Comparison of Effects of Propofol and Sevoflurane Used in Maintenance of General Anaesthesia on Post-Operative Nausea and Vomiting - A Prospective Observational Study

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ABSTRACT

BACKGROUND

Post-operative nausea and vomiting is a complication of general anaesthesia but can also be seen less commonly in regional anaesthesia. The uneasiness and discomfort associated with it can make the post-operative period eventful. We conducted this study to evaluate if sevoflurane and propofol used in maintenance of anaesthesia have any influence on post-operative nausea and vomiting.

METHODS

We included 64 patients in this prospective observational study who were undergoing elective otorhinolaryngology surgery belonging to American Society of Anaesthesiologist (ASA) PS I and II. After induction of general anaesthesia and endotracheal intubation, Group P received propofol at 100 - 200 mcg / kg / hr and group S received sevoflurane as maintenance anaesthetics agent at 1.5 - 2 %. All the patients were given ondansetron intravenously in the intra-operative period. Anaesthetic agents used for maintenance was stopped at the end of the surgery and patients were extubated and shifted to post-operative care unit. Patients were assessed for any occurrence of post-operative nausea and vomiting after extubation for 24 hours.

RESULTS

There were 2 (6.25 %) patients in the propofol group and 12 (37.5 %) patients in the sevoflurane group who had post-operative nausea and vomiting in the first hour. The difference in the nausea and vomiting between the groups was statistically significant with (P value of 0.0046) higher incidence in sevoflurane group. All the patients who had nausea and vomiting were treated with dexamethasone. When the patients were reassessed after four hours, five patients had nausea in sevoflurane group after four hours, which was treated with metoclopramide or Ondansetron. After six hours, none of the patients had nausea or vomiting.

CONCLUSIONS

The incidence of post-operative nausea and vomiting was lesser in the propofol group compared to sevoflurane group.

KEY WORDS

Post-Operative Nausea and Vomiting, Propofol, Sevoflurane, General Anaesthesia

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BACKGROUND

Post-operative nausea and vomiting (PONV) is one of the most common complications of anaesthesia in the post-operative period after pain. It occurs in the immediate post-operative period and sometimes it can be there up to 24 hours. It leads to discomfort and can increase the duration of stay in the post-operative care unit. PONV is triggered by multiple factors like the type of surgery, female gender, choice of anaesthesia and also use of opioids. It is more common among female gender, non-smokers and patients with history of motion sickness or previous history of post-operative nausea and vomiting.

PONV is more common in certain type of surgeries like laparoscopic, gynaecological, intra-abdominal, ophthalmic and otorhinolaryngology surgeries. Long duration of surgery and use of opioids in the post-operative period can also increase the risk of PONV.

The mechanism of post-operative nausea and vomiting is not very simple. It is due to activation of various receptors and centres in the cerebrum, midbrain and brainstem which leads to PONV. In the middle ear surgeries, its mainly due to the activation of vestibular system which induces emesis. In ophthalmic surgeries, nausea and vomiting is mainly due to vagal stimulation.¹ It is seen more commonly in paediatric age group after strabismus surgeries.

Risk of post-operative nausea and vomiting can be reduced in the intra-operative period by modifying the technique of general anaesthesia. Use of intravenous anaesthetic agents during maintenance of anaesthesia or total intravenous anaesthesia and use of prophylactic antiemetic drugs like 5 HT3 antagonists can reduce the risk of nausea and vomiting. Choosing regional technique or non-opioid analgesics for post-operative pain management can also reduce PONV.

Intravenous agents and total intravenous anaesthesia (TIVA) for maintenance of anaesthesia is helpful in reducing post-operative nausea and vomiting. Propofol has anti emetic properties at sub hypnotic dose and can reduce the incidence of nausea and vomiting in high risk patients. All the inhalational agents and volatile gas like nitrous oxide used for general anaesthesia are known to cause nausea and vomiting. PONV also depends on the type of anaesthetic agent used during maintenance of anaesthesia.

We conducted this study to evaluate if sevoflurane and propofol used in maintenance of anaesthesia has any influence on post-operative nausea and vomiting.

METHODS

This prospective observational study was conducted on 64 patients after institutional ethical committee approval. Sample size was calculated with power of 80 and 95 % confidentiality and standard deviation of 13, with 32 in each group. Duration of study was from December 2010 to August 2012. All the patients undergoing elective otorhinolaryngology surgeries with ASA PS I and II, aged between 20 - 50 years were included in the study. Exclusion criteria were emergency surgery, pregnancy and patients with ASA PS III and above.

After written and informed consent for the surgery and anaesthesia was taken, premedication alprazolam 0.5 mg and ranitidine 150 mg tablet were given per orally on the previous

night and on the day of surgery. After confirming the patients identity, intravenous canula was secured and ringer lactate fluid was started. Monitoring included heart rate, electrocardiogram, non-invasive blood pressure, oxygen saturation and capnography in the intra-operative period. General anaesthesia was induced with fentanyl 1 - 2 mcg / kg, propofol 2 mg / kg and vecuronium 0.1mg / kg and endotracheal intubation was done.

Maintenance of anaesthesia was done with propofol at 100 - 200 mcg / kg / hr. in group P and sevoflurane at 1.5 - 2 % in group S. Haemodynamic parameters were monitored throughout in the intra-operative period. Dose of the maintenance agent was titrated as per the vital parameters. Muscle relaxant vecuronium was repeated as per the requirement.

All patients were given ondansetron at 0.1mg / kg intravenously in the intra-operative period. At the end of the procedure, anaesthetics agents used for maintenance were stopped. All the patients were extubated and shifted to post-operative care unit for monitoring. All the patient who had nausea and vomiting in the post-operative period were treated with dexamethasone at 0.1mg / kg. If nausea and vomiting still persisted then they were treated with metoclopramide 10mg.

In the post-operative period, all the patients were assessed for post-operative nausea and vomiting at zero, four, six and 24 hours. If post-operative nausea and vomiting was present, injection dexamethasone was given.

Post-operative nausea is defined as unpleasant sensation of vomiting and vomiting is defined as expulsion of gastric contents. Post-operative nausea and vomiting persists for up to 24 hours in the post-operative period.

Statistical Analysis

Data was analysed using SSPS software version 20. All the parameters were represented in mean and standard deviation or percentage data. Fischer's exact test was used for categorical data and Mann -Whitney test was used for non - parametric data. P value of < 0.05 was considered significant.

RESULTS

The sample size for the study was calculated as 64 with 32 in each group. This study is a part of a bigger study.² Demographic parameters were comparable between the groups with mean age 29.69 (5.97) years in group P and 29.20 (6.64) years in group S with P value of 0.774 which was not statistically significant. All the other demographic parameters like age, sex, ASA PS were comparable between the groups.

The incidence of post-operative nausea and vomiting in group P was 2 (6.25 %) and 12 (37.5 %) in group S and the difference between the group was statistically significant with p - value of 0.0046. Group S had higher number of patients with nausea and vomiting compared to group P which was statistically significant. After four hours, five patients still had nausea in the sevoflurane group but no vomiting and none of the patient had nausea or vomiting in the propofol group. At the end of six hours, none of the patients had PONV in any of the group.

Post - Operative Nausea and Vomiting	Group P (N = 32)	Group S (N = 32)	P - Value
0	2 (6.25 %)	12 (37.5 %)	0.0046
4 th hour	nil	5	-
6 th hour	nil	nil	-
24 hours	nil	nil	-

Table 1 Post-Operative Nausea and Vomiting in the Two Groups

DISCUSSION

Post-operative nausea and vomiting is a complication seen after general anaesthesia and sometimes even after regional anaesthesia. Nausea and vomiting can make the patient uncomfortable and cause uneasiness in the recovery period. It is usually seen in the first 24 hours after surgery and sometimes can be present up to 48 hours. It leads to increased duration of stay in the post-operative period. Discharge from the hospital can also be delayed due to post-operative nausea and vomiting during day care / ambulatory surgeries. In this prospective observational study, we compared two different anaesthetic agents – propofol and sevoflurane used in maintenance of general anaesthesia and assessed the occurrence of post-operative nausea and vomiting between the two agents.

The mechanism of PONV is complex and not completely understood with multiple pathways and receptors involved. It has an afferent pathway like chemoreceptor trigger zone, vagal pathway, vestibular system, cerebral cortex and midbrain.^{3,4} This afferent pathway can be stimulated during surgery which in turn can activate receptors like cholinergic, dopaminergic, serotonergic or histaminergic receptors.^{3,4} These receptors further stimulate vomiting center in the reticular formation of brainstem and induce nausea and vomiting. Neurokinin receptor plays a very important role in causing emesis.^{3,4} Vomiting center can be stimulated by various exogenous and endogenous factors. Manipulation of bowel, hypoxia, hypercarbia, hypotension, positional changes and release of toxins can also lead to post-operative nausea and vomiting.

The risk of post-operative nausea and vomiting can be predicted using different scoring system. Apfel simplified scoring system is commonly used scoring system in predicting the risk of PONV. The risk factors are female gender, non-smokers, history of PONV or motion sickness and use of opioids.^{4,5,6,7} The other possible individual risk factors are age, higher body mass index (BMI), type of anaesthesia, type of surgery and duration of surgery. All these scoring system helps in predicting the risk of developing of post-operative nausea and vomiting. In our study, the number of male and female in both the groups were similar and was comparable. The duration of surgery was less than two hours in both the groups. Female patients have two to three times higher risk of developing PONV compared to male patients.⁴

Treatment of PONV needs multimodal approach. There is no single drug which can stop the nausea and vomiting altogether. 5-HT₃ receptor antagonist like ondansetron helps in reducing the incidence of the nausea and vomiting but may not stop nausea.⁷ Ondansetron is used as the first line of treatment in post-operative nausea and vomiting. It can be given as a prophylactic drug in the intra-operative period. Steroids like dexamethasone at a dose of 0.1mg / kg can be

helpful by reducing the prostaglandin synthesis and blocking the 5-HT₃ receptor.

Prokinetic drug like metoclopramide can also be used in the treatment of PONV. Neurokinin receptor antagonist are used in stopping the emesis but has less effect on the nausea. Other drugs which can be used are butyrophenones, anticholinergic drug like scopolamine, propofol, gabapentin and alpha 2 agonist.^{3,8,9} Other modalities used to reduce PONV include adequate hydration with intravenous fluids during peri-operative period, good anxiolytics in the pre-operative period, use of TIVA in the intra-operative period and non-opioid analgesics in the post-operative period can also reduce the incidence of nausea and vomiting.

In our study, the occurrence of PONV was lesser in the propofol group compared to the sevoflurane group. We noted only two patients in the propofol group had nausea and 12 patients in the sevoflurane group had nausea and vomiting. All the patients who had nausea and vomiting were given dexamethasone in the post-operative period and were observed for 24 hours. The nausea and vomiting were present only in the first 4 - 6 hours after extubation. All the patient received ondansetron in the intra-operative period.

Inhalational agents are known to cause emesis and the incidence is higher when there are other associated risk factors. Volatile gases like nitrous oxide is also known to cause nausea and vomiting. It is mainly due to the action of nitrous oxide on opioid and dopaminergic receptors. Nausea and vomiting seen with nitrous oxide use depends upon the duration of exposure.

Exposure of short duration of one or two hours does not induce nausea and vomiting.^{10,11} The PONV caused due to inhalational agent is an early onset type of PONV which is usually present immediately in the post-operative period.⁹ Propofol in sub hypnotic dose can reduce the incidence of post-operative nausea and vomiting. The exact mechanism is not known but the anti-emetic effect is due to the modulation of subcortical pathway.^{12,8} The dose of propofol used is 0.5 - 1mg / kg, but use of propofol in the intra-operative period for maintenance of anaesthesia or as a part of total intravenous anaesthesia is also helpful in reducing the incidence of PONV.^{12,8,9}

Post-operative nausea and vomiting also depends on the type of surgery and duration of surgery. It is more common in head and neck surgeries like tonsillectomy, strabismus surgery, laparoscopic surgeries, middle ear surgeries, orchidopexy, hernia repair, gynaecological procedures and bowel surgeries.^{10,13}

In our study, all the patients underwent otorhinolaryngology where the incidence of PONV is higher. But use of 5-HT₃ antagonists like ondansetron can reduce the risk of post-operative nausea and vomiting which was used in all the patients in the intra-operative period. Increased duration of surgery also has higher risk of developing post-operative nausea and vomiting. The duration of surgery in our study population was less than two hours.

Risk of post-operative nausea and vomiting is higher with inhalational agents compared to intravenous agents. When there are multiple risk factors, the use of TIVA can be helpful in reducing the incidence of post-operative nausea and vomiting.

CONCLUSIONS

Post-operative nausea and vomiting is the second most common problem seen in the post-operative period and is caused by multiple risk factors. Modification of intra-operative anaesthetic technique and use of total intravenous anaesthesia can reduce the incidence of PONV. Use of total intravenous anaesthesia and prophylactic anti-emetic drugs can reduce the incidence of post-operative nausea and vomiting.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

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