Pain assessment in neonates who underwent cardiac surgery*

Avaliação da dor em recém-nascidos submetidos à cirurgia cardiáca

Evaluación del dolor en recién nacidos sometidos a cirugía cardiaca

Mariana Bueno[1], Amélia Fumiko Kimura[2], Cibele Andrucioli de Matos Pimenta[3]

ABSTRACT

Objectives: To identify pain assessment methods used in neonates who underwent cardiac surgeries, to verify pain assessment frequency and to verify pain prevalence. **Methods:** Cross-sectional study. Retrospective data collection. **Results:** Pain assessment was performed in most (80.0%) of the neonates, between one and thirteen times. Specific pain assessment scale was used in 56.7% neonates. Pain assessment was done from one to thirteen times, 56.7% experienced pain and suffered a mean of 1.8 pain episodes. **Conclusion:** There is no standardized pain assessment or pain assessment frequency and the prevalence of pain was high.
Keywords: Infant, newborn; Pain measurement; Neonatal nursing.

RESUMO

Objetivos: Identificar o método utilizado para avaliar a dor pós-operatória em cirurgia cardíaca neonatal; verificar a freqüência de avaliação e identificar a prevalência de dor pós-operatória. **Métodos:** Estudo transversal com coleta de dados retrospectiva. **Resultados:** A maioria (80,0%) dos neonatos foi avaliada quanto a dor, o método mais utilizado foi a escala Neonatal Infant Pain Scale (NIPS) (56,7%). A freqüência de avaliações variou entre uma e 13 vezes e a maior parte dos neonatos teve sete ou mais avaliações. A maioria (56,7%) apresentou registro de dor e a média de episódios de dor foi 1,8. **Conclusão:** Tanto o método quanto a freqüência de avaliação de dor não seguem padronização e a prevalência de ocorrência de dor foi elevada.
Descritores: Recém-nascido; Dor; Medição da dor; Enfermagem neonatal

RESUMEN

Objetivos: Identificar el método utilizado para evaluar el dolor post-operatoria en cirugía cardiaca neonatal; verificar la frecuencia de la evaluación e identificar la prevalencia del dolor post-operatorio. **Métodos:** Estudio transversal con recolección de datos retrospectiva. **Resultados:** La mayoría (80,0%) de neonatos fue evaluado en cuanto al dolor, el método más utilizado fue la escala Neonatal Infant Pain Scale (NIPS) (56,7%). La frecuencia de evaluaciones varió entre una y 13 veces y la mayor parte de los neonatos tuvo siete o más evaluaciones. La mayoría (56,7%) presentó registro de dolor y el promedio de los episodios fue de 1,8. **Conclusión:** el método respecto a la frecuencia de evaluaciones del dolor no siguen un patrón y la prevalencia de su ocurrencia fue elevada.
Descriptores: Recién nacido; Dolor; Medición del dolor; Enfermería neonatal

INTRODUCTION

The prevalence of congenital heart disease is 8 to 10 out of every 1,000 live births and the majority of the defects can be surgically corrected[1]. Pain is a common postoperative event as a result of tissue damage and also of organs and tissue manipulation during surgery. Besides these, other factors can contribute to pain occurrence in the postoperative period, such as invasive devices that are necessary for monitorization and life support, e.g. tracheal tube, chest tubes, vascular catheters, handling by health care professionals and procedures repetitively performed such as venepunctures for blood samples, parenteral therapy and tracheal suctioning[2-3].

Pain is a complex, subjective and multilayered phenomenon, defined by the International Association for the Study of Pain (IASP) as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" [4]. Pain perception and the requirement for adequate analgesia are not related to the inability to communicate verbally or non verbally[5].

Pain control is fundamental in postoperative care[6], since it contributes to minimizing the chances of postoperative hemodynamic and metabolic complications, future affective and behavioral changes. It also protects neonates from the long-term harmful consequences of pain. In addition, two or more palliative or corrective surgical procedures tend to be necessary during childhood, which makes adequate postoperative analgesia in the neonatal period even more relevant.

Few Brazilian publications are available concerning postoperative pain in neonates. A retrospective study, conducted in a teaching hospital in the state of São Paulo, demonstrated that the use of analgesics in young and severely ill children is not common[7]. The importance of frequent health team training on provide postoperative analgesia is emphasized.

Pain assessment is essential for effective pain control and can be done by using pain indicators, which are described as physiological, behavioral and hormonal, and also by using specific pain scales. All methods have some advantages and limitations.

The objective of this study was to identify pain assessment methods used by nursing staff in neonates who underwent cardiac surgery; to verify the frequency of pain assessment and to identify the prevalence of postoperative pain in neonates who underwent cardiac surgery.

METHODS

Cross-sectional study, conducted in a Neonatal Intensive Care Unit (NICU) of a private and medium sized hospital in the city of São Paulo. This is a reference center for neonatal surgical heart treatment.

Data were collected from medical charts of neonates surgically treated between July 2001 and December 2005. Institutional forms analyzed for data collection were: Clinical history, Surgery description, Vitals signs registers, Nursing notes and Pain management notes.

Eligibility criteria were: gestational age e" 35 weeks at birth and surviving through the first 48 hours of postoperative. Medical charts of neonates with malformations besides the cardiac disease were excluded.

Only registers for the 24th to 47th complete postoperative hours were analyzed. Exclusion of the first 23 postoperative hour registers can be explained by possible residual effects of anesthetic agents used during the surgery.

The following variables were studied:

- Demographics: gestational age at birth, weight and postnatal age on day of surgery, type of surgical procedure and type of chest incision;

- Methods used by neonatal nursing team for pain assessment: behavioral and physiological indicators of pain, pain scale and use of pain indicators and scale combined. Behavioral indicators of pain were considered as follows: crying, including non vocalized crying, facial expression, agitation, excessive limb movements, thoracic rigidity and muscle tension[8-10]. Physiological indicators of pain were: increases in heart rate, blood pressure, intracranial pressure, intrathoracic pressure, change in respiratory pattern, decreased arterial oxygen saturation and vagal tonus[8-10]. The Neonatal Infant Pain Scale (NIPS)[11] was used.

- Pain assessment frequency: number of pain assessment registers from the 24th to the 47th postoperative hours;

- Pain occurrence: presence or absence of pain register.

Epi-Info Version 6.4 program was used for descriptive statistics.

In compliance with Resolution n.° 196/96 by the Brazilian National Health Council, procedures in this study were approved by the human subject protection committee of the institution where data collection occurred.

RESULTS

Forty two neonates underwent cardiac surgery and 30 met the eligibility criteria. Mean gestational age at birth was 37.64 weeks and mean weight 2885 grams. The majority of the neonates underwent surgical procedures in the first week of life (21 or 70.0%) and had sternal incisions (22 or 73.3%). Fourteen different types of surgical procedures were performed and 23 (76.7%) neonates underwent two or more combined surgical

repairs.

Table 1 shows pain assessment methods used by the nursing staff.

Pain assessment using Neonatal Infant Pain Scale (NIPS) was performed in 17 (56.7%) neonates. Behavioral and physiological indicators of pain were registered in 15 (50.0%) medical charts and are specified in Table 2.

Agitation and crying were commonly registered as pain indicators, revealing that the nursing team frequently relates these alterations to pain.

Table 3 shows pain assessment methods used in neonates considering the occurrence of pain.

Seventeen (70.8%) of the 24 neonates under assessment experienced postoperative pain. Absence of pain achieved by using NIPS was registered in seven (29.2%) medical charts. The number of registered pain episodes ranged from one to thirteen and most of the studied neonates received seven or more pain assessments (17 or 70.8%).

One episode of pain was registered in nine (30.0%) medical charts; two episodes in four (13.4%); three episodes in one (3.3%) and four episodes were registered in three (100%) medical charts. The median of pain episodes was 1.8 per neonate.

DISCUSSION

According to demographic data, complex surgical interventions were performed early and two or more combined surgical repairs by sternal incision were done in most of the neonates under study.

With regard to pain assessment, in November 2003, a standard pain evaluation was introduced at the institution where data were collected and NIPS was the standard tool at the NICU. This might explain the absence of pain assessment registers in 20.0% of the medical charts: all of them refer to neonates who underwent cardiac surgery before this period.

Table 1 – Pain assessment methods. São Paulo, 2001 – 2005.

		(N=30)
Pain assessment methods	**N**	**%**
Behavioral and physiological changes	7	23,3
Pain scale	9	30,0
Behavioral and physiological changes combined to scale	8	26,7
No assessment	6	20,0
Total	**30**	**100,0**

Table 2 – Behavioral and physiological changes related to pain. São Paulo, 2001 – 2005.

		(N=15)
Changes	**N**	**%**
Behavioral		
Agitation	11	36,3
Crying	6	20,0
Grimacing	4	13,4
Eyes open	1	3,3
Members movement	1	3,3
Irritation	1	3,3
Physiological		
Tachycardia	4	13,4
Increased blood pressure	3	10,0
Modified respiratory rate	1	3,3
Decreased oxygen saturation	1	3,3
Tachypnea	1	3,3

Table 3 – Pain assessment methods and pain occurrence. São Paulo, 2001 - 2005.

	Assessment method							(N=24)
	Behavioral and physiological changes		**Scale**		**Behavioral and physiological changes combined to scale**		**Total**	
Pain	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Presence	7	29,2	2	8,3	8	33,3	17	70,8
Absence	-	-	7	29,2	-	-	7	29,2
Total	7	29,2	9	37,5	8	33,3	24	100,0

Pain assessment was largely performed by using NIPS. However, behavioral and physiological indicators of pain were also commonly used and continued to be used by the nursing staff, despite the standardization of pain assessment through NIPS.

Behavioral and physiological alterations are considered important pain indicators by health care professionals. Half of the neonatal nurses who participated in a survey considered indicators as important measures for pain assessment[12]. In a Brazilian teaching hospital, all of the nurses considered crying, grumbling and facial contraction as signs of pain in neonates; they also considered changes in vital signs and body movements as pain indicators: 76.2% and 52.3% respectively[13].

Behavioral changes are considered as more specific than physiological changes for pain assessment[14]. Information about the nature and intensity of pain can be obtained by grimacing analysis[15].

Although behavioral and physiological changes are described in scientific literature as important measures of pain assessment its use during postoperative period might be better investigated. Some postoperative responses or complications, such as changes in heart rate, arrhythmias, increased blood pressure, hypoxemia and electrolytic disorders[16-17], can lead to behavioral and physiological changes which are similar to indicators of pain.

Furthermore, some disorders and the use of sedatives and analgesics can interfere in behavioral changes related to pain. Vasoactive drugs can also result in physiological changes similar to physiological indicators of pain. Another important limitation on the use of pain indicators is the presence of a tracheal tube, which makes it difficult to assess grimacing and crying.

Due to these reasons, behavioral and physiological indicators of pain can not be considered as the best choice for pain assessment in neonates who underwent cardiac surgery. The use of reliable, validated and multidimensional tools for pain assessment in neonates during the postoperative period is possibly better than using behavioral and physiological parameters[6,18-19]. Despite the large number of tools for neonatal pain assessment available in scientific literature, none of them can be considered an ideal instrument, nor can they be used in different situations, e.g. postoperative pain, procedure-related pain, prolonged pain[20].

NIPS is a multidimensional and practical instrument, based on specific parameters related to pain[21], which was developed for assessing acute pain in neonates during invasive procedures. Compared to two other specific tools for postoperative pain assessment, Expression, Sleeplessness (CRIES) and Children's and Infants' Postoperative Pain Scale (CHIPPS), NIPS presented the best results and was considered a valid, reliable and practical tool[22].

A limited number of postoperative pain assessment studies in neonates is available[23-26]. However, the large variety of instruments used in each of these studies, e.g. Pain Assessment Tool (PAT), Children's and Infants' Postoperative Pain Scale (CHIPPS), COMFORT, Neonatal facial coding system (NFCS), Premature infant pain profile (PIPP), Cry, Requires O2, Increased vital signs, Expression, Sleeplessness (CRIES), makes it difficult to establish positive and negative points of each scale and also prejudices choosing an ideal tool for postoperative pain assessment.

The use of a standard neonatal pain assessment tool demonstrates concern with improvement in pain management quality and effectiveness at the institution where data were collected. But this process requires continuous evaluation in terms of the utility of the tool, nursing staff training and recycling, which allows for the appropriate and uniform use of the adopted standard pain scale.

There is still no agreement related to postoperative pain assessment frequency. Pain assessment may be performed in every manipulation or care delivery, which can result in discomfort before and after any painful or invasive procedure, concomitant to vital signs assessment, when there is some suspicion of pain and also at established intervals from four to eight hours[2,27-28]. Using a specific tool at four-hour intervals in the first 24 postoperative hours, followed by an eight-hour interval in the next 96 hours, is also recommended in large to surgical procedures performed in neonates[29]. In this study, most neonates were assessed at appropriate intervals. One to three-hour intervals reinforce the possibility of pain assessment in association with vital signs assessment.

Pain is a common phenomenon in the postoperative period, and its absence is probably related to the effectiveness of analgesic therapy[28].

Pain absence was only diagnosed using NIPS. As a multidimensional and specific tool for neonatal pain assessment, NIPS may provide better evidence of the absence of pain when compared to behavioral and physiological indicators of pain. However, further investigation is needed to confirm the utility and validity of NIPS to diagnose the absence of postoperative pain in neonates.

Although the administration of analgesics and sedatives was not the aim of this study, it is important to mention that 96.7% of the neonates received analgesic therapy during the postoperative period. Despite this fact, neonates still suffered pain.

CONCLUSIONS

A specific tool was the most used method for pain

assessment in neonates who underwent cardiac surgery (17 or 56.7%). Prevalence of pain was 70.8%, seven or more assessments were performed in 70.8% of the neonates and 30.0% of the medical charts analyzed presented one register of pain occurrence.

The major limitation of this study is data collection from medical charts. Absence of or imprecise registers can compromise the accuracy and veracity of data.

However, presenting the profile of postoperative pain management in neonates at a specific institution stimulates reflections on pain assessment programs at other Brazilian institutions, permits assessment of the whole pain management process program in neonates who underwent cardiac surgery at the institution where the data were collected.

Greater scientific knowledge on postoperative pain management in neonates is needed. Using pain assessment tools in clinical practice and, consequently, defining effectiveness of these instruments can be considered as important measures for the implementation of pain management strategies in the postoperative period. Thus, well designed and well conducted clinical trials can provide this information.

Further studies are fundamental to provide evidence on the best instruments for neonatal postoperative pain assessment, and also to establish the ideal frequency and intervals for pain assessment in neonatal patients.

REFERENCES

1. Zanetta RAC, Afiune JY, Stape A. Abordagem das cardiopatias congênitas no recém-nascido. In: Knobel E. Pediatria e neonatologia. São Paulo: Atheneu; 2005. p.167-90.

2. Anand KJ, International Evidence-Based Group for Neonatal Pain. Consensus statement for the prevention and management of pain in the newborn. Arch Pediatr Adolesc Med. 2001;155(2):173-80.

3. Bellù R, de Waal KA, Zanini R. Opioids for neonates receiving mechanical ventilation [Cochrane Review]. Cochrane Database Syst Rev. 2005;25(1):CD004212.

4. Merskey H. IASP Pain Terminology [text on the Internet]. Seatle , WA: IAPS Press; 2001.[cited 2007 Jan 24]. Available from: http://www.iasp-pain.org/AM/Template.cfm? Section=Pain_Definitions&Template=/CM/HTMLDisplay.cfm&ContentID=1728.

5. Anand KJ, Aranda JV, Berde CB, Buckman S, Capparelli EV, Carlo W, et al. Summary proceedings from the neonatal pain-control group. Pediatrics. 2006;117(3):S9-22.

6. American Academy of Pediatrics Committee on Fetus and Newborn; American Academy of Pediatrics Section on Surgery; Canadian Paediatric Society Fetus and Newborn Committee, Batton DG, Barrington KJ, Wallman C. Prevention and management of pain in the neonate: an update. Pediatrics. 2006;118(5): 2231-41. Erratum in: Pediatrics. 2007;119(2):425.

7. Nascimento Junior P, Módolo NSP, Rolim Junior G. Analgesia pós-operatória para crianças com menos de 1 ano. Análise retrospectiva. Rev Bras Anestesiol. 2002;52(6):739-46.

8. Anand KJS, Hickey PR. Pain and its effects in the human neonate and fetus. N Engl Med. 1987;317(21):1321-9.

9. Jorgensen KM. Pain assessment and management in the newborn infant. J Perianesth Nurs. 1999;14(6):349-56.

10. Beacham PS. Behavioral and physiological indicators of procedural and postoperative pain in high-risk infants. J Obstet Gynecol Neonatal Nurs. 2004; 33(2):246-55.

11. Lawrence J, Alcock D, McGrath PJ, Kay J, McMurray SB, Dulberg C. The development of a tool to assess neonatal pain. Neonatal Netw. 1993;12(6):59-66.

12. Howard VA, Thurber FW. The interpretation of infant pain: physiological and behavioral indicators used by NICU nurses. J Pediatr Nurs. 1998;13(3):164-74.

13. Bueno M, Toma E, Berti ER. Percepção do enfermeiro assistencial acerca da dor aguda no recém-nascido. Rev Dor. 2003;4(2):71-80.

14. Guinsburg R, Balda RCX, Berenguel RC, Almeida MFB, Tonelloto J, Santos AMN, et al. Aplicação de escalas comportamentais para avaliação da dor em recém-nascidos. J Pediatr (Rio J). 1997;73(6):37-44.

15. Craig KD. The facial display of pain. In: Finley GA, McGrath PJ. Measurement of pain in infants and children. Seattle: IASP Press; 1998. p. 103-

16. Craig J. The postoperative cardiac infant: physiologic basis for neonatal nursing interventions. J Perinat Neonatal Nurs. 1991;5(2):60-70.

17. Wessel DL. Hemodynamic responses to perioperative pain and stress in infants. Crit Care Med. 1993;21(9 Suppl):S361-2.

18. Anand KJ, Craig KD. New perspectives on definition of pain. Pain. 1996; 67(1):3-6.

19. Grunau RE, Oberlander T, Holsti L, Whitfield MF. Bedside application of the Neonatal Facial Coding System in pain assessment of premature neonates. Pain. 1998;76(3):277-86.

20. Duhn LJ, Medves LJM. A systematic integrative review of infant pain assessment tools. Adv Neonatal Care. 2004;4(3):126-40.

21. Pereira ALST, Guinsburg R, Almeida MFB, Monteiro AC, Santos AMN, Kopelman BI. Validity of behavioral and physiologic parameters for acute pain assessment of term newborn infants. Rev Paul Med. 1999;117(2):72-80.

22. Suraseranivongse S; Kaosaard R; Intakong P; Pornsiriprasert S; Karnchana Y; Kaopinpruck J; Sangjeen K. A comparison of postoperative pain scales in neonates. Br J Anaesth 2006; 97(4):540-4.

23. Hodgkinson K, Bear M, Thorn J, Van Blaricum SV. Measuring pain in neonates: evaluating and developing a common language. Aust J Adv Nurs. 1994;12(1):17-22.

24. Büttner W, Finke W. Analysis of behavioral and physiologial parameters for the assessment of postoperative analgesic demand in newborns, infants and young children: a comprehensive report on seven consecutive studies. Paedriatr Anaesth. 2000;10(3):303-18.

25. Van Dijk M, de Boer JB, Koot HM, Tibboel D, Passchier J, Duivenvoorden HJ. The reliability and validity of the COMFORT scale as a postoperative pain instrument in 0 to 3-years-old infants. Pain. 2000;84(2/3):367-77.

26. Peters JW, Koot HM, Grunau RE, de Boer J, Van Druenen

MJ, Tibboel D et al. Neonatal facial coding system for assessing postoperative pain in infants: intem reduction is valid and feasible. Clin J Pain. 2003;19(6):353-63.

27. Gallo AM. The fifth vital sign: implementation of the Neonatal Infant Pain Scale. J Obst Gynecol Neonatal Nurs. 2003;33(2):199-206.

28. Clifford PA, Stringer M, Christensen H, Mountain D. Pain assessment and intervention for term newborns. J Midwifery Womens Health. 2004;49(6):514-9.

29. Balda RCX, Guinsburg R. Avaliação da dor no período neonatal. In: Kopelman BI, Santos AMN, Goulart AL, Almeida MFB, Miyoshi MA, Guinsburg R, editores. Diagnóstico e tratamento em neonatologia. São Paulo: Atheneu; 2004. p. 577-85.