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REVIEW

Monitoring cardiorespiratory instability: Current approaches and implications for nursing practice

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Summary Unrecognised in-hospital cardiorespiratory instability (CRI) risks adverse patient outcomes. Although step down unit (SDU) patients have continuous non-invasive physiologic monitoring of vital signs and a ratio of one nurse to four to six patients, detection of CRI is still suboptimal. Telemedicine provides additional surveillance but, due to high costs and unclear investment returns, is not routinely used in SDUs. Rapid response teams have been tested as possible approaches to support CRI patients outside the intensive care unit with mixed outcomes. Technology-enabled early warning scores, though rigorously studied, may not detect subtle instability. Efforts to utilise nursing intuition as a means to promote early identification of CRI have been explored, but the problem still persists. Monitoring systems hold promise, but nursing surveillance remains the key to reliable early detection and recognition. Research directed towards improving nursing surveillance and facilitating decision-making is needed to ensure safe patient outcomes and prevent CRI.

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Implications for Clinical Practice

- Establish clear guidelines for initiating a medical emergency team (MET) call.
- Provide education regarding adverse outcomes.
- Avoid behaviours that discourage prompt notification.
- Share positive outcomes following cardiorespiratory instability detection with the team as a way of promoting best practices.

Introduction

Unrecognised cardiorespiratory instability (CRI) risks adverse patient outcomes (Schien et al., 1990; Hillman et al., 2001; Franklin and Mathew, 1994). CRI, defined as abnormalities in heart rate (HR), respiratory rate (RR), blood pressure (BP) and peripheral oxygenation by pulse oximetry (SpO_2) that precede an adverse event, may not be detected until late in the instability course or until cardiopulmonary arrest. Nursing surveillance alone has not been successful in detecting CRI early enough to prevent negative outcomes (Henneman et al., 2012). Telemedicine and rapid response systems have been advocated as possible approaches to prevent adverse events, with mixed outcomes (Kerlin et al., 2013; Venkataraman and Ramakrishnan, 2015; Winters et al., 2013). Utilisation of early warning scoring systems, with or without automated calculation and notification, has resulted in improvement, but these systems also have deficiencies (Alam et al., 2014). Even mature rapid response systems, with track-and-trigger systems based on intermittent patient evaluation, miss avoidable cardiopulmonary arrest (Trinkle and Flabouris, 2011). The purpose of this review is to use the literature to analyse current approaches for early detection of CRI, identify why early detection is problematic and make recommendations that may lead to improved detection.

Methods

This narrative review was guided by the flowchart described by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Moher et al., 2009). A computerised search of literature was conducted using CINAHL via EBSCO host. Subject headings used in the search included ''cardiac arrest,'' ''nursing surveillance,'' ''telemedicine,'' ''rapid response systems'' and ''early warning scores.'' Additional relevant articles for review were found through cross-referencing. The review was not limited by study design but was restricted to full text articles published only in English, on adults (19 and above) and within the past 10 years. Of the 159 articles returned, 62 were chosen for inclusion in the review while the rest were not specific to the review purpose as stated (Fig. 1).

Outcomes of in-hospital cardiac arrest and evolving CRI

Once a patient experiences in-hospital cardiac arrest (IHCA), patient outcomes are poor. In a study that reported outcomes following IHCA in 732 patients, only 6.6% lived to discharge, 5.2% for one year and 3% for three years (Bloom et al., 2007). There is some evidence to suggest that CRI prior to its progression to IHCA is missed. In an international multi-centre study of 634 patients with IHCA by Kause et al., 79.4% had CRI evolving between four and 24 hours prior to the event (Kause et al., 2004). In another study by Rozen et al., all IHCA patients exhibited signs of evolving CRI in the preceding 12 hours and >50% experienced in-hospital mortality (Rozen et al., 2014). Another report examining the records of 14,720 adult patients before IHCA reported that few (44%) had return of spontaneous circulation and only 17% survived to discharge (Perberdy et al., 2003). These reports demonstrate that survival is poor once IHCA has occurred and suggest there may be missed opportunity to recognise instability and apply supportive interventions preceding IHCA.

Factors that impact poor detection of CRI

Nursing surveillance, a process wherein nurses assess patients on a routine or as-needed basis to evaluate and act on emerging indicators of a status change is a central nursing function that directly impacts patient outcomes (Bulechek et al., 2012). Although technology can improve assessment sensitivity, failure to notice subtle changes in VS over time prevents nurses from intervening to reverse the process.

Several reasons have been posed to explain why subtle status changes may go undetected. Patient mortality has been shown to be higher as a nurse's patient caseload increases (Aiken et al., 2011; Beaudoin and Edgar, 2003; Ebright et al., 2003; Needleman et al., 2011; Patrician et al., 2011). However, staffing level alone does not appear to influence CRI detection but, rather, staffing in combination with other nurse characteristics, such as education level and

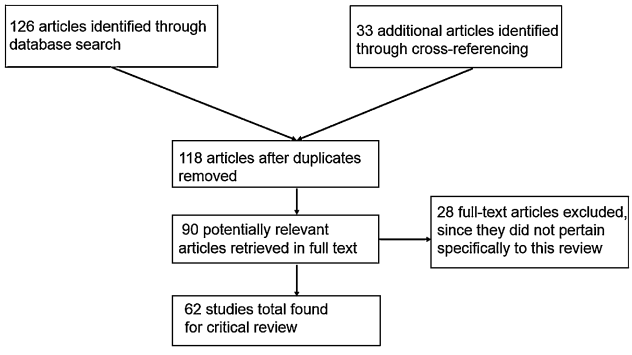

Figure 1 Literature search trail using PRISMA flowchart.