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Review Article

Presentation and Management of Acute Peritonitis

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Abstract

Introduction: Peritonitis is an inflammatory process of the peritoneum, which is primarily caused by infection with a very high mortality of 90%. Its presentation varies based on severity and location of irritant. The primary management strategy used is surgery to remove intra-abdominal infections and necrotic tissue. Prompt and aggressive treatment reduces mortality to lower than 20%.

Aim: In this review, we will look into the presentation of peritonitis and the best way to manage this condition.

Methodology: The review is comprehensive research of PUBMED since the year 1995 to 2018.

Conclusion: The second Most common site of sepsis is mainly at the Abdominal cavity, where a perforation of appendicitis being the source which is most frequent abdominal infection. a 1% mortality rate can occur if it progresses to septic shock and If it is not recognized. If peritonitis progresses it will complicate into the intra-abdominal compartment syndrome. antibiotic- therapy should be initiated as soon as it is available According to IAI guidelines, which all depends on the degree of the condition.

Keywords: *Peritonitis; Diagnosis of Peritonitis; Management of Peritonitis*

Introduction

Peritonitis is an inflammatory process of the peritoneum caused by drugs, bacteria, fungi, virus, any foreign body, or granuloma. Infection is a very common cause of peritonitis which happens as a result of abdominal sepsis. Peritonitis can present differently depending upon the severity and location of the irritant. Because of a high mortality, reaching as high as 90%, urgent management is very important. Major

management strategy used is surgery in case of intra-abdominal infections, which consist of removing the necrotic tissue, eliminating the septic foci, and draining of the purulent material. Additionally, treatment includes controlling the source of infection or irritation as well as washing the cavity with intra-abdominal lavage. If the source of infection cannot be identified the patient may undergo frequent multiple laparotomies. However, the treatment itself can lead to further complications such as abdominal wall edema, further abdominal wound, and increased intraabdominal pressure. Regardless, aggressive treatment caused mortality to become lower than 20%. Improved antibiotic coverage, prevention of an abdominal compartment syndrome, and further control of complication should also be the main stream of management [1].

In this review, we will look into the presentation and classification of peritonitis and the best way to manage this condition.

Classification of peritonitis

Primary peritonitis

Primary peritonitis happens due to inflammation of peritoneum by sources outside peritoneum, such as through hematogenous route. It is very dangerous, mainly in children who have nephrosis or patients who have cirrhosis. It happens in immunocompromised state. 70% of the time the causative agent is *Escherichia coli*, 10 - 20% by gram-positive cocci, and another 10% by anaerobes. This type is often treated by antibiotics and fluid resuscitation. Then may need surgery for diagnostic purposes, culture, or abscess drainage [2].

Secondary peritonitis

This type of peritonitis occurs as a result of inflammation or break of wall of a solid organ or tract into the peritoneal cavity. They can be further classified as peritonitis due to trauma, post-operative, or due to perforation [3].

Postoperative peritonitis

Incidence of postoperative peritonitis is 1 - 20% in patients after undergoing laparotomy. Most common reason is failure of anastomosis leading to leaks. The symptoms become evident five to seven days after surgery and has a high mortality. Leakage of proteolytic enzymes in the peritoneal cavity leads to inflammation and systemic response.

Post traumatic peritonitis

This type of peritonitis happens due to missed injuries of mesentery, ischemia, and intestinal perforation. This also occurs after injury from sharp penetrating objects, such as stab wounds. Peritonitis happens because of infection and contamination from the foreign object, or from the leakage of fluids from the gastrointestinal tracts.

Tertiary/recurrent peritonitis

This type of peritonitis is recurrent or persistent infection inside the peritoneal cavity after sufficient treatment of primary and secondary peritonitis. It is usually caused by low virulence organisms or can also be sterile [4].

Pathophysiology

The peritoneum consists of two layers: the perinatal peritoneum which covers the abdominal cavity, and the visceral peritoneum which covers the abdominal viscera. The peritoneum is made up of mesothelial cells on basement membrane along with adipose tissue, fibroblasts, macrophage, lymphocytes, and elastic fibers of collagen. Normally the peritoneum consists of 50 ML of fluid which has some macrophages and lymphocytes. The function of the peritoneal membrane is as a semipermeable barrier that allows bidirectional diffusion of water and most solutes. The total surface area for exchange is about $1m^2$. The diaphragmatic surface of the peritoneum has fenestrations that correspond to the underlying lymphatic drainage into lakes called lacunas. These lacunas are 8 - 12 microns and are responsible for

reabsorption of bacteria and large particles into the lymphatic system and ultimately into the thoracic duct. The intra peritoneal fluid and exudate circulate in the peritoneal cavity by forces of gravity and suction from the fenestrations in the diaphragmatic surface as contraction of the diaphragm creates suction forces. If the host is healthy and the bacteria is low, it will be controlled without systemic response. However, if the host is immunocompromised or if bacterial load is very large systemic inflammatory response, or sepsis takes place. Bacterial contact to peritoneum causes mesothelial cell injury which leads to activation inflammatory mediators causing activation of cellular and humoral responses [5].

As the peritoneum comes in contact with the bacteria, blood flow increases in the peritoneum and so does the exudate fluid and phagocytes. Within 2 to 4 hours neutrophils and key rising up to 72 hours. Neutrophils release cytokines and interleukin IL 1, IL 6, platelet activating factor, leukotrienes, tumor necrosis factor, C3 A and C5A. these mediators promote local inflammation. Once the bacteria start dying, the lipo-polysaccharides of gram-negative Enterobacteria induce a stronger stimulus for further inflammatory reaction.

This inflammation leads to production of fibrinogen and formation of fibrin that blocks the fenestration which traps bacteria into the cavity. This process can also lead to abscess formation. The most common location for abscess formation is sub phrenic areas [6].

Another mechanism of defense is production of large exudates rich in phagocytic cells, but they produce a massive displacement of fluid and proteins, specially albumin, in the third space, causing hypovolemia and shock. In case of severe bacterial peritonitis, the systemic response releases catecholamines, antidiuretic hormone, and aldosterone. The hypovolemia results in decreased cardiac output, increased resistance in peripheral vessels and increased oxygen consumption. Within 4-6 hours, IL 2 and IL 8 induce profound pancytopenia [7].

Clinical presentation

For any patient presenting with ascites, a high degree of suspicion for subacute bacterial peritonitis must be maintained. Most patients present with acute abdominal pain, fever, and chills. Fever is usually the most common presenting symptom. Patients with cirrhosis are usually hypothermic. Therefore, a patient who already has a history of cirrhosis, who present acutely with fever, a very high degree of suspicion for subacute peritonitis is encouraged. Many patients can also be asymptomatic, in about 30% of patients, and peritonitis may be found incidentally [7].

Additionally, peritonitis can present with diarrhea, new onset or worsening encephalopathy, altered mental status, paralytic ileus, or new onset or worsening renal failure. Ascites that does not improve with diuretics must also raise suspicion.

A study was done by Zoe., *et al*. [8] on 34 patients with peritonitis showed that fever and abdominal pain was present in 70% of the population and was the most common presenting symptom. Ascites was common in 56% followed by weight loss in 47%. Other noted symptoms were diarrhea, anorexia, abdominal mass, and salpingitis. In another study by Tsai., *et al*. [9], among 180 patients, abdominal pain was found in 83% of the patients followed by ascites in 59%, fever in 27%, nausea and vomiting in 20%, followed by diarrhea and malaise in a few.

Upon common presenting signs on physical exam, most presented in the emergency department with tachycardia (about 40%) and high temperature. Tachypnea and hypotension are also found but less common. It is important to carry out a thorough physical exam to rule out other conditions that can mimic peritonitis, such as pyelonephritis, empyema irritating the diaphragm. Quick laboratory investigation must be done soon after the initial patient encounter, consisting of complete blood count, blood culture, and peritoneal fluid analysis.

Diagnosis

Peritonitis is clinically diagnosed, based widely on history and physical examination. The most obvious presenting complain is abdominal pain. The pain is usually sharp or insidious; intense in nature and most of the time it is constant. The pain is increased with movement. Most patient lie still, while keeping their knees bent. They also raise the head. Such maneuvers decrease tension over the wall of abdomen and reduces the pain. Nausea, vomiting and loss of appetite are frequent symptoms. Nevertheless, depending on the etiology of the peritonitis and of their time of evolution, the symptoms can vary. Most of the cases have a severe presentation and poor general condition. They are febrile, usually above 38° centigrade. Patients with septic shock however may have hypothermia. Indications of hypovolemia are tachycardia and decreased amplitude of pulse, and they are common in the most of patients. Patients often show up with an increased cardiac output and decreased systemic vascular resistance. Patients may also have raised pulse pressure. Tenderness to superficial and deep touch most characteristic sign of peritonitis. There is voluntary guarding in the beginning after which the muscular wall has an involuntary and severe spasm. Bowel sounds may be present or absent resembling an early ileus.

Peritonitis if localized can generate pain in the region of the causative organ. Palpation of the abdomen may aid in accurately locating the point of maximum peritoneal irritation. Digital rectal examination, although valuable part of the physical examination, seldom orients toward the cause of the peritonitis. Initially, pain with peritoneal irritation is intense, but as time elapses, pain becomes more difficult to assess. Having a high index of suspicion plays a critical role in making an early diagnosis which could otherwise have poor consequences [10].

The labs may show elevated white cell count (often greater than 11,000 cells per mL) with a leftward shift. Leucopenia is suggestive of generalized sepsis and is often associated with a poorer prognosis. Blood chemistry is usually normal, but in severe cases it may be indicative of severe dehydration (e.g. increased blood urea nitrogen (BUN) and hypernatremia). Metabolic acidosis aids the confirmation of the diagnosis. Urinalysis is important for ruling out any urinary tract infection, pyelonephritis, and nephrolithiasis. Plain X-ray of the abdomen is not done routinely. However, at times, it could show paralytic ileus with air fluid levels indicating bowel distension. Upright chest X-ray is useful if perforation is suspected. Free air under the diaphragm may be seen in around 80% of cases with duodenal perforation from an ulcer and less frequently in cases of colon, small bowel, or intra-peritoneal rectum perforation [11].

When diagnosis can be made clinically, doing a CT of the abdomen only delays surgical intervention. CT abdomen can be useful in for cases with suspected recurrent or undrained infection in the postoperative period. Velmahos., *et al*. [12] advice on obtaining an abdominal CT in patients who are severely ill and in the post-trauma patients who are seen to have sepsis of unknown origin. Ct helps in guiding therapy in two out of three cases. Ultrasound of the abdomen may also help with diagnosis of patients who have postoperative complications. Depending on several factors, fluid collection may be seen. However, this finding may be entirely nonspecific. Ultrasound's greatest advantage is that it can be done on the bedside. Bowel loops can be spotted by seeing peristalsis, and a bedside percutaneous drainage can be performed in some cases, thus making easier the obtaining of samples for cultures. Go., *et al*. [13] performed a study to compare the use of ultrasound versus CT in the patients who had postoperative intra-abdominal infection. In their study it was seen that CT is the procedure of choice for these patients and that ultrasound may be used only in some cases.

Medical management

Regardless of what causes it, many measures are available and approved as increasing the survival rate. The most important factor is early recognition of IAI. Fluid balance should achieve immediately to replace any of the intravascular insufficiency. Vasopressive agents can be necessary to aid with fluid resuscitation.

The WISS study showed that sepsis increases mortality rate by a significant number, with only 1.2% occurring in the absence of sepsis, this number increases to 4.4% when sepsis is there and 71.8% when septic shock occurs [14].

Diagnosis	Monotherapy	Combination Therapy
Primary peritonitis	Ampicillin/Sulbactam	2nd generation Cephalosporin
Secondary peritonitis	Ampicillin/Sulbactam	2nd generation Cephalosporin + Metronidazole
Tertiary peritonitis	Depending on resistance of microorganism	Antifungal therapy can be added

Table 1*: Antimicrobials for types of peritonitis [14].*

Microorganisms associated may differ depending on the to the type of peritonitis and on the level at which perforation occurred in secondary or tertiary peritonitis. When perforation occurs higher up in the GI tract, e.g. the stomach or the duodenum, bacterial extravasation usually has less serious consequences as compared to perforation of the colon or rectum which usually leads to severe bacterial contamination which may prove to be life-threatening and is known to be a leading cause in affected patients for sepsis and septic shock [15].

Primary bacterial peritonitis is usually seen to be associated with gram-negative *Enterobacteriaceae* and *Streptococcus spp*. On the other hand, secondary bacterial peritonitis is usually caused by polymicrobial infection with gram-negative *Enterobacteriaceae*, gram-positive *Enterococci and Staphylococci*, or anaerobes and candida. Tertiary peritonitis is caused by a similar poly-microbial infection due to a secondary peritonitis and common organisms from patients are *Enterococcus*, *Candida* and *Staphylococcus epidermidis.* These organisms are much more likely to be involved in antibiotic-resistant strains [15].

The Study for Monitoring Antimicrobial Resistance Trends (SMART) studied the response of clinical gram-negative bacilli to antimicrobial agents. It has been seen that prevalence of extended-spectrum β-lactamase (ESBL)-producing *Enterobacteriaceae* in the clinical setting is of significant importance and it has been acknowledged to be growing across the world. Along with the expected increase in the total resistance to beta-lactams and fluoroquinolones, the resistance ESBL-positive *E. coli* causing intra-abdominal infections is now from 60 to 93% [16].

Surgical management

IAI guidelines have published graded guidelines, A, B, C, D, for the medical and surgical management of sepsis in the abdomen, A, is a strong recommendation and D, one that is less robust in its recommendation. Laparoscopic appendectomy is the main management modalities advised for perforated appendicitis. Antibiotic-therapy is applied to supplement surgery or to prolong a surgical procedure, though, on itself, it does not usually control an infection of intraperitoneal cavity. According to Kong [17] after a retractable septic shock, the average overall length of hospital stay was around five days, and the mortality rate was 1%.

In perforation of left colic diverticular disease associated with a small abscess, management is continued with antibiotics, with percutaneous drainage done in cases of large abscess formation. A known procedure known as The Hartmann is used in cases of diffuse peritonitis and when progression to sepsis has happened, and in perforated colonic carcinoma, the Hartmann procedure is the initial management of surgical treatment [18].

When local conditions happen, perforation subsequent to colonoscopy should be the immediate treatment by primary suture, if not, the resection of the colon containing the perforation may be a must. In perforations of the gastroduodenal ulcer, primary suturing, with or without an omentum patch, done open or laparoscopically, is the management of choice [19].

In perforation of the small bowel, primary suturing is the initial option, however, if it is associated with a large perforation or with a condition of local ischemia, segmental resection is important. It is now recommended that Early cholecystectomy in acute cholecystitis being superior to the previously held opinion of delaying cholecystectomy, with the laparoscopic technique being the choice of procedure. The alternative management, which considered to be the best option, especially when complications happen, is a classical approach [20].

The gold standard for biliary decompression is Endoscopic retrograde cholangiopancreatography in individuals with moderate to severe acute cholangitis, failing which, percutaneous biliary drainage is the alternative option. Ineffective control of the septic source is accompanied by significant elevated mortality rates [21].

Antibiotic management usually treats Pelvic inflammatory disease, though surgical drainage is usually important in patients with a tubo-ovarian abscess. Consideration of repair or anastomosis of the intestinal injuries is a must in cases of trauma accompanied by perforation. in colorectal injuries a colostomy is to be considered involving all layers when massive injuries or comorbid diseases are present 17658099.

Conclusion

The second Most common site of sepsis is mainly at the Abdominal cavity, where a perforation of appendicitis being the source which is most frequent abdominal infection. a 1% mortality rate can occur if it progresses to septic shock and If it is not recognized. If peritonitis progresses it will complicate into the intra-abdominal compartment syndrome. antibiotic- therapy should be initiated as soon as it is available According to IAI guidelines, which all depends on the degree of the condition.

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