ORIGINAL ARTICLE

Postoperative pain assessment using four behavioral scales in Pakistani children undergoing elective surgery

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ABSTRACT

Background: Several measurement tools have been used for assessment of postoperative pain in pediatric patients. Self-report methods have limitations in younger children and parent, nurse or physician assessment can be used as a surrogate measure. These tools should be tested in different cultures as pain can be influenced by sociocultural factors. The objective was to assess the inter-rater agreement on four different behavioral pain assessment scales in our local population. **Materials and Methods:** This prospective, descriptive, observational study was conducted in Pakistan. American Society of Anesthesiologists I and II children, 3-7 years of age, undergoing elective surgery were enrolled. Four pain assessment scales were used, Children's Hospital of Eastern Ontario Pain Scale (CHEOPS), Toddler Preschool Postoperative Pain Scale (TPPPS), objective pain scale (OPS), and Face, Legs, Activity, Cry, Consolability (FLACC). After 15 and 60 min of arrival in the postanesthesia care unit (PACU), each child evaluated his/her postoperative pain by self-reporting and was also independently assessed by the PACU nurse, PACU anesthetist and the parent. The sensitivity and specificity of the responses of the four pain assessment scales were compared to the response of the child. **Results:** At 15 min, sensitivity and specificity were >60% for doctors and nurses on FLACC, OPS, and CHEOPS scales and for FLACC and CHEOPS scale for the parents. Parents showed poor agreement on OPS and TPPS. At 60 min, sensitivity was poor on the OPS scale by all three observers. Nurses showed a lower specificity on FLACC tool. Parents had poor specificity on CHEOPS and rate of false negatives was high with TPPS. **Conclusions:** We recommend the use of FLACC scale for assessment by parents, nurses, and doctors in Pakistani children aged between 3 and 7.

Key words: *Behavioral scales, children, pain assessment, pediatric pain, postoperative pain*

INTRODUCTION

Measurement of postoperative pain presents several challenges in pediatric anesthesia practice. Children vary in their cognitive and emotional development and also in their response to pain and its therapy including postoperative pain. Treatment of pain requires accurate assessment.[1,2] Self-report, when available, is considered the primary source of information on pain intensity but can only be applied in children with sufficient cognitive and communication ability.[3] Several different tools have been used in this age group but with no consensus on the best tool.

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Using behavioral scales, we seek to measure, or assign numbers to, observable behaviors. Behaviors that are measured may be motoric (body movements), vocal (sounds), or verbal (words).[4] If a child is unable to rate pain, assessment is reliant on observer-based scales and either parent, nurse or a physician can be used as a surrogate. Factors like expertise of the observer become important when using these observer-based tools. Pain-measuring instruments used in the clinical settings must be valid, reliable, versatile as well as culturally sensitive as pain is also influenced by the sociocultural factors and it is important to test these tools in different cultures.[3] These culturally sensitive tools help health professionals

to develop appropriate interventions for pain management in their own particular environment.[5]

Our search revealed a dearth of literature in this area from the South Asian region. Our objective for conducting this study was to evaluate four behavioral pain assessment scales by determining inter-rater agreement among parents, nurses, and anesthetists in Pakistani children. We used child's self-reporting for postoperative pain to compare these scales.

MATERIALS AND METHODS

This was a prospective, descriptive, observational study conducted at Aga Khan University Hospital, a tertiary care center in Karachi, Pakistan. After obtaining approval from the ethical review committee, informed consent from parents, and assent from older children 52 subjects meeting the inclusion criteria were recruited. The inclusion criteria were children aged between 3 and 7 years of both gender and physical status American Society of Anesthesiologists I and II scheduled to undergo elective surgery under general anesthesia. Parental refusal to consent, emergency surgery, altered sensorium, developmental delay, and children requiring postoperative intensive care were excluded.

Four behavioral pain assessment scales were used in the study including: Children's Hospital of Eastern Ontario pain scale (CHEOPS) developed by McGrath *et al.* in 1985.[6] It is an observational scale for measuring postoperative pain in children aged 1-7 years. The scale includes six categories of pain behavior: (Cry, facial, verbal, torso, touch, and legs). A score ranging from 0 to 2 or 1 to 3 is assigned to each activity and the total score ranges between 4 and 13. The toddler-preschool postoperative pain scale (TPPS)[7] consists of seven items in three behavior categories; (vocal pain expression, facial pain expression, and bodily pain expression). The seven items are scored as one if the pain behavior is present during a 5 min observation period or as a zero if not present. Scores range from 0 to 7. Objective pain scale (OPS)[8] incorporates four pain behaviors (crying, movement, agitation, and verbalization) and BP change. Each of these categories is scored from 0 to 2. The FLACC assessment tool[9] was developed to provide a pain assessment in nonverbal or preverbal children. This scale incorporates five categories of behavior; each category is scored from 0 to 2 with total scores ranging 0-10. Appropriate cut-off points for each scale were identified. These were <3 for FLACC, OPS and TPPS scales and <6 for CHEOPS.[10] Values above these were taken as the presence of pain.

The choice and technique of intraoperative anesthesia and analgesia were left to the primary anesthesiologist responsible for clinical care of the patient. The parents were explained about all four tools of pain assessment in the preoperative assessment clinic, inpatient wards or surgical day-care unit preoperatively. The postanesthesia care unit (PACU) nurses and anesthesiologists involved in the study had a separate training session. This training included a discussion of the elements, the definition of behavior, and use of the scoring systems. Any queries related to pain assessment tools were resolved by one of the investigators.

In PACU, a nurse assigned to the patient, parent, and anesthesiologist handed the scales to observe the severity of pain, of every recruited child. This assessment was done independently by all three observers. The observations were noted for all four scales at 15 min of arrival in PACU and then again at 60 min by the three observers independently. The children if awake were asked about the presence or absence of pain, and this was recorded. Children asleep were considered pain-free. The child's response was taken as the gold standard.

Statistical analysis was performed using Statistical Package for Social Sciences Version 19 (SPSS Inc., Chicago, IL, USA) and NCSS Statistical Software, Version 9.0 (NCSS LLC Inc. Kaysville, Utah, USA). The score of each scale was the sum of rated items and a cut-off limit was used for each for the presence or absence of pain. Mean and standard deviation were computed for quantitative variables like age. Sensitivity, specificity, and accuracy were computed for each rater on different pain assessment tools. Sensitivity and specificity were computed by NCSS software. The sensitivity and specificity of the response by parents, nurses, and doctors were compared using the Pearson Chi-square test. A $P < 0.05$ was considered significant.

RESULTS

Fifty-two patients were enrolled in the study (age range 3-7 years). At 15 min, 41% ($n = 22$) children reported their pain. Sixteen children had felt pain, and six reported no pain. About 59% of the children were asleep and were considered pain-free. A comparison between children's self-report and the three observers scoring of child pain on the four assessment tools was used to determine the sensitivity and specificity of each behavioral scale and the agreement between the three observers. Results at 15 min are presented in Table 1.

FLACC showed high sensitivity and specificity when used by nurses and anesthesiologists while it was

less sensitive when used by parents. There were no false positive and minimal false negatives. Both the healthcare professionals had an agreement of over 0.95, and the parent's agreement was 0.81. These results indicate that sensitivity and specificity on FLACC scale was high for anesthesiologists and nurses. For parents, sensitivity was less than the doctors and nurses. Agreement between the three groups was between 81% and 100%. Pain assessment on the OPS scale showed 100% sensitivity and specificity by the doctors and 93% and 67% by the nurses, but parents showed frequent false negatives and poor agreement compared with both nurses and doctors.

All values for sensitivity and specificity on CHEOPS scale by nurses and doctors were >60%. Parents showed high sensitivity but very low specificity and a high ratio of false positives. For the Toddler Preschool Postoperative Pain Scale (TPPPS) anesthesiologist's performance was better than the other two groups whereas nurses and parents showed a high false positive and negative rate.

The comparison between child's pain at 60 min by parents, nurses, and anesthesiologist on the four pain scales is shown in Table 2. Seventy-nine percent (79.6%) of the children reported the presence or absence of pain. Rest of the children was asleep. High sensitivity and specificity were seen in the parental assessment on the FLACC tool. Doctors showed a sensitivity and specificity >60% but nurses showed a low specificity. The sensitivity was poor on the OPS scale by all the observers due to high false negative. On the CHEOPS scale, the sensitivity and specificity for nurses and doctors were >74%. Parents had poor specificity (0.4). Sensitivity and specificity of all observers were 0.71-0.80 on TPPPS scale but the rate of false negative was high.

Table 1: Sensitivity, specificity, and accuracy for observers regarding presence of pain at 15 min

Pain assessment tool and rater	*n*	TP	TN	FP	FN	Sensitivity*	Specificity*	Accuracy
FLACC								
Parent	16	7	6	0	3	0.70	1.00	0.81
Nurse	20	14	6	0	0	1.00†	1.00	1.00
Doctor	21	14	6	0	1	0.93	1.00	0.95
OPS								
Parent	15	1	6	0	8	0.11	1.00	0.47
Nurse	20	13	4	2	1	0.93†	0.67	0.85
Doctor	22	16	6	0	0	1.00‡	1.00	1.00
CHEOPS								
Parent	15	9	1	5	0	1.00	0.17	0.67
Nurse	20	13	4	2	1	0.93	0.67	0.85
Doctor	22	14	6	0	2	0.87	1.00†	0.91
TPPPS								
Parent	14	4	0	6	4	0.50	0.0	0.29
Nurse	20	10	2	4	4	0.71	0.33	0.60
Doctor	22	15	4	2	1	0.94‡	0.68‡	0.91

*Sensitivity and specificity were calculated considering the verbal self-reporting of child about presence of pain as the gold standard; †$P < 0.05$ nurse versus parent; ‡$P \leq 0.05$ doctor versus parent. TP: True positive; TN: True negative; FP: False positive; FN: False negative; CHEOPS: Children's hospital of eastern ontario pain scale; TPPPS: Toddler-Preschooler postoperative pain scale; OPS: Objective pain Scale; FLACC: Face, Legs, Activity, Cry, Consolability

Table 2: Sensitivity, specificity and accuracy for observers regarding presence of pain at 60 min

Pain assessment tool and rater	*n*	TP	TN	FP	FN	Sensitivity*	Specificity*	Accuracy
FLACC								
Parent	43	34	4	1	4	0.89	0.80	0.88
Nurse	42	32	2	2	6	0.84	0.50	0.81
Doctor	43	25	3	2	13	0.66*‡	0.60	0.65
OPS								
Parent	43	5	5	0	33	0.13	1.00	0.23
Nurse	43	22	5	0	16	0.58*†	1.00	0.63
Doctor	43	27	4	1	11	0.71‡	0.80‡	0.72
CHEOPS								
Parent	38	27	2	3	6	0.82	0.40	0.76
Nurse	43	28	4	1	10	0.74	0.80	0.74
Doctor	43	32	5	0	6	0.84	1.00	0.86
TPPPS								
Parent	38	24	4	1	9	0.72	0.80	0.74
Nurse	43	28	4	1	10	0.74	0.80	0.74
Doctor	43	27	4	1	11	0.71	0.80	0.72

*Sensitivity and specificity were calculated considering the verbal self-reporting of child about presence of pain at 60 min as the gold standard. TP: True positive; TN: True negative; FP: False positive; FN: False negative; CHEOPS: Children's hospital of eastern ontario pain scale; TPPPS: Toddler-Preschooler postoperative pain scale; OPS: Objective pain scale; FLACC: Face, Legs, Activity, Cry, Consolability

DISCUSSION

Postoperative pain if inadequately treated can lead to physiological and psychological consequences in children.[11] Inadequate management has shown to increase distress during subsequent procedures.[12,13] Several tools are currently available to assess pain in children. These vary in their complexity and ease of use. All these tools have been validated in the Caucasian population but cultural and experimental factors may affect pain assessment and it is important to conduct these studies in different cultures.[5,14] Traditionally, the role of pain assessment in the recovery area has been dedicated to the nursing staff supervised by an anesthesiologist in most countries. More recently, parents are being involved more often because of day care lists. In our hospital pain assessment is

the responsibility of recovery room nurses, but an anesthesia trainee is also stationed in the recovery while on rotation. Parents are called in the recovery once the patient is settled but do not formally take part in pain assessment.

At the initial assessment, the results showed an acceptable agreement between doctors and nurse (67-100%) assessment on FLACC, OPS, and CHEOPS scales. The TPPPS pain assessment by nurses was not found to be reliable due to high false positives and negatives, but and in comparison doctors performed better. Parents did not perform well on OPS, CHEOPS, and TTPS due to false negatives and positives, their assessment was acceptable on the FLACC scale. The results of involving parents in the assessment of pain in children have been variable.[15,16] Some authors have shown that parent's under-estimate the child's pain,[17] other has shown that parents can play a role in older children[18] and the value of involving parents. In our study, there were six to eight cases where the parents did not score at all at the initial assessment at 15 min. This probably reflected their emotional involvement with the child at that stage.

At the second assessment, at 60 min, parents performed better on the FLACC scale compared to doctors and nurses. Assessments done by doctors and nurses on the FLACC scale showed variable results as sensitivity of 0.84 and 0.66. OPS sensitivity was low with a high false negative rate for all observers showing unreliability of scale. Pain assessment on TPPPS was again found untrustworthy by all observers due to high false negatives. Sensitivity and specificity for CHEOPS were acceptable for doctors and nurses.

These results reflect parents as unreliable observers for assessing child's pain in the immediate postoperative period. They performed poorly on all scales except FLACC. Doctors and nurses performed consistently on all scales except TPPPS, and their differences were not significant. TPPS has been validated in Caucasian children aged 1-5 years for postoperative pain but according to some authors may be too complex to assess pain.[17] Our experience was the same.

There are limitations to this study as the surgical procedure was not standardized, and the age range of the children was wide and included both preschool and school-going children. Furthermore, the intensity of pain reported by the child was not measured. We only asked the children whether they were in pain or not. Self-reporting is usually possible from the 4th year of life. Another limitation is that pain measurement scales were not translated which may lead to difficulty of the respective measures.

On the basis of our findings, we recommend FLACC scale for postoperative pain assessment by nurses and doctors in Pakistani children aged between 3 and 7 years of age in the immediate postoperative period. Assessment of pain by the parents was unreliable on CHEOPS, OPS, and TPPS but acceptable on FLACC. Further research is warranted in different age groups.

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