



Pain Assessment and Treatment in Pediatric Patients

**Edmond Pistulli¹, Diamant Shtiza², Maks Basho², Alketa Hoxha¹, Durim Sala²
and Gentian Vyshka^{3*}**

¹*Department of Clinical Sciences, Faculty of Technical Medical Sciences,
University of Medicine in Tirana, Albania.*

²*Department of Service of Pediatric and Radiology, University Hospital Center "Mother Theresa",
Tirana, Albania.*

³*Department of Biomedical, Faculty of Medicine, University of Medicine in Tirana, Albania.*

Authors' contributions

This work was carried out in collaboration among all authors. Author EP designed the study and wrote the manuscript. Authors DS, MB, AH and DS are the treating clinicians that performed clinical evaluation and follow-up. Author GV revised the literature and rewrote the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Although there are a considerable number of pain assessment scales, only some of them can be used for practical intentions. The Faces Pain Scale is used for children 4 to 6-7 years old, while the Visual Analog Scale (VAS) is used for children above this age.

A study from December 1, 2011 to May 31, 2012, was used to assess the acute pain levels among 177 children from birth to 13 years old in Obstetrics and Gynecology Hospital, an University Hospital Centre, a Pediatric Hospital and an Outpatient Services in Tirana. For patients incapable to verbalize the pain intensity in a reliable way (neonates to the age of four years old), the hetero-evaluation was used. The hetero-evaluation is realized only with one assessment scale, while patients older than 4 years and younger than 6 years old were assessed using the hetero-evaluation and auto-evaluation scale according to the Faces Scale and VAS.

*Corresponding author: E-mail: gvyshka@gmail.com;

The auto-evaluation of the acute pain intensity is applied according to two different assessment scales during the same procedure, on the same patients. The assessment according to VAS is applied in two positions, horizontally and vertically. The results obtained from the different scales and the VAS positions are compared. The NFCS and the Faces Scale are much more easily accessible by the nursing staff; while the multidimensional scales (OPS, CRIES, PIPP) were found more difficult to be used.

Keywords: Pain; pediatric patients; pain treatment; visual analogue scale.

1. INTRODUCTION

The medical science is becoming more and more sophisticated, but unfortunately this is not always the case in pain management. Adults are the first persons that benefited from the recent researches in this direction, mainly in the last two decades; meanwhile “uncommonly”, the pain is still untreated or insufficiently treated among the children [1-3].

Physical pain is not just a transmission of electrical impulses in the corresponding sectors; it's considered as a “conflict” between the stimulant and the person that is suffering [4-6]. Unrelieved pain may cause anxiety and stress, or in other cases even psychological and behavioral long term damage [7-9].

Pain is an important part of the disease; it is the first evident symptom [10,11]. Recently it is not considered anymore by the researchers and the doctors as a symptom, but as a specific disease, defined as “The Fifth Vital Sign”. Synchronal with this conception, there are other new notions like nervous system hypersensitivity caused by the acute pain and the rehabilitation, known for their important role due to major developments in the multimodal analgesia.

Last years the researches are mostly focused on pain assessments as the main element that precedes the treatment [12]. They used a specific number of assessments scales to measure pain, mainly acute pain; but none of them fulfill at the same time all the criteria of validity, reliability and applicability. Anyway, we can say that there were adopted some assessment scales for the use in research or for daily use only.

Pain assessment is an essential element for adequate treatment. The success of a good analgesic management is based firstly on the valuation of the pain according to the used scales [12,13].

Schematically, we can say that we used the behavioral scale like NFCS or CHEOPS or multidimensional scales (that combine the physiological markers like Pam or SpO2 with the behavioral variations) like OPS, PIPP, CRIES, etc. to diagnose the children [14,15].

Pain assessment is based in two groups of measurement: The measurement of physiological parameters and the measurement of behavioral factors [7,16,17,18]. The physiological factors (like tachycardia, tachypnea, sweating, and the increase of arterial pressure) are always part of the pain, but they are not specific. Therefore, the behavioral scales are the main modalities used to assess the pain in neonates, infants and children under 4 years old that are not capable of verbal communication [18]. These scales are based on facial expressions (crying or grimace), motor response, the vision and verbal response; for example the FLACC scale.

Although there is a considerable number of pain assessment scales, only some of them could be used for practical intention. We can use the FLACC scale for abovementioned age-group. The Faces Pain Scale is used for children 4 to 6-7 years old, while the Visual Analog Scale (VAS) is used for children above this age [19-20].

2. MATERIALS AND METHODS

A 7-months study from December 1, 2011 to May 31, 2012, was used to assess the acute pain among 177 children from birth to 13 years old in Obstetrics and Gynecology Hospital, University Hospital Centre, Pediatric Hospital and Outpatient Services in Tirana.

For patients, incapable to verbalize the pain intensity in a reliable way (neonates to <4years old), we used the hetero-evaluation. The hetero-evaluation is realized only with one assessment scale.

While patients above 4 years old and younger than 6 years old are assessed using the hetero-evaluation and auto-evaluation scale according to the Faces Scale and VAS Table 1.

The auto-evaluation of the acute pain intensity is applied according to two different assessment scales, consisting in the same procedure, on the same patients. The assessment according to VAS is applied in two positions, horizontally and vertically. The results obtained from the different scales and the VAS positions are compared between one another.

The auto-evaluation scales are combined as below:

- VAS/ NRS
- VAS/ Faces Scale

Pain is divided in 4 different levels, for all the scales:

The population taken in consideration for the study is divided in 4 age-groups according to the suitable usage of the assessment scales, and it is represented in the table below Table 3.

The assessment is applied among 177 patients, 40.1% of them females and 59.9% males Fig. 1.

The division according to the type of pain (postoperative/acute non-postoperative) is represented in Fig. 2.

In the table below, it is represented the distribution of the patients according to age-group, associated with the graphical presentation:

Scoring averages of different scales according to age-groups are represented in the table below. Since there are used two different positions of

VAS (horizontal and vertical), all the information below is given separated according to the different variants (in which VASH is the horizontal variant and VASV is the vertical one).

The scoring system for the Face Scale, NFCS, VAS, OPS, CRIES and NRS is 0-10. While, for the CHEOPS (4-13) and PIPP (0-21) scales is applied the conversion of the average values to the 0-10 system Table 2.

3. DISCUSSION

According to the study results, the percentage of postoperative patients with intense pain is 47.62% and with maximum pain is 52.38%. There are 5.77% non-postoperative patients with moderate pain, 55.77% with intense pain and 38.46% with maximum pain [21,22]. In conclusion, all postoperative patients and 94.23% of non-postoperative children undergoing painful procedures experienced intense and maximum pain [23-25].

The average of the obtained results using all the scales varies in that way to show intense or maximum pain levels, as well.

Most of the researchers claim that if we compare the pain levels between males and females, the first ones are lower, but it is not considered as statistically significant ($p>0.05$ for all the scales). However, we should take in consideration the fact that the auto-evaluation is applied among a small sample (24 patients-13.56%) [26].

The previous studies indicate different levels of scoring, using the visual analog scale (VAS) in two different orientations-horizontal and vertical. Researchers argue that there are inequalities because of the difficulties among the children's spatial orientation, from 0-10 years old [27].

Table 1. Comparative overview of the numerical scales used for pain evaluation

Levels	NFCS	CRIES	OPS	NRS	VAS	Faces scale	CHEOPS	PIPP
	0-10	0-10	0-10	0-10	0-10	0-10	4-13	0-21
1 Mild Pain	0 - < 3					2	4 - < 7	0 - < 7
2 Moderate Pain	≥3 - < 5					4	≥ 7 - < 9	≥ 7 - < 11
3 Intense Pain	≥5 - <7					6	≥ 9 - < 11	≥11 - <17
4 Maximum Pain	≥7 - 10					8 or 10	≥ 11 - 13	≥17 - 21
Therapeutic Intervention Threshold	3/10					4/10	9/13	11/21

(According to Consensus Conference "Évaluation et Stratégies de Prise en Charge de la Douleur Aiguë chez L'Enfant de 1 Mois à 15 Ans", ANAES, March 2000)

Table 2. Age profile and operative setting of the usage of certain pain evaluation scales

Age group	Hetero-evaluation		Auto-evaluation	
	Postoperative	Non-postoperative	Postoperative	Non-postoperative
I 0 to <1 month	CRIES	NFCSPIPP		
II ≥1 month to < 4 years old	OPSCRIES	CHEOPS		
III ≥ 4 years old to < 6 years old	OPS	CHEOPS	VAS Faces Scale	VAS Faces Scale
IV ≥ 6 years old			VASNRS	VASNRS

Table 3. Age profile of the study group

Group I	Group II	Group III	Group IV
0 - < 1 month	≥ 1 month - < 4 years old	≥ 4 years old - < 6 years old	≥ 6 years old
22	114	17	24
12.43%	64.41%	9.60%	13.56%
177			

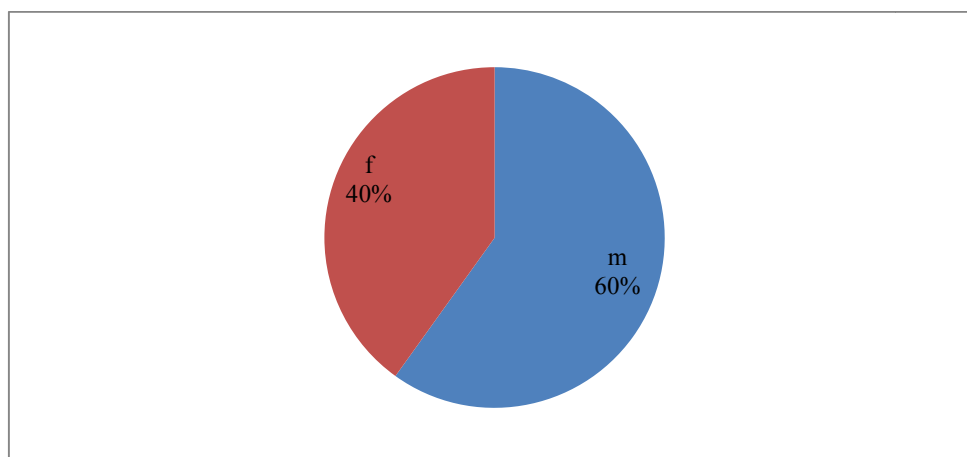


Fig. 1. Sex profile of the study group

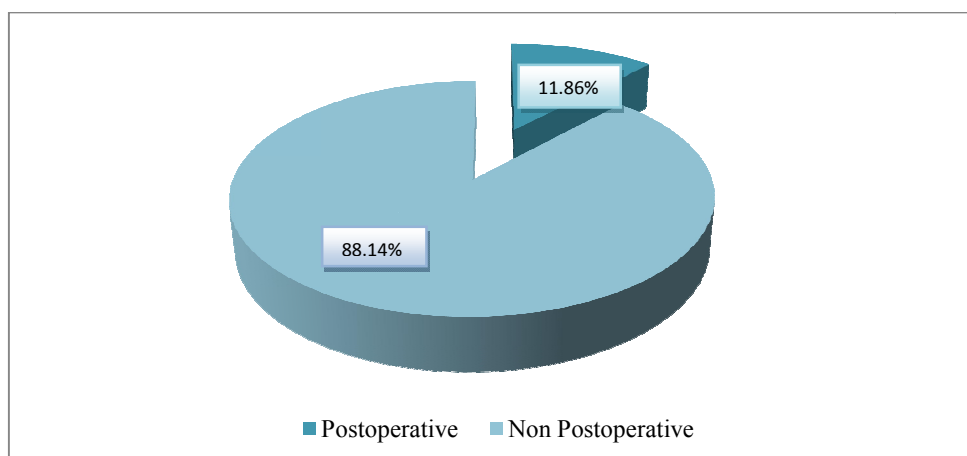


Fig. 2. Distribution of assessed pain cases in post-operative vs. non postoperative

The NFCS and the Faces Scale are much more easily accessible by the nursing staff; while the multidimensional scales (OPS, CRIES, PIPP) were found more difficult to be used (Fig. 3) [27,28]. This because of:

1. The considerable number of parameters to be assessed and saved in epidemiological files.
2. In many cases, there is not the required information about the levels of AP before and after the procedure.
3. There are fixed requirement for the reference values (the values of parameters before the surgical intervention or before the painful procedure), these could not always be documented [29].

The presence of parents during the auto-evaluation has played an important role in children's maximal collaboration, increasing in this way all obtained data validity [30-32].

4. TREATMENT

Pain treatment consists in providing a maximum pain relief and a minimum of side effects [22,34,35]. The multimodal analgesia is considered to be the most suitable method, based on the synergistic effects of different analgesics, decreasing the necessity of using high doses and lowering the incidence of adverse effects [15,35,36].

4.1 Analgesics

For treatment of mild and moderate pain: medicaments as paracetamol, NSAIDs (ibuprofen, naproxen, ketoprofen) and mild opioids (codeine, tramadol, and dextropropoxyphene) could be used.

For average pain intensity: Opioids, accompanied with NSAIDs.

In intense pain we: Recommend major opioids (morphine, fentanyl, hydrocodone, and oxycodone). NSAIDs could be used to increase the opioid's effects [22,37,38].

Local anesthetics could be used as peridural and intrathecal administration.

There are two types of analgesics: Minor and major, or opioids and non opioids [39].

Acetaminophen (Paracetamol) is a minor analgesic that increases the effects of analgesia when it is used with another major analgesic. It is the most widely used analgesic among children for oral and rectal use. The optimal dose of acetaminophen it is not exactly defined, but usually it is used 10-15 mg/kg, oral use. High doses of acetaminophen used in children with serious infections are considered as an indication for hepatic insufficiency. Therefore, it is suggested to be used for short period of times [40].

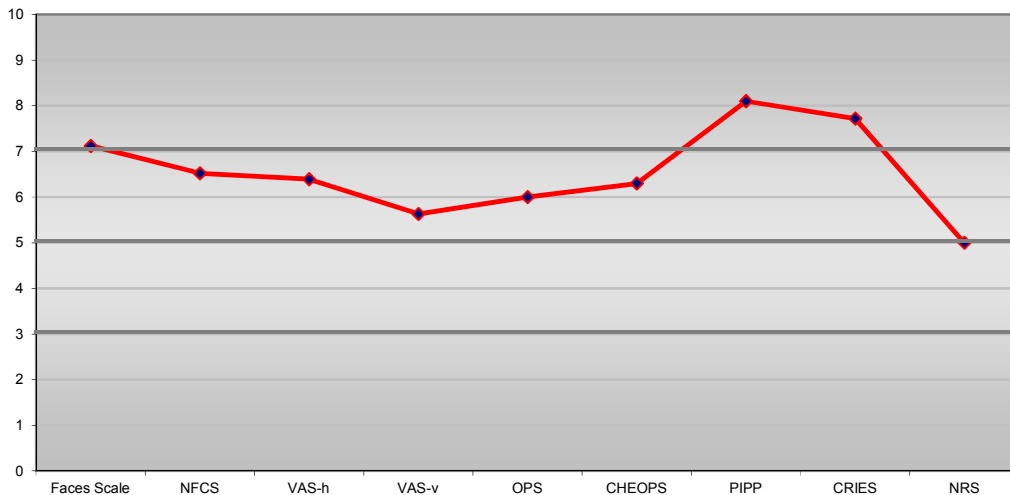


Fig. 3. An overview of the scores collected according to different pain scales used in the study

Ibuprofen is a non steroid anti inflammatory drug used mainly to treat the pain and temperature among children [39]. It is suggested a 15 mg/kg dose for oral use to have an analgesic effect. However, for a repeated dose among 6 months to 12 years old children, it is suggested a dose of 10 mg/kg, every 6h oral use (maximum daily dose-40 mg/kg) [41].

Naproxen has a longer half-life than ibuprofen, therefore it could be used every 8-12h. No specific information about the effect on infants is known. The usual or normal dose is considered 5-10 mg/kg oral use, every 8-12 h (maximum daily dose-20 mg/kg) [40,41].

Opioid analgesics are used by the nursing staff under strict supervision of a doctor, because of the serious side effects, such as inhibition of respiration [42].

Opioids are used to treat pain among patients of different ages [43]. If the dosage is correct, the analgesic effects among children could be easily distinguished [35,43]. There are different routes of administration available for opioids, including oral, intravenous, rectal, transmucosal or transdermal administration [44]. It is important to avoid the intramuscular or subcutaneous route to pediatric patients. Most of opioids are available in liquid forms and could be easily applied to children with difficulties in managing the opioid pills. Recently, to manage neoplastic pain treatment among children, it is used Fentanyl Transdermal Patch or other forms of Fentanyl.

Sedatives are mostly used for their calming or sleep-inducing effect to reduce pain [45].

The reasons why the pain could not be treated with opioids:

1. Side effects, such as respiratory depression.
2. Dependence.
3. Insufficient information possessed by the staff about these drugs.

4.2 Massage

Skin stimulation relieves pain, as well. There are used different techniques such as pressure, massage, vibration, heat and cold therapy, oily treatment which are considered to be very effective and safe. The activation of A β big fibers and the inhibition of A δ and C small fibers, which close the pain "gate", can cause sedative effects [35,43].

Friction massage applied to the painful region could relax the muscles and decrease the tension. It is not recommended to the damaged skin since it could enlarge the damage. Skin irritation could be treated with menthol products, which contain methyl salicylate that could be absorbed, causing an analgesic effect in the affected area. Heat and cold therapy are use to decrease muscular pain [23,33,46]. The immediate change of temperature, from heating to cold can cause analgesic effect that could last for hours. But, this is a method that cannot be used within the first 24 hours to a traumatized area. Cold therapy reduces blood circulation causing positive effects, but preliminary we should take in consideration some advices about heat and cold therapy:

- Do not use cold therapy to a hypo-vascular area
- To avoid extreme temperatures that can cause burn or freezing injuries
- Do not apply heat therapy to a fresh wound because it might cause or increase bleeding
- To stop the application if the pain is increasing

4.3 Transcutaneous Electrical Nerve Stimulation (TENS)

TENS by definition covers the complete range of transcutaneously applied currents, with low voltage, transmitted to the affected area through some electrodes. It produces analgesics effects through A β fibers stimulation and A δ fibers inhibition.

Skin irritation could be a side effect caused by the electrode stickers. This could be avoided using hypoallergenic stickers, while redness could be avoided by cleaning the electrodes with soapy water. Contraindications of TENS include the application in eyes, forehead, mouth, neck. It is still not approved that TENS could perform safety during the very first months of pregnancy, but it is used to lower back part after it [35,43].

4.4 Biofeedback

It is a method that trains patients to control certain bodily processes that normally happen involuntarily, such as heart rate, respiratory rate and muscle tone. Relaxation decreases pain, decreasing the anxiety as well, and increasing pain control. Fear from death can accelerate pain

levels. Sharing emotionally patient's experiences is as important as the treatment [47].

5. CONCLUSION

Assessment is the first step toward the appropriate postoperative and procedural acute pain management. The correct usage of assessment scales, according to a standard protocol ensures to truthfully measure pain intensity, being the "key to success" for the necessary information used to create the pain treatment modalities.

CONSENT

All authors declare that written informed consent was obtained from approved parties (parents or caregivers) for publication of these data.

ETHICAL APPROVAL

All authors hereby declare that the study was approved by the appropriate ethics committee and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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