Single Bruise Characteristics Associated With Abusive vs Accidental Injury

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abstract

OBJECTIVES: The TEN-4-FACESp bruising clinical decision rule (BCDR) is a validated screening tool utilizing information about a child's body region bruised, age, and pattern of bruising to predict abuse in children younger than 4 years of age. Our objectives were to (1) evaluate the accuracy of the BCDR in predicting abuse when only 1 bruise was present and (2) identify other characteristics differentiating abusive from accidental injury in young children with a single bruise.

METHODS: Patients included in this secondary analysis were those from the BCDR validation study whose only skin finding was a single bruise (including petechiae, subconjunctival hemorrhage, or frenulum injury). Cases were previously classified as abuse, accident, or indeterminate by an expert panel. We compared demographics, clinical characteristics, bruising regions, and psychosocial risk factors (PRFs) between abuse and accident groups.

RESULTS: Of 349 patients with a single bruise, 27 were classified as abuse. The TEN-4-FACESp BCDR performed with 81.5% sensitivity and 87.6% specificity in this sample. Patients with abusive injuries were (1) younger and (2) less likely to present with an injury complaint but more likely to (3) have a bruise in a BCDR-positive region, (4) have a lower Glasgow Coma Score, and (5) have PRFs.

CONCLUSIONS: The TEN-4-FACESp BCDR is an effective screening tool for abuse among young children with a single bruise in the pediatric ED. Even 1 BCDR-positive bruise indicated increased risk for abuse. Negative BCDR results must be interpreted with caution given the higher rate of false negatives in this analysis compared with the validation study.

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Dr Raut conceptualized and designed the study, drafted the initial manuscript, and critically reviewed and revised the manuscript. Dr Pierce conceptualized and designed the study, coordinated and supervised data collection, and critically reviewed and revised the manuscript. Dr Kaczor coordinated and supervised data collection and critically reviewed and revised the manuscript. Dr Lorenz carried out the statistical analyses and critically reviewed and revised the manuscript. Drs Bertocci and Bertocci contributed to data collection and critically reviewed and revised the manuscript. Dr Simonton critically reviewed and revised the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

WHAT'S KNOWN ON THIS SUBJECT: The TEN-4-FACESp bruising clinical decision rule (BCDR) is a validated screening tool that utilizes information about a child's body region bruised, age, and pattern of bruising to predict abuse with 95.6% sensitivity and 87.1% specificity in young children.

WHAT THIS STUDY ADDS: The TEN-4-FACESp BCDR is an effective screening tool among young children with a single bruise in the pediatric emergency department, performing with a moderate sensitivity and high specificity for abuse.

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INTRODUCTION

Bruising is the most common manifestation of child physical abuse and also the most likely injury to be overlooked or misdiagnosed before an abuse-related fatality or near fatality in a young child.[1–5] Although a bruise may be considered a relatively "minor" injury, early identification of bruising due to physical abuse holds major significance toward facilitating prompt intervention and preventing subsequent injuries of escalating severity.[6,7] Since mobile children often sustain bruises during everyday play and accidental events,[8] the ability to differentiate abusive from accidental bruising is of high importance to prevent unnecessary investigations.

Certain characteristics, such as multiple bruises or bruises in specific regions of the body, help to differentiate abuse from accidental injury.[9–11] The TEN-4-FACESp bruising clinical decision rule (BCDR) is a validated screening tool utilizing information about a child's body region bruised (Torso, Ears, Neck, Frenula, Angle of jaw, fleshy Cheek, Eyelids, Subconjunctiva), age (any bruise anywhere on an infant 4.99 months of age and younger), and pattern of bruising. It has been shown to predict abuse with 95.6% sensitivity and 87.1% specificity in children aged younger than 4 years.[12] However, the TEN-4-FACESp BCDR does not account for the number of bruises on a child, and the ability of a single bruise to predict abuse is unknown. Further investigation of characteristics that may differentiate abusive from accidental injury is needed to guide clinicians in their approach to evaluation and diagnosis when a child is identified as having only 1 bruise.

The first aim of this study is to evaluate the accuracy of the TEN-4-FACESp BCDR in predicting abuse when a single bruise was present. The second aim is to identify other characteristics differentiating abuse from accidental injury in young children with a single bruise. Clinical application of this information has the potential to inform and support medical decision-making and contribute positively to patient outcomes by improving recognition of abuse and reducing unnecessary diagnostic evaluations of children whose bruises are accidental in etiology.

METHODS

This was a planned secondary analysis of data collected for the BCDR validation study, a prospective observational cross-sectional study of bruising characteristics among children 0 to 3.99 years of age who presented to the pediatric emergency department (ED) at 1 of 5 tertiary care hospitals with varied population demographics. The methods for the BCDR study were previously published but are summarized here as pertinent to this secondary analysis.[12,13]

Following approval by the internal review boards at each site, enrollment and case classification were carried out from December 1, 2011, through March 31, 2016. ED practitioners performed deliberate, comprehensive skin exams to screen all children younger than 4 years of age for bruising, including petechiae, subconjunctival hemorrhages (SCHs), and/or frenulum injuries. Those with at least 1 bruise were eligible for enrollment in the BCDR validation study. Children with injuries from motor vehicle crashes, known coagulation abnormalities, preexisting severe neuromuscular impairment resulting in spasticity, or severe extensive skin disorders were excluded.

Trained research personnel documented characteristics of each skin injury including the type of injury (bruise, petechiae, SCH, or frenulum injury), the location of injury on the body, and whether an identifiable pattern was present. Each skin injury was documented in photographs and recorded on a spatially mapped electronic body diagram using 35 predefined anatomical regions; total bruise count and skin tone (fair, light, mid, brown, or black) were also noted.

Other documented variables included patient demographics, overall reason for seeking care (medical, trauma, or abuse evaluation referral) and associated chief complaints, Glasgow Coma Score (GCS), fatality, medical evaluation including diagnostic studies (skeletal surveys, head imaging) and identified injuries, and parent-reported information regarding 5 key psychosocial risk factors (PRFs) in the caregiving environment: prior law enforcement involvement, prior Child Protective Services involvement, domestic violence/intimate partner violence, mental health problems, and substance abuse histories. All data were collected at the time of patient presentation to the ED and deidentified. Cases were classified as abuse, accident, or indeterminate by a multidisciplinary panel of pediatric injury experts blinded to psychosocial information, as detailed by Lorenz et al.[13]

This secondary analysis, completed in August 2023, included all cases from the BCDR validation study in which the only skin finding was a single bruise (including petechiae, an SCH, or a frenulum injury, as key components of the TEN-4-FACESp BCDR). Given the difficulty of localizing bruises to small areas with differing BCDR significance (eg, orbital rim vs eyelid), all cases with bruising to these regions were reviewed for consistency by A.R. and M.C.P.

We described subject characteristics with counts and percents for categorical variables and with medians and quartiles for quantitative variables, for the full single bruise cohort and for the abuse and accident groups as per prior expert panel classification. We compared characteristics between the abuse and accident groups with Fisher exact test for categorical variables and the Wilcoxon rank sum test for quantitative variables and adjusted P values for multiple testing by the Benjamini-Hochberg correction. We estimated the sensitivity and specificity of the TEN-4-FACESp BCDR in the single bruise cohort with 95% score CIs. Analyses were conducted in the open-source R software environment (R: a language and environment for Statistical Computing. R Software Foundation, Vienna, Austria).

RESULTS

Study Sample and Demographics

A total of 349 patients had a single bruise as their only skin finding, 27 (7.7%) of whom were classified as abuse (Figure 1). Compared with patients with accidental injuries, those with abusive injuries were younger (median age 1.1 vs 1.8 years, $P = .005$). There were no significant differences based on sex or insurance type. There was limited variability in skin tone among patients with a single bruise: 62 (17.7%) fair, 24 (6.9%) light, 240 (68.8%) mid, 15 (4.3%) brown, and 8 (2.3%) black (Table 1).

TEN-4-FACESp BCDR Performance Among Patients With a Single Bruise

Among patients with a single bruise, the TEN-4-FACESp BCDR was positive for 22 of 27 patients classified as abuse and 40 of 322 patients classified as accident, thus performing with 81.5% sensitivity (95% CI, 61.9–93.7) and 87.6% specificity (95% CI, 83.5–91.0), compared with 95.6% and 87.1% in the validation study. There were no apparent differences in BCDR performance based on skin tone, although subanalysis was limited by the small sample size of skin tone subgroups.

Of the 5 patients misclassified as abuse by the TEN-4-FACESp BCDR, 3 were older than 1 year of age: 2 of whom presented with medical chief complaints and no history of trauma and 1 who was referred for sibling abuse evaluation; all 3 were found to have long bone fractures. Of the 2 patients aged younger than 1 year, one presented with a medical chief complaint but no known trauma history and the other with neurological symptoms after a reported fall; both were found to have cranial and/or intracranial injuries, and 1 case was fatal. Single bruise locations in the 5 abuse cases misclassified by the TEN-4-FACESp BCDR included forehead (2), upper arm (1), finger (1), and knee (1).

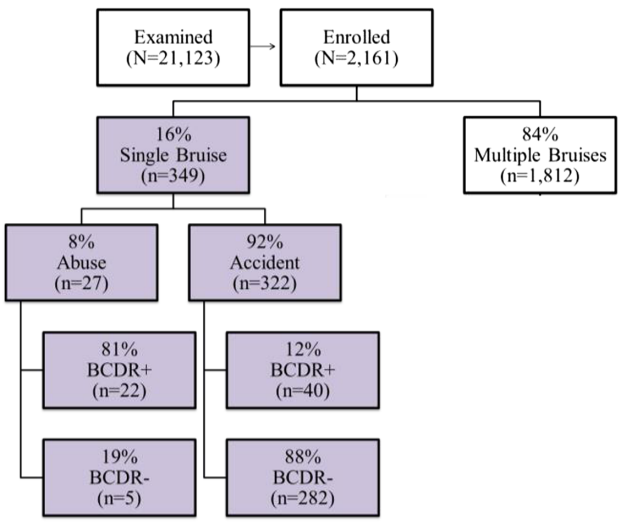

FIGURE 1.
Flowchart of patients included in single bruise secondary analysis (shaded in purple) from the BCDR validation study.

TABLE 1. Distribution of Demographic and Clinical Characteristics by Case Classification

Characteristic	Overall (N = 349)	Abuse (n = 27)	Accident (n = 322)	*P* Value
Age (IQR)	1.8 (1.1–2.8)	1.1 (0.4–2.1)	1.8 (1.2–2.8)	.005
<1 y, n (%)	75 (21)	12 (44)	63 (20)	
1 y and older, n (%)	274 (79)	15 (56)	259 (80)	
Male sex, n (%)	194 (56)	17 (63)	177 (55)	.614
Private insurance, n (%)	145 (42)	11 (41)	134 (42)	.839
Reason for seeking care, n (%)				<.001
Medical	204 (58)	13 (48)	191 (59)	
Injury/trauma	133 (38)	5 (19)	128 (40)	
Abuse evaluation referral	12 (3)	9 (33)	3 (1)	
GCS score <15, n (%)	6 (2)	5 (19)	1 (0)	<.001
Discharge home from ED, n (%)	295 (85)	17 (63)	278 (86)	.005
Fatality, n (%)	3 (1)	3 (11)	0 (0)	.001
BCDR positive, n (%)	62 (18)	22 (81)	40 (12)	
Region	47 (13)	19 (70)	28 (9)	
Age (<4.99 mo)	20 (6)	7 (26)	13 (4)	
Pattern	1 (0)	1 (4)	0 (0)	
Skeletal survey, n (%)				
Not obtained	321 (92)	7 (26)	314 (98)	
Obtained: positive	4 (1)	4 (15)	0 (0)	
Obtained: no new finding[a]	8 (2)	4 (15)	4 (1)	
Obtained: negative	16 (5)	12 (44)	4 (1)	
Head imaging, n (%)				
Not obtained	299 (86)	14 (48)	285 (89)	
Obtained: positive	19 (5)	7 (26)	12 (4)	
Obtained: negative	32 (9)	6 (22)	26 (8)	
Cumulative PRFs, n (%)				<.001
0	241 (69)	8 (30)	233 (72)	
1	59 (17)	8 (30)	51 (16)	
2	19 (5)	2 (7)	17 (5)	
3	15 (4)	3 (11)	12 (4)	
4	8 (2)	3 (11)	5 (2)	
5	4 (1)	2 (7)	2 (1)	
Data unavailable	3 (1)	1 (4)	2 (1)	

Abbreviations: BCDR, bruising clinical decision rule; ED, emergency department; GCS, Glasgow Coma Scale; PRF, psychosocial risk factor.
[a] Skeletal surveys were classified as having no new finding when an injury was identified but were already known from other imaging studies conducted during the same clinical encounter.

Bruising Regions

Single bruises were identified in 27 of the 35 predefined anatomical regions (Table 2). Of the 7 regions not represented in our sample—philtrum, preauricular region,

TABLE 2. Single Bruise Regions by Case Classification[a]

Region	Single Bruise Analysis (N = 349), N (%)	Abuse (n = 27), n (%)	Accident (n = 322), n (%)	Positive Likelihood Ratio
Lower leg	114 (33)	1 (4)	113 (35)	0.11
Forehead	79 (23)	3 (11)	76 (24)	0.47
Knee	34 (10)	1 (4)	33 (10)	0.36
Upper leg	21 (6)	0 (0)	21 (7)	0.00
Zygoma	18 (5)	1 (4)	17 (5)	0.70
Temporal/ parietal	15 (4)	1 (4)	14 (4)	0.85
Orbital rim	14 (4)	4 (15)	10 (3)	4.77
Eyelid	12 (3)	4 (15)	8 (2)	5.96
Ear	11 (3)	6 (22)	5 (2)	14.31
Lower arm	11 (3)	0 (0)	11 (3)	0.00
Cheek (fleshy)	9 (3)	1 (4)	8 (2)	1.49
Foot	8 (2)	0 (0)	8 (2)	0.00
Nose	8 (2)	1 (4)	7 (2)	1.70
Hand	7 (2)	1 (4)	6 (2)	1.99
Occiput	6 (2)	0 (0)	6 (2)	0.00
Abdomen	5 (1)	2 (7)	3 (1)	7.95
Back	4 (1)	2 (7)	2 (1)	11.93
Spinous process	4 (1)	1 (4)	3 (1)	3.98
Upper arm/s houlder	4 (1)	2 (7)	2 (1)	11.93
Chest	3 (1)	2 (7)	1 (0)	23.85
Elbow	3 (1)	0 (0)	3 (1)	0.00
Top of head	3 (1)	0 (0)	3 (1)	0.00
Ankle	2 (1)	0 (0)	2 (1)	0.00
Chin	2 (1)	0 (0)	2 (1)	0.00
GU/anal	2 (1)	1 (4)	1 (0)	11.93
Buttocks	1 (0)	1 (4)	0 (0)	-
Lip	1 (0)	0 (0)	1 (0)	0.00
Mastoid	1 (0)	0 (0)	1 (0)	0.00

Abbreviations: GU, genitourinary.
[a] Bruise count by region exceeds the number of patients because a single bruise could span multiple regions.

mouth, neck, angle of jaw, subconjunctiva, and frenula—the latter 4 correspond to TEN-4-FACESp components. Among patients with abusive injuries, the most common single bruise region was the ear (6 patients), followed by the orbital rim (4 patients) and eyelid (4 patients). Among patients with accidental injuries, the most common single bruise region was the lower leg (113 patients), followed by the forehead (76 patients), then knee (33 patients). Single bruises to the upper leg, lower arm, foot, occiput, elbow, top of head, ankle, chin, lip, and mastoid were identified in the accident group but not in the abuse group.

Clinical Presentation

Among all children with a single bruise, those classified as abuse were significantly less likely than those classified as accident to cite an injury or trauma as the reason for seeking care (5 [18.5%] vs 128 [39.8%], $P < .001$; Table 1). Common chief complaints among patients with abusive injuries who were brought to care for medical reasons with no history of trauma included unexplained bruising/marks, scalp swelling/bump, colic/irritability/fussiness, altered mental status, and unresponsiveness (Supplemental Table).

Injury Severity

Of all children with a single bruise, 6 presented with GCS less than 15, including 5 patients classified as abuse (18.5%) and 1 patient classified as accident (<1%, $P < .001$; Table 1). For all 5 of the patients classified as abuse, GCS was 5 or lower, and cranial or intracranial injuries were identified on head imaging. The 1 patient classified as accident had a GCS of 12 and no evidence of intracranial injury on imaging. Four of the 5 patients with abusive injuries and an abnormal GCS were BCDR positive, and the 1 patient with accidental injury was BCDR negative. There were 3 fatalities, and all were cases of abuse (Table 3); 2 of 3 were BCDR positive.

Imaging Studies and Identified Injuries

Among those aged younger than 2 years, skeletal surveys were obtained for 8 of 176 patients classified as accident (4.5%), of which 0 revealed a new injury, and 17 of 20 patients classified as abuse (85.0%), of which 3 (17.6%) revealed a new injury. All 3 patients classified as abuse with new injuries identified on skeletal survey were BCDR positive.

Among those classified as accident, head imaging was obtained for 14 of 22 patients aged younger than 6 months old (63.6%), 13 of 41 patients aged between 6 and 12 months old (31.7%), and 10 of 259 patients aged 12 months or older (3.9%). Of the 37 total studies performed among patients classified as accident, 12 revealed cranial or intracranial injuries (32.4%), and 8 of these 12 patients were BCDR positive (66.7%). Among those classified as abuse, head imaging was obtained for 5 of 6 patients aged younger than 6 months old (83.3%), 5 of 5 patients aged between 6 and 12 months old (100.0%), and 3 of 15 patients aged 12 months or older (20.0%). Of the 13 total studies performed in patients with abuse classifications, 7 (53.8%) revealed cranial or intracranial injuries, and 5 of these 7 patients (71.4%) were BCDR positive. In both the abuse and accident groups, patients with positive BCDR scores were more likely than those with negative BCDR scores to have an injury identified on head imaging.

Of all 27 patients classified as abuse, 14 (51.9%) had a single bruise as their only identified injury, although in 3 of these 14 cases, no imaging studies were obtained.

Psychosocial Risk Factors

All PRFs were more common among patients classified as abuse in comparison with those classified as accident,

TABLE 3. Demographic and Clinical Characteristics of Case Fatalities

Age	Reason for Seeking Care	Chief Complaint	BCDR (Criterion)	Bruise Region	PRFs	GCS	Other Injuries	Classification
4 mo	Medical	Unresponsive	Positive (age)	Right lower leg	LE, MH, SA	3	Right tibia fracture, right femur fracture, skull fracture, scalp hematoma	Abuse
12 mo	Medical	Unresponsive, vomiting	Positive (region)	Chest	CPS, DV/IPV[a]	3	Multiple rib fractures, bilateral humerus fractures, acute SDH, cerebral edema, acute liver injury	Abuse
9 mo	Trauma	Unresponsive, seizure after fall from bed	Negative	Forehead	CPS	5	Acute SDH, cerebral edema, midline shift, subfalcine and uncal herniation	Abuse

Abbreviations: BCDR, bruising clinical decision rule; CPS, prior Child Protective Services involvement; DV, domestic violence; GCS, Glasgow Coma Scale; IPV, intimate partner violence; LE, prior law enforcement involvement; MH, mental healthproblem; SA, substance abuse; SDH, subdural hematoma.

[a] Additional risk factors may have been present in this case but are unknown due to unavailable data.

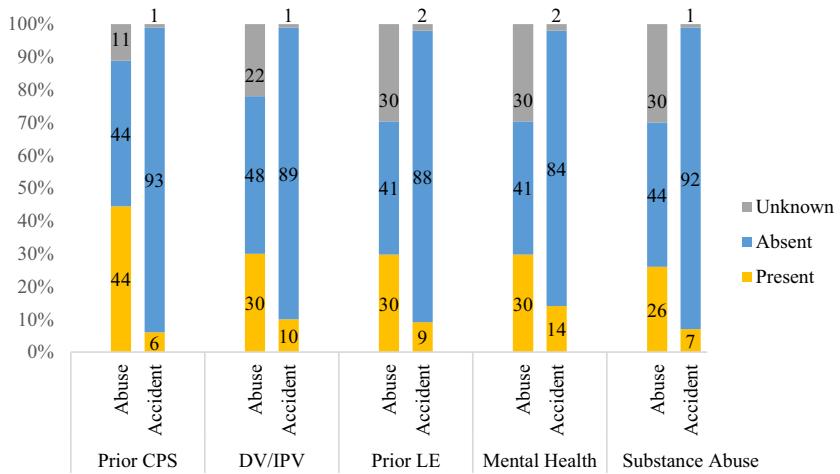

FIGURE 2.
Presence of psychosocial risk factors by case classification.

including prior Child Protective Services involvement (44.4% vs 6.2%, $P < .001$), domestic violence/intimate partner violence (29.6% vs 9.9%, $P < .001$), prior law enforcement involvement (29.6% vs 9.3%, $P < .001$), mental health problems (29.6% vs 14.0%, $P < .001$), and substance abuse (25.9% vs 7.5%, $P < .001$). Compared with those with abusive injuries, patients with accidental injuries were more likely to have 0 PRFs present (72.4% vs 29.6%, $P < .001$), and 88.2% of patients with accidental injuries had 1 PRF or fewer. More than one third of patients with abusive injuries had 2 or more PRFs present, compared with 11.2% of those with accidental injuries (Figure 2).

DISCUSSION

In this analysis of children with 1 bruise as their only skin finding, the TEN-4-FACESp BCDR performed with moderate sensitivity and high specificity for abuse. We identified 5 key differences associated with abusive vs accidental injury: patients classified as abuse were (1) younger and (2) less likely to present with an injury complaint but more likely to (3) have a bruise in a BCDR-positive region, (4) have a lower GCS, and (5) have PRFs present in their environment.

Most cases (92.3%) were determined to be accidental in nature, consistent with previous work by Hibberd et al revealing that accidental injury mechanisms, such as slips, trips, and falls, frequently resulted in only 1 bruise.[9] Nevertheless, a single bruise is not always reassuring. Of the 12 total fatalities in the BCDR validation study—all related to abusive injuries—3 (or 25%) had a single bruise as their only skin finding. Furthermore, in a study by Feldman and colleagues, 38% of infants with abuse classifications presented with a single bruise, highlighting that the absence of additional bruising does not rule out the possibility of physical abuse.[14]

Our results show the TEN-4-FACESp BCDR to be an effective screening tool even when only 1 bruise is present, correctly capturing 22 of 27 abuse cases. However, the BCDR performed with lower sensitivity in this sample (81.5%) than in the validation study (95.6%); thus, abuse may be

more likely to be missed in children with a single bruise based on TEN-4-FACESp BCDR results alone. The BCDR performed with high specificity for abuse among cases with single bruises (87.6%), matching its performance in the validation study (87.1%). Even 1 BCDR-positive bruise indicated increased risk for abuse.

These test characteristics should be considered in the context of pretest probabilities in this cohort. With a prevalence of only 7%, abuse was a very unlikely classification among patients with a single bruise, and false positives were a common occurrence. In clinical application, therefore, positive BCDR scores should prompt additional information to be gathered before conclusions are drawn. Conversely, the 93% prevalence of accident in this population meant that false negatives occurred infrequently; a negative BCDR score thus served as a strong indicator of accidental injury. In other words, even considering the strong performance of the TEN-4-FACESp BCDR, because abuse classification was a rare outcome, a positive test was far from confirmatory, while a negative test was very close to confirmatory. This supports the role of the TEN-4-FACESp BCDR as an effective screening test, with greatest value in ruling out abuse.

Prior research has shown that children experiencing abuse often present with vague medical chief complaints, such as vomiting, fussiness, or irritability, and frequently do not provide a trauma history.[5,15,16] Similarly, we found that patients with abusive injuries were significantly less likely than patients with accidental injuries to cite a trauma history as the reason for seeking care. We identified specific chief complaints commonly reported in cases of abuse, including bruising/marks, scalp swelling/bump, colic/irritability/fussiness, and altered mental status/unresponsiveness. These results underscore the importance of performing a thorough and deliberate head-to-toe skin examination in young children regardless of trauma status or chief complaint as well as carefully considering the differential diagnosis accordingly.

Consistent with a wealth of literature describing PRFs in the caregiving environments of abused children,[17–29] we found all 5 PRFs assessed to be more common in cases of abuse than accident. Studies of child maltreatment–related fatalities and near fatalities have revealed especially high levels of psychosocial risk,[3,30,31] and in our study, 1 or more risk factors were present in all 3 cases of single bruising with a fatal outcome. Thus, the number of cutaneous findings on a child may not be a reliable indicator of overall injury and, in fact, may underestimate that child's risk of physical abuse. Our findings therefore support the critical and consistent incorporation of psychosocial assessments into medical decision-making when young children presenting to a pediatric ED are found to have even 1 unexplained BCDR-positive bruise. Importantly, the BCDR is not intended to diagnose abuse nor to prescribe the next steps in diagnostic assessment but instead to function as a screening tool to improve the recognition of potentially abused children with bruising who require further evaluation.

In most cases, providers did not pursue occult injury evaluation, such as skeletal survey or head imaging. This is unsurprising for 2 reasons: (1) the screening significance of TEN-4-FACESp bruising was not yet known, and (2) this study includes children up to 3.99 years of age, for whom imaging may not be routinely indicated. That said, considering the 20 abuse cases for whom skeletal surveys were obtained, 16 (80.0%) showed no new injuries. This serves as an important reminder that a negative skeletal survey or negative head imaging does not negate the diagnosis of abuse but rather conveys the absence of skeletal or head injuries. Notably, every child with a new finding identified on skeletal survey in this study had a BCDR-positive bruise.

There are limitations to this study. First, because enrollment was conducted in the pediatric ED setting, enriched sampling of patients with potential abuse could contribute to a higher prevalence of bruising than would be found in primary care clinics or other clinical environments. Second, there is no established criterion standard for abuse and accident classification. The BCDR validation study therefore utilized a 9-member panel of multidisciplinary experts to minimize the potential impact of misclassification bias. Each panel member was asked a series of questions to provide justification in support of their case classification and could not base their conclusion on bruise location alone. In previous analyses, this approach has been shown to meet robust standards of accuracy and reliability.[13] Importantly, panel classifications of abuse or accident were made in reference to each overall case as opposed to each particular bruise or identified injury. Expert panel classification of cases preceded validation and publication of the TEN-4-FACESp BCDR.

CONCLUSIONS

In this sample of children with 1 bruise as their only skin finding, the TEN-4-FACESp BCDR performed with 81.5% sensitivity and 87.6% specificity for abuse. Positive BCDR results may therefore improve recognition of abuse among young children with a single bruise in the pediatric ED, although negative BCDR results must be interpreted with caution given the higher rate of false negatives in this analysis compared with the validation study. Beyond the physical exam, patient age, presenting characteristics, injury severity, and psychosocial factors may contribute to an overall risk assessment. Further prospective studies of young children with single bruises are needed, especially in the context of primary care and other clinical settings.

ABBREVIATIONS

BCDR: bruising clinical decision rule
ED: emergency department
GCS: Glasgow Coma Scale
PRF: psychosocial risk factor
TEN-4-FACESp: bruising to specific regions (Torso, Ears, Neck, Frenula, Angle of jaw, fleshy Cheek, Eyelids, Subconjunctiva), any bruise anywhere on an infant 4.99 months and younger, or if bruising is patterned.

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