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CONCEPTS

The Practice of Emergency Medicine

Developing an emergency department order set to treat acute pain in sickle cell disease

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Abstract

Study Objective: Patients with sickle cell disease (SCD) have many emergency department visits because of painful vaso-occlusive episodes (VOE). Guidelines recommend treatment within 30 minutes of triage, but this is rarely achieved in clinical practice. Our goal was to develop an order set that is being implemented in the ED to facilitate and standardize emergency care for SCD patients in acute pain from VOEs presenting to the emergency department (ED) in New York City (NYC).

Methods: Using a RAND/University of California, Los Angeles modified Delphi panel, we convened a multidisciplinary panel and reviewed evidence on how to best manage SCD pain in the ED. Panelists collaboratively developed then rated 202 items that could be included in an ED order set.

Results: A consensus order set, a practical how-to guide for managing SCD pain in the ED, was developed based on items that received high median ratings.

Conclusions: The management of acute pain experienced during VOEs is critical to patients with SCD; ED order sets, such as this one, can help standardize pain

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management, including at triage, evaluation, discharge, and follow-up care. After implementation in NYC EDs, studies to examine changes in quality care metrics (eg, wait times, readmissions) are planned.

KEYWORDS
acute pain, analgesics, anemia, emergency medicine, emergency service, hospital, opioid, practice guideline, quality of health care, sickle cell

1 | INTRODUCTION

1.1 | Background

Sickle cell disease (SCD) is characterized by the presence of sickle hemoglobin and is a life-threatening, multifaceted, debilitating disease. In the United States, SCD affects approximately 100,000 individuals and disproportionately affects African Americans (1 in 360).[1,2] SCD is especially prevalent in New York, where an estimated 1 in 1146 children are born with the disease.[3]

1.2 | Importance

Recurrent vaso-occlusive episodes (VOE), the hallmark of SCD, are acutely painful, incapacitating episodes. Patients with SCD have 2.59 emergency department visits per year on average,[1] the majority of which are for VOEs.[4] Frequent readmissions are associated with increased mortality.[5] Patients who present to the ED are often in severe pain, and although guidelines recommend treatment within 30 minutes of triage,[6] this rarely is achieved in clinical practice.[4,7,8] Inequity in ED care exists; patients with SCD report dissatisfaction with the quality of care received and experience delays in receiving analgesia compared with patients with other conditions, despite having higher pain scores and triage priority levels.[9–11]

ED protocols have been associated with improved outcomes in other conditions (eg, quicker identification of low-risk patients with chest pain appropriate for discharge[12,13] and improved efficiency of administrating therapy in patients with asthma[14]). There also has been some success with implementing ED protocols to manage VOEs in both adults and children with SCD (eg, reduction in time to therapy initiation[4,15] and reductions in pain scores and time to discharge[16]). The National Heart, Lung, and Blood Institute (NHLBI) guidelines provide a comprehensive resource on how to manage SCD, including pain resulting from VOEs, but order sets to implement these guidelines in the ED do not exist.[6]

1.3 | Goals of this study

In this study, we aimed to address this limitation in practice. The Community Care of North Carolina Sickle Cell Task Force developed a local protocol on how to treat SCD patients in North Carolina EDs presenting with pain.[17] Our goal was to develop a similar protocol unique to the New York City (NYC) area. Specifically, we convened a group of ED clinicians and SCD experts to review existing evidence and develop an order set to manage emergency care for patients with SCD presenting to the ED with pain that can be implemented in major NYC medical centers. By doing so, we also aim to improve the quality and consistency of care provided to patients with SCD in NYC EDs.

2 | METHODS

2.1 | Study design and participants

We used a RAND/University of California, Los Angeles (UCLA) modified Delphi panel method.[18–20] Briefly, this method is a formal group consensus process that systematically and quantitatively combines expert opinion and evidence by asking panelists to rate, discuss, then rerate items. The steps include a systematic literature review, the selection of panelists, the generation of a rating form, a first-round survey, an in-person meeting where panelists discuss areas of disagreement, final ratings and analysis of those ratings, and the development of a written summary of areas of agreement.

Through his professional network and prior collaborations, our panel chair recommended and convened a multidisciplinary panel of 10 clinicians (8 MDs, 1 DO, 1 nurse practitioner) practicing in NYC (Manhattan, Brooklyn, and Queens) with an average of 11 years (range 2–32 years) of experience caring for patients with SCD. Five panelists specialized in emergency medicine, 2 in emergency and internal medicine, 2 in hematology, and 1 in pain and palliative care. Although none specifically trained as pediatricians, those in the field of emergency medicine are trained to treat both adult and pediatric patients in the ED. The pain and palliative care physician also had SCD and was able to provide a patient perspective. Panelists were selected because of their experience treating patients with SCD in the ED, their diversity in specialty (eg, internal medicine, hematology, pain and palliative care), and because they worked at varied EDs throughout the NYC area (8 different EDs in 3 NYC boroughs, 5 of which were academically affiliated and 3 community based). Panelists were compensated for their time spent on this project by Novartis Pharmaceutical Corporation (which develops therapies for pain crises in patients with SCD). Novartis did not provide input on the methodology or results and no products developed or sold by Novartis were discussed.

TABLE 1 Second-round rating form results

Order set domain	Total items *N*	Median 1–3 *n* (%) of items rated	Median 4–6 *n* (%) of items rated	Median 7–9 *n* (%) of items rated	Disagreement[a] *n* (%) of items rated
Triage	5	0 (0%)	0 (0%)	5 (100%)	0 (0%)
Initial medical encounter	11	0 (0%)	2 (18%)	9 (82%)	4 (36%)
Perform targeted evaluation	45	1 (2%)	9 (20%)	35 (78%)	12 (27%)
Initial pain management	52	2 (4%)	9 (17%)	41 (79%)	22 (42%)
First pain reassessment	8	1 (13%)	2 (25%)	5 (63%)	3 (38%)
Second pain reassessment	35	2 (6%)	4 (11%)	29 (83%)	13 (37%)
Third pain reassessment	7	0 (0%)	0 (0%)	7 (100%)	1 (14%)
Preventive care	16	2 (13%)	7 (44%)	7 (44%)	12 (75%)
Discharge from ED	21	1 (5%)	2 (10%)	18 (86%)	6 (29%)
Other considerations	2	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Total	**202**	**9 (4%)**	**35 (17%)**	**158 (78%)**	**73 (36%)**

Note: The number (percentage) of items included from each rating form section are presented. Our suggested order set included items with median ratings ≥7, regardless of disagreement.
Abbreviation: ED, Emergency department.
[a]Items with ≥2 individual ratings outside the category in which the median rating fell were defined as having disagreement. Items with disagreement are duplicative of items reported by median ratings.

Using the NHLBI guidelines[6] and the Community Care of North Carolina Sickle Cell Task Force protocol[17] as our primary sources, we developed and reviewed a summary of evidence on how to best manage SCD pain in the ED to ensure the resulting order set would be based on the best available evidence. The summary included the general management of VOEs, specific treatments for VOEs (eg, opioids, patient-controlled anesthesia, non-opioids), and other considerations (eg, predictors of hospital admission and readmission, establishing a treatment plan).

Our study did not involve human subjects and, therefore, was not subject to institutional review board approval.

2.2 | Rating form

Through a literature review and individual phone interviews, we collaboratively developed a list of 202 items that could be included in an ED order set. Items were grouped into stages of care, including triage, initial medical encounter, targeted evaluation (ie, to rule out other SCD complications, such as acute chest syndrome), initial pain management, first pain reassessment, second pain reassessment, third pain reassessment, preventive care (eg, vaccinations, referrals), discharge (eg, prescriptions, scheduling follow-up appointments), and other considerations (eg, the use of non-pharmacologic approaches).

Using a 1 to 9 scale, we rated each item on multiple axes, including whether the item would increase the odds of a good outcome, whether it would help provide appropriate (benefits outweigh risks) and efficient (a productive use of ED staff time) care, and whether we would want the item on a loved one's order set (a summary question to assess overall optimal care). Dose options also were included and rated. For instance, in patients with an opioid allergy, we rated administering acetaminophen 650 mg or 975 mg to adults; for opioid dose adjustments, we rated repeating the same dose or escalating doses by 25%, 50%, or 100%.

Ratings were completed independently by each panelist before an in-person meeting (first-round ratings). At the in-person meeting, we discussed items where our ratings differed. Ratings were completed a second time at the conclusion of the meeting (second-round ratings).

2.3 | Analysis

Median ratings were calculated for each item and grouped into 3 categories (1–3, 4–6, 7–9). Items with ≥2 individual ratings outside the category in which the median rating fell were defined as having disagreement. For example, ratings of 4, 5, 6, 7, 8, 8, 8, 8, 9, 9 would result in a median of 8 with disagreement because 3 ratings were outside the 7–9 range.

Using the second-round ratings, we developed an order set (presented later) that included items with high median ratings (≥7) on the summary question about optimal care. Following the in-person meeting, we reviewed the resulting order set and, via a phone meeting, discussed items that remained unclear. We clarified these items and made formatting changes to the order set to facilitate implementation in individual EDs.

3 | RESULTS

The percentage of items with disagreement decreased after the in-person meeting (from 67% to 43%). Table 1 presents the number (and

percentage) of items within each median category and the number of items with disagreement on the summary question about optimal care. Overall, 158 items (78% of all items rated) received a median of 7–9, including all items rated in the triage, third pain reassessment, and other considerations domains. Overall, panelists continued to disagree on 36% of items in this question, with the highest proportion of disagreement in the preventative care domain (75%).

The final order set included all items with median ratings ≥7 on the summary question about optimal care. Refer to Table 2 for a sample of items included and the Appendix for a complete list of items recommended as well as an example of how to operationalize the order set. These items were those that the panel agreed to strongly agreed (ratings 7–9) that they would want this item on a loved one's orders (ie, if it were not included, they would suggest their loved one seek care elsewhere). These items were those with evidence supporting their inclusion (as described in the discussion that follows) and were often performed in practice by the expert panel. Despite the high median ratings, the panel continued to disagree on 28 of these items after the in-person meeting (labeled in Table 2 and in the Appendix). Areas of disagreement were discussed at the meeting, and differing practice patterns at the EDs represented by panelists likely resulted in the remaining disagreement in the second-round ratings.

The panel excluded items with median ratings < 7. These items were those that the panel disagreed to strongly disagreed that they would want the item on a loved one's orders (ratings of 1–3) or that they neither agreed nor disagreed regarding its inclusion (ratings of 4–6). Primarily, these items were alternative therapy dosing options (eg, acetaminophen 650 mg was excluded; whereas, acetaminophen 975 mg was included) or alternative labs (eg, a CBC blood test without differential was excluded; whereas; CBC with differential was included). In addition, the panel excluded therapies they believed were inappropriate (eg, intravenous fentanyl) as well as other labs or tests they believed were inappropriate to conduct in the ED during this type of visit either due to the availability of more appropriate tests (eg, VQ scan and D-dimer) or the need for follow-up after ED discharge (eg, haptoglobin, iron, total iron-binding capacity, and ferritin).

Refer to the Appendix for an example of how to operationalize the order set. The order set is a practical how-to guide for managing SCD pain in the ED. It includes items to assess at triage and in the initial medical encounter (eg, vitals, pain, whether the patient has an individual treatment plan that should be followed). In the targeted evaluation, the order set includes items to rule out other complications of SCD (eg, pulmonary embolism, myocardial infarction, and acute chest syndrome) as well as a suggestion of possible labs to run. The order set includes analgesic therapy options to be given first (within 30 minutes of triage), including for those with an opioid allergy and those without intravenous access, followed by possible adjustments at the first, second, and third reassessments based on patient-reported pain. Lastly, the order set lists items to consider for preventive care (eg, vaccinations and referrals) and items recommended for discharge (eg, follow-up appointments, prescriptions, and SCD education). For some items, different options are provided (eg, medication type, route, and dose).

4 | LIMITATIONS

This study has limitations. First, this order set was developed by and for NYC clinicians and not all content may be generalizable to SCD care across the United States. Further, none of the panelists were trained specifically as pediatricians and pediatric guidance presented should be interpreted with caution. Second, as described later, implementation is ongoing at the time of this writing, and whether this order set facilitates care, shortens ED visits, or improves outcomes has yet to be demonstrated. Third, despite high median ratings, panelists continued to disagree on some items. The resulting order set, therefore, should be adapted to individual clinical settings, which might differ in how pain management is approached. Lastly, although the modified Delphi method used in this study has extensive support in the literature,[21–23] panels consist of a relatively small number of clinicians who bring their individual clinical judgment and experience to the process.

Although Novartis Pharmaceutical Corporation funded this project, their role was limited to financing. The chair of the panel, an ED clinician, guided the entire methodological process. Novartis did not provide input on the evidence summary, rating form, or the resulting order set. Further, no products developed or sold by Novartis were discussed.

5 | DISCUSSION

We used validated methodology (a RAND/UCLA modified Delphi panel method) to develop an order set to care for patients experiencing VOEs in NYC EDs. This method has been used extensively to develop quality measures and clinical guidelines[21] and there is evidence that the resultant products have content, construct, and predictive validity.[22,23] We reviewed the literature including the NHLBI guidelines, collaboratively developed a list of items that could be included in an order set, and rated these items on multiple axes. The resulting evidence-based order set (Appendix) includes items that were rated highly by the group. It can serve as a practical how-to guide for facilitating and standardizing emergency care for SCD patients in acute pain in NYC EDs.

Items in the order set have been shown to improve outcomes. For example, in the initial medical encounter section, the order set encourages clinicians to implement a patient's documented SCD care plan, if one exists. Doing so has been shown to reduce ED and inpatient use.[24–26] For patients who do not have an individualized care plan, the order set reminds clinicians to establish one at discharge. The order set outlines the use of opioid therapy in treating VOEs, which is supported by several clinical trials.[27–30] For patients without an individualized care plan, the order set includes details on how to calculate and administer a patient-specific opioid dose, which reduces ED admissions and reported pain.[31]

The order set also encourages clinicians to implement rapid triage (Emergency Severity Index [ESI] Level 2) and initiate analgesic therapy within 30 minutes of triage, which has been shown to reduce length of hospitalizations[32] and is supported by the NHLBI guidelines.[6] The order set includes reminders for clinicians to assess pain using a visual analogue or verbal scale repeatedly throughout the visit, including

TABLE 2 Sample of order set elements recommended by expert panel

Triage	
• Identify SCD patient and initiate SCD protocol • Assess vitals, including O_2 sat; assess pain using VAS or verbal scale (1–10)	• Assign ESI Level 2 and begin implementation of a rapid protocol with the goal of initiating analgesic therapy < 30 minutes after triage
Initial medical encounter	
• Assess vitals (including O_2 sat), pain VAS • Note treatment prior to coming to ED or in triage (opioids, NSAIDs), baseline hemoglobin[a], date of and reaction to last transfusion[a]	• Assess if patient has a documented individualized SCD treatment plan • bullet-If yes, review with patient and integrate with items below • Confirm usual analgesic type and dose with patient
Perform targeted evaluation	
• Evaluate if patient experiencing their typical VOE symptoms; if yes, confirm with patient usual analgesic type and dose • If O_2 sat < 95%, provide oxygen (oxygen not indicated if O_2 sat ≥95%) • Consider SCD complications (see Appendix)	• Draw labs as appropriate (CBC with differential, reticulocyte count, electrolytes [CHEM-7], AST[a], ALT, LDH, bilirubin, hemoglobin fractionation/electrophoresis[a], type and screen [if drawing labs and no active type and screen])
Initial pain management	
• Initiate analgesic therapy < 30 minutes after triage • Assess if the patient has an opioid allergy; if yes, provide alternative (see Appendix) that will be used in place of opioid (consider assessing renal/liver function as needed) • Calculate and administer patient-specific opioid dose (IV route preferred; else SQ)	• If patient has IV access (eg., peripheral or central line), administer IV opioid (first dose);[a] if patient does not have IV access, administer opioid via other routes (first dose) • If initial VAS ≥5, see Appendix
Pain reassessment	
First • Assess vitals and VAS • If VAS ≥5 (VAS ≤4 refer to second pain reassessment): – If no hypoxia or sedation, repeat initial dose of IV opioid (second dose); if no hypoxia or sedation, dose may be escalated by 25%	Second • Assess vitals and VAS • Perform follow-up lab tests: Address abnormalities[a] • Reevaluate for serious complications (eg., acute chest syndrome, stroke, etc.) • Specific instructions included if VAS ≥7, 5–7, ≤4 (see Appendix)
Third • Assess vitals and VAS • Review follow-up lab test results: Address abnormalities • If VAS ≥5 (VAS ≤4 refer to second pain reassessment): Initiate PCA[a], admit (contact admitting service per hospital standards)	
Preventive care	
• Perform or consider vaccinations (eg., influenza, meningococcal and pneumococcal) if appropriate; consult CDC vaccination schedules which are updated frequently	• Inquire about access to behavioral health/psychiatric services • Consult Case Management and social work
Discharge from ED	
• Confirm patient's pain is adequately controlled • Order medication prescriptions[a] (eg, pain medication, adjunctive NSAIDs and constipation prophylaxis) • Schedule outpatient follow-up with PCP, hematology, or other SCD clinician within 1 week (lack of follow-up associated with readmission) • Discuss setting up individualized treatment plan with SCD clinician (associated with increased patient satisfaction and reduced ED/inpatient utilization)	• Provide and review SCD Pain Home Management discharge instructions and SCD education: • bullet-Review signs of serious complications and instruct patient to return to ED if experienced (eg, acute chest syndrome, stroke, sepsis, fever, etc.) • bullet-Discuss addiction awareness and overdose signs • bullet-Prescribe Naloxone kits (for self and family members) if receiving ≥50 mg per day morphine equivalent dose • bullet-Consider recommending that the patient discusses other disease-modifying treatments (hydroxyurea, L-glutamine[a]) with hematologist

Note: A sample of items recommended by the expert panel (with median ratings ≥7) are listed for each order set domain. Refer to the Appendix for a complete list of items recommended and an example of how to operationalize the order set.

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; CDC, Centers for Disease Control and Prevention; ED, emergency department; ESI, Emergency Severity Index; IV, intravenous; LDH, lactate dehydrogenase; NSAIDs, non-steroidal anti-inflammatory drugs; O_2 sat, oxygen saturation; PCA, patient-controlled analgesia; PCP, primary care physician; SCD, sickle cell disease; SQ, subcutaneous; VAS, visual analogue scale; VOE, vaso-occlusive episode (sometimes referred to as vaso-occlusive crisis [VOC]).

[a]Items the panel continued to disagree on after the in-person meeting.

during triage, the initial medical encounter, and for each analgesic dose administered to guide pain control.[33] Lastly, the order set reminds clinicians to schedule follow-up appointments at discharge to reduce readmissions and encourage longitudinal care.[34,35]

Our order set is consistent with existing evidence, namely the NHLBI guidelines and Community Care of North Carolina Sickle Cell Task Force local protocol.[17] All items included in the Community Care of North Carolina protocol are reflected in our order set. For example, assigning ESI Level 2 triage, integrating a patient's individualized care plan if available (and encouraging clinicians to develop one if not available), initiating analgesic therapy within 30 minutes of triage, administering up to 3 doses of intravenous opioids with pain reassessments every 30 minutes and an option to increase dose by 25% if pain is not improving, and scheduling follow-up appointments at discharge.

Our order set is unique and novel by aligning with local NYC laws. For example, at discharge, the order set reminds clinicians to check the prescription monitoring program (Internet System for Tracking Over-Prescribing) when prescribing opioids.[36,37] In addition, our order set also includes more specific guidance than the Community Care of North Carolina Sickle Cell Task Force protocol, such as specific steps to rule out other sources of pain (eg., to rule out pulmonary embolism, myocardial infarction, or acute chest syndrome), labs to run, and preventive care recommendations (eg., vaccinations, referrals to behavioral health/psychiatric services and SCD education).

The management of acute pain experienced during VOEs is critical to patients with SCD. Patients with SCD have many ED visits[1] and frequent readmissions are associated with increased mortality.[5] Guidelines recommend treatment within 30 minutes of triage, but this is rarely achieved in clinical practice.[4,7,8] Patients report dissatisfaction with care in the ED[9,10] and inequities exist.[11] ED order sets such as this one can help standardize evidence-based pain management (including at triage, evaluation, discharge, and follow-up) in a region with many SCD patients, which may improve health outcomes and patient satisfaction.

Implementation of this order set in NYC EDs is ongoing. Specifically, at the time of this writing, the Quality Committee within a major NYC health system is discussing the order set, and, if accepted, it will be adopted into the health system's electronic medical record database. Upon implementation, studies to examine quality care metrics (eg, wait times and readmissions) before and after implementation are planned.

CONFLICTS OF INTEREST

YD, BB, TB, KJ, SL, MM, M-LR, DS, and JS were paid by Novartis to participate in this panel. They have no other conflicts to disclose. DB, MSB, SNG, and IY are employees of Partnership for Health Analytic Research (PHAR), LLC, which was paid by Novartis to conduct the research described in this manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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