

Evaluation of Pain Assessment in Our Neonatal Intensive Care Unit

Thesis

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Presented By:

Abeer Sobhy Mohammed Mohi El -Din

(M.B.BchAin-Shams University, 2010)

Under Supervision of

Prof. Dr. Mohamed Nasr El Din El Barbary

*Professor of pediatrics & Neonatology
Faculty of Medicine-Ain-Shams University*

Dr. Rania Mohamed Abdou

*Lecturer of Pediatrics & Neonatology
Faculty of Medicine-Ain-Shams University*

Faculty of Medicine - Ain-Shams University

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List of Contents

Title	Page No.
List of Table.....	I
List of Figures.....	III
List of Abbreviations.....	V
Introduction.....	I
Review of Literature	
▪ Chapter (One): Neonatal Pain.....	12
▪ Chapter (Two): Physiological Changes of Pain on Body System...27	
▪ Chapter (Three): Neonatal Pain Assessment.....	39
▪ Chapter (Four): Pain Management and Sedation.....	53
Patients and Methods.....	66
Results.....	73
Discussion.....	90
Summary.....	98
Conclusion.....	103
Recommendations.....	104
Reference.....	105
Arabic summary.....	

List of Tables

Table No.	Title	Page No.
Table (1):	Development of Nociception and Pain Perception Pathway by Gestational Age	14
Table (2):	The Most Important Causes of Pain in NICU	18
Table (3):	Characteristics and functions of C fibre and A-delta fibres.....	21
Table (4):	Clinical features of Cushing's Syndrome and the proportion of patients affected by these features.....	35
Table (5):	Common features of hypocortisolemia in pa \in patients.....	37
Table (6):	Neonatal Pain, Agitation and Sedation Scale (NPAS).....	43
Table (7):	Pain Assessment Tool :	44
Table (8):	Explanation of PAT scoring system (Updated June 2012, RCH, Melbourne).....	45
Table (9):	Comfort Scale	49
Table (10):	Neonatal facial coding system	52
Table (11):	Guidelines for Pain Management	54
Table (12):	Analgesic Medications	63
Table (13):	Pain Assessment Tool	68
Table (14):	Explanation of PAT scoring system.....	69
Table (15):	Sex distribution among the studied patients, procedures done and diagnosis	73
Table (16):	Clinical factors of PAT score	75
Table (17):	Drugs used as analgesic and conscious status among the studied patients.....	76
Table (18):	PAT score and cortisol level among the studied patients.....	77

List of Tables

Table No.	Title	Page No.
Table (19):	Correlation between PAT score and cortisol level in all the studied patients (no. = 50)	79
Table (20):	Comparison between RBS punctures patients and Ven puncture patients regarding demographic data	80
Table (21):	Comparison between RBS punctures patients and Vein puncture patients regarding clinical factors of PAT score	81
Table (22):	Comparison between RBS punctures patients and Ven puncture patients regarding drug used as analgesic and conscious state	84
Table (23):	Comparison between RBS punctures patients and Ven puncture patients regarding PAT score and cortisol level	85
Table (24):	Correlation between PAT score and cortisol level in Vien puncture procedure patients and in RBS puncture procedure patients separately	86
Table (25):	Relation of PAT score and cortisol level with the demographic data of the studied patients	87
Table (26):	Relation of PAT score and cortisol level with the clinical factors of PAT score	88
Table (27):	Linear regression analysis for PAT score as a predictor of cortisol level	89

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Pain pathway.....	13
Figure (2):	The pain pathway.....	22
Figure (3):	CNS Influences on pain and sensory processing	25
Figure (4):	Pain stimulation of the hormone system causes adrenal, gonad and thyroid hormone levels to elevate in the serum. If pain remains uncontrolled for a considerable time period, hormonal depletion may occur, and serum levels drop below normal.	31
Figure (5):	Sex distribution among the studied patients.....	74
Figure (6):	Procedure done for the studied patients	74
Figure (7):	Diagnosis distribution among the studied patients.....	75
Figure (8):	Drug used as analgesic.....	77
Figure (9):	Conscious state.....	77
Figure (10):	Correlation between PAT score and cortisol level.....	79
Figure (11):	O2 Saturation changes during RBS and Vien puncture procedures.....	82
Figure (12):	Blood pressure changes during RBS and Vien puncture procedures.....	83
Figure (13):	Nurse perception of pain changes during RBS and Vien puncture procedures.....	83
Figure (14):	Correlation between PAT score and cortisol level in ven puncture and RBS puncture patients.	86

List of Abbreviations

Abb.	Meaning
ACTH	Adrenal corticotropin hormone
CNS	Central nervous system.
CRH	Corticotropin releasing hormone.
DMPP	Descending modulatory pain pathways.
FSH	Follicle stimulating hormone.
GRH	Gonadal releasing hormone.
HPATG	Hypothalamic–pituitary–adrenal–thyroid–gonadal System.
IASP	International Association for the Study of Pain.
LH	Luteinizing hormone.
NCM	Nursing Comfort Measures.
NDHN	Nociceptive dorsal horn neurons.
NFCS	Neonatal Facial Coding System.
NICU	Neonatal Intensive Care Unit
NIPS	Neonatal Infant Pain Scale.
N-PASS	Neonatal Pain, Agitation, and Sedation Scale.
NSAIDs	Nonsteroidal anti-inflammatory drugs.
PAIN	Pain assessment in Neonates.
PAT	Pain Assessment Tool.
SUN	Scale for Use in Newborns.
T₃	Triiodothyronine.
T₄	Thyroxin.
TRH	Thyroid releasing hormone.
TSH	Thyroid stimulating hormone.

Abstract

Background: The assessment of pain in newborns represents a great challenge. Two of the major limitations to achieving pain relief in clinical practice include: The lack of a reliable biomarker. The absence of a gold standard scale that is capable of measuring the intensity of the pain.

Aim of the work: in this study we will use clinical pain assessment scales and compare it by non-invasive measure the salivary cortisol level to evaluate the accuracy of our clinical skills in evaluating neonatal pain.

Patients and Methods: This study was carried out at the Neonatal Intensive Care Unit (NICU) of Ain Shams University. A cross sectional study of 50 full term infant gestational age between 37:41 weeks of both sexes from our NICU. Patients will be enrolled after consideration of inclusion and exclusion criteria.

Results: There is a significant linear relationship between salivary cortisol level and PAT score in assessment of pain in newborn. The PAT score is easy and reliable tool to assess neonatal pain. The PAT score must be done to evaluate pain in NICUE and mange it in collaboration with the Nursing team to reduce the suffering of the infant in the NICU.

Conclusion: Concluded that Pain assessment tool (PAT score) is a useful easy, non- invasive screening method for assess neonatal pain. There was highly statistically significant positive correlation between PAT score and salivary cortisol level.

Key words: PAT score - .salivary cortisol – Triiodothyronine- Thyroxin

Author: Abeer Sobhy Mohammed

Correspondences: Abeer193@hotmail.com

INTRODUCTION

Starting at birth, critically ill newborn babies undergo repetitive, painful stimuli as part of diagnostic and therapeutic procedures that are necessary for their survival (*Slate et al., 2010*).

In the neonatal intensive care unit (NICU) during the first two weeks after birth, newborns are exposed to approximately 16 invasive procedures per day, of which only one-third are completed under analgesia (*Carbaja et al., 2008*).

Some common painful procedures include:

- Heel prick.
- Intubation.
- Arterial or venous line insertion.
- Chest drain insertion.
- Inserting naso-gastric tube
- Pulling off tape.

Common false beliefs

“Preterm infants don’t feel pain”

“Preterm infants don’t remember pain and it Has no long term effects”

“It is too dangerous to give anaesthesia or analgesia”

Guiding Principle

Neonates, term and preterm, do experience pain and have the right to- receive effective and safe pain relief.

We all react to pain with behavioral, physiological and biochemical and hormonal change.

The cardiovascular and respiratory effects associated with the endocrine-metabolic response to acute nociceptive stimuli may increase neonatal morbidity and mortality (*Johnston et al., 2011*).

The assessment of pain in newborns represents a great challenge. Two of the major limitations to achieving pain relief in clinical practice include:

- The lack of a reliable biomarker.
- The absence of a gold standard scale that is capable of measuring the intensity of the pain.

Although there are more than 30 scales for assessing pain in newborns, no specific scale has demonstrated superiority. Most of these instruments rely on physiological and behavioral parameters, which are indirect responses to the painful stimulus (*Carbajal et al., 2008*).

Physiological parameters, including

Respiratory rate, Heart rate, Oxygen saturation, Intracranial and blood pressure. among others, have the

advantage of being objective measures, but changes in these parameters are not specific to painful phenomenon (*Raaside, 2011*).

The main behavioral responses to pain in preverbal infants are Crying and body and facial movements.

The facial expression reflects the painful experience effectively and specifically indeed, facial movements correlate best with cortical activity during a painful stimulus in comparison with physiologic indicators (*Grunau, 1987*).

Salivary cortisol: Cortisol level test which is the main adrenal glucocorticoid and plays a central role in glucose metabolism and in the body's response to stress.

Saliva tests are reliable indicators of the levels of all steroid hormones in our body. In fact, Salivary cortisol testing is covered by Plan B medicare. The National Institutes of Health (NIH) and the World Health Organization (WHO), recognize saliva cortisol testing as being very accurate (*Elias, 2008*).

AIM OF THE WORK

In this study we will use clinical pain assessment scales and compare it by non-invasive measure the salivary cortisol level to evaluate the accuracy of our clinical skills in evaluating neonatal pain.

Chapter One

NEONATAL PAIN

Definition of pain

Pain is 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" (*Merskey & Bogduk, 1994*).

However, the inability to communicate verbally does not negate the possibility that an individual is experiencing pain and is in need of suitable pain-relieving treatment (*Craig, 2006*).

Acute pain is defined as 'pain of recent onset and probable limited duration. It usually has an identifiable temporal and causal relationship to injury or disease'. **Chronic pain** 'commonly persists beyond the time of healing of an injury and frequently there may not be any clearly identifiable cause' (*Ready & Edwards, 1992*).

Pain is not only an unpleasant sensation, but a complex sensory modality essential for survival (*Nilesh Patel, 2010*).

The term nociception (Latin nocere, "to hurt") refers to the sensory process that is triggered, and pain refers to the perception of a feeling or sensation which the person calls pain, and describes variably as irritating, sore, stinging, aching, throbbing, or unbearable.

These two aspects, nociception and pain, are separate (*Bear, 2001*).

Neurodevelopmental Changes of Fetal Pain

Pain in the developing fetus is controversial because of the difficulty in measuring and interpreting pain during gestation. It has received increased attention lately because of recently introduced legislation that would require consideration of fetal pain during intentional termination of pregnancy. (*Semin Perinatol, 2007*).

Figure 1: pain pathway.

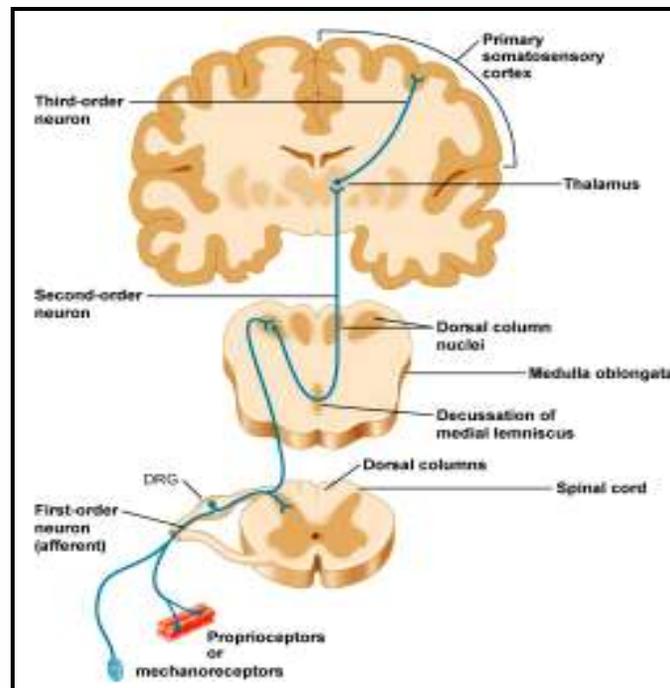


Figure (1): Pain pathway.

During development, sensory fibers are abundant by 20 weeks; a functional spinal reflex is present by 19 weeks; connections to the thalamus are present by 20 weeks; and connections to subplate neurons are present by 17 weeks with intensive differentiation by 25 weeks. These cells are important developmentally, but decline as a result of natural apoptosis. Mature thalamocortical projections are not present until 29 to 30 weeks, which has led many to believe the fetus does not experience emotional “pain” until then (*Semin Perinatol, 2007*).

Table (1): Development of Nociception and Pain Perception Pathway by Gestational Age (*JAMA, 2005*)

Anatomical/ Functional Characteristic	Description	Gestational Age, wk	Source
Peripheral cutaneous sensory receptors	Perioral cutaneous sensory receptors	7.5	Humphrey, 1964
	Palmar cutaneous sensory receptors	10–10.5	
	Abdominal cutaneous sensory receptors	15	
Spinal cord	Spinal reflex arc in response to nonnoxious stimuli neurons for nociception in dorsal root ganglion	8	Okado and Kojima, 1984 Konstantinidou et al, 1995
		19	

Thalamic afferents	Thalamic afferents reach subplate zone	20–22	Kostovic and Rakic, 1990 Hevner, 2000
	Thalamic afferents reach cortical plate	23–24	Kostovic and Rakic, 1984 Kostovic and Goldman-Rakic, 1983
Cortical function*	Somatosensory evoked potentials with distinct, constant components	29	Klimach and Cooke, 1988 Hrbek et al, 1973
	First electrocardiographic pattern denoting both wakefulness and act	30	Clancy et al, 2003 Torres

Fig. 1: Embryology of Nociceptors

- 1) 7 weeks
 - 2) 11 weeks
 - 3) 15 week
 - 4) 20 weeks
- (Anand & Hickey, 1987)

