

# When Intensive Care Is Too Intense: Variations in Standard Practices Across Hospital Acuity Levels

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A 31-day-old infant born at 38 weeks' gestation presented to the emergency department of a quaternary care children's hospital in January with 2 days of cough and congestion and 1 day of fever. The baby was eating well and had normal urine and stool output. He did not have vomiting or diarrhea, and several family members had upper respiratory tract infections. The review of systems was otherwise negative. Upon arrival in the emergency department he was febrile to 38.5°C, and initial vital signs were a heart rate of 170 beats per minute, respiratory rate of 40 breaths per minute, blood pressure of 85/50 mm Hg, and an oxygen saturation of 98% on room air. Physical examination was significant for moderate respiratory distress, subcostal retractions, and coarse inspiratory crackles throughout the lung fields. The child appeared well hydrated and alert.

The infant received a diagnosis of viral bronchiolitis. Because of his age and fever in triage, blood and urine cultures were obtained. His complete blood cell count revealed a white blood cell count of 23 520/ $\mu$ L, with 42% neutrophils and 47% lymphocytes. Urinalysis (via bladder catheterization) showed negative nitrite, negative leukocyte esterase, and negative bacteria. Two attempts at lumbar puncture were unsuccessful. He received ampicillin and ceftriaxone. A capillary blood gas was obtained showing pH 7.28,  $p_{CO_2}$  60 mm Hg,  $p_{O_2}$  28 mm Hg, and  $HCO_3^-$  28 mEq/L. Given the concern for acute respiratory failure, the patient was admitted to the NICU for additional management.

In the NICU, the patient was weaned quickly from 2 L per minute nasal cannula to 1 L per minute and by hospital day 2 or 3 was weaned to room air. Subsequent capillary blood gases also normalized. He was started empirically on ampicillin and gentamicin. On hospital day 2, the urine culture grew 10 000 colony-forming units/mL *Escherichia coli*, pansusceptible, and 1 to 9000 colony-forming units/mL *Streptococcus mitis*. The patient underwent a renal and bladder ultrasound, which were unremarkable. A test of cure catheterized urine culture was performed on hospital day 4, which was negative. The patient was continued on ampicillin and gentamicin for a planned 10-day course for a urinary tract infection (UTI). On hospital day 7 the patient was transferred to the general medical ward. He was well-appearing and breastfeeding well, and he was discharged from the hospital the next day with oral cephalexin to complete a 10-day course.

In the winter many young infants present to hospitals with lower respiratory tract infections. Many are admitted for their respiratory symptoms, and patients often undergo additional workup for fevers. However, would this patient's care have differed if he were admitted not to the NICU but the general medical/surgical ward? Was the emergency department or the NICU staff wrong in their management, or were they merely acting on their own

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illness scripts, developed over time through the care of very sick neonates? How much of our perception of risk is based on our specific patient population that we care for on a day-to-day basis?

This patient underwent a sepsis workup in the emergency department, which was prompted by his elevated white blood cell count in conjunction with his fever. However, this infant had clinical signs and symptoms of bronchiolitis. Several studies have found that overall the rates of serious bacterial infection are low in infants with viral bronchiolitis.<sup>1-4</sup> The most common occult bacterial infection is a UTI. However, even UTIs may be uncommon; Kaluarachchi et al<sup>5</sup> report that rates of UTI among 2- to 12-month-old febrile infants with respiratory syncytial virus decreased from 6.1% when they applied the diagnostic criteria of the 1999 American Academy of Pediatrics (AAP) guidelines to 1.1% when they used the diagnostic criteria of the 2011 AAP UTI guidelines. In patients with clinical bronchiolitis, Librizzi et al<sup>6</sup> demonstrated that despite this evidence, providers are still commonly ordering blood cultures and cerebrospinal fluid cultures, with up to 64.5% of the patients in the study having a blood culture drawn and 16.3% having cerebrospinal fluid cultures obtained. A lumbar puncture was unsuccessfully attempted twice on our patient and was not repeated. Given the evidence, the likelihood of meningitis was low, and the patient and his family could have been spared the attempted lumbar punctures.

The decision to admit this patient to the NICU was made on the basis of a single bad capillary gas. However, the patient never needed mechanical ventilation, and his subsequent capillary gases normalized quickly. Would this patient be safe for the floor after a longer observation period in the emergency department? Was the capillary blood gas necessary? Clinical features rather than diagnostic tests have been found to be independent predictors of admissions to the ICU or the need for mechanical ventilation.<sup>7,8</sup> Also, to what degree did the availability of a NICU bed contribute to his admission to the NICU? Roblin et al<sup>9</sup> found that within a large

managed care organization there is variation in use of NICUs that is based not on patient factors but rather on local factors such as practice patterns and policies. Epidemiologic data from 2007 to 2012 show that newborns being admitted to the NICU are heavier and less likely to be premature, which raises the question of appropriate resource utilization.<sup>10</sup> It is possible that if our patient had presented to a community hospital, he would have been admitted to the general pediatric ward without a capillary gas.

Of the current AAP Clinical Practice Guidelines, aside from the guideline on neonatal jaundice, none include infants <1 month of age or address intensive care settings.<sup>11-21</sup> However, in large tertiary care centers, infants with common pediatric diagnoses are occasionally admitted to the NICU. Intensivists accustomed to treating very ill patients needing close monitoring and frequent procedures may automatically apply a high degree of scrutiny to a patient not in need of that care. Over time, different perceptions of risk lead to different standards of care between the units of a hospital. There is growing evidence of significant care variation within and between ICUs for common pediatric diagnoses including UTI, asthma, bronchiolitis, and sepsis.<sup>22-26</sup> The management of our patient's positive urine culture, though different from the 2011 AAP guidelines, was consistent with previously reported NICU management that defined a UTI as any positive culture obtained via catheterization regardless of colony count and included a 10-day course of intravenous antibiotics and a subsequent test of cure for a majority of patients.<sup>25</sup> In addition, Spitzer et al<sup>26</sup> found that in suspected neonatal sepsis, 11% of the clinically well infants in the NICU received 7 to 10 days of intravenous antibiotics despite negative blood cultures. How has the management of the same diagnoses for the same patient population become so different? How does this variation affect quality of care, cost, and resource utilization?

The decision to admit to the NICU greatly affected length of stay and cost. Admission to the NICU resulted in a 7-day

hospitalization for the treatment of presumed sepsis and UTI for what could have been a shorter hospitalization on the general medical ward. If the estimated cost of a NICU stay is \$3000 per day, then the patient's NICU stay alone cost \$21 000, which is a significant difference in cost when one compares that with a 2- to 3-day inpatient stay that costs roughly \$1800 per day.<sup>27</sup> When multiplied by the number of patients with similar stories, the cost associated with care variation is significant. From 2000 to 2009, there has been a decrease in bronchiolitis hospitalizations but an increase in both costs and use of noninvasive or invasive mechanical ventilation.<sup>28</sup> These care disparities may result from lack of collaboration and consensus between physicians practicing within their isolated silos of inpatient ward, immediate care, and intensive care. There should be ongoing efforts to reduce variation of care not just on the inpatient ward but across the continuum of care for our patients.

Clinical pathways have been shown to reduce care variation and shorten length of stay.<sup>29,30</sup> At many institutions, including ours, there are multidisciplinary clinical pathways that exclude ICUs. However, Koves et al<sup>31</sup> showed that a diabetic ketoacidosis pathway that included both ICU and inpatient floors improved care, reduced adverse events, and decreased time in the ICU. We hope that with growing evidence of care variation within ICUs, there will be a trend toward the development of guidelines and the inclusion of ICUs in the development of clinical pathways. Our case highlights the limitations of current clinical practice guidelines in real-life situations. It also highlights how the management of the same diagnosis can differ between the different areas of the hospital and between different specialties. Physicians in the emergency department, inpatient wards, and intensive care all have very different perceptions of their patients' risks. However, we cannot operate as separate, isolated silos if we truly want to deliver effective, patient-focused care. As our patients cross the different realms of the hospitals, so must

our clinical pathways if we want them to be successful.

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