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ORIGINAL RESEARCH article

Assessment of knowledge and attitude of pharmacists toward the side effects of anesthetics in patients with hypertension: a cross-sectional study

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Abstract: Pharmacists are expected to play major roles as members of diverse perioperative care teams besides implementing medication safety standards, pharmacist's roles include optimizing drug therapy and other clinical interventions. Yet, developing general perioperative management as another crucial role operation room, pharmacists play and incorporating it into pharmaceutical education would be important. Enriching perioperative care provided by pharmacists can contribute toward improving the clinical competence of these professionals. Presently, there are no pharmacists in Zawia who participate in perioperative care. The objective of this study was to assess the pharmacist's knowledge of general anesthesia and drugs used to anesthetize patients who suffer from hypertension. A cross-sectional study was conducted in Zawia City, Tripoli in 2023. A self-designed questionnaire was distributed to 100 pharmacists. The study found that more than half of the pharmacists have humble knowledge about the drugs used in anesthesia, the findings indicated weakness in their information about drugs used to manage hypertension in surgery, and 36.0% know that sodium nitroprusside is used to control blood pressure during the operation. In conclusion, this study reported that some of the study's pharmacist participants had weak points that contributed to a high percentage of incorrect knowledge. These weak points may be attributable to poor educational preparation or a lack of training before the pharmacists began working in hospitals.

Introduction

Pharmacist plays a key role in facilitating safe and consistent medication management during rapid sequence induction and intubation. Pharmacists can play a fundamental role in adverse drug reactions (ADRs) monitoring and reporting, although the factors that affect underreporting among these professionals are unknown [1]. Underreporting could occur due to several reasons as lack of awareness, lack of effective pharmacovigilance programs, failure on the part of the healthcare professionals to report an adverse event, or failure to recognize the previous unknown adverse event. Pharmacists as drug experts are expected to know about the safety-related aspects of drugs, and report ADRs to health authorities. However, several obstacles prevented the complete implementation of clinical pharmacy services in developing nations. Several obstacles

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included the inability to maintain the service due to a lack of trained personnel, inadequate service promotions, and the fact that doctors and nurses had little experience working with pharmacists and had a hazy understanding of their roles, which made it harder for them to cooperate, the poor quality of drug information services, the lack of dedication and confidence among the pharmacists, and conflicts of interest resulting from the lack of clarity regarding the scope of practice [2]. Patients with hypertension are more susceptible to blood pressure fluctuations as a result of anesthetic drugs, vasopressors, and vasodilators, in response to anesthetic agents, which increases the hazards of anesthesia. These changes may result in myocardial and cerebral ischemia. To induce anesthesia, anesthetics and muscle relaxants are often given in substantial amounts over a brief period. These drugs have varying hemodynamic properties. Both laryngoscopy and endotracheal intubation cause considerable sympathetic stimulation, which can increase blood pressure and heart rate [3]. After that, initiating positive pressure ventilation reduces venous return and may result in a patient's blood pressure dropping.

Sprague described a mortality of 30.0% in patients with hypertension undergoing surgery, and several later reports also emphasized the high risk of anesthesia and surgery [4]. Barbiturates cause dose-related myocardial depression and decrease cardiac output and blood pressure [5]. Whereas benzodiazepines are used more frequently as premedication to provide sedation and amnesia, and occasionally as a component of inducing agents. When administered alone in small doses, this group of drugs causes minimal changes in myocardial contractility, heart rate and blood pressure [6]. Using them as strong sedatives and amnesic minimizes the blood pressure rise. When benzodiazepines are combined with barbiturates, they can cause hypotension and myocardial depression [7]. New potent opioids such as fentanyl and sufentanil do not depress the myocardium and cause minimal changes in blood pressure. Large doses of opioids suppress the release of catecholamine in response to sympathetic stimulation. Large doses of opioids do not produce prolonged postoperative respiratory depression that requires artificial ventilation. Large concentrations of inhalational agents cause hypotension and liability of blood pressure. They do not suppress sympathetic responses (hypertension and tachycardia) to stimulation or endotracheal intubation. These agents can be used in low concentrations during surgery and are effective in lowering high blood pressure and decreasing myocardial oxygen consumption. Muscle relaxants decrease muscle tone, reduce venous return, and can cause a drop in blood pressure. Preoperative ganglion blockers potentiate the effects of non-depolarizing muscle relaxants [4]. Various muscle relaxants have different effects on the heart rate and blood pressure. Pancuronium increases heart rate and blood pressure, and d-tubocurarine increases the heart rate and reduces blood pressure. Relaxants such as vecuronium and atracurium alone have minimum cardiovascular effects. However, large doses of atracurium cause histamine release [8]. It is clear from this summary of the hemodynamic effects of the drugs used in anesthesia that there is no ideal agent that stabilizes hemodynamics or at least does not interfere with patient hemodynamics and interact with other drugs [9]. Large doses of opioids together with appropriate muscle relaxants can be the top combination to lessen hemodynamic changes in hypertensive patients [10].

To control blood pressure during operation an agent called nitroprusside is used, it’s a peripheral vasodilator and it is the most used drug for the control of hypertensive crises. It is a peripheral vascular dilator that acts on the smooth muscles of both veins and arteries. It produces a drop in blood pressure within seconds; however, continuous monitoring is necessary. It is usually administered by a continuous infusion pump with the doses adjusted according to the response of the blood pressure. Computerized controllers of blood pressure have been developed to administer nitroprusside automatically. Nitroglycerin is not as potent an arteriolar as nitroprusside, it is a more potent vasodilator. It is a rapid-acting vasodilator that produces its effect within a few seconds. Usually, high concentrations of nitroglycerin are required to lower the blood pressure. It is the preferred vasodilator in the presence of myocardial ischemia because of its specific vasodilator effect. Labetalol is α- and β-adrenergic blocking agent. It lowers systemic vascular resistance as well as slows the

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heart rate with minimum changes in the cardiac output. In patients with coronary artery disease, it has the advantage of not causing tachycardia or selective redistribution of coronary blood flow, and it decreases myocardial oxygen consumption. During intravenous use of labetalol, the β-blocking activity dominates the α-blocking activity, and it can reduce the cardiac output. These two groups can be combined to get a significant reduction in SVR by the peripheral vasodilators while preventing or minimizing the reflex tachycardia by the beta-blockers. This combination allows the use of smaller doses of β-blockers to minimize their effect on myocardial contractility. Such combinations are being used successfully in hypotensive anesthesia techniques. After immediate blood pressure control is achieved, continuous IV infusion should be discontinued gradually while long-term antihypertensive treatment is initiated [4]. This study aimed to assess the knowledge of pharmacists working in hospitals about the anesthetics and their side effects in reducing the side effects of these drugs on hypertensive patients.

Materials and methods

This cross-sectional offline survey is conducted in Zwia City to obtain exact and reliable data. The self-designed questionnaire included structured questions to identify the knowledge of the pharmacists about anesthetic drugs and their side effects in hypertensive patients. Ethical approval has been obtained from the University of Zawia (43-2023) with oral agreement from all the participants.

The study consists of 100 Libyan pharmacists working in public or private hospitals and includes 24 questions divided into four parts. The first section is demographic data (five questions), the second section is general information about general anesthesia and diseases that are affected by it (five questions), and the third section is hypertension and its, relationship to anesthesia (seven questions).

Statistical analysis: Data presented as frequency and percentage. The Chi-square test was used to analyze the data and the correlation between the knowledge of the pharmacist about general anesthesia and hypertension was determined.

Results

To evaluate the responses of the study sample, data has been used to include frequency and percentage. **Table 1** shows that 20.0% of the sample study were males, while 80.0% of the sample study were females. Most of the participants (n=55, 55.0%) with the range of 20-30 years old, then with 31-40 years old with 36.0%. Pharmacists with Bachelor of Pharmacy are found to be 65.0%, and high diploma 05.0%. Most of the participants have experienced between one and five years (35.0%), while more than 10 years' experience 27.0%.

Table 2 shows that 39.0% of the sample study say that general anesthesia is loss of sensation, 19.0% of the sample study say that general anesthesia is an outing to sleep, while 22.0% of the sample study say that general anesthesia is loss of responses, and 20.0% of the sample study do not know what general anesthesia is. The Chi-square test revealed 10.640 ($p<0.05$) which gives a significant difference between participants in terms of general anesthesia. It can be seen that the highest percentage of general anesthesia is for loss of sensation.

Figure 1 shows that 13.0% of the participants said just one drug should be used to induce anesthesia, while 79.0% of the participants answered that more than one drug should be used to induce anesthesia, and 08.0% did not know how many drugs should be used to induce anesthesia. The Chi-square test revealed 94.220 ($p<0.001$) which means a high significant difference between the participants in terms of drugs that should be used to induce anesthesia. It can be seen that the highest percentage of drugs that should be used to induce anesthesia is more than one drug.

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Table 1: Distribution of the participants

Data	Frequency	%
Gender		
Male	20	**20**
Female	80	**80**
Age		
20-30	55	**55**
31-40	36	**36**
41-50	06	**06**
> 50	03	**03**
Educational level		
Bachelor of Pharmacy	65	**65**
Master of Pharmacy	06	**06**
Pharm. D	12	**12**
Diploma of Pharmacy	05	**05**
Others	12	**12**
Years of experience		
One year or less	19	**19**
One to five years	35	**35**
Five to ten years	27	**27**
More than ten years	19	**19**
Workplace		
Governmental hospital	67	**67**
Private hospital	33	**33**

Table 2: Knowledge of general anesthesia

Signs of anesthesia	n	%	Chi square	P value
Loss of sensation	39	39.0	10.64	0.014
Putting to sleep	19	19.0		
Loss of responses	22	22.0		
I do not know	20	20.0		
Total	**100**	**100**		

Figure 2 shows that 07.0% of the sample study say that route of administration of general anesthesia is inhaled gas, 03.0% of the sample study say that route of administration of general anesthesia is IV, while 84.0% of the sample study say that route of administration of general anesthesia is inhaled gas and IV, 02.0% of the participants say that route of administration of general anesthesia is oral pills and inhaled gas, and 04.0% of the participants do not know what is route of administration of general anesthesia is used?. The Chi-square test revealed 256.700 ($p<0.001$) which means a highly significant difference between sample studies in terms of the route of administration of general anesthesia. It can be seen that the highest percentage of using the route of administration of general anesthesia is inhaled gas and IV.

Figure 3 shows that 75.0% of the participants think that co-existing diseases affect the anesthesia, while 04.0% of the participants think that co-existing diseases do not affect the anesthesia, and 21.0% of the participants do not know. The Chi-square test revealed 82.460 ($p<0.001$) which means there is a highly significant difference between the participants in terms of do co-existing diseases affect the anesthesia. It can be seen that the highest percentage is that co-existing diseases affect the anesthesia is inhaled gas and IV.

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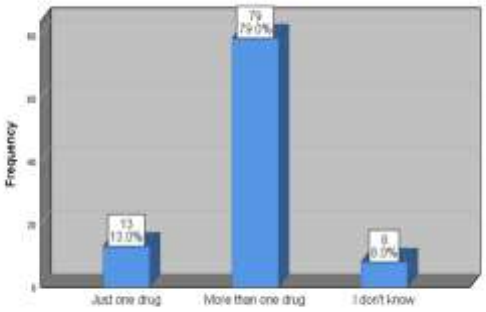

Figure 1: Knowledge about drugs used to induce anesthesia

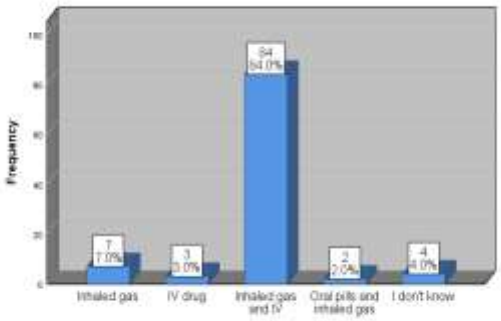

Figure 2: Knowledge about the route of administration of general anesthesia

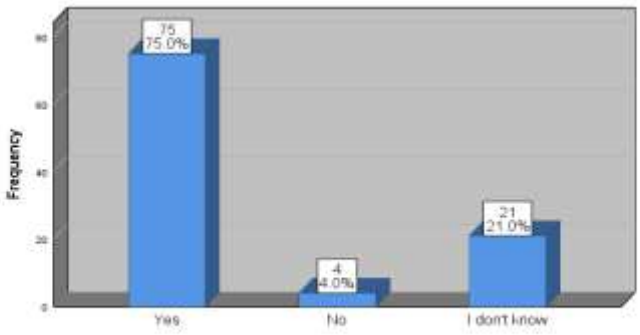

Figure 3: Participants' answers if co-existing diseases affect the anesthesia

Table 3 shows that 35.2% of the respondents think that cardiac diseases may affect the anesthesia, 11.4% of the respondents think that diabetes mellitus might affect the anesthesia, 19.3% of the respondents think that high blood pressure may affect the anesthesia, and 34.1% of the responses do not know that.

Table 3: Diseases assumed by participants that might be affected by general anesthesia

Diseases	Frequency	%
Cardiac disease	31	35.2
Diabetes mellitus	10	11.4
High blood pressure	17	19.3
Asthma	30	34.1
Total	**88**	**100**

Table 4 shows that 38.0% of the participants think that if the patient has hypertension, he/she should take their medicine before surgery, 07.0% of the participants think that if the patient has hypertension, he/she should take their medicine after surgery, while 50.0% of the participants think that if the patient has hypertension, he/she should take their medicine depends on the type of drug, and 05.0% of the participants do not know. The Chi-square test revealed 60.720 ($p<0.001$) which means the high significant difference between the participants in terms of patient have hypertension, he/she should take their medicine. It can be seen that the highest percentage of patient has hypertension, they should take their medicine depending on the type of drug.

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Table 4: Knowledge about the time at which hypertensive patient should take their medicine

State	n	%	Chi square	*P*
Before surgery	38	38.0	60.72	0.00
After surgery	7.0	7.0		
Depends on of drug type	50	50.0		
I don't know	5.0	5.0		
Total	**100**	**100**		

Figure 4 shows that 61.0% of the participants think that one of the most common side effects that might happen for hypertension patients during surgery is an increase in blood pressure, 03.0% of the participants think that one of the most common side effects that might happen for hypertension patients during surgery is malignant hyperthermia, while 18.0% of the participants think that one of the most common side effects that might happen for hypertension patients during surgery is lung collapse, and 18.0% of the participants do not know. The Chi-square test revealed 75.120 ($p<0.001$) which means a high statistically significant difference between sample studies in terms of one of the most common side effects that might happen for patients with hypertension during surgery. It can be seen that the highest percentage of one of the most common side effects that might happen for patients with hypertension during surgery is an increase in blood pressure.

Figure 5 shows that 36.0% of the participants think that if the patient has hypertension, the drug should be used to control blood pressure during surgery is sodium nitroprusside, 08.0% of the participants think that the drug should be used to control blood pressure during surgery is clevidipine, while 39.0% of participants think that if the patient has hypertension, the drug should be used to control blood pressure during surgery is furosemide, and 17.0% of the sample study do not know. The Chi-square test revealed 26.80 ($p<0.001$) which means a significant difference between participants in terms of patient has hypertension, and what drug should be used to control blood pressure during surgery. It can be seen that the highest percentage of patient has hypertension, what drugs should be used to control blood pressure during surgery are furosemide and sodium nitroprusside.

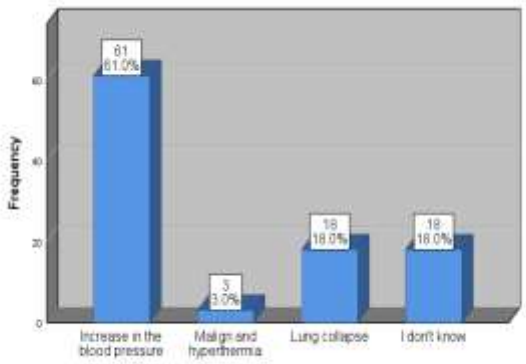

Figure 4: Knowledge about side effects that might happen for hypertensive patients during surgery

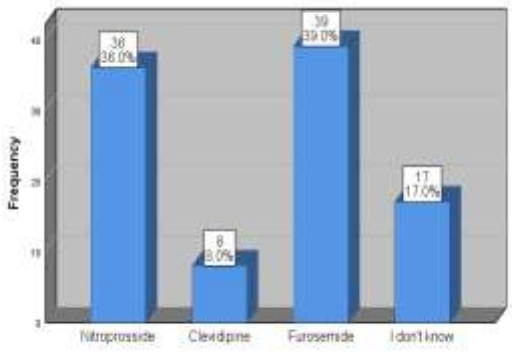

Figure 5: Knowledge about what drug should be used to control blood pressure during surgery

Further, data shows that 80.0% of the responses say that for hypertension patients, the drug used in their hospital to anesthetize is propofol, while 20.0% of the responses say that for hypertension patients, the drug used in their hospital to anesthetize is sodium thiopental.

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Figure 5 shows that 23.0% of the participants agree that there is a high risk of operating surgery for patients with elevated blood pressure and that surgery should be canceled, 04.0% of the participants disagree that there is a high risk of operating surgery for patients with elevated blood pressure and surgery should be canceled, while 53.0% of the participants say that there is a high risk of operating surgery for patients with elevated blood pressure and surgery should be cancelled depends on the type of surgery, and 20.0% of the sample study do not know. The Chi-square test revealed 50.160 ($p<0.001$) which means a highly significant difference between the participants in terms of there being a high risk of operating surgery for patients with elevated blood pressure and surgery should be canceled. It can be seen that the highest percentage agree that there are high risks of operating surgery for patients with elevated blood pressure and that surgery should be canceled.

Figure 6 shows that 22.0% of the participants think that hypoxia causes that result in increase in blood pressure in patients with hypertension during surgery, 20.0% of the participants think that anesthetic drugs cause that result in increase in blood pressure in hypertensive patients during surgery, while 34.0% of the participants think that not taking their medicine before surgery causes that result in increase in blood pressure in hypertensive patients during surgery, and 24.0% of the participants do not know. The Chi-square test revealed 4.640 ($p=0.200$) which means no significant difference between participants in terms of what causes that result in an increase in blood pressure in hypertensive patients during surgery.

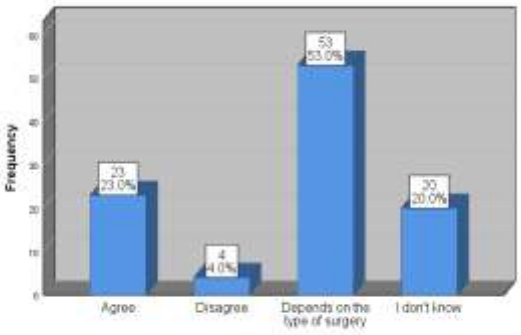

Figure 5: Opinion in case of patient with hypertension and needs surgery, is the surgery should be canceled

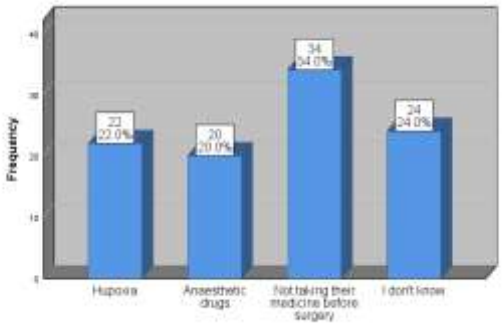

Figure 6: Knowledge about the causes in increase in blood pressure during surgery

Discussion

In this study, we surveyed 100 Libyan pharmacists on their understanding of anesthesia and the effects of anesthetic drugs on Libyan patients who had hypertension. These pharmacists are 80.0% female and 20.0% male with an age average of 20 to 50 years, 67.0% of them in public hospitals and 33.0% in private hospitals, have a Bachelor's degree in Pharmacy on average and at least a diploma. Their experience ranges from a few months to several years. General anesthesia is a controlled state of unconsciousness accompanied by a partial or complete loss of protective reflexes [11]. According to the current study, 39.0% of pharmacists define general anesthesia as a loss of sensation, 22% as a loss of responses, and 19.0% as putting the patient to sleep. To induce and sustain general anesthesia, a variety of IV and inhalational medicines are available. These drugs are frequently taken in combination [12]. In line with this current study, 84.0% of the pharmacists recommended using IV and inhalation routes to administer these medications. Only 13.0% of the pharmacists believed that only one anesthetic agent is necessary, while 79.0% said that multiple agents are necessary when we asked them whether the co-existing diseases affect the anesthesia or not, 75.0% of them said yes where and 04.0% said that the disease does not affect the anesthesia.

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Additionally, patients require a preoperative evaluation to identify any illnesses, which can affect the management procedure of anesthesia. Consideration should be taken to reduce morbidity and mortality of perioperative surgical and anesthetic procedures, and to return the patient to desirable functioning as quickly as possible [13]. The respondents' replies were different when asked what ailments the anesthetic medications would affect: Heart disease was noted by 35.0%, asthma by 34.0%, hypertension by 19.0%, and diabetes mellitus by 11.0%. In the current survey, we specifically tested pharmacists' knowledge of hypertension to see if they were aware of the condition, and its effects on anesthesia, and whether there was a particular medication used to anesthetize patients with this condition. Although there are several ways to manage hypertension, a clinical anesthesia physician and clinical pharmacists should be knowledgeable about the most often used hypertensive medicines. The morning before the operation, patients should continue taking CCBs, and -Blocking medications, -2 agonists, and other medications for sedation or general anaesthesia. With a missed dosage of - and/or -blocking drugs and the -2 agonists, rebound hypertension is a particular worry. Due to the possibility of experiencing refractory hypotension during induction, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and direct renin inhibitors may be stopped before undergoing general anesthesia. The cornerstone of anesthetic management has always been to keep blood pressure within physiologic ranges for a specific patient based on preoperative readings. To avoid serious hypotension, it's crucial to avoid anesthetic problems [14]. During the surgery, 39.0% of them answered that furosemide which is a diuretic is used to control the increase in blood pressure, while nitroprusside is the most used agent because it has an immediate onset of action and duration of effect of two minutes. 36.0% answered with nitroprusside which reflects a weakness in the knowledge about an important drug that saved the lives of many patients this weakness might be raised from the isolating the pharmacist from the operation room [4].

When we asked the pharmacist if the operation should be canceled if the patient had a marked increase in blood pressure, 53.0% answered that it depends on the type of surgery 23.0% agreed that it should be canceled but studies showed that it is normal to have elevated blood pressure before surgery especially if the patient was stressed this phenomenon is called preoperative blood pressure which we asked about it, 90.0% of the pharmacist agreed that stress may cause an elevation in blood pressure [15]. However, the most important thing is blood pressure should be mild to moderate and should be controlled if not, the surgery should be canceled if possible but if necessary special protocols are applied for safe surgery licensed [16, 17], and if the patient is already hypertensive and taking medication, 38.0% of the pharmacists think that the patient should take their medicine until the morning of the surgery and 50.0% answered that it depends on the type of medication. The last questions about hypertension discussed the primary factor that raises blood pressure during surgery the responses were very close and it is fair because the main reason that causes an increase in blood pressure is the activation of the sympathetic nervous system and this activation is caused by several reasons such as the anesthetic drugs or hypoxia [18], and about what the medication that is used for a hypertensive patient in the hospital where they work, the answers were different and mostly incorrect. It should be mentioned that one of the main issues we faced was the number of pharmacists who had good experience as clinical pharmacists, which is considered limited or negligible in Libyan hospitals. In contrast to many countries around the world, this field is one of the necessities in any hospital with operative units. This could be a reason to restrict the survey to a small size sample.

Conclusion: This study indicated that some of the pharmacists have weaknesses that resulted in a high number of inaccurate answers to various questions. These deficiencies may be a result of inadequate educational preparation or a lack of training before the pharmacist work in hospitals. Compared to public hospitals, private hospitals showed more signs of weakness, these results were accompanied by no pharmacist working clinically in the operating room.

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Author contribution: ERI conceived and designed the study, and ERI, MAG & MKE collected, analyzed, and interpreted of the data, WMA & MAI drafted the manuscript. All the authors approved the final version of the manuscript and agreed to be accountable for its contents
Conflict of interest: The authors declare the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Ethical issues: Including plagiarism, informed consent, data fabrication or falsification, and double publication or submission were completely observed by the authors.
Data availability statement: The raw data that support the findings of this article are available from the corresponding author upon reasonable request.

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