



EUROPEAN BOARD OF CARDIOTHORACIC SURGERY
Cardiovascular Surgery Critical Care Syllabus

2023



EACTS
European Association For Cardio-Thoracic Surgery
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1. Professional behavior and ethics in cardiovascular surgery critical care

- 1.1 Understanding of the value and need for multidisciplinary approach to patient care and application of the principles of team-based care.
- 1.2 Understanding of hierarchical physician responsibilities for patient care through the core concept that maintains the operating surgeon as the ultimate responsible throughout the surgical process.
- 1.3 Knowledge of checklists and briefings to prevent adverse events (e.g. WHO checklist).
- 1.4 Knowledge of the role and need for morbidity/mortality meetings to review clinical performance and departmental safety.
- 1.5 Knowledge of the principles and practice of obtaining informed consent for therapeutic interventions.
- 1.6 Ability to select and deliver and effective communication to the team to preserve patient safety and minimize healthcare associated errors including human factors in the intensive care unit.
- 1.7 Knowledge of biostatistics and evidence-based practice, including its limitations.
- 1.8 Knowledge of the role of audit, research, guidelines and standard setting in improving quality of care.
- 1.9 Ability to detect structural weaknesses in the healthcare systems, particularly in the ICU and develop projects for improvement of care.
- 1.10 Recognition of ethical issues in clinical practice and the ability to discuss, analyze and generate a plan for managing common and complex ethical situations.
- 1.11 Understand the complex issue and potential need for prioritization for allocating limited critical care resources.
- 1.12 Recognize the personal limits in complex clinical situations and the need to request assistance when required.
- 1.13 Ability to request help or supervision from more experienced colleagues.
- 1.14 Ability to effectively communicate with patients and carers to ensure the understanding and participation in complex decision-making.
- 1.15 Ability to analyze study designs and research outcomes in critical care including original research, systematic reviews and clinical practice guidelines.
- 1.16 Ability to minimize patient discomfort caused by instrumentation/examination.
- 1.17 Ability to avoid unnecessary testing or monitoring that is not adding to the quality of care.
- 1.18 Ability to promote respect for patient privacy, dignity and confidentiality.
- 1.19 Knowledge and judgement of the risk:benefit ratio and cost effectiveness of interventions.
- 1.20 Knowledge of management, conflict resolution and debriefing.
- 1.21 Knowledge on the need to lead, delegate and supervise appropriately.
- 1.22 Ability to recognize futility of invasive interventions and detection for the need to discuss end-of-life care.
- 1.23 Ability to effectively accompany the patient and the family through the end-of-life process.

2. Preoperative critical care management of patients requiring cardiovascular surgery

- 2.1. Ability to assess the need for urgent or emergent surgery for patients with cardiovascular surgery conditions.

- 2.2. Ability to obtain and judge the appropriate preoperative examinations that are necessary to safely conduct the operation and facilitate the surgical process.
- 2.3. Ability to preoperatively assess patients with acute aortic type A dissection (determine the presence of pericardial effusion/tamponade, aortic regurgitation, clinical malperfusion and myocardial ischemia).
- 2.4. Ability to preoperatively manage patients with type A aortic dissection (pharmacologic hemodynamic manipulation, pain control, heart rate control).
- 2.5. Knowledge of antithrombotic and antiplatelet therapies that influence timing of cardiovascular surgery.
- 2.6. Knowledge on preoperative optimization in view of urgent need for a cardiovascular surgery intervention (e.g. correction of coagulopathy, improve pulmonary edema, anemia correction, etc).
- 2.7. Ability to transfer patients to the operating room for any cardiovascular surgical intervention.
- 2.8. Ability to organize the preoperative multidisciplinary care of patients requiring urgent/emergent cardiovascular surgery.

3. Sedation in the cardiovascular surgery intensive care unit

- 3.1. Knowledge of common hemodynamic effects of used anesthetic agents.
- 3.2. Knowledge of pharmacology and commonly used doses of induction agents, anxiolytics, narcotics, and muscle relaxants.
- 3.3. Knowledge of sedo-analgesia after different cardiovascular surgery operations
- 3.4. Knowledge of pharmacology and interactions of sedo-analgesia.
- 3.5. Ability to select the best combination of sedation and analgesia for each postoperative setting.
- 3.6. Ability to monitor sedation and analgesia and facilitate mechanical ventilation and eventually postoperative interventions (minor and major).
- 3.7. Ability to deliver conscious sedation for postoperative examinations/interventions.
- 3.8. Ability to detect and manage complications related to anesthetics (neuroleptic malignant syndrome, hyperlacticaemia, etc).
- 3.9. Ability to prevent and treat delirium after surgery.
- 3.10. Ability to deliver sedation and myorelaxation for elective and emergent orotracheal intubation.

4. Airway and ventilation management in the cardiovascular surgery intensive care unit

- 4.1. Knowledge and ability to select and deliver the best ventilation option for each situation.
- 4.2. Knowledge of strategies to deal with a difficult airway and achieve a safe ventilation.
- 4.3. Knowledge of indications and contraindications for tracheostomy.
- 4.4. Knowledge of techniques to perform a tracheostomy and other surgical or percutaneous airway control.
- 4.5. Understand uses of different tracheostomy cannulas.
- 4.6. Knowledge and ability to wean tracheostomy tubes and transition to spontaneous natural ventilation.
- 4.7. Knowledge and prevention of complications associated to tracheostomy.
- 4.8. Knowledge of instrumentation to perform fibro bronchoscopy.
- 4.9. Knowledge of indications and contraindications for fibro bronchoscopy.
- 4.10. Ability to perform diagnostic fibro bronchoscopy under orotracheal/tracheal intubation and sedation.
- 4.11. Ability to aspirate secretions for diagnostic purposes and to correct life-threatening airway occupation.
- 4.12. Ability to identify the need to insert a pleural drainage (effusion, pneumothorax).
- 4.13. Ability to insert a large caliber pleural chest tube or pigtail.

5. Venous and arterial access

- 5.1. Knowledge of all different (jugular, femoral and subclavian) central venous access and the technique of inserting catheters-
- 5.2. Knowledge of all different arterial catheter access (radial, brachial and femoral).
- 5.3. Knowledge of bedside pulmonary artery catheterization and technique of insertion of Swan-Ganz catheter.
- 5.4. Knowledge of dialysis catheters and technique of insertion.
- 5.5. Knowledge of PICC catheters and technique of insertion.
- 5.6. Knowledge of how to remove each catheter.
- 5.7. Ability to select and insert the pertinent catheter for each patient and each clinical situation.
- 5.8. Knowledge on prevention of catheter related infections.

6. Advanced cardiac life support and emergency reesternotomy/rethoracotomy

- 6.1. Knowledge and ability to conduct reanimations after cardiovascular surgery according to the CALS protocols (Cardiac Advanced Life Support).
- 6.2. Ability to select the best reanimation according to each situation (closed or open chest techniques).
- 6.3. Knowledge of appropriate cardioversion or defibrillation for different postoperative arrhythmias and all forms of energy delivery (external and internal).
- 6.4. Ability to emergently reopen the chest in the ICU for resuscitation or bleeding control.
- 6.5. Knowledge and ability to appropriately deliver cardiac massage (including the presence of bypass grafts).

7. Management and use of mechanical circulatory support (MCS)

- 7.1. Knowledge and ability to insert/manage/troubleshoot intraaortic balloon pump.
- 7.2. Ability to manage and troubleshoot peripherally inserted mechanical circulatory support devices (e.g Impella).
- 7.3. Ability to manage and troubleshoot temporary paracorporeal circulatory support (LVAD, RVAD, BIVAD..).
- 7.4. Ability to emergently implant central or peripheral ECMO.
- 7.5. Ability to manage/troubleshoot venovenous and venoarterial ECMO (cannulation sides and system).
- 7.6. Ability to recognize the need to upgrade mechanical circulatory support devices.
- 7.7. Ability to manage and troubleshoot long term intracorporeal devices.
- 7.8. Ability to manage anticoagulation and bleeding under different forms of mechanical circulatory support.
- 7.9. Knowledge of best cannulas size and types for each MCS approach.
- 7.10. Knowledge on transferring patients under MCS for examinations or surgery out of the ICU
- 7.11. Knowledge on how to facilitate physiotherapy in patients with MCS.
- 7.12. Knowledge on postoperative care of transplant patients, including immunosuppression.

8. Echography and echocardiography

- 8.1 Knowledge of echocardiography imaging interpretation for the management of cardiovascular surgery patients.
- 8.2 Ability to acquire the basic echocardiographic images to guide care after surgery (biventricular function, pericardial effusion, tamponade, valve function).

8.3 Knowledge and ability to perform pulmonary echography to facilitate diagnosis of different conditions (pleural effusion/occupation, parenchymal consolidation, etc) and guide pleural effusion drainage.

8.4 Ability to guide insertion of venous and arterial lines with echography support.

9. Low cardiac output management

10.1. Ability to clinically recognize low cardiac output states.

10.2. Ability to invasive measure low cardiac output and interpret the data from a Swan-Ganz catheter.

10.3. Ability to diagnose and manage the underlying cause of low cardiac output.

10.4. Ability to select the most appropriate inotropic intervention for each postoperative setting.

10.5. Ability to recognize the need for escalation to support the circulation with the use of MCS.

10.6. Knowledge on the use of nitric oxide and other therapeutic interventions to improve hemodynamics in the setting of right ventricular dysfunction and/or elevated pulmonary artery resistance.

10. Temporary electrostimulation after cardiovascular surgery

11.1 Knowledge on different modalities of electrostimulation and its indications.

11.2 Ability to temporarily provide emergent transcutaneous pacing.

11.3 Ability to bedside insert a temporary transvenous electro catheter for emergent VVI pacing.

11.3 Knowledge of the most frequent postoperative pacing modalities after cardiovascular surgery (AAI, AOO, VVI, VOO, DDD, DOO..).

11.4 Knowledge of capture thresholds and sensitivity.

11.5 Knowledge of polarity, unipolar vs bipolar pacing, manipulation of AV delay.

11.6 Ability to safely manipulate the systems (generator and wires) providing pacing.

11.6 Ability to provide appropriate -to each clinical situation- epicardial pacing.

11.7 Ability to troubleshoot temporary pacing.

11.8 Knowledge on the possibility to suppress arrhythmias through epicardial patient override.

11.9 Knowledge on how to obtain atrial electrograms through epicardially placed temporary leads.

11.10. Knowledge on management for entrapped epicardial leads.

11. Management of new onset atrial fibrillation and specific postoperative management of atrial fibrillation ablation surgery (lone or concomitant)

11.1. Knowledge of risk factors to develop new onset atrial fibrillation after cardiovascular surgery.

11.2. Knowledge of pharmacology to restore sinus rhythm in the setting of new onset atrial fibrillation.

11.3. Knowledge on the indications and contraindications to cardiovert patients to sinus rhythm.

11.4. Knowledge on anticoagulation guidelines for patients with new onset atrial fibrillation.

11.5. Ability to electrically restore sinus rhythm by means of cardioversion.

11.6. Knowledge on anticoagulation/antiarrhythmic drugs for patients that have undergone pulmonary vein ablation or different Cox-Maze operations.

11.7. Knowledge on the risk/benefit and contraindications to anticoagulation after cardiovascular surgery with the presence of atrial fibrillation.

12. Management of invasive nutrition modalities

12.1. Knowledge on assessment of nutrition status in patients undergoing/after cardiovascular surgery.

12.2. Knowledge of indications and contraindications for enteral/parenteral nutrition.

- 12.3. Knowledge on assessment of dysphagia and risk for aspiration.
- 12.4. Knowledge on indications for percutaneous endoscopic gastrostomy, postpyloric feeding tube or nasogastric tubes.
- 12.5. Ability to recover and sustain an appropriate nutrition status after cardiovascular surgery.

13. Renal replacement therapies

- 13.1. Knowledge of different presentations of acute kidney failure.
- 13.2. Knowledge of the available modalities of renal replacement therapy.
- 13.3. Ability to select the best option based on hemodynamic status and metabolic situations.
- 13.4. Knowledge and ability to control volume status, emergency hyperkalemia and acid-base abnormalities.
- 13.5. Knowledge of metabolic assessment and supplementation during temporary renal replacement therapies.
- 13.6. Ability to determine the appropriate timing to start renal replacement based on hemodynamic data and individual post cardiovascular surgery situations.

14. Management of thoracoabdominal aorta surgery

- 14.1. Knowledge of the different descending aorta/thoracoabdominal interventions and its potential multiorgan impact.
- 14.2. Knowledge of appropriate postoperative strategies to minimize the risk of organic and spinal cord injury (appropriate cardiac output, higher hemoglobin, higher systemic blood pressure).
- 14.3. Knowledge of spinal cord protection and management of cerebrospinal fluid drainage.
- 14.4. Ability to timely diagnose and emergently manage spinal cord ischemia.
- 14.5. Ability to timely terminate the use of CSF drainage, remove it and identify complications related to its use.

15. Postoperative bleeding management and prevention

- 15.1. Recognize normal and abnormal chest tube output after each cardiovascular intervention.
- 15.2. Ability to prevent or correct bleeding due to coagulopathy through appropriate transfusion.
- 15.3. Ability to empirically transfuse blood products in certain clinical situations (ongoing bleeding with high volume requirements).
- 15.4. Ability to tailor transfusion based on laboratory and thromboelastographic data.
- 15.5. Recognize the complications related to human blood product transfusion.
- 15.6. Knowledge on other pharmacological means to treat bleeding beyond human blood bank products.
- 15.7. Recognize the need for a timely intervention.
- 15.8. Recognize when a patient cannot be transferred to the operating room and requires an emergent chest reexploration at the bedside.
- 15.9. Ability to temporarily control major bleeding through emergency bedside surgery.
- 15.10. Ability to identify the appropriate moment for drainage removal.

16. Delirium and stroke

- 16.1. Ability to diagnose and differentiate delirium and stroke.
- 16.2. Knowledge of non-pharmacological and pharmacological interventions to treat delirium.
- 16.3. Ability to judge the need for patient restraint.
- 16.4. Ability to recognize postoperative stroke and emergently manage the patient (e.g. facilitate timely mechanical thrombectomy).

17. Physiotherapy in the intensive care unit after cardiovascular surgery

- 17.1. Knowledge on the different physiotherapy modalities after cardiovascular surgery.
- 17.2. Ability to select appropriate modalities for each clinical condition and postoperative phase.
- 17.3. Knowledge on how to safely provide the maximum physiotherapeutic regimes to improve outcomes and facilitate recovery.
- 17.4. Knowledge on potential contraindications for certain activities during the postoperative period.

18. Management of wounds and instrumentation

- 18.1. Ability to assess and care for normal and pathologic wounds after different cardiovascular interventions.
- 18.2. Ability to remove drains, chest tubes and pacing wires after cardiovascular surgery.
- 18.3. Ability to remove urinary catheters.
- 18.4. Ability to remove arterial and venous lines.
- 18.5. Ability to drain infected and cultivate wounds.
- 18.6. Ability to indicate and deploy negative wound dressings to facilitate healing.
- 18.7. Knowledge and ability to care for drivelines in patients with durable VADs.

19. End of life, palliative care, organ donation process, organ protection and optimization

- 19.1 Ability to recognize futile continuation of multiorgan advanced support
- 19.2 Ability to identify candidates for organ donation in ICU
- 19.3 Knowledge of pharmacological strategies for palliative care
- 19.4 Knowledge of ethical principles underlying withdrawal of life support (WLS)
- 19.5 Knowledge of monitoring strategies and pharmacological strategies to provide WLS
- 19.6 Knowledge of ethical principles for multiorgan donation after WLS in patients with controlled Donation after Cardiac Death (cDCD - Maastricht III category)
- 19.7 Knowledge of surgical alternatives for organ reconditioning after cDCD (abdominal vs thoracoabdominal normothermic regional perfusion (NRP), direct procurement and ex-vivo perfusion, direct procurement and cold storage, NRP + ex-vivo perfusion, NRP and cold storage)