

Validity and reliability of Neonatal Infant Pain Scale in Neonatal Intensive Care Units in Iran (2010)

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ABSTRACT

Objective: This study aimed to determine validity and reliability of the NIPS (Neonatal Infant Pain Scale) in the neonatal intensive care unit (NICU).

Methodology: For this study, sixty eight infants were selected using available and purposive sampling method after translating the English version of NIPS to Persian using International Quality of Life Assessment (IQOLA) scale. These children have been filmed before, during and after two interventions of venipuncture and catheter insertion which was required and was ordered by physician. During painful interventions and until three minutes later, heart rate and arterial oxygen saturation of the infants were recorded. Thereafter, five observers (including three nurses, a neonatal specialist and the researcher nurse) scored the infants pain by watching the videos and using the translated version of NIPS.

Results: The Interclass correlation coefficient (ICC) was perfect ($ICC > 0.9$). The minimum correlation coefficient between inter-rater was 0.868. Validity tests showed a high correlation between NIPS and visual analog scale ($r = 0.949$; $p < 0.001$).

Conclusion: According to the confirmed validity and reliability of this scale, use of NIPS in neonatal intensive care units in Iran is possible and can be recommended.

KEY WORDS: Pain, Reliability, Validity, NICU, NIPS.

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INTRODUCTION

Pain is a hidden feeling and an emotional experience which is associated with acute or

potential tissue damage.¹ The hospitalized infants confront with many painful procedures such as venipuncture and etc. several times a day.^{2,3} Pain experience in infancy or childhood may cause emotional problems, attention deficit hyperactivity disorder and deficiencies in development of central nervous system.⁴

Today, the need for prevention, diagnosis and pain management of the infants and children is accepted as a universal principle.⁵ Assessing the pain in NICU is an important process that is considered as one of the primary responsibilities of the nurses.^{6,7}

International Association of Neonatal Nursing suggests that pain assessment should be conducted using valid and reliable multidimensional instruments. There are various pain assessment scales and tools for infants.⁸

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NIPS scale is used for measuring behavioral scale of the pain in infants which was first designed and used by Lawrence & et al in 1993. NIPS assesses six parameters; facial expression (0-1), cry (0-2), breathing patterns (0-1), arms (0-1), legs (0-1) and state of arousal (0-1), which would score between 0-7 in minimum and maximum rate respectively.⁹⁻¹² Many studies have been conducted in order to determine reliability and validity of pain assessment in infants. In the study of Carlo and Suraseranivongse which evaluated NIPS and other scale, the reliability of NIPS was much better.^{13,14} Studies in Iranian infants showed that educationally, unavailability of the pain assessment tools in infant units is considered as one of their major issues.⁷ Therefore, the present study aimed to determine validity and reliability of NIPS in Persian.

METHODOLOGY

This was a methodological study. Sixty-eight hospitalized infants were selected in NICU of one of the hospitals of Tehran (Iran) using available and purposive sampling method. In order to calculate sample size, the following method was used¹⁵:

$$r=0/38^{16}$$

$$C=\%5 \times \text{LN} [(1+r)/(1-r)] \quad \beta=\%10 \quad \alpha=5\%$$

$$n= [(Z \alpha + Z \beta)/c]^2 + 3 \quad n=68$$

The 1st step: (Translation, face and content validity of NIPS): After receiving permission from Children Hospital Eastern Ontario, Ottawa, Canada which has the property right of this scale translation of the scale done by IQOLA method. Here, the original version of it rendered (forward translation) from English to Persian by two translators (expert in both English and Persian languages). Then, each translator scored the other in every sentence by a visual analog scale (0-100). Scoring finished for clarity, concept similarity of every sentence, use of a common language, difficulty and general quality of the translation. Then each sentence was confirmed in Persian (face validity). Thereafter, difficulty in assessment of the Persian translation was done with content validity index (CVI). CVI designed and used by Walts & Balles in 1983.¹⁷ In this index, relevancy, clarity and simplicity of each sentence were confirmed by experts in the related field. After content validity, the scale was re-translated from Persian to English (Backward translation). Finally, the final English version was extracted from the Persian translation. (Table-I)

The 2nd step (Start sampling by entering to the study environment): Receiving the final version of the Persian version of NIPS, as described above, in three steps: before, during and after two painful procedures (venipuncture and catheter insertion) which were done according to physician recommendation, the infants had been filmed (it was starting 1min before the painful procedure to 3 min later). All the films were taken in the morning shift (8 A.M. to 12 at noon). Moreover, heart rate, pulse rate changes and arterial oxygen saturation were recorded during the two painful procedures.

The 3rd step (Watching films by the Raters using Inter-Rater method): After sampling, the five observers (including three nurses, a neonatal specialist and the researcher nurse) watched film and scored them in all three steps based on translated NIPS. In order for scoring infants behavior and using NIPS, all the mentioned observers had been trained. The researcher nurse, in addition to NIPS, scored the infants pain in three steps based on visual analogue scale (VAS) from 0 to 100. In VAS, zero indicates lack of pain and 100 indicates the highest possible pain. It should be mentioned that score of VAS and also heart rate and arterial oxygen saturation were used as criterion-related validity of NIPS scale.

To determine the construct validity, known-group technique was used. In this technique, the tool or scale is used for the groups who are expected to differentiate in one characteristic and then scores would be compared to each other. Provided with confirmation of the construct validity the expected difference would be revealed in the results.^{18,19} In the present study, prematurity or being a term infant were considered as the expected characteristics.

It should be noted that written consent form was received before start sampling from the parents for filming their children. After scoring, the data were analyzed using SPSS v17. In this study, the correlation between NIPS and VAS, physiological criteria and arterial oxygen saturation measured by Spearman-brown test. For confirmation of the construct validity, the Mann-Whitney U test and independent t-test were used. In addition, for assessing the reliability of Inter-Raters, ICC was used.

RESULTS

The study population among 68 participant included 29 males and 39 females. Translation quality was in a desirable level and the experts confirmed its face validity. In addition, content validation of NIPS obtained good for each sentence using CVI (the minimum obtained score was 85).

Table-I: Original English version and final version of NIPS translated into Persian using International Quality of Life Assessment.

| شماره | شاخص | Score | Characteristic | |
|-------|---|-------|--|-------------------------------------|
| 0 | آرامش عضلات: چهره آرام، چهره معمولی | 0 | Relaxed muscles: Restful face, neutral expression | Facial Expression حالت صورت |
| 1 | انقباض کردن: عضلات صورت در هم رفته، چانه، فک و پیشانی چین و چروک خورده (حالت غیر معمولی صورت - دهان، بینی و پیشانی) | 1 | Grimace: Tight facial muscles; furrowed brow, chin, jaw, (negative facial expression - nose, mouth and brow) | |
| 0 | فقدان گریه: ساکت، عدم گریه | 0 | No Cry: Quiet, not crying | Cry گریه |
| 1 | ناله: ناله خفیف، متناوب | 1 | Whimper: Mild moaning, intermittent | |
| 2 | گریه شدید: جیغ بلند، مداوم، گوشخراش و با صدای زیر (نکته: اگر کودک اینتوبه شده باشد گریه بدون صدا ممکن است از حرکات دهان و صورت مشخص شده و نمره بگیرد) | 2 | Vigorous Cry: Loud scream; rising, shrill, continuous (Note: Silent cry may be scored if baby is intubated as evidenced by obvious mouth and facial movement). | |
| 0 | آرام: الگوی معمول تنفس برای این نوزاد | 0 | Relaxed: Usual pattern for this infant | Breathing Patterns الگوی تنفس |
| 1 | تغییر در نفس کشیدن: تنفس نامنظم، تند تر از حد معمول، حالت آق زدن، تویکشدن و نگهداشتن نفس | 1 | Change in Breathing: Irregular, faster than usual; gagging; breath holding | |
| 0 | آرامش / مهار: عدم سفتی عضلات، حرکات خود به خودی بازو و دستها | 0 | Relaxed/Restrained: No muscular rigidity; occasional random movements of Arms | Arms دست ها و بازوها |
| 1 | خم شده / صاف شده: سفتی صاف و منقبض - خم کردن و کشش سریع و یا محکم | 1 | Flexed/Extended: Tense, straight arms; rigid and/or rapid extension, flexion | |
| 0 | آرامش/مهار: عدم سفتی عضلاتی، حرکات خود به خودی پاها | 0 | Relaxed/Restrained: No muscular rigidity; occasional random leg movement | Legs پاها |
| 1 | خم شده / صاف شده: پاهای صاف و منقبض - خم کردن و کشش سریع و یا محکم | 1 | Flexed/Extended: Tense, straight legs; rigid and/or rapid extension, flexion | |
| 0 | خوابیده/بیدار: ساکت، خواب آرام، با هوشیار و ساکت | 0 | Sleeping/Awake: Quiet, peaceful, sleeping or alert and settled | State of Arousal حالت برانگیختگی |
| 1 | داد و بیداد: هوشیار، بی قرار، دست و پا زدن | 1 | Fussy: Alert, restless, and thrashing | |

Result by using Spearman Brown correlation coefficient indicated that there was a direct and significant relationship between the scores of NIPS and VAS in three steps, before, during and after the painful procedure ($p < 0.001, r = 0.949$). In addition, there was a weak, but significant relationship between score of NIPS during the painful intervention and heart rate ($p < 0.01, r = 0.350$). Also, Spearman Brown correlation coefficient indicated, high reliability between inter-Raters ($r = 0.868, p < 0.001$).

Table-II indicates the construct validity confirmation of NIPS (known group technique). Recent studies indicated the difference pain rate between premature and non-premature infants.⁹ NIPS made a difference between the two groups during and after the painful procedure. Mean pain scores of NIPS before, during and after the painful procedure were 1.99 ± 1.23 , 5.62 ± 1.85 and 3.59 ± 2.41 respectively. Table-III indicates the reliability of NIPS scores in infants during the painful intervention based on cognitive variables and ICC.

Table-II: Comparison of the pain in two groups of premature and term infants.

| <i>Diagnosis↓</i> | <i>Stage →</i> | <i>During intervention</i> | <i>After intervention</i> |
|---------------------------------|------------------|----------------------------|---------------------------|
| Prematurity (premature newborn) | Statistical Test | U Mann-whitney | independent t-test |
| | P | <0.05 | <0.05 |
| | n | 35 | 35 |
| Full term newborn | Statistical Test | U Mann-whitney | independent t-test |
| | P | <0.05 | <0.05 |
| | n | 33 | 33 |

DISCUSSION

Neonatal pain assessment tool are so many, but not all of them are easy to use.²⁰ For example PIPP is used for term and premature infants pain assessment. This scale is not appropriate for pain assessment when using anesthetic medications or when the infant pain has prolonged. NIPS and CRIES comprehensively are used for term and premature infants. Meanwhile, CRIES shows a lower score in neonates who had been given anesthetic drugs. Moreover, its application is more difficult in comparison with NIPS.²¹ Applying NIPS does not require so much time or using extra and special equipments. In some studies, it was indicated that using NIPS in comparison with other scales was more user friendly by the nurses due to its ease of use.¹⁴

In the present study, reliability and validity of NIPS has been proven in Persian. The results showed that this scale has a high reliability and validity. The results of the present study were in accordance with Lawrence's, that, the reliability of inter-rater was so high ($r = 0.92-0.97$). In addition, in that study, VAS was used for confirmation of concurrent criterion validity. The correlation coefficient between VAS and NIPS varied from 0.53 to 0.84.²²

In addition, reliability and validity of NIPS had been investigated by Backus. In Backus study which was done on 30 premature and term infants during painful procedures, the reliability between the inter-rater was reported as the following: ($r = 0.69-0.90$, $p < 0.001$). Mean scores of NIPS, before, during and after the painful intervention were 0.44, 3.04 and 0.6 respectively. In addition, in backus studies, no significant correlation was observed between heart rate, pulse rate and arterial oxygen saturation and mean scores of NIPS.²³ In our study, no significant relationship was observed between mentioned criteria except a weak but significant relationship between heart rate and NIPS score during the painful procedure.

In the study of Suraseranivongse & et al, interclass correlation coefficient was perfect in NIPS ($ICC = 0.98$).¹⁴ The results of the present study were in accordance with the above mentioned study. In the study of Carlo, the reliability of NIPS was good.¹³

CONCLUSION

The reliability and validity of NIPS has been confirmed in Persian. Therefore, this scale can be used for pain assessment of term and preterm infants in painful procedures from now onward.

Table-III: Reliability of NIPS scores in infants during the painful intervention based on cognitive variables.

| <i>Group↓</i> | <i>Statistics→</i> | <i>n</i> | <i>Mean±SD</i> | <i>ICC*</i> |
|-------------------|--------------------|----------|----------------|-------------|
| Total population | | 68 | 5.62 ± 1.85 | 0.981 |
| Sex | Male | 29 | 1.96±5.50 | 0.980 |
| | female | 39 | 2.24±1.34 | 0.983 |
| Age (day) | 1-10 | 57 | 1.80±5.73 | 0.996 |
| | 10-30 | 11 | 2.07±5.03 | 0.930 |
| Weight (gram) | 1000-2500 | 51 | 1.92±5.48 | 0.990 |
| | 2500-4000 | 17 | 1.60±6.03 | 0.945 |
| 1 min | <7 | 3 | 6±1 | |
| Apgar | 7-10 | 65 | 5.6±1.88 | 0.981 |
| | <7 | 0 | | |
| Apgar | 7-10 | 68 | 1.85±5.62 | 0.981 |
| Mother delivery | Vaginal | 13 | 1.93±5.98 | 0.997 |
| | C/S | 55 | 1.84±5.53 | 0.977 |
| Diagnose | Prematurity | 35 | 2.16±5.1 | 0.989 |
| | Icter | 17 | 1.35±6.07 | 0.940 |
| | Thacypenea | 9 | 1.5±6.28 | 0.977 |
| | Other | 7 | 0.76±6.28 | 0.985 |
| Oxygen saturation | <95% | 31 | 5.63±1.82 | 0.979 |
| | 95-100% | 37 | 5.61±1.89 | 0.984 |
| Heart rate | <120 | 2 | 5.6±0.84 | 0.976 |
| | 120-140 | 8 | 3.55±2.43 | 0.993 |
| | >140 | 58 | 1.61±5.91 | 0.974 |

*Interclass correlation coefficient (ICC)

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