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Peritonitis Source Control

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ABSTRACT

Intra-abdominal infection remains a serious problem worldwide. Hospital mortality associated with intra-abdominal abscesses varies between conditions and diseases, and can be as high as 23%-38%. Severe intra-abdominal infections are the second most common cause of sepsis in critically ill patients. Achieving rapid and adequate control of the source of infection is a cornerstone in the management of this process. Source control is the general term for all procedures used to control or eliminate the focus of intra-abdominal infection. Marshall describes this process as "drainage of abscesses or infected fluid, removal of necrotic infected tissue, and definitive measures to control the source of ongoing microbial contamination and restore anatomy and normal function. In the context of intra-abdominal infections, eradication of the source is often identified as a purely mechanical control of leakage of contents from the gastrointestinal tract. Operative intervention remains the best therapeutic strategy to control intra-abdominal infection. Source control can be achieved by surgical intervention (laparotomy or laparoscopy) or nonoperatively (percutaneous drainage).

Peritonitis Source control

Intra-abdominal infection remains a serious problem worldwide. Hospital mortality associated with intra-abdominal abscesses varies between conditions and diseases, and can be as high as 23%-38%. Severe intra-abdominal infections are the second most common cause of sepsis in critically ill patients. Achieving rapid and adequate control of the source of infection is a cornerstone in the management of this process [1,2]. The term "source control" originated in the environmental literature and referred to efforts to reduce the amount of waste from a particular source. More specifically, it referred to actions that prevented pollution through an effect on its origin. Similarly, source control in the medical context refers to any intervention aimed at the primary origin of an infectious process. This term was first used in medicine in the early twentieth century. Source control is a term that encompasses all physical actions taken in the course of treatment to control the focus of infection and subsequently reduce the favorable conditions that promote the growth of microorganisms, or that maintain the compromised host defenses [3,4].

Source control is the general term for all procedures used to control or eliminate the focus of intra-abdominal infection. Marshall describes this process as "drainage of abscesses or infected fluid, removal of necrotic infected tissue, and definitive measures to control the source of ongoing microbial contamination and restore anatomy and normal function."/John E. Mazuski et. Al, 2018/. Successful management of intra-abdominal infection relies on the use of appropriate operative measures to address peritonitis. Prospective clinical trials have also taught us the importance of the concept of "source control". Source control encompasses all measures that remove the focus of infection, prevent ongoing contamination, and correct anatomic abnormalities to restore normal physiologic function.

This typically includes: /Mark A Malangoni et al, 2006/

1. Drainage of abscesses or infected fluids;
2. Decompression of necrotic or infected tissues;
3. Definitive measures to control the source of contamination and to restore anatomy and function.

Each individual aspect of this definition is important, but elimination of the source and control of ongoing contamination should receive primary attention as they determine early and long-term treatment success. Restoration of anatomy and full function can be accomplished at a later stage because prolonging surgical intervention may further impair the patient's condition at the first operation,

which is often the case for critically ill patients [5,6]. Mortality from intraperitoneal infection in the early twentieth century was nearly 90%.

At that time, this problem was dealt with primarily nonoperatively until Kishner introduced the basic principles of surgery for intra-abdominal infections into clinical practice:

1. Elimination of septic foci;
2. Removal of necrotic tissue;
3. Drainage of purulent exudate

By the 1930s the mortality rate had been reduced to 50%. With the introduction of antibiotics, mortality continued to decline slowly. The use of cephalosporins in the early 1970s was associated with a reduction in mortality to less than 40%. Subsequent advances in the understanding of physiology, monitoring and correction of cardiopulmonary abnormalities, rational use of new drugs, and intensive care unit care helped stabilize mortality to about 30% [7,8]. Surgical source control is the most important determinant of survival and should be placed at the top of the therapeutic priority list. There is no controversy regarding standard treatment, which includes source control and intra-abdominal lavage; however, in patients with advanced peritonitis, the source of infection may not be completely eradicated with a single surgical intervention. Thus, controversy arises, especially on issues such as timing and frequency of repeat laparotomies and treatment of the open wound/abdomen. Furthermore, the aggressive approach in these patients causes bowel and abdominal wall edema, which may be associated with increased intra-abdominal pressure exacerbated by premature closure of the abdominal wall. To date, it is clear that the reduction in mortality below 20% has been the result of a better understanding of the role of the source of infection, prevention of intra-abdominal compartment syndrome and improved antibiotics with newer broad-spectrum effects (Table 1). Despite these advances, control of the source of infection remains one of the most fundamental indicators determining patient survival [5,9].

In the context of intra-abdominal infections, eradication of the source is often identified as a purely mechanical control of leakage of contents from the gastrointestinal tract. Surgeons often claim that source control is part of the surgical intervention, but rather the opposite is true: surgical intervention is part of the source control approach in a patient with intra-abdominal infection. The goal of surgical treatment is to eradicate the source of infection - to remove the cause of the contamination. In the surgical approach, it is necessary to ensure adequate and complete examination of the abdominal cavity - thorough hemostasis and thorough examination are paramount. The other major goal in surgical management is to reduce the amount of bacterial load to prevent sepsis and recurrent re-accumulation of purulent material [10]. The decision to repeat laparotomy is made at the time of the initial operation. The patient may undergo repeat laparotomy every 48 hours until the septic focus is completely controlled, i.e. the source of infection completely eradicated.

Failure to obtain adequate source control during operation is due to:

- Inadequate or poor drainage
- Diffuse fecal peritonitis
- Hemodynamic instability
- Insufficiency of the anastomosis
- Intra-abdominal hypertension

Prompt identification and eradication of the source of infection is vital because delay leads to loss of physiological reserve, which together with comorbid systemic disease, particularly in the elderly, results in significantly worse outcomes. The pathophysiology of generalized peritonitis involves complex processes in each organ system, which deplete physiologic reserves and these inhibit the ability to localize, combat, and eradicate infection.

Source Control Principles

Principle 1 - Drainage

Drainage is the evacuation of the contents of an abscess or abdominal fluid collection. The effectiveness of the drainage used is very important. It must be adequately sized to allow complete evacuation of the exudate. If this is not fully accomplished, source control will fail. Drainage can be performed surgically or percutaneously, under ultrasound or CT scan control [11]. The latter are preferred in situations where adequate drainage is possible and no anatomic structures are removed or restored. Especially in critically ill patients in whom surgical intervention may be difficult, this approach may be a valuable alternative and postpone definitive action until a later stage. Surgical drainage is indicated when percutaneous drainage cannot be performed or is not sufficient to control the source, (e.g. multiple abscesses).

Principle 2 - Debridement

Debridement is the removal of necrotic tissue and foreign bodies from the patient. This can only be achieved surgically. The extent to which this should be done remains a controversial topic and is highly dependent on the underlying condition. A minimalist approach consisting of removal of dead tissue and pus, or an aggressive approach with a large volume peritoneal lavage and meticulous removal of all fibrin adherent to the bowel or abdominal wall. The latter carries a higher risk for iatrogenic bowel injury and is also associated with a higher rate of postoperative abscesses [12]. The anatomical relationships of the necrosis also play an important role. In the case of necrosis in pancreatitis, complete removal of all necrotic tissue may result in injury to organs or blood vessels.

Principle 3 - Restoration of Anatomy and Function

Restoration of anatomy and function is the final step in the treatment of surgical infections. In most patients it can be done with the first operation, but in some patients it should be delayed until the patient's condition permits. Judgment is individual, but it is generally recommended not to prolong surgical intervention unnecessarily in patients who are in shock or have severe organ dysfunction.

Source Control Time

The best possible source control solution is complete control of the source of infection with the least delay. However, the evidence regarding the optimal time to perform procedures remains weak, probably because of ethical constraints on clinical trials. Joint guidance issued by the Department of Health and the Royal College of Surgeons of England states that source control interventions should be performed as soon as possible, targeting a delay no longer than 7-22 h from diagnosis, without systemic inflammation. In severe intra-abdominal infection intervention should be carried out immediately. According to guidelines issued by the Surgical Infection Society (SIS), source control should be conducted within 24 h of diagnosis [13].

Adequacy of Control

Failure of source control is a controversial topic in the multidisciplinary management of peritonitis that does not include clear definitions of diagnosis, surveillance index, or interventions. Various studies recommend using biomarkers of systemic inflammation or organ system dysfunction to recognize patients with likely failed source control. But very often inflammatory markers such as C-reactive protein, leukocyte count and procalcitonin seem to be unpredictable in quite a few cases. Another indicator is the persistence of organ failure after the initial intervention, which correlates strongly with the ultimate failure of source control [14]. Antimicrobial therapy is also constantly evolving. But the appropriate duration of antimicrobial therapy after adequate source control remains unclear. Patients may be treated with antibiotics until resolution of fever and leukocytosis, resulting in therapy of 7 - 14 days. New studies suggest that with adequate source control, a fixed duration of 4 days of antibiotic treatment is sufficient. It has been confirmed that the beneficial effects of systemic antimicrobial therapy are limited primarily in the first few days after surgical intervention. Shorter duration of antibiotic exposure may reduce the risk of bacterial resistance to antibiotics, which is particularly important in this era of spreading antimicrobial resistance.

Source Control Procedures

Operative intervention remains the best therapeutic strategy to control intra-abdominal infection. Source control can be achieved by surgical intervention (laparotomy or laparoscopy) or nonoperatively (percutaneous drainage). Surgical source control includes resection or suture of an altered or perforated viscus (e.g., diverticular perforation, gastroduodenal perforation), removal of the infected organ (e.g., appendix, gallbladder), debridement of necrotic tissue, resection of ischemic bowel, and repair/resection of traumatic perforations with primary anastomosis or bowel exteriorization. Rarely, in rigorously selected patients, an effect can be achieved without definitive source control if the patient responds satisfactorily to antimicrobial therapy [15].

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