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"Bandemia" without leukocytosis: A potential Emergency Department diagnostic pitfall

Emergency physicians routinely employ leukocyte counts as a risk stratification tool in a variety of clinical presentations. While a leukocyte count within the normal reference range is widely acknowledged as unreliable, it is nonetheless commonly interpreted as reassuring in a patient not otherwise suspected of harboring severe and acute illness. However, recent data has drawn renewed attention to immature neutrophils ("bands") as a reliable predictor of acuity, even in the presence of a normal leukocyte count.

Peduzzi et al. reported no correlation between leukocyte counts and bacteremia in nearly 500 patients with sepsis in 1992 [1]. In 2012, Seigel et al. found that, among more than 300 patients with culture-confirmed bacteremia, 52% had normal leukocyte counts, and 17.4% had neither leukocytosis nor fever [2]. Several authors have previously reported a correlation between elevated *immature* neutrophil counts ("bandemia") and bacteremia, sepsis and death [2-4]. In a study of over 2000 admitted patients with normal leukocyte counts, Drees et al. found moderate to high band counts in 16% of cases, and reported a correlation between elevated bands and both bacteremia and death [4]. More recently, Shi et al. found steadily increasing risk for death with increasing bandemia, irrespective of leukocyte count [5]. The authors further reported bandemia with normal leukocyte count and normal heart rate in some patients requiring readmission following discharge from the ED (Table 1). Some authors have questioned the clinical utility of screening for elevated band counts [6-8]. Still, bandemia has remained a component of risk scoring tools for more than thirty years, and an association between bandemia and morbidity is evident [9-11].

Standard complete blood counts (CBC) provide automated, quantitative measurements of the number of leukocytes. When requested, a CBC with differential analysis will further provide an automated measurement of leukocyte morphologies (i.e. basophils, eosinophils, monocytes, neutrophils and lymphocytes), and will flag abnormal or immature morphologies (e.g. bands). Quantitative measurement of bands requires a manual differential performed by a laboratory technician, and each hematology lab defines specified criteria to trigger performance of a manual differential. Hospital-based labs commonly perform manual differentials when flagged cells are reported on automated counts, or when samples are submitted from specified departments (e.g. Emergency Departments). However, the process of identifying and quantifying "bandemia" is time-consuming, and results may become available much later than initial CBC results. Further, clinicians may be unaware of flagged results as manual differentials are queued and pending if no reporting system for flagged automated results exists. Emergency physicians must recognize this complex and variable reporting process to avoid early discharge of otherwise well-appearing patients before determination of band counts.

Emergency physicians face increasing external forces to improve both efficiency and accuracy while operating in an inherently high-stakes clinical setting. Throughput is a necessary surrogate for quality, though health outcomes remain the primary operational driver. While emergency physicians may feel compelled to find reassurance in a normal leukocyte count, the balance of evidence strongly suggests a more prudent approach would be to wait for the bands.

Table 1
Correlation between the total white blood cell count, "bandemia", fever, heart rate, and mortality.

WBC	Fever	"Bandemia"	Heart rate	Mortality
4.1 k	No	11	106–113	3.7%
5.6 k	No	13	102–126	
11.4 k	No	17	66–95	
3.6 k	Yes	18	101–108	
8.9 k	Yes	18	63–99	
8.4 k	No	29	58–67	3.9%
4.0 k	Yes	33	107–108	4.9%
4.3 k	No	33	95–102	
8.6 k	No	41	136–137	
7.9 k	No	45	98–126	

Ref: Shi E, Vilke GM, Coyne CJ, Oyama LC, Castillo EM. Clinical outcomes of ED patients with bandemia. Am J Emerg Med. 2015; 33 (7): 876–81.

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S. Davis MD
R. Shesser MD, MPH
K. Authelet BS
A. Pourmand MD, MPH *
Emergency Medicine Department, George Washington University School of Medicine and Health Sciences, Washington, DC, United States
* Corresponding author at: Department of Emergency Medicine, George Washington University School of Medicine and Health Sciences, 2120 L St., Washington, DC 20037, United States.
E-mail address: pourmand@gwu.edu (A. Pourmand)

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Slime product injuries managed at emergency departments

Homemade slime is promoted as a substance that can be produced by children at home or at school. One version of homemade slime uses water, borax (sodium tetraborate), and Elmer's glue, and sometimes food coloring, glitter, or other additives. The American Chemical Society website provides directions for this version of homemade slime [1].

Recipes for homemade slime and its use have been around for years. However, in 2016 and 2017 its promotion on social media, such YouTube and Instagram, increased interest in the substance [2,3]. News stories reported increases in sales of glue linked to homemade slime [3].

At the same time as homemade slime's increased popularity have been reports of injuries when making or playing with the substance [2]. There is limited information on the potentially adverse effects of exposure to homemade slime. One meeting abstract described 38 inquiries involving 41 patients exposed to homemade slime reported to French poison centers during 2010–2017 [4].

The National Electronic Injury Surveillance System (NEISS) operated by the United States Consumer Product Safety Commission (CPSC) collects data on consumer product-related injuries in the United States from the emergency departments (EDs) of approximately 100 hospitals as a probabilistic sample of the more than 5000 hospitals with EDs in the United States [5]. Injuries to slime products or the ingredients being used to make slime in NEISS during 2001–2017 were identified by searching the Narrative_1 and Narrative_2 text fields for any mention of the terms "slime," "borax," "borate," and "boric." The resulting records were then reviewed to determine whether the substance involved in the injury appeared to be a slime product. Exposures to slime that were clearly not a product (e.g., slime on a rock) were excluded.

Twenty-seven injuries related to slime products were identified during 2001–2017. One (3.7%) case was reported in 2003, one (3.7%) in 2009, one (3.7%) in 2014, one (3.7%) in 2016, and 23 (85.2%) in 2017; 21 (87.5%) of the injuries were reported during May–December 2017. Seventeen (63.0%) of the cases suggested that the slime product was homemade. Eleven (40.7%) of the cases mentioned one or more of the ingredients used to make slime, and 5 (18.5%) mentioned that borax was specifically involved in the production of the slime. The distribution of the cases by route was 10 (37.0%) dermal, 6 (22.2%) ocular, 5 (18.5%) ingestion, 3 (11.1%) otic, 1 (3.7%) inhalation, and 2 (7.4%) unknown route. Of the ten dermal exposures, 4 (40.0%) involved the hand, 4 (40. %) the finger, 1 (10.0%) the face, and 1 (10.0%) the upper trunk. Ten (37.0%) of the injuries occurred at home, 4 (14.8%) at school, 2 (7.4%) at sports, and 11 (40.7%) at an unknown location.

Seven (25.9%) of the patients were age five years or less, 16 (59.3%) 6–12 years, 3 (11.1%) 13–19 years, and 1 (3.7%) 20 years or more; the mean age was 10 years (range 0–38 years). Twenty-three (85.2%) of the patients were female and 4 (14.8%) were male. The distribution by race/ethnicity was 12 (44.4%) white, 4 (14.8%) black/African American, 6 (22.2%) other, and 5 (18.5%) not specified.

Twenty-five (92.6%) of the patients were treated and released from the ED and 2 (7.4%) left without being seen. The reported symptoms were dermal burn (4), conjunctivitis (2), ocular pain (2), rash (2), blurred vision (1), cellulitis (1), contact dermatitis (1), dermal pain (1), dermal redness (1), dizziness (1), fever (1), headache (1), itching (1), laceration (1), lethargy (1), oral pain (1), peeling skin (1), urticaria (1), and vomiting (1).

In summary, slime product injuries reported to the NEISS increased greatly in 2017, after the promotion of homemade slime in 2016 and 2017 on social media increased interest in the substance. The exposures were most likely to occur by dermal, ocular, and ingestion routes and occur at home or in school. Patients tended to be children and female and did not need to be admitted to a healthcare facility. Continued surveillance of social media and healthcare data may be useful to determine whether interest in homemade slime, and the injuries that may result from its production and use, will continue or wane over time.

Declarations of interest

None.

Mathias B. Forrester
4600 Monterey Oaks Boulevard #F2335, Austin, TX 78749, USA
E-mail address: mathias.forrester@gmail.com

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Dextrose dilution for pediatric hypoglycemia

Emergency physicians (EPs) commonly treat hypoglycemia. When parenteral dextrose is required for an adult patient, EPs feel comfortable ordering "1 ampule of D50", which amounts to 25 g of 50% dextrose in sterile water. However, a solution of D50W is a significantly hypertonic solution. When a child has hypoglycemia, concentrations of dextrose must be lower than 50% due to increased risk of small vein sclerosis. Hypertonic solutions may lead to osmotic diuresis and tissue damage if extravasated. Furthermore, smaller gauge intravenous catheters typically used in