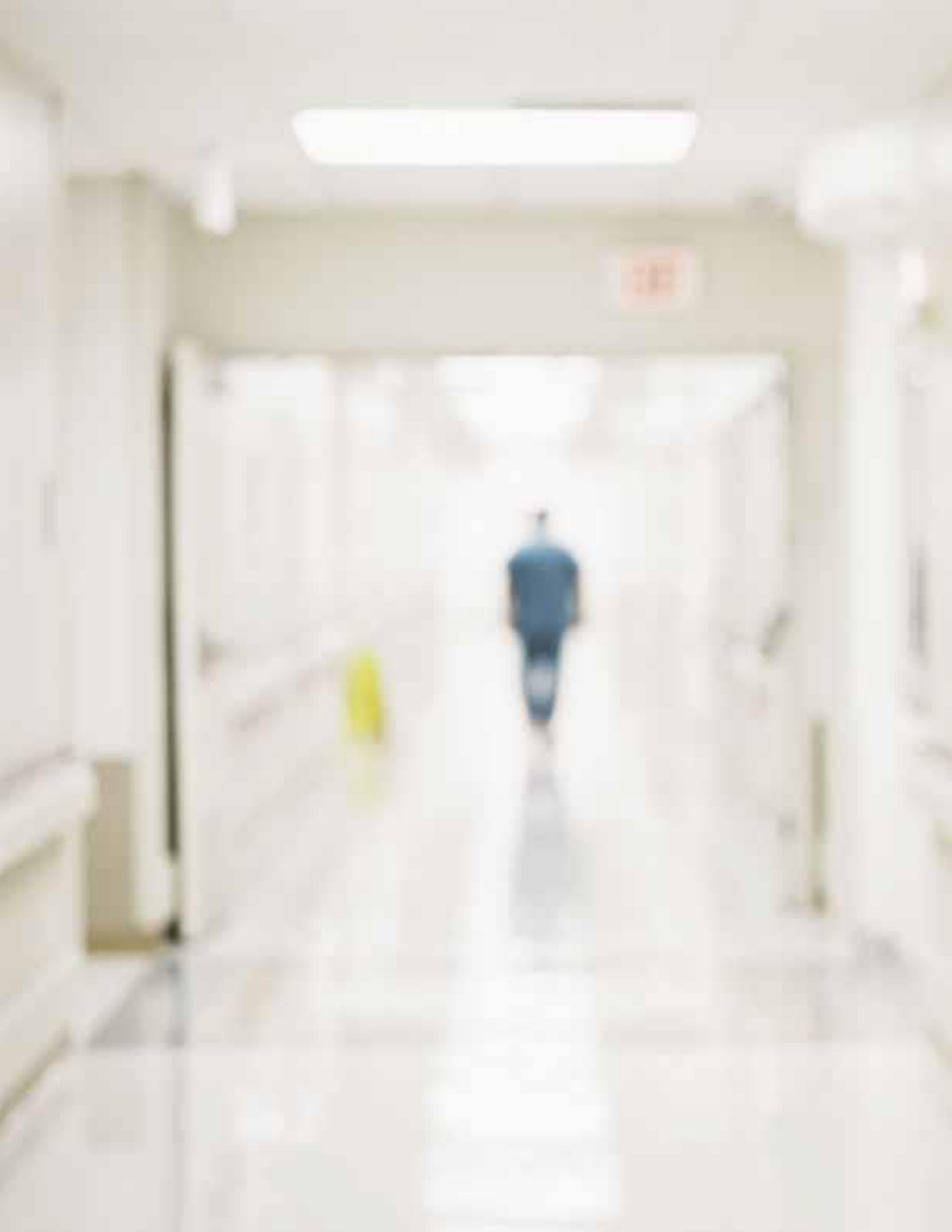

GYNECOLOGIC SURGERY PROBLEMS AND COMPLICATIONS

PART 2

BOB L CARUTHERS, CST, PHD

Except for a few procedures in gynecologic surgery, pelvic anatomy determines the difficulties encountered during the procedure and the most likely complications of pelvic surgery. Pelvic anatomy also provides the surgical responses available, especially during an instance of critical hemorrhage. Most bleeding can be handled in routine fashion with pressure, ligation, or electrocauterization. This article will focus on more specific and critical instances of hemorrhage.

Principles of securing pelvic hemostasis

The standard rules for handling major bleeding can be stated simply and clearly:

- Lacerations to large abdominal and pelvic arteries should be repaired.
- Small openings in large abdominal and pelvic veins should be repaired.
- Large veins with lacerations that are not amenable to suturing should be tied off.
- Of the veins, only the portal can not be tied off. (Tying the vena cava is acceptable under difficult conditions. Bilateral lower-extremity edema will result until collateral return develops to the required sufficiency.)

Common abdominal and pelvic structures that may require special consideration or techniques include the vena cava, internal iliac vein, and common iliac artery. Pregnancy creates special conditions for the gynecologic surgeon to consider. Obstetric DIC, a paradoxical coagulopathy, may require both surgical and medical intervention. An important anatomical reminder for the surgeon and the first assistant is that most potential problems are lateral to the uterus. Specific problems will be considered below.

Puncture to the vena cava

The most common defect in the wall of the vena cava is circular, found above the bifurcation, and caused by evulsion of a perforator vein.[1] The standard procedure follows:

- Apply digital pressure to control hemorrhage.
- Gain exposure.
- Secure vascular instruments.
- Grasp the puncture point with vascular tissue forceps.
- Lift gently and "tent" the vena cava.
- Apply a hemoclip parallel to the normal course of the vena cava.[1]

Laceration to the internal iliac vein

Iliac injuries are more common on the right side. This significant clinical finding is typically the result of trocar insertion with the right hand.[1] The standard procedure is:

- Apply digital pressure to control hemorrhage.
- Use sponge sticks proximally and distally to the bleeding site to occlude the vessel. ("Sponge-on-a-stick" used to press down on the vessel.)
- Stop bleeding at site and gain exposure.
- Place DeBakey vascular clamps proximally and distally to the laceration.
- Use synthetic absorbable suture to tie off the vessel proximally and distally to the laceration site.[1]
- Special care must be taken to avoid injury to the right ureter, which is close to both the artery and vein.[1]

Laceration to the common iliac artery

The iliac injuries are more common on the right side. This significant clinical finding is most commonly the result of trocar insertion with the right hand.[1] The standard procedure follows:

- Apply digital pressure to control hemorrhage.
- Use sponge sticks proximally and distally to the bleeding site to occlude the vessel ("Sponge-on-a-stick" used to press down on the vessel.) Note: Do not apply nonvascular clamps to the artery.
- Stop bleeding at site and gain exposure.
- Place DeBakey vascular clamps proximally and distally to the laceration.
- Use 5-0 synthetic monofilament suture on a vascular needle to close the laceration.[1]
- Special care must be taken to avoid injury to the right ureter, which is close to both the artery and vein.[1]

Damage to internal iliac branches in sacrospinous ligament

This situation may develop from dissection anterior to the iliac spine that enters the lateral extension of the cardinal ligament.[1] The standard procedure follows:

- Place packs into the pararectal space.
- Control gross bleeding with pressure.
- When bleeding is controlled, "roll" packs laterally and inferiorly.
- Use a long clamp to clamp branches that can be identified individually.
- Use a synthetic absorbable suture on a needle to suture-ligate the plexus.
- Continue rolling the pack laterally and inferiorly and identify the next plexus.
- After each venous plexus has been sutured, continue to roll the pack laterally and inferiorly and identify and clamp the branches of the hypogastric vein.
- Suture-ligate with a fine synthetic absorbable suture.[1]

Damage to the ureter or bladder

The intimate position of the bladder in relation to the uterus and other female pelvic structures places it at a higher risk for injury, as does the long course of the ureter. Its relation to the distal portion of the uterus, for instance, places it in the position of high-risk for traumatic injury. A look at surgical trauma to the urinary tract is found in a reflective study by Raut et al.[2] in which 1,188 cases were reviewed. Of that number, 892 of the procedures were gynecologic and 296 obstetric. The total number of injuries found was 15 (12 were gynecologic and three obstetric). Of the complications, 13 were related to bladder injuries, with only two related to damage to the ureter. Contributing conditions were studied and primary risk factors determined to be: infiltrated carcinoma of the cervix, pelvic adhesions, adhesions secondary to prior surgery, and distorted anatomy.[2]

The CST and CFA should know the normal course of the ureter and its relation to gynecologic structures, as well as common variants. For effective assisting, the CST and CFA must be able to describe the course of the ureter and to visualize it in their minds. This tactic of visualization permits one to constantly compare what one is actually seeing with the expected. A simple comment such as, "Does that ureter seem to be moving more medially than usual?" may alert the surgeon who is focused elsewhere to a potential problem.

If concern exists about damage to the ureter, the following approach is advised:

- Two options exist: (a) remove the ligatures until the ureter is identified and place a stent, or (b) open the abdomen and dissect out the ureter, then remove the sutures.
- The anesthesia provider should administer one ampule of indigo carmine dye IV.
- A water cystoscope should be inserted into the bladder, and blue colored urine should be verified flowing from the ureteral orifice.
- If no dye is noted after 10 minutes, a ureteral catheter will need to be placed.
- Re-ligate the veins.

Postoperative complications—overview

All surgical procedures run the risk of complications. These may be minor or life-threatening, and a speedy and sure diagnosis with proper intervention is required. Typically, certain complications are more likely to occur within a given time frame. Immediate complications occur during surgery, and the vast majority of these are traumatic injury to a structure (eg bowel or ureter) or the need to control hemorrhage. These complications require immediate surgical response. Cardiac arrest requires a team approach to resuscitation and may require termination of the procedure.

Early complications occur within 48 hours following surgery. These are usually hemorrhagic, cardiac or pulmonary complications. During the first postoperative week, watch for paralytic ileus (third day), wound dehiscence, pelvic hematoma, secondary bleeding (as late as 14 days), and urinary tract fistula. Complications that may occur long after the operative date include adhesion formation, incisional hernia, prolapse and urinary incontinence, and uterine scarring. A sense of these postoperative complications can be found in the study by Sotto, which followed 627 cases of radical hysterectomy and documented complications.[3]

Overall:

- Surgical deaths: six (causes: hemorrhage, sepsis, atelectasis, blood transfusion reaction).
- 23.8% infections in the unirradiated group: urinary track 13.6%; incisional 5.5%; pelvic 4.7%.
- Fistulas in unirradiated group: ureterovaginal 1.3%, vesicovaginal 0.5%.
- 48.4% infections in the irradiated group (twice the incidence of the other group).
- Fistulas in the irradiated group: six rectovaginal 9.7% (did not occur in other group); one ureterovaginal; two vesicovaginal.[3]

Circulatory and cardiac concerns

Postoperative hemorrhage is always a worry. Bleeding may be quickly identified and corrected if the site is apparent. Intra-abdominal bleeding is not easy to identify. It requires vigilant monitoring of vital signs. One should maintain a high level of suspicion during the postoperative phase. The objective is to identify intra-abdominal bleeding quickly, before the patient is in the initial stages of shock. One should never delay because of the potential of compromise of renal circulation, followed by cardiac and cerebral impairment.

Slow bleeding, while not life threatening, may result in anemia if allowed to continue over a prolonged period of time. Slow bleeding can also delay recovery. It can lead to the formation of a pelvic hematoma. This can cause increased pain and serve as a site for infection.

Once established, thrombosis can be a potentially life-threatening condition. Thrombosis and subsequent embolism are relatively rare and may be avoided with the use of low-dose subcutaneous heparin. Should thrombosis be identified, the patient will need prompt treatment with intravenous heparin as indicated.[4]

As previously noted, most postoperative complications are usually medical in nature and not surgical. Myocardial infarction is a severe medical complication and requires a team approach for management.

Respiratory concerns

Pulmonary complications are generally related to the length of time the patient is under anesthesia. Atelectasis is a common finding after general anesthesia. Atelectasis is often accompanied by a transient pyrexia, dry cough, chest pains and mild shortness of breath.[5]

If the portion of collapsed lung is small, the condition will usually resolve without any further complication. However patients with preexisting pulmonary disease, a history of smoking, and/or increased age are at high risk for infection. Careful monitoring of fluid intake and output is necessary, since pulmonary edema secondary to fluid overload dramatically exacerbates the condition. This is true of all surgical patients, but increased vigilance is necessary with patients who were pre-eclamptic. There may be dramatic shifts between fluid compartments in the postoperative period.

Adult respiratory distress syndrome is infrequent in gynecologic patients. When it occurs, it presents a serious problem that requires aggressive intervention, including positive pressure ventilation.[5]

Gastrointestinal concerns

Traumatic injury to the bowel must be addressed immediately. If necessary, assistance from a general surgeon may be required. These injuries are rather infrequent, but management of the gastrointestinal tract is required for every patient and may include nutritional therapy. In cases where the bowel is manipulated, the return to function is normally delayed. It is necessary, however, to distinguish between postoperative ileus and bowel obstruction (Table 1).[5]

Shock in the gynecologic patient

Shock, secondary to any of its several causes, presents a major problem for the physician. In the United States, septic shock alone is believed to affect 100,000 to 300,000 patients. Of those affected, 40-60% will die. In obstetrics, hemorrhagic complications and sepsis continue to be two of the three major causes of obstetric mortality.[6]

TABLE 1 **Ileus vs obstruction**[5]

Postoperative ileus	Sign/symptom	Obstruction
Distension discomfort, but not cramping pain	**Abdominal pain**	Cramping becoming progressively severe
48-72 hrs postoperative	**Relation prior to surgery**	Usually delayed: 5-6 days for remote onset
Present	**Nausea and vomiting**	Present
Present	**Distension**	Present
Absent or reduced	**Bowel sounds**	Borborygmi with peristolic rushes and high pitched tinkles
Only if there is an associated peritonitis	**Fever**	Rare; if present may suggest a gangrenous bowel
Gas in colon; distended loops of small and large bowel	**Radiographs**	Single or multiple loops of distended bowel (small more common) with air/fluid levels
Conservative Nasogastric suction; enemas; cholinergic stimulation	**Treatment**	Conservative: nasogastric decompression Surgical intervention

TABLE 2 **Basic classification of shock states**[6]

Type	Definition
Hypovolemic	An inadequate circulating blood volume results from hemorrhage or acute volume depletion
Distributive	Total body water is normal or slightly decreased but is pulled into the interstitial fluid compartment, resulting in an intravascular volume depletion
Cardiogenic	Intrinsic pump failure exists
Extracardiac obstructive	The heart is intrinsically normal and total blood volume is adequate, but mechanical factors interfere with performance

Shock is an acute clinical syndrome characterized by hypoperfusion and severe dysfunction of the organs that are vital for survival. This condition results from an acute and systematic loss of cardiovascular function. The result is a reduction in cardiac output and/or circulatory blood volume. Shock may be subdivided into several classifications on the basis of its underlying cause. One scheme used is presented in Table 2.[6]

Shock presents a very complicated medical picture and the clinical presentation may vary considerably. Primary factors affecting the clinical picture are:

- The severity of the profusion defect
- The type and severity of the underlying etiology
- The type and degree of any pre-existing organ dysfunction.[6]

Hypovolemic shock

Hypovolemic shock refers to a condition in which the circulating blood volume is inadequate. This inadequacy may result from hemorrhage or acute volume depletion. The clinical features of early hypovolemic shock are presented in Table 3.[6]

TABLE 3 **Signs and symptoms of the early stage of hypovolemic shock[6]**

System	Symptom/sign	Cause
CNS	Mental status changes	Decreased cerebral profusion
Cardiac circulatory	Tachycardia Rapid and thready pulse	Adrenergic stimulation increases contractility, increasing both cardiac output and resistance in the vascular system
Systemic circulatory	Normotensive or hypotensive; jugular vein distention decreased; narrow pulse pressure	Vascular system resistance decreased; venous return decreased secondary to volume loss; sympathetic nervous system increases vascular tone
Renal	Oliguria	Perfusion decreased secondary to decreased circulating blood volume
Respiratory	Normal or tachypneic	Sympathetic stimulation; acidosis
Skin	Cold, clammy	Vasoconstriction; sympathetic stimulation

TABLE 4 **Classification of hypovolemic shock[6]**

Sign	Class 1	Class 2	Class 3	Class 4
Blood loss (mL)	Less than 750	750-1500	1500-2000	Greater than 2000
Blood volume (%)	Less than or equal to 15	15-30	30-40	Greater than 30
Heart rate (beats/min)	< 100	> 100	> 120	> 140
Blood pressure	Normal or increased	Normal	Decreased (mean arterial <60 mmHg)	Decreased
Pulse pressure	Normal	Decreased	Decreased	Decreased
Capillary refill	Normal	May be delayed	Usually delayed	Always delayed
Respirations (per min)	Normal	Mildly increased	Moderate to marked tachypnea	Marked tachypnea; respiratory collapse
Urinary output (mL/hr)	> 30	20-30	5-15	Essentially anuric
Mental status	Normal or anxious	Anxious	Confused	Lethargic or obtunded

Hemorrhagic shock

Hemorrhagic hypovolemic shock is the most common form of shock seen in the operating room. A useful classification system is presented in Table 4. Be aware, however, that estimating intravascular volume can be difficult clinically. Clinical manifestations of hemorrhagic shock may vary considerably. In part, the variation will depend on the rate at which blood is being lost and the total volume of blood loss at a given time.[6]

Septic shock

Septic shock presents on a continuum from an early-shock or early hyperdynamic phase to the late-shock phase. Historically, a variety of

terms with inconsistent definitions were used to describe early shock. In 1992, the American College of Chest Physicians/Society of Critical Care Medicine Consensus Conference developed a set of clinical definitions to define the subsets of serious clinical infection (Table 5). Septic shock was defined as sepsis with hypertension that persists despite adequate fluid resuscitation, leading to derangements in cellular and organ system function force.[6]

Sepsis is the precursor to septic shock and multiple organ failure. Sepsis represents a major medical problem in the United States today. In spite of all advances in medicine, the number cases of sepsis reported each year continues to grow. Most of the infections (over 50%) are caused by gram negative organisms. Nosocomial infections have increased likewise. To some extent, this is reflective of the current patient population. Increased risk factors include advanced age, underlying systemic disease, frequent use of indwelling catheters and other mechanical devices, burns, prolonged or indiscriminate use of broad spectrum antibiotics, aggressive cytotoxic chemotherapy, and the use of cortical steroids or other immunosuppressive agents. The surgical team must be aware that sepsis often causes hemostatic defect, adding to the risk factors to be considered.[6]

Early recognition and response to septic shock is important. The signs and symptoms of early septic shock are presented in Table 6.[6]

Signs and symptoms—late stage of shock

The signs and symptoms associated with the late stage of shock are the same for both hypovolemic and septic shock. (Table 7.)[6]

Management of shock

Shock requires clear and decisive management. The management of shock is clearly outside the role and responsibility of the surgical technologist. As always, it is helpful to know basic priorities and intentions in order to be an effective

TABLE 5 **Clinical definitions of infection syndromes[6]**

Condition	Definition
Infection	Microbial phenomena characterized by an inflammatory response to the presence of microorganisms or the invasion of normally sterile host tissue by these organisms.
Bacteremia	Presence of a of viable bacteria in the blood.
Systemic inflammatory response syndrome	Systemic response to infection manifested by two or more of the following conditions as a result of infection: temperature > 38 degrees Celsius or < 36 degrees Celsius; heart rate > 90 beats per minute; respiratory rate > 20 breaths per minute or $PaCO_2$ of less than 30 mmHg, or WBC > 12,000 µL or < 4000 µL.
Sepsis	Systemic response to infection manifested by two or more of the following conditions as a result of infection: temperature > 38 degrees Celsius or < 36 degrees Celsius; heart rate > 90 beats per minute; respiratory rate > 20 breaths per minute, or $PaCO_2$ of less than 30 mmHg, or WBC > 12,000 µL or < 4000 µL.
Severe sepsis	Sepsis associated with organ dysfunction, hypoperfusion, or hypotension. Anomalies can include, but are not limited to do, lactic acidosis or acute alteration in mental status.
Septic shock	Sepsis with hypotension, despite adequate fluid resuscitation along with profusion. Anomalies can include, but are not limited to, acidosis or oliguria.
Hypotension	A systolic blood pressure of less than 19 mmHg, or a reduction of > 40 mmHg from baseline in the absence of other causes of hypotension.
Multiple organ dysfunction syndrome	Presence of altered organ function in acutely ill patients. Homeostasis cannot be maintained without intervention.

TABLE 6 **Early signs and symptoms of septic shock**[6]

System	Symptom/sign	Cause
CNS	Subtle mental status changes, septic encephalopathy	Decreased cerebral profusion; cytokine-related endothelial cell damage creates a leaky blood brain barrier
Cardiac circulatory	Tachycardia; bounding pulse	Myocardial ischemia; depressed cardiac function; decreased or increased cardiac output; decreased systemic vascular resistance
Systemic circulatory	Normotensive or hypotensive; widened pulse pressure	Decreased systemic vascular resistance; decreased circulatory volume
Renal	Oliguria	Afferent arteriolar vasoconstriction
Respiratory	Normal or tachypneic	Pulmonary edema; acidosis; muscle fatigue
Skin	Warm	Peripheral vasodilation; sympathetic stimulation; febrile response
Other	Fever or hyperthermia	Infection; endotoxins; cytokines

assistant. One way to remember the priorities for the treatment of shock is to restore *ORDER*.[6]

O Provide adequate oxygen delivery.
R Restore volume with crystalloid and/or blood products.
D Drug therapy (blood pressure support, antibiotics, and other agents as needed).
E Evaluate the response to therapy.
R Remedy the underlying cause.[6]

Postoperative infections

Determining precisely the cause of postoperative infections is a difficult task. Different definitions and criteria have been used in studies to establish the causes of infection, which is compounded by the fact that the population studies also vary considerably. Hager reviewed the literature and reported the following[7]:

- Pelvic infection following abdominal hysterectomy—3.9% to 50%
- Pelvic infection following vaginal hysterectomy—1.7% to 64%
- Septic pelvic thrombophlebitis after gynecologic procedures—0.1% to 0.5%.[7]

While the incidence range is too great to answer many specific questions, it does point out that there is a significant problem to be faced by the gynecologic surgeon to prevent and treat postoperative infection.[7] The risk factors for postoperative infection are as follows:

- Altered immunocompetence
- Surgery in an infected operative site
- Failure to use prophylactic antibiotics
- Altered immunocompetence
- Diabetes mellitus
- Premenopausal age
- Obesity
- Prolonged preoperative hospitalization
- Excessive intraoperative blood loss
- Operative inexperience
- Lower socioeconomic status
- Prolonged operative time
- Excessive devitalized tissue[7]

Of all the risk factors, the single most important is immunocompromise, a lowering of the patient's normal ability to defend herself against certain potentially dangerous organisms.[7]

Vaginal flora and infection types

Pelvic infections are, for the most part, the result of the endogenous sources of bacteria. The vagina is a rich source of bacteria and the most frequent source of the bacteria that cause postoperative infections. The bacteria composing normal vaginal flora are listed in Table 8.[7]

Because of the rich quantity of bacteria, pelvic infections are almost always polymicrobial. The following types of infection occur: cuff cellulitis, cuff abscess, ovarian abscess, septic pelvic thrombophlebitis, osteomyelitis pubis, wound infection, urinary tract infection, and bacteremia.[7]

The surgeon must respond to a febrile state with a set treatment regimen. A battery of diagnostic tests may be used to determine the location and type of infection. This is then treated with the appropriate regimen.[7]

Routine postoperative care

The first 72 hours are critical in the postoperative period. The patient is admitted to the postanesthesia care unit (PACU) and their cardiovascular, respiratory and renal status is carefully monitored. The preoperative evaluation (discussed above) and intraoperative findings or

TABLE 7 **Signs and symptoms of the late stage of hypovolemic and septic shock[6]**

System	Symptom/sign	Cause
CNS	Disorientation; obtundation	Hypoxia; increased cerebral edema
Cardiac circulatory	Cardiac dysfunction; tachycardia; other dysrhythmia	Irreversible ischemia; decreased cardiac index; decreased ejection fraction
Systemic circulatory	Right heart failure; extra vascular pooling	Right heart failure; extra-vascularizing
Renal	Oliguria progressing to anuria	Acute renal failure
Respiratory	Tachypneic	Adult respiratory distress syndrome
Skin	Cold, clammy	Vasoconstriction; sympathetic stimulation
Other	Lactic acidosis; coagulopathy; thrombocytopenia; depressed platelet function	Anaerobic metabolism; hepatic dysfunction; endothelial cell injury; platelet deposition; vascular thrombosis

TABLE 8 **Bacteria composing normal vaginal flora[7]**

Aerobes	Anaerobes
Staphylococcus aureus	*Peptostreptococcus* sp
Staphylococcus epidermidis	*Peptococcus* sp
Group B streptococcus	*Bacteroides* sp
Streptococcus sp	*Fusobacterium* sp
Enterococcus faecalis	*Prevotella biviua*
Lactobacilli	*Prevotella disiens*
Corynebacterium sp	*Bacteroides fragilis* group
Escherichia coli	
Klebsiella sp	
Gardnerella vaginalis	

complications will determine specific diagnostic and treatment needs. The patient will be discharged from PACU to a surgical unit or other intensive care unit.[8]

Routine postoperative orders must account for the following:

- Diagnosis following surgery
- Vital signs every 15 minutes until stable
- Vital signs every two hours for 24 hours (then switch to every eight hours if stable)
- Intake and output monitoring
- What conditions constitute a call to the surgeon or specified intervention
- Activity level
- Diet
- Intravenous fluids
- Inspirometer use or other respiratory aids
- Type and care of drains
- Pain medications
- Antiemetic
- Antibiotics
- Any other medications
- Bladder catheterization orders[8]

About the author

Bob Caruthers, CST, PHD, served as former AST deputy director and director of professional development. He received his BA from the University of Texas, Austin, in 1972 and his PhD in 1995. He started his medical career as an emergency room orderly and was subsequently employed as a certified operating room technician. He later specialized in neurosurgery and developed a consuming interest in the human brain and its study.

He joined the faculty at Austin Community College and later moved to Colorado to work for AST. He was responsible for leading many significant efforts and was executive editor of the first edition of *Surgical Technology for the Surgical Technologist: A Positive Care Approach,* launched a program of educational CD-ROMs, was instrumental in the success of the AST National Conference and initiated the development of advance practice forums.

In January 2000, Bob was diagnosed with glioblastoma multiforme and faced his illness with strength and determination. In 2002, he lost the battle—and is still missed. This article was excerpted from his manuscript that was related to an OB/GYN advanced practice manual.

References

1. Wheeles Jr CR. *Atlas of Pelvic Surgery,* 3rd ed. Baltimore: Williams and Wilkins; 1997: 492-7.
2. Raut V. Shrivastava A, Nandanwar S, Bhattacharya M. Urological injuries during obstetric and gynaecological surgical procedures. *J Postgrad Med.* 1991 Jan; 37(1):21-23.
3. Sotto LS. Radical hysterectomy with bilateral pelvic node dissection. Our experience at the Philippine General Hospital. *Eur J Gynaecol Oncol.* 1990; 11(6):447-52.
4. Thompson JD, Rock WA. Control of Pelvic Hemorrhage. In: *Te Linde's Operative Gynecology,* 8th ed. Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 219-226.
5. Horowitz IR. Postanesthesia and postoperative care. In: *Te Linde's Operative Gynecology,* 8th ed. Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 140-142.
6. Smith HO. Shock in the gynecological patient. In: *Te Linde's Operative Gynecology,* 8th ed. Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 245-255.
7. Hager WD. Postoperative infections: prevention and management. In: *Te Linde's Operative Gynecology,* 8th ed. Rock JA, Thompson JD, eds. Philadelphia: Lippincott-Raven Publishers;1997: 233-238.
8. *Surgical Technology for the Surgical Technologist: A Positive Care Approach.* Caruthers BL, et al, eds. Albany, NY: Delmar Thomson Learning; 2001.