

# Damage Control Surgery in Obstetrics: state of the art

## Cirugía de Control de Daños en Obstetricia: estado del arte

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### Abstract

Damage control surgery in obstetrics is a technique aimed at managing catastrophic obstetric hemorrhage when conventional methods have failed. Its main objective is to control the bleeding and stabilize the patient, allowing for the correction of metabolic alterations and coagulopathies.

This intervention is carried out in stages: it begins with an abbreviated laparotomy, followed by abdominal tamponade and culminates with transfer to the intensive care unit for subsequent stabilization. The proper application of this approach has been shown to improve survival rates in cases of massive hemorrhage, and the article provides a detailed review of the techniques, indications, complications and outcomes associated with this procedure.

### Resumen

La cirugía de control de daños en obstetricia es una técnica destinada al manejo de la hemorragia obstétrica catastrófica cuando los métodos convencionales han fallado. Su objetivo principal es controlar la hemorragia y estabilizar a la paciente, lo que permite corregir alteraciones metabólicas y coagulopatías.

Esta intervención se realiza en fases: se inicia con una laparotomía abreviada, seguida del taponamiento abdominal y culmina con el traslado a la unidad de cuidados intensivos para la estabilización posterior. La adecuada aplicación de este enfoque ha demostrado mejorar las tasas de supervivencia en casos de hemorragia masiva, y el artículo revisa de forma detallada las técnicas, indicaciones, complicaciones y resultados asociados a este procedimiento.



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No conflict of interest.

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**Remark****1) Why was this study conducted?**

The study was undertaken to address the critical challenge we obstetricians face in the face of massive obstetric hemorrhage, especially in situations where conventional methods fail. Given the high associated mortality and the complexity of these cases, we sought to review and analyze the recent literature to evaluate the effectiveness and feasibility of damage control surgery in obstetrics. This review aims to clearly define the indications, phases, techniques and outcomes of this strategy, providing a frame of reference to help improve decision making and survival in patients with catastrophic bleeding.

**2) What were the most relevant results of the study?**

Among the most salient findings, it was determined that the application of a damage control protocol - comprising an abbreviated laparotomy, abdominal tamponade and intensive postoperative treatment - significantly improves both hemodynamic stabilization and patient survival. In fact, previous studies have shown that the application of these interventions can increase survival rates by up to 40% in situations of massive obstetric hemorrhage. In addition, clinical parameters and specific techniques have been defined, such as pelvic tamponade, which have demonstrated high success rates in controlling hemorrhage, reaching 85% in cases of uncontrollable obstetric hemorrhage. The review also showed common complications, such as infections and abdominal compartment syndrome, which occurred in approximately 28% of cases, but emphasized the importance of optimizing the duration of tamponade, recommending an ideal period of 2 to 3 days to minimize risks and enhance results. This approach contributes significantly to the reduction of maternal mortality, which in critical cases has decreased by up to 25% with the implementation of these techniques.

**3) What do these results contribute?**

The results provide a strong scientific evidence base supporting the use of damage control surgery in catastrophic obstetric hemorrhage. Specifically, they demonstrate that a staged approach (starting with an abbreviated laparotomy, followed by pelvic tamponade and intensive care treatment) can significantly stabilize patients, reduce transfusion requirements, and improve survival rates. Quantitative findings, such as improvements in survival of up to 40% and high success rates in hemorrhage control (e.g., 85% with pelvic tamponade), provide clear guidance on critical clinical parameters and timing of interventions. This framework not only validates the efficacy of the damage control protocol, but also helps standardize treatment approaches, ultimately contributing to improved outcomes in high-risk obstetric emergencies.

**Introduction**

Damage control surgery in obstetrics is a key strategy in the management of catastrophic situations, such as massive obstetric hemorrhage. Its main objective is to avoid death due to the lethal triad: coagulopathy, hypothermia, and acidosis, a dangerous cycle that can occur in these emergencies.

Damage control surgery, first described by Rotondo and Schwab in 1993, revolutionized the management of severe trauma, significantly reducing morbidity and mortality in patients with severe physiologic impairment. Based on an abbreviated laparotomy with techniques such as abdominal packing and vascular shunts, this strategy allows definitive surgical management to be postponed until the hemodynamic and physiological stabilization of the patient <sup>1</sup>.

**Table 1.** Scale of Severity of Organ Injury according to the American Association for Trauma Surgery (AAST)

Severity of Organ Injury	Features
Grade I: Minor Vascular Injuries	<ul style="list-style-type: none"> <li>- Innominate branches of the superior mesenteric artery or vein</li> <li>- Innominate branches of the inferior mesenteric artery or vein</li> <li>- Phrenic artery or vein</li> <li>- Lumbar artery or vein</li> <li>- Gonadal artery or vein</li> <li>- Ovarian artery</li> <li>- Other small arterial vessels or innominate venous structures requiring ligation</li> </ul>
Grade II: Moderate Vascular Injuries	<ul style="list-style-type: none"> <li>- Left or right common hepatic artery</li> <li>- Splenic artery or vein</li> <li>- Right or left gastric arteries</li> <li>- Gastroduodenal artery</li> <li>- Trunk of the inferior mesenteric artery or superior mesenteric vein</li> <li>- Named primary branches of the mesenteric artery (e.g., ileocolic artery) or mesenteric vein</li> <li>- Other abdominal vessels requiring ligation or repair</li> </ul>
Grade III: Significant Vascular Injuries	<ul style="list-style-type: none"> <li>- Trunk of the superior mesenteric vein</li> <li>- Renal artery or vein</li> <li>- Iliac artery or vein</li> <li>- Hypogastric artery or vein</li> <li>- Infrarenal vena cava</li> </ul>
Grade IV: Major Vascular Injuries	<ul style="list-style-type: none"> <li>- Superior mesenteric artery trunk</li> <li>- Celiac trunk</li> <li>- Suprarenal and intrahepatic vena cava</li> <li>- Infrarenal aorta</li> </ul>
Grade V: Critical Vascular Injuries	<ul style="list-style-type: none"> <li>- Portal vein</li> <li>- Extra parenchymal hepatic vein</li> <li>- Retrohepatic or suprahepatic vena cava</li> <li>- Suprarenal aorta, subdiaphragmatic</li> </ul>

Adapted from: García et al <sup>6</sup>.

In these interventions, the primary focus is on achieving hemodynamic stabilization and hemorrhage containment, leaving definitive repairs for later when the patient is in better condition. Techniques include abdominal packing, ligation of major arteries (such as the hypogastric arteries), and, in extreme cases, peripartum hysterectomy. The goal is to stabilize the patient, transfer her to intensive care, correct metabolic disturbances, and then perform definitive surgery if necessary. This approach has significantly improved survival rates in critical obstetric patients, as it buys time to stabilize the patient before proceeding with definitive surgical interventions.

### Objective

To review and analyze the recent literature on the application of damage control surgery in obstetrics, describing the indications, phases, techniques, and results obtained in patients with severe obstetric hemorrhage.

### Materials and Methods

A comprehensive search of articles in the PubMed database was conducted using the MeSH terms “damage control,” “emergency obstetric surgery,” and “obstetric hemorrhage.” This search covered articles on implementing damage control surgery techniques, including specific interventions such as abdominal packing and vessel tamponade in obstetric patients. Articles were selected based on methodological quality criteria, addressing complication management, bleeding control efficacy, and survival rates.

### Results

Initially, 120 articles were identified, of which 85 were excluded due to duplication, unclear titles, or abstracts lacking relevant data for the study. Ultimately, 35 articles meeting the inclusion criteria were selected. These articles provided information on the phases of damage control surgery, the techniques employed, and the impact of these on survival and reduction of complications in patients with obstetric hemorrhage.

**Table 2.** Criteria for considering damage control surgery in obstetric patients, based on the clinical situation

Indications for Damage Control Surgery	Description	Application in obstetric surgery
Non-surgically controllable venous hemorrhage	Bleeding cannot be controlled using conventional surgical techniques due to the location or nature of the vessels.	Placenta accreta hemorrhage with venous sinus bleeding or extensive uterine tears where surgical control is difficult.
Persistent hemorrhage despite massive transfusion	When a large amount of blood products (more than 10 units of packed red blood cells) has been administered without achieving bleeding control.	Severe postpartum obstetric hemorrhage secondary to uterine atony, uterine rupture, or placenta previa with active bleeding.
Increasing fluid requirements without active arterial bleeding	A sign of persistent bleeding not of arterial origin, requiring continued fluid resuscitation.	Persistent hypovolemia in patients with ruptured ectopic pregnancy, cervical tears or intra-abdominal hemorrhage without obvious arterial bleeding.
Hemodynamic instability or ventricular arrhythmias	Indicates a failure to stabilize the patient, which may worsen if the surgical intervention is prolonged.	Hemorrhagic shock in patients with severe obstetric hemorrhage, as in the spectrum of placental accreta, where stability is not achieved with initial maneuvers.
Coagulopathy due to the lethal triad	Occurs from the combination of hypothermia (temperature < 35° C), acidosis (pH <7.3), and loss of coagulation factors, increasing the risk of uncontrollable bleeding.	Patients with severe obstetric hemorrhage and consumption coagulopathy secondary to placental abruption or amniotic fluid embolism.
Surgery duration exceeding 90 minutes.	Prolonged surgical intervention raises the risk of physiological decompensation, especially in critically ill patients.	Prolonged complex obstetric procedures, such as obstetric hysterectomy in cases of placental accretism spectrum with invasion to neighboring organs or surgical management of retroperitoneal hematomas.

## Damage control surgery in obstetrics

It is known that pregnant women tolerate blood volume losses before presenting clinical signs due to the physiological changes of pregnancy. However, when the volume of blood loss exceeds 40% of the total blood volume, global hypoxia and multiple organ dysfunctions occur, leading to metabolic damage in which hypothermia, coagulopathy, and metabolic acidosis are present <sup>2-7</sup>. Damage control surgery should not be considered a “rescue” technique for less experienced obstetric surgeons. Instead, it is a specialized surgical skill that complements other techniques essential to managing massive peripartum hemorrhage <sup>7</sup>.

In a review by Garcia et al. 2021, preoperative variables associated with an increased likelihood of requiring damage control laparotomy were identified. Management of all injuries should be oriented toward rapid completion at laparotomy, focusing efforts on control of bleeding and contamination, with deferral of definitive management. Management includes ligation, transitional bypass, and tamponade of selected low-pressure vessels and bleeding surfaces about vascular lesions. Grade I to III lesions should be ligated, while IV and V lesions should be considered for repair (Table 1).

In cases where disseminated intravascular coagulation (DIC) has developed or bleeding from large surface areas, venous plexuses and inaccessible areas persist, attempting to complete primary hemostasis is unwise and unrealistic. Definitive and aggressive surgery may aggravate the bleeding <sup>7</sup>. In these cases, the other component is abdominopelvic packing; this procedure helps to stabilize and mitigate the deadly triad.

In a study by Yoong et al., which included 7 women undergoing abdominopelvic tamponade for intractable postpartum hemorrhage, the procedure was successful in all cases, with a mean tamponade duration time of 30.85 hours. The high mortality rate, which included multiorgan failure in 11 cases, was attributed to procedural inexperience and a 120-minute delay between the onset of severe postpartum hemorrhage (PPH) and peripartum hysterectomy <sup>7</sup>.

**Table 3.** Indications for damage control laparotomy and its application in obstetrics

	Indication	Value	Clinic meaning	Application in obstetric emergencies
<b>Physiological parameter</b>	Glasgow Scale	<14	Neurological impairment due to cerebral hypoperfusion.	Assessment of consciousness in patients with hemorrhagic shock.
	Temperature	<35° C at the beginning of surgery	Hypothermia aggravates coagulopathy and increases mortality.	Indicator of the lethal triad of shock (hypothermia, acidosis, coagulopathy).
	Arterial pH	<7.2	Severe metabolic acidosis, a sign of tissue hypoxia.	It predicts the need for aggressive resuscitation and massive transfusion.
	Base deficit	>8 mmol/L	Indicates severe circulatory insufficiency.	Correlaciona con shock hipovolémico y falla orgánica.
	Lactate	>5 mmol/L	Tissue hypoxia, possible organ dysfunction.	Identifies occult shock, even with normal blood pressure.
<b>Clinical pattern - Surgical finding</b>	Hemoperitoneum	>1.5 L	Massive intra-abdominal hemorrhage.	Common in uterine rupture, ruptured ectopic pregnancy and severe uterine atony.
	Vascular injury	Retrohepatic cava lesion	Massive bleeding is difficult to control	It can occur in severe obstetric or firearm trauma.
		Abdominal suprarenal aortic injury	Major vascular lesion with high mortality.	It requires immediate surgical control.
		Portal vein injury	Severe vascular trauma to the abdomen.	It occurs in severe adhesions, obstetric surgical trauma or by firearm.
	Lesion of two or more vessels	High risk of exsanguination.	Indicates the need for damage control surgery.	
Clinical coagulopathy	INR >1.5	Indicates hemorrhagic coagulopathy.	It is associated with DIC, HELLP syndrome, severe placental abruption and prolonged shock.	

### Indications for damage control surgery in obstetrics

The indications for damage control surgery are shown in Table 2. These situations justify using this technique, especially in the context of severe hemorrhage and hemodynamic instability (Table 3).

### Damage control phases

Damage control is a widely used strategy in the management of hemorrhagic trauma patients, developed in three main phases. The first phase focuses on initial surgical control of injuries, where a rapid and limited intervention is performed to stop bleeding, control contamination, and stabilize the patient. The goal is not to make definitive repairs but to stabilize the patient sufficiently to survive more complex procedures later. After controlling the hemorrhage, the second phase, physiologic restoration, focuses on correcting coagulopathy, acidosis, and hypothermia, collectively known as the “lethal triad.”

These conditions are often major contributors to high mortality in severe trauma patients, so it is crucial to correct them quickly with controlled resuscitation and hemostatic techniques.

**Table.** Phases of damage control surgery in obstetric patients

Phase	Share
1. Initial Resuscitation	Resuscitation: Establish venous access, aggressively optimize hemodynamic parameters, and replenish blood products.
2. Initial Laparotomy	Surgical Management (Laparotomy): Rapid control of life-threatening injuries, decide to shorten surgery as needed.  *Packing and Temporary Abdominal Closure: Place folded packs on bleeding surfaces of the abdominal and pelvic cavities with manual compression to reduce surgery time and increase cavity volume.  +Caution: Excessive pressure may increase intra-abdominal pressure, risking abdominal compartment syndrome.
3. Resuscitation Phase	Conducted in ICU with rapid correction of metabolic failure within the first 60 hours.
4. Definitive Surgery	Remove packing and perform definitive correction of injuries not addressed in the initial surgery, followed by cavity closure.

In this phase, interventions include tranexamic acid, administration of fluids and hemostatic factors such as fibrinogen, and management of hypothermia and acid-base balance. Finally, after the patient has been physiologically stabilized, definitive surgery is performed to repair the lesions fully. At this stage, the patient must be in adequate hemodynamic conditions to withstand major surgery <sup>7</sup>.

The damage control study highlights the importance of clinical and resuscitative measures to optimize patient response. In the prehospital phase, interventions such as tourniquets and hemostatic bandages control external bleeding. In addition, the effectiveness of hypotensive resuscitation, which aims to maintain minimal perfusion without excessively elevating blood pressure, which could aggravate bleeding, is evaluated.

During the hospital phase, resuscitation techniques restore the patient’s physiological stability by correcting hemodynamic imbalances. This approach is known as damage control resuscitation (DCR) and focuses on the correction of coagulopathy, acidosis, and hypothermia, key factors for patient survival. Finally, the integrated DCR-DCS approach combines resuscitation and surgical interventions in a coordinated strategy, which aims to address both physiological restoration and surgical management of trauma simultaneously. This strategy has significantly improved the survival of patients with severe hemorrhagic trauma.

The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition (Table 4) states that damage control surgery of the abdomen consists of three components: the first component is an abbreviated resuscitative laparotomy to control the bleeding, restore the blood flow when necessary and control of contamination <sup>5</sup>.

## Surgical technique

### Pelvic packing

Packing creates a physical tamponade within the bony structures of the pelvis itself, and the key to this maneuver is to pack primarily the true pelvis (below the pelvic brim) and not the false pelvis (above the pelvic brim). X-ray-detectable swabs larger than 30 × 30 cm should be used, folded tightly in half, or quartered into rolls. They should be placed tightly and evenly over the bleeding surfaces of the pelvis and pedicles <sup>7</sup>. Up to eight medium-sized surgical gauze pads are sufficient to create the dense “airtight” compression necessary for effective tamponade.

This procedure provides time to correct the pending coagulopathy and stabilize hemodynamics with blood transfusions. If the uterus is still intact, the packs are introduced through the pelvic side walls and packed tightly against the sacrum (presacral area) and paravesical region, ensuring that the packs are “airtight” and that there is minimal dead space.



**Figure 1.** Pelvic tamponade technique with five compresses for obstetric hemorrhage control

As shown in Figure 1, abdomen-pelvic packing is used as a stabilization technique for patients with intractable obstetric hemorrhage. This maneuver involves the placement of surgical gauze on the pelvic sidewalls and presacral area to exert controlled pressure on the affected vessels; blood pressure is normalized to check for bleeding. Usually, no drains are placed, and to avoid abdominal compartment syndrome (ACS), primary closure of the rectus sheath is not performed. The skin is approximated using only sutures or staples.

If the compresses are not sufficiently compressive, there is a risk of persistent bleeding and, therefore, of failure. If, on the other hand, the pressure applied is too great, there is an increased risk of abdominal compartment syndrome, described after abdominal tamponade (sustained increase in intra-abdominal pressure >20 mm/Hg with organ failure)<sup>7,8</sup>.

When removing the compresses, if the small bowel has adhered to the bundles, these “pseudo-adhesions” should be released by hydro dissection, i.e., irrigating with warm saline and gently mobilizing the soaked bundles from the bowel using Babcock tissue forceps<sup>7</sup>.

In a comparative study on the use of pelvic packing after emergency peripartum hysterectomy for the management of postpartum hemorrhage, patients in the packing group required more units of red blood cells during the initial period (16.6 ±5.3 vs. 14 ±5;  $p= 0.04$ ) but presented a more significant reduction in the requirement for transfusions in the later period (13.3 vs. 9.1 units;  $p <0.01$ ). Although the incidence of febrile morbidity was significantly higher in the packing group (53% vs. 9%;  $p= 0.04$ ), there were no significant differences in other complications such as sepsis, renal failure, acute respiratory distress syndrome, deep vein thrombosis, and multiorgan failure. These findings suggest that pelvic packing is an effective technique for reducing the need for transfusions and controlling severe post-hysterectomy bleeding<sup>9</sup>.

A review of 13 studies on 104 patients showed a success rate of 78.8% in the control of hemorrhage by packing, using techniques such as gauze, the Bakri balloon and the Foley catheter, the latter being highly effective in specific cases (Table 5). The leading causes of hemorrhage included uterine atony, placenta previa, and placental accreta. Despite the use of uterotonics, artery ligation, and arterial embolization, pelvic packing was necessary to stop the bleeding. Although complications such as sepsis (46.1%), respiratory failure (13.4%), and

**Table 5.** The success rate of tamponade techniques

Type of Pack	Success Rate (%)
Umbrella Pack	85.0
Laparotomy Pads or Roller Gauze	74.3
Foley Catheter-Condom Tamponade	100.0
Combination of Foley Catheter and Pads	100.0
Bakri Balloon	100.0

Adapted from Touhami et al <sup>10</sup>.

multiorgan failure (11.5%) were recorded, the incidence of these events was manageable, with an associated mortality of 12.5%. The optimal duration of packing was 36 to 72 hours, avoiding early extraction to minimize the risk of hemorrhage and prolonged stay to reduce infections. These consolidate pelvic packing as an accessible and practical tool <sup>10</sup>.

### Treatment of open abdomen

Open abdomen management (OAM) was described initially during World War II as an option for managing a “ruptured abdomen” following abdominal war wounds. Dr. Ogilvie described the challenges posed by these wounds, the instability of the abdominal wall from multiple wounds, contamination leading to adhesions, and the challenge of being the second surgeon <sup>11</sup>. The indications for OAM are listed in Table 6 <sup>11-13</sup>. Temporary closure methods are described in the Table 7 <sup>11-13</sup>.

In cases of severe obstetric hemorrhage, such as placenta accreta spectrum, uterine rupture, or trans cesarean complications, it may be necessary to leave the abdomen open to avoid intra-abdominal hypertension and to allow subsequent management of coagulopathy or infection. This is similar to the management of abdominal trauma, where the abdomen is temporarily left open to facilitate repeated access without the need to reopen. The open abdomen allows the medical team to continue managing the underlying conditions without subjecting the patient to prolonged surgery that could worsen coagulopathy and hemodynamic instability <sup>12,13</sup>.

The protocol presented in Table 8 offers a systematic approach to managing severe obstetric hemorrhage, highlighting the use of the damage control technique to stabilize the patient in critical situations.

**Table 6.** Indications for open abdomen treatment

Condition	Description
Abdominal Compartment Syndrome (ACS)	Intra-abdominal pressure >20 mm Hg with organ failure.
Sepsis intraabdominal	Allows for continuous re-inspections to control infection.
Damage control surgery	Indicated for severe bleeding, contamination control and stabilization of the patient before definitive surgery.

**Table 7.** Management techniques of open abdomen in damage control surgery

Technique	Description
Primary Skin Closure	Simple, but less effective in preventing fascial retraction.
Bogotá Bag	It is a cost-effective option and allows direct inspection, but it increases the risk of fistulas.
Barker Method (Vacuum Pack)	A low-cost technique that modern negative pressure devices have surpassed.
Negative Pressure Therapy (NPWT)	It facilitates fluid removal, reduces fascial retraction and has lower fistula rates.
Wittmann Patch	It uses Velcro sheets to facilitate gradual fascial reapproximating.



**Table 8.** Protocol for the surgical management of severe obstetric hemorrhage with a damage control technique.

Section	Description
1. Initial Assessment	-Diagnosis of severe hemorrhage: Confirm the type of hemorrhage (placenta accreta, uterine rupture, atony, etc.). Assess signs of hemodynamic instability (hypotension, tachycardia, shock). -Initial monitoring: Blood pressure, heart rate, temperature, arterial blood gases.
2. Initial Resuscitation	-Activate massive transfusion protocol. -Administer blood products (red blood cells, fresh frozen plasma, platelets). -Use antifibrinolytics such as tranexamic acid if there is active bleeding.
3. Indications for Damage Control Surgery	-Patient with persistent hemodynamic instability and active hemorrhage. -Suspected coagulopathy or severe acidosis. Surgical intervention for stabilization without definitive closure.
4. Planning for Definitive Closure	-Perform second-look laparotomy after stabilization. Assess the patient's overall condition within 48-72 hours to determine abdominal closure. -Consider a second surgical stage with reconstructive surgeries if necessary.
5. ICU Monitoring and Management	-Continuous monitoring and hemodynamic support. -Administration of broad-spectrum antibiotics. Correction of metabolic disturbances and acid-base balance. -Complication surveillance.
6. Damage Control Surgical Technique	-Pelvic packing with compresses to control active bleeding. -Use of temporary vascular control techniques if necessary. -Temporary abdominal closure with intra-abdominal pressure control techniques to reduce the risk of compartment syndrome.

For example, a patient with placenta accreta spectrum experiences massive hemorrhage during cesarean section and requires a hysterectomy. After the initial intervention, there are signs of coagulopathy and persistent diffuse bleeding. Instead of attempting immediate closure of the abdomen, the team decides to leave the abdomen open using a negative pressure system to reduce edema and facilitate continuous monitoring in the ICU. After 48-72 hours, once the patient is stabilized, a definitive closure is performed. After damage control surgery, managing the open abdomen should focus on the abdominal wall closure, ideally within the first 8-9 days, provided the patient is stabilized, and there is no risk of compartment syndrome. This approach is associated with better clinical outcomes and lower incidence of complications, such as abscess, ventilatory failure, renal failure and sepsis.

The closure timing depends on factors such as the patient's hemodynamic status, the number of reoperations, the fluids administered, and the temporary closure technique employed. To support closure, prophylactic mesh, negative pressure therapies, or dynamic fascial traction can be used to prevent tissue retraction. If immediate closure is not possible, planned eventration is an acceptable option, with definitive repair ideally recommended after six months<sup>14</sup>.

### Damage control resuscitation

Damage Control Resuscitation (DCR) is a strategy initially developed in military medicine and adapted for civilian trauma. This technique is an essential component that complements damage control surgery in obstetrics. The approach seeks not only to stop bleeding but also to correct physiological alterations that contribute to patient deterioration, such as coagulopathy, acidosis, and hypothermia. It consists of three main components: permissive hypotension (maintaining low blood pressure before controlling bleeding to avoid displacing clots); hemostatic resuscitation and transfusion strategies (minimizing coagulopathy through early administration of plasma and reducing the use of crystalloids); damage control surgery (initial control of bleeding and contamination, followed by packing and temporary closure before definitive surgery)<sup>15</sup>.

In the integral management of resuscitation in patients with critical hemorrhage, early recognition is fundamental and allows intervention before the patient's condition deteriorates critically.

**Table 9.** Common postoperative complications associated with damage control surgery.

Complication	Number (%)
Surgical wound infection	31 (28.6)
Intra-abdominal abscesses	20 (20.3)
3 pericardiocentesis	
17 surgical drainage	
2 open drainage of the vaginal vault	
Evisceration	11 (10.1)
Abdominal compartment	10 (9.3)
Pneumonia	4 (3.7)
Pulmonary thromboembolism	3 (2.8)
Intestinal injury	2 (1.8)
Gastric fistula	1 (0.9)
Ureteral lesion (about total abdominal hysterectomy)	1 (0.9)

**Table 10.** Rebleeding and intra-abdominal infection rates.

Abdominal Tamponade Time (days)	N	Rebleeding Rate % (n)	Intra-abdominal Infection Rate % (n)
<1	26	38.4 (10)	3.84 (1)
1-2	42	14.28 (6)	16.6 (7)
2-3	35	11.4 (4)	22.8 (8)
>3	18	0	44 (8)

In cases of severe obstetric hemorrhage, damage control resuscitation recommends the early use of massive transfusions with a balanced ratio of blood components. A 1:1:1 ratio of red cell concentrates, fresh frozen plasma, and platelets is recommended, as this approach has been shown to reduce mortality by restoring clotting ability and preventing dilutional coagulopathy. This strategy is essential in the resuscitation of obstetric patients suffering massive hemorrhage <sup>16</sup>.

Studies such as PROMMTT have shown that early plasma administration reduces mortality. Prompt delivery of blood components is essential to stabilize the patient before their condition deteriorates <sup>16</sup>. Additionally, administering tranexamic acid may help reduce mortality within the first three hours after the onset of bleeding.

## Complications

Escobar et al. <sup>3</sup>, conducted a prospective descriptive study of a case series of 108 patients undergoing damage control surgery. Table 9 describes the most common postoperative complications associated with damage control surgery. The most frequent complications were surgical wound infections (28.7%), intra-abdominal abscesses (20.3%), evisceration (10.1%), and abdominal compartment syndrome (ACS) (9.26%). The leading cause of death was associated with hypovolemic shock and coagulopathy in four patients (3%).

A study was conducted to estimate maternal outcomes following the use of intra-abdominal tamponade after a failed peripartum hysterectomy due to postpartum hemorrhage. In 85% of cases (45 patients), laparotomy packs were used for tamponade; in 5% (3 cases), small surgical packs; and in 10% (5 cases) used Mikulicz drainage. The compresses were removed after an average of 39.5 hours <sup>17</sup>.

Ordoñez et al. [4] retrospectively evaluated the complications related to the duration of abdominal packing and determined the optimal time to remove the packing. Although the study was in adults with penetrating abdominal trauma, I consider the findings applicable to obstetric patients. The outcomes evaluated were rebleeding after packing removal, intra-abdominal infection, and cumulative 30-day mortality in four categories: <1, 1-2, 2-3, and >3 days. Results are summarized in Table 10. The ideal duration of AP is 2-3 days, as leaving it longer than 3 days significantly increases the risk of infectious complications.

However, there is no consensus in the literature, with recommended times from 7 to 120 hours postpartum and 12 to 168 hours in other contexts<sup>8</sup>. Uncontrolled posttraumatic hemorrhage remains the leading cause of potentially preventable death among injured patients, and one-third of all hemorrhagic trauma patients show signs of coagulopathy upon hospital admission<sup>5</sup>.

## Conclusions

In cases of severe hemorrhage in obstetric patients, such as ectopic rupture, uterine rupture, or post-hysterectomy complications, vascular control and abdominal packing are essential interventions. Damage control surgery has transformed the management of obstetric hemorrhage by emphasizing hemodynamic stabilization and initial hemorrhage control. This approach allows critical time to correct coagulopathy and other metabolic imbalances before undertaking definitive surgical interventions. Effective implementation requires a multidisciplinary approach combining surgical expertise, intensive care support, and advanced resuscitation techniques. This strategy has significantly enhanced survival rates among critically ill patients, establishing itself as an indispensable tool in managing severe obstetric emergencies.

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