Student: Annabelle Vincent

Title: Volatile Anaesthetic Agent Use During Induction of Paediatric Anaesthesia

Supervisor(s): Dr Ben van der Griend, Associate Professor Ross Kennedy and Margie McKellow

Sponsor: The Anaesthetist's Instrument Pool Limited

Introduction:

Inhaled anaesthetic agents such as sevoflurane and nitrous oxide are often used during induction of anaesthesia in children. Sevoflurane and nitrous oxide are both greenhouse gases therefore excessive usage and wastage has important environmental consequences, as well as economic implications. The anaesthetic department at Christchurch Hospital has a long-standing interest in gas flow reduction and thus reduction in anaesthetic agent usage, with significant data collected and published in adults. However there has been limited data collected in children. High fresh gas flow rates are still commonly employed during induction of paediatric anaesthesia and sometimes continued into the maintenance phase. One prior study in the department found that just as much sevoflurane was being used in short 20 minute or less paediatric cases as major adult procedures lasting 1-2 hours. Gas flow reduction measures taken in the department over the last year 10 years have been estimated to have reduced annual expenditure by $200,000 and reduced the environmental impact by the equivalent of 200-300 tonnes of carbon dioxide per year. We now look to extend this success into paediatric anaesthesia.

Aim:

The aim of this study was to quantify the use of sevoflurane and nitrous oxide during the induction and the maintenance phases of anaesthesia for children presenting for surgery. Understanding current practice can then help direct the implementation of strategies to reduce consumption.

Impact: (in lay terms)

By exploring gas flows and anaesthetic agent consumption in paediatric anaesthesia we now have a better understanding of current practice. Based on this data, strategies can be devised to establish more sustainable practice in paediatric anesthesia, which will reap both environmental and economic benefits.

Method:

Data was collected from operating theatre two, the dedicated paediatric theatre, at Christchurch Hospital. Children presenting for surgery over a three month period having anaesthesia using inhaled anaesthetic agents were included in this observational study. We recorded the gas flows and amount of sevoflurane and nitrous oxide consumed in both the induction room and operating theatre as well as patient demographics and anaesthetic duration. Anaesthetic agent consumption was logged by the machine and recorded after each case.

The data was then analysed and compared to the existing adult data set.

Results:

Table 1	Duration (min)		Sevoflurane Consumption (mL)	
	Median	IQR	Median	IQR
Induction	9	7-12	12	8-16
Maintenance	43	26-71	7	5-10
Total	51	35-79.5	19	13.5-25

When comparing our results (Table 1) with the existing adult data set we found that sevoflurane consumption was remarkably higher in paediatric cases. Adult data indicated a median case duration of 86 minutes used a median of 12 mL of sevoflurane while our paediatric data shows a median case duration of 51 minutes used a median of 19 mL of sevoflurane. When separated into induction and maintenance phases of anaesthesia, consumption was highest during induction due to the utilisation of high gas flows. However we were surprised to see in the data that sometimes gas flows remained high during maintenance as well, leading to very high sevoflurane consumption.

Conclusion:

We can conclude that volatile anaesthetic agent usage in pediatrics is far in excess of that in adults. High consumption was particularly notable during the induction phase of anaesthesia, which could be a potential target for strategies to reduce gas flows and consequently anaesthetic agent usage. This could include using lower gas flows where appropriate or reducing gas flows earlier. Even small reductions in use can have a large overall impact when multiplied across nearly 5000 paediatric cases per year. It would also be of interest to carry out a follow-up study in the future to investigate the success of any changes to practice in paediatric anaesthesia.