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PONV ATTITUDES, KNOWLEDGE AND ANTIEMETIC PRESCRIBING PRACTICES AMONGST SURGEONS IN A PAEDIATRIC HOSPITAL

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Abstract

Background: Postoperative nausea and vomiting (PONV) is a problem in pediatric post-surgical patients. The incidence in high risk patients can be as high as 80% resulting in delayed discharge, decreased parental satisfaction and increased cost for the hospital and patient. It is important to assess the attitudes, knowledge and current practice of doctors in pediatric surgery departments in their management of PONV and improve overall postoperative experience for patients.

Methods: A peer validated questionnaire was distributed to all the doctors working in pediatric surgery departments in a local pediatric hospital to assess surgical attitudes toward PONV. The questionnaire sought to evaluate three aspects – their attitudes toward PONV, their knowledge of PONV and their anti-emetic prescribing practices. The questionnaires were collected by drop-box. Data was entered using Epidata and imported into Stata 12.0 and Fischer's exact was used for analysis of data.

Results: 109 surveys were distributed. 85 were returned. 89.4% of respondents felt that PONV was an important problem but only 12.9% felt vomiting was more distressing than pain and only 3.5% felt that nausea was more distressing than pain. Subspecialty pediatric surgeons were more likely to correctly define PONV, identify PONV as an important problem and rank both nausea and vomiting as more distressing than pain compared with general pediatric surgeons (OR 2.6, 95%CI 1.0-6.8). Knowledge about PONV was poor. 15.3% of respondents were able to correctly identify combination anti-emetics as the gold standard for PONV treatment. 50.6% correctly identified more than three risk factors for PONV and 34.1% correctly identified three or more barriers to effective treatment of PONV. Working experience did not influence the correct identification of risk factors for PONV ($p=0.692$) but there was a trend toward older doctors being better able to identify PONV risk factors correctly ($p=0.076$). Respondents who displayed a positive attitude toward PONV were more likely to feel that PONV occurred frequently (OR 8.5, 95%CI 1.8-39.6), and

to correctly prescribe a different anti-emetic if their patients vomited recurrently (OR 6.7, 95%CI 2.2-16.6). Those who did not feel that PONV occurred frequently were less likely to feel that patients had not received intraoperative prophylaxis (OR 0.13, 95%CI 0.04-0.39), had returned to the ward without a prescription (OR 0.2, 95%CI 0.1-0.6) and had failed to respond to a single dose of antiemetic (OR 0.2, 95%CI 0.1-0.6). Those who did not feel that PONV occurred frequently were also less likely to be able to identify more than three risk factors for PONV (OR 0.3, 95% CI 0.1-0.97). Those who felt that patients usually felt better after a single vomit and did not require anti-emetics were more unlikely to treat a child who had not received prophylaxis but had one episode of PONV on the ward (OR 3.4, 95% CI 1.2-10.0). However, other perceptions of PONV frequency, perceptions of single dose anti-emetic success and knowledge of anti-emetics were not found to influence doctors' decisions to treat PONV.

Conclusion: Doctors do not find PONV more distressing than pain. They lack knowledge about PONV and PONV practices. A more positive attitude toward PONV did not translate into better knowledge about PONV and did not influence prescribing practices. More can be done to improve knowledge about PONV and overcome the reluctance to treat PONV amongst doctors.

Keywords: PONV, pediatric post-surgical patients

1. BACKGROUND AND LITERATURE REVIEW

Many studies have shown that the incidence of PONV can be twice as high in children compared with adults (24-25,30). Postoperative nausea and vomiting (PONV) has been widely acknowledged to be a "big-little" problem particularly in the pediatric population (29,31). In certain groups of pediatric patients the incidence of PONV can be as high as 70-80% (7,19).

Impact of PONV

PONV has been ranked by adult patients as the most undesirable surgical outcome, even exceeding that of pain (12-13,26). It has been documented to decrease parental satisfaction; increase the use of resources like medical, nursing care and drugs; increase length of hospital and increase healthcare costs for both the patient and hospital (5,9,21,24,33-34,36,38).

PONV Management

The management of PONV is multimodal and involves both prophylactic as well as therapeutic aspects.

a) PONV Prophylaxis

The most important aspect of PONV prophylaxis is identifying children who are at high risk of PONV. There are many risk factors for PONV as summarized in the table below. Studies have shown that patients who have three or more risk factors are considered high risk (40).

Table 1: Summary of risk factors for PONV in the pediatric population (1,9,12,24,27,40)

Patient-related	
Age	Young age/ Adolescence
Patient history	Previous PONV
	Previous motion-sickness
Family history	Parent or sibling with history of PONV
Surgery-related	
Type of surgery	Strabismus, Tonsillectomy, Adenoidectomy
Duration of surgery	More than 30 minutes
Anesthesia-related	
Type of anesthesia	GA
Type of analgesia	Use of opioids
Method of induction	Inhalational anesthesia
Anesthetic agents used	Nitrous oxide

Risk factor identification is the most integral part of PONV management. Several centers have included PONV risk factor checklists as part of their preoperative assessments and have even attempted to use automated reminders to alert doctors to the checklist (24-25). Early preoperative identification of high risk patients can facilitate targeted changes in anesthetic techniques, facilitate administration of prophylactic anti-emetics and improve post-operative management thereby effectively reducing PONV in children (4,11). The correct combination of prophylactic anti-emetics has also been found to effectively reduce PONV with the intraoperative administration of a steroid antiemetic in combination with a serotonin receptor antagonist decreasing PONV rates by almost 30% (3,37). Other techniques such as minimizing anxiety pre-surgery, ensuring adequate IV fluid hydration during surgery, and using certain anesthetic and analgesic techniques such as regional anesthesia and total intravenous anesthesia with propofol have also been found to improve PONV rates significantly (2,7,23). Use of multimodal methods for analgesia and avoidance of opioid dominance has also been found to reduce PONV (17, 24).

b) PONV Treatment

PONV treatment has been found to be more efficacious with the use of different classes of anti-emetics that target different receptors, particularly for patient who suffer from recurrent episodes of PONV (4). Multiple drug therapies have been shown to not only be more effective than single drug therapy but also have fewer side effects due to the decreased dependence on increasing the dose of a single antiemetic (8,10,17).

Surgeons and PONV

Both patients and anesthesiologists agree that PONV is an important post-operative issue, particularly amongst pediatric patients (10,14,27,39). However, the attitudes of surgeons

toward the impact of PONV, their knowledge of PONV and anti-emetics as well as their anti-emetic prescribing practices and PONV ward management are not well established. In fact, PONV is still often under treated, with some studies showing disappointing rates of compliance with established guidelines (14,20,28). This is despite the active role that surgeons play in postoperative patient care.

2. AIMS OF STUDY

This study aimed to assess the attitudes of doctors toward PONV, the knowledge that they have about PONV and their current anti-emetic prescribing practices. The secondary aims were to examine if positive attitudes toward PONV translated to improved knowledge about PONV and correct anti-emetic prescribing practices among doctors.

3. METHODS

A thorough literature review using PubMed was conducted. Studies about methods of PONV prevention, best practice guidelines for the management of PONV and physician and patient attitudes towards PONV were reviewed. Approval from the hospital's Institutional Research Board was sought and granted.

A questionnaire was then designed examining three key aspects of PONV practice - **(a) attitudes toward PONV (b) knowledge of PONV and (c) anti-emetic prescribing practices**. Reference was taken from other PONV practice questionnaires (30,35). Attitudes toward PONV were examined by asking respondents how they defined PONV, how distressing they thought patients found nausea, vomiting and pain and how important they felt PONV was as a problem in children after surgery. Knowledge of PONV was assessed by asking respondents what they knew about anti-emetics, what the gold standard for PONV therapy was and what the risk factors for PONV were. Anti-emetic prescribing practices were evaluated with questions that asked about the doctors' perceptions of PONV practices and personal prescribing practices. Perceptions of PONV practices were elucidated by questions on doctors' perceptions of PONV frequency, PONV intraoperative prophylaxis, PONV post-operative prescriptions, perceived PONV prescribing barriers and perceived effectiveness of a single dose of anti-emetic. Personal prescribing practice was tested by questions based on three different scenarios – decision to treat patients with no prophylaxis who vomit, decision to treat patients with prophylaxis who vomit and decision to treat patients who vomit recurrently.

The questionnaire underwent a process of validation. Two anesthesiologists in the hospital reviewed the questionnaire to ensure adequate content. Five clinicians were then asked to take the questionnaire twice over a period of two weeks to ensure that the questionnaire had sufficient test-retest reliability. Their responses were consistent and similar each time they were asked to answer the questionnaire.

The questionnaire was distributed to the individual pigeonholes of all the doctors working in pediatric surgical departments in the hospital. An email explaining the purpose of the study and notifying them about the questionnaire was also sent out to all the surgical departments in the hospital.

To ensure anonymity, questionnaires were collected and returned via the respective department secretaries. Each department secretary was instructed to enclose the physical copies of collected questionnaires in brown unlabeled envelopes and return the envelopes through a drop-box. The collection of questionnaires occurred over a 2- week period.

After the questionnaires were collected, data from the questionnaires was entered using Epidata software. The results were then collated and imported into Stata 12.0 where statistical analyses were conducted. For further results analysis, respondents were categorized as having a good attitude toward PONV if they defined PONV correctly, felt that PONV was an important post-operative problem in children **and** ranked both nausea and vomiting as more distressing than pain. Respondents' knowledge was assessed based on the adequacy of their knowledge about PONV risk factors and PONV treatment. Based on the responses to the question about factors that influenced a doctor's decision to treat a child with PONV, respondents were categorized into those who were able to correctly identify more than three risk factors for PONV and those who were unable to do so. Respondents were also categorized based on their knowledge about gold standard therapy for PONV. Those who were able to correctly identify combination anti-emetics as the most effective treatment for PONV were differentiated from those who identified other options. Similarly based on the responses to the question on perceived barriers to PONV treatment, those who correctly identified three or more barriers were differentiated from those who were unable to identify more than three barriers. Each of the three scenario questions that tested personal prescribing practices had a correct answer and responses were tabulated according to the doctors' ability to respond correctly.

Having categorized and refined the responses for each of these questionnaire components, the doctors' attitudes, knowledge of risk factors, knowledge of gold standard therapy, perceptions of PONV practices and personal prescribing practices were analyzed together with years of working experience and surgical specialty using Fischer's Exact Test and multinomial regression.

4. RESULTS

Demographics

The questionnaires were distributed to all the doctors working in the hospital's pediatric surgical departments. 109 questionnaires were distributed in total. Of the 109 pre-intervention questionnaires that were distributed, 85 were returned. 43.5% of the respondents were doctors working in department of general pediatric surgery while 56.5% were from doctors working in other pediatric surgical subspecialties.

40% of the questionnaire replies came from practitioners with more than 10 years of experience while 35.3% had at least 5 years of experience. There was no association found between departments and years of experience ($p=0.573$).

Table 2: Demographics of Respondents

Survey Demographics		
Total number given out	109	
Total number returned	85	
Return Rate (%)	78.0	
Years of Experience	Number	%
Less than 5 years	21	24.7
5-10 years	30	35.3
More than 10 years	34	40.0
Departments		
General Surgery	37	43.5
Other Subspecialties	48	56.5
<i>Orthopedics</i>	12	14.1
<i>Plastic Surgery</i>	9	10.6
<i>Otolaryngology</i>	9	10.6
<i>Neurosurgery</i>	2	2.4
<i>Ophthalmology</i>	10	11.8
<i>Cardiothoracic Surgery</i>	6	7.0

Attitudes

There were five questions used to assess the attitudes of the doctors toward PONV. The doctors were asked to define PONV and to rate its perceived and relative importance.

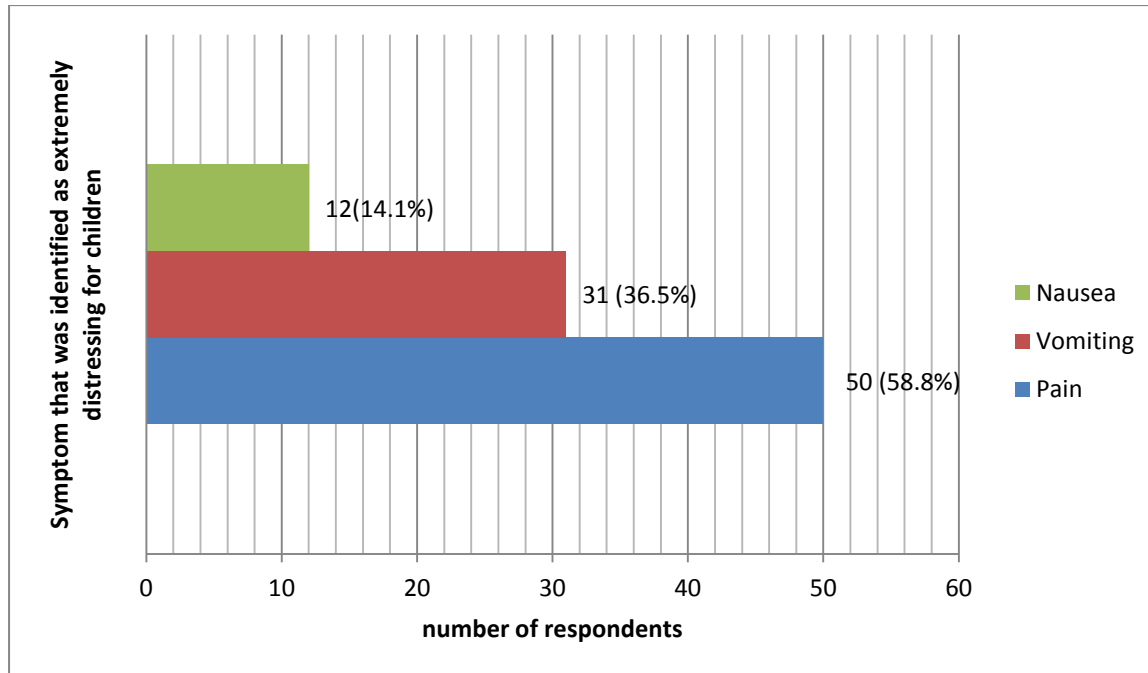
Regarding the definition of PONV, 11 (12.9%) felt that PONV was only applicable to patients in the recovery and 3 (3.5%) thought it was only associated with the use of PCA. Only 9 of the 85 respondents (10.6 %) correctly identified PONV as any episode of nausea and vomiting that occurs in the ward after surgery.

76 (89.4%) of respondents felt that PONV was an important problem. Out of the 85 respondents, 50 (58.8%) felt that pain was extremely distressing compared to 31 (36.5%) who felt that vomiting was extremely distressing and 12(14.1%) who felt that nausea was extremely distressing (Figure1). Only 11 (12.9%) respondents felt that vomiting was more distressing compared to pain and only 3 (3.5%) respondents felt that nausea was more distressing than pain.

Only 5 of the 9 respondents who correctly defined PONV identified PONV as an important problem and ranked both nausea and vomiting as more distressing than pain. Doctors working in subspecialty pediatric surgery departments displayed a more positive attitude toward PONV than those working in the general pediatric surgery department ($p=0.045$). They were 2.63 times more likely than doctors working in the general pediatric surgery department to correctly define PONV, identify PONV as an important problem and rank both nausea and vomiting as more distressing than pain (OR 2.6, 95%CI 1.0-6.8).

Those who displayed a positive attitude toward PONV were more likely to feel that PONV occurred frequently (OR 8.5, 95%CI 1.8-39.6) and more likely to correctly prescribe a different anti-emetic when patients vomited recurrently (OR=6.7, 95%CI 2.2-16.6). However, having a positive attitude toward PONV did not influence decision to treat a patient who vomited once on the ward with or without prophylaxis ($p=0.791$, $p=0.797$ respectively). Having a positive attitude toward PONV was not associated with an improved ability to correctly identify the gold standard for PONV therapy ($p= 0.358$) or to correctly identify more than 3 risk factors for PONV ($p=0.177$).

Figure 1: Respondents who identified vomiting, nausea or pain as extremely distressing for children¹

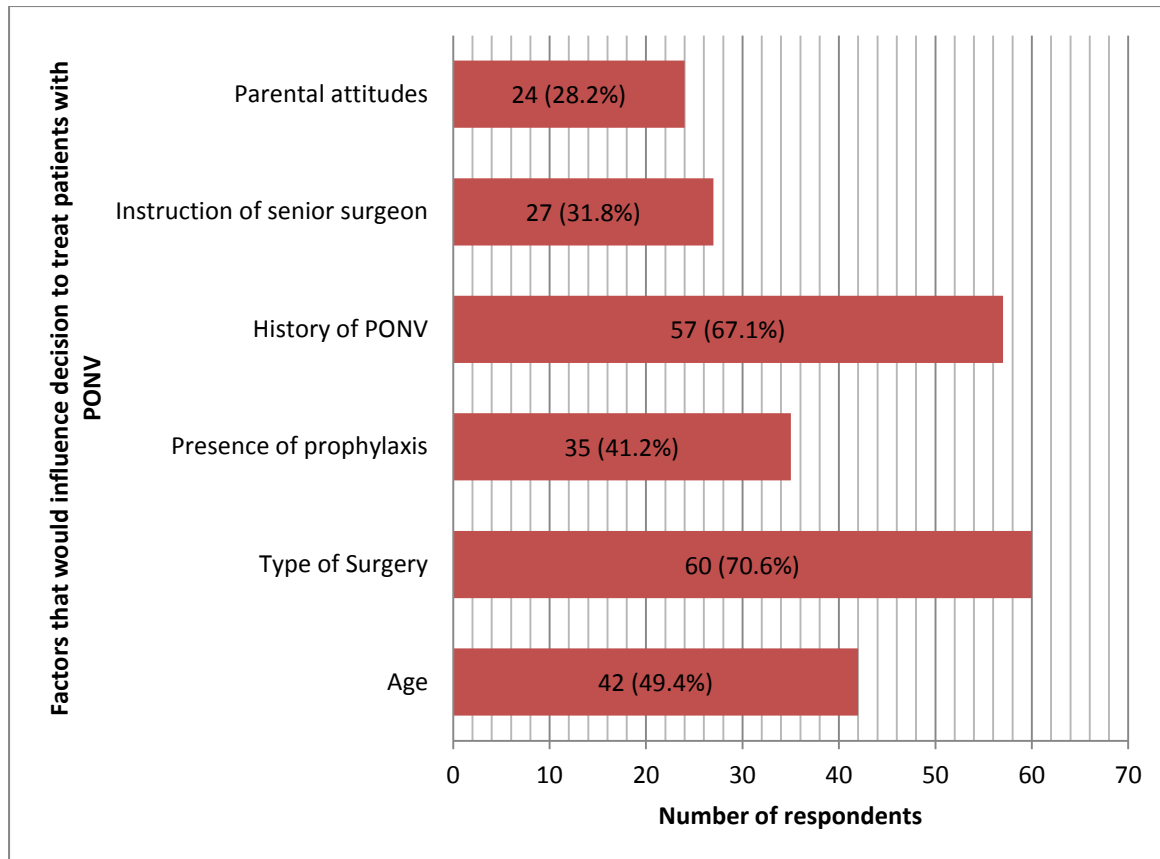


Knowledge

Most (54, 63.5%) respondents felt that they had some knowledge about anti-emetics while the remaining number (31, 36.5%) felt that their knowledge was very limited. Yet only 13 of the 85 respondents (%) were able to correctly identify combination anti-emetics as the gold standard for PONV treatment. The years of working experience that a doctor had did not influence the doctor's correct choice of anti-emetics ($p=0.692$).

Only slightly more than half (50.6%) correctly identified more than 3 risk factors for PONV. Most surgeons correctly identified PONV risk factors as type of surgery and prior history of PONV (Figure 2). However less than half of respondents identified age (49.4%) and intraoperative administration of prophylactic anti-emetics (41.2%) as risk factors for PONV. The years of working experience that a doctor had did not influence the correct identification of risk factors for PONV, although there was a trend for doctors who had worked longer to be more likely to correctly identify PONV risk factors ($p=0.076$).

¹ Respondents were asked to rate on a scale of 0-10 how distressing each of these individual symptoms – nausea, vomiting and pain were for children. Extremely distressing was any value more than or equal to 8.

Figure 2: Factors that would influence surgeons' decision to treat patients with PONV²

Most respondents (63, 74.1%) felt that children vomited frequently after surgery. 49 (57.7%) felt that patients often did not receive intraoperative antiemetic prophylaxis, while 51 (60%) felt that patients did not return to the wards after surgery with an antiemetic prescription. Compared to those who felt that children vomited frequently, those who felt that children did not vomit frequently postoperatively were less likely to feel that patients did not receive intraoperative prophylaxis (OR= 0.13, 95% CI 0.04-0.39). They were less likely to feel that patients returned to the ward without an antiemetic prescription (OR =0.2, 95%CI 0.1-0.6) and less likely to feel that a single dose of antiemetic was effective (OR=0.2, 95%CI 0.1-0.6) (Table 3). The majority of respondents (57, 67.1%) felt that most children recovered after a single vomit and did not need any anti-emetics, while 45 (54.1%) felt that most children responded to a single dose of rescue anti-emetic. Doctors from the general pediatric surgery department were more likely to feel that most children responded to a single dose of anti-emetic compared with other subspecialty pediatric surgeons (OR =3.3, 95%CI 1.3-8.2).

² More than one response was allowed.

Table 3: Perceptions of PONV frequency, intraoperative prophylaxis, postoperative antiemetic prescriptions and response to a single dose of antiemetic

	Perceived frequency of patients NOT having received intraoperative prophylaxis administration (OR= 0.13, 95% CI 0.04-0.39)		Perceived frequency of patients returning to ward WITHOUT antiemetic prescription (OR =0.2, 95%CI 0.1-0.6)		Perceived failure of single dose of antiemetic (OR=0.2, 95%CI 0.1-0.6)	
	Frequent	Infrequent	Frequent	Infrequent	Frequent	Infrequent
Respondents who perceived frequent PONV (%)	44 (69.8)	19 (30.2)	44 (69.8)	19 (30.2)	35 (44.4)	28 (55.6)
Number of respondents who did not perceive frequent PONV (%)	5 (22.7)	17 (77.3)	7 (31.8)	15 (68.2)	4 (81.8)	18 (18.2)

Those who did not feel that children vomited frequently after surgery were also less likely to have correctly identified more than 3 risk factors for PONV compared to those who felt that children vomited frequently after surgery (OR =0.3, 95%CI 0.1-0.97), However there was no difference in the knowledge of PONV gold standard therapy between these two groups. (OR=2.1, 95%CI 0.4- 10.4) (Table 4).

Table 4: Perception of PONV frequency and knowledge about PONV

	Knowledge of PONV risk factors (OR =0.3, 95%CI 0.1-0.97)		Knowledge of PONV treatment (OR=2.1, 95%CI 0.4- 10.4)	
	Unable to identify more than 3 risk factors	Able to identify more than 3 risk factors	Unable to identify gold standard	Able to identify gold standard
Respondents who perceived frequent PONV(%)	27 (42.9)	36 (57.1)	52 (82.5)	11 (17.5)
Respondents who did not perceive frequent PONV (%)	15 (68.2)	7 (31.8)	20 (90.9)	2 (9.1)

Those who felt that children often recovered after a single vomit were also more likely to choose not to prescribe anti-emetics when a child who had not received intraoperative prophylaxis suffered PONV (OR=3.4 95%CI 1.2-10.0) (Table 5). Those who felt that children vomited frequently after surgery were more likely to feel that children frequently failed to respond to a single dose of antiemetic (OR=0.2, 95%CI 0.1-0.6) (Table 3). Yet those who felt that children vomited more frequently after surgery and failed to respond to a single dose of antiemetic were not more likely to prescribe an antiemetic if a patient who had not received intraoperative prophylaxis suffered a single episode of PONV in the ward ($p=0.383$), and not more likely to know what to do with children who vomited recurrently ($p=0.593$) (Table 5).

Table 5: Perception of PONV frequency, perceived recovery after single vomit, perceived failure of single dose of anti-emetics and personal prescribing practices

Personal prescribing practices based on scenarios						
	Child has single episode of vomiting and did not receive intraoperative prophylaxis		Child has single episode of vomiting and received intraoperative prophylaxis		Child has recurrent episodes of vomiting	
	Decision NOT to treat with anti-emetic	Decision to treat with anti-emetic	Decision NOT to treat with different anti-emetic	Decision to treat with different anti-emetic	Decision NOT to treat with different anti-emetic	Decision to treat with different anti-emetic
	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)
Perceived recovery after single vomit with no need for anti-emetics						
	OR=3.4 95%CI 1.2-10.0		OR=0.7 95%CI 0.2-2.0		OR=1.4 95%CI 0.5-3.7	
Infrequent	49 (86.0)	8 (14.0)	41(71.9)	16(28.1)	41(71.9)	16(28.1)
Frequent	18 (64.3)	10(35.7)	22(78.6)	6(21.4)	18(64.3)	10(35.7)
Perceived frequency of PONV						
	OR= 0.3 95%CI 0.1-1.4		OR=0.8 95%CI 0.3-2.5		OR=0.6 95%CI 0.2-1.8	
Infrequent	20 (90.9)	2 (9.1)	17(77.3)	5(22.7)	17(77.3)	5 (22.7)
Frequent	47 (74.6)	16 (25.4)	46(73.0)	17(27.0)	42 (66.7)	21(33.3)
Perceived failure of single dose of antiemetic						
	OR=0.3 95%CI 0.3-2.6		OR=2.7 95%CI 1.0-7.3		OR=2.0 95%CI 0.8-5.1	
Infrequent	36 (78.3)	10 (21.7)	38(82.6)	8 (17.4)	35 (76.1)	11(23.9)
Frequent	31(79.5)	8 (20.5)	25(64.1)	14(35.9)	24(61.5)	15(38.5)

Prescribing Practices

Only 29 (34.1%) of respondents were able to correctly identify 3 or more barriers to effective treatment of PONV. The barriers that respondents most frequently identified as hindering effective treatment of PONV were the failure to prescribe anti-emetics to high-risk patients and the wait and see attitude of doctors and nurses.

Most respondents (67, 78.8%) stated that they would often prescribe a single dose of anti-emetic to patients after their first vomit. However 21 (24.7%) of the respondents said that if an antiemetic had already been given intra-operatively they would wait for the next dose to be due. 27 (31.8%) said they would wait and see. Only 22 (25.9%) said they would prescribe a different class of antiemetic.

In the case of persistent vomiting not responsive to a single dose of antiemetic, only 26 (30.6%) said that they would prescribe a different anti-emetic. Conversely, 23 (27.1%) said that they would opt to keep the patient fasted, 19 (22.4%) thought decreasing opioid dose would help, and 13(15.3%) said they would continue to wait and see.

5. DISCUSSION

PONV is one of the most commonly reported adverse effects of anesthesia with a baseline 10% risk for PONV described for patients with no known risk factors (6). Adult patients frequently list postoperative nausea and vomiting as their main perioperative complaint and this was ranked even higher than pain as one of the most undesirable clinical outcomes (22,26). Similar concerns are difficult to elicit in a pediatric population but it is of even more concern since children are often unable to vocalize their discomfort.

Yet, based on the results of our questionnaire, majority of the doctors working in pediatric surgical departments thought that pain was more distressing to patients than vomiting or nausea. The results from the questionnaire also displayed an alarming lack of knowledge amongst surgeons regarding PONV management. It was apparent that many doctors were not aware of certain evidence based practices such as early identification of high risk patients, intraoperative prophylaxis for high risk patients and combination anti-emetic therapy. 78.8% of doctors said that they would treat a patient who vomited for the first time and who had no prophylaxis. This was lower than the 67% of anesthesiologists who reported that they would treat a patient with an anti-emetic if no prophylaxis had been given in a study conducted by Macario et al (30).A worryingly large percentage of the doctors who responded to our questionnaire (84.7%) did not know what the gold standard for treatment of PONV was. This was similar to Macario's study where less than 15% of the anesthesiologists surveyed said they would use combination anti-emetics. Most doctors did not know what to do if a patient who had already been prescribed prophylactic anti-emetics vomited on the ward or if a patient vomited recurrently on the ward.

Years of work experience did not have any influence on knowledge, although it was interesting to note that doctors working in subspecialty surgical departments were more likely than doctors

working in general pediatric surgery to find PONV distressing for patients. This can be attributed to the fact that several documented emetogenic surgeries are subspecialty surgeries e.g. strabismus surgery by the ophthalmologists and removal of tonsils and adenoids by the otolaryngologists (10,29,39). These subspecialty surgeons would therefore be more cognizant of PONV as a post-operative complication. This was consistent with the finding that doctors from the general pediatric surgery department were more likely to feel that most children responded to a single dose of anti-emetic compared with other subspecialty pediatric surgeons.

Most doctors identified the two biggest barriers to effective PONV treatment as the wait and see attitude of nurses and doctors and the failure to treat high-risk patients. Many also felt that postoperative vomiting was frequent, that patients frequently returned to the ward with no antiemetic prescriptions and frequently did not receive intraoperative prophylaxis. Yet there was still an alarming reluctance to treat PONV even amongst those with a positive attitude toward PONV. PONV appeared to be grossly undertreated with more than half of the doctors surveyed (69.4%) choosing not to treat recurrent vomiting. This was higher than previously reported figures of 40% non-compliance with treatment guidelines (38) and leaves much to be desired in terms of PONV management. It is apparent that PONV education is important to overcome this general reluctance.

Although doctors who identified PONV as a frequent post-operative problem also knew more about PONV e.g. risk factors of PONV, their prescribing practices were disappointingly no different from doctors who had less knowledge or who viewed PONV as infrequent. This misalignment in beliefs, knowledge and prescribing practices could be contributed to by the general prescribing practice of the hospital and is worthwhile exploring further in future.

This is the first study in Singapore that examines the attitudes toward PONV, knowledge about PONV and anti-emetic prescribing practices of doctors in Singapore. Only one previous article has been written by local authors and it only reviewed existing literature on PONV (28). In addition, unlike many studies that surveyed anesthesiologists, this questionnaire focused on the attitudes, knowledge and prescribing practices of doctors in pediatric surgical departments. In Singapore, the surgical team usually has the primary role in post-operative care while anesthesiologist follow-up is limited to patients on special types of post-operative pain treatments e.g. epidural analgesia or patient-controlled opioid analgesia. Given the high incidence of pediatric PONV and the important role of the surgical team in the management of post-operative pediatric patients, examining the PONV attitudes, knowledge and prescribing practices in this group of practitioners can help to target future interventions for PONV management.

This study had several limitations. Although there was a return rate of 78%, it was limited by its small sample size. Unfortunately pediatric surgical departments in Singapore are small. There are only two public hospitals in Singapore that undertake surgery on children. This study was conducted in the larger of the two hospitals and the questionnaire was distributed to all the doctors working in the surgical departments at this pediatric hospital. Inclusion of other pediatric surgery centers can be considered for future studies. More demographic data on gender of the doctors surveyed and details on their training e.g. local or overseas could also

have been collected to evaluate whether PONV attitudes, knowledge and practices were influenced by other factors besides specialty and experience.

To improve the practicability of the study results in clinical practice, it may be more useful to also review the attitudes and knowledge of PONV of other stakeholders such as nurses and parents. This would enable a multi-prong approach toward improving PONV management in hospitals. Surveying nurses would shed more light on ward practices making targeted intervention more effective, while surveying parents would more accurately align PONV treatment with PONV assessment as parents often act as the assessors of their children's discomfort.

As discussed in other studies, the benefit of appropriate antiemetic use can only be realized if there is clinical data from the healthcare facility in question and clinical practice guidelines can be contextualized to the local setting (18,41). Therefore, in addition to reviewing the attitude and knowledge of PONV of other stakeholders, it would be valuable to also undertake a separate study to examine the incidence of PONV, the rates of anti-emetic administration in response to PONV, the rates of anti-emetic prescription after surgery and the rates of intraoperative prophylactic anti-emetic administration (10, 21, 33, and 36). This would give us a more holistic view of the current PONV situation in the pediatric hospital and gives us a basis of comparison when assessing the efficacy of future interventions.

Variations in practice have been attributed to lack of knowledge about the efficacy of interventions, differences in medical training and education, differences in professional judgment and beliefs about side effect profiles and drug costs (35). Specifically for PONV, antiemetic prescribing practices have been shown to improve with education, audit of practices and the use of clinical algorithms (3,16). Hence, it can be seen that to promote changes in PONV prevention and management, education to improve attitudes, knowledge and prescribing practices is important.

In view of the lack of knowledge, unfamiliarity with evidence-based antiemetic prescribing practices and the generally blasé attitude displayed by the surgical doctors in this pediatric hospital, some interventions can be considered. PONV education should be extended to all doctors who manage post-surgical patients on the wards. This can be made available electronically, via lectures and tutorials or via hand-outs. To assess the efficacy of these educational methods, multiple choice question tests can be created. Other simple methods of PONV education can include an electronic pop-up reminder when surgeons are writing post-operative orders, or placing physical copies of PONV guidelines on the walls of the wards and toilets or in the doctors' rooms (24-25).

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