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Diarrhoea in the Enterally Fed Critically ILL Patients: A Literature Review

Abubakar M Ballah*[1], Abdullahi M Kirfi[2], Olabisi O Ogunleye[3], Auwal Adamu[2], Aminu M Baffah[4], OB Essien[5], Kefas J Bwala[3], Hajara A Galadima[6], Queeneth N Kalu[7], Roseline Duke[8], Abdull M Mahdi[9], Adamu S Abubakar[10], Kamilu M Karaye[11]

[1]Department of Anaesthesia, Abubakar Tafawa Balewa University, Bauchi, Nigeria

[2]Department of ENT, Abubakar Tafawa Balewa University, Bauchi, Nigeria

[3]Department of Surgery, Abubakar Tafawa Balewa University, Bauchi, Nigeria

[4]Department of Obstetrics and Gynaecology, Abubakar Tafawa Balewa University, Bauchi, Nigeria

[5]Department of Chemical Pathology, University of Calabar Teaching Hospital, Calabar, Nigeria

[6]Department of Anaesthesia and ICU, Federal Teaching Hospital, Gombe State Nigeria

[7]Department of Anaesthesia and ICU, University of Calabar Teaching Hospital, Cross River State Nigeria

[8]Department of Opthalmology, University of Calabar Teaching Hospital, Cross River State Nigeria

[9]Department of Opthalmology, Abubakar Tafawa Balewa University, Bauchi, Nigeria

[10]Department of Anaesthesia and ICU, University of Maiduguri Teaching Hospital, Borno State Nigeria

[11]Department of Internal Medicine, Bayero University/Aminu Kano Teaching Hospital, Kano, Nigeria.

ABSTRACT

Diarrhea is a complication in critically ill patients, contributing to increased morbidity and healthcare costs. It is often multifactorial in origin, arising from infections, enteral nutrition, medications (especially antibiotics), and altered immunity and gastrointestinal function due to critical illness. Diarrhea in these patients can exacerbate fluid and electrolyte imbalances, increase the risk of skin breakdown, and contribute to malnutrition. Identifying the underlying etiology is essential for targeted management. Diagnostic approaches typically include stool cultures, assessments for Clostridium difficile infection, and evaluation of medication-related causes. Treatment involves supportive care, such as fluid and electrolyte replacement, modifying enteral nutrition, and judicious use of anti-diarrheal agents when appropriate. Preventative strategies, such as the careful use of antibiotics and probiotics, may reduce the incidence of diarrhea in critically ill patients. Addressing diarrhea effectively requires a multidisciplinary approach to reduce complications and improve patient outcomes in the critical care setting.

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INTRODUCTION

Nutrition is an essential factor in all critical care settings because it can reduce the metabolic response to stress, modify the immune system, shorten hospital stays, and lower mortality rates for patients in critical condition. In the critically ill, there are two options for administering these nutrients: enterally or parenterally. Enteral Nutrition (EN) provides calories, protein, electrolytes, vitamins, minerals, trace elements, and fluids via an intestinal route. At the same time, Parenteral Nutrition (PN) is the intravenous administration of nutrition, which may include protein, carbohydrates, fat, minerals and electrolytes, vitamins, and other trace elements for patients who cannot eat or absorb enough food through feeding tube or by mouth to maintain good nutrition status. (1)

Since the enteral route helps to maintain gut function by preventing mucosal atrophy, reducing endotoxin translocation, and preserving gut immunity, it is the preferred route of administration in patients with a functional gastrointestinal tract whose oral intake does not meet the required daily caloric intake. (2)

There is no consensus definition of diarrhea; nevertheless, it has been loosely defined as an increase in intestinal peristalsis and frequency of stool. Although the World Health Organization advises more than three loose stools per day, several interpretations exist. According to a recent study, regardless of frequency, 50% of the medical and nursing staff classified diarrhea as pasty or watery stools, while the remaining 50% defined diarrhea as an increased frequency of

daily bowel movement. Enteral tube feeding diarrhea is presently defined in over thirty ways, depending on factors such as consistency (liquid, unformed), weight (>200 g, >300 g), duration (>1 day, >48 hours), frequency (>2 stools, >3 stools, >4 stools), and a combination of consistency and frequency. [2]

EPIDEMIOLOGY

There are few studies on the epidemiology of diarrhea among critically ill patients. These studies have looked at diarrhea in critically sick patients who are enterally fed, risk factors for diarrhea, and gastrointestinal failure (such as feeding intolerance, gastrointestinal hemorrhage, and ileus). Since enteral feeding is being utilized earlier and more frequently than in the past—often thought to be the cause of diarrhea in the intensive care unit (ICU)—interest in diarrhea has grown significantly.[3]

According to recent studies, between 14 and 21% of critically sick patients experience diarrhea; this number rises when the patients are fed enterally. Diarrhea is prevalent in critically ill patients who are fed enterally, with a median onset of symptoms occurring 6 days after ICU admission. The incidence of diarrhea ranges from 2 to 90%.[3]

After a bowel management protocol was instituted, Ferrie et al. found that the prevalence of diarrhea among ICU patients fed enterally decreased from 36% to 23%. On the other hand, the mean APACHE II score was substantially lower (22 vs. 29%, P<0.001) in the second phase of the trial, suggesting that diarrhea was more common in the more critically sick individuals. The overall frequency of gastrointestinal complications was 62.8% in an observational multicenter study conducted in 37 Spanish intensive care units. A cohort of 400 patients was followed prospectively over one month to determine the rate of gastrointestinal complications linked to enteral feeding. On the other hand, diarrhea accounted for 15.7% of these complications, a significantly lower percentage than delayed stomach emptying. Elpern et al. only discovered 38% of cases of diarrhea (based on data gathered over three months in a medical ICU); in contrast, over 95% of pediatric patients with severe burns had diarrhea.[4, 5]

PATHOPHYSIOLOGY OF DIARRHEA

A disruption in the delicate equilibrium between the intestinal secretory and absorptive systems causes diarrhea. Four distinct methods based on pathophysiological mechanisms have been described. They are exudative, secretory, osmotic, and motoric.[6]

OSMOTIC DIARRHOEA

Osmotic diarrhea results from an osmotically active agent in the intestinal tract that cannot be absorbed. Common causes include medications such as magnesium hydroxide/phosphate or sulfate, antacids containing magnesium, lactose in lactase-deficient individuals, sorbitol-containing products, and enteral feeds. This leads to watery and intermittent diarrhea.

SECRETARY DIARRHOEA

Secretory diarrhea occurs due to mucosal secretion of electrolytes and fluid into the intestinal lumen and may also be associated with decreased absorption. Large volumes of water are normally secreted into the small intestinal lumen, but most water is efficiently absorbed before reaching the large intestine. Secretory diarrhea occurs when the secretion of water into the intestinal lumen exceeds absorption. Producing “secretagogues” by neuroendocrine tumors such as gastrin and vasoactive intestinal polypeptide leads to watery and voluminous diarrhea.

Vibrio cholerae produces cholera toxin, which strongly activates adenylyl cyclase, causing a prolonged increase in intracellular concentration of cyclic AMP within crypt enterocytes. This change results in prolonged opening of the chloride channels that are instrumental in the secretion of water from the crypts, allowing uncontrolled secretion of water. This has led to many deaths.(7)

EXUDATIVE OR INFLAMMATORY DIARRHEA

The epithelium of the digestive tube is protected from insult by several mechanisms constituting the gastrointestinal barrier. Disruption of the epithelium of the intestine due to microbial or viral pathogens is a very common cause of diarrhea. It may result from invasive infections or Immune-mediated (i.e., inflammatory bowel disease, graft-versus-host disease) and lead to bloody stools and stool with mucus/pus. In such cases, water absorption occurs very inefficiently, and diarrhea results. Examples of pathogens frequently associated with infectious diarrhea include:

- Bacteria: *Salmonella*, *E. coli*, *Campylobacter*
- Viruses: rotaviruses, coronaviruses, parvoviruses (canine and feline), norovirus
- Protozoa: coccidia species, *Cryptosporium*, *Giardia*

The immune response to inflammatory conditions in the bowel contributes substantively to the development of diarrhea. Activation of white blood cells leads them to secrete inflammatory mediators and cytokines, which can stimulate secretion, imposing a secretory component on top of inflammatory diarrhea. Reactive oxygen species from leukocytes can damage or kill intestinal epithelial cells, which are replaced with immature cells that typically are deficient in the brush border enzymes and transporters necessary for the absorption of nutrients and water. In this way, components of an osmotic (malabsorption) diarrhea are added to the problem.

MOTILITY DIARRHEA

Motility or motoric diarrhea results from gut hypermotility, leading to decreased contact of solutes to the mucosal surface. It is associated with vagotomy, hyperthyroidism, and diabetic autonomic neuropathy. For nutrients and water to be efficiently absorbed, the intestinal contents must be adequately exposed to the mucosal epithelium and retained long enough to allow absorption. Disorders in motility that accelerate transit time could decrease absorption, resulting in

diarrhea even if the absorptive process per se were proceeding properly.

Alterations in intestinal motility (usually increased propulsion) are observed in many types of diarrheas. What is not usually clear and very difficult to demonstrate is whether primary alterations in motility cause diarrhea or simply an effect. (6, 8)

RISK FACTORS FOR DIARRHOEA

Enteral nutrition can maintain the structure and function of the gastrointestinal mucosa better than Parental nutrition; however, diarrhea can occur when enteral nutrition is initiated, depending on the administration methods, amount, flow rate, and type of enteral nutrition. Clostridium difficile-associated diarrhea is the most frequent cause of diarrhea in the critically ill however other causes reported include but are not limited to Overdose of hyperosmotic drug (sorbitol, etc.), use of broad-spectrum antibiotics, Pseudomembranous enteritis due to Clostridioides (Clostridium) difficile, Intestinal infections (MRSA enteritis, CMV enteritis, etc.), Inflammatory bowel diseases, Intestinal graft-versus-host disease after hematopoietic stem cell transplantation, Use of anticancer agents, etc. (3)

In the ICU, risk factors include Fever or hypothermia, Presence of infections, Malnutrition or hypoalbuminemia, Sepsis or multiple organ failure, Open-feed container, Previous total parenteral nutrition, etc.

DIARRHOEA IMPACT AND COMPLICATIONS

In critically ill individuals, diarrhea can have various severe effects and consequences, which can be local or systemic. Dehydration can occur rapidly due to fluid and electrolyte imbalance brought on by significant fluid loss, particularly in critically ill patients with poor fluid balance. Fluid loss results in the loss of electrolytes like sodium, potassium, and chloride, leading to electrolyte imbalances that can impair the heart, muscles, and nervous system. Hemodynamic instability can also occur from sudden changes in blood circulation volume caused by diarrhea; metabolic acidosis can result from massive losses of electrolytes and bicarbonate ions during digestion, malabsorption, and malnutrition; and depleted potassium, magnesium, and zinc stores can cause arrhythmias and membrane instability.(9) Other documented effects of diarrhea in critically ill patients include:

NUTRITIONAL COMPLICATIONS: Diarrhea can exacerbate malnutrition in critically ill individuals by obstructing the intestinal absorption of nutrients. Diarrhea can make it difficult for these patients to get and absorb vital nutrients that are necessary for their healing and rehabilitation.

INFECTION RISK: Patients in critical care settings are more vulnerable to infections due to compromised immune systems, and diarrhea can exacerbate this risk. Diarrhea can damage the intestinal barrier, making it easier for infections to enter the circulation.

DRUG ABSORPTION: Dehydration can interfere with oral drug absorption, resulting in less-than-ideal therapeutic dosages. Patients who are critically sick frequently depend on drugs to control their diseases, and uneven drug absorption can affect how well a treatment works.

RENAL COMPLICATIONS: This can arise from diarrhea-induced fluid and electrolyte imbalances, which can put a strain on the kidneys and increase the risk of acute kidney injury (AKI) or worsen pre-existing renal dysfunction.

SKIN ISSUES: Extended contact with faeces can cause infection, rashes, and skin damage. Patients in critical condition who may not be able to move are especially vulnerable to pressure ulcers and other skin problems.

DELAYED WOUND HEALING: It is essential for critically ill patients recovering from surgery or injuries to avoid wounds from becoming infected or worsening due to nutritional deficits and fluid imbalances caused by diarrhea.

VENTILATOR-ASSOCIATED PNEUMONIA: Diarrhea can raise the risk of ventilator-associated pneumonia (VAP), caused by stomach contents containing bacteria that can aspirate into the lungs and cause pneumonia.

PROLONGED HOSPITALISATION: Prolonged hospital stays resulting from severe diarrhea and its complications can put an additional burden on the patient and the healthcare system.

MULTI-ORGAN DYSFUNCTION SYNDROME (MODS): When many organ systems aren't functioning correctly, a series of events set off by acute diarrhea may occasionally exacerbate the condition.

PSYCHOLOGICAL IMPACT: For individuals who are sick, diarrhea can be upsetting and may even lead to worry and humiliation. Their recovery may be hampered, and this psychological stress may adversely affect their general well-being.

EVALUATING AND DIAGNOSING METHODS

Most patients use the term "diarrhea" to refer to loose faeces, although some may also refer to it as faecal incontinence, urgency, or frequency. Diarrhea and pseudo-diarrhea can be distinguished using the Bristol Stool Form Scale (BSFS). The hardest stool type (Type 1) to the softest stool type (Type 7) is represented on the BSFS, an ordinal scale. When combined with other symptoms suggestive of constipation, Types 1 and 2 are seen as tough faeces, whereas Types 6 and 7 are regarded as abnormally loose or liquid stools (and in conjunction with other symptoms, indicated diarrhea). Hence, types 3, 4, and 5 are typically considered the most "normal" stool forms and are the most prevalent in cross-sectional studies of persons in good health.(10)

HISTORY TAKING

Patients should be questioned about important past features, such as the appearance and smell of their stool, any urgency

or tenesmus that may have been present, discomfort, the frequency and length of symptoms, presence or absence of blood, water/voluminous, postprandial, and potential triggers. The clinician can be directed toward an appropriate workup for infections or food intolerance using a comprehensive travel and dietary history. Extraintestinal symptoms of the illness may become apparent through a systems review. It is recommended to obtain a thorough medical history that includes all over-the-counter drugs, illicit drug use, alcohol consumption, and supplement use. It is essential to have an account of behavioral health, including information about the patient's psychosocial symptoms and any possible side effects. Before doing additional testing, records from past office visits, lab tests, and diagnostic treatments should be acquired.

PHYSICAL EXAMINATION

Any patient reporting persistent diarrhea should have a complete physical examination, which includes a digital rectal examination, an abdominal examination, and a visual check of the anus and perianal skin. When inflammatory problems are suspected, office anoscopy may be beneficial.

DIAGNOSTIC APPROACH

Stool studies (comprehensive fecal analysis, including a 24-hour stool mass for the quantification of diarrhea and calculation of fecal components), a complete blood count, a quantitative fecal fat test (i.e., 24- to 48-hour chemical analysis or quantitative Sudan microscopy), and a fecal chemistry test (i.e., pH level, osmolality, electrolytes, and phosphate) are all recommended as part of the initial laboratory workup. If the patient exhibits alarm characteristics, such as anemia, unintentional weight loss, or persistent blood in the stool, serum electrolytes, albumin, and blood cultures should be examined further. Patients with alarm characteristics, aberrant laboratory values, or suspected structural illness may benefit from computed tomography (CT) or magnetic resonance imaging (MRI) with enterography. Patients with alarm features or those for whom a reasonable initial workup has not produced a diagnosis should also have a colonoscopy. Even if the endoscopic mucosal appearance is normal, numerous mucosal biopsies should be obtained when a colonoscopy is conducted to investigate chronic diarrhea. Testing for fecal occult blood (fecal immunochemistry test), fecal calprotectin (fecal leukocytes or lactoferrin), and fecal fat (fecal Sudan stain) may be helpful to classify diarrhea as watery, fatty, or inflammatory when the first evaluation is unable to narrow the differential diagnosis.(11)

MANAGING OF DIARRHOEA IN THE CRITICALLY Ill.

PREVENTION OF DIARRHOEA

Diagnosing diarrhea in critically unwell patients can be challenging. The lack of a standard definition is primarily to blame for the vast variation in reported prevalence rates. Among the etiologies are acute diverticulitis, ischemic bowel disease, malnutrition, hypoalbuminemia, microbial contamination of formulae, intolerance to enteral feedings, and infectious processes. Additionally, diarrhea is a documented side effect of almost all drugs. Medications that might induce diarrhea that are often used in critical care include potassium supplements, antihypertensives, antibiotics, and antidysrhythmics. Elixir-formulated medications such as furosemide, metoclopramide, and acetaminophen may consist of significant levels of sorbitol, which might result in diarrhea. Antibiotic-related diarrhea usually starts between day five and day ten of treatment. The overabundance of competing microbes like Clostridium difficile is the most plausible mechanism. There is mucosal damage, diffuse inflammation, and pseudo-membrane development (pseudomembranous colitis). Given the possibility of toxic colon dilatation and perforation, early detection and intervention are crucial. A stool sample should be tested for the C difficile toxin in patients with fever and diarrhea who have taken an antibiotic (particularly a cephalosporin, clindamycin, or ampicillin) during the previous three weeks. Diarrhea is stressful for patients and workers, even if it is not directly linked to an increase in mortality. It can cause skin deterioration, contaminate wounds, hinder enteral nutrition delivery, and increase nurses' workload. Diarrhea can also result in hemodynamic, acid-base, and fluid and electrolyte imbalances.(12, 13)

The ideal course of managing diarrhea is prevention, but several factors that may promote diarrhea in the critically ill are unavoidable. Nevertheless, indications for each drug, such as Proton Pump Inhibitors, must be considered carefully before administration. It's important to follow enteral nutrition administration guidelines to avoid feeding-associated diarrhea. Iso-osmolar solutions and continuous infusion are commonly used to alleviate diarrhea in patients fed enterally.

Low-fat or medium-chain triglyceride-containing diets are advised for people with fat malabsorption, lactose intolerances, and other situations. There have been reports that fibers, such as pectin, can lower the incidence of diarrhea. No data support an elemental diet for the prevention or treatment of diarrhea.

Certain types of infectious diseases and pancreatic exocrine insufficiency can be treated specifically. All patients with diarrhea need to receive supportive care in addition to efforts to determine and treat the underlying cause.

It is important to provide supportive treatment that includes replacing fluids and electrolytes and closely monitoring investigation results and organ function. It's also critical to prevent effects (such as skin lesions) or to identify and treat them early. All symptomatic patients with infectious diarrhea who are bedridden and often incontinent must follow isolation protocols to prevent nosocomial spread.(14)

Probiotics are living, non-pathogenic microorganisms that stimulate mucosal immunity to lessen bacterial translocation. Probiotics help patients with diarrhea by restoring the gut microbiota, preventing antibiotic-associated diarrhea, shortening the duration of acute infectious diarrhea, alleviating diarrhea associated with inflammatory bowel disease, and managing diarrhea associated with irritable bowel syndrome. They also increase short-chain fatty acids and suppress systemic inflammatory response by stabilizing the gut microbiota. Probiotics dramatically lower the risk of diarrhea in the very sick.(15, 16)

CONCLUSION

Diarrhea is common among the critically ill, and it has several predictors. It can lead to increased medical costs and strain on hospital staff and may be associated with higher mortality among ICU patients.

DECLARATION OF INTEREST

None

AUTHOR'S CONTRIBUTIONS

BA conceived, designed, and drafted manuscript, OO, KB, AK, AA, ES assisted with manuscript drafting. All authors read and approved the final manuscript.

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