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Research Article

Post Splenectomy Sepsis of Multi Trauma Patients in the ICU

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Abstract

Background/Aims

The aim of our study is to present the 15-year experience (2000-2014) gained in the ICU from hospitalization of patients with after multi trauma post splenectomy sepsis (PSS), the appropriate measures of prophylaxis in order to minimize the risk of life-threatening infection and the complications occurred after splenectomy.

Methodology

This study investigated 23 (21 Males – 2 Females) hemodynamically unstable patients with chronic diseases who were admitted to our ICU with after multi trauma PSS. When admitted to ICU, the Injury Severity Score (ISS) of all patients was > 29.0, while the Glasgow Coma Scale (GCS) was > 13 for 18 patients and <12 for the rest of them (5 pts).

Results

All 23 patients (100%) presented acute respiratory failure-refractory hypoxemia due to pneumonia. Thus, intermittent positive pressure with positive end expiratory pressure was started immediately. The mean duration of mechanical ventilation (MV) was 14 days and the average hospitalization time was 23 days. Ten out of twenty three pts (43.47%) died while in ICU. None of the 23 pts had previously received vaccination for *Streptococcus pneumoniae*.

Conclusions

The data from our study reveal that the risk of sepsis is greater in patients with chronic diseases. Young adults are more prone to develop PSS after multiple trauma. The main causative organisms in our pts were *Pseudomonas aeruginosa*, *Acinetobacter baumannii* and *Streptococcus pneumoniae*. Mortality rate is high in pts with sepsis after multiple trauma splenectomy (43,47%), with highest rates among patients with thalassaemia major (4 pts) and sickle-cell anaemia (3 pts). Early and aggressive administration of broad spectrum antibiotics intravenously is critical in the case of patients with after multiple trauma PSS, even though it does not completely eliminate the risk of mortality.

Keywords: Post-Splenectomy; Trauma; Splenectomy Complications; Postsplenectomy Pneumococcal Vaccine; Prevention and Management

Abbreviations

Mechanical Ventilation = MV;

Intensive Care Unit = ICU;

Post-Splenectomy Sepsis = PSS.

Introduction

The spleen not only clears bacteria from the circulation but also processes this foreign material to stimulate the production of opsonizing antibody. This function is particularly important in the clearance of encapsulated organisms [1]. However, when very severe, splenic trauma can be difficult to manage because it carries a high mortality rate. During the past 20 years the splenic injury has undergone a major revision in its approach. The nature of the definitive management of the splenic injury should be guided by an overall assessment of the patients' condition, which includes an evaluation of the hemodynamic instability and the presence of dilutional or consumptive coagulopathy. When a patient with splenic trauma comes under the care of the ICU team, the primary scope is to keep him stable and to avoid complications (infection, hemorrhage and circulation shock).

The clinical consequences of overwhelming postsplenectomy infection have been well documented. The syndrome usually presents with fever, brief upper respiratory tract infection, and within hours, progresses to shock, disseminated intravascular coagulation, and multiple organ failure. Postsplenectomy infection can occur in the immediate postoperative period or in a delayed manner, more than 25 years after splenectomy [2, 3].

The aim of our study is to present the 15-year experience gained in the ICU from hospitalization of patients with after multi trauma PSS, the appropriate measures of prophylaxis in order to minimize the risk of life-threatening infection and the complications occurred after splenectomy.

Methodology

In this study we present the experience in our ICU of hospitalized patients (pts) with multiple trauma who had undergone open splenectomy (Table 1). At admission, all patients had undergone thorax (AIS 3-4) and abdomen injuries (AIS 4-5) while 5 had head (AIS 2) and extremity injuries (AIS 2). We described the main reason of admission to ICU, duration of mechanical ventilation, average hospitalization time, type of infection, main causative microorganisms and mortality rate. Even though laparoscopy is a safe, feasible, and effective procedure for evaluation and treatment of hemodynamically stable patients with splenic injuries for whom nonoperative treatment is controversial,

in our case, the high rates of ISS (>29), GCS rates (> 13 for 18 and <12 for 5 pts) as well as hemodynamically instability led to the appliance of open splenectomy procedure [4].

Number of pts admitted in ICU	23 (21Males-2Females)
ISS at admission in ICU	> 29
GCS at admission in ICU	> 13
Number of pts with head injuries	5
Number of pts with thorax injuries	23
Number of pts with abdomen injuries	23
Number of pts with extremity injuries	5
AIS head	2
AIS thorax	3-4
AIS abdomen	4-5
AIS extremity	2

Table 1. General data analyses of studied splenic injured patients with open splenectomy.

During a period of 15 years (2000-2014), 23 pts with chronic diseases (21 Males-2 Females) were admitted to our ICU with postsplenectomy sepsis after having undergone open splenectomy. At admission, the ICU team applied the appropriate management: rapid diagnosis, fluid resuscitation and early surgical consultation [5]. All patients were carefully observed, blood pressure was monitored continuously using an intra-arterial catheter, hematocrit was measured every 6 hours and abdominal examination was repeated serially [6].

Results

The average age of our patients was 37 years (age-range 18-78 years). The main reason of sepsis for the 23 pts (100%) of our study was pneumonia. Considering the average age of our pts (37±4 years), we found that young adults are more prone to develop PSS after trauma. None of our pts had previously received vaccination against *Streptococcus pneumoniae*. All patients presented severe respiratory failure-refractory hypoxemia and they were intubated and intermittent positive pressure with positive end expiratory pressure was started immediately. The main causative organisms identified in cultures of samples obtained through bronchoalveolar lavage - BAL (thresholds of 10,000 cfu/ml) from our pts were: *Pseudomonas aeruginosa* (26%), *Acinetobacter baumannii* (17.4%), and *Streptococcus pneumoniae* (17.4%) (Table 2). There was no positive blood culture at the time of admission.

The mean duration of mechanical ventilation was 14 days and the average hospitalization time was 23 days. The mortality rate was 43.47% while the highest rates were observed among patients with thalassaemia (4 pts) and major sickle-cell anaemia (3 pts) (Table 3). Of the 10 patients

who died, 8 were below the average age and only 2 above it. All five patients who were admitted with GCS <12 survived (Table 4).

Table 2. Causative organisms of infection.

Type of infection: Pneumonia 23pts (100%)
Causative organisms-number of pts:
1. <i>Pseudomonas aeruginosa</i> 6 (26%)
2. <i>Acinetobacter baumannii</i> 4 (17.4%)
3. <i>Str pneumoniae</i> 4 (17.4%)
4. <i>Klebsiella pneumoniae</i> 3 (13%)
5. Unidentified 2 (8.7%)
6. <i>Serratia marcescens</i> 2 (8.7%)
7. <i>Haemophilus influenzae</i> 1 (4.4%)
8. <i>Enterobacter spp</i> 1 (4.4%)

Table 3. Mortality rate of patients with post-splenectomy sepsis (PSS) in ICU by chronic disease.

Total number of deaths	10 (100%)
Mortality rate of pts with thalassaemia major	40% (4 pts)
Mortality rate of pts with sickle-cell anaemia	30% (3 pts)
Mortality rate of pts with chronic lymphocytic leukemia	10% (1 pt)
Mortality rate of pts with Crohn's disease	10% (1 pt)
Mortality rate of pts with Diabetes insipidus	10% (1 pt)
Mortality rate of pts with Hypertension	0

Table 4. Presentation of patients with post-splenectomy sepsis (PSS) in ICU.

Number of pts with post-splenectomy Sepsis in ICU	23 (21Males-2Females)
Average age	37±4 years
Age-Range	18-78 years
Severe respiratory failure	23 (100%)
Mechanical Ventilation (MV)	23 (100%)
Mean duration of MV	14 days
Average Hospitalization	23 days
Mortality	10 (43.47%)
Mortality of patients with GCS <12	0
Vaccination	0

Discussion

The role of the spleen for clearance of bacteria and humoral immune response is particularly important because the

spleen serves as the largest lymphoid organ within the body and contains nearly half of the body's total immunoglobulin-producing B lymphocytes. Asplenic patients and those with impaired splenic function are at risk for a fulminant sepsis syndrome usually due to *Streptococcus pneumoniae* [7, 8].

Even though the management of splenic injury has undergone continued re-evaluation, splenic salvage is usually attempted only if the patients are stable and do not have a shattered spleen. In this sense, only approximately 50% of splenic injuries can be salvaged. For patients who had undergone splenectomy, post-operative complications include atelectasis, pneumonia, pleural effusion, pancreatitis, wound infections, thrombocytosis and intra-abdominal abscesses while the incidence of postsplenectomy sepsis after trauma is 1.45% (9). Our study confirms that the risk of sepsis is greater in patients with chronic diseases, but has no relationship with age, the type of injury, delay in operation, use of drains, or other individual injuries [10,11].

Pts presented in our department with signs and symptoms of an upper respiratory tract infection. Within hours they developed acute respiratory failure-refractory hypoxemia and intermittent positive pressure with positive end expiratory pressure was started immediately. The clinical consequences of PSS have been well documented. Although less than 1% of the population is affected, infection induces shock with rapid progression to death in at least 50% of cases. PSS can occur in the immediate postoperative period or in a delayed manner, more than 25 years after splenectomy [12,13,14].

Mortality rate for pts with sepsis after trauma splenectomy was high (43.47 %) and it was proportional to the number of associated injuries, patients' age and the presence of shock admission.

The identified type of infection in the 100% of our pts was pneumonia since no vaccination against *Streptococcus pneumoniae* was noted in our pts with splenectomy sepsis.

Currently, the standard of care for post-splenectomy pts includes immunization with polyvalent pneumococcal vaccine, *H. influenza* type b conjugate, and meningococcal polysaccharide vaccine within 2 weeks of splenectomy. Despite this established standard, the literature reflects a diverse 11% to 75% postsplenectomy immunization rate. A relatively recent report of 77 cases of PSS documented that only 31% of individuals had received pneumococcal vaccination before PSS. In patients who had undergone surgical splenectomy, the time interval between surgery and PSS varied from 24 days to 65 years. Thus, second PPSV23 vaccination is recommended 5 years after the first dose for persons aged 19-64 years with functional or anatomic asplenia [15]. It is essential to collect samples for culture, but the beginning of treatment should not be delayed. Therefore, the choice of the drug should be empirical. The initial antibiotics are those that have good activity against *S. pneumoniae*, *H. influenzae* and *N. meningitidis*, the most common agents of fatal form of the disease. Despite some disagreement in the literature, we recommend – as

most authors do – choosing vancomycin 1g 12 / 12h and Ceftriaxone 2g IV daily. Penicillin, Ampicillin, Cefotaxime, Chloramphenicol, Imipenem and meropenem should also be alternatives to scheme while fourth generation cephalosporins should be reserved for cases of resistant pneumococci [16-18].

Conclusions

Our experience shows that, in case of sepsis, intensive support consisting in blood and blood products transfusion is critical. Vasoconstrictor drugs may be necessary; however, the most important therapy is early and aggressive administration of broad spectrum antibiotics intravenously.

Our study has several limitations. The number of pts included is small for reliable conclusions considering PSS in ICU. We do not describe concurrent injuries in trauma pts or trauma scores, to explain the high mortality rate in this group while prior hospitalization time is not mentioned.

However, data from our study reveal that severe respiratory failure was the main reason of admission in ICU (100% of pts). While the risk of sepsis is greater in patients with chronic diseases, young adults are more prone to develop PSS after multiple trauma. No vaccination against *Streptococcus pneumoniae* was noted in our pts while the main causative organisms in our pts were *Pseudomonas aeruginosa*, *Acinetobacter baumannii* and *Streptococcus pneumoniae*. Mortality rate is high in pts with sepsis after multiple trauma splenectomy with highest rates among patients with thalassaemia major and sickle-cell anaemia. Thus, prophylactic measures should be applied for patients who had undergone splenectomy (early vaccination). Early and aggressive administration of broad spectrum antibiotics intravenously is critical in the case of patients with after multiple trauma PSS even though it does not completely eliminate the risk of mortality.

Competing Interest

The authors declare that they have no competing interests.

Authors' Contribution

All authors had substantial contributions to conception and design, acquisition of data, analysis and interpretation of data, drafting the article. All authors approved the final version to be published.

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