The effect of *Lactobacillus* bacteria supplement on sepsis and its complications in patients with acute burns


1. Introduction

The etiology of sepsis after burn has changed in recent decades. In the past, wound infection was the main reason for systemic infection. This cause has been minimized with the advances in wound treatment that include early surgical care, appropriate antibiotics, and better dressing techniques. A less investigated mechanism that seems to contribute to sepsis in burns is bacterial translocation—the passage of microorganisms and/or their products from the gastrointestinal tract (GIT) lumen. The presumed mechanism for the translocation is a diminished mesenteric blood supply during the severe burn and the following stress period [1]. Physiological stress and trauma influence the incidence of translocation from the GIT. Stress alone does not seem to evoke translocation, but once it is accompanied by trauma, especially one that involves extensive tissue damage (such as that in burns) translocation ensues [2]. Moreover, hypovolemic or anemic shock (states quite prevalent in burns) are directly connected to bacterial translocation in a mechanism of reduced mesenteric blood flow [3]. GIT flora composition also contributes to the degree of translocation. The greater the concentration of pathogenic...
bacteria, the greater the incidence of translocation [4]. Maintaining normal flora in the GIT decreases the level of the translocation [5].

Antibiotic therapy, also very common in burn care, further contributes to the translocation through alteration of the GIT flora [6]. Finally, burn itself was shown in animal models to evoke translocation. It was found that the severity of the burn is directly related to translocation [7].

Several treatment options were investigated to decrease bacterial translocation, among them a per os supplement of lactobacillus bacteria. Those bacteria may decrease translocation by improving host defenses in several ways [8]—some are non-immunological in nature, such as production of antimicrobial agents [9], competition with the pathogens on adhesion to GIT cells [10], stabilization of the GIT epithelial barrier [11], and promotion of the GIT motility and by that reducing the number of anaerobic GIT bacteria [12].

Lactobacillus bacteria also influence the immunological defense system by the production of diverse cytokines that enhance the reaction of the immunological system to pathogens [13], enhancement of the phagocytic capabilities of polymorphonuclears [14], augmentation of natural killer cell activity [15], and amplification of production of specific antibodies against pathogenic bacteria [16].

The benefit of oral administration of lactobacillus bacteria was shown in animal models suffering stress situations similar to burns such as acute liver injury [17], and liver resection and colonic anastomosis [18]. In humans, a benefit was shown in patients after major abdominal surgery [19], elective surgery [20], liver transplantation [21], and acute pancreatitis [22]. In acute burn itself, the benefit of lactobacillus bacteria supplements has previously been shown only in rat models [23].

Our study aimed to assess benefits of lactobacillus bacteria supplements in acute burn injury in a clinical, retrospective, cohort study.

2. Materials and methods

Our study investigated a retrospective cohort and utilized data collected from the files of 56 patients with acute burns who were admitted to Soroka University Medical Center from May 1999 to June 2003.

The lactobacillus supplement was recommended by the dietitian to all the burned patients admitted. Twenty-eight patients who agreed to take the supplement were singled out as the treatment group. Matched to them as the control group, were 28 patients with similar demographic characteristics and initial clinical status. The two groups were similar with regard to demographics and initial clinical status (Table 1). The two groups were similar in age, first hospitalization to the ICU, and mean TBSA. As a result of the retrospective nature of this study and matching difficulty, there was a higher incidence of women and inhalation injury in the treatment group. In the 41–70% TBSA subgroup there were no significant differences between the subgroups in all the parameters except for the mean TBSA that was higher in the control group (51.6% in the control group versus 46.9% in the treatment group; Table 2).

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3. Results

3.1. Demographics and admission condition

The treatment and control groups were similar with regard to demographics and initial clinical status (Table 1). The two groups were similar in age, first hospitalization to the ICU, and mean TBSA. As a result of the retrospective nature of this study and matching difficulty, there was a higher incidence of women and inhalation injury in the treatment group. In the 41–70% TBSA subgroup there were no significant differences between the subgroups in all the parameters except for the mean TBSA that was higher in the control group (51.6% in the treatment group versus 60.0% in the control group; Table 2).

3.2. Outcome parameters

The following infection morbidity parameters (Table 3) were measured: mean number of days in which body temperature above 38.5 or below 36 °C was measured, mean number of positive bacterial cultures, mean number of days in which antibiotics were given, and mean time from injury to hospital discharge (days); all were higher in the treatment group. Those parameters were also higher in the treatment subgroup of 41–70% TBSA (Table 4). Mortality – in all cases reviewed – was a result of severe sepsis with intractable shock and multi-organ failure. Mortality, unlike the morbidity parameters, was higher...
in the control group (Table 3). However, that dissimilarity was insignificant ($p = 0.071$). In the subgroup of 41–70% TBSA (Table 4), there was a significantly higher mortality than in the control subgroup ($p < 0.01$).

4. **Discussion**

In the treatment group there was less mortality than in the control group (2 versus 7). This difference between the two arms was not significant ($p = 0.071$). In the subgroup of 41–70% TBSA, that difference was augmented (0 versus 5 deaths) and was statistically significant ($p < 0.01$).

That subgroup of extensive TBSA is especially important, because a greater degree of bacterial translocation can be expected here, due mainly to the elevated physiological stress and trauma typical of such injuries.

It should be noted that in the 41–70% TBSA subgroup, there was an average lower TBSA of 8.4% in the treatment group (Table 2). Notwithstanding this, the striking difference in mortality in those subgroups is still significant in our view because of the similarity between the subgroups in mean age, inhalation injury, gender, and the third degree thickness of the burn injury.

Our research was a retrospective cohort study. Due to nature of the study, the lactobacillus bacteria supplement was not given in ideal conditions. The lactobacillus bacteria were given in two ways and the supplement was given, on average, 8.25 days after the injury and thus covering only the stress phases that followed that period. These constraints may have reduced the gains of the supplement.

Morbidity compared to mortality showed an inverse trend. There was a higher morbidity in the treatment group. Several reasons for that trend are proposed. It may have been caused...
by the higher ratio of inhalation injury patients (12 versus 8) and women (11 versus 8) in the treatment group. Female gender and inhalation injury were shown to be risk factors for higher morbidity and mortality in burns. O’Keefe et al. [24] found that the risk factors for morbidity and mortality are high TBSA, deeper degree of the burn, inhalation injury, advanced age, and female gender. Moreover, Tobiasen and colleagues abbreviated burn severity index [25] points to inhalation injury and female gender as important risk factors. Thus, higher inhalation rate and more women in the treatment group may have been the reason for its higher morbidity.

It could be hypothesized that the greater morbidity in the treatment group might have been caused by the administration of the lactobacillus bacteria themselves. A different type of probiotic – Sacharomyces cerevisiae – was found to be a cause of fungemia in immunosuppressed patients who were given that supplement [26].

Notwithstanding, bacterial cultures were taken for each patient every few days, none with Lactobacillus bacteria. Moreover, lactobacillus bacteria and their safety as food additives were investigated more than S. cerevisiae. It is known that bacteremia caused by lactobacillus bacteria is extremely rare, and data on its clinical significance are based only on case reports [27].

Another explanation for the inverse trend between mortality and morbidity can be found in the increased mortality rate in the control group compared to the treatment group (7 versus 2). This higher mortality rate meant that there were fewer patients in the control group who had numerous fever days, positive bacterial cultures, days of treatment with antibiotics, and hospitalization days, and that they did not survive long enough to develop these complications.

The difference in trends in morbidity and mortality between the two groups points to a beneficial effect of the lactobacillus bacteria supplement, since there was reduced mortality even in the face of higher morbidity.

In conclusion, our findings suggest that in acute burns, lactobacillus bacteria food additives may be clinically beneficial in patients with a total burned body surface area of 41–70%. Comprehensive, prospective, controlled, and blinded studies are needed to clarify this issue further.

It is our impression that lactobacillus bacteria supplement may become an addition to the routine regimen for reducing sepsis and mortality in acute extensively burned patients.

REFERENCES


