Overview of surgical procedures for patient with abdominal sepsis

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Abstract:

This review will focus on the treatment of abdominal sepsis with a specific emphasis on surgical treatment. Especially new evidence published in the last few years will be discussed. Medline, and Embase, databases were searched for relevant studies discussing the abdominal sepsis through, October, 2017. Search restriction was applied to only English language published studies with human subjects. Management of abdominal sepsis needs a multidisciplinary approach. The greatest benefits of surgery originated from treatments which are performed in response to a certain treatable abnormality, irrespective of whether organ failure is present or not. Surgeons and intensivists should strive, by non-invasive or minimally invasive ways, to determine infective emphases so that they can be managed early at the stage of the systemic inflammatory response, before the advancement of organ disorder. The concern which surgical technique is suitable for the management of high danger patients with intra-abdominal infection, can only be answered by additional prospective randomized trials. Closing the abdomen after source control and just reopening it in case of deterioration of the patient without various other (percutaneous) options is the favored technique in abdominal sepsis. If closing the abdomen is not possible due to extreme visceral edema or reopening the abdomen is required in case of a real ACS, negative pressure therapy with continual mesh-mediated fascial traction shows the best outcomes.

Introduction:

Abdominal sepsis, or secondary peritonitis, is a challenge dealt with by many surgeons around the world every day. Peritonitis is specified as an inflammation of the serosal membrane that lines the abdominal cavity and the organs contained therein. The peritoneum, which is an otherwise sterile environment, responds to various pathologic stimuli with a relatively uniform inflammatory response. Depending on the underlying pathology, the resultant peritonitis may be infectious or sterile (ie, chemical or mechanical). Intra-abdominal sepsis is an inflammation of the peritoneum triggered by pathogenic microorganisms and their products [1]. The inflammatory procedure might be local (abscess) or diffuse in nature. Peritonitis is frequently caused by intro of an infection right into the otherwise sterile peritoneal environment through organ perforation, yet it might likewise arise from various other irritants, such as foreign bodies, bile from a perforated gall bladder or a lacerated liver, or gastric acid from a perforated ulcer. Women also experience localized peritonitis from an infected fallopian tube or a ruptured ovarian cyst [2].Patients may provide with an acute or dangerous onset of signs, restricted and mild disease, or systemic and serious illness with septic shock

Peritoneal infections are classified as primary (ie, from hematogenous dissemination, usually in the setup of an immunocompromised state), additional (ie, pertaining to a pathologic procedure in a visceral body organ, such as perforation or trauma, including iatrogenic trauma), or tertiary (ie, persistent or recurrent infection after adequate initial treatment). Primary peritonitis is frequently spontaneous bacterial peritonitis (SBP) seen mostly in patients with chronic liver illness. Additional peritonitis is without a doubt the most common form of peritonitis experienced in

medical practice [3]. Tertiary peritonitis often develops in the absence of the original visceral body organ pathology. Infections of the abdominal muscle are additional separated into generalized (peritonitis) and localized (intra-abdominal abscess). Multiple underlying illness triggering abdominal sepsis can be determined and treatment relies on the kind and severity. Immediate medical diagnosis and appropriate treatment are of utmost importance to enhance patients' outcome.

This review will focus on the treatment of abdominal sepsis with a specific emphasis on surgical treatment. Especially new evidence published in the last few years will be discussed.

Methodology:

Medline, and Embase, databases were searched for relevant studies discussing the abdominal sepsis through, October, 2017. Search restriction was applied to only English language published studies with human subjects. Our search strategy used following keywords via databases; “abdominal sepsis”, “Surgical treatment”, “management”. Further we scanned the references of included studies for more concerned articles.

Discussion:

- **Abdominal sepsis**

An intra-abdominal infection (IAI) is, after a pulmonary focus, considered as the 2nd most typical reason for sepsis [4].An uncomplicated IAI seldom triggers crucial illness with failing of other organs. Alternatively, a complicated IAI (cIAI) that is triggered by a disturbance of the

gastrointestinal tract or other hollow viscus, causes either localized or diffuse inflammation of the peritoneum and subsequent sepsis. This situation is also referred to as abdominal sepsis or additional peritonitis. Abdominal sepsis can be caused by a spontaneous perforation, for example, gastric abscess perforation, complicated diverticulitis (area obtained) or as a complication of elective abdominal surgery (healthcare connected). This distinction is crucial with respect to underlying pathogens and related antibiotic therapy selection. As a result of a range of descriptions and patient features death rates reported range 7.6 and 36% [5], [6].Lately, Sartelli et al. have conducted 2 large studies covering a wide geographical location and reported an overall mortality rate of abdominal sepsis of 7.6% in Europe [5] and 10.5% globally [7].In 2016, a worldwide group of professionals has upgraded the definitions for sepsis and septic shock initially created in 1991 [8] and very first upgraded in 2001 [9].Sepsis is specified as life-threatening body organ disorder caused by a dysregulated host action to infection. Organ disorder itself can be determined as an acute modification in overall consecutive [Sepsis-related] Organ Failure Assessment (SOFA) rating of two or more factors [10].A part of sepsis, in which circulatory, cellular, and metabolic irregularities result in suboptimal tissue oxygenation and perfusion is defined as septic shock and associated with a greater risk of mortality.According to the Surviving Sepsis standards [11] resuscitation in the initial 6 h, to preserve tissue perfusion, is of utmost value to avoid multi-organ failing and to improve outcome.

- **Surgical strategies**

The key task in the surgical management of patients with abdominal sepsis is resource control. Resection of the affected organ and/or restoration of the gastrointestinal tract are the important action in removing abdominal sepsis. Various surgical techniques have been used for many years, depending upon surgeon and setting. Typically, 3 various surgical approaches in the direction of

abdominal sepsis can be differentiated; a planned relaparotomy (PR), a (planned) open abdomen (OA), and a relaparotomy on demand (ROD). Definitions are presented in Table 1.

In the prepared method, the cosmetic surgeon reassesses the abdominal cavity, generally every 36-- 48 h, till peritonitis is absent. In the case of an OA the fascia is purposefully not approximated or not feasible to approximate. The previous two strategies remain in contrast with a ROD, where the abdomen is closed primary and the patient is reoperated only in case of deterioration or absence of improvement with presumably an abdominal emphasis.

As much as 2007, a PR was a commonly performed strategy. This altered when the RELAP trial was released [12].In this research, 232 patients with serious peritonitis were randomized between a Public Relations and a ROD. The primary endpoint was fatality and/or peritonitis relevant morbidity within a 12-month followup period. An overall of 42% of the ROD patients underwent a relaparotomy compared to 94% of the PR patients. No considerable distinction in composite primary endpoint was discovered (57% ROD vs. 65% planned, P 1/4 0.25). Nevertheless, a substantial decrease in relaparotomies, health care use, medical costs, and ICU and health center stay were found [12].In the same year, Robledo et al. [13] released a RCT including 40 patients with serious peritonitis and randomized between OA and ROD. This research study was quit halfway because of a twofold enhanced risk of fatality in the OA team (relative risk and odds ratio for fatality were, respectively, 1.83 and 2.85 times greater).

However, the beneficial results of an ondemand strategy are not typically identified and some surgeons still do planned relaparotomies. One feasible description is that the surgeon may not be certain concerning source control and consequently defers conclusive closure of the abdomen. For this scenario the phrase 'a PR is for the surgeon not for the patient', is specifically applicable. In our opinion, this strategy needs to be strongly discouraged taking into consideration the risks

of unselected resuming the abdomen while two thirds subsequently show unfavorable searchings for. More explicit, ROD is definitely the favored strategy if one weighs the reduced threat of (short-term) complications against the danger of long-term complications (as seen for PR). An additional explanation for the persistent use of unselected relaparotomies is the troubleshooting surgery (DCS) approach, taken on from trauma care, likewise in patients with abdominal sepsis [14].DCS refers to presented laparotomies to manage trauma patients who are physiologically decompensated. In the first laparotomy, just necessary and limited treatments are performed (i.e., stapling of the damaged bowel or intra-abdominal packaging for bleeding) and reconstructive surgery is done when a patient is hemodynamically steady once more. Adapted from trauma surgery, DCS in abdominal sepsis is often described as rapid source control laparotomy (RSCL). To decide for DCS in injury patients the lethal triad parameters (hypothermia, acidosis, and coagulopathy) are used [15].A recently published retrospective research of Becher et al. [16] evaluated whether this lethal triad is also applicable for nontrauma patients. No survival benefit was discovered in this research. Nevertheless, in patients with elevated lactate, pH 7.25, age 70 years, and male sex performing a RSCL might lower mortality in patients with preoperative serious sepsis or septic shock. Potential validation of these specifications is still needed. A three group propensity score matched case accomplice research study [17] compared DCS in intraperitoneal blood poisoning (RSCL) to DCS in penetrating trauma and blunt trauma. Propensity racking up was done utilizing demographic and presenting physiologic information. They found that in patients with RSCL the rate of primary fascial closure was cheapest and time to clear-cut closure was raised [relative danger (RR): 1.8; 1.3- 2.2; $P < 0.03$] Intra-abdominal complication and death rates were higher for RSCL. These outcomes strongly sustain the principle that abdominal injury and abdominal sepsis require a different method. There is no convincing evidence that DCS or RSCL is beneficial in patients with abdominal sepsis. As a

result, they recommend, immediately, a timely solution to shut the abdomen and no 'hit and run' surgical treatment. If worry for anastomotic leakage in a hemodynamically unpredictable patient exists, opting for a deviating enterostomy or no anastomosis can be considered [18].

Predicting which patients require a ROD stays challenging. A study investigating various racking up systems on the RELAP information did not find any one of the widely used scoring systems of medical value in choice making [19].A new forecast version was established [20] and lately verified in 69 patients and 161 evaluations [21].This version revealed fair accuracy (AUC or ROC: 0.79). In scientific technique, a reduced rating revealed a great unfavorable predictive value for ongoing sepsis.

Table 1. Definitions

PR	Planned relaparotomy	Reevaluation of the abdominal cavity every 36–48 h, until peritonitis is absent
ROD	Relaparotomy on demand	The abdomen is permanently closed and the patient is re-operated only in case of deterioration
OA	Open abdomen	The fascia is intentionally not approximated or not possible to approximate
DCS	Damage control surgery	Staged laparotomy for patients who are physiologically decompensated. In the first procedure only life-saving procedures are performed and reconstructive surgery is delayed
RSCL	Rapid source control laparotomy	Damage control surgery for abdominal sepsis
TAC	Temporary abdominal closure	A temporary closure of the abdomen to avoid damage to the abdominal content and prevent retraction of the fascia
PL	Peritoneal lavage	Lavage of the abdominal cavity without resection of the infected organ

- **Decision making process for leaving the abdomen open in patients with abdominal sepsis**

Results of patients with severe sepsis/septic shock because of abdominal resource belong to very early aggressive hemodynamic support, punctual surgical source control and early and adequate antimicrobial therapy.

Sepsis resource control is based on three concepts: drainage and lavage of the infected fluid or various other collections, debridement of infected/necrotic tissue and conclusive or temporary procedures to fix structural derangements (as an example closure of perforated viscus) and to restore optimal function [22].In critically sick patients with extreme sepsis these concepts can be applied at various times in the same patient.

Choosing whether to complete the initial operation or perform an abbreviated surgery in critically sick patients is an essential and complicated choice. The OA concept is closely connected to damage control surgical treatment, and might be quickly adapted to patients with advanced sepsis and could integrate the principles of the Surviving Sepsis Campaign [23].In these patients an OA method may be needed for different factors including: managing any consistent resource of infection, preventing abdominal compartment disorder and deferring definitive treatment and anastomosis.

- **Damage control surgery in patients with severe sepsis**

The origins of damage control surgery was originally developed in the 1980s by Stone at the Grady General Hospital (Atlanta, GA, USA) [24], and specificed by Burch at the Ben Taub General Hospital (Houston, TX, USA) in the early 1990s [25].The shortened laparotomy for trauma patients was defined as the preliminary control of surgical bleeding by easy surgical techniques such as packing and so on permanently saving techniques. The patient was required to ICU where succeeding resuscitation corrected hypothermia, acidosis, and coagulopathy. As soon

as the patient had regained their physiologic reserve, definitive re-exploration and reconstructive surgery was done with or without last abdominal closure. This sort of management can be successfully obtained serious abdominal sepsis including OA method.

Patients may proceed to serious sepsis and septic shock having dynamic body organ dysfunction, hypotension, myocardial anxiety and afterwards coagulopathy. These patients are hemodynamically unstable and plainly not optimum candidates for instant complex surgical interventions [26].After preliminary surgery, the patient is swiftly taken to the ICU for physiologic optimization. Early treatment with aggressive hemodynamic assistance can restrict the damages of sepsis-induced tissue hypoxia and might restrict the more than stimulation of endothelial activity [23].Following the very early hemodynamic assistance, in principle after 24-48 h, reoperation might be performed with or without last abdominal closure.

- **Relaparotomy and 'relook'**

OA facilitates repeated abdominal expedition in the patients with peritonitis and severe sepsis/septic shock. Reoperations, in handling patients with extreme sepsis/septic shock due to extreme peritonitis, prevail and might work in undermining the inflammatory reaction of patients with ongoing infections.

In some patients, peritoneal infection might quickly lead to an extreme inflammatory reaction, triggering organ failure. In these patients, a very early reintervention with surgical lavage of the peritoneal cavity and evacuation of harmful material and inflammatory cytokines could be vital for stopping the septic cascade. This enables much better control of the neighborhood inflammatory reaction and enhanced end results.

Numerous research studies have assessed clinical variables that may be associated with the need for relaparotomy in the instant post-operative duration [27].In a retrospective study of 219 successive patients that went through emergency laparotomy for secondary peritonitis, van Ruler et al. [27] showed that both the origin of secondary peritonitis and searchings for at emergency situation laparotomy were poor signs for a very early relaparotomy. Indications of progressive or consistent organ failure throughout very early postoperative duration were the very best signs for continuous infection.

In a retrospective study involving 523 successive patients with secondary peritonitis, Koperna et al. [28] evaluated results of 105 patients in whom standard surgical treatment of secondary peritonitis failed and who had to go through relaparotomy for continuing abdominal sepsis (study group). While there were no differences in mortality between "planned relaparotomy" and "relaparotomy on demand", re-exploration carried out more than 48 h after the initial procedure caused a substantially greater mortality rate (76.5 % versus 28 %; p=0.0001). The most affordable mortality rate (9 %) was accomplished in patients who underwent reoperation within 48 h. The outcomes of this study showed that prompt relaparotomy should be done early and within 48 h.

The decision to perform a re-operation on a patient in the on-demand setup is complex and typically it is based upon the patient generalized septic action and on the lack of clinical enhancement throughout very early postoperative period [27].The on-demand technique implies a vigilant observation of the patient and consists of reoperation when patients reveal scientific degeneration or do not improve [29].However, these problems are not well defined [30] and often relaparotomy might be carried out too late. In patients with severe sepsis and septic shock, OA allows easy second-look to manage the resource of infection and evacuate inflamed and toxic

content, decreasing the tons of peritoneal cytokines and various other inflammatory compounds and avoiding their production by removing the source itself.

Conclusion:

Management of abdominal sepsis needs a multidisciplinary approach. The greatest benefits of surgery originated from treatments which are performed in response to a certain treatable abnormality, irrespective of whether organ failure is present or not. Surgeons and intensivists should strive, by non-invasive or minimally invasive ways, to determine infective emphases so that they can be managed early at the stage of the systemic inflammatory response, before the advancement of organ disorder. The concern which surgical technique is suitable for the management of high danger patients with intra-abdominal infection, can only be answered by additional prospective randomized trials. Closing the abdomen after source control and just reopening it in case of deterioration of the patient without various other (percutaneous) options is the favored technique in abdominal sepsis. There is no persuading evidence that damage control surgical treatment is beneficial in patients with abdominal sepsis, however this method interferes with the principle of closing the abdomen whenever feasible. If closing the abdomen is not possible due to extreme visceral edema or reopening the abdomen is required in case of a real ACS, negative pressure therapy with continual mesh-mediated fascial traction shows the best outcomes.

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