LOW FLOW ANAESTHESIA USING “EQUILIBRATION TIME” AND THREE DIFFERENT VOLATILE INHALATIONAL AGENT- DESFLURANE, SEVOFLURANE AND ISOFLURANE

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INTRODUCTION

Institution of Low flow anaesthesia, as advised by J A Baum in 1995, is commonly done by giving initially high fresh gas flow (HFGF) for a fixed time interval i.e. 10-20 min to build up adequate alveolar concentration of inhalational anaesthetic agents followed by reduction to low fresh gas flow (LFGF). **M R Nel et al in 1997 and Tanuja Malik et al in 2012** used **equilibration time (ET)** as the change over time from high to low flow so as to reduce the period of HFGF. **Equilibration time** is the time when ratio of expired (Fe) and inspired (Fi) anaesthetic agent (AA) concentration becomes 0.8 (Fe/Fi=0.8). Equilibration time varies with different anaesthetic agents, depending on their blood gas solubility

AIM & OBJECTIVES OF STUDY

Aim:

- To know whether the ‘**equilibration time**’ can be used as change over point from HFGF to LFGF.

Objectives :

- To know ‘**equilibration time**’ of Desflurane, Sevoflurane and Isoflurane.
- To know the MAC and BIS value at ‘**equilibration time**’
- To maintain the LFA using MAC as the target point and to correlate MAC with Bispectral index
- To observe the **recovery time**
- To know the **incidence of awareness**
- To observe **any critical events** (hypoxia, hypercarbia and major hemodynamic alterations)

MATERIALS AND METHODS

Permission from institutional committee: Yes

Type of study: Prospective, Randomized, Single blind clinical study

Sample size calculation: Done using parameter “**equilibration time**” (Ref: M R Nel et al 1997), using **G-Power software** considering **mean difference=15.9, SD (standard deviation) =6, effect size= 1.126, confidence interval=99% and power=90%**, sample size comes to be **21 in each group**.

Inclusion criteria: Age group 18-60 years, ASA status I and II, Patients posted for elective surgical procedures of about 1-3 hours under general anaesthesia

Exclusion criteria: History of alcohol or drug abuse, Pregnant and obese patients, reported hypersensitivity of any of the drugs used in the study

Premedication: Inj. Glycopyrrolate 0.2 mg IM, Inj. Fentanyl 2 µg/kg IV, Inj. Ondansetron 4 mg IV, Inj. Ranitidine 50mg IV

Randomization: Done using **Concealed Envelop** method into three groups of 21 patients each.

Group D (n=21) - Patients receiving **Desflurane**

Group S (n=21) - Patients receiving **Sevoflurane**

Group I (n=21) - Patients receiving **Isoflurane**

Induction: In all three groups

Preoxygenation with 100% O₂ for 3min with close circuit.

Inj. **Propofol** 2 mg/kg IV till loss of eye lash reflex.

Inj. **Suxamethonium Chloride** 1.5mg/kg IV

Maintenance:

- Close circuit with Drager sorb 800 soda lime was used.
- High FGF mixture of **6 L/min (Oxygen 2L/min and Nitrous oxide 4L/min)** & dial setting of the Inhalational agent was set at **1.3 times the MAC**. Ventilator to be set with tidal volume -10ml/kg and respiratory rate -12/min.
- High FGF was given till equilibration time, i.e. when **Fe/Fi ratio became 0.8**. High FGF reduced to low **FGF 1L/min. (O₂:N₂O.50:50)**.
- During LFA vaporizer dial setting was changed to maintain **MAC of 1 or above** depending upon type of surgery.

Reversal: Reversal of neuromuscular blockade was done using inj. Neostigmine (50ug/kg) IV and Inj. Glycopyrrolate (10ug/kg) IV.

DRAGER FABIUS PLUS WITH SCIOFOUR GAS ANALYZER

BIS VISTA MONITOR

INFINITY VISTA XL MONITOR

MONITORING

Inhaled AA conc.(Fi), Exhaled AA conc. (Fe), Fe/Fi ratio, Equilibration time, MAC and BIS value, FeN₂O, Haemodynamic parameters, FiO₂, SpO₂, EtCO₂, Recovery time, any critical event and post operatively - Incidence of awareness(by asking 4 question)

STATISTICAL ANALYSIS

Software used – **Medcalc 12.5.0.0 version**. Data presented in mean±SD. Parametric data were analyzed by **student t test** and non parametric data were analyzed by **chi-square** test for all three groups.

Significance of statistical test was judged as follows:

p > 0.05 = Not significant

p < 0.001 = Highly significant

p < 0.0001 = Very highly significant

p < 0.05 = Significant

RESULT AND DISCUSSION

All the demographic data were comparable in all the three groups.

Equilibration time was shorter with Desflurane than Sevoflurane followed Isoflurane. This difference is due to different blood gas solubility of Desflurane (0.42), Isoflurane (1.4) and Sevoflurane (0.69). Our results match with those of **Tanuja Mallik et al 2012, M R Nel et al 1997 and D J H Lee et al 1996**

The MAC value at ET in all the three groups was ≥1.3 and the BIS values were also between 30 to 60. So, surgery was allowed soon after the ET was achieved

MAC was targeted 1 or more during anaesthesia (as per **Tanuja Malik et al**) and **BIS was between 40-60** showing a good correlation between two.

None of the patients complained about awareness. So, MAC can be very well used as guide to depth of anaesthesia

R.T.-“Time from discontinuation of the inhalational agent to the time when patient open his/her eyes on verbal command”

D < S < I

Our results match with those of **Tanuja Malik et al 2012**.

All the patients were hemodynamically stable and none of the patient developed any unanticipated clinical events (like hypoxia, hypercarbia etc.)

SUMMARY

- Equilibration Time** was achieved early with Desflurane followed by Sevoflurane & Isoflurane . (Inter group p value <0.0001)
- Targeted MAC value was achieved at ET, so change over from HFA to LFA done
- We found correlation between **MAC & BIS**.
- There was no incidence of intraoperative awareness.**
- Recovery time** was in order of D < S < I
- No significant changes in haemodynamic parameters, EtCO₂ and FiO₂ were seen.

CONCLUSION

- ET can be used as change over point from FFA to LFA**
- Desflurane and Sevoflurane are better agents for low flow anaesthesia compared to Isoflurane.”**

REFERENCES

- Tanuja Malik, S. Aneja, R Tope, V Muralidhar. A randomized prospective study of desflurane versus isoflurane in minimal flow anesthesia using “equilibration time”. Journal of Anaesthesiology Clinical Pharmacology. Oct-Dec 2012; Vol28; Issue 4
- M. R. Nel, R. Ooi, D.J.H. Lee and N. Soni. New agents, the circle system and short procedures. Anaesthesia, 1997, 52, pages 364-381