

Experience in two hospitals regarding the observation of pain responses in hospitalized preterm infants

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ABSTRACT

Introduction: Every child born before 37 weeks' gestation is considered preterm. These children need support in order to survive; therefore, according to the Iberoamerican Society of Neonatology, children born preterm undergo various procedures which mostly cause pain. All children under 32 weeks' gestational age are subjected to between 5 and 14 painful procedures per day and 80% receive no analgesics. It is important to consider that the result of suffering pain could lead to consequences in their development, whether in the short or long term.

General objectives: To observe pain reactions of preterm babies at different gestational age categories and collaborate in the awareness of healthcare personnel regarding the matter of pain in preterm infants.

Material and methods: An observational study was therefore carried out on 27 cases in two hospitals in Argentina, one private and the other public. Painful procedures on premature children hospitalized in the Neonatal Intensive Care Unit (NICU) were observed and both physiological and behavioral values were recorded.

Results: The results show that there are differences in children's reactions as rated by gestational ages, especially in regard to heart rate and gestures.

Conclusions: It was found that adequate pain management is a right for premature children and not always taken into account, so the need arises for further work in developing a specific scale for these children and raising awareness among healthcare personnel, humanizing interventions in children.

Key words: Premature, neonatal intensive care units, pain, physiological indicators, behavioral indicators.

RESUMEN

Introducción: Todo niño nacido antes de las 37 semanas de edad gestacional es considerado prematuro. Estos infantes necesitan de apoyo para lograr la supervivencia; es así como, según la Sociedad Iberoamericana de Neonatología, los niños nacidos pretérmino son sometidos a diversos procedimientos que en la mayoría de los casos producen dolor. Los bebés prematuros menores a 32 semanas de edad gestacional son sometidos a entre 5 y 14 procedimientos dolorosos por día, y el 80 % de ellos no recibe analgésicos. Es importante, a su vez, considerar que el hecho de sufrir dolor podría generar consecuencias en su desarrollo, ya sea a corto o largo plazo.

Objetivos generales: Observar las reacciones de dolor de niños nacidos prematuros en diferentes categorías de edades gestacionales y colaborar en la concientización del personal de salud sobre la temática del dolor en el niño prematuro.

Material y métodos: Por tal motivo se llevó a cabo un estudio observacional de 27 casos en dos hospitales de Argentina, uno de ellos privado y el otro público. En el mismo se presenciaron procedimientos dolorosos realizados a infantes prema-

turos internados en Unidad de Cuidados Intensivos Neonatales (UCIN) y se registraron tanto valores fisiológicos como comportamentales.

Resultados: Los resultados demuestran que existen diferencias en las reacciones de los niños según la clasificación de edades gestacionales, sobre todo en lo que respecta a la frecuencia cardíaca y a lo gestual.

Conclusiones: Se concluye en que el adecuado manejo del dolor es un derecho para el prematuro que no siempre es tenido en cuenta, por lo que se postula la necesidad de seguir trabajando en la elaboración de una escala específica para estos infantes y en la concientización del personal de salud, humanizando las intervenciones en el niño.

Palabras clave: Prematuro, unidades de cuidado intensivo neonatal, dolor, indicadores fisiológicos, indicadores comportamentales.

INTRODUCTION

According to UNICEF, any child born before finalizing 37 weeks' gestational age is considered premature (1); in turn, there exists a classification of these children by the same body: moderate prematurity, gestational age lies between 36 and 31 weeks, extreme between 30 and 28 weeks and very extreme in those born before 28 weeks' gestational age.

The World Health Organization (2) also proposes sub-categories of premature birth according to their gestational age. These are: extremely preterm (less than 28 weeks' gestational age), very preterm (between 28 and 32 weeks) and moderate to late preterm (from 32 to 37 weeks).

These children need support in order to survive. This is the assertion of the Iberoamerican Society of Neonatology (3), children born preterm are subjected to a number of procedures that cause pain in most cases. Premature babies before 32 weeks' gestational age are subjected to between 5 and 14 painful procedures a day and 80% of them do not receive analgesia; the lower the gestational age, the greater the number of procedures. It is important, therefore, to consider that the circumstance of undergoing pain could lead to consequences in their development, either in the short or medium term.

With the aim of analyzing these children's physiological reactions and behavior against pain and contributing to their correct diagnosis regarding proper treatment, an observation of painful procedures in preterm children was carried out, in the context of an investigation intended to develop a pain scale specifically for premature children. This study was carried out in two hospitals: one of them private, located in the Autonomous City of Buenos Aires, and another public, located in the Buenos Aires Conurbation.

This work took into account an idea of pain open to the different strata that make up a person, using different

authors for its definition, but always based on the concept provided by the International Association for the Study of Pain (IASP), which asserts that this is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (4).

Background of pain in childhood

History may have been hard with newborns, and even more with premature babies.

In ancient Greek-Roman civilizations, the father was entitled to decide whether the child would live or die, especially in cases of deformities or out-of-marriage births. In the Middle Ages, babies were sent to live with wet-nurses who breastfed them and educated them until puberty; accordingly, this type of abandonment continued until the 19th century. Children were thought of as miniature adults (5).

We cannot forget the exhibitions of premature babies for lucrative purposes to satisfy curiosity regarding the survival of such small children. These "freak" fairs were carried out in Berlin in the year 1896 and later in Chicago, New York, Coney Island, among others (6). These events, which could be classified as circus acts, not only exhibited children to possible infections, but also, from the point of view of association, were infants who had no contact with their parents. Despite all of this, it is true that these fairs raised the money necessary to build the incubators we have at present.

By focusing on pain management within the care of premature babies, we may come up against a slow process that is still developing. Initially, it was not believed that these children born prematurely could undergo pain. This belief stemmed from myths that continue to arise in some cases, such as for example that they are unable to feel pain or that they are less sensitive to it because they cannot express it; all because pain is learned through prior experiences, that they are unable to remember pain and that their capacity to metabolize drugs is limited, so analgesia would be hazardous (7). All these points were subsequently refuted by carrying out investigations, but even today there is some resistance in considering the scope of pain in preterm children.

With the situation experienced by Jeffrey Lawson, change began in the paradigm. Jeffrey was born prematurely in the year 1985 and had to be subjected to corrective surgery for ductus arteriosus; in this procedure, the child was given muscle relaxants and minimal anesthetic management (8). His mother Jill told her experience in a Neonatal Intensive Care Unit in Washington DC and, in view of what happened, sued the team of professionals who treated her son, indignant by the lack of pain management. The

case was dismissed because pain was not acknowledged in the child as he was premature. Considering this response, she decided to publish her case in the Washington Post, receiving support from families of children who had been through similar situations (9).

As from 1985, there began to further investigations relating to pain in neonates, with Anand as one of its major exponents. But it was in the year 1987 when the American Academy of Pediatrics promoted pain management for premature children (8).

Neuro-functional basis of pain in premature babies

According to García, Amaya, and Narváez-Ramos (10), as from 1990, there began greater study of the neuroanatomy and neurophysiology regarding pain. They describe a child's central nervous system as immature but, in turn, that they have the capacity of neuronal plasticity. This immaturity predominantly affects the function of inhibitory modulation.

Considering premature babies as an "ex utero" fetus, Cibeira (11) asserts that a fetus' brain is active as from studies showing behavior and metabolism. Accordingly, we can detect any sensorial or sensory stimulus. Endorphin levels, which are responsible for inhibiting pain, are regulated several days after birth. Faced with something that causes pain, the response may come from the autonomous, somatic and hormonal system, with an increase in catecholamines, cortisol, glucagon, aldosterone and insulin.

The same author reports that the expression of pain due to damaged tissue is not a reflexive reaction, but a behavioral experience.

Basso (12) suggests that nociceptors start to mature at an embryological level between 6 and 8 weeks of gestation. The information they provide is processed at a medullar level, in the brain stem, the thalamus and the somatosensory cortex (postcentral gyrus), with major modulation of the limbic system. These latter structures start developing in week 14 and by around week 30 have finalized.

The system for regulating substances that manage pain inhibition and control has not yet been fully developed at the time of birth, but rather proceed to do so during the first months of ex utero life. *There is significant evidence that immature neural pathways are not good pain modulators, so its magnitude may be greater and its effect even more lasting in premature newborn children* (12), coinciding with findings by García et al. (10).

A broad overview of pain

Undergoing pain does not only take shape as physical suffering, but rather involves factors that affect a person

entirely. It may be seen in the vision of every human being. This situation makes it an enigma that lies within each person's culture and experience (11).

Cicely Saunders faced the challenges involved in the biopsychosocial study of pain in the sixties. The author explains that when pain is not relieved, it becomes the center of a human life, because it comprises physical, emotional, social and spiritual elements. Accordingly, we find total pain (13). In the case in hand, patients may be considered as not only the baby, but the dyad or triad of parents-child; so the pain of premature babies is suffering for its parents; they are committed in every sphere described.

Pain is a symptom or a syndrome that seems to constitute the whole illness in some cases, as in headaches, trigeminal neuralgia and ghost pain. By definition, pain is sensitivity, emotion and experience, with receptors that act as keys whose sound produces a chord that resonates in the cerebral cortex. When the strings are slack, melody becomes impossible (11).

According to Dinerstein and Brundi (14), the greatest source of pain in premature infants is iatrogenic, caused by therapeutic procedures and diagnoses that have to be carried out due to the child's situation. In their investigations, they come to the conclusion that premature babies not only perceive pain, but rather as a result of their immaturity they feel it with greater intensity and as diffused pain.

Following this idea, the American Academy of Pediatrics (15) asserts that pain prevention is necessary in neonates not only for ethical reasons, but because exposure to feelings of pain at such early ages, and especially prematurely, may lead to consequences at different levels of the persona. There may be repercussions in the short and medium term. Among the first, Anand (16) reports difficulties in adaptation to the postnatal environment, giving rise to problems in bonding with parents and in feeding.

Neonates demonstrate neuroplasticity, but if exposed to painful situations, they will generate a low pain threshold for the rest of their lives (10). In turn, González-Fernández and Fernández-Medina (17) add that as a consequence of pain, premature children may suffer vomiting, regurgitations, lack of appetite, motility and sleep dysfunction.

In the long term, we find psychological consequences, such as anxiety, defensive behavior, deficit in memory and learning and greater tendency towards somatization. Psychological involution and developmental delay can also be observed. (3,17).

In considering reagents that allow us to assess pain in such young children, Stevens et al. (18) propose two items: physiological and behavioral indicators.

As regards the first, it may be seen newborns at term show an increase in heart rate (HR) or a decrease in vagal tone (inhibitory control that the vagus nerve exercises on heart rate); an increase in respiratory rate (RR) and a

decrease in oxygen saturation (SO₂). Conversely, among premature infants they find an increase or variability in HR, a decrease in SO₂, an increase in intracranial pressure and variability in RR. These indicators provide objective, precise information as regards pain responses in children. However, they take on greater value if observed together with behavioral indicators.

According to the latter, it is considered that the most studied among neonates, both at term and premature, refer to facial activity, crying and body movements. Crying may not always be present in the cases studied, as for many it is prevented by mechanical ventilation. Additionally, both body movements in general, and a movement of withdrawal in particular, highlight another difference when referring to premature babies and babies born at term, as in the latter movements would be seen as more vigorous and in premature children the response would be shown by muscular flaccidity.

UNICEF (19) considers the experiences of premature children and their family group during hospitalization and presents the decalogue of premature children's rights; that although they show the need to receive care in accordance with their situation, it considers it should include, among the rights of this decalogue, the necessary diagnosis and treatment of pain in preterm children, still lacking in this document (Table I).

OBJECTIVES

General objectives

- Observe the reactions to pain of children born prematurely in different gestational age categories.
- Collaborate in raising awareness of healthcare personnel in understanding the subject of pain in premature children.

Specific objectives

- Detect, by changes in values in the monitors to which the child is connected, physiological reactions to pain in premature babies.
- Detect, by observation of behavioral responses (body and facial) to pain in preterm infants.
- Count the time the child takes to return to baseline values after a painful procedure.
- Compare the results obtained among different gestational age groups and between the two hospitals.
- Through bibliographical review and the results obtained, make a contribution with regard to the subject regarding pain for healthcare personnel who work with hospitalized premature children.

TABLE I
THE RIGHTS OF PREMATURE CHILDREN

<i>The rights of the premature child</i>	
1	Prematurity can be prevented, in many cases, by control of pregnancy, to which all women are entitled
2	Premature newborn children have a right to be born and to be assisted in adequate places
3	Premature newborn children have the right to receive appropriate care for their needs, considering their weeks of gestation, their weight at birth and their individual characteristics. Each step in their treatment should be considered with a view to the future
4	Premature newborn children are entitled to receive high quality nursing care, aimed at protecting their development and family-focused
5	Premature newborn children are entitled to be breast-fed
6	All premature children are entitled to the prevention of blindness due to retinopathy of prematurity (ROP)
7	A high-risk newborn premature child should have access, when they leave hospital, to special monitoring programs
8	Families of newborn premature children are fully entitled to information and participation in decision-making regarding their health throughout their neonatal and pediatric care
9	Premature newborn children have the right to be accompanied by their family at all times
10	Premature newborn children have the same right to social integration as those born at term

METHOD

Study type: Cross-sectional, observational.

Population: the sample comprised a total of 27 premature hospitalized children, corresponding to every category of premature birth proposed by UNICEF (1). Out of the total population, 15 were in a private hospital in the Autonomous City of Buenos Aires, and the other 12 in a public hospital in Buenos Aires Conurbation.

Material and methods: observation was carried out on children in Neonatal Intensive Care Units (NICU) who were hospitalized for premature birth. Observations were made by a psychologist trained in perinatal psychology at the time when the children were subjected to different painful procedures, such as blood samples, injections, ocular fundus, change of respirator and aspiration. Indicators registered were heart rate (HR, which is the number of heart beats per unit of time), oxygen saturation (SO₂, which is the amount of oxygen that combines with hemoglobin), behavioral signs (facial expressions, body movements, crying or crying expression) and recovery time (RT, which is the time that elapses until the child returns to their baseline values).

Data on HR and SO₂ was provided by the monitors to which the child was connected. Behavioral indicators and RT were obtained from direct observation of the child. Observations were made three times: 15 seconds before beginning, during and after concluding the procedure, until the child was able to recover, returning to baseline values.

This work was approved by the ethics committee and informed consent was obtained.

RESULTS

In reference to the private hospital, according to the data gathered, we can see that HR tends to fall when faced with painful stimulus among extreme and very extreme preterm children. The opposite occurs among infants born moderately prematurely, who showed an increase in HR. Something similar occurs with expressions and movements, which are present in older premature babies, but appear less in lower gestational ages.

In the public hospital such an acute difference as the case of the private hospital as regards HR and behavioral signs is not found, but the youngest babies continue to show a percentage where, despite suffering pain, are unable to express it through gestural indicators, body movements or increased HR values.

With respect to SO₂, we see a deficit in this value in almost the whole sample, regardless of the child's gestational age and the place they are hospitalized.

If we consider recovery time, we may see it is variable, showing a longer time in being able to return to baseline values in extreme and very extreme premature children in both institutions (Table II).

DISCUSSIONS AND CONCLUSIONS

Recalling the harsh background of premature children with respect to pain and considering the experience of Jeffrey Lawson and the possibility of a paradigm change, we may see that we have come a long way on the road to

TABLE II
RESULTS ACCORDING TO GESTATIONAL AGES AND HOSPITALS

%	Private Hospital		Public Hospital <i>ublico</i>		Total	
	Moderate	Extreme + very extreme	Moderate	Extreme + very extreme	Moderate	Extreme + very extreme
Increased HR	60	40	100	11	80	25.5
Reduced HR	40	60	0	89	20	74.5
Increased SO ₂	40	0	0	0	20	0
Reduced SO ₂	60	100	100	100	80	100
Gestures YES	60	10	67	67	63.5	38.5
Gestures NO	40	90	33	33	36.5	61.5
Movements YES	60	40	83	78	71.5	59
Movements NO	40	60	17	22	28.5	41
Recovery Time	96 seconds	198 seconds	50 seconds	60 seconds	67.8 seconds	129 seconds

queries, experiences and changes. Myths have been shown up, which were preventing correct pain diagnosis in such young ages. Villamizar (7) considers that many of these myths continue to exist among healthcare personnel, and coincides in the necessity to continue working on this problem, building awareness and providing a scale for diagnosis according to pain in the population studied, with the observations detailed in this report a part of the process to create this specific scale.

Pain in premature children has particular characteristics, mainly among those of lesser gestational ages, placing them as the most vulnerable against pain. In each group studied, we can see how the lesser the gestational age, the greater the tendency to reduce HR, while expressions and body movements are not always present, and recovery times could lengthen. The opposite is true in the premature group closer to children at term age.

These results coincide with Stevens (18) in that, when assessing such young children, it is necessary to combine both physiological and behavioral aspects, while it is important to differentiate the possible response in children born prematurely and at term. On the basis of what has been observed in this study, it is believed that previous investigations have not taken fully into account the absence of gestural indicators and the drop in HR among these patients, together with a minimized importance of considering a third time in observing this phenomenon, thus allowing a register of the time elapsed until the child returns to their baseline values. This last aspect offers the possibility, in the future, of developing pain protocols that not only determine nociception level but also consider a stage of its relief and the children's company, considering them a complete person; in short, humanizing them.

It is therefore essential to continue studying this phenomenon, because if we act on the basis of generalities, we may finally under-evaluate pain in children who may be suffering it, although their physiological and behavioral values are not as expected, especially if we base our assessment on values for children born at term.

The study coincides with the findings of Guerra de la Garza (2014) in developing the theory of Saunders, as pain surpasses physical aspects and affects emotional, social and spiritual life, leading to total pain, which if not alleviated becomes the center of the person's life. In the case in hand, not only would it take on major relevance in the experience of a premature child, but also becomes suffering for his or her parents, especially if any of the short term sequels referred by Anand (16) create difficulties in bonding and feeding caused soon after pain. Both are very significant aspects for achieving adequate recovery from preterm birth during hospitalization and after discharge.

It is not only the duty of healthcare professionals to address the suffering of hospitalized children and their families, but it also a right of premature children to receive

integral care and, within this, to specifically make a correct diagnosis and treat pain; accordingly, it is essential to observe children's behavioral and physiological values, always bearing in mind the possible responses of children born prematurely.

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CONFLICT OF INTERESTS

There are no conflicts of interests.

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