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Commentary

Pain assessment in mechanically ventilated PICU patients: It's complicated

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Pain assessment of critically-ill ventilated infants and children in the Pediatric Intensive Care Unit (PICU) is complicated. Ventilated children are often sedated making self-report of pain difficult (Marx et al., 1994). Consequently, it falls on the clinical judgment of the multidisciplinary team to determine if the child is in pain. Clinical judgment, however, has its flaws due to multiple interpretations of pain among clinicians. These disagreements can lead to significant fluctuations in the administration and discontinuation of analgesia predisposing the child to inadequate pain control, adverse reactions, withdrawal (Carnevale & Ducharme, 1997; Jin et al., 2007), and increased length of ventilation and PICU stay (Jin et al., 2007).

Physiological and behavioral based pain tools have been developed for objective assessment of pain (Ambuel et al., 1992; Marx et al., 1994; Merkel et al., 1997; Ramelet et al., 2007). This commentary highlights conceptual difficulties in the development and application of these tools to the mechanically ventilated child.

The overlap with non-pain related distress

Pain assessment tools include behavioral cues that can signal the presence of pain or non-pain related distress (e.g. fear, anxiety, depression, frustration, dysphoria, delirium). For example, crying, sobbing, physical tension, clinging, restlessness, and seeking or avoiding touch is observed in children exhibiting pain and non-pain related distress (von Baeyer & Spagrud, 2007). Our systematic review of instruments for scoring physiological and behavioral cues of pain, non-pain related distress, and adequacy of sedation and analgesia in mechanically ventilated children found overlap between pain-exclusive tools and sedation-exclusive tools (Dorfman et al., 2014). Overlapping behavioral variables included physical/motor response, facial expression, alertness/level of consciousness, tears, consolability, and respiratory response/tolerance of ventilator. Overlapping physiological variables included blood pressure (BP) and heart rate (HR). Therefore, in mechanically ventilated children it is challenging to discriminate pain from other causes of distress making the clinical application of these tools difficult.

Physiological variables

Physiological variables have been shown to change in response to the presence of pain in critically ill adults and children, yet there is debate about their relevance in assessment tools (van Dijk et al., 2001). An increase in mean arterial pressure (MAP), HR, and respiratory rate (RR) is associated with acute pain in critically ill adults (Puntillo et al., 1997; Payen et al., 2001). Similarly, in critically ill children, Ramelet et al. (2006) found that HR, MAP, diastolic pressure, and central venous pressure changed significantly in response to postoperative pain.

The question, however, is whether physiological changes are due to pain or non-pain related distress. This question has led to physiological variables being excluded from pain assessment in nonverbal adults due to lack of evidence. For example, the MAP, HR, RR, and oxygen saturation (SpO_2) of ventilated critically ill adults did not correlate with the conscious patient's self-report of pain. In contrast, the behavioral variables of the Critical-Care Pain Observation Tool (CPOT) for nonverbal adults strongly correlated with the conscious patient's self-report on pain (Gélinas & Johnston, 2007). This finding, overlaid with clinician criticism of nonspecific pain physiological indicators and lacking empirical support, lead to their exclusion from the CPOT (Gélinas et al., 2009).

Physiological variables, however continue to be used in pain assessment tools developed for critically ill children and infants. For instance, HR and BP have been used in both the COMFORT scale (Ambuel et al., 1992) and the Multidimensional Assessment Pain Scale (MAPS; Ramelet et al., 2007) even though the internal consistency would improve for both scales if HR and BP were removed (Ambuel et al., 1992; Ramelet et al., 2007). This inconsistency may be related to the variability of the physiological variables during the observation period. This problem is rectified in the COMFORT scale, if raters note the HR and BP from the monitor every 20 seconds during the 2-minute scoring period achieving excellent interobserver consistency (van Dijk et al., 2000). Similar improvements were found with the MAPS when baseline measures were taken when the child was stable (Ramelet et al., 2007).

Additional investigation into the relationship between physiologic indicators of pain and the behavior dimension of the COMFORT scale showed significant correlations between physiological and behavioral pain indicators. Specifically, correlations between the behavioral measure, COMFORT behavior and the MAP and MAP variability were high. The physiological-behavior correlation improved with increasing pain intensity, suggesting that the combination of both dimensions may confirm the diagnosis of high intensity postoperative pain, but not moderate pain (van Dijk et al., 2001).

These findings suggest that physiological variables should be considered when assessing pain in critically ill ventilated children and infants due to their importance in the accurate assessment of high intensity pain. Care, however, should be taken to ensure the variables are assessed accurately (i.e. several times during observation period, against the patient's baseline, when the patient is stable). Because there is evidence indicating physiological variables are inconsistent and nonspecific to pain, they should not be used alone in pain assessment (Herr et al., 2006), and clinicians should remember that a lack of a change in vital signs does not indicate an absence of pain (Gélinas et al., 2005).

Facial expression

There is evidence of the importance of facial expression in pain assessment (Craig, 1992; Prkachin, 1992; Hill & Craig, 2004). Facial actions common to acute pain include a lowered brow, raised cheeks, tightened eye lids, raised upper lip or opened mouth, and closed eyes (Prkachin, 1992). Most assessment instruments include one or more components of facial expression. Five of the six scales identified for the assessment of pain in mechanically ventilated children, in our systematic review, included facial expression (Dorfman et al., 2014). FLACC (Faces, Legs, Cry, Consolability Scale; Merkel et al., 1997), Modified FLACC (Johansson & Kokinsky, 2009), COMFORT scale (Ambuel et al., 1992; van Dijk et al., 2000), COMFORT behavior scale (van Dijk et al., 2000; Ista et al., 2005), and MAPS (Ramelet et al., 2007) include facial expression; the Cardiac Analgesic Assessment Scale (Suominen et al., 2004) does not. These scales are vague in their descriptions of using the presence or absence of grimace, facial tension, or cry (silent or audible). None of these scales accurately employ or describe the well-validated facial expressions common to acute pain.

Moreover, an intubated patient's facial expression is difficult to interpret. Evaluating for a nasolabial furrow may be difficult in intubated children given placement of the tube (Ramelet et al., 2004). The Child Facial Coding System (Gilbert et al., 1999) is a more detailed measurement of facial expression and may more accurately identify pain yet it requires more intensive training and time to administer (Gilbert et al., 1999; von Baeyer & Spagrud, 2007). Quick descriptive facial expression terms for evaluating pain may be more useful.

Consolability

Consolability was found in six tools in a systematic review of pain measurement in critically ill children (Ramelet et al., 2004). In our systematic review (Dorfman et al., 2014) only the FLACC and its modified form used consolability in their pain assessment. This difference may be because our review was limited to assessment tools used in the PICU where pharmacological methods for the treatment of pain are more often employed than nonpharmacological methods.

The challenge with consolability items in these scales is they do not consider the duration or method of consolation; instead a subjective assessment of the level of consolability is used. The health care provider may not know how to console a particular child (i.e. use of touch, singing, warmth), and consequently have more difficulty (Dorfman et al., 2014). Additionally, it is difficult to assess consolability in the absence of the child's parents. Strangers, loud noises, or other environmental stimuli may preclude typical methods for consoling the child whose fear and distress is non-pain related (Ramelet et al., 2004).

The FLACC (Merkel al., 1997) assesses consolability by simplifying it into 3 possible outcomes: (1) content and relaxed, (2) reassured by occasional touching, hugging, or being talked to, distractible, (3) difficult to console or comfort. The psychometric properties of FLACC were assessed in a population of critically ill adults (n = 29) and children (n = 8, of which 3 were ventilated). Consolability was found to correlate well with the other items on the scale and contribute significantly to the variance in FLACC scores (Voepel-Lewis et al., 2010). This study needs to be replicated in a larger population of critically ill ventilated children before consolability can reliably be employed as a construct for pain assessment in children. More information is needed to determine if it can be simplified and still be used to assess pain in critically ill ventilated children where parental participation in care may be limited.

Body movement

Body movement is a common pain tool construct. All six scales identified by Dorfman et al. (2014) included body movement. Rigid limited body movement or increased/restless body movement described by parameters of the MAPS and FLACC have been shown to be indicators of pain (Ramelet et al., 2006). In contrast, muscle tone, a parameter used in the COMFORT scale is more appropriate for the assesment of oversedation given that patients who are are oversedated exhibit reduced muscle tone (Ambuel et al., 1992). As pain increases, movements become rigid and limited rather than flaccid and limited. Therefore, body movement should be assessed based on a description of the movement related to amount and degree of rigidity.

Conclusion

The constructs of HR, BP, facial expression, consolability, and body movement are useful parameters for pain assessment in mechanically ventilated children. However, they can also occur in the presence of non-pain related distress (Dorfman et al., 2014). We recommend that none of these constructs be used independently for pain assessment; rather as a component of a pain assessment tool. HR and BP should be employed as indicators of pain with discretion as they are often variable, and inconsistent, and pain can exist when no change is noted in vital signs. Items related to facial expression, consolability, and body movements need to be user friendly, objective, and clear. The user must have a good understanding of the tool, its terms, and be objective in their assessments. Education and training, therefore, is essential when initiating the use of these scales in the PICU.

In our systematic review, we evaluated 15 instruments for their psychometric properties and clinical utility. Based on this review we recommend the COMFORT scale (Ambuel et al., 1992) for assessing postoperative pain and nonprocedural pain in mechanically ventilated pediatric patients. The Modified FLACC (Johansson & Kokinsky, 2009) and the MAPS (Ramelet et al., 2007) are recommended for assessing procedural pain and other brief painful events in mechanically ventilated pediatric patients (Dorfman et al., 2014).

Pain assessment instruments are readily available and promoted, yet are not incorporated in the daily management of pain in the PICU. Simply giving clinicians these assessment tools does not mean they will use them in their everyday practice or use them correctly. Instead individuals must be given information about the instruments, how to use them, and the importance of their use. Based on this information, clinicians will hopefully decide to adopt and implement these instruments into their practice and then see confirmation that this adoption improved patient care (Scott-Findlay & Estabrooks, 2006). The challenge of knowledge translation needs to be addressed to ensure that the constructs of pain are understood, assessment scales are employed correctly, and pain is consistently treated and reassessed.

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