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].
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>
<thead>
<tr>
<th>Sedation level</th>
<th>Minimal sedation (anxiolysis)</th>
<th>Moderate sedation</th>
<th>Deep sedation</th>
<th>General anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsiveness</td>
<td>Normal</td>
<td>Verbal or tactile stimuli</td>
<td>Repeated painful stimuli</td>
<td>Unresponsive to painful stimuli</td>
</tr>
<tr>
<td>Airway</td>
<td>Normal</td>
<td>No intervention required</td>
<td>Intervention may be required</td>
<td>Intervention usually required</td>
</tr>
<tr>
<td>Spontaneous ventilation</td>
<td>Normal</td>
<td>Adequate</td>
<td>May be inadequate</td>
<td>Usually inadequate</td>
</tr>
<tr>
<td>Cardiovascular function</td>
<td>Normal</td>
<td>Normal</td>
<td>Usually maintained</td>
<td>May be impaired</td>
</tr>
</tbody>
</table>

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].


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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].

**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.

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**Table 3:** Ramsay sedation scale.

<table>
<thead>
<tr>
<th>Level</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awake</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Anxious, agitated or restless</td>
</tr>
<tr>
<td>2</td>
<td>Cooperative, accepting ventilation, oriented, or tranquil</td>
</tr>
<tr>
<td>3</td>
<td>Resonds only to commands</td>
</tr>
<tr>
<td>Asleep</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Brisk response to light, glabella tap or loud noise</td>
</tr>
<tr>
<td>5</td>
<td>Sluggish response to light, glabella tap, or loud noise</td>
</tr>
<tr>
<td>6</td>
<td>No response to light, glabella tap, or loud noise</td>
</tr>
</tbody>
</table>

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].

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

<table>
<thead>
<tr>
<th>Drug</th>
<th>Route of administration</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midazolam</td>
<td>Oral</td>
<td>0,5 mg/kg</td>
</tr>
<tr>
<td></td>
<td>Intranasal</td>
<td>0,3-0,4 mg/kg</td>
</tr>
<tr>
<td></td>
<td>Intravenous</td>
<td>0,02-0,2 mg/kg</td>
</tr>
<tr>
<td></td>
<td>Intramuscular</td>
<td>0,1-0,3 mg/kg</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>Intranasal</td>
<td>1-3 µg/kg</td>
</tr>
<tr>
<td></td>
<td>Subcutaneous</td>
<td>1-3 µg/kg</td>
</tr>
<tr>
<td></td>
<td>Sublingual</td>
<td>1-3 µg/kg</td>
</tr>
<tr>
<td></td>
<td>Intravenous</td>
<td>1-5 µg/kg</td>
</tr>
<tr>
<td>Propofol</td>
<td>Intravenous</td>
<td>0,5-1 mg/kg</td>
</tr>
<tr>
<td>Chloral hydrate</td>
<td>Oral</td>
<td>25-50 mg/kg</td>
</tr>
<tr>
<td></td>
<td>Rectal</td>
<td>25-50 mg/kg</td>
</tr>
</tbody>
</table>

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• 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\textsubscript{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


