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Staged Physiologic Restoration and Damage Control Surgery

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Abstract. The fundamental objective of staged laparotomy is to accomplish definitive operative management in a calculated, stepwise fashion based on the patient's physiologic tolerance. This important concept has emerged from collective experience with massive acute abdominal injuries but clearly extends to elective operative procedures and surgical challenges in other torso compartments. Whereas the inability to achieve hemostasis is due most frequently to a recalcitrant coagulopathy following trauma, other scenarios include inaccessible venous injuries, coexisting extraperitoneal life-threatening injuries, uncertain viability of abdominal contents, and the inability to reapproximate abdominal fascia due to reperfusion-induced visceral edema. There are five critical decision-making phases of staged laparotomy: I, patient selection; II, intraoperative reassessment; III, physiologic restoration in the surgical intensive care unit; IV, return to the operating room for definitive procedures; and V, abdominal wall reconstruction. The abdominal compartment syndrome (ACS) is a common, often insidious complication of staged laparotomy. In fact, during phases II and III there is often a delicate balance between effective pressure tamponade of capillary bleeding and the untoward effects of the ACS. During phases IV and V a frequent dilemma is how to enclose the abdominal contents to reduce protein loss and facilitate patient mobilization.

The concept of staged operative procedures for life-threatening injuries is no longer controversial, but the specific indications and technical details remain to be established. This discussion focuses on staged laparotomy for catastrophic intraabdominal trauma, but clearly a similar approach may be applicable for massive injuries in other body regions and for a variety of complex elective operative procedures. The fundamental principles of staged laparotomy [1] are based largely on the evolving practice of perihepatic packing for extensive liver injuries [2–5]. For analytic purposes, staged laparotomy can be compartmentalized into five decision-making steps or phases of management (Table 1). The controversial aspects of each of these phases are addressed in the sequence encountered in the critically injured patient.

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Stage I: Patient Selection for Abbreviated Laparotomy

Major liver injury remains the most frequent indication for abbreviated laparotomy, but the list has continued to expand [6] and generally separates into six categories (Table 2). In practice, the decision to abort laparotomy is frequently based on a combination of these factors and may be additionally influenced by the resources available (e.g., inadequate blood products, limited surgical expertise, multiple casualties). Irrespective of the setting, progressive coagulopathy is the most prevalent reason for staged laparotomy [7–10]. The pathogenesis of a recalcitrant coagulopathy, the so-called bloody vicious cycle [11], in the postinjury scenario is multifactorial (Fig. 1), but specifics [12–16] are beyond the scope of this discussion. Nonetheless, the ability to predict who is at risk for life-threatening coagulopathy is critical for patient care. Defining this state as (1) a prothrombin time (PT) more than two times normal and (2) a partial thromboplastin time (PTT) more than two times normal, we have analyzed our recent experience to develop a predictive model [12]. The independent risk factors and their respective odds ratio for coagulopathy in patients who required a blood volume transfusion were (1) injury severity score (ISS) $> 25 = 7.7$ (1.5–38.8); (2) systolic blood pressure (SBP) < 70 mmHg $= 5.8$ (1.2–28.2); (3) arterial pH $< 7.10 = 12.8$ (2.4−−64.0); and (4) core temperature $< 34°C = 8.7$ (1.8−41.8). Taken together, these factors provide a probability model for predicting the likelihood of developing a life-threatening coagulopathy within 12 hours of admission (Table 3). Such models should be regarded as guidelines; the decision to terminate the laparotomy must occur before profound coagulation defects are confirmed by laboratory analysis.

Once the decision has been made, the technical aspects of abridged laparotomy are dictated by the pattern of injuries [17, 18]. The primary objectives are (1) arrest the bleeding and the inciting coagulopathy; (2) limit contamination and the secondary inflammatory response; and (3) enclose the abdominal contents to protect viscera and minimize protein loss. The procedures for expeditious vascular control include ligation of accessible blood vessels and selective arterial inflow occlusion including intravascular balloons or vascular clamps. Solid-organ tamponade is achieved through gauze packing, circumferential mesh wrapping, and various balloon catheter devices (e.g., Fogarty, Foley). In our

Table 1. Critical decision-making phases for staged laparotomy.

Phase	Criterion
I	Patient selection for abbreviated laparotomy
II	Intraoperative reassessment of abbreviated laparotomy
III	Physiologic restoration in the surgical intensive care unit
IV	Return to the operating room for definitive procedures
V	Abdominal wall closure/reconstruction

experience, the most rewarding balloon device (Fig. 2) has been an inflated Penrose drain employed for bilobar transfixing hepatic gunshot wounds [19]. Injured blood vessels nonessential for organ survival are ligated (e.g., the celiac axis, left or right hepatic artery, infrarenal vena cava, and superior mesenteric vein). Active bleeding from the distal internal iliac artery in the pelvis is best achieved with on-table selective embolization due to abundant cross circulation. Under dire circumstances, the portal vein is ligated if it is not amenable to simple venorrhaphy. Similarly, arteries deemed critical should be reconstituted as simply as possible. A variety of temporary intraluminal shunts (e.g., Javid, Argyl) have been proposed for extensive segmental loss, including a recent impressive case in which a patient survived after 36 hours of superior mesenteric arterial shunting [20]. Perforated intestine can be excluded by stapling or umbilical tape ligation. Ideally, an extensively damaged segment of colon is resected to reduce bacterial contamination; this can be achieved rapidly with clips on the mesentery and staple transection. External tube drainage is effective for injuries of the common bile duct, proximal pancreatic duct, or ureter. Alternatively, cholecystostomy can be employed for biliary decompression.

The final objective of stage I is closure of the abdominal cavity. The method depends on whether the skin edges can be reapproximated without producing excessive intraabdominal hypertension. We prefer the towel clip closure devised by the Ben Taub group [17] because it can be performed quickly and, more importantly, is readily reversible in the surgical intensive care unit (SICU). Standard metal towel clips are placed 1 cm back from the skin edge and spaced 1 cm apart for the length of the incision (Fig. 3). When extensive reperfusion edema of the small bowel and abdominal packing precludes towel clip approximation, a temporary silo is fashioned from plastic. The 3-liter cystoscopy irrigation bag (Bogota bag) is ideal for this situation because it is strong, inexpensive, and available. The bag is opened along its seams, cut to an appropriate oval size, and affixed to the skin edges with towel clips (Fig. 4). Alternatively, the bag can be sewn to the skin edges with a continuous no. 2 nylon suture.

Stage II: Intraoperative Reassessment for Abbreviated Laparotomy

An underemphasized decision point during staged laparotomy is when to transfer the patient from the operating room (OR) to the SICU. Three key issues must be addressed: (1) Is there residual mechanical bleeding? (2) Is packing necessary? (3) Is this heroic care futile? Although prompt transfer for completion of resuscitation may be cost-effective, premature departure with ongoing mechanical bleeding may lead to an inexorable bloody vicious cycle in the SICU. Conversely, there are select cases in which packing may not be necessary once the patient's coagulation status has improved. Experience has shown that abdominal packing is not an innocuous procedure. Finally, there are patients with massive irreversible head injuries in whom extensive cerebral disruption is driving the progressive coagulopathy. With ongoing intracranial pressure (ICP) monitoring and active neurosurgical participation, care of these patients should be declared futile in the OR to avoid further waste of blood products and personnel time. For these reasons, in the patient who requires abdominal packing for acute hemorrhage control we close the abdomen with towel clips and commit 30 minutes, by the OR clock, to focusing our collective efforts (anesthesia/surgery/blood bank) on reversing the factors provoking the coagulopathy.

Towel clip closure of the abdomen begins to address the iatrogenic component of accidental hypothermia. The other standard maneuvers include placing an aluminum foil turban on the head and Bair Hugger on the lower extremities, insinuating a heated ventilator cascade, and using warming devices for all infused fluids. Continuous chest tube lavage is employed for moderate hypothermia (< 35°C), but if the temperature falls to less than 33°C we prefer the continuous arteriovenous warming technique developed by Gentillelo et al. [21]. To minimize the adverse effects of cellular shock and repeated ischemia–reperfusion events, oxygen delivery is optimized via volume [pulmonary capillary wedge pressure (PCWP $>$ 15 mmHg)] and hemoglobin (Hb $>$ 12/de) loading [22, 23]. Theoretically, aggressive rewarming should not precede effective resuscitation because of the risk of oxygen supply–demand imbalance [24]. Although controversial, we administer sodium bicarbonate for a refractory metabolic acidosis at pH < 7.20. An active dialogue with the blood bank is particularly important at this juncture to ascertain the needs for blood component repletion (platelets, fresh frozen plasma, cryoprecipitate). A variety of replacement formulas have been proposed [25, 26], but once the blood vicious cycle is entered the process becomes empiric.

After this 30-minute intensive team effort to optimize the physiologic status of the patient, the towel clips are removed and the abdomen reassessed. Packs, except those successfully tamponading major hepatic venous injuries, are withdrawn sequentially to determine efficacy as well as necessity. Indeed, there are cases in which the packing can be completely removed; and without recurrent bleeding, the abdomen is closed primarily. On the other hand, it is not uncommon to discover residual mechanical bleeding that demands further hemostatic measures and overlooked intestinal lesions that require stapling prior to definitive packing. Furthermore, repacking provides an opportunity to reduce contamination via lavage and débridement of clearly nonviable tissue. With bleeding effectively controlled, the abdomen is then reclosed as outlined in stage I. Whether towel clip closure or a plastic silo is employed, there is considerable fluid loss via the abdominal wound for the first 24 to 72 hours. Therefore we position two closed suction drains (Jackson-Pratt) externally on the lateral abdominal wall and enclose the entire area with an iodine-impregnated adhesive drape (Ioban) to control the obligatory fluid collection (Fig. 5).

Stage III: Physiologic Restoration in the SICU

Priorities in the SICU focus on restoring the global physiologic status of the patient. The major goal is to arrest the bloody vicious

Table 2. Indications for abbreviated laparotomy.

1. Inability to achieve hemostasis owing to a recalcitrant coagulopathy
2. Inaccessible major venous injury (e.g., retrohepatic vena cava, pelvic veins)
3. Time-consuming procedure in the patient with suboptimal response to resuscitation (e.g., pancreaticoduodenectomy, complex vascular reconstruction)
4. Management of extraabdominal life-threatening injury (e.g., active pelvic hemorrhage necessitating angiography, torn thoracic aorta)
5. Reassessment of intraabdominal contents (e.g., compromised intestinal blood supply due to extensive mesenteric injuries)
6. Inability to reapproximate abdominal fascia due to splanchnic reperfusion-induced visceral edema (e.g., following protracted shock that requires massive fluid administration)

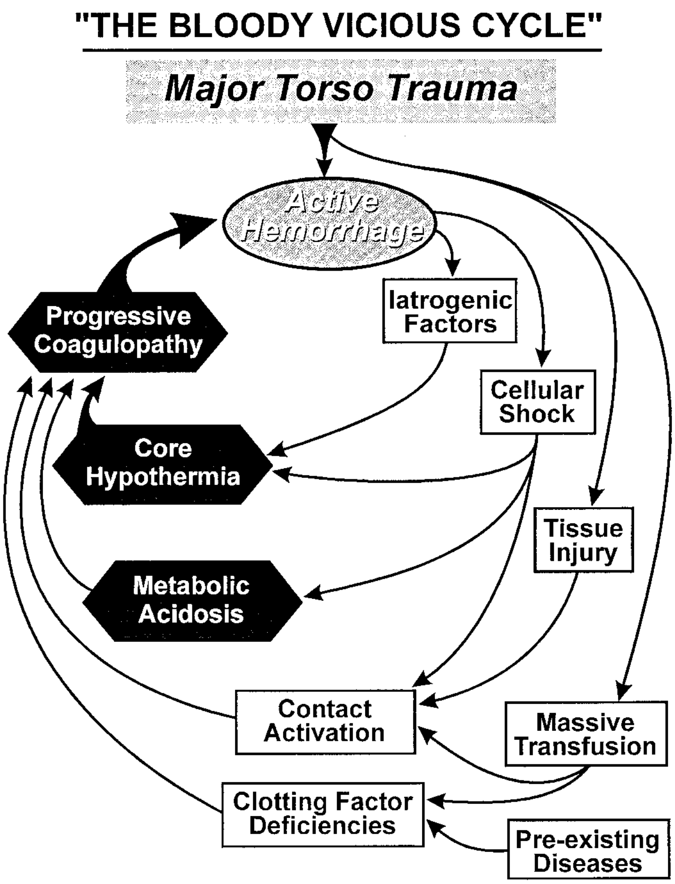

Fig. 1. Pathogenesis of the bloody vicious cycle after severe injury is multifactorial, but progressive core hypothermia and persistent metabolic acidosis are pivotal. (From Moore [1], with permission.)

Table 3. Conditional probability of developing life-threatening coagulopathy.

Conditions	Probability (%)
No risk factor	1
ISS > 25	10
ISS > 25 + SBP < 70 mmHg	39
ISS > 25 + pH < 7.10	58
ISS > 25 + temp < 34°C	49
ISS > 25 + SBP < 70 mmHg + temp < 34°C	85
ISS > 25 + SBP < 70 mmHg + pH < 7.10 + temp < 34°C	98

ISS, injury severity score; SBP, systolic blood pressure; pH, arterial blood pH; temp, core body temperature.

Fig. 2. A balloon device fashioned from a Penrose drain may be highly effective for internal tamponade of bilobar transfixing penetrating wounds to the liver.

cycle (Fig. 1), and the fundamental objectives are those outlined in the 30-minute reassessment period of stage II. Our resuscitation targets are an oxygen delivery index > 600 ml/min/m^2, oxygen consumption index > 150, and lactate < 2.5 mmol/L within 12 hours [22, 23]. Serum lactate may rise paradoxically during early reperfusion but should fall with a sustained hyperdynamic response. Inotropic support is required frequently but should be reserved until volume and hemoglobin loading have been accomplished. Rewarming the patient is pivotal for reversing coagulopathy and should be vigorously pursued until the core temperature is less than 35°C. Blood components should be administered until the PT and PTT are < 1.25 times normal, the platelet count is > 100,000/mm^3, and the fibrinogen level is > 100 mg/de. Finally, mechanical ventilation is optimized to ensure adequate arterial oxygen saturation while minimizing volutrauma and negative effects on the heart.

A common but often insidious complication of abbreviated laparotomy is the abdominal compartment syndrome (ACS), that is, the adverse physiologic consequences of an acute increase in intraabdominal pressure (IAP). In our prospective study of 145 injured patients requiring emergent laparotomy and SICU admission, 21 (14%) developed ACS; 14 of the 21 (67%) had undergone abdominal packing and staged laparotomy [27]. In fact, there is often a delicate balance between effective pressure tamponade of capillary bleeding and the untoward effects of an elevated IAP. The pathophysiologic consequences of ACS have been well characterized [28–33]. In sum, the adverse effects include impaired cardiac work, com-

Fig. 3. Towel clip closure of the abdominal cavity is preferred for staged laparotomy because it can be performed quickly and is readily reversible.

Fig. 4. A temporary silo fashioned from a plastic bag may be necessary to enclose the abdominal contents when there is extensive reperfusion-induced visceral edema.

Fig. 5. Fluid loss is considerable from the abdominal cavity during the first 24 to 72 hours. Consequently, closed suction drains are placed externally on the abdominal wall, and the entire area is enclosed in an iodine-impregnated adhesive drape.

Table 4. Grading the abdominal compartment syndrome.

Grade	Bladder pressure (mmHg)	Recommendation
I	10–15	Maintain normovolemia
II	16–25	Hypervolemic resuscitation
III	26–35	Decompression
IV	> 35	Decompression and reevaluation

Table 5. Organ dysfunction per postinjury ACS grade.

	Renal	Pulmonary	Cardiovascular (%)	
Grade	UO < 0.5 ml/kg/hr (%)	PAP > 45 (%)	SVR > 1000	DO_2I < 600
I	—	—	—	—
II (n = 5)	0	40	20	20
III (n= 14)	65	78	65	57
IV (n = 2)	100	100	100	100

PAP, peak airway pressure (cm H_2O); DO_2I, oxygen delivery index (ml O_2/min/m^2); SVR, systemic vascular resistance (dyne/s/cm^{-5}); UO, urine output (ml/min).

promised pulmonary function, and reduced splanchnic perfusion (except adrenal). Clinically, the most conspicuous signs of ACS are progressive oliguria and advancing hypoxemia. Cardiac output is decreased secondary to elevated systematic vascular resistance, reduced myocardial compliance, and diminished venous return, underscoring the importance of maintaining preload in the setting of increased IAP. Pleural pressure increases proportionally with the abdominal pressure, thus artifactually increasing the PCWP readings (similar to the effects of positive end-expiratory pressure, or PEEP). Pulmonary embarrassment appears to be primarily mechanical; that is, increased IAP elevates the diaphragm, thereby compressing the lungs. Thus adequate ventilation is achieved at the expense of increased airway pressure (reduced compliance). Compounded by elevated pulmonary vascular resistance, hypoxia ensues as a result of ventilation–perfusion mismatch. Renal dysfunction is believed to be the net result of renal vein compression, renal parenchymal compression, and increased total renal vascular resistance.

As originally emphasized by Kron et al. [34], the most accurate and simple method for detecting an evolving ACS is to measure the bladder pressure via a Foley catheter [35]. A practical alternative is to determine gastric pressure through a nasogastric or gastrostomy tube, but the readings are less reliable [36]. Our general approach to postoperative abdominal hypertension is based on the relative pressure elevation (Table 4) and the patient's physiologic response. In a prospective study [27], we attempted to correlate the level of IAP with the incidence of organ dysfunction (Table 5). Based on this experience, we approach ACS according to the IAP grade. Grade I (< 15 mmHg) is usually inconsequential in the setting of normovolemia, and most patients tolerate grade II (< 25 mmHg) with volume expansion. The subclinical reduction in splanchnic blood flow [31], however, may represent a significant risk factor for multiple organ failure (MOF) [37]. Indeed, MOF is the most frequent cause of death following abdominal packing. Increased IAP may also elevate the ICP. Thus abdominal decompression may be warranted earlier in patients with associated head injury. Grade III (26–35 mmHg) is physiologically critical and, with persistent oliguria or peak alveolar pressure > 50 mmHg, warrants semiurgent decompression. This may be accomplished by simply removing the central abdominal towel clips in the SICU. Grade IV (> 35 mmHg) suggests ongoing arterial bleeding and should be addressed by emergent formal reexploration in the OR.

Stage IV: Return to OR for Definitive Procedures

Timing the return to the OR is governed by (1) the indication for abbreviated laparotomy; (2) the injury pattern; and (3) the physiologic response in the SICU. Patients with persistent bleeding (> 2 units of red blood cells per hour × 3 hours) despite correction of hypothermia and acidosis and restoration of clotting warrant prompt intervention. Angiography with selective embolization is done prior to reexploration if packing was required for major liver injuries or pelvic fracture hemorrhage [38]. Additionally, patients who develop grade IV ACS (Table 4) undergo immediate reoperation. Note that postoperative bleeding is not a prerequisite for the development of advanced ACS. Indeed, we have encountered small bowel infarction secondary to intestinal reperfusion-induced ACS (> 40 mmHg) following prolonged cardiopulmonary resuscitation.

The remaining patients who have been packed for hemorrhage control are returned to the OR within 24 hours after injury for removal of packs, clotted blood, and fluid collections; débridement of dead tissue; reconstruction of digestive tract injuries; and jejunal feeding access with gastric decompression. We believe early reoperation is important to reduce the local immunologic provocation from these postinjury by-products and foreign material, which may result in an exaggerated systemic inflammatory response syndrome (SIRS). Occasionally, recurrent bleeding necessitates repacking. If this occurs following the extraction of perihepatic tamponade for a retrohepatic vena caval tear, we have employed transhepatic venous stenting for definitive hemorrhage control prior to another attempt at packing removal [38].

Scheduled reoperation for patients who have required Bogota bag closure because of extensive reperfusion-induced gut distension, on the other hand, is generally delayed 48 to 72 hours, awaiting sufficient edema resorption to allow primary abdominal fascial closure. This decision is facilitated by direct inspection of the small intestine via the plastic window, corroborated by normalization of the IAP.

Stage V: Abdominal Wall Closure/Reconstruction

The final challenge of staged laparotomy is closure of the abdomen in those patients in whom fascial approximation is precluded by fascial retraction (multiple delayed procedures) or abdominal wall loss (trauma or infection). The impetus to achieve structural integrity is based on the importance of early mobilization in the SICU and long-term functional recovery. The optimal method of abdominal wall reconstruction, however, remains unsettled. The usual approach is to bridge the fascial defect with a synthetic mesh template to facilitate secondary wound healing. The material of choice has changed over the past decade, driven largely by the recognized risk of intestinal fistulization in these complicated cases [39–41]. In fact, we have encountered complex enteric fistulas with absorbable (polyglactin and polyglycolic acid) and permanent (polypropylene and nylon) mesh when positioned over exposed gut. Although polytetrafluoroethylene (PTFE) avoids

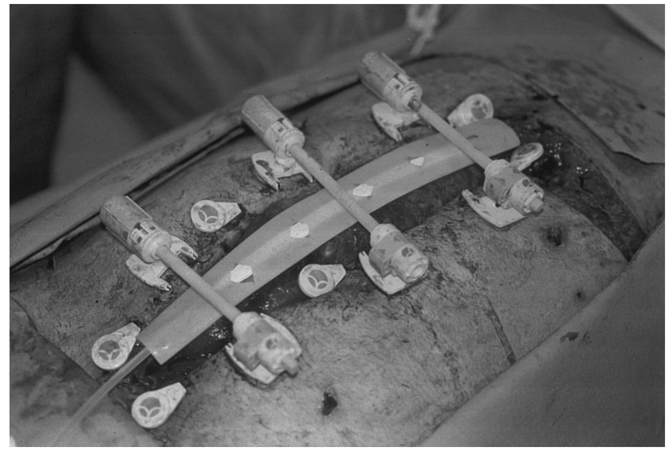

Fig. 6. Abdominal wall closure may be facilitated with tension-loaded skin fixation devices, employing latex rubber to protect the underlying viscera during skin reapproximation.

fistula formation because it does not adhere to the serosal surface, it is prohibitively expensive and becomes infected readily if not covered by skin. Latex rubber and Silastic are alternatives to PTFE as a temporary fascial bridge but ultimately require removal because they are an unwelcomed foreign material.

Our approach to delayed abdominal wall closure is individualized according to the peritoneal environment. When the fascia cannot be adjoined, our goal is to close the skin as soon as possible. Exposed gut becomes inflamed and thickened, and it is prone to develop fistulas. If there is sufficient omentum to protect the underlying viscera, an absorbable mesh is sutured to the free edge of the open fascia. In the SICU the mesh is loosely covered with moistened gauze as the skin margins are closed progressively (1–5 days) with tension-loaded fixation devices. If there is inadequate omentum, latex rubber or a Silastic sheet is placed temporarily over the exposed gut as the skin is gradually approximated (Fig. 6). In the hostile abdomen (peritoneal infection or active gastrointestinal leak), gauze packing is the mainstay of treatment until the contamination is controlled and a granulation bed matures sufficiently to accept skin grafting. A variety of reconstructive procedures, including bilateral fascial release, are available for more extensive abdominal wall defects [17, 18, 36], but specifics are beyond the scope of this discussion.

Résumé

L'objectif principal de la laparotomie ≪par étapes≫ est de réaliser le traitement définitif des lésions d'une façon calculée, par paliers, basé sur la tolérance physiologique du patient. Ce concept important est le résultat d'une expérience collective portant sur le traitement de lésions abdominales massives, mais celui-ci certainement peut s'étendre vers des procédés de chirurgie à froid ainsi qu'au traitement des problèmes chirurgicaux des autres compartiments du corps humain. L'impossibilité d'obtenir une hémostase satisfaisante en raison d'une coagulopathie incontrôlable représente l'indication la plus fréquente de cette modalité thérapeutique. Les autres situations critiques pouvant faire l'objet d'une telle attitude comprennent les lésions veineuses majeures, inaccessibles, la coexistence d'autres lésions extra péritonéales

menaçant le pronostic vital, le doute de la viabilité de certains organes et l'impossibilité de fermer les aponévroses abdominales en raison de l'œdème viscéral de re-perfusion. Les stades décisionnels critiques de la laparotomie ≪par étapes≫ comprennent: I — la sélection des patients, II — la ré-évaluation peropératoire, III — la réanimation en soins intensifs, IV — le retour en salle d'opération pour une chirurgie définitive, et V — la reconstruction de la paroi abdominale. Le syndrome de compartiment abdominal (SCA) est une complication fréquente et insidieuse de la laparotomie ≪par étape≫. En fait, pendant les phases II et III, on joue sur un équilibre délicat entre d'un cτoé, l'effet bénéfique du tamponnement du saignement capillaire et de l'autre, les effets néfastes de l'hyperpression intra-abdominale. Pendant les phases IV et V, le dilemme est de choisir le moment propice pour la fermeture pairétale afin de réduire les pertes protéiniques et faciliter la mobilisation du patient.

Resumen

El objetivo fundamental de la laparotomía en etapas es lograr el tratamiento operatorio definitivo de manera calculada y progresiva, teniendo en cuenta la tolerancia fisiológica del paciente. Tan importante concepto ha surgido de la experiencia colectiva en el manejo de lesiones abdominales masivas, pero también se aplica a procedimientos operatorios electivos sobre otros compartimentos del torso.

Se reconoce que la imposibilidad de lograr hemostasia en casos de coagulopatía recalcitrante constituye la indicación más frecuente de laparotomía en etapas en pacientes traumatizados, aunque también está indicada en otras situaciones tales como lesiones venosa inaccesibles, lesiones extraperitoneales concomitantes que ponen en peligro la vida del paciente, viabilidad precaria de las vísceras abdominales y la imposibilidad de reaproximar la fascia abdominal por edema de reperfusión en las vísceras.

Las fases de importancia crítica en el proceso de decisión sobre laparotomía en etapas comprenden: I - selección del paciente, II - re-evaluación intraoperatoria, III - recuperación fisiológica en la unidad de cuidado intensivo, IV - retorno al quirófano para practicar procedimientos definitivos y V - reconstrucción de la pared abdominal. El síndrome de compartimiento abdominal es una complicación común, en ocasiones insidiosa, de la laparotomía en etapas. En realidad, en el curso de las fases II y III con frecuencia ocurre un delicado balance entre la presión efectiva de taponamiento de la red capilar sangrante versus los efectos indeseables del síndrome de compartimiento abdominal. En las fases IV y V con frecuencia se presenta el dilema pertinente al cierre del contenido abdominal para reducir la pérdida de proteína y facilitar la movilización del paciente.

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Invited Commentary

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The detrimental effects of hypothermia on the coagulation system have been known since 1957 [1]. Since then it has been shown that hypothermia is associated with a wide array of disorders, including increased susceptibility to skin infection, hypokalemia, impaired myocardial function, respiratory depression, and negative nitrogen balance [2–4]. Hypothermia increases the overall mortality, and hypothermic patients spend more time in the recovery room (increased costs) and in hospital [2–5]. Heat loss during open operation results from a cool operating room temperature, evaporation from surgical skin preparations, exposed body cavities, and the use of cold irrigation fluids [6, 7]. Increased heat loss in the field before operation and increased operating time only aggravate the problems.

Coagulopathy—essentially due to dilution, the result of massive fluid resuscitation, and hypothermia once installed—increases blood loss and makes surgical hemostasis difficult if not impossible [8]. Persistent or repeated hypotension results in metabolic acidosis: The normal cell physiology is altered; and as metabolism changes from aerobic to anaerobic, lactic acidosis results. Metabolic acidosis increases when therapeutic procedures such as aortic clamping, vasopressor support, and massive transfusions combine with impaired myocardial performance. Persisting in the operation when hypotension cannot be controlled or when new or repeated hemorrhage is a threat means creating an inextricable situation under which the patient becomes a trauma victim once again. In this case, however, the culprit is the surgeon.

The indications for abortion and closure, even if makeshift or temporary, are not confined to abdominal trauma or to the trauma patient alone. This technique has wide implications. It may be indicated during any operation (abdominal or not) that because of its complexity, an intraoperative mishap (e.g., unexpected hemorrhage), or the nature of the disease (diffuse peritonitis, intraabdominal abscess, complicated abdominal vascular surgery) the risks of increased intraabdominal pressure (ACS) take precedence over the cure. Abridged operation and planned reintervention can also be indicated in the obstetric patient not only when the pregnant woman is the victim of trauma but also specifically during the third trimester of pregnancy in life-threatening conditions such as spontaneous liver rupture, abdominal pregnancy, or postpartum hemorrhage due to uterine atony and in the occasional patient with placenta accreta, increta, or percreta [9]. Another form of damage control in gastrointestinal surgery, handed down from master to disciple, without having gone through any controlled methodology, has stood the test of time: refusing to anastomose when frank peritonitis is present [10–12].

Knowing when to stop is a difficult lesson to teach, both to one's students and to one's self. The nefast consequences of prolonging an operation *coût que coût,* however, can lead to disastrous results and unwarranted high mortality. Knowing when to stop is not a sign of abandon but, rather, recognition that the patient can benefit from this tactical enterprise and may survive an otherwise inextricable situation. Stopping the hemorrhage, limiting contamination, and getting out of the abdomen must be done early, well before an irrereversible situation is attained. This is food for thought, as there are certainly many stereotypical situations that require an early decision to adopt this tactic. Let the surgeon beware: One's pride is not at stake, too much may be harmful (for the patient, not for the surgeon).

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