A Primer for Students Regarding the Cardiac Intensive Care Unit and Operating Room Basics: Primer 5 of 7

Zach Brennan, BS,[a] Nadia Bakir, MD,[b] Natalia Roa-Vidal, BS,[c] Sarin Paluri, BS,[d] Rohun Bhagat, MD,[b] Connor McDonald, MD,[e] Eric Pruitt, MD,[f] Clauden Louis, MD, MS,[g] David Blitzer, MD,[h] and Lauren K. Barron, MD,[i,j] East Lansing, Mich; Cleveland, Ohio; San Juan, Puerto Rico; Chicago, Ill; San Antonio and Houston, Tex; Gainesville, Fla; Boston, Mass; and New York, NY

From the [a]Michigan State University College of Osteopathic Medicine, Michigan State University, East Lansing, Mich; [b]Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic, Cleveland, Ohio; [c]University of Puerto Rico Medical Science Campus, San Juan, Puerto Rico; [d]Chicago College of Osteopathic Medicine, Midwestern University, Chicago, Ill; [e]Division of Cardiothoracic Surgery, Department of Surgery, University of Texas Health Sciences Center San Antonio, San Antonio, Tex; [f]Cardiovascular Surgery, Department of Surgery, University of Florida, Gainesville, Fla; [g]Heart and Vascular Center, Department of Surgery, Brigham and Women's Hospital, Boston, Mass; [h]Division of Cardiac, Thoracic, and Vascular Surgery, Department of Surgery, Columbia University/New York Presbyterian Hospital, New York, NY; [i]Division of Cardiothoracic Surgery, The Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, Tex; and [j]The Texas Heart Institute, Houston, Tex.

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Address for reprints: Rohun Bhagat, MD, Department of Thoracic and Cardiovascular Surgery, Cleveland Clinic, Heart, Vascular & Thoracic Institute, 9500 Euclid Ave, Cleveland, OH 44195 (E-mail: rohun.bhagat@gmail.com).

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Preparation and opportunity lead to success.

CENTRAL MESSAGE

This primer introduces the usual cardiac surgery OR and ICU environment to medical students, answering the common what and why questions that students have.

OPERATING BASICS AND THE INTENSIVE CARE UNIT (ICU)

Understanding some basic principles in the operating room (OR) offers the surgically inclined medical student a clear advantage when trying to gain a surgical fund of knowledge. This foundation can aid a student in understanding the differences encountered in a cardiothoracic surgery service at various institutions. Before stepping up to the OR table in a valve replacement, to assist on a coronary artery bypass graft, or help remove a malignant lung mass, the student should begin by understanding the fundamentals of which sutures will be used, how the patient should be positioned, and what draping will allow for appropriate exposure.

Suture Material Sizes and Types

It is commonly said that the greater the number, the smaller the suture, and this is true for all sutures smaller than size 0 (pronounced "oh"). Size 0 is the largest size suture one is likely to see in practice, and thicker sutures are generally called "number" 1 and higher for increasing sizes. Larger sizes are most commonly used as free ties to secure tubes and sometimes as retention sutures during difficult closures. From size 0 progressing to smaller, sutures are described as 2-0 (pronounced "two-oh"), 3-0, 4-0, continuing toward very small sizes such as 10-0 (0.02 mm). A more detailed description of usage of different sutures depending on size can be found in Table E1.

Absorbable Versus Nonabsorbable Sutures

Absorbable sutures are best for tissues that heal quickly and in situations in which removal is difficult. They will start to lose strength somewhere between 1 and 3 weeks depending on the material and are typically absorbed entirely within 3 months, although duration will vary by material. Nonabsorbable sutures are used when strength needs to be maintained long-term or healing is of a longer duration. Sternal and fascial closures are 2 examples of times when permanent material is desired. These are left in the body long-term and carry a risk of infection that can require removal. Both absorbable and nonabsorbable sutures can be made from natural and synthetic materials. See Table E2[1] to obtain

more information of materials, tension, and tissue reactivity of commonly used sutures.

Fundamentals of Suturing

To learn how to suture, start by exploring instructional resources with a suture kit and materials (can be purchased on Amazon for approximately $30 US or obtained at your school's simulation laboratory). Instruments required to get started include a needle driver, forceps, suture, and scissors. Often suture can be obtained from the OR after cases. Many times, all that is needed is a friendly request to the resident or scrub nurse and the clean, unused sutures can be obtained after cases.

Suture Techniques

Simple interrupted. This is the standard technique for closure and epidermal approximation. It can be used for small, well-approximated wounds under minimal-to-no tension (eg, traumatic laceration, small punch biopsy). This is also often used as a secondary layer to aid in approximation of epidermis when the dermis has been closed using a dermal or deep suturing technique. It is best to use the thinnest suture possible to minimize track marks and foreign-body reactions. Suture choice depends on anatomic location of the wound and the goals of suture placement.

Advantages

- Depth of bite, matching the correct layers, and distributing tension is adjusted with each stitch, allowing optimal control.
- More reliable than a continuous technique in closure with high tension.
- Can allow for the opening of just a small portion of the wound in areas with high risk for infection.
- Drainage of wound between sutures.
- Does not cause ischemia of the wound edges.

Disadvantages

- Time-intensive, requiring multiple knots.
- Not a watertight closure.

Simple running suture. Also known as simple uninterrupted, simple continuous, or "baseball," this technique is often used for closures that need to be watertight, such as fascia or vascular anastomoses. It is not ideal for dermal closures or vascular repairs.

Advantages

- Allows for expeditious wound closure, which is completed with one continuous length of suture.
- Watertight.

Disadvantages

- Ischemic wound edges.
- Less precise.
- Increased scaring on epidermal layers.

Mattress technique: horizontal and vertical. These are everting techniques[2] used for closure and epidermal approximation in wounds in which the dermal/epidermal layers are fragile or under high tension (eg, amputation stumps use a high number of vertical mattress sutures). Mattress sutures are also frequently used for temporary approximation of the skin edges before using a simple interrupted technique. The horizontal mattress distributes tension across a line parallel to the wound. It can be used to achieve broader anchoring bites and can help limit tissue tear-through, which can happen with simple interrupted sutures in fragile tissue (atrophic skin). Vertical mattress sutures distribute tension parallel to the cut edge, relying on the tensile strength of tissue further away but in line with the area that is to be approximated. It is useful for simultaneous dermal and epidermal approximation using a single suture or in situations in which the tissue edges are of questionable quality or would not heal well due to parallel tension (amputation stumps).

Advantages

- Good for friable tissue and can help prevent tearing through tissue.
- Strong closure with good eversion control.

Disadvantages

- Vertical mattress sutures can create ischemic tissue directly under suture (Figure 1).
- Horizontal mattress sutures can constrict tissue within the confines of each stitch, leading to tissue ischemia.
- This technique is contraindicated for wounds on the face, palms, or soles, as the suture is blindly threaded deep into the skin.

Subcuticular running technique. This technique is used for cosmetic closure of a straight, clean laceration under minimal-to-no tension. Stitches are placed intradermally, thus avoiding potential scarring related to penetration of the epidermis. Due to the depth and technique of suture placement, absorbable sutures can be used. If the wound is deeper, a deep dermal layer will prevent tension on the epidermal layer and subsequent scarring.

Advantages

- Excellent control of wound edges, increasing the likelihood of good cosmesis.

- Intradermal suture placement avoids transverse "railroad track" scarring.
- Good for patients prone to keloid formation, with problematic suture removal (eg, wounds beneath inaccessible regions like casts), young patients who may be apprehensive toward suture removal, and patients with high risk for inability to follow-up for removal.

Disadvantages

- Time-consuming and requires patient cooperation (can be difficult in small children and those who are altered).
- Contraindicated in wounds that have irregular edges that are not easily approximated and in wounds under high tension.

Simple buried dermal or deep dermal. Best for moderate-tension areas. This technique is the standard for dermatologic and plastic surgery cases. It can be used on facial or truncal skin when inversion of skin is desired, for example, with nasolabial, melolabial folds, and antihelix/umbilicus regions. In general surgery, this technique is used when the knots might cause a dermal reaction. The suture is placed deep to superficial then superficial to deep, allowing the knot to be "buried." This is commonly used to close port holes for minimally invasive surgery, a common procedure for a medical student on a surgical service.

Square knot versus surgeon's knot. A square knot is a simple, frequently used knot where the throws are in opposite directions. It can be challenging to get the first throw to stay down in areas with any tension. To overcome this, a surgeon's knot can be used on the first throw. With an instrument tie, simply wrap the suture around the instrument twice before grasping the other tail, pulling to form the knot. With a 2-handed tie, the suture is passed under twice before securing (step by step can be found here).

Sternal wires. Sternal closure with wires after a median sternotomy is the standard. During this closure, edges should be approximated evenly to avoid improper healing, to increase stability, and reduce postoperative complications. Common closure methods use a series of wires, either interrupted or in a figure-of-eight, to secure the sternal halves created during the median sternotomy.[3-5]

Draping and Positioning

Drapes are used to minimize microbial migration, and contamination from nonsterile to sterile areas are minimized by isolating the incision site and creating a sterile field with the use of drapes.[6] Although not always obvious in a prepped patient, sterile team members must avoid contact with the undersurface of the drape, as it is considered contaminated. Once a drape has been positioned, it should not be repositioned. The top of draped equipment, such as the OR table, back table, and prep table, are considered sterile. The portion of the drape hanging below the edge is considered nonsterile.

Why does the surgeon choose one position and draping method over another for each case? When trying to decide how this should be done, consider 3 things.

- What is being operating on and what incision will be used to access and expose this area? Consider the aortic arch. If access is needed to any area proximal to the left subclavian, a median sternotomy would offer the best exposure. To facilitate this, the patient would be supine and the drapes from the chin, out to the nipples and down to the knees (assume groins should always be prepped in for urgent vascular access in median sternotomy). If the aortic pathology were distal to the subclavian, it would need to be approached from a thoracotomy and possibly laparotomy, requiring left lateral elevation and placing the arms on the same side of the body.
- What access will anesthesia need to safely monitor the patient? Positioning and draping must allow for intravenous access, monitoring (transesophageal echo, neuro, etc), and intervention when needed (ice to the head during circulatory arrest).
- What are the most common intraoperative complications and what access will be needed to address these? Consider an acute type A dissection. Although the imaging may suggest that this will only require an ascending repair, the axillary area and groins should be prepped so that alternative cannulation can be achieved quickly if the dissection progresses or the dissection is more extensive than expected.

The most efficient way for a student to learn to prep and drape is to introduce themselves to the OR staff and show up before the case with enough time to ask the team if they would be willing to teach the steps. Often the first time working with a team, this involves verbal instruction then progresses to having the student do this part of the case. Investing in this process can build trust and facilitate more opportunities.

Common Surgical Positions

Description of common surgical positions used in cardiothoracic surgery are shown in Table 1.

Operating Room Etiquette

When planning to scrub, students should get their own gown and gloves and give them to OR staff beforehand. Once scrubbed, it is critical to notify the OR staff immediately if you inadvertently contaminate yourself or part of the field. Simply notify the team and prepare to re-gown or re-glove. Do not argue if a member points out a breach. To maintain a patient-centered focus, it is critical that you demonstrate the ability to heed the concern of the team and re-scrub. Do not take instruments from the scrub nurse's

TABLE 1. Description of common surgical positions used in cardiothoracic surgery

Supine	Patient is on their back, flat, with their face toward the ceiling.
Prone	Patient is on their stomach, flat, with their face toward the floor.
Left lateral decubitus	Patient lying on their left side.
Right lateral decubitus	Patient lying on their right side.
Lithotomy	Patient is supine, but their legs are spread, usually using something to hold their feet up.
Trendelenburg	Patient is supine, but their head is down. Usually, the surgeon will dictate a degree. Sometimes called "head down."
Reverse Trendelenburg	Patient is supine, but their head is up. Usually, the surgeon will dictate a degree. Sometimes called "head up."

table without first asking permission. Each scrub will have a setup that allows for quick access to instruments at critical points, and disturbing the setup without communication will be detrimental to efficiency at key moments. Remember that "please" and "thank you" are simple reminders to the staff that you appreciate and value their efforts to accommodate your learning process. In the cardiac operating room, there is an appropriate time to ask questions. This can be tricky for a student new to the cardiac OR, as silence is often a sign that the surgeon is concentrating on a challenging aspect of the case and a calm demeanor is required for even the most critical points. Some favorable times for questions are when giving cardioplegia or waiting for an instrument to be brought to the room. Less-favorable times would be during circulatory arrest, going on or coming off pump, and when tying sutures. However, if an instruction wasn't clear, students should ask to clarify, never assume. Using the phrase, "I'm not sure what you mean by XXXXX. Could you say it a different way?" is a succinct way to communicate that and prompts the surgeon to refrain from using colloquial terms in favor of the more formal terms that students have often read. The same thing is true when cutting sutures: ask whether to leave a long or a short tail and make sure to pay attention to why each type of suture is cut at what length. When holding retractors or a camera on a laparoscopic case, try to take up the least amount of space while giving the surgeon the widest field of vision possible.

ICU MANAGEMENT AND BASIC PROCEDURES

Postoperative management of cardiothoracic surgery patients is complex and different from the general surgery patients, as there is increased emphasis in monitoring and following hemodynamic changes. Learning why some symptoms and findings are prioritized is a critical learning point, and the basics of the ICU apply broadly to most specialties and critical care settings. This chapter will focus on a step-by-step explanation of the most common procedures performed in the cardiothoracic intensive care unit (CTICU) and why these procedures are performed.

Management of the Immediate Postoperative Patient

Management of postoperative CTICU patients can vary widely by hospital system and often by specific surgeons within the same hospital system. Expect that each patient will behave a little differently in the postoperative period based on the consequences of their underlying medical conditions and the surgical intervention performed. It is also common for hospital systems and/or surgeons to have a guide or pathway for postoperative management that serves as a starting point for management in uncomplicated patients. Many of the items on these pathways are quality metrics and can be obtained from the ICU or resident team. Often, the student will have to ask for these documents or about the pathway, as it will have become routine for the ICU team. Learning these pathways will help the student anticipate next steps and what is likely to be prioritized at different phases of care. Knowing what information the team is likely to want each day can help the student become a functional member of the team rather than remaining in the observer role.

It is important to pay attention to when certain things are occurring for a patient and why so that next steps can be anticipated. Some examples can be found on Table 2.

The ultimate goal for a patient in the ICU is to improve so they can get to the next step—getting out of the ICU. Figuring out what is the barrier for the patient getting out of the ICU is important: do they need better hemodynamics, do they need better pain control, is it a placement issue? What things can we manage for the patient to help them progress? Using this question helps to understand the priorities of an ICU team when there are multiple complex management plans occurring simultaneously.

Hemodynamics

After a patient is transported from OR to the CTICU, hemodynamics takes center stage. The hemodynamic measurements offer a quantitative overview to many processes on a minute-to-minute scale. Pre- and intraoperative events, along with the patient's comorbidities, are important to note when assessing the absolute numbers displayed on the monitor. To simplify, hemodynamics are the result of 3 key processes:

TABLE 2. Examples of common CTICU procedures and anticipatory actions

Action	Anticipatory cues	Pre-emptive steps
Weaning inotropes	Cardiac index is >2.2	If patient has mechanical cardiac support (Impella or IABP), weaning plan is discussed.
Chest tube removal	Output is decreasing or less than 100 mL/24 h	Ask resident or attending what the usual threshold is for removal. Make sure there is no air leak.
Removal of temporary pacing wires	The patient has a normal rhythm, is off inotropes and pressors, and has tolerated a beta-blocker.	Know when the last inotrope or pressor was administered and what beta-blocker the patient is currently on as well as their home dose.
Starting beta-blocker	Weaned from inotropes and pressors and is not in heart block.	Know the home med and dose.

IABP, Intra-aortic balloon pump.

1. Cardiac function—the heart must generate enough forward flow to maintain adequate pressure. This initial finding allows the team to gauge whether cardiac function is adequate for tissue perfusion.
2. Vasoplegia—between medications, hypothermia, and age, nearly all patients experience some vasoplegia intraoperatively, and most will persist through the immediate postoperative period. Pressors (norepinephrine and vasopressin) are commonly used to decrease the vasoplegic component of hypotension.
3. Volume—when patients are hypotensive with good cardiac function (cardiac index >2.2 or transesophageal echocardiogram showing good ventricular squeeze) and not having a sustained response to a steady pressor dose, it's time to consider volume. The most direct way to assess this is with echo and looking at the volume in the heart. Central venous pressure is a convenient surrogate but can be misleading in patients with heart failure. If bleeding is significant (there will be chest tubes), consider suggesting that the team evaluate how the patient would respond to volume. It's important to understand laboratory values such as platelets, international normalized ratio, partial thromboplastin time, thromboelastography (a quantitative measure of whole blood's ability to clot) results to decide whether there is a derangement and what is needed to correct the laboratory values (albumin, blood, platelets, fresh frozen plasma, cryoprecipitate, or other product). Thromboelastography, while a newer tool, is increasingly used and will be important to understand.

Medical management of hemodynamics. Often, concomitant drugs are seen in the CTICU to maintain proper cardiac function. It is acceptable to use both inotropes with vasoconstrictive properties (alpha-adrenergic) alongside vasodilators (eg, propofol, nitroprusside) to increase cardiac contractility while avoiding an increase in systemic vascular resistance.[7,8] Likewise, it is appropriate to use inotropes with vasodilatory function (eg, milrinone) alongside a vasoconstrictive drug (eg, phenylephrine) to maintain systemic vascular resistance. In addition, catecholamines (eg, epinephrine) can synergistically provide inotropic effects when used with phosphodiesterase inhibitors (eg, milrinone) while permitting pulmonary and systemic vasodilation. A description of the commonly used inotropes, pressors, and antiarrhythmics can be found in Table E3.

Medical Management

There are many things to consider in the management of a postoperative CTICU patient, and the complexity can be overwhelming. However, there a few consistent parameters that require action on the part of the surgical team. Paying attention to these parameters offers the student opportunities to further contribute by alerting the team to changes and learning from the response. Chest tube output that is persistently greater than 200 cc/h or chest tube output that changes suddenly can indicate the need for re-exploration or more detailed investigation of contributors to coagulopathy. When presenting this information to the team, the student would benefit from knowing the latest laboratory values and hemodynamic trends. Decreases in urine output can be an early warning of systemic malperfusion and the need for potential dialysis access in the patient with anuria. To help determine the need for dialysis, it is helpful to know if the patient can manage electrolytes (potassium is a good marker), acid–base status (look at the pH on the arterial blood gas), and volume, ie, has the respiratory support changed? Changes in the heart rhythm, particularly frequent nonsustained episodes of ventricular arrhythmias, can be an early warning of ventricular ischemia. In the postoperative revascularization patient, this may indicate a graft that is in distress. In arterial grafting, this may indicate vasospasm, and medication changes may be needed. In venous grafts, this may indicate the need for further investigation by the team. Acute changes in neurologic status, particularly after aortic cases or in cases in which the patient has a high atherosclerotic burden in the aorta, are concerning for postoperative stroke. This is an important finding and even in cases in which acute intervention is not advised will alter the blood pressure and anticoagulation plan for the patient.

Daily Rounding and Information Gathering

It is helpful to know how the residents are organizing presentations to the attending. Presenting information in a predictable order allows the listener to mentally organize the data and offer feedback. It is helpful to ask the resident how they organize the data for particular attendings or to listen to a presentation and make a template for gathering data. One example can be found on Table E4.

Tips and Tricks at the Medical Student Level

Knowing the details of the patient data that allow for forward progress, such as when a patient can begin diuresis, meets criteria for chest tube removal, or is ready for but has not been evaluated by physical therapy, can really help keep the ICU moving and avoid bogging down the team. Keeping track of bowel status, neurologic status, inputs and outputs, and other factors can keep rounds moving and make sure the surgical team has knowns how patients are progressing after surgery.

Keeping track of a patient's consult needs and results is also a great way to provide added value to your role as a medical student. Most patients will have many consulting services. Some common consults to look out for are speech language pathology (diet recommendations), physical and occupational therapy (mobility and disposition recommendations), and other medical/surgical specialists managing specific organ system issues (neurology, nephrology, etc). Helping to keep track of these consults and providing the team with the recommendations allows the student to contribute to better outcomes for patients and enhance understanding how each contributes to the team approach.

Pain control is another common issue for CTICU patients. Most patients are on both scheduled and as needed regimen for pain control. The "sweet spot" in ICU pain management is the balance between enough medication to allow patients to inhale deeply, cough, and move in the bed but not so much that patients are lethargic or unable to stay awake during daylight hours. Monitoring patient pain levels and relaying them to the team to adjust pain control is an important role for medical students. Most pain regiments are multimodal and change over time; becoming familiar with the basics of pain management *at your institution* is important.

Understanding Postoperative Ventilator Management

Most often ventilator settings begin with tidal volumes at 0.7 mL/kg and a positive end-expiratory pressure of around 5 cmH_2O and support is titrated to achieve optimal saturations and ventilation (CO_2). Keep in mind that, in many circumstances, lower tidal volumes and reduced airway pressures should be the goal as lung-protecting measures when using artificial ventilation; discuss lung-protective strategies with ICU staff, residents, and attendings to ensure you understand and can manage ventilator settings. Patients can be considered for extubation once they meet criteria for spontaneous breathing (see the section "Extubation Considerations"). Many use ventilator criteria, like rapid shallow breathing index, respiratory rate/tidal volume <100, negative inspiratory force >20 cmH_2O, tidal volume >5 mL/kg, vital capacity 10 mL/kg, respiratory rate <30 breaths per minute, but it is also important to assess the patient clinically: are they able to protect their airway? There is no substitute for clinical assessment.

Extubation Considerations

- Patient is awake and responsive.
- Patient is comfortable.
- Patient is sustaining spontaneous breathing.
- Inspired oxygen fraction is <0.5 with arterial oxygen saturation >95%.
- CO_2 <53 mm Hg.
- Core temperature $\geq$36.8 °C
- No excessive blood loss is appreciated.
- Patient is hemodynamically stable.

Common Complications

There are many complications that can happen in the CTICU or intraoperatively before a patient arrives. Understanding why these occur and the implications to patient management should be the goal for medical students in the ICU. In short, learn to recognize the most common complications and know what the response should be. Arrythmias, acute kidney injury, reopening for cardiac tamponade, pneumonia, and mediastinitis are some of common complications after cardiac surgery and being familiar with this subset prior to beginning a rotation might allow further learning opportunities for an interested student.[7,8]

CONCLUSIONS

This article is meant as a primer for the basics of the operating room and the ICU. While it covers many important topics. local variations on management and techniques will exist and it is important to gain an understanding of how each center will manage specific items. This article should be used as a foundation to be built upon with institution-specific guidelines.

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TABLE E1. Description of appropriate usage of different suture sizes

	Number 1 and 0	2-0 and 3-0	4-0 and 5-0	6-0 and 7-0
Free ties	Securing tubes	Ligating large vessels (subclavian artery in a carotid–subclavian bypass or IMA stump)	Ligating unnamed vessels (small)	Not typically used
Suture	Fascia and intercostal closure	Chest wall fascia and deep dermal on the thick skin of the back	Repair of the atria or major vessels (aorta or vena cava), graft to vessel anastomosis	Coronary anastomosis or repair

IMA, Inferior mesenteric artery.

TABLE E2. Commonly used suture materials and their descriptions

Suture	Type	Structure	Length of time it maintains strength	Tissue reactivity
Surgical gut	Absorbable	Chromic	Variable	Moderate reaction
VICRYL (polyglycolic acid)	Absorbable	Braided	50% by 25 d	Minimal acute inflammatory reaction
Coated VICRYL (polyglactin)	Absorbable	Braided	75% by 2 wk, 50% by 3 wk, 25% by 4 wk	Minimal acute inflammatory reaction
MONOCRYL (poliglecaprone)	Absorbable	Monochromic	50%-60% by 1 wk, 20%-30% by 2 wk Lost in 3 wk	Minimal acute inflammatory reaction
PDS II (polydioxanone)	Absorbable	Monofilament	70% by 2 wk, 25% by 6 wk	Slight reaction
Silk	Nonabsorbable	Braided	Progressive degradation results in gradual loss over time	Acute inflammatory reaction
Polypropylene	Nonabsorbable	Monofilament	No change	Minimal acute inflammatory reaction
Nylon/Polyamide	Nonabsorbable	Monofilament	Progressive hydrolysis results in gradual loss over time	Minimal acute inflammatory reaction
Polyester	Nonabsorbable	Monofilament	No change	Minimal acute inflammatory reaction

Adapted from the *Sabiston Textbook of Surgery*.[1]

TABLE E3. Commonly used inotropes, pressors, and antiarrhythmic drugs

Medications	Classification	Mechanism of action	When to use	Effect	Side effects
Epinephrine	Pressors	Alpha 1 and beta agonist	Cardiac arrest, low CO	Increases SVR, HR, CO and BP	Tachycardia
Norepinephrine	Pressors	Alpha 1 and beta agonist	Hypotension due to low SVR	Increased BP, MAP, SVR and CO	Tachycardia
Phenylephrine	Pressors	Alpha 1 agonist	Hypotension due to low SVR	Peripheral vasoconstriction, increased BP, MAP, and SVR	Reflex bradycardia
Vasopressin	Pressors	ADH analog, V1 and V2 stimulation	Hypotension due to low SVR	Increases BP and SVR	Arrythmias
Dobutamine	Inotropes	Beta 1 agonist	Increased afterload causing low CO	Increases contractility and CO	Tachycardia
Milrinone	Inotropes	Phosphodiesterase inhibitor	Low CO with high SVR or pulmonary hypertension	Increases contractility and CO	Tachycardia, hypotension
Amiodarone	Antiarrhythmic	K+ channel blocker	SVT, V-tach, AF	Increases cardiac tissue refractory period	Hepatotoxic, arrhythmogenic
Digoxin	Antiarrhythmic	Na+/K + ATPase inhibitor	SVT, AF	Increases intracellular calcium, decreases atrioventricular conduction	Arrhythmogenic, AV block
Lidocaine	Antiarrhythmic	Na + channel blocker	V-tach	Decrease ventricle automaticity	Arrhythmogenic
Carvedilol	Antiarrhythmic	Beta-Blocker	AF, AFL	Rate control, AV node depression	Bradycardia, AV block
Diltiazem	Antiarrhythmic	Calcium channel Blocker	A-fib	Rate control	AV block

CO, Cardiac output; *SVR*, systemic vascular resistance; *HR*, heart rate; *BP*, blood pressure; *MAP*, mean arterial pressure; *ADH*, antidiuretic hormone; *SVT*, supraventricular tachycardia; *V-tach*, ventricular tachycardia; *AF*, atrial fibrillation; *AV*, atrioventricular; *AFL*, atrial flutter.

TABLE E4. Postoperative ICU presentation template

Parameters	Presentation template	Notes
General		
Postoperative day and procedure	This is Mr. X and he is postoperative day __ from __.	–
Overnight events	Overnight, he had ___ significant events.	Significant events require intervention from the surgical team or cause the patient to veer from the expected course. Some examples are reintubation, changes in rhythm, bleeding, or mental status changes.
Vital signs	His HR was (give range). His MAPs were (range) on (*give inotropes and pressors and whether they are up down or stable compared with yesterday*). He is in ___ rhythm and has or has not had episodes of arrhythmia.	Note any big variants to alert rhythm issues.
If Swan-Ganz (Edwards LifeSciences) catheter in place	–	Present PA pressures as fraction of systolic (<1/3 is ideal). Present Svo_2 and CI as range
If blood products were administered	–	Present what was received and whether response was appropriate
If intubated	His PEEP is ___ and his FIO_2 is ___.	If 40% FIO_2 and 5 of PEEP tell why patient still intubated.
Volume balance	UOP total was ___. 24-h fluid balance was NET ___ and they are on (diuretic meds, route, and dosage).	If receiving dialysis, report what volume is being taken off and dialysis type (CRRT vs SLED vs in line with ECMO).
Chest tube	Chest tube output over 24 h was __.	
Laboratory values		
CBC and coags	–	Look for abnormal values and know what the trend is. Present Hgb daily with trend (up, down, or the same).
BMP	–	Look for abnormal values and know what the trend is. Present Cr daily with trend (up, down, or the same).
Medications		
Pressors (norepinephrine, vasopressin)	–	Present with vitals
Inotropes (epinephrine, dobutamine, milrinone)	–	Present with vitals Present last Svo_2 and the trend of inotropes
Diuretics (usually Lasix, Bumex, or metolazone)	The patient is using ___ (dosage and frequency).	It's helpful to know what they take at home.
Antibiotics	The patient is on ___ day ___ of _____	
Benchmark meds such as Aspirin, statin, beta-blocker for normal EF elective CABG ACE or ARB in patients with heart failure Dual antiplatelet therapy in acute coronary syndrome	–	Know if they are on these meds and if not do they have a plan for initiation.
Physical examination		
Make sure you have examined Wounds Fingers and toes (ischemia) Pacer boxes (need current setting and underlying)	–	Unless directed to specifically give a verbal report of the full examination, stick with abnormal findings but be ready to discuss.

(Continued)

TABLE E4. Continued

Parameters	Presentation template	Notes
Imaging		
CXR	Daily CXR shows ___.	Compare with previous and any new imaging obtained.
Plan		
Next steps	Mr. X is now POD #___His barriers to (insert next step here: extubation, transfer from ICU, disposition to discharge) are ___. The plan to address this is ___.	-

HR, Heart rate; *MAP*, mean arterial pressure; *PA*, pulmonary artery; *Svo_2*, venous oxygen saturation; *CI*, cardiac index; *PEEP*, positive end-expiratory pressure; *FIO_2*, inspired oxygen fraction; *UOP*, urinary output; *CRRT*, continuous renal-replacement therapy; *SLED*, sustained low-efficiency dialysis; *ECMO*, extracorporeal membrane oxygenation; *CBC*, complete blood count; *coags*, coagulation; *Hgb*, hemoglobin; *BMP*, basic metabolic panel; *Cr*, creatinine; *EF*, ejection fraction; *CABG*, coronary artery bypass grafting; *ACE*, angiotensin-converting enzyme; *ARB*, angiotensin receptor blocker; *CXR*, radiograph of the chest; *POD*, postoperative day.