

Pain Assessment in Newborns, Infants, and Children

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ABSTRACT

Pain in children is underestimated and undertreated because of lack of pain assessment tools. Pain assessment depends on the cognitive development of the child being tested, clinical context, and pain typology. For children older than age 6 years, pain assessment is based on a self-report. For children younger than age 6 years, behavioral pain scales are needed to assess pain. Numerous pain scales exist. Many are reliable and some are recommended, but all have specific conditions for their use. In this article, we review the available pain scales for children from birth to adolescence. We provide the validity criteria of each pain scale to help caregivers use the adapted tools. We then propose a synthesis of the reliable tools to use based on the pain context. [*Pediatr Ann.* 2017;46(10):e387-e395.]

Despite progress, pain remains underestimated and undertreated in children. One of the main obstacles to treating pain is the lack of dissemination of available assessment tools.¹ According to recommendations for treatment, the pain must be detected, located, quantified, and reassessed; its acute or chronic nature defined; and its cause determined.¹⁻³ The age and cognitive development of the child influences the pain assessment. Self-reported pain intensity is the gold standard for children older than age 6 years; for younger

children, the use of behavioral pain scales is mandatory.

Numerous pain scales exist, and each one has been validated according to specific methodology. Each pain rating scale has specific psychometric properties as well. The reliability of the tool depends on the clinical context and the quality of the validity criteria, which guides the caregiver in choosing the correct tool.

This article reviews the methodology and validity criteria for pain scales for children from birth to adolescence. It

provides a synthesis of the scales with strong validation criteria depending on the clinical setting for their use.

BACKGROUND

During development, a child acquires the ability to identify the pain stimulus, locate it, quantify it, and finally verbalize its painful sensation. Pain induces behavioral, physiological, and metabolic changes. The expression of pain in children younger than age 6 years is essentially nonverbal and bodily. Behavioral pain scales involve observing the child to assess pain. Some others use physiological variations to detect pain. However, facial expressions, bodily movements, and physiological modification can also be present when a child experiences hunger, fear, anxiety, and cold.¹⁻⁴

Different types of pain exist: (1) acute pain, resulting from a pathology, trauma, or pain from a medical procedure, (2) prolonged pain, and (3) chronic pain. Each pain rating scale has been validated in a specific context. Some scales are polyvalent and have been validated by several studies in different contexts. Some scales measure the discomfort of the newborn or infant.

The ideal pain assessment tool would be sensitive and free from bias; have good internal consistency, good interrater reliability, and good construct and discriminant validity; and be easy to understand and use for all children and for all types of pain in all clinical settings.⁴ No scale has all of these attributes, and very few scales possess both strong validity criteria and are polyvalent.

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PAIN ASSESSMENT SCALES FOR NEWBORNS AND INFANTS

In newborns and infants, pain assessment scales must be able to detect pain, locate it, and quantify it. The following text explains how that can be done.

Location of Pain

To locate pain in children, the clinician uses observation and examination techniques such as analgesic positions, avoidance, or induced crying. However, the caregiver's experience is also fundamental for locating pain.¹

Pain Intensity

Only behavioral pain scales require contributions from children. They require caregivers' experience, knowledge of the infant's usual behavior (outside a painful context), and sufficient observation time. Often, parents help clinicians assess an unusual behavior.

Acute pain and procedural pain.

There are seven scales used to measure acute pain and procedural pain in newborns and infants (**Table 1**) (although only five are discussed in this section as the other two can also be used in older children and therefore are examined later in this article).

Premature infant pain profile. The Premature Infant Pain Profile (PIPP) has been validated in term and preterm newborns for acute pain and procedural pain.⁵ It is comprised of three items on facial expression and two items on variations in physiological constants. The pain threshold is weighted by gestational age and quality of sleep. This assessment can be optimized by video recording. The observation time is prolonged and requires knowledge of the infant's usual behavior.

Neonatal facial coding system. The Neonatal Facial Coding System (NFCS) was originally validated with 10 facial expression items for acute pain in pre-

term and term newborns and infants up to age 18 months,⁶ it was simplified to only four facial expression items: brow bulge, eyes squeeze, naso-labial furrow, and open lips. The tool is easy to use, reliable, fast, and results are reproducible.

Evaluation enfant douleur. The Evaluation Enfant Douleur (EVENDOL) scale has been validated for acute pain and procedural pain in children age 0 to 7 years in an emergency setting, in out-of-hospital emergency medicine, and in postoperative care^{7,8} (**Table 2**). It has four behavioral items and one item related to the environment. Caregivers should note everything observed, even if they think the symptoms are not due to pain but to fear, fatigue, or illness. It is easy to use, reliable from age 0 to 7 years, and is not influenced by hunger, fever, or fear.

Douleur aigue du nouveau-né. The Douleur Aigue du Nouveau-né (DAN) scale has been validated for acute pain and procedural pain in preterm, term newborns, and infants up to age 3 months.⁹ It is reliable and easy to use. It is used in French intensive care units but has not been validated in English-speaking countries.

Neonatal infant pain scale. The Neonatal Infant Pain Scale (NIPS) has been validated in 190 newborns from 25 to 47 weeks of gestational age with excellent intra-class correlation.¹⁰ It is suitable for infants younger than age 1 year.

Prolonged pain and discomfort.

Neonatal pain and discomfort scale. The Neonatal Pain and Discomfort Scale (NPDS) has been validated in 126 term and preterm newborns.¹¹ It evaluates prolonged pain, stress, and discomfort. It is easy to use and reliable. It requires knowing the baseline behavior of newborns 1 to 4 hours before they express pain. It is widely used in French intensive care units (**Table 3**).

Pain in sedated or unconscious newborns and infants.

COMFORT behavior scale. The COMFORT Behavior Scale is used to monitor excess sedation in children from birth to adolescence, intubated ventilated or unconscious children in intensive care units, and in the postoperative setting.¹² It assesses prolonged acute pain, discomfort, and distress. It includes eight items (with three physiological items). This scale takes a long time to administer and is not reliable with curarization or paralysis. A version without blood pressure and heart frequency items was created because of the nonspecific variations of these features and is easier to use and more reliable.

Postoperative pain.

Evaluation enfant douleur and children and infants postoperative pain scale. Several postoperative behavioral pain scales have good validity criteria, but EVENDOL and the Children and Infants Postoperative Pain Scale (CHIPPS) are more polyvalent and assess all infants younger than age 1 year (**Table 4**).¹³ CHIPPS has also been validated for postoperative pain in children age 0 to 5 years. It includes only behavioral items.

Amiel Tison scale. This has been validated in children age 1 to 7 months (usable from age 0 to 3 years) in an immediate postoperative setting with 10 items. Its disadvantages are the limited age of children, the fact that the score is reversed, and its heterogenic psychometric properties.¹⁴

Crying, requires increased oxygen administration, increased vital signs, expression, sleeplessness. The Crying, Requires increased oxygen administration, Increased vital signs, Expression, Sleeplessness (CRIES) scale has been validated in newborns from 32 weeks gestational age to age 6 months in in-

TABLE 1.

Behavioral Pain Scales in Acute and Procedural Pain by Child’s Age

Scale	Age									
	NB	1 mo	3 mo	6 mo	12 mo	18 mo	24 mo	4-5 y	6 y	12-15 y
PIPP	+									Self- assessment
NIPS	+									
DAN	+	+	+							
NFCS	+	+	+	+	+	+				
EVENDOL	+	+	+	+	+	+	+	+	+	
FLACC			+	+	+	+	+	+	+	
CHEOPS					+	+	+	+	+	

CHEOPS, Children’s Hospital of Eastern Ontario Pain Scale; DAN, Douleur Aigue du Nouveau-né EVENDOL, Evaluation Enfant Douleur; FLACC, Face, Legs, Activity, Cry, Consolability; NB, newborn; NFCS, Neonatal Facial Coding System; NIPS, Neonatal Infant Pain Scale; PIPP, Neonatal Infant Pain Scale.

TABLE 2.

EVENDOL Pain Scale

Behavioral and Environmental Expressions	Sign Absent	Sign Weak or Transient	Sign Moderate or Present About Half the Time	Sign Strong or Present Almost All the Time
Vocal or verbal expression Cries, screams, moans, complains of pain	0	1	2	3
Facial expression Furrowed forehead, frown, furrowed or bulging brow, tense mouth	0	1	2	3
Movements Restlessness, agitation, rigidity, muscular tension	0	1	2	3
Postures Unusual and/or antalgic posture, protection of the painful area, immobility	0	1	2	3
Interaction with the environment Can be comforted, interested in playing, interacts with people	Normal 0	Low 1	Very low 2	Absent 3

Abbreviation: EVENDOL, Evaluation Enfant Douleur.
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tensive care units.¹⁵ CRIES (Crying, Requires increased oxygen administration, Increased vital signs, Expression, Sleeplessness) has 10 points (similar to Appearance, Pulse, Grimace, Activity, and Respiration [APGAR] scoring). The

validity criteria are less strong than with the EVENDOL or CHIPPS.

Clinical examples of pain assessment.

Venous puncture. A newborn has the following behavior: tightness of body,

brow bulge, eye squeeze, withdrawal movement, intermittent moans, and loss of interest in its surrounding environment. Behavioral pain scales give the following scores: NFCS 3/4, NIPS 5/7, DAN 8/10, EVENDOL 11/15. The

TABLE 3.

Behavioral Pain Scales in Prolonged Pain by Child’s Age

Scale	Age										
	NB	1 mo	3 mo	9 mo	12 mo	18 mo	24 mo	4-5 y	6 y	12 y	15 y
NPDS	+									Self-assessment	Self-assessment
DEGR				+	+	+	+	+	+	+	Self-assessment
HEDEN				+	+	+	+	+	+	+	Self assessment

Abbreviations: DEGR, Gustave-Roussy Child Pain Scale; HEDEN, Hetero-Assessment of Child Pain; NB, newborn, NPDS, Neonatal pain and discomfort scale.

TABLE 4.

Behavioral Pain Scales in Postoperative Pain by Child’s Age

Scale	Age									
	NB	1 mo	3 mo	6 mo	12 mo	18 mo	24 mo	4-5 y	6 y	12-15 y
CRIES	+									Self-assessment
Amiel Tison		+	+	+						
CHIPPS	+	+	+	+	+	+				
EVENDOL	+	+	+	+	+	+	+	+	+	
CFCS						+	+	+	+	
BOPS					+	+	+	+	+	
OPS					+	+	+	+	+	
TPPPS					+	+	+	++		
POSYC					+	+	+	+		

Abbreviations: BOPS, Behavioral Observational Pain Scale; CFCS, Child Facial Coding System; CHIPPS, Children and Infants Postoperative Pain Scale; CRIES, Crying, Requires increased oxygen administration, Increased vital signs, Expression, Sleeplessness; EVENDOL, Evaluation Enfant Douleur; OPS, Objective Pain Scale; POSYC, Pain Observation Scale for Young Children; TPPPS, The Postoperative Pain Measure for Parents.

PIPP (16/21) scale requires heart frequency and oxygen saturation variations. All these scales detect pain in this child.

Abdominal pain and necrotizing enterocolitis. A premature newborn changes his behavior during the abdominal palpation examination and shows the slightest mobilization: crying, brow bulge, eye squeeze, open lips, protection of painful area, tenseness, and consolability reduced but possible. At rest, the infant displays the following behaviors: calm, alternating closing and soft opening of

eyes, restrained movements, no crying, antalgic posture, and restrained interaction with the environment. During mobilization, all of the pain scales (ie, NFCS, PIPP, DAN, NIPS) detect pain, but at rest only EVENDOL (6/15) and NPDS (7/15) detect pain in a prostrate newborn. Their tools quantify the lack of relationship with the environment, prostration, and immobility.

Noninvasive ventilation. A premature newborn has the following behavior: intermittent agitation, sleep interrupted by spontaneous awaken-

ings, intermittent grimaces, moaning, and calming down with difficulty. The Échelle Douleur Inconfort Nouveau-Né (EDIN) scale (6/15) shows that the newborn is experiencing pain not and not just discomfort.

PAIN ASSESSMENT SCALES FOR CHILDREN

Location of Pain

Children older than age 4 years can show, verbalize, or draw the painful site. In children younger than age 4 years, the caregivers need to observe and examine to locate the painful site.²

Intensity of Pain

Self-assessment scales

Self-assessment scales are only reliable after age 6 years because they require cognitive and language skills. Between ages 4 and 6 years, the use of several self-reporting pain tools is recommended.^{1,2,4}

Visual analog scale. Self-reporting using the The Visual Analog Scale (VAS) is the gold standard and is the most validated tool. The vertical version is more suitable for children (**Figure 1**).

Numerical rating scale. The child must know how to count and be able to transcribe the intensity of the pain in numbers to use this scale.

Verbal rating scale. This scale contains a list of adjectives describing different levels of pain intensity rated on a 4-point scale: 0, no pain; 1, mild; 2, moderate; 3, severe. The scales were recently developed for children older than age 8 years.

Faces pain scale. This scale represents faces in 5 levels of pain.¹⁶ The absence of standardized representation of painful facial expression is a limit. The faces can represent feelings such as joy, sadness, or anger and not just pain.

Poker chips. Poker-like chips are offered to the child, and the amount of chips taken is proportional to the intensity of the pain. The instruction to the child is “each chip represents a piece (or a piece of pain). Take as many chips as you hurt.”

Drawing. A color system allows for distinguishing 4 levels of pain with their respective locations.

When communication is impossible or the self-report is discordant, the clinician must use a behavioral pain scale.

Behavioral pain scales used in children.

Acute pain and procedural pain. The Children’s Hospital of Eastern Ontario

Pain Scale (CHEOPS) is validated for acute postoperative and procedural pain in children from age 1 to 5 years.¹⁷ It is easy to use, fast, reproducible, and has good sensitivity and specificity (**Table 1**).

EVENDOL is validated in children younger than age 7 years when self-assessment is not reliable, which is an important advantage compared with other tools.^{7,8}

The Faces, Legs, Activity, Cry, and Consolability (FLACC) scale was recently validated in children age 6 months to 5 years with acute pain in different settings with good validity criteria for acute pain in critically ill children^{18,19} It is easy to use, polyvalent, and reliable but has not been validated in term or preterm newborns.

Postoperative pain. The Child Facial Coding System was inspired by the Neonatal Facial Coding System and uses facial expressions to assess pain in children older than age 18 months and up to age 6 years.²⁰ The combination of these two scales based on facial expressions is interesting because it allows for assessing children from age 0 to 6 years; however, no study has validated this association.

EVENDOL, CHIPPS, and FLACC¹⁸ can also be used in the postoperative pain setting.¹⁸

The Behavioral Observational Pain Scale was validated in 76 children age 1 to 7 years in a surgical care unit and a neurosurgical postoperative care unit. It is reliable and easy to use.²¹

The Objective Pain Scale (OPS) was validated for postoperative pain in children age 1 to 13 years.²² It is comprised of physiological items but is not specific. Many use it without blood pressure variation but this has not been validated.

The Toddler Preschooler Postoperative Pain Scale has been validated

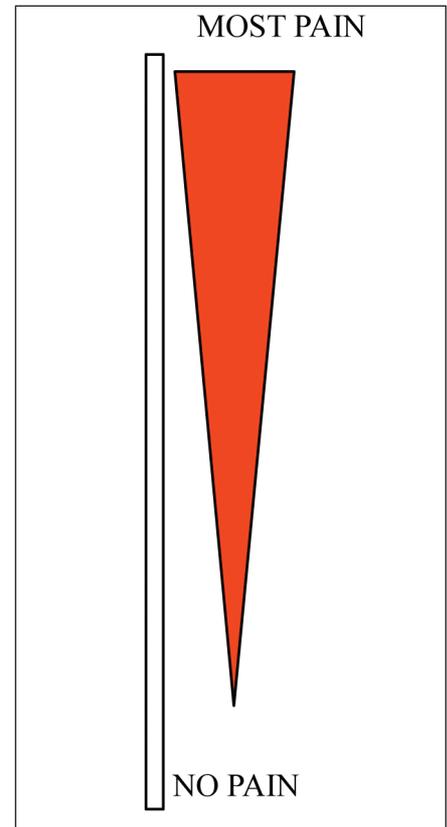


Figure 1. The Visual Analog Scale.

in children age 1 to 5 years in an immediate postoperative setting and has seven behavioral items.²³ The observational time required is >5 minutes.

The Pain Observation Scale for Young Children assesses postoperative pain (otorhinolaryngology surgery) in children age 1 to 4 years.²⁴ It consists of seven behavioral items.

The Postoperative Pain Measure for Parents has 15 items and is used by parents after children return home.²⁵ It is reliable and was initially validated for children age 7 to 12 years. A simplified version with 10 items for children older than age 1 year has been proposed and validated (**Table 4**).

Prolonged pain. The Gustave-Roussy Child Pain Scale (DEGR) was developed for children age 2 to 6 years with prolonged pain, particularly cancer pain.²⁶ It is reliable for children

TABLE 5.

Pain Scales and Therapeutic Threshold According to Age

Clinical Context	Age		Pain Scale	Therapeutic Threshold
Acute pain or procedural pain	Preterm and term newborns	0-3 months	Douleur aigue du nouveau-né	03/10
		0- 18 months	Neonatal Facial Coding System	1/4
		Preterm newborns	Premature Infant Pain Profile	Over 6/21
		0-7 years	EVENDOL	4/15
		0-1 years	Neonatal Infant Pain Scale	3/7
	Infants to children <6 years	1-7 years	Children's Hospital of Eastern Ontario Pain Scale	9/13
		0-7 years	EVENDOL	4/15
		2 months to 7 years	Faces, Legs, Activity, Cry and Consolability scale	3/10
	Children >6 years		Visual Analog Scale	3/10
			Numerical Rating Scale	3/10
			Verbal Rating Scales	Moderate
			Faces Pain Scale Revised	4/10
			Poker Chips	
Prolonged pain	Preterm and term newborns	0-3 months	Neonatal Pain and Discomfort Scale	5/15
	Infants to children <6 years	2-6 years	Gustave-Roussy Child Pain Scale	10/40
		2-7 years	Hetero Evaluation Douleur Enfant	3/10
	Children >6 years	6-18 years	Visual Analog Scale	3/10
			Numerical Rating Scale	3/10
			Verbal Rating Scales	Moderate
			Face Pain Scale Revised	4/10
		Drawing	According color	

age 9 months to 10 years. It consists of 10 behavioral and complaint items. In addition to the total score, it has three subscores: direct signs of pain, voluntary expression of pain, and psychomotor atony. The observational time required is more than 4 hours. The Hetero-Assessment of Child Pain (HEDEN) is a shortened version of the DEGR.

Pain in sedated or unconscious children. The COMFORT Behavior Scale is reliable for children from birth to adolescence. The Pasero Opioid-Induced Sedation Scale is used to monitor the state of consciousness and respiratory function of children

receiving morphine.²⁷ Depending on these two features, actions are recommended to increase or reduce posology or to dispense naloxone.

Noncommunicating children's pain. The Noncommunicating Children's Pain Checklist (NCCPC) is reliable in children older than age 3 years who cannot communicate verbally because of a cognitive handicap or polyhandicap, regardless of the level of disabilities.²⁸ It includes 30 behavioral items. For a postoperative setting, the scale has three fewer items (concerning sleeping and feeding). The observational time is longer than 10 minutes.

The Pediatric Pain Profile assesses pain in children age 1 to 18 years with severe intellectual disabilities. It can be used by parents and caregivers at home, at school, and in the hospital.²⁹ It has 20 items.

The Revised FLACC (r-FLACC) scale was recently validated for children with cognitive disabilities.³⁰ The FLACC scale was modified by expanding the definition of each item and allowing for adding divergent behaviors specific to the child. It can be completed with or without parental input. Because it is similar to the FLACC, it would likely require less training time.

TABLE 5. (continued)

Pain Scales and Therapeutic Threshold According to Age

Clinical Context	Age		Pain Scale	Therapeutic Threshold	
Postoperative pain	Preterm and term newborns	0-5 years	Children and Infants Postoperative Pain scale	4/10	
		0-7 years	EVENDOL	4/15	
	Infants to children <6 years	0-5 years	Children and Infants Postoperative Pain Scale	4/10	
		1-7 months	Amiel Tison scale	5/20	
		0-7 years	EVENDOL	4/15	
		2 months to 7 years	Faces, legs, activity, cry and consolability scale	3/10	
		1-6 years	Child Facial Coding System	1/4	
		1-7 years	Behavioral Observational Pain Scale	2/6	
		1-5 years	Toddler Preschooler Postoperative Pain Scale	Not communicated	
		1-4 years	Pain Observation Scale for Young Children	3/7	
		8 months to 13 years	Objective pain scale	3/10	
		2-12 years	Postoperative Pain Measure for Parents	6/15	
	Children >6 years			Visual Analog Scale	3/10
				Numerical Rating Scale	3/10
		Verbal Rating Scales	Moderate		
		Faces Pain Scale Revised	4/10		
Sedated or unconscious	Birth to adolescence		COMFORT Behavior Scale	Normality between 8 and 19	
Noncommunicating children's pain	3 years to adult		Noncommunicating Children's Pain Checklist	11/90	
	Birth to adult		Pain Child San Salvador	6/40	
	1-18 years		Pediatric Pain profile	14/60	
	2 months to 7 years		Revised Faces, Legs, Activity, Cry and Consolability Scale	3/10	

Abbreviation: EVENDOL, Evaluation Enfant Douleur.

The Pain Child San Salvador scale involves a retrospective pain assessment (>8 hours). It compares 10 items with the answers to 10 questions from parents, which allows for determining the usual behavior of the child.³¹

The Individualized Numeric Rating Scale does not have sufficient validity criteria to be recommended.³²

Clinical cases. After surgery for hypospadias, a 6-month-old infant has the following behavior: lack of facial ex-

pression, no tears, limited movement, no relationship with the mother, tense limbs, eyes closed but sleep is short. All scales show pain (CHIPPS 8/10, Amiel Tison scale 11/20).

Another example is a 5-year-old child in an emergency department setting who cannot move his arm. He complains at the slightest movements of it and during the examination. He answers the questions but has an analgic posture. He locates the pain to his right arm. At first,

self-assessment is necessary. The VAS is 6/10 (pain), and the Faces Pain Scale-Revised is 2/10 (no pain). These results necessitate the use of behavioral pain scales: EVENDOL (10/15) and FLACC (7/10).

The postoperative period after surgery for acute appendicitis in a 4-year-old child is another situation that requires use of pain measurement. In the postoperative intensive care unit, the child displays these attributes: lightly

sleeping, calm, spontaneous and ventilator breathing, quiet breathing, no occasional (≤ 3) slight movements, restrained muscle tone, less resistance than normal, and normal facial tone. The COMFORT Behavior scale (10/30) shows excess sedation. One hour later, the patient has intermittent complaints, infrequent movements, unusual position, indifference to everything, and tenseness of limbs if mobilization occurs. The COMFORT Behavior scale (16/30) and OPS (2/10) scales underevaluate the pain of a child in distress, but the CHEOPS (8/13), FLACC (5/10), and EVENDOL (7/15) scales do not. After 2 days, a purulent abscess has formed. The child refuses to be touched, complains, has tenseness of body, anxiety, and is inconsolable. All scales are used to assess the pain in the child. The child locates pain to his scar. Self-assessment could be performed with the VAS. Behavioral pain scales could be necessary if there are discordant results or in case of doubt. EVENDOL (13/15), FLACC (8/10), and CHEOPS (9/10) detect the painful sensations.

A 5-year-old child with lymphoma treated with chemotherapy also requires pain assessment. In this case, the child has complaints, loss of enthusiasm, is uncomfortable whatever its position, has restrained movements, and opposition to mobilization. Self-assessment must be performed with VAS or drawing. Self-assessment could be difficult because of loss of enthusiasm and prostration. The DEGR (29/40) and HEDEN (7/10) scales help the caregiver to quote and reassess pain after treatment.

CONCLUSIONS

Numerous pain assessment scales for children exist, but the caregiver must target their use (Table 5). For children older than age 6 years, the gold standard remains self-assessment by a VAS.

For children younger than age 6 years, behavioral pain assessment is required. To assess acute or procedural pain, the EVENDOL and FLACC scales have the strongest validity criteria. EVENDOL, but not the FLACC scale, is reliable for term and preterm newborns. The use of these scales in association NFCS and CFCS scales is interesting because they are polyvalent and easy to use.

To assess prolonged pain, two scales are needed: the EDIN for newborns and DEGR for children older than age 2 years.

To assess postoperative pain, several scales are reliable in children older than age 1 year, but the most polyvalent remain EVENDOL and CHIPS.

To assess pain in sedated or unconscious children, the COMFORT Behavior scale is recommended.

To assess pain in children with cognitive disabilities, two scales seem reliable: NCCPC and r-FLACC.

Caregivers must familiarize themselves with these main pain scales, how to use them on a daily basis, and how to disseminate them. In this way, we can improve pain assessment and overall pain management in children.

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