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Effects of Growth Hormone on Bacterial Translocation Due to Intestinal Obstruction

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Abstract: Bacterial translocation is an important etiologic factor in multisystem organ failure and sepsis, which have a high mortality rate. To determine the effects of growth hormone on bacterial translocation, an experimental study was performed. Twenty pathogen-free rabbits were divided into two groups each containing 10 rabbits. After loop obstruction was performed, the rabbits in the control group were given saline solution whereas the rabbits in the study group received growth hormone. Relaparotomy was performed after 24 hours, and tissue and blood samples were collected for histopathologic and microbiologic examinations. Bacterial translocation rates were higher in the control group than in the study group. In conclusion, the growth hormone was found to have protective effects against bacterial translocation.

Key Words: Bacterial translocation, growth hormone.

Introduction

Bacterial translocation is defined as the passage of viable bacteria from the gastrointestinal tract to extraintestinal organs, such as the mesenteric lymph node complex, liver, kidney, lungs, spleen, pancreas, peritoneum and blood stream (1-9). Bacterial translocation can cause multiple organ failure and sepsis, which can be seen in thermal injuries and severe hypermetabolic illness (1-4,10,11).

Normal intestinal mucosal structure and flora are the most important barriers against bacterial translocation (1-6,9). In many experimental studies, it has been shown that a number of conditions promote bacterial translocation, including hemorrhagic shock, thermal injury, antibiotic therapy, cytotoxic drugs, intestinal obstruction and intravenous feeding (5,12,13).

Growth hormone has a protective effect on intestinal mucosa and it stimulates mucosal epithelial growth. It has been demonstrated that growth hormone deficiency can cause mucosal hypoplasia (14).

This experimental study was performed to determine the effects of growth hormone on bacterial translocation and intestinal wall injury.

Materials and Methods

Twenty pathogen free, male New Zealand rabbits were divided into two groups, each containing 10 rabbits. All the rabbits were fed standard laboratory chow and given water. They fasted during the night before the operation. Anesthesia was performed with 20mg/kg ketamin HCl and 10mg/kg xilazin.

Group 1 (control group): After a median incision was performed without damaging any vessels, 5 and 25 cm proximal to terminal ileum, the intestine was ligated with 3/0 silk to perform loop obstruction. After closing the abdomen, 0.5 cc saline solution was administered through a vein in the ear.

Group 2 (study group): After loop obstruction was performed and the abdomen was closed, 1mg/kg recombinant human growth hormone (Lilly Humatrope® Lilly France Usine de Fegersheim, France) was administered through a vein in the ear.

After 24 hours a relaparotomy was performed, a 1ml blood sample was obtained from the vena cava for blood culture, and tissue samples were taken from the liver, spleen, mesenteric lymph nodes (MLN) together with a loop segment of the intestines for histopathologic and microbiologic examinations.

One-gram tissue samples were homogenised and placed in Triptic Soy Borth solution. 0.1ml from this solution was diluted with 0.9ml saline solution. Then it was plated in McConkey agar for g(-) microorganisms, and blood agar for g(+) microorganisms. The plates were incubated at 37°C for 24 hours. Any bacterial colonisation was accepted as bacterial translocation. classification of bacteria was performed after Gram staining.

The tissue samples were dehydrated with alcohol and embedded in paraffin blocks, which were cut in 5μm sections for histologic staining with hematoxylin and eosin. Oedema, vascular congestion, and polymorphonuclear leukocyte (PNL) infiltration were evaluated in all the tissues, together with ulceration in the intestine, lymphoid hyperplasia in MLN, and kuppfer cell hyperplasia in the liver. Bacteria in the tissue samples were determined with Braun and Breen method (15).

Testing for significant differences between the control and study groups was carried out using the X^2 test. P≤0.05 was considered significant.

Results

Bacterial translocation rates in the control group were 60%, 100%, 90% and 100% in the blood, liver, spleen and MLN respectively. These rates in the study group were 10%, 20%, 40% and 40% in the blood, liver, spleen and MLN respectively. The results are summarized in Table 1. The bacterias which were isolated from the cultures are shown in Table 2.

Microscopic examinations showed severe oedema PNL infiltration and vascular congestion in all the tissues in the control group and slight oedema, PNL infiltration and vascular congestion in all the tissues in the study group. Ulceration in the intestines was severe in the control group and slight in the study group. Lymphoid follicular hyperplasia was mild in the control group and slight in the study group. Kuppfer cell proliferation was mild in the control group and absent in the study group. The histopathological findings are shown in Table 3.

Discussion

It is widely recognized that the gut is a reservoir of microorganisms that can induce sepsis. Over the last few years, many investigators have been studying the permeability of the GI tract following various disease processes, such as sepsis, trauma, malignant neoplasm and inflammatory bowel disease. Permeability refers to the facility with which the intestinal mucosal surface can be penetrated by the unmediated diffusion of specific constituents. A number of conditions promote bacterial translocation, including hemorrhagic shock, thermal injury, antibiotic therapy, cytotoxic drugs, intestinal obstruction and intravenous feeding (2-5,8,12-14,16,17).

Growth hormone stimulates intestinal mucosal epithelial growth and affects mucosal function (14). Deficiency of the hormone causes hypoplasia in intestinal mucosa. Growth hormone receptors in the mucosal cells of the intestine show that growth hormone has a direct effect on the intestine and it has been suggested that growth hormone has a role in gastrointestinal proliferation (14). Growth hormone, both directly and by increasing IGF-I levels, has a protective effect on intestinal mucosa and prevent mucosal atrophy. Thus, it decreases mucosal barrier insufficiency (18). In our study, mucosal atrophy, oedema in lamina propria and PNL infiltration were lower in the study group than in the control group (p<0.05).

Huang et al. (18) reported that mucosal permeabilty increase because of mucosal atrophy in burns and this causes bacterial translocation. It was determined that in burned rats treated with IGF-I, body weight and intestinal mucosal weight were higher than in the control group. Bacterial translocation rates were lower than in the control group (30% versus 89%). In our study, bacterial translocation was lower in the study group than in the control group (40% versus 100%) (p<0.05). Growth hormone has a positive effect on the immune system (19,20). It promotes migration of monocytes and chemotaxis and it increases secretion of the cytokines

Table 1. Bacterial translocation rates (%).

	Blood	Liver	Spleen	MLN
Group A	60	100	90	100
Group B	10*	20*	40*	40*

*p<0.05

Table 2. Translocated bacteria.

Bacterias	%
E.Coli	62
Clostridium	15
Anaerobic g(-)	11
S.aureus	4
Enterobacter	3
Others	5

Table 3.   Histopathological findings.

Groups	Organs	Eodema	Vascular congestion	PNL infiltration	Ulceration	Follicular hyperplasia	Kuppfer cell proliferation
Group A	Intestin	+++	+++	++++	+++		
	Spleen	+++	+++	+++			
	Liver	+++	++	+++			++
	MLN	+++	+++	++++		++	
Group B	Interstin	+	+	+	+		
	Spleen	+	+	+			
	Liver	+	+	-			-
	MLN	+	+	+		+	

(-) no pathological findings, (+) light, (++) mild, (+++) severe, (++++) deeply severe.

(20). Because of these effects, it decreases bacterial translocation from the intestines. In our study, bacterial translocation was lower in the study group than in the control group. In the study group, bacterial translocation was 10% in the blood cultures, 20% in the liver, 40% in both MLN and spleen, whereas in the control group these rates were 60%,100%, 90% and 100% respectively. The differences between the two groups were statistically significant (p<0.05).

We conclude that growth hormone decreases bacterial translocation because of its protective effects on intestinal mucosa.

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