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Attitudes of Anesthesiology and Reanimation Specialists Towards Pediatric Anesthesia Outside of the Operating Room Practices: A Survey Analysis

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ABSTRACT

There is a growing demand for safe and effective sedation/anesthesia of pediatric patients outside the operating room.

This study was designed to investigate the practices and resources of pediatric anesthesia outside the operating room. A total of 219 anesthesiology and reanimation specialists (mean±SD age: 38.3±7.2 years, 50.7% female) voluntarily completed this online questionnaire survey. The questionnaire included items on demographic data, professional characteristics, type of hospital, and the characteristics of anesthesia applied outside the operating room.

Most respondents reported that they performed pediatric anesthesia outside the operating room frequently, ranging from a couple of days per week (47.2%) to every day (27.3%), mostly for MRI (87.7%), endoscopy (60.1%), pediatric angiography (58.9%) and biopsy (54.6%) procedures. Overall, 60.1% and 25.8% of the anesthetists stated that they use ASA criteria (inclusion of ASA I-II patients, 39.9%) and age criteria for candidacy, respectively. The professors were determined to be the group with the highest rates for the procedure (66.7%) on a daily basis, while state hospitals were associated with less frequent implementation of the procedure ($p<0.001$ for each).

In conclusion, this questionnaire-based survey revealed frequent and guideline-adherent application of pediatric anesthesia outside the operating room by anesthesiology and reanimation specialists. Together with the likelihood of professional training and hospital type influencing the frequency of the procedure and recovery strategies, these findings emphasize the need for improved practice regarding consideration of appropriate candidacy for ASA physical status and patient age as well as a uniform and standardized recovery practice among anesthesiology and reanimation specialists.

Key Words: Pediatric anesthesia outside the operating room; anesthesiology and reanimation specialists; adherence to guidelines; practices; resources

Introduction

In relation to financial pressures regarding the provision of more cost-effective and efficient healthcare, a variety of diagnostic and therapeutic procedures have become more commonly performed outside the operating room (1,2). In children, most of these procedures require sedation, analgesia or both to achieve the degree of co-operation or immobilization necessary to complete these procedures successfully (3). Hence, there is a growing demand for safe and effective sedation/anesthesia of pediatric patients for a multitude of surgical procedures outside the operating room (2,4-6).

Although specialists who are not anesthesiologists such as intensivists, emergency medicine physicians and hospitalists may also be involved in the provision of procedural sedation outside the operating room, the standards of care are set by the anesthesiology department and necessitates the involvement of an anesthesiologist either directly or indirectly (2,5,6).

Increased recognition of the importance of a multifaceted approach to pediatric sedation, the provision of focused and comprehensive training for all members of a procedural anesthesia team and utilization of pooled data on safety and outcomes after sedation are considered essential to create and maintain improved pediatric sedation services (6).

This questionnaire-based survey was therefore designed to investigate the practices and resources of anesthesiology specialists applying pediatric anesthesia outside the operating room.

Material and Methods

Study Population: The study included a total of 219 anesthesiology and reanimation specialists, comprising 50.7% females and 49.3% males with a

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Table 1. Demographic data and professional characteristics of the participants

Participant characteristics		
Age (years)	mean(SD)	38.3(7.2)
	median (min-max)	37 (25- 58)
Gender, n(%)		
Male		108(49.3)
Female		111(50.7)
Professional title, n(%)		
Specialist without academic position		142(64.9)
Resident		46(21.0)
Faculty member	Associate Professor	17(7.8)
	Professor	14(6.4)
Type of hospital, n(%)		
University hospital		103(47.0)
State hospital		56(25.6)
Training and research hospital		46(21.0)
Private hospital		14(6.4)
Practice of pediatric anesthesia outside the operating room, n(%)		
Yes		163(74.4)
Specialist without academic position		89(62.7)
Resident		45(97.8)
Faculty member	Associate Professor	16(94.1)
	Professor	13(92.9)
No		56(25.6)
Specialist without academic position		53(37.3)
Resident		1(2.2)
Faculty member	Associate Professor	1(5.9)
	Professor	1(7.1)

SD: standard deviation; min: minimum; max: maximum

mean age of 38.3±7.2 years, 50.7% were female. The participants voluntarily completed an online questionnaire, and a final analysis was made of 163 of the 219 physicians who confirmed the practice of anesthesia outside the operating room.

Written informed consent was obtained from each subject following a detailed explanation of the objectives and protocol of the study. Approval for the study was granted by the Ethics Committee of Van Yuzuncu Yil University ethics committee of clinical research (Date:13.02.2019 No:02).

Questionnaire: An e-mail invitation was sent to eligible physicians for participation in the survey, with access to the survey link with an identification number and log-in code to complete the online survey. The survey instrument consisted of 33 items exploring the approaches of the clinicians to pediatric anesthesia outside the operating room. The questionnaire included items on demographic data (age, gender), professional title, type of hospital, and characteristics related to the practice of anesthesia outside the operating room, including frequency per week, indications, American Society of Anesthesiology (ASA) physical status criteria for candidacy, age criteria for candidacy, use in emergency conditions, hospital conditions, use of premedication 1-day before the anesthesia, the role of parent/legal guardian, fasting period, the team members, available equipment, preferred method for anesthesia, use of regional anesthesia, preferred method for non-invasive monitorization, hypnotic agents used for sedo-analgesia, use of antagonism, preferred antagonist agent, place of recovery, most frequently encountered post-procedural complications and previous experience of patient death related to the procedure.

Study parameters: Characteristics related to the practice of anesthesia outside the operating room were evaluated in the overall study population and

Table 2. Practices and resources for pediatric anesthesia outside the operating room (n=163)

Pediatric anesthesia outside the operating room		n(%)
Frequency per week	Couple of days	76(47.2)
	Every day	44(27.3)
	On demand	31(19.3)
	Rarely	10(6.2)
Indications	MRI	143(87.7)
	Endoscopy	98(60.1)
	Pediatric angiography	96(58.9)
	Biopsy	89(54.6)
	ESWL	67(41.1)
	Wound care	33(20.2)
	Physical examination	32(19.6)
	Other	26(16.0)
Use in emergency conditions	Total	117(71.8)
	MRI	74(45.4)
	Endoscopy	69(42.3)
	Pediatric angiography	53(32.5)
	Biopsy	32(19.6)
	Wound care	16(9.8)
	ESWL	15(9.2)
	Physical examination	15(9.2)
	Other	6(3.7)
ASA criteria for candidacy	None	65(39.9)
	ASA I-II	64(39.3)
	ASA I-III	28(17.2)
	ASA I	6(3.7)
Age criteria for candidacy	None	121(74.2)
	Exclusion of neonatal age group	21(12.9)
	Exclusion of <3 years age group	13(8.0)
	Exclusion of infantile age group	8(4.9)
Parent/legal guardian	Obtaining informed consent	161(98.7)
	Witness during procedure allowed	22(13.5)
	Never	141(86.5)
Questioning the fasting period (yes)		163(100.0)
Premedication 1-day before the anesthesia (yes)		53(32.5)
The team members	Anesthesia technician	160(98.2)
	Anesthesia specialist	150(92.0)
	Anesthesia nurse	12(7.4)
	Health officer	4(2.5)
	Other	37(22.7)
Hospital conditions	Appropriate	125(77.6)
	Not appropriate	38(23.3)
The room for procedure	Sufficiently large	88(54.0)
	Safe	60(36.8)
Available equipment*	Oxygen source	159(97.5)
	Pulse oximetry	154(94.5)
	Aspirator	152(93.3)
	Emergency care bag	149(91.4)
	Monitor	146(89.6)
	Crash cart	131(80.4)
	Fixed line telephone	122(74.8)
	Anesthesia device	102(62.6)
	Defibrillator	60(36.8)
	Pager	34(20.9)

	Help button	19(11.7)
	Other	18(11.0)
Equipment check-list before the procedure*	Available	94(57.7)
	Not available	54(33.1)
	No idea	15(9.2)
Preferred method for anesthesia*	Deep sedation	132(81.0)
	Conscious sedation	88(54.0)
	General anesthesia	61(37.4)
Use of regional anesthesia*	Yes	16(9.8)
	Peripheral blockade	12(7.4)
	Spinal anesthesia	5(3.1)
	Epidural anesthesia	3(1.8)
	Caudal anesthesia	2(1.2)
	Other	11(6.7)
Preferred method for non-invasive monitorization*	Pulse oximetry	162(99.4)
	ECG	136(83.4)
	Non-invasive blood pressure	101(62.0)
	ET CO2	54(33.1)
	Heat monitorization	11(6.7)
	Other	3(1.8)
Hypnotic agents used for sedoanalgesia*	Midazolam	154(94.5)
	Propofol	140(85.9)
	Ketamine	146(89.6)
	Thiopental	43(26.4)
	Etomidate	2(1.2)
	Other	11(6.7)
Use of antagonism	Always	12(7.5)
	Sometimes	95(59.0)
	Never	54(33.5)
Preferred antagonist agent*	Sugammadex	65(39.9)
	Flumazenil	61(37.4)
	Neostigmine	41(25.2)
	Naloxone	18(11.0)
Place of recovery	Recovery room	73(44.8)
	Same room as the procedure	72(44.2)
	Waiting room	12(7.4)
	Ward	6(3.7)
Most frequently encountered post-procedural complications*	Desaturation	154(94.5)
	Nausea/vomiting	55(33.7)
	Brady-arrhythmia	52(31.9)
	Hypotension	19(11.7)
	Other	4(2.5)
Previous experience of patient death during procedure	Yes	4(2.5)
	Due to anaphylaxis	1(25.0)
	Due to hypoxia	1(25.0)
	Due to respiratory arrest	1(25.0)
	Due to high risk patient	1(25.0)

*Multiple choices were possible

according to the professional title of physicians and the type of hospital.

Statistical Analysis: Data obtained in the study were analyzed statistically using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA). Pearson Chi-square and Fisher-Freeman-Holton tests with Monte Carlo simulation technique and Benjamini-Hochberg correction were used to analyze categorical variables. Data were expressed as mean ± standard deviation (SD), median(min-max) values and number (n) and percentage (%) where appropriate. A value of $p<0.05$ was considered statistically significant.

Results

Demographic and Professional Characteristics of Participants: The study population comprised 50.7% females and 49.3% males with a mean age of 38.3 ±7.2 years. Most (52.1%) of the participating physicians were specialists without an academic position, and 14.2% were also faculty members. University hospitals (47.0%) were the most common type of hospitals, followed by state hospitals (25.6%) and training and research (21.0%) hospitals (Table 1).

In total, 163 of 219 physicians stated that they practice pediatric anesthesia outside the operating room. The 56 respondents who reported that they do not perform pediatric anesthesia outside the operating room comprised 53 of 142 (37.3%) specialists without academic position, 1 of 46 residents, 1 of 17 associate professors and 1 of 14 professors (Table 1).

Practice of Pediatric Anesthesia Outside The Operating Room (N=163): Most of the participant physicians stated that they perform pediatric anesthesia outside the operating room frequently, ranging from a couple of days per week (47.2%) to every day (27.3%), mostly for MRI (87.7%), endoscopy (60.1%), pediatric angiography (58.9%) and biopsy (54.6%) procedures, including emergency conditions (71.8%) (Table 2).

Overall, 60.1% and 25.8% of physicians reported that they use ASA criteria (inclusion of ASA I-II patients, 39.9%) and age criteria (exclusion of neonatal age group, 12.9%) for candidacy, respectively. The majority of the physicians stated that they obtain informed consent from the parent/legal guardian of the patient prior to the procedure (98.7%) and do not allow the parent/legal guardian to witness the procedure (86.5%). All physicians reported that they questioned the fasting period and the use of premedication 1-day before the anesthesia was confirmed by 32.5% (Table 2).

Anesthesia technicians and anesthesia specialists were identified as the leading members of the team, hospital conditions were considered to be appropriate by 77.6% of physicians and the size of the room for the procedure was considered appropriate by 54.0%. Available equipment included an oxygen source pulse oximetry, aspirator, emergency care bag, monitor and crash cart in the majority of cases. An equipment check-list before the procedure was stated to be available only by 57.7% of the physicians (Table 2).

The majority of the physicians stated the preferred method for anesthesia to be deep sedation (81.0%), the preferred method for non-invasive monitorization to be pulse oximetry (99.4%) and ECG (83.4%). Midazolam (94.5%), propofol (85.9%) and ketamine (89.6%) were identified as the most common hypnotic agents used for sedoanalgesia. The use of regional anesthesia was reported by 9.8% (peripheral blockade in 7.4%) of physicians, while use of antagonism was stated by 66.5% (always in 7.5%, with sugammadex or flumazenil in ~40%) (Table 2).

The place of recovery after anesthesia was identified as the recovery room or the same room in which the procedure had been applied by 44.8% and 44.2% of physicians, respectively. Desaturation (94.5%), followed by nausea/vomiting (33.7%) and brady-arrhythmia (31.9%) were the most frequently encountered post-procedural complications, while previous experience of patient death during the procedure was reported by 4 (2.5%) physicians due to anaphylaxis, hypoxia, respiratory arrest or high risk patient (n=1 for each) (Table 2).

Practice of Pediatric Anesthesia Outside The Operating Room According To Professional Title: The professors were determined to be the group with the highest rates of applying these procedures (66.7%), and residents (4.5%) were the group with the lowest rates for performing pediatric anesthesia outside the operating room on a daily basis ($p<0.001$ for each). The use of regional anesthesia was more common among faculty members (25.0% for associate professors, 30.8% for professors) compared with residents (6.7%) and specialists without an academic position (5.6%) ($p<0.01$ for each) (Table 3)

The place of recovery was reported to be the recovery room by a higher percentage of associate professors (50.0%) and specialists (57.3%) than resident physicians (20.0%), while the same room was used for both anesthesia and recovery according to a higher percentage of residents than specialists (68.9% vs. 29.2%, $p<0.01$) (Table 3).

No significant difference was noted in the practice of pediatric anesthesia outside the operating room according to professional title in respect of the use of candidacy criteria, methods for anesthesia and non-invasive monitorization, types of sedoanalgesia and antagonism or post-procedural complications (Table 3).

Practice of Pediatric Anesthesia Outside the Operating Room According to Hospital Type: State hospitals were associated with less frequent implementation of pediatric anesthesia outside the operating room with an on-demand or rarely practice rate of 62.5% compared with the corresponding rates of 19.5%, 37.5% and 20.8% in training-research, private and university hospitals, respectively ($p<0.01$ for each) (Table 4).

Table 3. Practices and resources for pediatric anesthesia outside the operating room according to professional title of physicians

Pediatric anesthesia outside the operating room		Professional title				
		Resident (n=45)	Associate Professor (n=16)	Professor (n=13)	Specialist without academic position (n=89)	p value
Frequency per week	Couple of days	29 (65.9)[q]	7 (43.8)	4 (33.3)	36 (40.4)	0.001[1]
	Every day	2 (4.5)	6 (37.5)[*]	8 (66.7)[*,q]	28 (31.5)[*]	
	On demand	10 (22.7)	2 (12.5)	0 (0.0)	19 (21.3)	
	Rarely	3 (6.8)	1 (6.3)	0 (0.0)	6 (6.7)	
ASA criteria for candidacy	None	17 (37.8)	7 (43.8)	7 (53.8)	34 (38.2)	0.772[1]
	ASA I-II	19 (42.2)	4 (25.0)	4 (30.8)	37 (41.6)	
	ASA I-III	6 (13.3)	5 (31.3)	2 (15.4)	15 (16.9)	
	ASA I	3 (6.7)	0 (0.0)	0 (0.0)	3 (3.4)	
Age criteria for candidacy	None	33 (73.3)	12 (75.0)	11 (84.6)	65 (73.0)	0.970[1]
	Exclusion of neonatal age group	6 (13.3)	2 (12.5)	1 (7.7)	12 (13.5)	
	Exclusion of <3 years age group	5 (11.1)	1 (6.3)	0 (0.0)	7 (7.9)	
	Exclusion of infantile age group	1 (2.2)	1 (6.3)	1 (7.7)	5 (5.6)	
The room for procedure	Sufficiently large	21 (33.9)	10 (29.4)	7 (28.0)	50 (31.6)	0.871[2]
	Has crash cart	31 (50.0)	14 (41.2)	12 (48.0)	74 (46.8)	
	Safe	10 (16.1)	10 (29.4)	6 (24.0)	34 (21.5)	
Method for anesthesia	General anesthesia	12 (16.2)	7 (25.0)	7 (26.9)	35 (22.9)	0.851[2]
	Deep sedation	35 (47.3)	12 (42.9)	12 (46.2)	73 (47.7)	
	Conscious sedation	27 (36.5)	9 (32.1)	7 (26.9)	45 (29.4)	
Use of regional anesthesia	Yes	3 (6.7)	4 (25.0)[*,q]	4 (30.8)[*,q]	5 (5.6)	0.008[1]
	No	42 (93.3)	12 (75.0)	9 (69.2)	84 (94.4)	
Method for non-invasive monitorization	ECG	37 (30.3)	15 (30.6)	11 (28.2)	73 (28.7)	0.166[1]
	Pulse oximetry	45 (36.9)	16 (32.7)	13 (33.3)	88 (34.6)	
	Non-invasive blood pressure	32 (26.2)	11 (22.4)	10 (25.6)	48 (18.9)	
	ET CO2	5 (4.1)	7 (14.3)	3 (7.7)	39 (15.4)	
	Heat monitorization	3 (2.5)	0 (0.0)	2 (5.1)	6 (2.4)	
Hypnotic agents used for sedoanalgesia	Midazolam	43 (32.6)	15 (28.8)	13 (34.2)	83 (31.6)	0.958[1]
	Propofol	40 (30.3)	15 (28.8)	11 (28.9)	74 (28.1)	
	Ketamine	41 (31.1)	16 (30.8)	10 (26.3)	79 (30.0)	
	Etomidate	1 (0.8)	0 (0.0)	0 (0.0)	1 (0.4)	
	Thiopental	7 (5.3)	6 (11.5)	4 (10.5)	26 (9.9)	
Use of antagonism	Always	3 (6.7)	2 (12.5)	0 (0.0)	7 (8.0)	0.186[1]
	Sometimes	29 (64.4)	12 (75.0)	10 (76.9)	44 (50.6)	
	Never	13 (28.9)	2 (12.5)	3 (23.1)	36 (41.4)	
Place of recovery	Waiting room	4 (8.9)	0 (0.0)	1 (7.7)	7 (7.9)	0.002[1]
	Recovery room	9 (20.0)	8 (50.0)[*]	5 (38.5)	51 (57.3)[*]	
	Ward	1 (2.2)	0 (0.0)	0 (0.0)	5 (5.6)	
	The same room as procedure	31 (68.9)[q]	8 (50.0)	7 (53.8)	26 (29.2)	
Post-procedural complications	Desaturation	44 (51.8)	15 (55.6)	13 (50.0)	82 (57.7)	0.901[1]
	Hypotension	7 (8.2)	1 (3.7)	3 (11.5)	8 (5.6)	
	Brady-arrhythmia	14 (16.5)	5 (18.5)	6 (23.1)	27 (19.0)	
	Nausea/vomiting	20 (23.5)	6 (22.2)	4 (15.4)	25 (17.6)	

[1]Fisher Freeman Halton test (Monte Carlo), [2]Pearson Chi-Square Test (Monte Carlo); Post Hoc Test: Benjamini-Hochberg correction

[*]$p<0.01$ compared to resident physicians, [q]$p<0.01$ compared to specialists

A recovery room was more commonly used for recovery in state (62.5%), training-research (61.0%) and private (62.5%) hospitals than in university hospitals (33.7%) ($p<0.01$ for each), while use of the

same room for both anesthesia and recovery was more common in university hospitals (58.2%) compared with state (31.3%), training-research (24.4%) and private (0.0%) hospitals ($p<0.01$ for each). The use of hospital wards for recovery was more common in private hospitals (25.0%) than in training-research (2.4%) and university (2.0%) hospitals ($p<0.01$ for each) (Table 4).

No significant difference was noted between hospital types in the practice of pediatric anesthesia outside the operating room in respect of the use of candidacy criteria, the room for the procedure, methods for anesthesia and non-invasive monitorization, use of regional anesthesia, types of sedoanalgesia and antagonism or post-procedural complications (Table 4).

Discussion

This questionnaire-based survey revealed frequent application of pediatric anesthesia outside the operating room by most of the participating physicians, ranging from a couple of days per week to every day and mostly for MRI, endoscopy, pediatric angiography and biopsy procedures. ASA physical status rather than the age of patient was considered more commonly by physicians in the selection of appropriate candidates. Desaturation was reported to be the most commonly noted post-procedural adverse event, while only 4 physicians had previously experienced the death of a patient related to the procedure.

Accordingly, the findings of this study seem consistent with the frequent use of pediatric anesthesia outside the operating room in invasive medical procedures, such as imaging diagnostics, invasive radiology, cardiac catheterization and endoscopies (7) with a well-described overall low adverse event rate involving persistent desaturation in most cases for a variety of procedures in certain settings (8). In fact, the association of age <1 year or 5 years and ASA status III or IV with failed sedation and an increased risk of adverse events has consistently been reported in the literature (2,3,8-12). Therefore, the consideration of ASA physical status I-II by only 39.3% and patient age by only 25.0% of physicians in the present cohort seems notable.

The most commonly preferred method for anesthesia was deep sedation (81.0%), while pulse oximetry (99.4%) and ECG (83.4%) were the most commonly preferred methods for non-invasive monitorization with the use of end-tidal carbon dioxide by 33.1% of physicians in this cohort. This seems notable as pulse oximetry is not considered to be sufficient to detect the respiratory complications of sedation, and it is recommended that close clinical monitoring of the breathing pattern of the patient is applied with the use of end-tidal carbon dioxide for the detection of such complications and for the early detection of airway obstruction (11).

In the current study, midazolam (94.5%), propofol (85.9%) and ketamine (89.6%) were reported to be the most common hypnotic agents used for sedoanalgesia, which seems to be consistent with agents recommended for non-pain procedures (i.e. MRI; propofol, chloral hydrate, diazepam, midazolam, methohexithal, pentobarbital and etomidate) with the addition of non-opiate analgesics such as ketamine or opiate analgesics to the treatment regimen for painful procedures (i.e. bone marrow biopsy, reduction of fractures, burn scrubs) (13,14). Nonetheless, while propofol or ketamine with the co-administration of benzodiazepines (principally midazolam) are the most commonly used agents for pediatric anesthesia outside the operating room, the clear benefit of these combinations on pain reduction or amelioration of recovery agitation as well as their impact on the developing brain remains controversial (2,4,7,12,15-22). This also seems notable given the recently reported trend of using more potent sedatives and hypnotics by non-anesthesiologists (i.e. physicians and nurses) (13,23,24).

Anesthesia technicians and anesthesia specialists were identified as the primary members of the team, while hospital conditions were considered to be appropriate by 77.6% of the physicians and the room for procedure was considered sufficiently large by 54.0%. Available on-site equipment included an oxygen source pulse oximetry, aspirator, emergency care bag, monitor and crash cart in the majority of cases, while an equipment check-list was reported to be available before the procedure by only 57.7% of physicians. Several guidelines are available on the provision of services for anesthetic care outside the operating room including USA Centers for Medicare and Medicaid Services (CMS) directives (25), UK Royal College of Anesthetists guidelines (26), the National Institute for Clinical Excellence (NICE) Clinical Guidelines (27) and American Academy of Pediatrics (AAP) guidelines in collaboration with the American Academy of Pediatric Dentistry (AAPD) and the American Society of Anesthesiologists (ASA) (28,29). A summary of their recommendations includes delivery of anesthesia services by appropriately trained healthcare providers and in accordance with recognized standards for anesthesia care including informed consent, appropriate fasting intervals, infection control, safety practices, availability of age and size appropriate equipment, the use of physiological monitoring, the need for basic life

Table 4. Practices and resources for pediatric anesthesia outside the operating room according to hospital type

Pediatric anesthesia outside the operating room		Hospital type				
		State hospital (n=16)	Training-research hospital (n=41)	Private hospital (n=8)	University hospital (n=98)	p value
Frequency per week	Couple of days	3 (18.8)	19 (46.3)	2 (25.0)	52 (54.2)	0.009
	Every day	3 (18.8)	14 (34.1)	3 (37.5)	24 (25.0)	
	On demand	6 (37.5)	5 (12.2)*	3 (37.5)	17 (17.7)	
	Rarely	4 (25.0)	3 (7.3)	0 (0.0)*	3 (3.1)*	
ASA criteria for candidacy	None	6 (37.5)	15 (36.6)	1 (12.5)	43 (43.9)	0.281
	ASA I-II	8 (50.0)	14 (34.1)	5 (62.5)	37 (37.8)	
	ASA I-III	1 (6.3)	11 (26.8)	1 (12.5)	15 (15.3)	
	ASA I	1 (6.3)	1 (2.4)	1 (12.5)	3 (3.1)	
Age criteria for candidacy	None	10 (62.5)	27 (65.9)	5 (62.5)	79 (80.6)	0.117
	Exclusion of neonatal age group	3 (18.8)	5 (12.2)	2 (25.0)	11 (11.2)	
	Exclusion of <3 years age group	3 (18.8)	4 (9.8)	1 (12.5)	5 (5.1)	
	Exclusion of infantile age group	0 (0.0)	5 (12.2)	0 (0.0)	3 (3.1)	
The room for procedure	Sufficiently large	7 (28.0)	25 (34.2)	7 (36.8)	49 (30.2)	0.869
	Has crash cart	14 (56.0)	31 (42.5)	7 (36.8)	79 (48.8)	
	Safe	4 (16.0)	17 (23.3)	5 (26.3)	34 (21.0)	
Method for anesthesia	General anesthesia	1 (4.2)	17 (25.0)	3 (23.1)	40 (22.7)	0.237
	Deep sedation	11 (45.8)	33 (48.5)	7 (53.8)	81 (46.0)	
	Conscious sedation	12 (50.0)	18 (26.5)	3 (23.1)	55 (31.3)	
Use of regional anesthesia	Yes	0 (0.0)	2 (4.9)	0 (0.0)	14 (14.3)	0.172
	No	16 (100.0)	39 (95.1)	8 (100.0)	84 (85.7)	
Method for non-invasive monitorization	ECG	13 (34.2)	35 (27.6)	4 (21.1)	84 (30.0)	
	Pulse oximetry	15 (39.5)	41 (32.3)	8 (42.1)	98 (35.0)	
	Non-invasive blood pressure	7 (18.4)	26 (20.5)	3 (15.8)	65 (23.2)	0.627
	ET CO2	3 (7.9)	22 (17.3)	3 (15.8)	26 (9.3)	
	Heat monitorization	0 (0.0)	3 (2.4)	1 (5.3)	7 (2.5)	
Hypnotic agents used for sedoanalgesia	Midazolam	16 (33.3)	40 (32.3)	6 (27.3)	92 (31.6)	0.987
	Propofol	13 (27.1)	36 (29.0)	6 (27.3)	85 (29.2)	
	Ketamine	15 (31.3)	37 (29.8)	6 (27.3)	88 (30.2)	
	Etomidate	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.7)	
	Thiopental	4 (8.3)	11 (8.9)	4 (18.2)	24 (8.2)	
Use of antagonism	Always	1 (6.7)	4 (9.8)	0 (0.0)	7 (7.2)	0.545
	Sometimes	6 (40.0)	24 (58.5)	4 (50.0)	61 (62.9)	
	Never	8 (53.3)	13 (31.7)	4 (50.0)	29 (29.9)	
Place of recovery	Waiting room	0 (0.0)	5 (12.2)	1 (12.5)	6 (6.1)	<0.001
	Recovery room	10 (62.5)ϥ	25 (61.0)ϥ	5 (62.5)ϥ	33 (33.7)	
	Ward	1 (6.3)	1 (2.4)	2 (25.0)ϥ,w	2 (2.0)	
	The same room as procedure	5 (31.3)ϥ	10 (24.4)ϥ	0 (0.0)ϥ	57 (58.2)	
Post-procedural complications	Desaturation	14(66.7)	40(58.0)	6(75.0)	94(51.6)	0.410
	Hypotension	0(0.0)	2(2.9)	1(12.5)	16(8.8)	2
	Brady-arrhythmia	2(9.5)	15(21.7)	1(12.5)	34(18.7)	
	Nausea/vomiting	5(23.8)	12(17.4)	0(0.0)	38(20.9)	

Fisher Freeman Halton test(Monte Carlo); Post Hoc Test: Benjamini-Hochberg correction

* $p<0.01$ compared to state hospital, ϥ $p<0.01$ compared to university hospital and w $p<0.01$ compared to training and research hospital

support skills, access to resuscitation and monitoring equipment (particularly for children assessed as an ASA 3 or higher grade and/or the under 1 year of age) and proper recovery/discharge procedures and (6,25-29).

The findings of the current study indicate that the practice of pediatric anesthesia outside the operating room as stated by the participating physicians is in accordance with the standards for anesthesia care recommended in these guidelines in terms of members of the anesthesia team, informed consent, appropriate fasting intervals, available equipment and access to resuscitation and monitoring equipment. Likewise, data from a large prospective survey examining pediatric sedation/anesthesia in a tertiary academic hospital revealed that a dedicated sedation team using a written protocol provided a service with minimal case cancellation, no sedation failure, favorable safety, and excellent parental satisfaction (11).

Notably, the professors were determined to be the group with the highest rates for the procedure on a daily basis and use of regional anesthesia was more common among faculty members, while state hospitals were associated with less frequent implementation of pediatric anesthesia outside the operating room compared with training-research, private and university hospitals. This seems notable given the consideration of the exemplary training and education of individuals involved in sedating children along with developing and maintaining robust systems for them to work within as the key to providing safe and effective pediatric sedation (6).

Professional title or hospital type had no significant impact on the practice of pediatric anesthesia outside the operating room in terms of candidacy criteria, methods for anesthesia and non-invasive monitorization, types of sedoanalgesia and antagonism or post-procedural complications. However, the place of recovery was more commonly the recovery room in hospitals other than university hospitals, was the same room in which the anesthesia procedure had been applied in university hospitals and was the hospital ward in private hospitals.

The current study findings also indicate a need for improved practice regarding consideration of appropriate candidacy for ASA physical status and patient age in addition to a uniform and standardized recovery practice among anesthesia specialists.

Currently, most of the available sedation guidelines consider specific specialties with a lack of uniform sedation guidelines and conformity and agreement between specialists on recommendations and practice (30). Hence, a need for large scale multi-specialist delivered sedation studies has been emphasized to be able to provide specific sedation-related outcomes to support the design of evidence-based guidelines (30).

Certain limitations to this study should be considered. First, the cross-sectional nature of the study precludes the possibility of drawing extensive causal conclusions. Second, the relatively small sample size reduces the generalizability of the findings, necessitating a need for continued investigations in this area. Third, collection of data based on an online questionnaire form rather than direct observation of practice seems to be another limitation which otherwise would extend the knowledge achieved in the current study.

In conclusion, this questionnaire-based survey revealed frequent application of pediatric anesthesia outside the operating room by anesthesiology and reanimation specialists and adherence to recommended guidelines with similar scope of practice and resource allocations for the procedure between different hospital types. Alongside the likelihood of professional training and hospital type to influence frequency of the procedure and recovery strategies, these findings emphasize a need for improved practice regarding consideration of appropriate candidacy for ASA physical status and patient age as well as a uniform and standardized recovery practice among anesthesiology and reanimation specialists. Large prospective outcome studies on sedation practice with a collaborative effort of all sedation providers are necessary to determine optimal sedation practices within and between specialties.

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