HOT TOPIC

IS VOLATILE-ONLY ANAESTHESIA A POOR CHOICE IN CHILDREN?

SUMMARY OF KEY POINTS:

- Emergence Agitation remains a significant post anaesthetic problem that interferes with the child's recovery.
- The incidence of EA is reduced by propofol TIVA, propofol maintenance after sevoflurane induction, bolus of 1mg/kg propofol at end of operation and adjuncts like alpha-2 agonists (dexmedetomidine, clonidine), fentanyl and ketamine.
- Volatile anaesthesia without adjuncts should be avoided in children at risk of EA.

REVIEW OF EVIDENCE

Background:

Volatile anaesthetic agents are widely used for induction and maintenance of anaesthesia in children, but their use has been associated with an increased incidence of Emergence Agitation (EA) when used as a sole anaesthetic agent[1]. EA is defined as a **dissociated state of consciousness** in which the child is inconsolable, irritable, uncooperative, typically thrashing, crying, moaning, or incoherent. These behavioural changes are also referred to as Emergence Delirium (ED). But ED appears to represent a subset of EA as not all agitated children are truly delirious[7]. The incidence of EA varies from 2% to 80% and is common in the 2 to 6 year old age group.

Why should EA be prevented?

Agitated behaviour associated with EA places the patient at risk of harming themselves or others, requires greater postoperative nursing resources, is distressing for parents and staff, may prolong recovery and decreases parent satisfaction with health care.

Behavioural change is a measure of the psychological impact of an event. Hospitalisation is a stressful event for many children. Previous studies have shown children can develop negative behaviour after hospitalisation for surgery[2], and there is a strong association between a child's previous traumatic healthcare experience[3], distress during induction of anaesthesia[6] and the development of EA and post-operative negative behaviour changes. A study by Power et al[3] showed a high percentage of British children experienced problematic behaviour (PB) at home for at least 4 weeks after discharge following surgery. Typical behaviour changes described included attention seeking, temper tantrums, waking up at night, eating problems, generalised anxiety and regression.

Can EA be predicted?

The main risk factors for EA are young age, poor adaptability and volatile-only anaesthesia[4]. Kain et al[5] published a study showing children who were more anxious during the induction of anaesthesia had a higher excitement score on entrance to the PACU. Anxious children also had a higher incidence of EA compared with the children who were not anxious (9.7% vs 1.5%). In a study from Bristol, Beringer et al[6]

showed a Paediatric Anaesthesia Behaviour (PAB) score at induction correlates well with the incidence of post-op EA and Post-operative Behaviour disturbance.

How can we reduce the incidence of EA?

A comprehensive meta-analysis published in the Cochrane library by Costi et al[7]looked at 137 studies comparing sevoflurane to other General Anaesthesia and the use of adjuncts with regards to the incidence of EA in children. The important findings from this analysis are summarised below.

a. Propofol for induction and maintenance (TIVA): Fourteen studies investigated risk of EA for this comparison and found that propofol anaesthesia reduced risk of EA (RR 0.35, 95% CI 0.25 to 0.51, 1098 participants, high quality of evidence). Fig 1.

b. Sevoflurane induction followed by Propofol maintenance: Eight studies reported risk of EA and found that the propofol group had a lower risk of EA (RR 0.59, 95% CI 0.46 to 0.76, 738 participants, high quality of evidence). Fig 1.

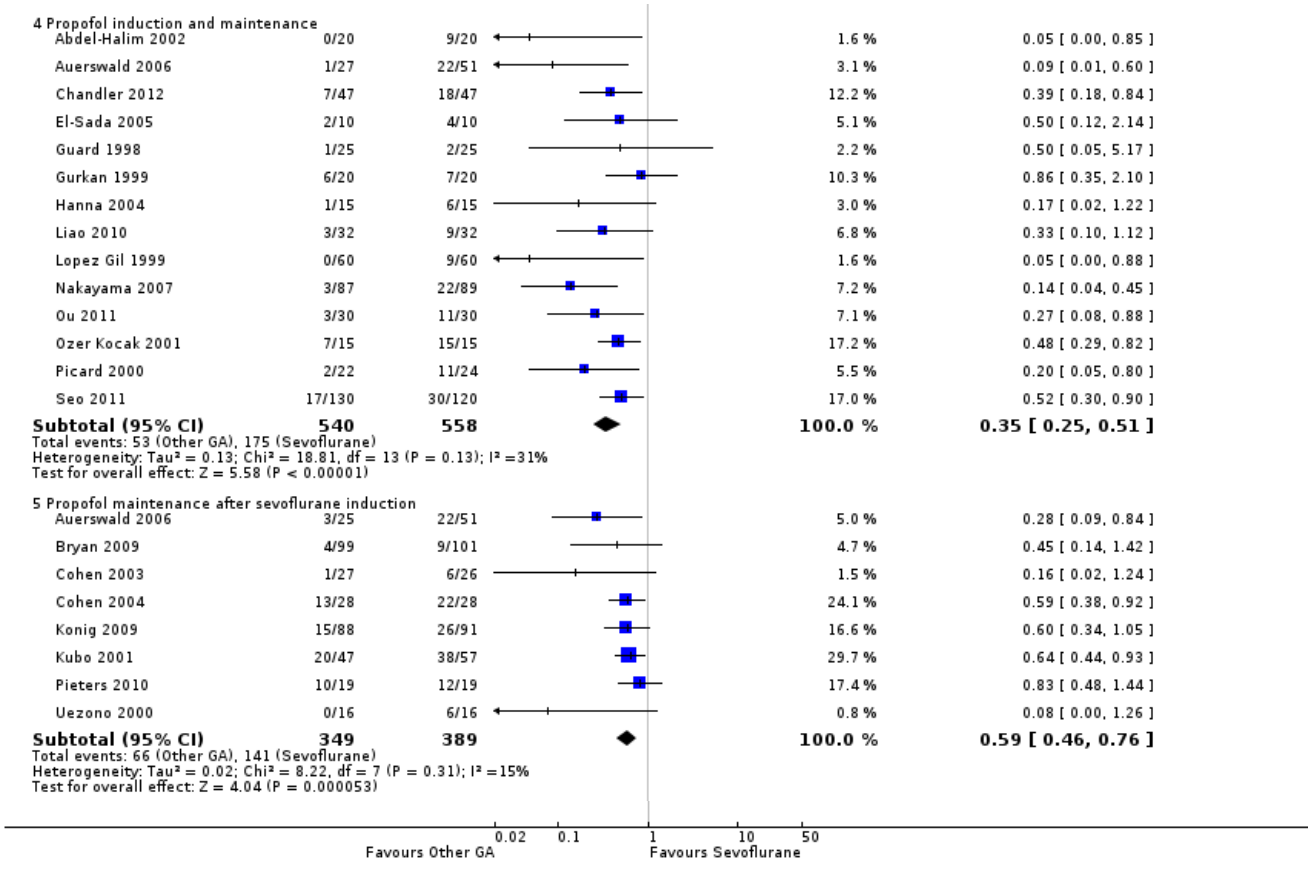

Figure 1. Forest plot from Costi et al[6] showing studies comparing a. Sevoflurane with propofol and b. propofol maintenance after sevoflurane induction with regards to EA. Extract from Cochrane library. (https://doi.org/10.1002/14651858.CD007084.pub2)

c. Sevoflurane vs isoflurane: Six studies investigating this comparison reported no difference in EA.

d. Sevoflurane vs desflurane: Six studies included in the analysis reported no difference in EA.

Effect of adjuncts with sevoflurane anaesthesia:

a. Propofol bolus at end of anaesthesia- Five studies investigating the effect of 1 mg/kg of propofol administered at the end of anaesthesia showed decreased risk of EA (RR 0.58, 95% CI 0.38 to 0.89).

b. Clonidine - Nine studies investigated risk of EA and showed an overall reduction in risk of EA (RR 0.45, 95% CI 0.31 to 0.66).

c. Dexmedetomidine: Twelve studies investigating this intervention found a large overall reduction in risk of EA (RR 0.37, 95% CI 0.29 to 0.47).

d. Fentanyl: Fifteen studies showed an overall decrease in risk of EA (RR 0.37, 95% CI 0.27 to 0.50).

e. Ketamine 0.25 mg/kg bolus at end of anaesthesia: Three studies showed an overall reduction in risk of EA (RR 0.30, 95% CI 0.13 to 0.69).

Treatment of EA:

Pharmacological treatment of EA may be necessary when facing intense agitation with self-injury risks in PACU. There has been little research to guide clinical practice, but propofol, fentanyl, ketamine and alpha-2 agonists have been effective in the treatment of EA[8]. Parental presence during emergence showed no difference in the risk of EA[7].

Conclusion:

Reducing perioperative behavioural morbidity is one of the major future challenges in paediatric anaesthesia. Anaesthetic and peri-operative management needs to be tailored to the individual child with the aim of reducing postoperative behavioural disturbance. The incidence of EA can be reduced by making simple alterations to one's anaesthetic technique.

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AUTHORS:

Dr. Arivazhagan Sampath, Consultant Paediatric Anaesthetist, Bristol Royal Hospital for Children.
Arivazhagan.sampath@uhbw.nhs.uk