not clinically significant (>20%) with increasing doses (difference = 19mmHg - 17% from base line)
- Mean arterial pressure decrease was clinically significant (>20%) with increasing doses (difference = 23mmHg – 28% from baseline)
- Blood pressure returned to within 10% of baseline once intubation was achieved.

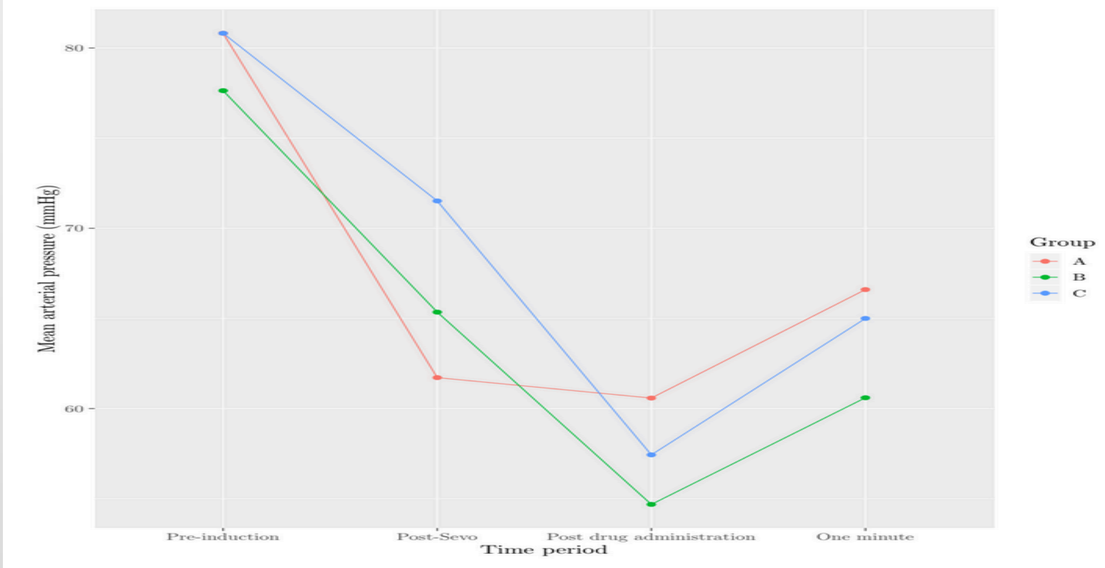
Adequacy of intubation scores related to dosage of remifentanil

Remifentanil dose Parameter	0,5µg/kg (n = 20)	0,75µg/kg (n = 20)	1µg/kg (n = 20)	Significance p < 0.05
Laryngoscopy	20 (100%)	20 (100%)	20 (100%)	p = 0.277
Vocal cord	16 (80%)	18 (90%)	20 (100%)	**p = 0.0394**
Coughing	17 (85%)	18 (90%)	20 (100%)	p = 0.1017
Jaw relaxation	19 (95%)	20 (100%)	20 (100%)	p = 0.0518
Limb movement	19 (95%)	19 (95%)	20 (100%)	p = 0.0518
Total score	18 (90%)	19 (95%)	20 (100%)	p = 0.0919

Ease of intubation per dose







***Legend**: Pre-induction = before induction, Post sevo = At Sevo 4% Post drugs administration = after remifentanil, One minute = 1 minute after intubation.*

Conclusion:

- For day case procedures where intubation is necessary, but where muscle relaxant duration of action exceeds the duration of surgery, the use of remifentanil 1µg/kg & propofol in a dose of 1.5mg/kg is advocated to aid intubation.
- This dosing schedule allows intubating conditions comparable to those achieved by means of muscle relaxants whilst maintaining excellent cardiovascular stability.

1. Du Preez T, Dippenaar JM. Intubating conditions following four different doses of propofol. SAJAA.2020
2. Helbo-Hansen S, Ravlo O, Trap-Anderson S. The influence of alfentanil on the intubating conditions after priming with vecuronium. Acta Anaesthesiol Scand. 1988; 32:41-44.