Sedation and Analgesia Practices in Pediatric Intensive Care Units: A Survey of 27 Centers from Turkey

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Abstract

The management and monitoring of sedoanalgesia are important measures in improving the efficacy of procedures and mechanical ventilation, as well as reducing adverse effects and preventing withdrawal syndrome, and delirium in pediatric intensive care units (PICUs). As there is an ongoing need to clarify the best approach to sedoanalgesia in PICUs, we aimed to analyze the current approaches in sedation, analgesia, withdrawal, and delirium practices among PICUs in Turkey. Twenty-seven PICUs completed the survey. Only 9 (33.3%) and 13 (48.1%) centers had a written protocol for analgesia and sedation, respectively. Paracetamol and a combination of midazolam and fentanyl were preferred in 51.8 and 40% of the PICUs for postoperative periods, respectively, and 81.4% of the units preferred ketamine for short-term interventions. For prolonged sedation in mechanically ventilated children, a combination of benzodiazepines and opiates were the most preferred first-line agents with a very high percentage of 81.4%, whereas ketamine and dexmedetomidine accounted for 62.9 and 18.5%, respectively, as second-line options. Although sedative and analgesic agent preferences were comparable with the relevant literature, we should focus on developing a standardized, evidence-based algorithm for sedation and analgesic drugs.

Keywords

- ▶ analgesia
- ▶ delirium
- ▶ pediatric intensive care
- ▶ sedation
- ▶ withdrawal

Introduction

Optimal sedation and analgesia management are the most important issues regarding treatment in pediatric intensive care units (PICUs).¹ Several factors can create fear, stress, anxiety, and pain in children: the underlying disease, recurrent invasive interventions, mechanical ventilation, monitoring processes, crowds, unfamiliar environments, noise, night–day cycle disruption, and separation from parents. These can lead to undesirable effects in critically ill patients.² Although some strategies can help children and their parents cope with this anxiety and fear, it is sometimes necessary to provide medical treatment. Adequate and appropriate sedoanalgesia can help to improve a patient's comfort and

safety, as well as ventilation efficiency by ensuring patient-ventilator compliance. However, adverse effects, such as tolerance, dependence, and withdrawal syndrome, following drug discontinuation may cause serious problems for both the patient and the physician. Patients exposed to benzodiazepines and opiates in particular are at risk. If drugs are used at high doses for long periods of time without appropriate follow-up, there may be an increase in hospital length of stay, nosocomial infections, and the occurrence of critical disease neuromyopathy, leading to an increase in hospital costs.³ Benzodiazepine use is also an important risk factor for the development of delirium.^{4,5}

Current protocols usually consist of combination therapy that includes the use of two or more drugs to achieve

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sedoanalgesia at a targeted level. However, there is no universally accepted standardized approach or practice guide for sedation–analgesia in critically ill pediatric patients.^{6–8} Studies investigating sedoanalgesia approaches, postoperative analgesia management, scoring–evaluation systems, and drug delivery methods in children have previously been reported from different countries.^{9–11} There is an ongoing need to clarify the best approach to sedoanalgesia in PICUs with studies based on real-world data.

Therefore, in this article we aimed to investigate current experiences and practices in sedation, analgesia, withdrawal and delirium practices, pharmacological agent preferences, and nonpharmacological approaches used in mechanical ventilation and scoring systems among PICUs in Turkey.

Materials and Methods

Participants

We invited all PICUs in Turkey led by pediatric intensive care specialists or faculty members with expertise in this field to participate in the study. Medical directors of the centers were informed of the study via e-mail on April 8, 2019. It included a link to the survey (<https://en.surveymonkey.com/r/T8NMZCK>) called “Sedation–Analgesia Withdrawal and Delirium Approaches in Pediatric Intensive Care Units in Turkey,” which consisted of 49 questions. The instructors or intensive care specialists were asked to answer the questionnaire. If agreed, the centers were given 4 weeks to complete the survey. After completion of the questionnaires, answers from each center were recorded in a Microsoft Excel 2018 file, with the name of the center coded with a number for confidentiality. The study was approved by the local ethics committee of Çukurova University Faculty of Medicine (approval number: 86).

Survey/Questionnaire

The survey consisted of 49 questions in five parts, as follows: general information, pain and anxiety, sedoanalgesia during mechanical ventilation, withdrawal, and delirium. Twenty-nine questions were prepared as closed-ended and multiple-choice questions. The remaining 20 questions were open-ended and included an “other” option to allow for alternative answers.

Part one of the questionnaire was titled “General Information.” It related to the characteristics of the unit, including the type of hospital (public/private/foundation and if the unit was affiliated with a university), number of beds, average percentage of intubated patients, and experience of the physician who completed the questionnaire. Part two was titled “Pain and Anxiety.” It examined sedoanalgesia policies in postoperative patients, including the first choice and most commonly used analgesic drugs, which opiates were used, and pain scoring systems. Sedoanalgesia applications in short-term interventions were also included in this section. Part three, titled “Sedoanalgesia during Mechanical Ventilation,” included questions about sedation evaluation scales and their applications in intubated patients, the utilization of

bispectral index (BIS), the most and least preferred agents and their administration, and the preferred adjuvant agents. Part four, titled “Withdrawal,” surveyed scoring scales and their application routes, and pharmacological and nonpharmacological approaches in withdrawal treatment. Part five, titled “Delirium,” consisted of questions about delirium evaluation scales and their evaluations, frequency of assessment for delirium, and treatment approaches in a case with delirium. Predicted time for completion of the survey was 15 to 20 minutes. All participants (one physician from each center) completing a questionnaire gave their informed consent prior to the study.

Statistical Analysis

Only descriptive statistics were analyzed. Categorical variables were expressed in percentages (%) and continuous variables were calculated as mean $\pm$ standard deviation (SD). Microsoft Excel 2018 was used to analyze data.

Results

General Features

Of the 33 centers contacted, 27 (82%) agreed to participate in the study (►Table 1). Of them, 48.1% were training

Table 1 General features of pediatric intensive care units and the participants

Parameter		n	%
Properties of the hospital	Training and research hospital	13	48.1
	University hospital	8	29.7
	Public hospital	6	22.2
Properties of PICU	Medical	7	26
	Medical + surgical	20	74
	Surgical	0	0
Number of beds	0–10	11	40.8
	11–15	5	18.5
	16–20	4	14.8
	21–30	5	18.5
	>30	2	7.4
Frequency of mechanically ventilated patients in PICU	<%25	0	0
	%25–50	12	44.4
	%50–75	12	44.4
	>%75	3	11.2
Presence of PICU fellowship		9	33.3
PICU experience of the participants (y)	0–5	12	44.4
	5–10	11	40.7
	10–20	4	14.8
	>20	0	0
Total		27	100

Abbreviation: PICU, pediatric intensive care unit.

Table 2 Pain assessment methods and their utility in pediatric intensive care units

Parameter		n	%
Routine pain assessment	Yes	26	96.3
	No	1	0.7
Frequency of pain assessment	Every 2 hours	0	0
	Every 4 hours	15	55.5
	Every 8 hours	4	14.8
	Every 12 hours	5	18.5
	Every 24 hours	2	7.4
Attendant practitioner	Nurse	23	85.1
	Physician	4	14.8
Scales used for pain assessment	Wong–Baker FACES pain rating scale ²³	14	51.8
	Numeric rating scale ²⁴	3	11.1
	Visual analogue scale ²⁵	10	37
	COMFORT behavior scale ²⁶	12	44.4
	FLACC scale ²⁷	8	29.6
	MAPS ²⁸	0	0
	Behavioral pain scale ²⁹	1	3.7
	Neonatal infant pain scale ³⁰	1	3.7
	Not applicable	1	3.7

Abbreviations: FLACC, face legs activity cry consolability; MAPS, multidimensional assessment pain scale.

Note: Availability of scales for age: NIPS: 28–40 weeks; FLACC: 0–7 years; COMFORT behavior scale: 0–3 years; MAPS: 0–31 months.

and research hospitals. The majority of centers (74%) offered both medical and surgical intensive care unit (ICU) services. Only seven centers (25.9%) had a bed capacity of 20 or more. Among the 27 centers, 23 health care professionals (85.2%) had less than 10 years of experience in PICUs. Overall, only 9 (33.3%) and 13 (48.1%) of the centers had a written protocol for analgesia and sedation, respectively.

Pain Assessment and Nonpharmacological Measurements for Pain Control in PICUs

All but one PICU (96.3%) routinely performed pain assessment in daily practice, and this was often performed by nurses (85.1%). The scales used for pain assessment are detailed in ►Table 2.

All PICUs utilized at least one type of nonpharmacological measurement for pain control. The frequency of nonpharmacological manipulations were as follows: pacifier use in 27 (100%), parental stay in PICU in 26 (96.3%), cuddling in 21 (77.8%), swaddling in 20 (74.1%), watching television in 12 (44.4%), listening to music in 10 (37%), oral sucrose in 8 (29.6%), reading books in 5 (18.5%) and toys in 3 centers (11.1%).

Table 3 Analgesic preferences of the participants from 27 PICU centers for postoperative periods and short-term interventions

Drugs	First choice		Second choice	
	n	%	n	%
1. Analgesic drug choices of the PICU centers for postoperative periods				
Opiates	11	40	13	48.1
Paracetamol	14	51.8	10	37
Ibuprofen and other NSAIDs	0	0	0	0
Dexmedetomidine	2	7.4	2	7.4
Ketamine	0	0	2	7.4
2. Opiate choices of the PICU centers for postoperative periods				
Morphine	3	11.1	11	40.7
Meperidine	0	0	3	11.1
Fentanyl	23	85.1	3	11.1
Remifentanyl	0	0	5	18.5
Tramadol	1	3.7	5	18.5
3. Preferences of sedoanalgesia for short-term interventions				
Ketamine	22	81.4	5	18.5
Midazolam	2	7.4	12	44.4
Opiates (fentanyl, morphine)	0	0	1	3.7
Midazolam plus opiate	2	7.4	6	22.2
Midazolam plus ketamine	0	0	1	3.7
Propofol	1	3.7	2	7.4
Dexmedetomidine	0	0	0	0
Etomidate	0	0	0	0

Abbreviations: NSAID, nonsteroidal anti-inflammatory drug; PICU, pediatric intensive care unit.

Analgesic Preferences for Postoperative Periods in PICUs

As a first-line option, the most preferred analgesic agents for patients during postoperative periods were paracetamol (51.8%) followed by opiates (40%). Only two centers (7.4%) chose dexmedetomidine, a relatively new sedative agent preferred for its analgesic effects, as their first-line option for postoperative analgesia. Among second-line analgesic agents, the leading agents were opiates (48.1%) followed by paracetamol (37%). Fentanyl and morphine were the most commonly preferred opiates as first and second choices, respectively. ►Table 3 illustrates the preference of analgesics and opiates in PICUs involved in the study.

Sedoanalgesia for Short-Term Interventions in PICUs

Local anesthesia was preferred for ensuring analgesia during short-term interventions in 18 of the PICUs (66.7%). Among sedative and analgesic agents, ketamine and midazolam were the most commonly preferred. Combination therapy, including midazolam plus opiates and midazolam plus

Table 4 Preference of sedative agents and opiates in sedoanalgesia during mechanical ventilation in pediatric intensive care units

Sedoanalgesia preference		First option		Second option	
		n	%	n	%
Sedative agents	Benzodiazepines plus opiates	22	81.4	2	7.4
	Barbiturates	2	7.4	3	11.1
	Ketamine	3	11.1	17	62.9
	Dexmedetomidine	0	0	5	18.5
	Clonidine	0	0	0	0
	Propofol	0	0	0	0
Opiates	Morphine	3	11.1	13	48.1
	Fentanyl	24	88.9	3	11.1
	Remifentanyl	0	0	9	33.3
	Sufentanyl	0	0	0	0
	Tramadol	0	0	2	7.4

ketamine, was preferred in only 7.4% of centers, whereas the same protocol gained a total preference rate of 25.9% as the second option. ▶Table 3 shows the data regarding sedoanalgesia practices for short-term interventions in PICUs.

Sedation Practices during Mechanical Ventilation in PICUs

Benzodiazepines were the most common pharmacological agents, preferred as both first and second options for sedation during mechanical ventilation among PICUs involved in the study. All participants also stated that they administrate benzodiazepines via intravenous infusion, not intermittent bolus. All centers preferred concomitant opiate use for analgesia in addition to sedative agents. Opiates were reported to be used via continuous infusion in 26 centers (96.3%); only one participant declared the preference of intermittent bolus administration. The most common combined agents preferred in PICUs were midazolam in 27 (100%), fentanyl in 22 (81.4%), and ketamine in 12 (44.4%) centers. ▶Table 4 summarizes sedative agents and opiates preferred by the participants from 27 PICUs.

In the case of inadequate sedation, participants from 27 PICUs reported that they chose the following adjuvant agents: ketamine in 19 (70.3%) centers, dexmedetomidine in 15 (55.5%), chloral hydrate in 13 (48.1%), thiopental in 8 (29.6%), phenobarbital in 4 (14.8%), diphenhydramine in 4 (14.8%), propofol in 3 (11.1%), and oral lorazepam in 1 (3.7%) center.

Routine assessment of sedation efficacy during follow-up on mechanical ventilation was performed in all PICUs. The properties of sedation efficacy assessment including frequency, scales used, and providers are detailed in

Table 5 Practices on assessment of sedation efficacy in pediatric intensive care units

Parameter		n	%
Attendant practitioner	Nurse	18	66.6
	Physician	9	33.3
Frequency of sedation efficacy assessment	Every 2 hours	1	3.7
	Every 4 hours	12	44.4
	Every 6 hours	6	22.2
	Every 8 hours	2	7.4
	Every 12 hours	2	7.4
	Every 24 hours	4	14.8
Bispectral index monitoring	Always	2	7.4
	Often	2	7.4
	Sometimes	3	11.1
	Seldom	4	14.8
	Never	16	59.2
Scales used in assessment of sedation efficacy	Ramsay sedation scale ³¹	10	37
	State behavioral scale ³²	3	11.1
	Richmond agitation and sedation scale ³³	2	7.4
	COMFORT ³⁴	15	55.5
	COMFORT-B ²⁶	3	11.1
	Brussels sedation scale ³⁵	4	14.8

▶Table 5. BIS monitoring has been performed in 11 centers (40.7%) for sedation efficacy assessment.

Assessment and Management of Withdrawal Syndrome and Delirium in PICUs

The participants were asked whether they assess withdrawal symptoms within patients receiving sedoanalgesia during dose reduction or drug cessation, the frequency of assessments, which scale they use, and what the pharmacological and nonpharmacological treatment approaches are (▶Table 6). It was found that 22 centers (81.4%) routinely perform withdrawal syndrome assessment of which the majority were performed by physicians in PICUs.

Treatments preferred by participants for patients experiencing withdrawal syndrome included increasing the dosage of benzodiazepine and opiates in 21 (77.8%), drug switch or addition in 18 (66.7%), parental stay in PICU in 13 (48.1%), listening to music in 6 (22.2%), watching television in 5 (18.5%), and oral feeding in patients without any contraindications in 4 (14.8%) centers. Pharmacological

Table 6 Assessment of withdrawal and delirium methods within patients receiving sedoanalgesia during dose reduction or drug cessation in PICUs

Parameter		n	%
Routine assessment for withdrawal		22	81.4
Attendant practitioner for withdrawal assessment	Nurse	2	7.4
	Physician	25	92.6
Frequency of withdrawal assessment	Every 4 hours	5	18.2
	Every 6 hours	7	25.9
	Every 8 hours	3	11.1
	Every 12 hours	4	14.8
	Every 24 hours	6	22.2
Scales used for withdrawal assessment	Sedation withdrawal score ³⁶	12/25	48
	WAT-1 ³⁷	9	36
	Opioid and benzodiazepine withdrawal score ³⁸	4	16
	The Sophia observation withdrawal symptoms scale ³⁹	0	0
Routine assessment for delirium		6	22.2
Attendant practitioner for delirium assessment	Nurse	6/6	100
	Physician	0	0
Frequency of delirium assessment	Every 8 hours	3	50
	Every 12 hours	0	0
	Every 24 hours	3	50
Scales used for delirium assessment	pCAM-ICU or psCAM-ICU ⁴⁰	4	
	CAPD ⁴¹	1	
	Pediatric anesthesia emergence delirium scale ⁴²	1	

Abbreviations: CAPD, Cornell assessment of pediatric delirium; PICU, pediatric intensive care unit; WAT-1, withdrawal assessment tool.

agents preferred by the participants for withdrawal syndrome treatment were found as follows: dexmedetomidine in 15 (55.5%) centers, chloral hydrate in 11 (40.7%), phenobarbital in 5 (18.5%), ketamine in 5 (18.5%) centers, oral diazepam in 1 (3.7%), and oral lorazepam in 1 (3.7%) center.

The data regarding delirium assessment, including frequency and scales used in PICUs, are detailed in ▶ **Table 4**. Nonpharmacological measurements preferred in PICUs were parental stay in PICU in 22 (81.4%) centers, avoidance of invasive procedures in 17 (61.9%), bringing toys or other objects belonging to the patient to PICU in 16 (59.2%), approaches toward improving sleep quality in 16 (59.2%), mobilization in 6 (22.2%), and listening to music or parents' voices in 1 center (3.7%). Seven centers (25.9%) preferred tapering the dose of sedative agents and opiates. Preferred

pharmacological treatment for delirium included haloperidol in 22 (81.4%) centers, risperidone in 6 (22.2%), quetiapine in 1 (3.7%), and dexmedetomidine also in 1 (3.7%) center.

Comparison of Sedoanalgesia Preferences between Centers with and without Fellowship Programs

We investigated whether sedation and analgesia preferences differed between training and research/University hospitals with fellowship training programs ($n = 9$) and centers that did not have fellowship training programs ($n = 18$). There were no statistically significant differences between these two groups.

Discussion

The questionnaire was completed by 82% of the units we contacted. In the present study, we found that almost all PICUs implement routine pain assessment with most following scales: Wong-Baker FACES pain rating scale, visual analogue scale (VAS), COMFORT behavior scale and face, legs, activity, cry, consolability (FLACC) scale. The majority of units preferred paracetamol and opiates (mostly fentanyl) for postoperative pain management and ketamine for short-term interventions. For prolonged sedation in mechanically ventilated children, the combination of benzodiazepines and opiates were the most preferred first-line agents. Ketamine and dexmedetomidine accounted for 62.9 and 18.5% of the second options. Propofol was never preferred for sedoanalgesia in this study; it has been reported to have potentially fatal adverse effects and is not advised for use as a sedation drug in pediatric intensive care units.¹² Sedation efficacy was found to be assessed routinely in all PICUs, and the COMFORT and Ramsay's sedation scales were the most commonly used scales for this purpose. BIS was available in 41.8% of PICUs; however, it was routinely performed in only 7.4% of them. Routine assessment of withdrawal and delirium was present in 81.4 and 22.2% of units, respectively. Sedation withdrawal score (SWS), withdrawal assessment tool (WAT-1), and opioid and benzodiazepine withdrawal score (OBWS) were used for withdrawal assessment. In addition, pediatric confusion assessment method-intensive care unit (pCAM-ICU) or preschool confusion assessment method-intensive care unit (psCAM-ICU), Cornell assessment of pediatric delirium (CAPD) and pediatric anesthesia emergence delirium scale (PAED) were utilized for delirium assessment.

Centers with established fellowship training programs may benefit from advantages such as having standardized sedoanalgesia protocols. However, sedoanalgesia practices did not differ significantly between PICUs with and without fellowship programs. This may be due to inadequately powered sample size, and the influence of staffing the remaining centers with PICU specialists recently graduated from fellowship training. Nonetheless, we think that more comprehensive studies including larger numbers of centers may be useful to clarify our results.

In 2002, Rhoney and Murry¹³ surveyed 176 physicians from 145 PICUs. Only 13.4% of the participants declared the presence of a written protocol for sedative use. The most

preferred agents were midazolam, fentanyl, lorazepam, and morphine which is similar to the findings in our study. These agents were mostly administered via intravenous route. While 19.2% of physicians in the study indicated they do not monitor patients under sedation, the remainder monitored often using clinical assessment and tools such as the Glasgow coma scale (47.3%) and the COMFORT scale (20.3%).¹³ In our study, the COMFORT scale was the most commonly preferred assessment tool. In 2003, Playfor et al¹⁴ conducted a survey, involving 18 PICUs in the United Kingdom, which showed that 50% of the centers had a written protocol for sedation in critically ill children. Sedation efficacy was found to be monitored in 40% of the centers using locally devised scoring tools, except for one that utilized the COMFORT scale. Midazolam was the most common preferred sedative. Morphine and fentanyl were the most commonly used analgesic agents. Propofol was preferred in cases of head injuries due to its rapid offset time to facilitate frequent neurological assessments.¹⁴ Centers in our study showed similar sedative and analgesic drug preferences, and similar COMFORT scale utilization rates for sedation monitoring. However, fewer centers in our study had a written protocol for sedoanalgesia.

Another study investigated sedation practices in prolonged mechanical ventilation among eight PICUs in Australia and New Zealand, which revealed that written protocols for sedation were present in 50% of the centers. The majority of centers (75%) preferred concomitant benzodiazepine and opiate use as their first-line regimen. All but one center chose continuous infusion combined with intermittent bolus dosing. Sedation efficacy was tested using BIS monitoring in only one center, and seven out of eight centers did not routinely screen patients for withdrawal symptoms using a validated tool.¹⁵ In comparison to this study, fewer centers in our study had a written sedation protocol, however drug choices and uncommon use of BIS monitoring were similar.

In 2007, 20 PICUs from the United Kingdom presented their data, which showed that the most common intravenous analgesic and sedative agents used were morphine (78%) and midazolam (55%), respectively. Enteral sedation was also performed on 55.5% of children, and the most commonly used enteral sedative agents were chloral hydrate, triclofos, and alimemazine. Propofol was preferred only for a minority of patients for which no adverse effects were reported. Withdrawal symptoms were alleviated by clonidine (17%), morphine (11%), chloral hydrate (11%), paracetamol or other nonsteroidal anti-inflammatory drugs (NSAIDs; 10%), diazepam (5%), fentanyl with midazolam (5%), and ondansetron with dexamethasone (2%).⁶ In comparison, drug preferences in our study were similar; however, enteral sedation preferences were not explored in our survey questionnaire.

A study of 19 PICUs from Italy showed the highest rate of sedation protocol presence (73.6%) and that a benzodiazepine-opioid combination was the first-line treatment of choice. In addition, the same study revealed that 63% of Italian PICUs did not use validated tools to assess sedoanalgesia. Remaining centers used the Ramsey scale (32%), the

COMFORT scale (21%), and the sedation agitation scale (16%). BIS was used only in case of curarization.¹⁶ Propofol was preferred as the first choice in 7% of the PICUs in that study; however, our data showed that propofol is not currently preferred by PICUs in Turkey for sedoanalgesia in critically ill children. A worldwide survey undertaken in 2010 similarly found benzodiazepines (particularly midazolam) and opiates were the first-line sedative options reported by the majority of participants.¹⁰ Interestingly, 2% of participants also reported the addition of propofol to that regimen. While physicians in the United States preferred fentanyl over morphine, the preferences of respondents from other countries were almost equal with regard to opiates.¹⁰ In our study, we found the most preferred first-line regimen to be similar; however, fentanyl was the predominant choice (88.9%). In the same study, it was also found that although 70% of participants had a written sedation scoring protocol in their PICU, only 42% included it in their daily practice. Furthermore, while 72% of physicians reported BIS was available in their units, only 4% consistently used this method in mechanically ventilated children.¹⁰ In contrast, the presence of a written sedation protocol is surprisingly absent from the majority of PICUs in Turkey, 59.2% of units never utilize BIS monitoring, and routine BIS is available in only 7.4% of them. The optimal monitoring modality for sedation in the PICU remains controversial. There is no gold standard for evaluating levels of sedation in critically ill patients. The most commonly used scales rely on a combination of hemodynamic and clinical variables, and some of these scales have not been validated in children for all ages. BIS monitoring can be particularly useful for achieving the correctly intended level of sedation in paralyzed or deeply sedated patients. It has been suggested that BIS monitoring may help clinicians to be aware of over- and undersedation. Our study showed a relatively low rate of BIS monitoring use in PICUs, and no testing of its performance in sedation monitoring. Only after improving the knowledge and assessment of this monitoring modality in our country, through further studies, may we better clarify its utility.

Delirium assessment rates were also evaluated in the study. It was shown that only 2% reported delirium screening was performed on regular basis.¹⁰ In contrast, routine delirium assessment, performed once or thrice a day, was reported in 22.2% of the PICUs in Turkey.

Preferences and clinical experiences of sedoanalgesia procedures have been reassessed over time. Twite et al¹¹ found that benzodiazepines and opiates remained the first-line sedative agents; however, experience with new drugs, such as remifentanyl and dexmedetomidine, was also observed. An increase in preference for ketamine, and a decrease in usage of pentobarbital, was noted. The study showed that a routine pain and agitation assessment and BIS for mechanically ventilated children was available in 85.7 and 20% of PICUs in the United States respectively.¹¹ These rates were superior to the data of the previous decade and comparable with our findings.^{11,13,14} Withdrawal symptoms were most commonly treated with methadone, lorazepam, diazepam, and clonidine. Intriguingly, methadone was not

chosen as first-line treatment for withdrawal in our study. This may be attributed to individual experience and easier accessibility to alternative agents.

Another survey conducted in the United States investigating sedation experiences among anesthesiologists and other professionals, including pediatric intensivists, emergency department physicians, and pediatricians, in patients undergoing short-term procedures. Propofol was the most common preferred agent, followed by ketamine and a combination of fentanyl and midazolam.¹⁷ In our study, ketamine was the most preferred first-line agent (81.4%) in short-term painful procedures, and the second option commonly included midazolam either alone or combined with opiates. Propofol preference was below 10%. This difference may be due to the inclusion of only pediatric intensivists in the survey, the concerns about the adverse effects of the drug and the diversity of the clinical experience of physicians among different specialties in the former study. Although choice of propofol rate seems to be very low in short procedures, this data may not indicate the real-time practices in PICUs.⁷

A more recent study from Canada revealed that 83 and 96% of participants were utilizing routine sedation and withdrawal assessment tools in their units respectively.¹⁸ In addition, 84% of respondents stated they did not routinely screen patients for delirium. Only 36% of physicians were found to have written sedoanalgesia protocols in their PICUs. Our results were comparable with that study; while routine assessment of sedation efficacy and withdrawal were applicable in the majority of PICUs, routine delirium screening was available in only 22.2%. The most commonly preferred regimen in the intubated child was a continuous infusion of midazolam and morphine. Chloral hydrate, diphenhydramine, and clonidine were the most frequently preferred adjuvant agents for inadequate sedoanalgesia, which was similar to our results. The major difference in this study was that propofol was used as continuous infusion by at least 60% of physicians, which is significantly higher than the relevant literature. Preferences for nonpharmacological comfort measures in intubated children were first investigated in the same study. The use of pacifiers was the most common method (83%), followed by TV/video, swaddling, music, sucrose solutions, and cuddling in upwards of 50% of the units.¹⁸ Our results were comparable to these findings, except the preference rates for TV, music, and oral sucrose solutions were slightly lower, and approximately 96% of respondent units chose parental stay at PICUs as a non-pharmacological approach.

Due to these results indicating differences among populations from the same countries, we should reconsider the need for general recommendations regarding sedoanalgesia in critically ill children, both under short-term procedures and mechanical ventilation. The best example came from Italy, with reported survey results after 2013 introducing recommendations for analgesia and sedation in PICUs.^{16,19} This study showed the adoption of a standardized protocol for sedoanalgesia, routine assessment of pain, and sedation efficacy in 70, 55, and 35% of the units, respectively. Despite

the lack of total adherence to the latest recommendations in Italy, the researchers postulated an increased adherence to standardized protocols with the more common use of scales.¹⁶ Our study showed that, although the procedures that take part in assessment of pain, delirium and withdrawal symptoms should be standardized using a common tool, our sedoanalgesia assessment practices were still compatible with the clinical recommendations of the European Society of Pediatric and Neonatal Intensive Care.²⁰ Sedoanalgesia practices were also similar to the recommendation proposed by Playfor et al, which advocate for routine pain assessment, continuous intravenous infusions of morphine or fentanyl, and adjuvant NSAIDs for analgesia. Continuous midazolam infusion was recommended for sedation as the first-line choice, and regular assessments of sedoanalgesia using validated scoring systems such as the COMFORT scale was also suggested.²¹

Scales including the SWS and OBWS, of which the former is no longer preferred while monitoring withdrawal symptoms, were utilized in a significant proportion of PICUs in our study. In a recent systematic review, validated tools for withdrawal assessment such as the WAT-1 and OBWS, were found to effectively detect withdrawal in critically ill pediatric patients.²² Garcia Guerra et al reported that the WAT-1 and Finnegan tool were the most commonly used withdrawal scores, whereas utilization of the Sophia observation withdrawal symptoms scale (SOS) and OBWS were reported to be rare.¹⁸ We think that such variability in scale selection could be handled by implementing standardized protocols for each center.

Limitations

Several limitations to this study need to be acknowledged. The sample size is small. However, with respect to the total number of PICUs in the country, the sample of 27 PICUs is actually representative. Another major limitation of this study is that this is a survey of treatment strategies, and does not focus on actual treatments applied over a specified period of time. Moreover, surveys can only characterize the opinions of respondents, rather than practices of the entire unit.

In addition, this study did not explore preferences in the use of neuromuscular blockade, it did not evaluate the benefits of different sedoanalgesia regimens, nor did it expand upon the reliability of scales used for pain, sedation efficacy, withdrawal, and delirium assessment. Nonetheless, we believe that the insights gained from this study may be of assistance to further research on the development of a national guideline for sedoanalgesia practices in children and future prospective evaluation of changes in real-world practices.

Conclusion

In conclusion, although sedative and analgesic agent preferences in our study were found to be comparable with the findings described in other published surveys, with the exception of a few differences among countries, fewer PICUs

adopted written protocols on sedation and analgesia in Turkey than in the reported literature. We also found great variability in the scales used by hospitals to assess pain and sedation, but there were not many differences with the analgesic and sedative agents used. Few PICUs had written protocols to treat iatrogenic withdrawal and delirium. Similar to the beliefs of other researchers, we believe that scales should be standardized for certain scenarios in PICUs, and that BIS utilization should be encouraged. Future efforts should be focused on implementation of standardized management and assessment strategies for withdrawal and delirium.

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Conflict of Interest

None declared.

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