MATHEWS JOURNAL OF PEDIATRICS

Review Article

ISSN: 2572-6560

Vol No: 4, Issue: 2

Received Date: Jun 3, 2019

Published Date: Nov 18, 2019

Cristina García-Muro[1]*

Eduardo Esteban-Zubero[2]*

Moisés Alejandro Alatorre-Jiménez[3]

Carlos Arturo López-García[4]

Alejandro Marín-Medina[5]

[1]Medical Doctor in Department of Pediatrics of Hospital San Pedro, Logroño, Spain

[2]Medical Doctor in Emergency Department of Hospital San Pedro, Logroño, Spain

[3]Department of Pediatrics, SUNY Downstate, Brooklyn, NY, USA

[4]Department of Pathology, Hospital San Jose-TecSalud, Monterrey, Nuevo León, Mexico

[5]Department of Genetics, Western biomedical research center, Mexican Institute of Social Security, Guadalajara, Mexico

Corresponding Author:

Cristina García-Muro*

Pediatrics Department of Hospital San Pedro. Calle Piqueras 98. ZIP Code: 26006. Logroño, Spain.

Eduardo Esteban-Zubero*

Emergency Department of Hospital San Pedro, Calle Piqueras 98. ZIP Code: 26006. Logroño, Spain.

Procedural Sedation and Analgesia in Pediatric Emergencies

ABSTRACT

Procedural sedation and analgesia (PSA) involves all the treatments leaded to mitigate pain and anxiety. These symptoms are especially related with several consultations in Pediatric Emergencies. Historically, PSA has been underestimated and undertreated. Nevertheless, recently, there has been a growing interest in improving the proper management of pain and anxiety in children. These researches has been realized by both personal health specialized in sedative/anesthetics process and not.

The purpose of this mini-review is to summarize the role of PSA in children. To reach it, we are going to describe briefly pain assessment as well as the degree of sedation with different scales, and the different treatments, including pharmacological and non-pharmacological interventions. All these principles will be commented attending to the safety and effectiveness.

Keywords: Sedation; Analgesia; Anxiety; Pain; Pediatric; Pediatric Emergencies.

INTRODUCTION

Pain and anxiety are related with several consultations in Pediatric Emergencies. Pain, or the fear of suffering it, is the main cause of suffering and anxiety in children who come to the Emergency Department [1].

Historically pain has been underestimated and undertreated in Pediatrics [2]. However, in recent decades, there has been a growing interest in improving the proper management of pain and anxiety in children, until in recent years it has reached the conclusion that procedural sedation and analgesia (PSA) should be a priority of Pediatric Emergency Services [1,2].

Pain is defined as an unpleasant sensory and emotional experience, which is associated with actual or potential bodily harm. It is a complex phenomenon, subjective and whose assessment in the pediatric age differs from that of the adult, implying an additional difficulty [3]. Analgesia is the absence or suppression of any painful sensation without loss of the other modes of sensation [4]. Sedation is defined as the use of analgesic, anxiolytic or sedative drugs to reduce pain, anxiety or movement and thus facilitate the performance of diagnostic or therapeutic procedures, provide an adequate degree of amnesia or decrease in consciousness, or guarantee the patient safety. The degree of sedation may vary from mild to deep or anesthesia [5].

DOI: https://doi.org/10.30654/MJP.10021

The purpose of this mini-review is to summarize the role of PSA in children, especially in procedures developed in the Emergency Department.

PAIN ASSESSMENT IN PEDIATRICS

The systematic assessment of pain in pediatric emergencies should be considered as part of the evaluation of the patient, considering it a parameter of good clinical practice [6]. In addition, the measurement of pain intensity is necessary to apply the adequate and proportionate therapies of PSA to this pain [1,2].

As previously mentioned, this assessment in Pediatrics presents a greater complexity than in adults, due to the inability of children to express their fears and concerns, and ignorance about the procedures that will be performed [3]. In addition, it also differs according to age (neonate, infant, child), since the way of expressing this pain and the manifestations will be different [3,7].

To facilitate the evaluation of pain in Pediatrics, several scales have been developed and validated, different for each age group [8]. Objective scales assess the child's attitudes and behavior in the face of pain, and both the emotional component and the sensory component of pain are evaluated. Within this group are included the FLACC (Face, Legs, Activity, Cry, Consolability) scale **(Table 1)** and the OSBD (Observational Scale of Behavioral Distress), among others. Also in this section we could include pain assessment scales in neonates, among which the CRIES (Children's Revised Impact of Event Scale) scale or PIPP (premature infant pain profile), which also include objective parameters such as oxygen saturation of the blood, heart rate or blood pressure [9].

On the other hand, we have the subjective scales, in which the child defines his own pain. These tools for self-assessment of pain, more similar to those used in adults and can only are used from 3-4 years. Within this group are the visual analog scale, the scale of faces or facial drawings, and the numerical scale [10].

ASSESSMENT OF THE DEGREE OF SEDATION

When PSA procedure is realized, an assessment of the level of sedation reached by the patient should be made. Classically, 4 levels of sedation are described, which are detailed in **(Table 2)** [11].

Table 1: FLACC pain assessment scale (Face, Legs, Activity, Cry, Consolability).

	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaints	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or "talking to". Distractable	Difficult to console or comfort

Table 2: Assessment of the level of sedation reached by the patient.

Sedation level	Minimal sedation (anxiolysis)	Moderate sedation	Deep sedation	General anesthesia
Responsiveness	Normal	Verbal or tactile stimuli	Repeated painful stimuli	Unresponsive to painful stimuli
Airway	Normal	No intervention required	Intervention may be required	Intervention usually required
Spontaneous ventilation	Normal	Adequate	May be inadequate	Usually inadequate
Cardiovascular function	Normal	Normal	Usually maintained	May be impaired

There are numerous rating scales for sedation, which give a score based on the observation of clinical signs. These scales relate the different degrees of sedation with the patient's response to stimuli of various kinds. Within these scales, one of the most used for its simplicity of application is the Ramsay scale **(Table 3)** [12]. There are other more complex scales, such as the COMFORT scale, which also incorporate physiological parameters. However, its application is more expensive, which does not make them very practical for use in urgent PSA procedures [13].

DOI: https://doi.org/10.30654/MJP.10021

Table 3: Ramsay sedation scale.

Level	Response
Awake	
1	Anxious, agitated or restless
2	Cooperative, accepting ventilation, oriented, or tranquil
3	Resonds only to commands
Asleep	
4	Brisk response to light, glabella tap or loud noise
5	Sluggish response to light, glabella tap, or loud noise
6	No response to light, glabella tap, or loud noise

The assessment of the degree of sedation using these described scales always has a subjective component [14]. There are other valuation methods that give us more objective information, such as the bispectral index (BIS). It is a non-invasive method that provides us with a value that evaluates the degree of sedation of the patient by analyzing the wave frequencies of the electroencephalogram. It is a method used in intensive care units to assess the degree of sedation in patients for various reasons, so its application in emergency services has not yet been generalized [15].

CHOICE OF TREATMENT

There is a wide range of pharmacological options when performing urgent PSA procedures. The choice of drug will depend on the type of procedure that will be carried out (painful or not painful), the characteristics of the patient (age, attitude) and the experience of the responsible physician [16].

For non-painful procedures where is only necessary to reduce the child's anxiety and avoid movements, are usually used anxiolytic drugs. In slightly painful techniques in which the only objective is analgesia, we can use topical anesthetics or assess the inhaled nitric oxide, which also provides a level of anxiolysis that may be desirable in some cases [17]. If we are dealing with procedures that generate moderate or intense pain we will have to use more powerful analgesic drugs (opioids), and sometimes two drug associations (opioids and sedatives) [18].

In addition, within sedative drugs, we will choose one or the other, as well as the route of administration, depending on the degree of sedation desired [19]. For a minimum degree of sedation or anxiolysis we may use midazolam at low doses by any of its routes of administration (oral, intranasal, intravenous or rectal) or nitrous oxide inhaled. If on the contrary we intend a moderate or deep sedation we will use midazolam at higher doses, propofol, etomidate, chloral hydrate, or even a combination of drugs (midazolam and fentanyl, propofol and fentanyl, etc.) [20,21]. **(Table 4)** shows the doses of the drugs most commonly used in pediatric PSA procedures.

The pharmacological offer is wide, so it is important that the doctor and the nursing staff are familiar with a few drugs, since in this way we minimize errors in both preparation and dosing of these drugs [20].

Table 4: Doses of the drugs most commonly used in pediatric procedural sedation and analgesia procedures.

Drug	Route of administration	Dose
Midazolam	Oral Intranasal Intravenous Intramuscular	0,5 mg/kg 0,3-0,4 mg/kg 0,02-0,2 mg/kg 0,1-0,3 mg/kg
Fentanyl	Intranasal Subcutáneo Sublingual Intravenous	1-3 µg/kg 1-3 µg/kg 1-3 µg/kg 1-5 µg/kg
Propofol	Intravenous	0,5-1 mg/kg
Chloral hydrate	Oral Rectal	25-50 mg/kg 25-50 mg/kg

NON-PHARMACOLOGICAL ANALGESIA AND SEDATION

Non-pharmacological analgesia and sedation are a series of prophylactic and complementary measures that aim to reduce pain and anxiety in children, and do not involve the administration of medication [22]. The mechanism of action of these maneuvers is varied: release of endorphins, activation of neuropeptide systems with opioid-enhancing action, or simply distraction from pain [22].

Since the 90s there has been a growing interest in this type of analgesia, especially in neonates and infants, although its application has been extrapolated to older children to minimize pain and the use of drugs [23].

The measures used vary according to age [24]:

- In neonates and infants it is essential to maintain a calm and comfortable environment (control of light and noise), to allow the company of parents, to use toys or objects that comfort him, use of non-nutritive suction (pacifier) or breastfeeding, or even carrying out the procedure in the parents' arm if possible.
- In preschool and school children the presence of parents is also of great help, as well as giving clear explanations and that they can understand about the procedure they are going to perform, the use of distraction and relaxation, etc.

DOI: https://doi.org/10.30654/MJP.10021

- In the case of adolescents, it is essential to establish a good relationship with them prior to the procedure, favoring their collaboration. It is also important to answer all your questions, encouraging them to ask. The use of relaxation and distraction may also be of great help in this age group.

SECURITY

The efficacy of PSA procedures depends on the proper use of analgesic and/or sedative medications [25]. International guidelines recommend that the physician in charge of a sedation-analgesia procedure must be familiar with the drugs, be trained to carry out a resuscitation in patients with a level of sedation greater than desired and qualification to solve complications or adverse effects that may occur in these situations [26].

Sedation procedures pose risks (respiratory depression, hypoxia, apnea, laryngospasm, bronchospasm, broncho-pulmonary aspiration, hemodynamic instability, etc.) that must be taken into account. For this reason, adequate monitoring of both the level of consciousness, ventilation and oxygenation, and hemodynamic parameters is important. This allows early recognition of complications, which facilitates the rapid onset of timely resuscitation maneuvers [27,28].

To assess the level of consciousness, the patient's response to various stimuli (verbal, tactile and painful) must be assessed, for which there are also scales, one of the most used is Ramsay's, previously mentioned [12]. Ventilation will be evaluated clinically by pulmonary auscultation and observation of chest movements and respiratory rate. More recently, it has been shown that the use of capnography to monitor exhaled CO_2 in patients undergoing moderate or deep sedation procedures allows the detection of episodes of hypoventilation, so that their incorporation into the routine monitoring of these patients may improve the safety of these procedures [29]. For the monitoring of oxygenation pulse oximetry is used, in addition to the clinical assessment of visual form (coloration of skin and mucous membranes). Finally, we must perform heart rate and blood pressure controls before starting these procedures and during their entire duration if they extend over time or sedation reached is at least moderate. If possible, continuous monitoring of these parameters will be carried out [30].

REFERENCES

1. Young VB. (2017). Effective Management of Pain and Anxiety for the Pediatric Patient in the Emergency Department. Crit Care Nurs Clin North Am. 29(2): 205-216.
2. Gaglani A and Gross T. (2018). Pediatric Pain Management. Emerg Med Clin North Am. 36(2): 323-334.
3. Merritt C. (2014). Fear and loathing in the ER: managing procedural pain and anxiety in the Pediatric Emergency Department. R I Med J (2013). 97(1): 31-34.
4. Krauss BS, Calligaris L, Green SM and Barbi E. (2016). Current concepts in management of pain in children in the emergency department. Lancet. 387(10013): 83-92.
5. Kraemer FW and Rose JB. (2009). Pharmacologic management of acute pediatric pain. Anesthesiol Clin. 27(2): 241-268.
6. O'Donnell FT and Rosen KR. (2014). Pediatric pain management: a review. Mo Med. 111(3): 231-237.
7. Shavit I, Keidan I and Augarten A. (2006).The practice of pediatric procedural sedation and analgesia in the emergency department. Eur J Emerg Med. 13(5): 270-275.
8. Beltramini A, Milojevic K and Pateron D. (2017). Pain Assessment in Newborns, Infants, and Children. Pediatr Ann. 46(10): e387-e395.
9. Cohen LL, Lemanek K, Blount RL, Dahlquist LM, et al. (2008). Evidence-based assessment of pediatric pain. J Pediatr Psychol. 33(9): 939-955.
10. Bailey B, Bergeron S, Gravel J and Daoust R. (2007). Comparison of four pain scales in children with acute abdominal pain in a pediatric emergency department. Ann Emerg Med. 50(4): 379-383.
11. Míguez Navarro C, Oikonomopoulou N, Lorente Romero J, Vázquez López P, et al. (2018). [Preparation of sedation-analgesia procedures in spanish paediatric emergency departments: A descriptive study]. An Pediatr (Barc). 89(1): 24-31.
12. Poropat F, Cozzi G, Magnolato A, Monasta L, et al. (2018). Teaching pain recognition through art: the Ramsay-Caravaggio sedation scale. Ital J Pediatr. 44(1): 20.

DOI: https://doi.org/10.30654/MJP.10021

13. Johansson M and Kokinsky E. (2009). The COMFORT behavioural scale and the modified FLACC scale in paediatric intensive care. Nurs Crit Care. 14(3): 122-130.

14. Sloman R, Wruble AW, Rosen G and Rom M. (2006). Determination of clinically meaningful levels of pain reduction in patients experiencing acute postoperative pain. Pain Manag Nurs. 7(4): 153-158.

15. Dominguez TE and Helfaer MA. (2006). Review of bispectral index monitoring in the emergency department and pediatric intensive care unit. Pediatr Emerg Care. 22(12): 815-821.

16. Shavit I and Hershman E. (2004). Management of children undergoing painful procedures in the emergency department by non-anesthesiologists. Isr Med Assoc J. 6(6): 350-355.

17. Pedersen RS, Bayat A, Steen NP and Jacobsson ML. (2013). Nitrous oxide provides safe and effective analgesia for minor paediatric procedures--a systematic review. Dan Med J. 60(6): A4627.

18. Smally AJ, Nowicki TA and Simelton BH. (2011). Procedural sedation and analgesia in the emergency department. Curr Opin Crit Care. 17(4): 317-322.

19. Pitetti RD, Singh S and Pierce MC. (2003). Safe and efficacious use of procedural sedation and analgesia by nonanesthesiologists in a pediatric emergency department. Arch Pediatr Adolesc Med. 157(11): 1090-1096.

20. Misra S, Mahajan PV, Chen X and Kannikeswaran N. (2008). Safety of procedural sedation and analgesia in children less than 2 years of age in a pediatric emergency department. Int J Emerg Med. 1(3): 173-177.

21. Harvey M, Cave G and Betham C. (2011). Contemporary sedation practice in a large New Zealand emergency department. N Z Med J. 124(1344): 36-45.

22. Krieser D and Kochar A (2016). Paediatric procedural sedation within the emergency department. J Paediatr Child Health. 52(2): 197-203.

23. Kato Y, Maeda M, Aoki Y, Ishii E, et al. (2014). Pain management during bone marrow aspiration and biopsy in pediatric cancer patients. Pediatr Int. 56(3): 354-359.

24. Scherrer PD (2011). Safe and sound: pediatric procedural sedation and analgesia. Minn Med. 94(3): 43-47.

25. Thompson EM, Andrews DD and Christ-Libertin C. (2012). Efficacy and safety of procedural sedation and analgesia for burn wound care. J Burn Care Res. 33(4): 504-509.

26. Leroy PL, Gorzeman MP and Sury MR. (2009). Procedural sedation and analgesia in children by non-anesthesiologists in an emergency department. Minerva Pediatr. 61(2): 193-215.

27. Metzner J and Domino KB. (2010). Risks of anesthesia or sedation outside the operating room: the role of the anesthesia care provider. Curr Opin Anaesthesiol. 23(4): 523-531.

28. Cravero JP. (2009). Risk and safety of pediatric sedation/anesthesia for procedures outside the operating room. Curr Opin Anaesthesiol. 22(4): 509-513.

29. Langhan ML, Shabanova V, Li FY, Bernstein SL, et al. (2015). A randomized controlled trial of capnography during sedation in a pediatric emergency setting. Am J Emerg Med. 33(1): 25-30.

30. Minardi C, Sahillioğlu E, Astuto M, Colombo M, et al. (2012) Sedation and analgesia in pediatric intensive care. Curr Drug Targets. 13(7): 936-43.

Copyright: García-Muro C, et al. © 2019. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: https://doi.org/10.30654/MJP.10021