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Does bacterial translocation influence the postoperative infections in splenectomized patients after abdominal trauma?

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ABSTRACT

Background: Some studies suggested that after abdominal trauma, postoperative infections are associated with bacterial translocation, whereas others have not replicated these findings. We have assessed the bacterial translocation and postoperative infections in patients undergoing splenectomy after abdominal trauma, using a very homogeneous study population.

Methods: We consecutively studied, in a prospective observational clinical study, 125 patients who required urgent surgical treatment (splenectomy) following blunt abdominal trauma. For bacterial translocation identification, tissue samples were taken from liver, spleen and mesenteric lymph nodes (MLNs). Postoperative infectious complications in these patients were registered, confirmed by a positive culture obtained from the septic focus. Associations between clinical variables, bacterial translocation presence, and postoperative infection development were established.

Results: Bacterial translocation was detected in 47 (37.6%) patients. Postoperative infections were present in 29 (23.2%) patients. A significant statistical difference was found between postoperative infections in patients with bacterial translocation evidence (22 of 47 patients: 46.8%) in comparison with patients without bacterial translocation (7 of 78 patients: 8.9%) ($P < 0.05$). After multivariate adjustment analysis: a) the bleeding $\geq$ 1500 mL was significantly associated with the risk of bacterial translocation and, b) bacterial translocation was significantly associated with the risk of postoperative infections. Bacterial strains isolated from infection sites were the same as those cultured in MLNs in 48.3% of the cases (n = 14 of 29).

Conclusions: There is higher risk of bacterial translocation in patients who required urgent surgical treatment (splenectomy) following blunt abdominal trauma and it is associated with a significant higher number of postoperative infections.

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The intestinal epithelium is in a constant state of renewal and is, therefore, formed by cells in distinct phases of differentiation. The integrity of the intestinal epithelium is of paramount importance in maintaining good health,[1] and any cell injury may affect cells' proliferation and differentiation resulting in structural and functional alterations of the bowel epithelium. The gut epithelium forms a barrier between bowel lumen and systemic circulation; pathological situations (such as shock, surgical stress or trauma) may alter the intestinal epithelium leading to bacterial and/or endotoxin translocation from the bowel lumen to the systemic circulation.[2] This has been involved in post-surgical complications, such as systemic inflammatory response syndrome (SIRS), sepsis and multiorgan failure (MOF).[3] Bacterial translocation is the migration of viable bacteria from gut lumen through the intact intestinal barrier to mesenteric lymph nodes (MLNs) and beyond; this process may lead to the post-surgical sepsis.[4]

A number of studies have investigated the relationship between abdominal trauma, bacterial translocation and postoperative infections,[5–8] although the data from these studies are discordant because some studies suggest that there is higher risk of bacterial translocation in trauma patients, associated with a significant increase of postoperative infections,[7,8] others have not replicated these findings.[5,6]

One of the principal reasons for such discordant results is maybe that prior studies have entered a heterogeneous population of patients and procedures, which may have precluded the discovery of small but important differences. To overcome this problem, we performed a prospective observational clinical study in a patient population with a single diagnosis (rupture of spleen after blunt abdominal trauma) and treated them using one surgical standard approach (splenectomy through a midline laparotomy). Hence, the aim of our study was to obtain satisfactory statistical information regarding the effects of bacterial translocation on postoperative infections in a relatively homogenous study population.

Patients and methods

From February 2011 to November 2015, we studied, in a prospective observational clinical study, 125 patients consecutively (71 men and 54 women; mean age, 41.3 years; range 16–78) who required urgent surgical treatment (splenectomy) following blunt abdominal trauma, at Department of Surgery, University Hospital of L'Aquila, Italy.

Clinical exclusion criteria were patients who had received antibiotic therapy 2 weeks before surgery, admission > 10 h after injury, penetrating injuries, hematologic, or immunologic diseases and death in the first 48 h after admission.

This study was approved by the Research Ethics Committee of the University of L'Aquila. Informed consent was obtained initially from a guardian or relative and as soon as appropriate from the patient. The patients were classified as grade I, II, or III according to the American Society of Anesthesiologists (ASA) grading system[9] (Table 1).

The risk of infection was assessed using the NNISS (National Nosocomial Infections Surveillance System) and the SENIC (Study of the Efficacy of Nosocomial Infection Control) scales.[10,11] The NNISS and SENIC scores have been extensively validated, and larger values in these scores indicate a greater risk of infection. In the SENIC scoring system,[11] 1 point is given for each of the following:

- presence of 3 or more diagnoses;
- surgery lasting longer than 2 h;
- operation classified as contaminated or dirt-infected;
- abdominal surgery.

In the NNISS scoring system,[10] 1 point is given for each of the following:

- ASA score of 3, 4, or 5;
- operation classified as contaminated or dirt-infected;
- operation lasting longer than expected for the operative procedure being performed.

Before surgery, prophylactic antibiotics were administered (cefotaxime: 2 g i.v.) followed postoperatively by further two doses.

Anesthesia was performed using the same procedure. Preanesthesia was accomplished using atropine (0.01 mg/kg) plus promethazine (0.5 mg/kg), induction using sodium thiopental (5 mg/kg) and atracurium (0.5 mg/kg), and tracheal intubation and assisted ventilation using nitrogen dioxide (NO_2)/oxygen (O_2) in the ratio 2:1. After intubation, anesthesia was maintained with oxygen in air, sevofluorane, and remifentanil (0.25 mg/kg/minute).

Tissue samples were taken from the liver of 56 patients, and from the spleen and mesenteric lymph nodes (terminal ileum) of all the patients. These samples were weighed under sterile conditions. The liver tissue was obtained performing a wedge biopsy on superior surface only in patients from ASA I (11 patients) and ASA II (45 patients) because the complications of liver biopsy (local and general) are frequent. Then, the collected samples were taken to the microbiology laboratory in a Cary-Blair transport medium. After homogenization, all tissue specimens were grown in brain–heart infusion broth (Oxoid, UK) in a quantitative manner with 1:10 serial dilutions. Both cultures of homogenates, which showed turbidity, were subcultured onto 5% blood agar and Eosin Methylene Blue agar (Oxoid, UK). They were then assessed following incubation under aerobic conditions at 37 °C for 24–72 h. The growth of bacteria was recorded as colony forming units (CFUs) per gram tissue. For bacterial identification, conventional microbiological methods were used, and when necessary, confirmation was obtained by means of a Crystal ID system (BBL, MD, USA) and the grouping latex of agglutination (Oxoid, UK).[12]

The patient's postoperative period was systematically monitored for the detection of infections, and recorded prospectively. Postoperative septic complication was defined as the presence of clinical, hematological, or radiological evidence of infection, where positive bacterial culture was obtained from a septic focus.[13] Cultures of peripheral blood, sputum, urine, and central lines were taken whenever clinically appropriate. All wound discharges and fluid collections identified on imaging were also cultured. The 30-day hospital postoperative infections rate was used and patients

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