Chapter

Damage Control in Hinchey III and IV Acute Diverticulitis

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Abstract

Acute diverticulitis is one of the most common surgical causes of admission to Emergency Departments in Western Countries. Although most of the cases can be managed conservatively or electively, a number of them will require an emergency surgical treatment. Among these patients, an even smaller number of them will present with a full-blown catastrophic septic shock. These minorities of cases have accounted for a significant part of the overall mortality and morbidity of complicated acute diverticulitis itself. The implementation of Damage Control strategies has shown to be useful also in these septic catastrophes, where a profound derangement of physiology makes unsafe a classic approach. Damage Control, as we intend it, is not a surgical "technique." A close collaboration between different specialties brought forth a strategy of treatment. The Surgeon, the Anesthetist, and the Intensivist are the three most involved specialists in the treatment of these cases. It is paramount for them to learn how to work side by side and in harmony, since the patients will benefit from each-one's input in their care.

Keywords: acute diverticulitis, damage control, peritonitis, laparostomy, Sepsis

1. Introduction

Diverticular disease is a common and increasing cause of emergency consultation in Western countries with 3–5 cases per 100,000 habitants. Although in most cases it remains asymptomatic, roughly 20% may require emergency treatment. The advances both in image quality of new multi-slice CT scans and laparoscopic procedures have influenced changes in the way we treat these complicated patients. Complications of sigmoid diverticulitis due to acute inflammation and colonic wall perforation may manifest as pericolic (Hinchey I) or extra-mesocolic (Hinchey II) abscesses, and purulent (Hinchey III) or fecal peritonitis (Hinchey IV). Although the first two are managed conservatively, treatment for stages III/IV is not that straightforward. We will refer to Hinchey III/IV acute diverticulitis as complicated acute diverticulitis (CAD) [1–3].

The clinical and surgical approach to CAD differs basically on the physiological status of the presenting patient [4].

Fortunately enough, even if CAD is, by definition, severe sepsis, a good proportion of the patients are not in septic shock at presentation. This means that they are still in a physiological state to tolerate a definitive "classical" procedure. Standard surgical therapy for CAD has been to perform either an open or laparoscopic resection, followed by a primary anastomosis or a protected anastomosis or a terminal colostomy. The latter is still the most common procedure. In recent years, a less invasive approach has been used to fit patients with Hinchey III peritonitis. In these cases, a laparoscopic lavage and drainage (LLD) seem to be, according to a growing number of surgeons, a safe option [1–6].

In this chapter, we will not linger any longer on these previous strategies.

We will focus only on the smaller group of patients with CAD who present with such an advanced derangement of their physiology that needs to be treated in a Damage Control Modality.

Damage Control, in our view, is not merely a surgical technique. It is in fact, a strategy of treatment brought forward by a close collaboration between different specialties, among which surgery, intensive care (ICU) and anesthesia play a significant role. Thus, we will present the input on each of these specialties on the therapeutic strategy.

2. Assessing the patient

We can think, out-of-the-book, abdominal emergencies as a devilish blend of dangerous ingredients. Diagnosing an acute abdomen is sorting out the different components from the mix to finally draw conclusions on its danger.

Ideally, we should be able to do it quickly, pragmatically, and in a cost-effective manner.

We appreciate that there is a significant disparity in what can be used in different health systems. What is readily available in high-income countries, it is not (or is inexistent) in low-income countries. The authors' bias is to work in some of the best health systems in the world, at least according to the World Health Organization, where almost everything is available 24/7/365.

We all know the signs and symptoms of a patient with acute diverticulitis.

They usually have persistent moderate to severe abdominal pain with guarding and rebound tenderness located in the left lower quadrant or hypogastrium (Hinchey I–II), which turns to be diffused to all the abdominal cavity as the infection is no longer localized (Hinchey III–IV).

Nausea, vomiting, fever, and in some cases, dysuria can also be present in many patients.

In modern and mature health care systems, patients with diffuse peritonitis and septic shock should be diagnosed straightforwardly with a CT abdomen-pelvis with intravenous contrast. We never stress enough to our trainees, and during our M&M, how a speedy diagnosis contributes to saving lives. Also, we are very adamant that a CT without IV contrast is a suboptimal examination in almost all the emergency clinical situations. Acute kidney injury (AKI) or chronic renal failure (CRF) are not, and should not be a contraindication to obtain a good quality CT scan. The quantity of literature on the safety of modern IV contrasts is vast and easily searchable in PubMed.

CT scan gives us all the information we need; such as free fluid vs. localized collection, the distribution of free air, and direct signs of diverticulitis. Not infrequently,

it informs us of other unknown conditions that could change the overall attitude such as multiple liver metastases, primary neoplasms of the large bowel or other organs, etc.

We agree that diagnosis is paramount, but treatment is our real goal. And treatment should start before diagnosis.

An acute abdomen is a diagnosis based on clinical examination. Sepsis should be considered as the primary cause of an acute abdomen until proven otherwise. Sepsis can be identified within minutes by recognizing hypotension, tachycardia, tachypnea, and oliguria. Blood tests (White Blood Cells and C-Reactive Protein) together with venous or arterial blood gases (lactates) can add crucial information towards the final diagnosis of sepsis. Are they septic? Are they in septic shock? Usually, in acute diffuse peritonitis, from diverticulitis or other causes as well, the answer is many times, yes, they are already in septic shock. Some Health Systems, like the United Kingdom's National Health System (NHS), introduced the "Sepsis-Six." The Sepsis-Six consists of three diagnostic and three therapeutic steps—all to be delivered within 1 h of the initial diagnosis of sepsis [7]:

1. Titrate oxygen to a saturation target of 94%.

2. Take blood cultures and consider source control.

3. Administer empiric intravenous antibiotics.

4. Measure serial serum lactates.

5. Start intravenous fluid resuscitation.

6. Commence accurate urine output measurement.

Someone could argue that extremely sick patients, who are the ones who will require damage-control procedures, can be diagnosed on the spot by merely looking at them. They could also argue that a lot of scoring is useless and done only for scoring sake. We do not agree with them. It is imperative in our practice to assess the response to our treatment, and this can be done only if we have determined our starting point. We still use, as many other colleagues do, the concept and definitions of the "Surviving Sepsis Campaign: International Guidelines for the Management of Severe Sepsis and Septic Shock: 2012." We stress to our trainee the importance of assessing the patient and following their response to the treatment. Diagnosis at a glance also does not correlate with morbi-mortality, and it is not a common language used when dealing with other specialties, who would look upon your surgeon as a caveman.

We use the Sepsis definition, and the p-POSSUM score as a minimum to assess patient severity and surgical risk. We appreciate that P-POSSUM has been criticized, and possibly is not the best scoring tool available. Let us say that p-POSSUM is as bad as all the others available [7–9].

Septic patients are treated according to the Surviving Sepsis Campaign Bundle. Upon arrival, once the acute abdomen has been identified (again, it is a clinical diagnosis!), blood cultures are taken, and broad-spectrum antibiotics are started along with intravenous fluid replacement. For each hour of delay of antibiotic administration, there is a cumulative increase in mortality of 4%.

Which antibiotic should be administered is up to your hospital policies. Piperacillin/Tazobactam is the first choice in no-penicillin allergic patients in many hospitals.

Antibiotics, fluid, and oxygen are all you can do to start optimization and treatment. At the same time, you are now ready to pass the patient through the CT scan.

If you have done things correctly, you have lost no more than 30 min from arrival, and you should have been able to assess the problem (acute peritonitis), rule out other mimicking conditions (ruptured AAA clinically and laboratoristically is quite different) and evaluate the severity while starting the treatment. Ideally, a simple Chest X-ray should be performed during the initial assessment in the Accident & Emergency Department, to exclude free gas under the diaphragm (hollow viscous perforation). Furthermore, an abdominal ultrasound scan can exclude a AAA and give a piece of valuable information on possible free intraperitoneal fluid. Early involvement of a senior surgeon is crucial for the decision making and for coordinating with the other specialties.

An essential skill of the Emergency Surgeon should be interpreting CT scans. The Surgeon should be able to see the CT scan in real-time and seek advice from the Radiologist. Reviewing the scans together with the Radiologist, can give valuable information to the Surgeon and help him significantly to plan the strategy of the operation if needed. Since we are focusing on damage-control procedures, let us exclude all Hinchey I–II acute diverticulitis, and concentrate only on Hinchey III–IV, cases that are acute peritonitis. Usually, diagnosis of acute diffuse peritonitis is quite straightforward on a CT scan, even for a surgeon: free fluid, pneumoperitoneum, and fat stranding, alone or combined, are the key features. We see the CT scan, and we know that they will go to the OR for the source control.

Re-evaluation of the critically ill surgical patient is critical and essential. In many cases, the initial resuscitation has been adequate. The patient, hopefully, now has a good (or better) urinary output of at least 0.5 mL/Kg/h, is better perfused and does not require inotropic drugs. However, the patient still needs an emergency operation. In that case, the management options include a primary anastomosis with or without a prophylactic ileostomy or a Hartmann's procedure. That means that, most likely, a damage-control procedure is not needed.

Unfortunately, there are cases when the patient is not able to respond to resuscitation. The patient remains hypoperfused, oliguric/anuric, acidotic, coagulopathic, and often hypothermic. This sub-group of critically ill surgical patients is among the most challenging scenarios in emergency surgery. They are very often of old age, with multiple comorbidities and low reserves. They, unwillingly, form the vast majority of the mortality rate.

Yet, if you and the other members of the multidisciplinary team you are working with decide that invasive treatments are not futile, it is time to hurry up and do things properly.

In the real world, you have already spent at least 90 min: the patient has already been resuscitated all that it is advisable, and ideally, nothing can be added if source control is not obtained.

Just a couple of notes before entering the OR.

Remember the lethal triad in trauma: hypothermia, acidosis, and coagulopathy. We aim to fight those. Do not forget to actively warm your patients since they arrive to your observation. That means a warm environment and warm fluids. Also, if coagulation if deranged for the sepsis or in case they are on antiplatelet drugs or anticoagulants, you should involve the hematologist on-call as soon as possible, or use pre-existing protocols if available. It is not wise, although it is not infrequent, to find out an INR more than 2 just when you are ready to transfer them to OR. It is not a mortal sin, but it means more time to wait before source control, which, yes, increases mortality. Ways to correct the INR urgently in order to proceed with damage-control surgery include administering intravenous vitamin K, and transfusion of coagulation factor concentrates.

3. Operating room (OR)

Now the patients need a general anesthesia. Anesthetists know very well that the anesthetic management of these patients requires always a rapid sequence induction due to the high risk of bronchoaspiration.

This consists of giving the patient supplementary O_2 close to 100% for 30 s, asking to take three deep breaths as long as they are still conscious and collaborative. Subsequently, the hypnotic drug will be administered while another person assists by performing cricoid pressure. The cricoid pressure is maintained from the moment of induction until the intubation is completed. Applying pressure on the cricoid collapses the esophagus and prevents the passage of gastric contents to the larynx and respiratory tract. A fast-acting myorelaxant such as succinylcholine at a dose of 1 mg/kg iv or rocuronium at a dose of 1.2 mg/kg iv, will be administered just after the hypnotic drug. It will achieve a rapid opening of the vocal cords after approximately 15–20 s, allowing to pass the tracheal tube.

Basic intraoperative monitoring will be achieved by ECG, non-invasive TA, O_2 saturation by pulse oximetry, bispectral index (BIS), neuromuscular, core temperature, and hourly diuresis. Arterial canalization for invasive blood pressure monitoring and canalization is advised as well as obtaining a central venous route to administer large amounts of fluid therapy, vasopressors, blood products, or parenteral nutrition if required in the postoperative period [7, 10].

The primary anesthetic aim in these patients is to maintain or restore an adequate blood flow to guarantee an optimal O_2 delivery to the tissues. Objective-directed IV fluid therapy will be administered using dynamic hemodynamic variables (stroke volume variation—SVV, pulse pressure variation—PPV) to predict the response to fluid loading, guided by hemodynamic monitoring devices (CardioQ, PiCCo, and LiDCo) [11, 12]. If these devices were not available, static hemodynamic variables will be used with the following goals: maintaining central venous pressure >8 cm H_2O; mean arterial pressure (MAP) >65–70 mmHg; diuresis >0.5 ml/kg/h; a venous saturation central ($ScvO_2$) >70% or a mixed venous saturation of O_2 (SvO_2) >65 mmHg and normalization of lactate.

Unfortunately, static (HR, BP, and CVP) are not sensitive enough to predict a response to a fluid reposition and therefore are poor indicators of intravascular volume status.

Initial resuscitation with fluid therapy should be done with crystalloids. The administration of hydroxyethyl starch 130/0.4 should be avoided, as it appears to increase morbidity and mortality in these patients [13]. If the SSV or PPV are less than 10–15% with a PAM <65–70 mmHg despite the fluid challenge, or we do not have hemodynamic monitoring devices, but we have hypotension that does not respond to fluid therapy, vasopressors will be administered. Norepinephrine is the vasopressor of choice. Other options are adrenaline or vasopressin to reduce the dose of norepinephrine. Dobutamine will be administered in the presence of myocardial dysfunction or low cardiac output, or when signs of hypoperfusion persist despite adequate intravascular volume or MAP.

It is also necessary to maintain an adequate hydroelectrolytic and hemostatic balance, administering bicarbonate when essential and different hemostatic components to restore or maintain the coagulation. Coagulation can be assessed by standard tests, or by viscoelastic tests (VETs). The latter allow a treatment oriented assessment of coagulation, and if available should be used as first choice.

As for the transfusion of blood products, it is recommended to maintain hemoglobin levels between 7 and 9 g/dl, and glycemic levels should be kept below 180 mg/dl [14].

Now the ball is back in our court, the surgeon's.

Your patient is in a pretty bad clinical situation, and they will have a high mortality/morbidity rate whatever you are going to do. Your challenge is to make all the right decisions and quickly. Some of them are not straightforward, and will be surely discussed in the following M&M. Some are extremely easy though, and if you make mistakes here, you will be surely crucified in the M&M. So, for both the patient's sake and yours: do a laparotomy. If you are really convinced that laparoscopy is a good indication in a crashing patient in septic shock, you can as well stop reading this chapter, since you will not find anything useful for you.

We have too many hours of both elective laparoscopic colorectal surgery and emergency surgery to stand by what we are saying. Laparoscopy has no place in this scenario. So, prepare your OR for a formal laparotomy, with all the instruments you are going to need. We usually want advanced cautery devices in this case, as well as staplers, to minimize the OR time.

As we have already said, delaying the surgical procedure can lead to a progressive deterioration of the patient status, and it may contribute to a more unfortunate outcome.

The surgical team should be ready and prepared to operate even at night hours, because any delay is increasing the already high chances of losing the patient. Excellent communication and coordination between the attending team members should be emphasized; the team leader, generally, the surgeon should coordinate all the resources needed in order to complete the task swiftly. Well-organized teams formed by anesthetists, intensivists, and nursing staff will work faster and will obtain better results when a real team attitude is practiced.

Now that you are already scrubbed and about to start, keep in mind two easy concepts: size matters (big incision); time matters (be quick).

The key for a quick resection is good exposure: bone-to-bone midline laparotomy is just a few centimeters too long in this situation. Small incisions that compromise surgical exposure should be avoided. Proper retraction is also indispensable, self-retracting devices can be quite helpful, especially in obese patients. The abdominal wall should be protected with wall protectors that, in many cases, can be used both as protecting devices that reduce surgical site infection and also as an additional retracting tool.

Once the abdomen is opened, a quick general evaluation of the abdominal cavity should be routinely performed, and samples taken for aerobic and anaerobic cultures. The origin of the colonic wall perforation should be controlled temporarily by whatever means you fancy (clamps, sutures, staplers, etc.), and a first lavage should be carried out to remove gross contamination. Once this has been done, you will have to achieve a definitive source control, which can be done only by colonic resection (formal sigmoidectomy vs. segmental colectomy).

As a general rule, you will find extremely inflamed tissues, which, especially in obese patients, will make the dissection difficult. This is not a cancer operation, though. There is no need for you to go down in the mesentery to find the root of the inferior mesenteric artery (IMA) or the inferior mesenteric vein (IMV). You should be comfortable with the anatomy and the surgical technique and use judgment. This means that you should tailor the operation not only to the patient's needs, but also to your abilities. A proper retraction makes a lot of difference in difficult open surgery. If your assistant is more inexperienced than you and a more senior help is available, call them in: it is easy to operate when assisted by someone who knows how to.

The use of energy devices like the LigaSure Atlas of 10 mm–20 cm (Medtronic®) can be beneficial both for blunt dissection and also for hemostatic control of the thickened mesocolon, always taken care to identify the ureter in cases of sigmoid resection. The colonic segment should be excised using GIA reloadable stapling devices. After the resection is performed and the specimen extracted, a

thorough washout of the abdominal cavity should be done with a warm saline solution with particular attention to the pouch of Douglas, left and right gutters, and both subphrenic areas.

The decision to whether performing a definitive procedure vs. a damage control should have already been taken before entering the OR since it should have been based on physiological assessment. It is improbable that after surgical aggression, the patient will be hemodynamically and physiologically better. In some rare circumstances though, you will find out that there are exceptions to what was stated before: the patient unexpectedly has significantly improved, maybe inotropes are being tapered down, urine output has normalized. In these circumstances, you can reconsider your previous decisions and go for a definitive procedure, namely primary anastomosis or terminal colostomy.

If we can give good-samaritan advice, twink twice, and then think once again. If you have access to modern systems for the open abdomen, you should not change your pre-op decision. We have all done it, and the results have not always been favorable. Be pragmatic and stick to doing damage-control, surgery.

In any case, the rule of the thumb is that you have been so quick (not kidding) that the anesthetists are still putting IV lines, and the patient is still unstable and on vasopressors. The surgical part of damage control is completed. We strongly advise to leave the stumps inside, perform a meticulous washout and leave a temporary abdominal closure for a second procedure in the following days, once the patient's conditions are more favorable for an anastomosis. Performing a stoma at this stage is time consuming, and really does not offer any advantage. Performing a primary anastomosis now, even if has been advocated by other colleagues, seems to us an unnecessary act. Our philosophy is to minimize the surgical aggression and the operative time.

If you have decided for a temporary closure of abdomen, you should already know that currently, there are several temporary abdominal closure devices available, and the use of one or another will depend on availability and the surgical team preference. One of the most used devices, and the one that we have more experience with, is the ABThera Sensa T.R.A.C ® (KCI) [1].

This is a temporary negative pressure abdominal closure therapy composed of four components. A visceral protective layer (VPL), a perforated foam, the plastic adherent drape, and tubing, connected a negative pressure source. These devices can help to protect the abdominal content and create a temporary functional abdominal closure avoiding a sustained or repeated pathologic elevation in abdominal pressure above 12 mmHg. Another benefit of the negative pressure therapy is that it actively removes fluid from the abdominal cavity and draws the wound edges together, avoiding fascial retraction. Both the initial application and subsequent dressing changes should be performed under aseptic conditions, either in the OR or in the ICU, between 24 and 72 h, depending on the level of contamination and infection of the abdominal cavity. With each dressing change, the surgical team should perform a thorough re-evaluation of the abdominal cavity and whether the abdomen can be finally closed, but the correct timing and the definitive closure should be individually tailored depending on the patient's general status and response to therapy.

These types of commercial devices have the advantage of delivering a controlled negative pressure throughout the abdominal cavity, especially in the paracolic gutters and pouch of Douglas, but they are expensive and not always available. In cases where there is no availability of these devices, then, an Barker closure of the abdomen can be done. It is similar to the one we use in trauma damage-control surgery. These improvised systems consist of using a layer that can cover the sensitive abdominal organs, and at the same time, keep them warm.

The layer can be made by two layers of surgical drape made with a robust, conformable, and breathable polyester incise film coated with medical-grade acrylate adhesive containing molecular iodine as the active antimicrobial agent. Between the layers, we use large swabs. After making the layer, we shape it and cut according to the gap we would like to cover. Because of the surgical drape that covers both sides, this layer can be inserted inside the abdomen and be in touch with the bowel without problems. Then, the whole abdomen (all four quadrants) is covered with an extra surgical drape offering adequate sealing. We need to highlight the need for insertion of two large abdominal drains (usually 30Fr) to drain potential intra-abdominal fluid and, most importantly, to prevent abdominal compartment syndrome.

4. Intensive care unit (ICU)

We surgeons have done what we could and had to do. The patients need now an Intensivist and an ICU. Your colleagues are expecting them to arrive at any time, the anesthetist has already called them, and everything is ready. Intensivists are well aware of what is at stake. They know that grade III and IV diverticulitis implies the presence of intestinal macro-perforations responsible for the appearance of purulent or fecaloid peritonitis, which is associated with a high percentage of complications such as peritoneal abscesses, pyogenic liver abscesses due to the dissemination of the process through the portal circulation, small intestine obstructions, fistulas, etc.

The most common germs are gram-negative bacilli such as enterobacteria, anaerobes, and less frequently Enterococci and *Pseudomonas aeruginosa*. In post-surgical patients, there is an increase in cases of *Staphylococcus aureus* infection resistant to methicillin and *Candida* sp. if they have received the previous antibiotherapy.

Secondary peritonitis can trigger a dysregulated response by our organism that can lead to sepsis or septic shock and multiorgan failure depending on the severity, which implies significant morbidity and mortality.

The recognition of a septic patient is based on the alteration of clinical and analytical parameters such as mean blood pressure (MAP) <70 mmHg or systolic pressure (SBP) <100 mmHg, renal failure with the presence of oliguria/anuria and increased creatinine levels >1.2 mg/dl, at the respiratory level may lead to respiratory distress syndrome that occurs with severe hypoxemia and need for respiratory support with high flow oxygen systems or invasive mechanical ventilation. Neurologically, obnubilation, or low level of consciousness may be seen. In terms of analytical parameters in the blood, metabolic acidosis, hyperlactacidemia, consumptive coagulopathy, and plaquetopenia stand out.

If the patient needs vasoactive substances after adequate volume replacement to maintain MAP >60 mmH and serum lactate is >2 mmol/l, it is called septic shock.

For treatment, from the first hours of admission, an attempt will be made to maintain adequate hemodynamic stability thanks to the administration of fluid therapy (30 ml/kg in the first 3 h) with intravenous crystalloids. The therapeutic and hemodynamic response will be re-evaluated frequently, to maintain Average Arterial Pension (MAP) >65 mmHg, Heart Rate (HR) >60, Oxygen Saturation (SO_2) >90%, Central Venous Pressure (CVP) 12–8 mmHg, Temperature <37°C, and Diuresis greater than 0.5 ml/kg/h. We will try to optimize different analytical parameters such as ions, renal function, liver function, lactate levels, presence of acidotic, alkaline or mixed pattern, platelet count, and hemoglobin, indicating the transfusion of red blood cells with hemoglobin levels ≤7 g/dL [15].

The lactic acid evaluated in a venous or arterial gasometry is a marker of adequate tissue irrigation, keeping our objectives in values lower than 2 mg/dL [15].

If, after initial resuscitation, the situation of instability persists, the initiation of vasopressors without delay is indicated, with Noradrenaline being the first-line agent in septic shock. In refractory cases, the start of other vasopressors such as vasopressin, inotropic agents such as dobutamine, and glucocorticoids may be indicated.

In the most severe cases, it will be necessary to implement different support measures such as renal replacement therapy, indicated in renal failure with oliguria or anuria and severe alteration of analytical values, invasive mechanical ventilation (IMV) in those who develop respiratory distress syndrome.

In these patients measurement of intra-abdominal pressure (IAP) is mandatory. If it exceeds 12 mmHg, we would speak of intra-abdominal hypertension and if it exceeds 20 mmHg of abdominal compartment syndromes with the need to use specific techniques such as placement of NGS, force negative balance. Since they already have a laparostomy it is unlikely, but not impossible, that they may need a further surgical decompression.

5. Back to OR

The operation has been done and the patient has been left in the experienced hands of ICU.

We do not fool ourselves: some (maybe many) of them will die in the next 12–24 h. The toll to pay is simply too much, especially in the case of elderly patients, or in the ones with many comorbidities. Usually the sicker, and more unstable, they were in theater, the sooner are expected to pass. We cannot give any percentage, because we do not have it, and also because it would be not pertinent to our story. Suffice to say that the reality is just a little better than what the P-POSSUM score told you, but not so much better as you would like.

For those who actually improve, they will eventually need a second operation, a so-called "second look."

The planning and decision making for a second look ideally were made by the operating surgeon while performing the initial damage-control surgical procedure. The second-look laparotomy is based on the fact that the surgeon should explore the patient's abdomen within 24 or 48 h, depending on the patient's hemodynamic stability. That means that a second-look laparotomy is a scheduled procedure and should ideally be performed in a patient that is stable with as less inotropic support as possible.

In any case, negative pressure abdominal dressings should be changed after 72 h most.

One of the most important parameters to have is the intra-abdominal pressure, or IAP. IAP should have been measured in ICU and you should prepare to measure it when attempting the closure.

Anesthetic-wise, usually the second-look poses no big challenges.

Intraoperatively, we have to assess if there is still contamination, the viability of the colonic stumps and whether or not there are any other issues that need to be dealt with (i.e., iatrogenic damages from the first surgery). Also, this is the time to finish the preparation of the proximal colon for the terminal colostomy.

In very selected cases, those who have improved very well in ICU and without comorbidities, we can opt for a primary anastomosis. Unfortunately, collectively, we have encountered very few of them. But we know that other colleagues have been more lucky.

Just a word about the rectal stump. It is quite uncommon to detect any problem at this level now, but not uncommon to have a dehiscence of the stump later on. We always leave a pelvic drain, only to drain the stump should it leak.

Usually, the "bowel" part of the second-look causes no big problem: whatever you do, it is more or less easy.

The challenge of the second-look is often the abdominal closure. Sometimes, it can be difficult to approximate the abdominal wound edges, mainly because of the edema of the intra-abdominal organs that can result in a high intra-abdominal pressure and difficulty to approximate the midline laparotomy edges successfully. The extent to which you can close the abdomen under tension is difficult to judge. We rely much on IAP, and feel safe to close if IAA is <12 mmHg. But also the quality of the tissue is crucial, and this is something that you cannot judge objectively.

As a rule, we do primary closure of the fascia is IAP <12 mmHg and accept the need of following surgeries for incisional hernia. We do not routinely do advanced abdominal wall reconstruction surgery at this stage, and prefer to do them, if indicated, during a former repair of an incisional hernia.

In the few cases, where you cannot close the abdomen due to elevated IAP, we use a **mesh-mediated** vacuum-assisted wound closure as proposed by Petersson et al., which in our hands is what works best [1].

An in-depth discussion of abdominal wall reconstruction is beyond the topic of this chapter.

Usually, after the second look, the patient will go back to the ICU. If the evolution is favorable in the following days, we can minimize the necessary support measures. In patients who have presented septic shock and multiorgan failure, we will progressively withdraw invasive mechanical ventilation, renal replacement therapies, and vasoactive drugs, depending on the recovery of these organs.

It is essential after overcoming the initial shock situation, at 24–48 h, to initiate adequate nutritional therapy since patients in septic shock suffer a hypercatabolic phase mediated by increased cytokines and lipid mediators with a peak between 3 and 4 days but which can be maintained for 7–10 days.

6. Conclusions

Whether you are an experienced (old) surgeon, an enthusiastic (not quite old) fellow, or a young trainee, you will be facing, again and again, patients with acute diverticulitis. When called upon to assess them, you will know beforehand that most of them will be Hinchey I–II, and commonly only a small number of them will have diffuse peritonitis, purulent, or fecal. As an experienced clinician, you should be assessing the patient's physiologic status even before considering whether your patient has acute diverticulitis or other conditions. Early in your evaluation, you should determine whether you are dealing with septic but contained infection or a patient with septic shock. Patients with sepsis should be treated promptly and appropriately to avoid fatal outcomes.

Currently, the application of the Sepsis-Six protocol is indicated, and it should be applied as soon as possible. This approach implies being very aggressive in management. It is advisable to start resuscitation even before having made a diagnosis of the cause. Once you have started your resuscitation and treatment based on your clinical experience, you can confirm your findings with blood-test results and imaging studies in cases of sepsis due to severe acute diverticulitis the CT scan (always with IV contrast) will provide you with valuable information.

If you have done things correctly, you will not only have diagnosed the etiology but also, and most importantly, you will have a diagnosis of severity. Sepsis due

to acute diverticulitis with diffuse peritonitis without septic shock or contained is not the same as "unresponsive" septic shock due to the same condition. There is a massive difference in morbidity and mortality among both presentations. When in shock, all the derangement of the physiological status and its response to resuscitation should not be delayed. If you wait to complete the work-up and delay initial treatment, you will waste precious time and have an unfavorable outcome and higher mortality.

You should follow your clinical instinct and make a correct initial evaluation, anticipating the needs of your patient, and preparing your team approach. Surgeons, anesthetists, radiologists, OR nurses, are all part of this team and should be prepared. For those patients with unresponsive septic shock, consider damage-control as the approach that will maximize the possibility of recovery to your patient. Imagine a patient with an unresponsive septic shock as a KO-ed boxer. He needs to stop the fight, has his opponent removed from the ring, and be allowed to rest and recover before being able to fight another match and maybe win it. Damage-control is removing the opponent (source control) and resting and recovering (ICU). Even if there are no guarantees, your patient may return to fight another day. In our scenario, it is all about doing a quick source control followed by resuscitation in ICU, leaving the definitive procedure for when your patient is in a better physiological status.

Your team of clinicians formed by the surgeon, anesthetist, intensivist, knows how to do it.

As an experienced surgeon, remember that is not the patient for a key-hole surgical approach. It is mandatory to have good exposure and to be quick: nothing less than a good (almost)-full midline laparotomy is advisable. Surgery should be easy; try not to complicate it yourself: non-oncological resection with stapler, leave everything inside, do a temporary closure of the abdomen and come back after 24–48 h if the patient survives.

A final word for the forgotten actors of this play: the patient and their family. We are not going to linger on the consent form or other bureaucratic matters. We want to stress that they should be kept involved in the decision process and also be informed frankly on the expected timeline. People do not quickly grasp the concept of open abdomen and second look. The standard expectation for surgical treatment is not to start today and finish after 2 or 3 days if all goes well. The information you give to them and honest expectations are critical in these complex scenarios. So, try to be consensual with your colleagues and avoid discrepancies in the information provided; this maintains the patients' and family members' trust in the assisting team. Sometimes you have to sit down again and again and go through everything you have already explained with your patient and family members.

You should provide not only surgical techniques and medications but also provide support to the worried families as well. Sometimes they only need some empathy and a word of comfort, or just feeling that you (or whoever is in charge) cares about their dear ones. Taking time to give your support and listen to the patient and his family's concerns is never a waste of time.

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