

Evaluation of gastrointestinal dysfunction in burn patients

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Background:

INTRODUCTION: Determine and evaluate the factors that predispose to gastrointestinal dysfunction in burn patients.

METHODS: Observational, longitudinal study, carried out in the intensive burn therapy area. During a period of 9 months, patients were admitted with informed consent and institutional clinical records.

OBJECTIVES: To evaluate clinical data of gastrointestinal dysfunction in burn patients, describe the clinical, radiological and biochemical findings during their medical care.

RESULTS: During the study period, 28 patients diagnosed with burns due to different etymologies were treated. The most prevalent symptom was suspension of enteral nutrition in the presence of gastrointestinal symptoms (75%), constipation (71.4%), abdominal distension (60.7%), followed by high residual gastric volume (46.4%), in this group the most frequent acute-onset intestinal failure and alterations reported intestinal lesions correspond to the initial stage of the injury in the first 24 hours. (Fig 1)
DISCUSSION: Early recognition of clinical signs of gastrointestinal dysfunction in burn patients has an important role in the prevention of sepsis and multiple organ failure. The symptoms of gastrointestinal dysfunction are very varied (vomiting, abdominal distension, diarrhea, nutritional intolerance, bleeding, absence of abdominal sounds, intra-abdominal hypertension) and often the severity of the situation cannot be determined.

CONCLUSIONS: Current studies for the evaluation of gastrointestinal dysfunction have limited value and we need to find new reliable markers. It is essential to recognize the associated factors early and carry out therapeutic measures that avoid this type of situation for patients.

Keywords: Burns, Gastrointestinal dysfunction.

Factors such as duration of contact, contact surface area, involved tissue, and temperature correlate with the extent and depth of burn injuries.¹ Systemic responses are more intense in burns affecting more than 20% of the body surface area, leading to the release of inflammatory mediators, capillary leakage, splanchnic vasoconstriction, tissue necrosis, myocardial depression, and secondary infections. These factors, either individually or collectively, can lead to shock, sepsis, multi-organ failure, and death.²

The gastrointestinal tract of burn patients undergoes significant physiological changes due to these alterations. Some of these changes include increased gastric secretion, reduced intestinal motility, decreased nutrient absorption surface, increased gastrointestinal mucosal permeability, loss of intestinal villi, changes in the microbiome and microbiota, and intra-abdominal hypertension. These occur in 36-70%

of patients with burns covering more than 60% of the body surface area and are considered poor prognostic factors.³

In recent years, the study of gastrointestinal dysfunction in burn patients during the acute phase has increased, due to theories linking it to patient prognosis and multi-organ failure.⁴

During the acute phase following thermal injury, there are multiple gastrointestinal alterations: motility changes due to hormonal shifts, intestinal ischemia leading to increased permeability and disruption of the intestinal barrier, bacterial translocation from the intestinal microbiota, and impairment of gut-associated lymphoid tissue.⁵

The European Society for Clinical Nutrition and Metabolism (ESPEN) published the "Definition and Classification of Intestinal Failure in Adults" in 2015.¹¹ They define gastrointestinal dysfunction as a

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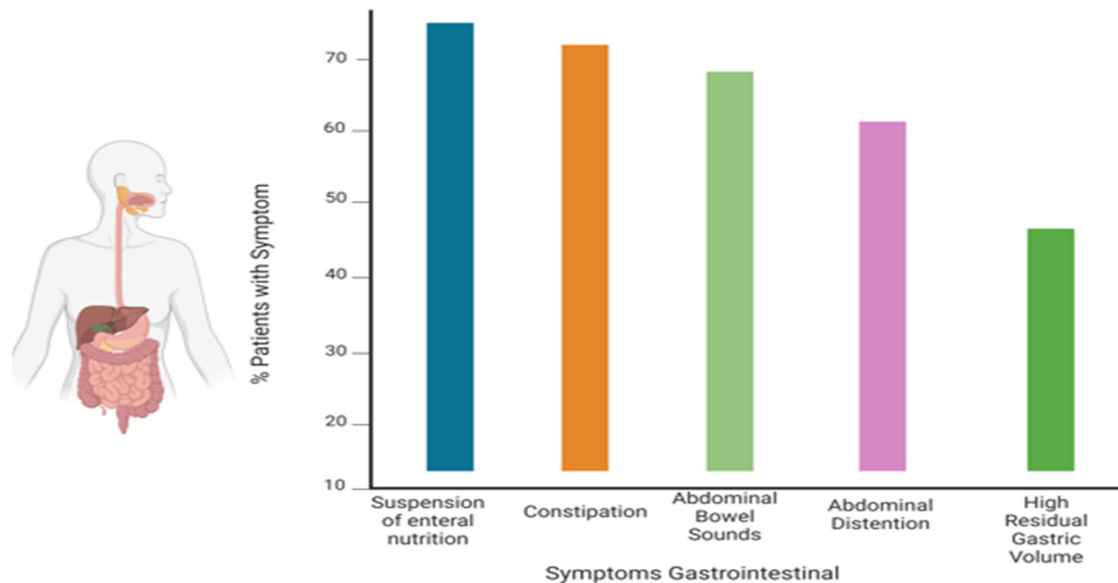


Figure 1. Prevalence of gastrointestinal symptoms in critically ill patients.

reduction in intestinal absorption function accompanied by some degree of intestinal failure.⁶ Intestinal failure is defined as the reduction of intestinal function below the minimum necessary for the absorption of macronutrients, water, and electrolytes, necessitating intravenous supplementation to maintain homeostasis.

Intestinal failure can be classified into three types based on its presentation, duration, and severity: Acute: Typically short-lived and self-limiting, often occurring after abdominal surgery or in critically ill patients.

Prolonged: Metabolically unstable patients requiring multidisciplinary care and intravenous supplementation for weeks or months.

Chronic: Metabolically stable patients requiring supplementation for months or years, which may be reversible or irreversible.

Acute intestinal failure can appear in 15% of postoperative or critically ill patients. Intestinal dysfunction is found in 40% of patients with pneumonia, 50% with respiratory failure or sepsis, over 60% with pancreatitis, 70% with traumatic brain injury, and over 80% with intracranial hypertension. Literature on burn patients is very limited and mostly consists of case reports.

Other authors report motility disorders in 50% of mechanically ventilated patients and gastrointestinal symptoms in 62% of critically ill patients at least once a day.⁷

Therefore, these alterations are extremely frequent and variable. Reported manifestations in studies with adequate methodology include nausea, vomiting, regurgitation, abdominal distension,

diarrhea, flatulence, loss of bowel sounds, increased gastric residue, hemorrhage, as well as intolerance to enteral feeding and abdominal hypertension.

On the other hand, gastrointestinal dysfunction in the intensive care unit is a frequent condition that requires further study. In recent years, multidisciplinary working groups have been created, providing useful tools for managing these patients. An example is the classification of acute gastrointestinal disorders in critically ill patients proposed by the European Society of Intensive Care Medicine's abdominal problems working group, divided into four types based on severity:

Grade I (risk): Postoperative nausea or vomiting during the first days post-surgery, absence of bowel sounds, decreased intestinal motility in the initial shock phase.

Grade II (gastrointestinal dysfunction): Gastroparesis with increased gastric residue, gastrointestinal tract paralysis, diarrhea, increased intra-abdominal pressure (IAP) between 12-15 mm Hg, blood in gastric contents or stools, and enteral feeding intolerance (considered if 20 kcal/kg has not been provided within 72 hours).

Grade III (acute intestinal failure): Persistent intolerance despite therapeutic intervention with increased gastric residue, gastrointestinal paralysis, increased intestinal distension, elevated IAP (15-20 mm Hg), and low abdominal perfusion pressure (< 60 mm Hg).

Grade IV (acute intestinal failure): Intestinal ischemia with necrosis, gastrointestinal hemorrhage, even hemorrhagic shock, Ogilvie syndrome,

DEMOGRAPHIC CHARACTERISTIC STUDY POBLATION (N=28)			
GENDER	AGE GROUP	N	%
MALE	18-29 YEARS	9	32.14
	30-39 YEARS	7	25
	40-49 YEARS	4	14.28
	50-59 YEARS	2	7.14
	> 60 YEARS	0	-
	TOTAL	22	78.57
FEMALE	18-29 YEARS	1	3.57
	30-39 YEARS	2	7.14
	40-49 AÑOS	2	7.14
	50-59 YEARS	1	3.57
	> 60 YEARS	0	-
	TOTAL	6	21.42
TOTAL PATIENTS	18-29 YEARS	10	35.71
	30-39 YEARS	9	32.14
	40-49 YEARS	6	21.42
	50-59 YEARS	3	10.71
	> 60 YEARS	0	-
	TOTAL	28	100

Table 1. Demographic characteristics of the patients included in the study.

abdominal compartment syndrome. This represents a more advanced, life-threatening failure.

The use of intra-abdominal pressure (IAP) as a criterion or parameter for classification is based on the impact its elevation has on mortality, especially in surgical, trauma, or burn patients.

Several scales have been proposed to assess the severity of intestinal failure, given that the evaluation of presenting symptoms can be subjectively interpreted. Despite these efforts, a consensus is still needed to define the severity of gastrointestinal dysfunction in burn patients, to conduct studies that aid in treating this problem.⁸

Methods

This pilot study is observational, longitudinal, and conducted as a routine clinical practice trial with standard treatments. It involves deliberate intervention and prospective data collection. The study population includes patients admitted to the Intensive Care Unit (ICU) within the study period.

General Objective: The primary aim of the study is to determine the presence of gastrointestinal dysfunction in burn patients.

BURN PERCENTAGE OF EVALUATED BURN PATIENTS (N=28)			
GENDER	TOTAL BODY SURFACE AREA BURNED	N	%
MALE	21- 30 %	2	7.14
	31- 40%	9	32.14
	41- 50 %	7	25
	51- 60%	2	7.14
	> 60 %	2	7.14
	TOTAL	22	78.57
FEMALE	21- 30 %	2	7.14
	31- 40%	0	-
	41- 50 %	2	7.14
	51- 60%	2	7.14
	> 60 %	0	-
	TOTAL	6	21.42
TOTAL PATIENTS	21- 30 %	4	35.71
	31- 40%	9	32.14
	41- 50 %	9	21.42
	51- 60%	4	10.71
	> 60 %	2	7.14
	TOTAL	28	100

Table 2. Percentage of total body surface area burned in the study group.

Specific Objectives: These include identifying factors associated with gastrointestinal dysfunction.

Inclusion Criteria:

Patients admitted to the Burn Intensive Care Unit.

Study period from March 1 to November 30 of the same year.

Patients with burns covering more than 20% of the body surface area, including mixed second-degree, deep second-degree, and third-degree burns.

Patients with airway burns admitted to the ICU.

Patients older than 18 years.

Patients with high-voltage electrical burns.

Exclusion Criteria:

Patients with burns covering less than 20% of the body surface area.

Burn patients not admitted to the ICU.

The sample size corresponds to the number of patients meeting the criteria during the study period. As this is an uncontrolled variable, it is considered a pilot study. Statistical tools were used to determine prevalence and confidence levels. Statistical significance was tested using the Student's t-test, and variable normality was verified with the Shapiro-Wilk test. Finally, all risk factors were evaluated using a

REPORTED PREVALENCE OF GASTROINTESTINAL SYMPTOMS IN CRITICALLY ILL PATIENTS			
SYMPTOM	MONTEJO 1999	MONTEJO 2002	REINTAM 2009
ABNORMAL BOWEL SOUNDS	UNREPORTED	UNREPORTED	41%
ABDOMINAL DISTENTION	13%	9%	11%
VOMIT	12%	6%	38%
DIARRHEA	15%	14%	14%
CONSTIPATION	16%	5%	UNREPORTED
HIGH RESIDUAL GASTRIC VOLUME	39%	25%	23%
GASTROINTESTINAL BLEEDING	UNREPORTED	UNREPORTED	7%
SUSPENSION OF ENTERAL NUTRITION IN THE PRESENCE OF GASTROINTESTINAL SYMPTOMS	15%	UNREPORTED	63%
PRESENCE OF ANY GASTROINTESTINAL SYMPTOM	UNREPORTED	61%	59%

Table 3. Reported prevalence of gastrointestinal symptoms in critically ill patients in various studies.

binary logistic regression model to identify predictors of gastrointestinal dysfunction. Data management and analysis were performed using SPSS 21.0 (IBM©) for Windows.

Results

During the study period, 28 patients with burn injuries from various etiologies were treated. Of these patients, 78.5% were male and 21.4% were female, predominantly in the 20-29 age group (Table 1). The injury mechanisms included 23 cases (82.14%) of direct flame burns, 4 cases (14.28%) of electrical

burns, and 1 case (3.57%) of scalding burns, with variable affected body surface areas (Table 2).

There were no cases of early mortality in this group. The most useful tool for monitoring patient status, as determined by the study group, was the measurement of intra-abdominal pressure. Patients requiring mechanical ventilatory support and vasopressor therapy exhibited the most symptoms. The findings of this study align with international reports concerning the early onset of symptoms associated with Gastrointestinal Dysfunction, although the small sample size limits the ability to establish causal relationships (Table 3).

PREVALENCE OF GASTROINTESTINAL SYMPTOMS IN EVALUATED BURN PATIENTS (N= 28)		
SYMPTOM	N	%
ABNORMAL BOWEL SOUNDS	19	67.8%
ABDOMINAL DISTENTION	17	60.7%
VOMIT	11	39.2%
DIARRHEA	3	10.7%
CONSTIPATION	20	71.4%
HIGH RESIDUAL GASTRIC VOLUME	13	46.4%
GASTROINTESTINAL BLEEDING	0	0
SUSPENSION OF ENTERAL NUTRITION IN THE PRESENCE OF GASTROINTESTINAL SYMPTOMS	21	75%
PRESENCE OF ANY GASTROINTESTINAL SYMPTOM	6	21.4%

Table 4. Reported prevalence of gastrointestinal symptoms in patients included in the study

Discussion

Recognizing early clinical signs of gastrointestinal dysfunction in burn patients plays a crucial role in preventing infection, sepsis, multi-organ failure, and death. The symptoms of gastrointestinal dysfunction are highly variable, including vomiting, abdominal distension, diarrhea, intolerance to nutrition, bleeding, absence of bowel sounds, and intra-abdominal hypertension, making it often challenging to determine the severity of the condition. Various studies on gastrointestinal dysfunction in critically ill patients, as shown in Table 3, reveal a higher prevalence of Type I dysfunction compared to our study's findings. The timing of symptom onset from ICU admission was evaluated in our study, focusing on the early phase, which may be a limitation. However, reference studies do not typically assess symptom onset timing (Illustrated in Table 4). Published results on the impact of burns on the progression of patients with gastrointestinal failure indicate an increased mortality risk in this group. Therefore, early evaluation and documentation of this pathology could help reduce the associated mortality.

Conclusion

Current studies on the evaluation of gastrointestinal dysfunction in burn patients are limited. A deeper understanding of the relationship between the extent of thermal injury, the degree of gastrointestinal dysfunction, and their underlying mechanisms is essential for developing new therapeutic strategies. It is highly relevant to investigate the long-term implications related to the mediation of the immune response to thermal injury, the hypermetabolic state of these patients, and the direct effects of thermal injury on the gut microbiota.

Conflicts of interest

The authors have no conflicts of interests to declare.

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