Original Article

Descriptive Study of Medication in General Anesthesia at Tertiary Care Teaching Hospital of South Bihar

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ABSTRACT

Background: The drug utilization study in general anesthetics is useful in understanding and interpreting the wide variations of drug used, according to various surgical departments and helps to understand the preferences of drug used according to patient's profile and clinician choice and other related factors. So, by analyzing the decision of drug choice and comparing the prescribing pattern of health system with the existing standard guidelines, necessary changes can be made so that the drug therapy can be optimized.

Aims/ objective: To study the drug utilization of patients undergoing general anesthesia with the objective of determining the percent utilization and dosing of various anesthetic agent and pre-anesthetic medication in tertiary care hospital of eastern India.

Materials and Method: In this observational & prospective study, 84 patients undergoing surgery under general anesthesia with any ASA physical status were surveyed. Details of the pre-anesthetic medications and other medications prescribed were recorded. For the general anesthesia, the agent chosen for induction and maintenance were recorded along with the record of clinical status monitoring during anesthesia as well as recovery period and quality of recovery.

Results: Glycopyrrolate and ondansetron were used in all patients whereas midazolam and fentanyl were used in more than 90% patients. Propofol was most commonly used inducing agent used in more than 95% cases. Halothane was used for maintenance of anesthesia in 47.92% of patients followed by isoflurane (41.67%). More than 95% of patients required skeletal muscle relaxant whereas more than 90% were given vecuronium. Most of the patients (66.67) were at level 2 of sedation as per Modified Ramsay Sedation Scale. 75% of patients had Modified Aldrete Score of 9 while 25% had 10 score.

Conclusion: The study results strongly suggest use of cheaper and cost-effective drugs. Thus, there is need for pharmacoeconomic analysis combined by pharmacovigilance activities to promote availability of newer drugs with better safety and efficacy.

Keywords: Drug Utilization Study, General Anesthesia, Pre-anesthetic medication, Inducing Agent, Maintenance Agent.

INTRODUCTION

A descriptive study of medications in general anesthesia involves investigating and characterizing the use of various drugs during the administration of anesthesia in medical procedures. According to WHO (1997) Drug Utilization Review is defined as —the marketing, distribution, prescription, and use of drugs in the society, with special emphasis on the resulting medical, social and economic consequences. [1-3]

It involves a comprehensive review of patient's prescription and medication data before, during and after dispensing to ensure appropriate medication decision-making and positive patient outcomes. The participation of pharmacologists in drug utilization review can directly improve the quality of care for patients individually and as populations, by striving to prevent the use of unnecessary or inappropriate drug therapy, prevent adverse drug reactions and improve overall drug effectiveness. [4]

The issue of general anesthesia was selected for a drug utilization study because it is a significant and important drug category that requires careful consideration of several convenience and safety factors in practice. [5]

The main objective of general anesthesia is to suppress autonomic reflexes, make the patient unconscious, and prevent them from feeling pain. Intravenous anesthetics, inhalational anesthetics, Intravenous sedatives, synthetic opiates, and neuromuscular blocking agents are the five primary types of anesthetic agents. Every class has unique advantages and disadvantages, and the surgical team can benefit from knowing these details as well as important adverse effects. The anesthesiologist should take the particular clinical scenario into account when selecting from the range of anesthetic drugs that are currently accessible. The patient's features (age, medical comorbidities etc.), the surgeon's or anesthesiologist's choice, and the kind of surgery being done are all important factors to take into account.[6]

Patient's worry, post-operative discomfort, post-operative nausea and vomiting, and the possibility of aspiration pneumonitis are the main causes for concern after surgical treatments. Pre-anesthetic medications are typically administered to expedite surgery, lower the risk of post-operative problems, and prevent the unfavorable effects of general anesthesia.[7] Drugs for reducing gastric acid production, benzodiazepines, anti-cholinergic agents, anti-emetics, pentazocine, and opioid analgesics are among the drugs used as pre-anesthetics.[8-12] In order to make anesthesia safer and more tolerable for the patient, pre-anesthetic medications are administered between 30 and 60 minutes before to an anesthetic agent.

The drug utilization study in general anesthetics is useful in understanding and interpreting the wide variations of drug used, according to various surgical departments and helps to understand the preferences of drug used according to patient's profile and clinician choice and other related factors. So, by analyzing the decision of drug choice and comparing the prescribing pattern of health system with the existing standard guidelines, necessary changes can be made so that the drug therapy can be optimized.

Keeping in fact the existing evidences, the present study was done to study the drug utilization of patients undergoing general anesthesia with the objective of determining the percent utilization and dosing of various anesthetic agent and pre-anesthetic medication in tertiary care hospital of eastern India.

MATERIALS AND METHODS

The present observational study was conducted in collaboration of the Department of Pharmacology and Department of Anesthesiology, Narayan Medical College & Hospital, Jamuhar, Sasaram, Bihar. 84 patients planned to undergo surgery under general anesthesia were enrolled in the study spanning over a period of 18 months. The patient's informed consent was obtained from the patients/their attendants in writing in their language with assurance of not revealing their identity at any state without their consent. This study was duly approved by Institute Ethical Committee (IEC).

Sampling method: Consecutive sampling method was used and all patients fulfilling our inclusion and exclusion criteria in the study period was included in the study.

Inclusion Criteria:

a) Patients planned for surgery under general anesthesia in all the surgical department.

b) Patients going for surgery with any co-morbidities.

c) Patients who give consent.

d) Patient in any ASA physical status.

Exclusion Criteria:

a) Pregnant women.

b) Patients who do not give consent.

Methodology:

A predesigned proforma was used to collect data on decision for choice of particular anesthetic agent for particular surgery, process of administration and monitoring of drug and adverse outcomes if any was noted.

Specific anesthetic procedures and specific surgical procedures were recorded in the proforma. Details of the pre-anesthetic visits by the anesthetists, any specific investigations instructed by the anesthetists, details of the pre-anesthetic medications and other medications prescribed were recorded. For the general anesthesia, the agent chosen for induction and maintenance were recorded along with the record of clinical status monitoring during anesthesia as well as recovery period and quality of recovery.

Statistical Analysis:

Data collected from the patients undergoing general anesthesia were collected in tabular form using Microsoft Excel 365 and then transferred to Graph Pad version 8.4.3 for further statistical analysis. Descriptive statistics were used to calculate the frequency & percentage of utilization and mean ± standard deviation (SD).

OBSERVATIONS AND RESULTS

In this observational & prospective study, 84 patients undergoing surgery under general anesthesia with any ASA physical status were surveyed. Their baseline demographic and clinical characteristics is given in **Table 1.**

Table 1: Age Distribution of Patients undergoing General Anesthesia

Variables	Value
Age (Years) in mean ± SD	34.99 ± 18.58
Weight (Kg) in mean ± SD	51.58 ± 15.56
Gender, n (%)	
Male	46 (54.76)
Female	38 (45.24)
Duration of Surgery	
≤1 hour	14 (16.67)
1.1-2 hours	29 (34.52
2.1-3 hours	31 (36.90)
>3 hours	10 (11.90)
Procedure, n (%)	
Laparoscopic Cholecystectomy	20 (23.81)
Tympanoplasty	18 (21.43)
Appendicectomy	5 (5.95)
Biopsy	4 (4.76)
MRM	3 (3.57)

Apart from above surgical procedure [Table 1], there were two cases of Craniotomy, Split skin grafting, Exploratory Laparotomy, Open Cholecystectomy, Open Sinus Surgery, PCNL, Septoplasty, and Thyroidectomy each and one case of Abdominal Rectopexy, Bilateral Tonsillectomy, CPE+ RT. URSL + DJ STENTING, D & E, Decompression & fixation with fusion, ERCP + Stent, Extraction of Pellet, Incision & Drainage, ORIF with plating, repair of meningomyelocele, reversal of Stoma, mastoidectomy, spine fixation, TEP, TENS nailing, stabilization & laminectomy, total Abdominal Hysterectomy and VSD closure + PDA ligation + ASD closure each.

Most of the patients were of age group of 21-40 years (42.86%). Most of the patients underwent abdominal surgery (53.57%) in department of general surgery followed by department of ENT (30.95).

Table 2: Distribution of Patients undergoing General Anesthesia with respect to Pre-Induction Medication

Pre- Induction Medication	Number of Patients	% of Patients (n=84)
Glycopyrrolate	84	100.00
Ondansetron	84	100.00
Midazolam	83	98.81
Fentanyl	81	96.43
Succinylcholine	19	22.62

Glycopyrrolate and ondansetron were used in all patients whereas midazolam and fentanyl were used in more than 90% patients. Most common dose for glycopyrrolate was 0.2 mg, 4 mg for ondansetron, 2 mg for midazolam, 100 micrograms for fentanyl and 75 mg for succinylcholine. Most of the patients (>80%) received pre-oxygenation with 100% O_2.

Table 3: Distribution of Patients undergoing General Anesthesia with respect to Induction Agent

Agent	Dose (mg) mean ± SD	Number of Patients	% of patients (n=84)	Time (Secs) mean ± SD	Repeated Dose Required
Propofol	89.26 ± 17.01	79	94.05	19.71 ± 2.01	0/79
Propofol + Ketamine	40.00 ± 17.32 & 33.33 ± 11.54	3	3.57	21.00 ± 3.61	2/3
Ketamine	30	1	1.19	30	1/1
Etomidate + Rocuronium	1.9 & 3	1	1.19	20	0/1

All inducing agent were given intravenously with no uneventful episode and with no requirement of correction therapy.

Propofol was most commonly used inducing agent used in more than 95% cases. Propofol was used at 50% dose when given in combination with ketamine but repeated dose was required in 66.67% of cases.

Table 4: Distribution of Patients undergoing General Anesthesia with respect to Maintenance Agent

Agent	Dose N (%)	Number of Patients	% of patients (n=84)
Halothane	<1%: 28 (70) 1%: 12 (30)	40	47.62
Isoflurane	<1%: 2 (5.71) 1%: 33 (94.29)	35	41.67
Sevoflurane	<1%: 1 (16.67) 1%: 1 (16.67) >1%: 4 (66.67)	6	7.14
No Inhalational Maintenance	NA	3	3.57

All maintenance agent were given via inhalational route at continuous flow with no uneventful episode and with no requirement of correction therapy.

Halothane was used for maintenance of anesthesia in 47.92% of patients followed by isoflurane (41.67%). Halothane was mostly used at <1% whereas isoflurane and sevoflurane were used at >1%.

Table 5: Distribution of Patients undergoing General Anesthesia with respect to Muscle Relaxants & Reversal Agents

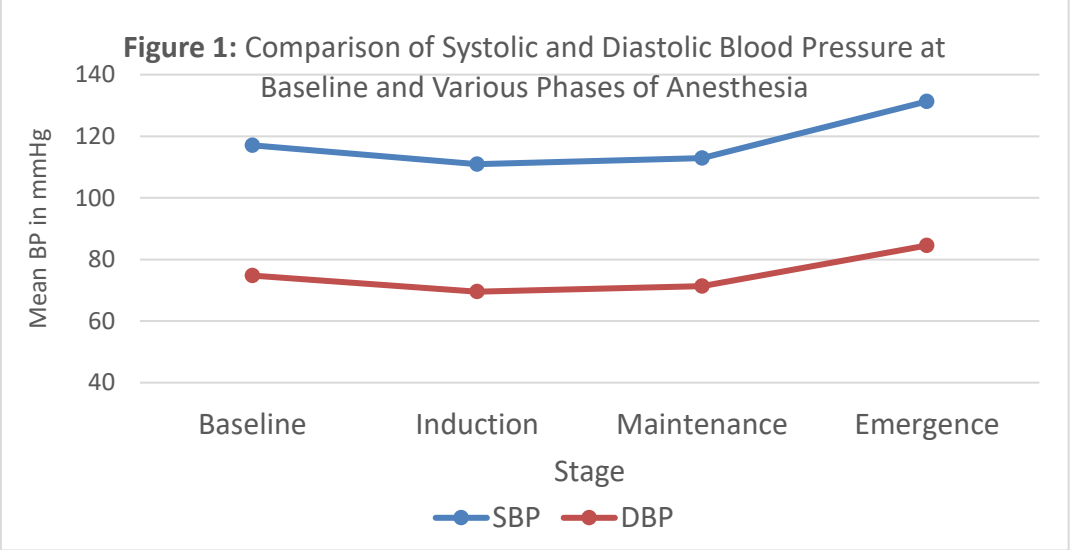
Agent		Dose (mg) mean ± SD	Number of Patients	% of patients (n=84)
Muscle Relaxants	Vecuronium	8.75 ± 2.20	77	91.67
	Atracurium	13.00 ± 8.38	4	4.76
	No relaxant	_	3	3.57
Reversal Agent	Myopyrolate	5.30 ± 1.19	63	75.00
	No reversal agent	_	21	25.00

All muscle relaxants were given via intravenous route. More than 95% of patients required skeletal muscle relaxant whereas more than 90% were given vecuronium. Reversal agents were required in 75% of cases.

Table 6: Distribution of Patients undergoing General Anesthesia with respect to Outcome

Outcome		Number of Patients	% of patients (n=84)
Level of Sedation as per Modified Ramsay Sedation Scale	1	11	13.10
	2	56	66.67
	3	17	20.24
Smoothness of Recovery as per Modified Aldrete Score	9	63	75.00
	10	21	25.00

Most of the patients (66.67) were at level 2 of sedation as per Modified Ramsay Sedation Scale. 75% of patients had Modified Aldrete Score of 9 while 25% had 10 score.



There was fall in heart rate, SBP & DBP after induction of anesthesia and these hemodynamic parameters increased significantly above baseline at stage of emergence.

DISCUSSION

In this observational and prospective study, 84 patients undergoing surgery under general anesthesia with any ASA physical status were surveyed. Their mean age was 34.99 ± 18.58 and most of the patients were of age group of 21-40 years (42.86%). There was slight male preponderance in our study population.

A retrospective study carried out in 2019 by Gajjala R, et al. found that adults in the 25–39 age range underwent the most procedures (49%) of any age group. [13] According to a 2017 study by Santos ML et al., 55.9% of the patients in the 18–59-year-old age group were comparable. [14]

An increasing amount of data points to the possibility that a patient's sexual orientation influences their reaction to general anesthesia on its own. [15,16]

Most of the cases were of laparoscopic cholecystectomy (23.81%) and tympanoplasty (21.43%). Subsequently, most of cases were related to surgery department (53.57%) followed by ENT (30.95%). According to Shah R et al., there were several surgical procedures estimated in

their study. The top three procedures that were performed frequently were laparoscopic appendectomy (31.0%), laparoscopic cholecystectomy (30.3%), and tympanoplasty of left ear (10.3%). [17]

It is especially important to preoxygenate before anesthesia if mask breathing becomes too difficult to manage. These situations occur in patients who are at risk of rapidly desaturating, such as those who are obese, pregnant, febrile, or have pulmonary diseases; in patients whose abdomen is assumed to be fully contracted; in situations where mask ventilation issues are anticipated; in situations where, tracheal intubation may take longer than expected; and in situations where specialized intubation techniques—such as the insertion of a double lumen tube—are required to manage the patient's airways. All patients are advised to get preoxygenation prior to the induction of general anesthesia because unanticipated tracheal intubation complications are somewhat prevalent. [18]

Most common dose for glycopyrrolate was 0.2 mg, 4 mg for ondansetron, 2 mg for midazolam, 100 micrograms for fentanyl and 75 mg for succinylcholine. According to Shah R et al., 215 (53.8%) of the 400 patients had various major procedures performed on them. Midazolam 2 mg, Pethidine 25 mg, and 0.2 mg glycopyrrolate in 352 (88%), ondansetron in 276 (69%) and others 58 (14.5%) were administered as preanesthetic agents to all patients, with the exception of children (1 mg). [19]

The FDA's approval of 5-HT3 receptor antagonists has significantly altered the way that post-operative nausea and vomiting are prevented.[19] Pre-anesthetic medications are typically administered to facilitate surgery, lower the risk of problems following surgery, and prevent the unfavorable effects of general anesthesia. Pre-anesthetic drugs include benzodiazepines, opioid analgesics, anticholinergic drugs, antiemetics, pentazocine, and medicines that reduce stomach acidity.[20]

Propofol was most commonly used inducing agent used in more than 95% cases. Propofol was used at 50% dose when given in combination with ketamine but repeated dose was required in 66.67% of cases. Collins SJ et al. found in their study that, in comparison to isoflurane, propofol was found to provide adequate anesthesia, favorable recovery characteristics, and a low rate of post-operative nausea and vomiting in previous research.[21] In the study of Gomathi G et al., patients who underwent laparoscopic cholecystectomy tolerated the propofol infusion well enough to maintain anesthesia during induction. [5]

Halothane was used for maintenance of anesthesia in 47.92% of patients followed by isoflurane (41.67%). Halothane was mostly used at 1%.

Patients were induced and intubated in the Kangralkar G et al. trial using increasing doses of sevoflurane (1%–7%) and halothane (0.5–5%) in a 50% nitrous oxide and 50% O2 mixture. Vital signs were recorded, along with the duration of the induction and intubation, the recovery features, and the recovery and discharge times. The induction and intubation times for sevoflurane and halothane differed statistically significantly, showing that sevoflurane had a quicker induction and a shorter intubation time than halothane.[22]

There was fall in heart rate, SBP & DBP after induction of anesthesia but HR and blood pressure increased significantly above baseline at stage of emergence. The equilibrium between sympathetic and para- sympathetic activity may be responsible for the various responses exhibited by the agents. When coupled with nitrous oxide, sevoflurane is shown to boost both parasympathetic and sympathetic activity, while isoflurane solely enhances sympathetic activity. [23]

CONCLUSION

Laparoscopic cholecystectomy and tympanoplasty was commonest surgeries performed in our study. Most of the patients received 100% O_2, anticholinergics, anti-emetic agents and sedatives before induction of anesthesia. Propofol was most commonly used induction agent whereas halothane was most common maintenance agent. Most of the patients received skeletal muscle relaxants which was reversed by neostigmine. There was fall in heart rate and blood pressure after induction of anesthesia but they increased significantly above baseline at stage of emergence.

The study results strongly suggest suggests use of cheaper and cost-effective drugs. Thus, there is need for pharmacoeconomic analysis combined by pharmacovigilance activities to promote availability of newer drugs with better safety and efficacy.

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