

Non-Invasive Monitoring of Physiologic Compromise in Acute Appendicitis: New Insight into an Old Disease

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Purpose: Traditional vital signs are late indicators of physiologic compromise in children. We hypothesized that the Compensatory Reserve Index (CRI), a new adjunctive cardiovascular status indicator that trends changes in intravascular volume, would accurately trend compensatory changes in children with acute appendicitis.

Methods: Children ages 1-17 years old who presented with signs/symptoms of acute appendicitis from July – December 2016 were monitored with a CipherOx CRI™ M1 pulse oximeter (Flashback Technologies Inc., Boulder, CO), which recorded CRI every five seconds. For clarity, CRI=1 equates to supine normovolemia, CRI=0 equates to hemodynamic decompensation (SBP < 80 mm Hg), and CRI values between 1 and 0 indicate the proportion of additional volume loss a patient can tolerate before the onset of decompensation. Two sample t-tests were used to test whether CRI was associated with perforated appendicitis at various time points. P-value <0.05 was considered significant.

Results: 94 patients met the study criteria (11±3.6 years old, 52% male). Interventions included appendectomy (n=83), radiographic-guided drainage of abscesses (n=6), and intravenous antibiotics only (n=5). Fifty-five children (59%) had non-perforated appendicitis and 39 (41%) had perforated appendicitis. CRI on admission was significantly higher in those with non-perforated appendicitis compared to those with perforated appendicitis (0.56, 95% confidence interval [CI] 0.51-0.62 vs. 0.37, 95% CI 0.3-0.44, p<0.001). The difference between the two groups remained significantly different following intervention (0.51, 95% CI 0.46-0.57 vs. 0.38, 95% CI 0.31-0.45 p=0.01) and at 1 hour (0.63, 95% CI 0.57-0.69 vs. 0.46, 95% CI 0.39-0.54 p<0.001), but disappeared at 2 hours (0.62, 95% CI 0.56-0.69 vs. 0.54, 95% CI 0.47-0.62 p=0.12; Figure 1).

Conclusion: Low CRI values in children with perforated appendicitis are indicative of their lower reserve capacity due to peritonitis and hypovolemia. CRI offers a non-invasive adjunctive tool to monitor children whose volume status may be difficult to ascertain.

FIGURE 1: AVERAGE CRI OVER TIME

