Comparison between Sevoflurane and Desflurane on Emergence and Recovery Characteristics of Children undergoing Surgery for Spinal Dysraphism

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BACKGROUND

- Rapid recovery is desirable after neurosurgery as it enables early postoperative neurological evaluation and prompt management of complications
- Sevoflurane is generally considered as a suitable inhalational agent in neuroanesthesia practice
- Desflurane is expected to provide earlier emergence from anesthesia, and may be a preferred agent in neurosurgical patients
- Previous studies comparing the emergence from sevoflurane and desflurane in children are scarce and results are far from uniform
- Rarely, any study compared the recovery characteristics in pediatric neurosurgical patients

OBJECTIVE

Primary:

- To compare the the effect of sevoflurane and desflurane anesthesia on emergence and extubation in children undergoing spinal surgery

Secondary: To assess:

- Postanesthetic recovery with Modified Aldrete score
- Postoperative pain with modified Objective Pain Score
- Emergence delirium with Cole's Agitation Scale
- Intraoperative and postoperative fentanyl requirements
- Haemodynamic changes
- Postoperative complications: PONV, shivering, seizures, desaturation etc.

METHODS

- Prospective, randomized controlled study

Exclusion Criteria

- 60 consecutive children
- aged 1-12y, ASA Grade I/II
- undergoing elective surgery for spinal dysraphism

Exclusion Criteria

- Children who underwent prior spinal surgery
- Children with cardiac, renal, hepatic and respiratory dysfunction
- Children with associated hydrocephalus, Arnold-Chiari malformation and history of seizures

Anesthetic Management

- Premedication: no sedative premedication
- Routine monitors connected
- Induction: Sevoflurane 8% in O_2 @ 6 L/min
- IV access secured → Fentanyl 2 µg/kg
- Tracheal intubation: Rocuronium 1 mg/kg
- Maintenance: Randomized to receive:

  Sevoflurane+ O_2 + N_2O (40:60) + FGF @ 2L/min

  or

  Desflurane+ O_2 + N_2O (40:60) + FGF @ 2L/min

  Along with fentanyl (1 µg/kg/h) and rocuronium
- Monitoring: ECG, SPO_2, $EtCO_2$, NIBP, BIS (45 – 55)

Observations

- Intraoperative Data
  - Demographics, hemodynamics, EtAA
  - Fentanyl & Rocuronium consumption
  - Emergence & Extubation times
- Postoperative Data
  - Hemodynamics
  - Modified Aldrete Score (MAS)
  - Objective Pain Score by Hannallah *et al* (OPS)
  - 5-point Cole's Agitation Score (ACS)
  - Time to achieve full MAS
  - Time to 1st analgesic

Statistical analysis

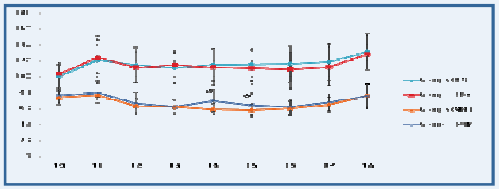
- Within group categorical variables: Chi-square test
- Parameteric continuous variables: t-test & ANOVA
- Non-parameteric continuous variables (within group):
  - Freedman test & Wilcoxon sign rank test
- p -value ‹ 0.05 was considered as significant

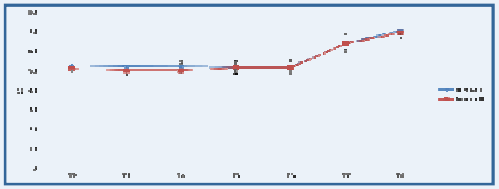
RESULTS

Demographic Data (Mean±SD)

Parameters	Group S (n=30)	Group D (n=29)	P
Age (yr)	5.8±3.5	5.9±3.3	0.95
Weight (kg)	21.6±9.5	19.1±7.4	0.26
Sex (M:F)	14:16	14:15	0.79
Duration of surgery (min)	168.1±76.3	188.2±97.1	0.44
Duration of anesth (min)	213.5±69.3	236.5±89.3	0.33

Intraoperative Hemodynamics (HR beats/min; MBP mmHg)





T_0, baseline; T_1, before induction; T_2, after induction; T_3, skin incision; T_4, laminectomy; T_5, dural incision; T_6, dural stretching; T_7, skin closure; T_8 anaesthetic agent discontinuation, * p <0.05

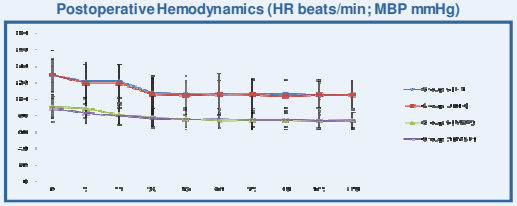
Intraoperative Data [Mean±SD/Median (Range)

Parameters	Group S (n=30)	Group D (n=29)	P
Total Fentanyl (µg)	96.3±51.0	80.5±45.0	0.18
Total rocuronium (mg)	33.8±17.7	35.8±19.9	0.77
Time to emergence (min)	8(2.5-14)	2.5(0.83-8)	0.0001
Time to extubation (min)	5.5(1.2-14)	3(0.8-10)	0.0003
Total fluid administered (ml)	525 (210-3200)	600 (250-3000)	0.56
Urine output (ml)	150(25-550)	150(40-450)	0.90
Blood loss (ml)	50(10-800)	60(10-500)	0.61
Blood replacement (ml)	0.0(0-500)	0.0(0-300)	0.07

Postoperative Data [Median (Range)/ Number (%)

Parameters	Group S (n=30)	Group D (n=29)	P
Time to attain full MAS (min)	0(0-10)	0(0-15)	0.22
Immediate postoperative pain (OPS≥4)	20(66.7%)	16(55.2%)	0.22
Immediate severe EA (ACS 4/5)	13(43.3%)	6(20.7%)	0.05
Time to Ist analgesic (min)	10(5-120)	10(5-120)	0.28
No. of patients requiring Fentanyl	21(70%)	19(65.5%)	0.71
No. of patients with PONV	2(6.67%)	2(6.89)	0.99

Postoperative Hemodynamics (HR beats/min; MBP mmHg)



DISCUSSION

- Hemodynamics was comparable at all stages of surgery except the MBP was higher with desflurane during laminectomy (T_4) and dural incision (T_5)
  - Possibly due to intense surgical stimulus
  - May be due to rapid rise in concentration of desflurane to maintain prefixed BIS values, resulting in sympathetic stimulation during painful stages of surgery [1]
- The extubation and emergence times were significantly less with desflurane
- Mean emergence and tracheal extubation times were shorter as compared to other studies[2,3]
  - May be due to reduced anesthetic depth during skin closure, in this study
- MAS at admission to PACU and time to achieve full score was comparable between two groups
- Incidence of severe EA (ACS 4/5) was comparable
- Incidence of severe pain (OPS ≥4), and PONV were comparable

CONCLUSION

- Desflurane provided early emergence and tracheal extubation as compared to sevoflurane in children undergoing corrective surgery for spinal dysraphism

REFERENCES

1. Kang H *et al*: Acta Medica Okayam 2010;64:307-16
2. Cohen IT *et al*: Anest Analg 2002;94:1178-81
3. Kim JM *et al*: Yonsei Med J 2013; 54:732-8