



Discerning Gradients of Paediatric Pain; Employing the Colour Analogue Scale (CAS) for Stratifying Degrees of Pain Severity in Juvenile Patients in Emergency Department

Ashwin Deepak¹, Rajadurai Meenakshisundaram², Salman Saeed³, Hari Baskar⁴, Prabakaran P⁵, Esther Monica J⁶, Athivaram Chaitanya Reddy⁷, Nihlas Babu⁸, Anand Raj⁹

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ABSTRACT

Background: This study endeavours to accurately gauge the spectrum of mild, moderate, and severe acute pain in the paediatric demographic by leveraging the colour analogue scale (CAS). The primary objectives encompass the meticulous quantification of pain gradients, delineating specific centimetre thresholds for each category. Through this, the research aims to augment precision in the realm of paediatric pain management practices.

Materials and methods: This prospective study, utilising convenience sampling, focused on pain complaints in children aged 5–16 in the Emergency Department. Exclusions involved altered sensorium, clinical instability, intensive care unit (ICU) admission needs, or developmental delays. Participants used a standardised 10-cm CAS to mark and categorise their pain severity as 'none', 'mild', 'moderate', or 'severe'. This approach aims to comprehensively understand paediatric pain in the Emergency Department.

Results: In a cohort of 150 juveniles (mean age 10.51 years), gender distribution was balanced (48% males, 52% females). Trauma-related cases constituted 47%, with 63% falling into the low socio-economic category. Pain nature analysis revealed 47% soft painful conditions, 31% abdominal pain, and 21% headaches. Preliminary assessments showed 12% reporting no pain, 23.3% mild, 42.7% moderate, and 22% severe pain. Traumatic aetiology comprised 46.7%, primarily soft-tissue injuries. Numeric representations for pain scores were 0.56 cm (no pain), 2.03 cm (mild), 4.61 cm (moderate), and 7.62 cm (severe). Statistical analysis found no significant differences in age, gender, or aetiology concerning pain scores, but socio-economic status correlated significantly with CAS scores. A highly significant correlation was observed between pain type, pain score, and CAS score (correlation coefficient 0.903).

Conclusion: This study delves into defining levels of mild, moderate, and severe pain on the CAS in paediatric cases. The insights gained provide a practical guide for promptly recognising children experiencing significant pain. The outlined scores also prove valuable for identifying eligible participants in analgesic studies. It's crucial to note the distinction in the perception of pain severity between adults, as documented in existing literature, and the nuanced paediatric perspective.

Keywords: Colour analogue scale, Convenience sampling, Emergency department, Exclusion criteria, Paediatric pain perception.

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INTRODUCTION

The analysis of pain management in acute settings has been insufficient, prompting increased research efforts. Sensitivity in analgesia trials requires patients to experience at least moderate discomfort before treatment. A study on adult subjects revealed that moderate pain correlated with a 30 mm score on the visual analogue scale (VAS). Currently, VAS benchmarks for mild, moderate, and severe pain in paediatric populations are undisclosed.¹ The gold standard for pain quantification relies on self-reporting. Validated tools specific to the context, such as the colour analogue scale (CAS) in the Emergency Department (ED), enhance evaluation. Colour analogue scale utilises a spectrum of hues to represent pain intensity, and patients mark their pain on a 1–10 cm scale (Fig. 1).² Children aged 3 or 4 and older are recommended to self-disclose pain intensity using developmentally appropriate tools like the Faces Pain Scale – Revised (FPS-R) and CAS. However, the qualitative interpretation of FPS-R scores lacks well-defined parameters meaningful to children. Understanding reported pain scores in distinct categories (mild, moderate, severe) is crucial for clinical decisions and research applications.³ Children's pain articulation may be influenced by age, gender, and ethnic background,

^{1–9}Department of Emergency Medicine and Critical Care, KH Institute of Health Sciences, Apollo KH Hospital, Ranipet, Tamil Nadu, India

Corresponding Author: Ashwin Deepak, Department of Emergency Medicine and Critical Care, KH Institute of Health Sciences, Apollo KH Hospital, Ranipet, Tamil Nadu, India, Phone: +91 8825733809, e-mail: v.ashwindeepak@gmail.com

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impacting perception and sensitivity (Fig. 2). It's unexplored whether pain scale scores exhibit variability based on patient

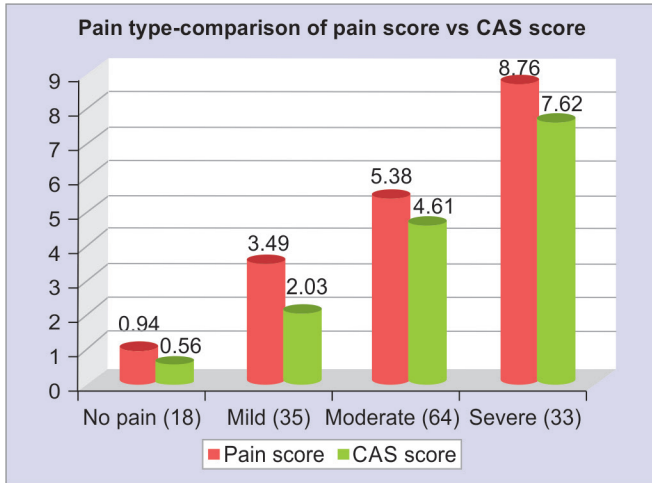


Fig. 1: Colour analogue scale and pain score scale

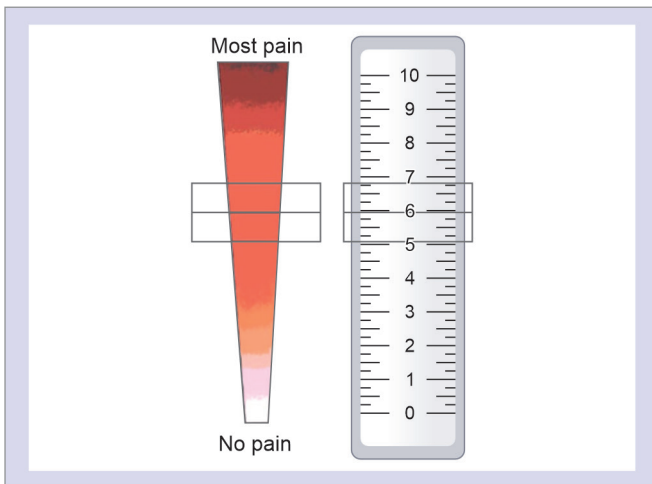


Fig. 2: Comparing pain severity with pain score vs CAS score

Table 1: Age distribution

Age	Age distribution	
	No. of cases	%
5–10 (82)	82	54.7
11–16 (68)	68	45.3
Total	150	100.0

attributes when using FPS-R or CAS. The objective is to delineate FPS-R and CAS scores associated with no pain, mild, moderate, and severe pain in paediatric ED presentations, discerning dissimilarities based on age, gender, and ethnicity.⁴ Colour analogue scale is a duplex plastic apparatus with a chromatic gradient and numerical scale (Table 1). Children adjust the slider to signify pain level, and corresponding values are documented. Evaluations are conducted in the child’s primary language. Descriptors like ‘A little bit of pain’, ‘a lot of pain’, or ‘somewhere in between’ serve as surrogates for pain classifications.⁵ Racial and ethnic attributes follow NIH guidelines (Table 2). Descriptive statistics, ROC-based methodology, and comparative analyses are employed to synopsis data and

Table 2: Gender distribution

Gender	Gender distribution	
	No. of cases	%
Male	72	48.0
Female	78	52.0
Total	150	100.0

Table 3: Pain type distribution

Pain type	Pain type distribution	
	No. of cases	%
No pain	18	12.0
Mild	35	23.3
Moderate	64	42.7
Severe	33	22.0
Total	150	100.0

discern optimal cut points for pain intensity categories (Table 3).⁶ The study provides valuable insights for recognising paediatric pain and identifying participants in analgesic studies, considering distinctions in pain perception between adults and children.⁷

PURSUIITS AND INTENTIONS

The primary goal of this study is to precisely define, in centimetres, the boundaries distinguishing mild, moderate, and severe acute pain in paediatric populations. Using the advanced CAS for precise pain assessment, the study aims to quantitatively calibrate pain gradients, providing detailed insights into the nuanced dimensions of paediatric acute pain. This objective aligns with the broader aim of improving the accuracy and sophistication of pain assessment methods, contributing significantly to the advancement of paediatric pain management practices.

MATERIALS AND METHODS

The research unfolds as a prospective study, employing convenience sampling to encompass paediatric attendees aged 5–16 with pain complaints in an ED. Exclusions were systematically applied, excluding children with altered sensorium, clinical instability, ICU admission needs, or developmental delays to maintain study coherence. To measure pain dimensions, each child used a standardised 10-centimetre CAS, sliding a marker to indicate their pain intensity and subsequently categorising it as ‘none’, ‘mild’, ‘moderate’, or ‘severe’. The investigation spanned from July 2021 to June 2023, conducted within the ED. Informed consent was ethically obtained from patients or their designated attendants, laying the foundation for the thorough exploration of the paediatric pain landscape in this hospital setting.

INCLUSION AND EXCLUSION CRITERIA

This study’s inclusion criteria encompass paediatric attendees aged 5–16 years within the ED presenting with pain complaints. Conversely, exclusion criteria target specific conditions to ensure a focused cohort: children with altered sensorium, clinical instability, or a requirement for intensive care unit (ICU) admission.

Additionally, individuals dealing with developmental delays are excluded. By defining these criteria, the study aims to create a homogeneous group of paediatric patients experiencing pain within the ED setting. This approach ensures that the research is tailored to the targeted age range and medical conditions, facilitating a more specific investigation into the parameters of pain assessment in this particular population. The careful delineation of inclusion and exclusion criteria contributes to the study's precision and relevance in understanding acute pain experiences amongst children in the ED.

RESULTS

A cohort of 150 juveniles, with a mean age of 10.51 years (SD 3.65), displayed a gender distribution of 48% males and 52% females. Age-wise, 55% fell within 5–10 years, and 45% spanned 11–16 years. Trauma-related cases constituted 47%, and non-traumatic cases were 53%. Socio-economically, 63% were low, 29% medium, and 8% high. Pain analysis revealed soft painful conditions in 47%, abdominal pain in 31%, and headaches in 21%. Self-reported pain levels varied, with 12% reporting none, 23.3% mild, 42.7% moderate, and 22% severe. Traumatic cases (46.7%) featured soft-tissue injuries and fractures, whilst non-traumatic conditions (53.3%) included abdominal pain and headaches. Numeric representations showed mean scores for no pain (0.56 cm), mild pain (2.03 cm), moderate pain (4.61 cm), and severe pain (7.62 cm). Statistical comparisons between demographic variables and pain scores, as well as CAS scores, yielded no significant differences based on age, gender, aetiology, or painful condition. However, there was a significant difference between socio-economic status and CAS score ($p = 0.037$), indicating an association. Additionally, a highly significant correlation was found between pain type and both pain scores and CAS scores ($p < 0.001$), underscoring the influence of pain type on subjective experiences. A very high correlation (coefficient = 0.903) was observed between pain scores and CAS scores, emphasising the consistency between self-reported pain intensity and the CAS. In summary, this cohort study provides a comprehensive overview of demographic characteristics, pain types, and their associations, shedding light on the nuanced experiences of juvenile patients within the explored parameters.

DISCUSSION

This study meticulously developed a pain scale for acute paediatric pain, categorising scores within the CAS into levels ranging from the absence of pain to mild, moderate, and severe pain. Notably, children reporting no pain did not consistently register scores of zero, introducing complexity in distinguishing between 'a little bit of pain' and 'somewhere in between'. Whilst statistically significant differences in mean/median pain scores across patient characteristics were observed, these lacked clinical significance. Cut points for both FPS-R and CAS were non-integer values, deviating from conventional standards for FPS-R, scores of 0 and 2 indicated no pain, 4 denoted mild pain, 6 represented moderate pain, and 8 and 10 indicated severe pain. CAS cut points aligned with 0.25 increments, designating 0–1 as no pain, 1.25–2.75 as mild pain, 3–5.75 as moderate pain, and 6–10 as severe pain, differing from conventional categorisations.⁸ Notably, a substantial proportion of children reporting no pain registered scores other than zero, challenging conventional assumptions. Deviation from convention in FPS-R (score of 4 for mild pain) and CAS (score of 6 for severe pain)

could impact clinical decisions. Despite meticulous methodology, overlap in scores for mild and moderate pain highlights the need for comprehensive assessments, integrating clinical judgment and contextual considerations. The study emphasises the need for routine pain assessments, with self-report deemed the most reliable method even in young children. The study's focus on acute pain limits generalisability to chronic pain situations. The use of descriptive phrases to denote pain categories introduces imprecision.⁹ The study suggests that assigning urgency to pain scores of six or higher in triage could enhance timely and nuanced pain management in the ED.¹⁰ Whilst exploring paediatric pain intensity, the study recognises the limitations of relying solely on pain scale scores, suggesting alternative strategies considering functional objectives or needs. This comprehensive approach is essential, especially given the potential variations in pain perception amongst children. This study significantly contributes to the understanding of paediatric pain assessment, challenging conventional practices and proposing nuanced adjustments for clinical applications. The findings underscore the importance of context, clinical judgment, and individualised approaches in gauging paediatric pain intensity.^{11,12}

In this study conducted in an urban ED, the research focused on a predominantly South Asian (South Indian) paediatric population.

Limitations

Recognising potential gender, ethnic, and age-related variations in pain self-reporting, the study acknowledges limitations in subgroup analyses due to a large overall sample size of 150 children. Notably, the absence of inquiries about past painful episodes in children's lives and the exclusive study of acute pain limit the generalisation of results to those with chronic pain. The utilisation of a Likert scale for pain intensity, despite its effectiveness in children aged 5 years and older, poses challenges for younger children in using verbal descriptors consistently. The study emphasises the importance of understanding the limitations associated with alternative phrases and the lack of validation for colour-coded pain severity interpretations.

CONCLUSION

This study underscores the crucial role of evaluating and addressing paediatric pain in medical practice. It provides insights into defining mild, moderate, and severe pain on the CAS, offering practical guidance for identifying children experiencing significant pain. The delineated scores also serve as a valuable tool for selecting participants in analgesic studies. The study highlights the nuanced perspective on pain severity in paediatrics compared with the existing literature on adults.

ORCID

Rajadurai Meenakshisundaram  <https://orcid.org/0000-0002-5811-3062>

Esther Monica J  <https://orcid.org/0009-0003-8086-1635>

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