

Pain assessment in venepuncture among children: Experience from a single centre study in Sri Lanka

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Abstract

Introduction: Venepuncture is the commonest and feared painful experience in hospitalized children.

Objectives: To assess the venepuncture pain (VP) status and associated factors among children admitted to paediatric units in Teaching Hospital Karapitiya (THK).

Method: A cross-sectional study was conducted among 300 children aged 2 months to 8 years, who underwent venepuncture in above setting in 2021. Data were collected by direct observation of the procedure and by administering a questionnaire to primary caregivers. Pain scores were documented using the Face, Legs, Activity, Cry and Consolability (FLACC) pain scoring system on an ordinal scale (0-10). The median pain scores among groups were compared using Mann Whitney U test. The level of significance was considered as 0.05.

Results: Of the observed 300 venepunctures, 71 (23.6%) were blood samples and 229 (76.3%) were intravenous cannulations. The median (IQR) VP score was 6 (2). There was zero practice of assessment and documentation of VP using a pain scale. The practice of multimodal pain management (MPM) was observed only in 9 (3%), while 24 (8%) children did not receive any VP management. Two hundred and sixty (86.7%) parents were not satisfied with existing pain management, while 239 (79.7%)

parents expected more actions to improve the practice, including MPM (80%, n=192). Of suggested methods, anaesthetic gel application before venepuncture (87.7%, n=263) was identified as the highest expected method. Statistically significant higher pain scores were associated with younger age groups ($p = 0.000$), being a single child ($p = 0.002$), increased number of attempts ($p = 0.000$) and longer duration of procedure ($p = 0.000$) in Mann Whitney U test.

Conclusions: In this study, statistically significant higher pain scores were associated with younger age groups, being a single child, increased number of attempts and longer duration of procedure.

(Key words: Pain management, Venepuncture, Children)

Introduction

Pain is defined as an “unpleasant sensory and emotional experience associated with or resembling that associated with, actual or potential tissue damage”¹. The 2019 global year against pain in the most vulnerable focused on 4 vulnerable groups of which infants and children was one². The year 2020 was the global year for the prevention of pain³. Multimodal analgesia consists of pharmacotherapies, local anaesthesia, and non-pharmacological methods such as psychology, spirituality, integrative activities, and rehabilitation². All aspects of paediatric pain have been less studied in the Sri Lankan setting^{4,5}. Cohen LL⁶ recommends behavioural approaches to pain management for paediatric venous access. Birnie KA, *et al*⁷ strongly supports distraction and hypnosis for reducing pain and distress from needle procedures. Lander J, *et al*⁸ recommend EMLA as an effective topical anaesthetic for children. Furthermore, their study has shown that amethocaine is superior to EMLA in the management of venepuncture pain (VP)⁸.

Evidence from the studies of pain in vaccination procedures can be applied to venepuncture. Sucrose or glucose administered prior to immunization had moderately reduced incidence and duration of crying for infants aged 1-12 months⁹. According to Taddio A, *et al*¹⁰ evidence for interventions that reduced procedural pain and distress in infants and children included measures to avoiding aspiration, giving the

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most painful vaccine last, giving several injections at the same time, comforting and positioning, dummy sucking, and cold external vibrating device. However, the international society for the study of pain recommends multimodal analgesia with combined pharmacological and non-pharmacological methods².

Fernando C, *et al*⁴ compared three self-report pain scales in the paediatric population in Sri Lanka and concluded that the reliability of the three pain scales was moderate to high and that they could be used to assess pain in Sri Lankan children⁴. De Silva B, *et al*⁵ highlighted the importance of developing pain management policies in Sri Lanka in his study of post-operative pain management practices among Sri Lankan nurses. There are no local studies to describe children's pain levels, and parents' perspective of their child's pain, practices among medical practitioners / hospitals, or parents' expectations in the child's pain management. This study aims to fill the existing gaps to provide better evidence to develop a pain management policy for the paediatric population of Sri Lanka.

Objectives

To assess the venepuncture pain (VP) status and associated factors, existing pain management practice, and parent's perspectives and expectations during elective venepunctures in children aged 2 months to 8 years in the paediatric wards of Teaching Hospital, Karapitiya (THK).

Method

A cross-sectional study was conducted among children who underwent venepuncture in paediatric units at THK from January to June 2021. A convenience sample of 324 consecutive children, aged 2 months to 8 years, undergoing the first elective venepuncture in the paediatric wards of THK and their primary caregivers were recruited for the study. Children with physical disabilities, developmental delays, intellectual disabilities, behavioural concerns or psychiatric disorders were excluded from the study. The same child was not taken into the study during repeated admissions.

Ethical issues: The study was approved by the Ethics Review Committee of the Sri Lanka College of Paediatricians (Ref. SLCP/ ERC/ 2020 /37). Written informed consent was obtained from the parents of the children participating in the study.

Statistical analysis: Data were collected by direct observation of the procedure and by using an interviewer administered questionnaire to caregivers. Pain scores were documented using the Face, Legs, Activity, Cry and Consolability (FLACC) pain scoring system on an ordinal scale (0-10)¹¹. In addition, median pain scores among groups were compared using Mann Whitney U test. The level of significance was considered as 0.05. For further analysis of association of factors with pain scores, pain scores were divided into two categories and analysed using Chi square test with the level of significance of 0.05. Multiple logistic regression was applied to significant factors, following Chi square analysis.

Results

A total of 324 children aged 2 months to 8 years was observed during their first elective venepuncture of current admission; 24 children were excluded from the analysis due to missing data. Of the 300, 165 (55%) were males. The majority of caregivers were in the age range of 31-40 years. Demographic data of children and primary caregivers are shown in Table 1.

Of the 300, 103 (34.4%) had a chronic illness, and 84 (27.7%) had undergone venepuncture within the past three months. Only 12 (4%) were already in pain at the beginning of the procedure. However, 51 (17%) had received paracetamol before the procedure for different indications.

Venepuncture pain management practices

Out of 300, intravenous (IV) cannulation and blood sampling were carried out on 229 (76.3%) and 71 (23.6%) occasions, respectively. The procedure was explained to 147 (49%) caregivers, and verbal consent was obtained on 73 (24.3%) occasions. In 85% circumstances, the caregiver stayed with the child, and 233 (77%) children received comfort from the caregiver during the procedure (Figure 1).

Table 1: Sociodemographic data of children and primary caregiver (n=300)

Characteristic	Category	n (%)
Child's age	<2 years	100 (33.3)
	2-4 years	72 (24.0)
	4-6 years	49 (16.3)
	6-8 years	79 (26.3)
Sex of the child	Female	135 (45.0)
	Male	165 (55.0)
Race	Sinhala	285 (95.0)
	Tamil	02 (0.7)
	Muslim	13 (04.3)
Social class	Lower	93 (31.0)
	Middle	204 (68.0)
	Upper	03 (01.0)
Educational level of caregiver	< Grade 5	08 (02.7)
	Grades 5-11	148 (49.3)
	Grade 11-13	116 (38.7)
	Tertiary	28 (09.3)
Occupation of the caregiver	Professional	04 (01.3)
	Skilled	66 (22.0)
	Unskilled	230 (76.7)
Age of the caregiver	19-30 years	121 (40.3)
	31-40 years	151 (50.3)
	41-50 years	23 (07.7)
	>50 years	05 (01.7)

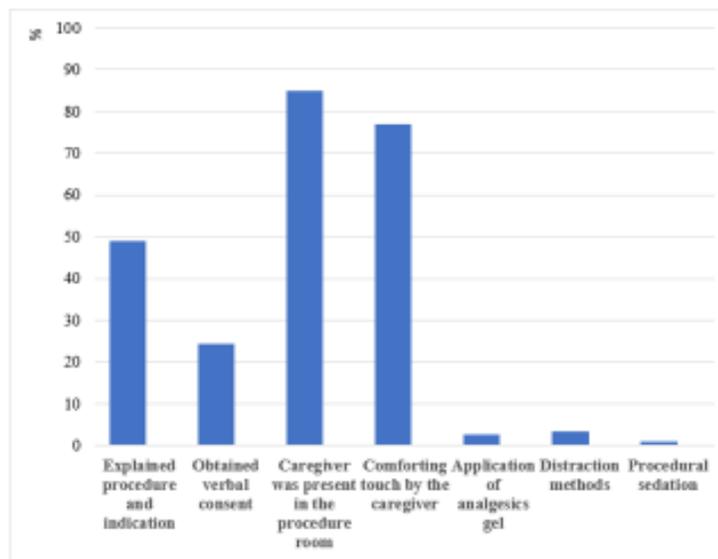


Figure 1: Venepuncture pain management – current practice (n=300)

All venepunctures were performed by paediatric ward staff; 294 (98%) of them were female nurses. The dorsum of the hand was used as the site for venepuncture in 274 (91.3%) instances. The time spent during the procedure was <15 min in 258 (86%) occasions. In 237 (79%) occasions, the venepuncture was successful at the first attempt. Except for one event, no significant complications related to the procedure were observed.

The assessment and documentation of VP were never practised. The anaesthetic gel was used only in 7 (2.3%) patients. Distraction methods and procedural sedatives were used in 10 (3.3%) and 3 (1%) occasions. At least some form of pain management was practised in 276 (92%) patients. Only 8 (2.7%) received multimodal pain management, including both pharmacological and non-pharmacological methods. There were 24 (8%) cases in the study group who had not received pain management.

Median venepuncture pain score

The pain scores were assessed by the investigators using the Face, Legs, Activity, Cry and Consolability (FLACC) pain scoring system. Different pain scores ranging from 0 to 10 were recorded. (Pain scores are considered as ordinal data). The median pain score was 6 (IQR 2).

Factors associated with venepuncture pain

Association between median pain score and age of the child was analysed using Spearman Rho and a negative age, pain score correlation was observed (Spearman rho – 0.355, P – 0.000) (Figure 2).

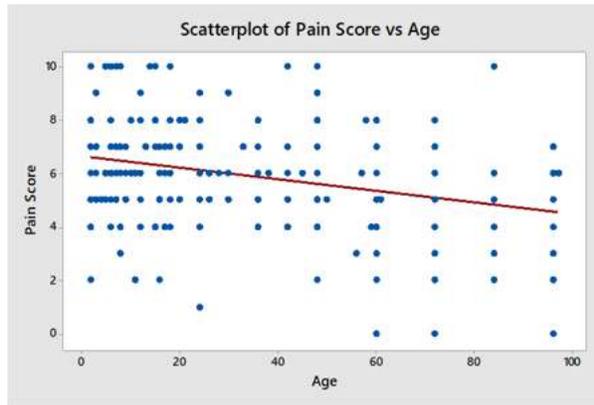


Figure 2: Scatterplot of pain score vs age

As all the other factors in the two groups, age was also divided into two categories based on its mean (48 months) to include it into analysis via Mann Whitney U test, Chi square test and multiple logistic regression.

practice-related, factors were analysed using the Mann Whitney U test. Statistically, significantly higher pain scores were associated with younger age groups, a single child, increased number of attempts, and longer procedure duration (p <0.01 for all) as shown in Table 2.

Association between median pain scores and patient-related, performer and procedure-related and

Table 2: Factors associated with venepuncture pain: Results of Mann Whitney U test (n=300)

Factor	Frequency (%)	p -value
<i>Age of the child</i>		
2 months – 4 years	172 (57.3)	0.000*
4 years – 8 years	128 (42.7)	
<i>Only child of the family</i>		
Yes	117 (39.0)	0.002*
No	183 (61.0)	
<i>Time spent for the procedure</i>		
<15 minutes	258 (86.0)	0.000*
≥ 15 minutes	42 (14.0)	
<i>Number of attempts</i>		
One	237 (79.0)	0.000*
More than one	63 (21.0)	

*Significance at 0.01

For further analysis, pain scores were categorized into two groups based on its **median** (6): scores less than 6 (median) and 6 (median) or more. The significance of associated factors was re-analysed using Chi-square test and multiple logistic regression. Five factors demonstrated an association with the higher pain scores, and they are considered as independent variables in the multivariate analysis. Younger age of child (p<0.01), a single child of the family (p<0.05), higher social class (p<0.05),

increased number of attempts (p<0.05) and longer duration of procedure (p<0.01) were associated with significantly higher pain scores according to Chi square test (Table 3). There was no statistically significant association between pain score and the gender, presence of chronic illness, use of paracetamol, previous experience of venepuncture, type of venepuncture and performers' experience based on our study.

Table 3: Factors associated with venepuncture pain: Chi-square test (n= 300)

Factor	Pain score <6 n (%)	Pain score 6 or > n (%)	Total n (%)	p-value
<i>Age of the child</i>				
2 months – 4 years	52 (30.0)	120 (70.0)	172 (100.0)	0.000*
4 years – 8 years	74 (58.0)	54 (42.0)	128 (100.0)	
<i>Sex of the child</i>				
Female	59 (44.0)	76 (56.0)	135 (100.0)	0.588
Male	67 (41.0)	98 (59.0)	165 (100.0)	
<i>Only child of the family</i>				
Yes	40 (34.0)	77 (66.0)	117 (100.0)	0.028*
No	86 (47.0)	97 (53.0)	183 (100.0)	
<i>Social class</i>				
Lower	48 (52.0)	45 (48.0)	93 (100.0)	0.024*
Middle and upper	78 (38.0)	129 (62.0)	207 (100.0)	
<i>Chronic illness</i>				
No	76 (39.0)	121 (61.0)	197 (100.0)	0.097
Yes	50 (48.0)	53 (51.0)	103 (100.0)	
<i>Received paracetamol</i>				
No	103 (41.0)	146 (59.0)	249 (100.0)	0.623
Yes	23 (45.0)	28 (55.0)	51 (100.0)	
<i>Past venepuncture</i>				
No	94 (43.0)	122 (57.0)	216 (100.0)	0.455
Yes	32 (39.0)	52 (61.0)	84 (100.0)	
<i>Type of venepuncture</i>				
Blood sampling	27 (39.0)	44 (61.0)	71 (100.0)	0.507
Cannulation	99 (43.0)	130 (57.0)	229 (100.0)	
<i>Comforting touch</i>				
No	37 (54.0)	30 (46.0)	67 (100.0)	0.013
Yes	89 (38.0)	144 (62.0)	233 (100.0)	
<i>Number of attempts</i>				
One	108 (46.0)	129 (54.0)	237 (100.0)	0.015*
More than one	18 (29.0)	45 (71.0)	63 (100.0)	
<i>Time spent for the procedure</i>				
<15 minutes	118 (45.0)	140 (55.0)	258 (100.0)	0.001*
≥ 15 minutes	08 (19.0)	34 (81.0)	42 (100.0)	
<i>Performer's experience</i>				
<5 years	47 (41.0)	67 (59.0)	114 (100.0)	0.832
≥5 years	79 (42.0)	107 (58.0)	186 (100.0)	

*Significance at 0.05 level

With the analysis of multiple logistic regression at 0.05 significance level, to identify the statistically significance of the association after controlling for confounding factors, younger age group of the child, higher social class and longer duration of the procedure were significant (Table 4).

The children from middle and upper social class (OR – 1.990, 95% CI - 1.161-3.411), taking more than 15 minutes for the procedure (OR – 3.275, 95% CI – 1.338-8.016) were identified as risk factors to have higher pain scores, while being an older child (age group 4y -8y) (OR – 0.332, 95% 0.196-0.562) was identified as a protective factor to have higher pain scores (Table 4).

Caregiver's perception on pain management

Two hundred and sixty (86.7%) caregivers were not satisfied with the existing pain management practices during venepuncture; 239 (79.7%) expected further measures, among which 192 (80%) were expecting both pharmacological and non-pharmacological methods together. Application of anaesthetic gel prior to the procedure was suggested by 87.7% caregivers. Figure 3 illustrates the percentage of the practice vs percentage of further expectations of different pain management measures.

Table 4: Multiple logistic regression for factors associated with pain (n=300)

Factor	Pain score <6 n (%)	Pain score 6 or > n (%)	Total n (%)	OR (95% CI) p-value
<i>Age of the child</i>				
2 months – 4 years	52 (30.0)	120 (70.0)	172 (100.0)	0.332 (0.196-0.562)
4 years – 8 years	74 (58.0)	54 (42.0)	128 (100.0)	0.000*
<i>Only child of the family</i>				
Yes ®	40 (34.0)	77 (66.0)	117 (100.0)	0.839 (0.487-1.446)
No	86 (47.0)	97 (53.0)	183 (100.0)	0.527
<i>Social class</i>				
Lower	48 (52.0)	45 (48.0)	93 (100.0)	1.990 (1.161- 3.411)
Middle and upper	78 (38.0)	129 (62.0)	207 (100.0)	0.012*
<i>Number of attempts</i>				
One	108 (46.0)	129 (54.0)	237 (100.0)	1.589 (0.793-3.182)
More than one	18 (29.0)	45 (71.0)	63 (100.0)	0.171
<i>Time spent for the procedure</i>				
<15 minutes	118 (45.0)	140 (55.0)	258 (100.0)	3.275 (1.338-8.016)
≥ 15 minutes	08 (19.0)	34 (81.0)	42 (100.0)	0.009*

*Significance at 0.05 level, ® Reference group

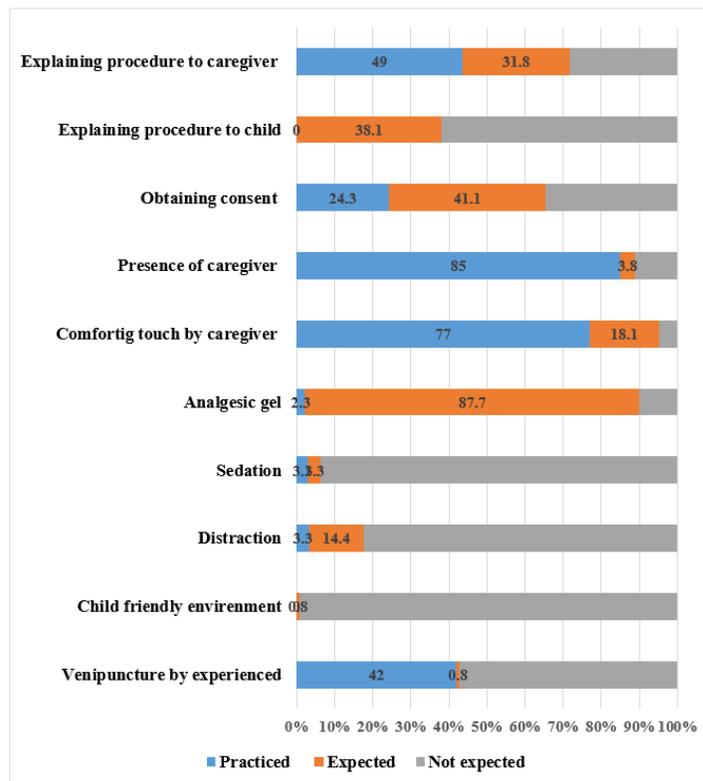


Figure 3: Current practice vs parents' expectations of venipuncture pain management (n=300)

Discussion

The most significant result obtained from our study was the relatively higher pain scores among the studied age group of children during elective venepunctures. We observed a median pain of 6 (IQR 2) out of 10 based on the FLACC pain classification scale. In contrast, a Canadian study¹² among a cohort of children aged 3-18 years undergoing venepuncture revealed that the median pain score was 3.

Another study consisted of 3–6-year aged children has shown majority (36%) had reported moderate pain¹³. The case was similar in the majority of our study group, but that majority was much higher in our group (78%). Our study revealed that, there is significant pain in children irrespective of the nature of their illness. However, some international studies suggest there are increased pain levels in children with chronic diseases¹⁴. Our study has demonstrated an association of higher pain scores with the younger

age groups. Similarly, Langer J¹⁵ in 1991 showed higher pain perception among younger age groups.

Based on the Mann Whitney U test analysis, there was an association with increased pain scores in children with no siblings; however, that association was not significant with the multivariate analysis. We also found there were increased pain scores with children of higher social class according to the Chi-square and multivariate analysis. However, we failed to show any significant association between other parent-related factors and the pain score. According to Schinkel MG¹⁶ parent and sibling factors and behaviours are well-known influences of pain and pain-related behaviours of children. Association of higher pain scores with an increased duration and increased number of attempts of procedure were also observed in our study. Some international studies have revealed that the previous history of cannulation is associated with higher pain scores due to anticipatory anxiety¹⁷; however, this was not evident in our study.

There are multiple studies in the international literature that show the association of lower pain scores with various pharmacological and non-pharmacological methods like anaesthetic gel application^{6,8,9,10,18,19}. However, we were unable to assess associations of these methods with the pain score as these methods were used only in a small minority of children in our study group. The study revealed zero practice of assessment and documentation of venepuncture pain using a pain scale among the observed staff of the treating medical team. This finding supports the similar results of the Sri Lankan study by De Silva B, *et al*⁵. Regarding the overall pain management practices, adherence to IASP recommendation 'the use of multimodal analgesia for children' was seen only in 2.7% of the cases. In addition, 8% of children in the study did not receive any pain management measures. However, the practice of non-pharmacological methods alone was somewhat satisfactory (92%).

According to the parent's perspective, the majority were not satisfied with existing practice and expected more and multimodal measures for their child's VP management. The highest expected action was the application of the anaesthetic gel before the procedure (87.7%). Higher pain scores in children and inadequate pain management practices along with higher parents' expectations, highlight the need for a proper VP management policy for children in Sri Lanka. In addition, the collected data from our study will help develop future guidelines for pain management in children in Sri Lanka. We strongly recommend an introduction of a guideline for venipuncture pain assessment and multimodal pain management for the paediatric settings in Sri Lanka.

There were some limitations in our study. Although we were planning for a sample size of 384 children, we were only able to collect the sample of 300 due to limited number of paediatric admissions during current COVID19 pandemic. Although we planned to analyse the association between some other pain related factors/practices and pain scores (application of analgesic gel, use of distraction methods, use of procedural sedatives, etc.), it was not possible the small number of sub samples limited the use of Chi square and Mann Whitney u test.

Conclusions

In this study, statistically significant higher pain scores were associated with younger age groups, being a single child, increased number of attempts and longer duration of procedure.

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