



جامعة الإمام عبد الرحمن بن فيصل

IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY

كلية العلوم الطبية التطبيقية

College of Applied Medical Sciences

قسم تقنية القلب

دليل المعامل

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MESSAGE FROM THE HEAD OF THE DEPARTMENT

Dear Students,

It is with great pleasure that I welcome you to the Department of Cardiac Technology at Imam Abdulrahman Bin Faisal University. You are joining a program that is committed to academic excellence, professional integrity, and the advancement of cardiovascular health care through education, research, and community service.

Our vision is to be a leading program of academic distinction in cardiac technology education and research at both the national and international levels. In line with this vision, our mission is to graduate competent cardiac technologists equipped with evidence-based knowledge and clinical skills, empowered with innovative research capabilities, and committed to effective community service, while upholding the highest ethical values of the profession.

As you undertake this academic journey, you will be encouraged to engage actively in your studies, apply critical thinking in practice, and embrace opportunities for research and professional growth. The department's faculty and staff are dedicated to supporting your development and ensuring that you are well prepared to meet the demands of a dynamic and evolving health care environment.

I invite you to approach this year with dedication, curiosity, and a strong sense of responsibility toward yourself, your patients, and your community.

Together, we will continue to build on the department's achievements and contribute to the progress of cardiovascular medicine.

I wish you every success in your academic and professional journey.

With sincere regards,

Dr. Abrar Ibrahim Alnaimi

Assistant Professor of Cardiovascular Sciences

Head of the Department of Cardiac Technology

College of Applied Medical Sciences, Imam Abdulrahman Bin Faisal University

INTRODUCTION

Cardiac technology (CT) is an allied health profession specifically focused on the diagnosis and management of patients with cardiac and vascular disease. In laboratory sessions throughout courses of Cardiac Technology Program, students will be able to develop and gain different cognitive, sensory, motor, as well as communication competencies that will enable them to understand and apply different techniques of electrocardiography, echocardiography, cardiac catheterization, cardiac perfusion, basic life support, advanced life support, and other clinical skills.

CT students should be oriented about several points prior to their involvement in lab sessions, which will be conducted in the department's laboratories located in the ground floor of building 55, and in the first floor of building A4 under direct supervision by course coordinators, clinical instructors, or lab supervisor. This manual aims to provide CT students and lab users with all information needed including general and specific information about the program, program laboratory objectives, user guidelines, safety precautions, list of the available labs along with their description, and laboratory skills and competencies that must be achieved by the end of the lab sessions to serve in achieving course learning outcomes.

PROGRAM VISION, MISSION, AND GOALS

Vision

A leading program of academic excellence for cardiac technology education and research nationally and internationally.

Mission

Graduate cardiac technologists who are competent in evidence-based knowledge and practice, innovative research skills, and effective community service compatible with the best ethical values of the profession.

Goals

- Provide quality education, and continuously improve learning standards with the best clinical experience.
- Graduate qualified cardiac technologists of national and international standards to fulfil labor markets' needs.
- Promote scientific research in the field of cardiac technology.
- Maintain effective community service and partnership.

Values

- Excellence.
- Loyalty.
- Teamwork.
- Initiative.
- Responsibility.
- Transparency.
- Creativity.

CARDIAC TECHNOLOGY LABORATORIES' DESCRIPTION

Cardiac Technology laboratories are well equipped with variety of simulators, medical devices, and tools which are used for demonstration, measurements, and training.

Echocardiography Simulation Lab

The echocardiography simulation lab is a facility designed to provide hands-on training and simulation experience for Cardiac Technology students. Echocardiography is a non-invasive imaging technique used to assess the structure and function of the heart. In the simulation lab, Cardiac Technology students can practice and enhance their skills in performing and interpreting echocardiograms. The lab typically consists of dedicated spaces equipped with state-of-the-art echocardiography equipment and simulation mannequins.

The Lab is equipped with:

1. Ultrasound Simulators

The lab is equipped with high-fidelity mannequins that replicate human anatomy and physiology. These simulators mimic real-life scenarios, allowing the students to practice acquiring images for both TTE and TEE, identifying structures, and interpreting echocardiographic findings.



2. Echocardiography Machines

Echocardiography machines including ultrasound GE and Philips systems and transducers that are used in clinical settings. Students can learn how to operate the different types of machines including portable machines and familiarize themselves with the various imaging modes and settings.



3. Workstations

Students will learn how to interpret accurately and will study the different structures of the heart, such as the chambers, valves, and blood flow patterns, and learn to identify any abnormalities or pathologies. Softwares such as EchoPAC are used to archive normal and abnormal echo studies that aid in learning and assessment.



This lab serves in developing student skills in the following courses:

<i>Course</i>	<i>Year</i>
Introduction to Cardiovascular Technology	<i>2nd year</i>
Basic Echocardiography	<i>3rd year</i>
Advanced Echocardiography 1	<i>4th year</i>
Advanced Echocardiography 2	<i>4th year</i>
Pediatric Echocardiography	<i>4th year</i>

Cardiac Catheterization Simulation Lab

The Cardiac Catheterization Simulation Lab is a facility designed to simulate procedures and conditions related to cardiac catheterization. In this lab, various simulations and training scenarios are conducted to enhance the skills and knowledge of Cardiac Technology students. The simulations in the lab focus on a wide range of procedures, including diagnostic angiograms, balloon angioplasty, stent placement, and other interventions. Students have the opportunity to navigate through the simulated cardiovascular system using catheters, wires, and other interventional devices.

The Lab is equipped with:

1. Radiation Safety Equipment

Students will familiarize themselves with specialized tools and devices used to protect individuals from the harmful effects of radiation exposure. This equipment is designed to limit or prevent the absorption of radiation.



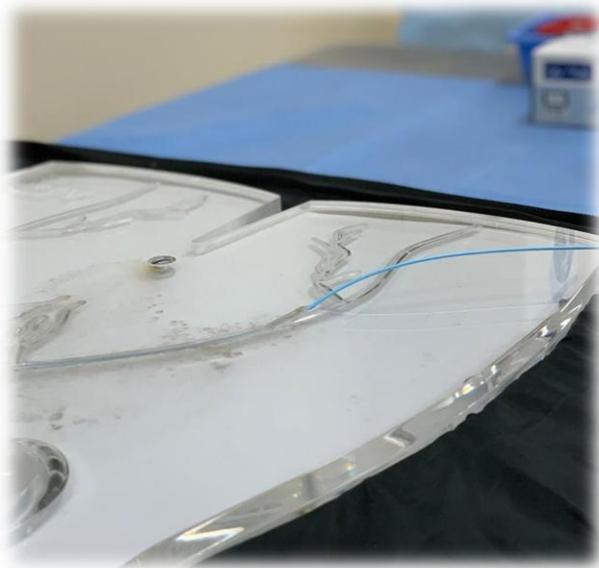
2. Cardiac Catheterization Simulator

Cardiac Catheterization Simulator is a virtual reality simulator that provides a safe work environment for a variety of endovascular procedures. The simulator allows the students to handle Guidewire and catheters, train to perform diagnostic arteriography and various interventional technique and skills.



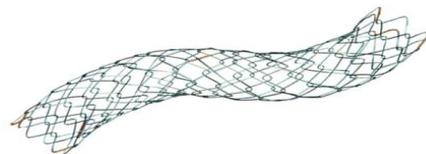
3. Vascular Access Mannequins

These mannequins are designed to mimic the anatomy of patients when it comes to vascular access and catheter placement. They provide a realistic training environment for Cardiac Technology students to learn and practice various procedures, such as venipuncture, and arterial line placement.



4. Diagnostic and Interventional Equipment

Diagnostic and interventional equipment simulates the tools utilized during catheter-based interventions, such as balloon angioplasty, stent placement, or thrombectomy. These instruments may include guidewires, catheters, balloon catheters, sheaths, stents, electrophysiology catheters and equipment, pediatric catheters and equipment, and other devices used in various conditions in the Cath lab.



This lab serves in developing student skills in the following courses:

<i>Course</i>	<i>Year</i>
Introduction to Cardiovascular Technology	<i>2nd year</i>
Basic Cardiac Catheterization	<i>3rd year</i>
Advanced Cardiac Catheterization 1	<i>4th year</i>
Advanced Cardiac Catheterization 2	<i>4th year</i>
Pediatric Cardiac Catheterization	<i>4th year</i>

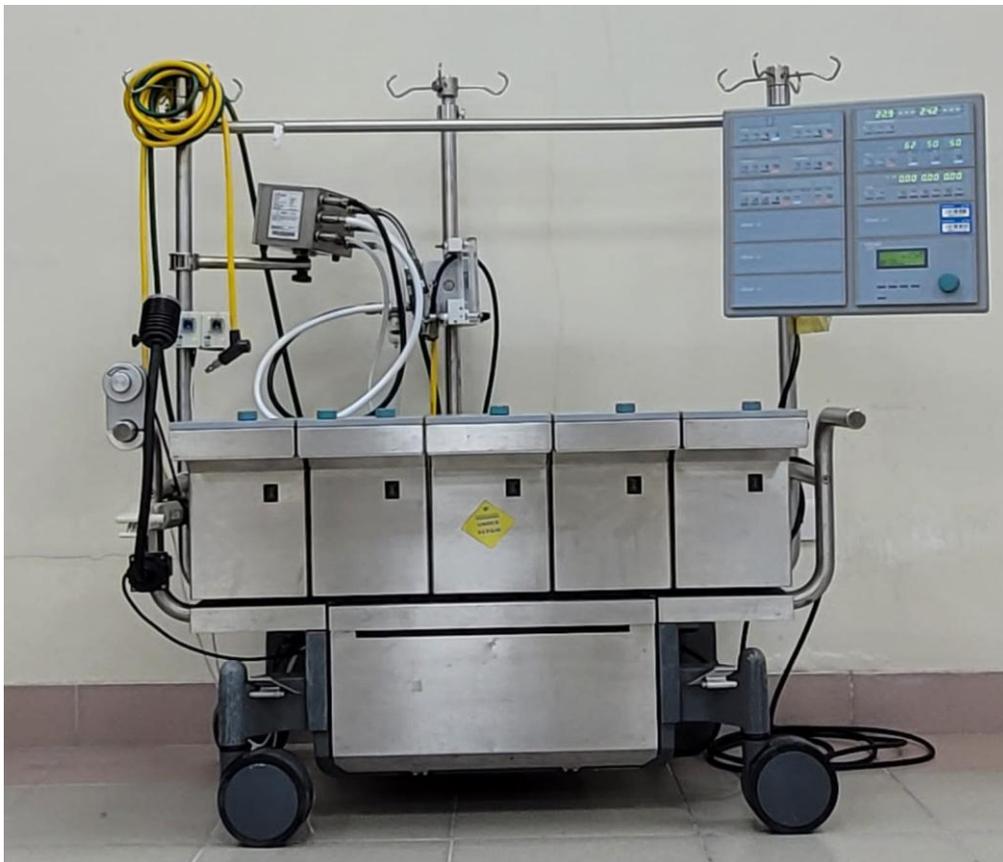
Cardiac Perfusion Lab Simulation

The Cardiac Perfusion Simulation Lab is a facility designed to provide Cardiac Technology students with practical training in cardiac perfusion. In the simulation lab, students can practice essential perfusion techniques and gain hands-on experience with managing and operating advanced extracorporeal circulation equipment. This comprehensive training helps students develop the technical expertise and skills required for effective cardiac perfusion management in a clinical setting.

The Lab is equipped with:

1. Cardiac Perfusion Tools

One common type of cardiac perfusion tool is a heart-lung machine, also known as a cardiopulmonary bypass (CPB) machine. This apparatus takes over the function of the heart and lungs during cardiac surgery, providing oxygenated blood to the body and removing carbon dioxide. It allows for the repair or replacement of damaged or diseased cardiac structures. Additionally, the lab is equipped with Intra-aortic balloon pumps from different vendors to help in differentiating between their criteria and usage.



This lab serves in developing student skills in the following courses:

<i>Course</i>	<i>Year</i>
Introduction to Cardiovascular Technology	<i>2nd year</i>
Basic Cardiac Perfusion	<i>3rd year</i>
Advanced Cardiac Perfusion 1	<i>4th year</i>
Advanced Cardiac Perfusion 2	<i>4th year</i>
Pediatric Cardiac Perfusion	<i>4th year</i>

Electrocardiogram Simulation Lab

Electrocardiogram Simulation Lab is a facility designed to provide a simulated environment for Cardiac Technology students to learn and practice how to record and interpret different electrocardiograms. By utilizing this lab, students can improve their skills and confidence in interpreting ECGs, enhance their understanding of cardiac rhythms, and diagnose potential heart conditions more accurately. Additionally, these labs also serve the students as a platform for learning different procedures such as hooking and analyzing Holter monitors and simulate stress test scenarios.

The Lab is equipped with:

1. ECG Machines and Connection Mannequins

ECG machines and connection mannequins are used to simulate a patient's body and provide a realistic experience for the students. These mannequins are allowing users to attach the ECG leads and practice the correct placement technique. By working with connection mannequins, students can learn how to properly position the electrodes, understand the correct lead placement, and observe the resulting ECG waveforms.



2. Exercise Stress Test Equipment

Exercise stress test equipment including treadmill, stationary bike, and exercise monitoring system are used to simulate physical exercise while tracking various parameters during the stress test, such as heart rate, blood pressure, and oxygen saturation levels. The students will be able to familiarize themselves with the procedure from lead connection step to patient discharge.



3. Holter Monitor Devices and Software.

The Holter Monitor is a portable medical device used for the continuous monitoring of a patient's heart rhythm. The simulation lab is enabling the students to practice Holter connection and recording analysis through the installed software on a prepared workstation.



This lab serves in developing student skills in the following courses:

<i>Course</i>	<i>Year</i>
Cardiovascular Physiology	<i>2nd year</i>
Introduction to Cardiovascular Technology	<i>2nd year</i>
Electrocardiogram 1	<i>3rd year</i>
Electrocardiogram 2	<i>4th year</i>

Clinical Skills Lab

In the Cardiac Technology department, the Clinical Skills Lab is equipped with equipment and resources that replicate the technologies and tools used in measuring vital signs and pressure assessment, and heart sounds simulators. This allows students to familiarize themselves with the various basic clinical procedures, such as blood pressure measurement, cardiac examination, inserting IV lines, and more.

The Lab is equipped with:

1. Heart Sounds Simulator

The simulator mimics various pathological and normal heart sounds that can be heard through a stethoscope. By using this equipment, learners can become familiar with the different sounds associated with specific cardiac conditions, such as murmurs, valve abnormalities, or arrhythmias, and develop their ability to recognize and diagnose these conditions. It offers a valuable tool for honing clinical skills and enhancing patient care.



2. Blood Pressure Simulators and Machines

By practicing on blood pressure simulators, Cardiac Technology students can enhance their proficiency in identifying and diagnosing different blood pressure abnormalities, as well as improve their understanding of the impact blood pressure has on a patient's overall health. In addition, they will familiarize with both electronic and manual techniques.



3. Blood Draw and Injections Simulators

Using simulators, students can learn how to locate veins, properly insert needles, and perform procedures such as blood draws and injections. Moreover, they can practice different techniques and gain confidence in their skills in a safe and controlled environment.



This lab serves in developing student skills in the following courses:

<i>Course</i>	<i>Year</i>
Cardiovascular Physiology	<i>2nd year</i>
Applied Pathology for Heart Diseases	<i>2nd year</i>
Nursing Skills	<i>3rd year</i>

BLS and ACLS Lab

BLS and ACLS lab is designed to provide students with hands-on training in emergency medical procedures and resuscitation techniques. During lab sessions, students can practice and refine their skills in a controlled environment before applying them in real-life situations. Students also can learn and practice critical life-saving skills such as CPR (cardiopulmonary resuscitation), automated external defibrillator (AED) use, and basic airway management techniques. They also learn how to recognize and respond to choking emergencies and effectively provide care for patients who are experiencing cardiac arrest or respiratory distress. In this lab section that contains anatomical models, cadavers, anatomical charts, and computer-based tools. These resources allow participants to study and identify different body systems, such as the musculoskeletal, nervous, cardiovascular, and respiratory.

The Lab is equipped with:

1. CPR Mannequins



2. ACLS Simulator and Crash Cart

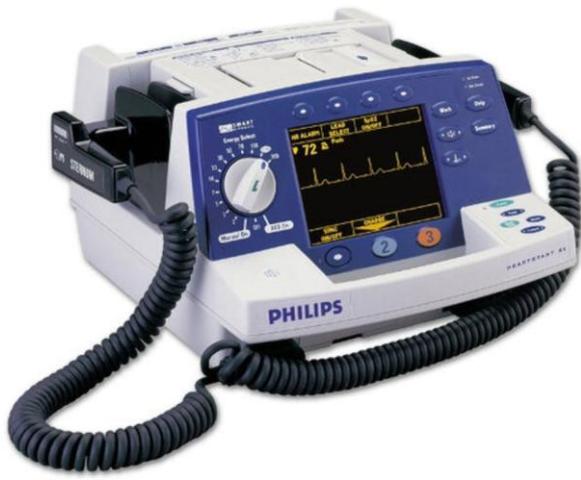
The ACLS Simulator is a training tool that allows healthcare professionals to practice critical thinking, decision-making, and hands-on skills in a realistic simulated environment. It replicates various scenarios, such as cardiac arrests, arrhythmias, and other cardiac emergencies, allowing students to apply their knowledge and skills in a controlled setting. This simulation-based training helps to improve competence, confidence, and teamwork in managing cardiac emergencies.



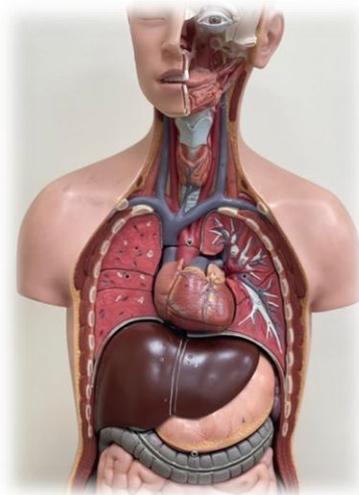
3. Airway Management Devices



4. Defibrillators



5. Anatomical Models



This lab serves in developing student skills in the following courses:

<i>Course</i>	<i>Year</i>
Cardiovascular Anatomy	<i>2nd year</i>
Basic and Advanced Cardiac Life Support	<i>4th year</i>

LABORATORIES' GENERAL OBJECTIVES

The objectives of having simulation laboratories can vary depending on each specific course at the program. However, below are common shared objectives:

1. **Enhancing practical skills:** Simulation laboratories provide a controlled environment where students can practice various procedures and techniques related to cardiac technology. The primary objective is to improve their hands-on skills through repetitive practice and feedback.
2. **Promoting critical thinking:** Simulation exercises can challenge students to think critically and make informed decisions in simulated patient scenarios. The objective is to develop their ability to analyze complex situations and respond appropriately, considering patient safety and best practices.
3. **Fostering teamwork and communication:** Cardiac technology often involves working closely with other healthcare professionals. Simulation labs can facilitate collaborative learning experiences, allowing students to practice effective communication and teamwork skills in a safe environment.
4. **Applying theoretical knowledge:** Simulation exercises enable students to apply the theoretical knowledge gained in classrooms to practical scenarios. By practicing real-life situations, students can reinforce their understanding of cardiac technology concepts and procedures.
5. **Assessing competency and skills:** The simulation lab can serve as an assessment tool to evaluate students' competencies and skills in cardiac technology. Through structured scenarios and performance evaluations, course coordinators can objectively assess students' skills and identify areas for improvement.
6. **Promoting patient safety:** Patient safety is paramount in healthcare. Simulation labs provide an opportunity for students to develop and practice protocols and techniques that prioritize patient safety, including infection control, and emergency response.

These objectives aim to provide a comprehensive learning experience to prepare students for the real-world cardiac technology practice. Also, it works in parallel with the field experience to offer the students the best learning experience.

COURSE BASED LABORATORIES' LEARNING OUTCOMES

At the first lecture of each course, the primary course coordinator will introduce basic information about the course. This orientation session includes course learning outcomes, assessment methods, and other specific information. By the end of each course students should achieve specific skills and competencies using the department's laboratories, available learning resources, and facilities. This section lists skills learning outcomes that should be achieved per course.

Second Year Courses

Cardiovascular Physiology

At the end of the course the student should be able to:

1. Measure arterial blood pressure using sphygmomanometer.
2. Connect standard 12 leads electrocardiogram.

Cardiovascular Anatomy

At the end of the course the student should be able to:

1. Identify the parts of the heart and the blood vessels including key anatomical landmarks.

Applied Pathology for Heart Diseases

At the end of the course the student should be able to:

1. Analyze the clinical pathology of different cardiac diseases using critical thinking to reach diagnosis.
2. Perform a practical application of full cardiac examination.

Introduction to Cardiovascular Technology

At the end of the course the student should be able to:

1. Differentiate indications and functions of different equipment used in the field of cardiac technology.
2. Develop basic skills in calibrating and operating ECG, Echocardiography, Cardiac Catheterization, and Imaging techniques.

Third Year Courses

Electrocardiogram 1

At the end of the course the student should be able to:

1. Perform correctly Electrocardiogram procedure(s) at rest.
2. Measure accurately ECG waveforms and intervals.
3. Interpret systematically ECGs with normal and abnormal findings.

Basic Echocardiography

At the end of the course the student should be able to:

1. Perform standard trans-thorathic echocardiography with application of different measurements in order to diagnose different cardiac diseases.
2. Analyze different echocardiographic findings aiming to reach diagnosis or differential diagnosis.

Nursing Skills

At the end of the course the student should be able to:

1. Perform complete patient assessment.
2. Measure the vital signs accurately.
3. Develop skills in IV therapy and medication administration.

Basic Cardiac Catheterization

At the end of the course the student should be able to:

1. Develop skills in scrubbing, patient, cath table and equipment preparation.
2. Interpret different angiographic views and hemodynamic tracings to reach diagnosis.

Basic Cardiac Perfusion

At the end of the course the student should be able to:

1. Develop skills in scrubbing, patient, and equipment preparation.
2. Assess accurately in Pulsatile and Non-pulsatile perfusion techniques.

Fourth Year Courses

Basic and Advanced Cardiac Life Support

At the end of the course the student should be able to:

1. Perform effective CPR and ventilation techniques.
2. Apply the concept of team dynamics and role of BLS in the team dynamics.
3. Develop the skills in decision making and application of ACLS pathways.

Electrocardiogram 2

At the end of the course the student should be able to:

1. Interpret accurately resting ECGs, ECG Exercise Stress test, and 24-hour Holter monitoring findings.
2. Evaluate heart rate, blood pressure measures, and other hemodynamics response during ECG Exercise Stress tests.
3. Connect correctly Holter monitor devices.

Advanced Adult Echocardiography 1

At the end of the course the student should be able to:

1. Perform effectively a standard trans thoracic echocardiography scan.
2. Demonstrate practical echocardiographic skills in diagnosing a spectrum of cardiac and systemic diseases.
3. Interpret abnormal echocardiographic findings in the context of diagnosing abnormal cardiac findings.

Pediatric Echocardiography

At the end of the course the student should be able to:

1. Apply the principles of echocardiography in paediatric settings.
2. Interpret accurately paediatric echocardiography views.
3. Evaluate a spectrum of congenital cardiovascular malformations.

Advanced Adult Echocardiography 2

At the end of the course the student should be able to:

1. Demonstrate practical echocardiographic skills using trans-esophageal Echocardiography.
2. Interpret abnormal echocardiographic findings using transesophageal, stress and contrast echocardiography.

Advanced Adult Cath 1

At the end of the course the student should be able to:

1. Develop skills in obtaining invasive cardiac techniques through calibrating and manipulating equipment's and drugs.
2. Perform accurately invasive cardiac catheterization with emphasis on coronary angioplasty, stenting, and valvular interventions.
3. Evaluate accurately the results and findings obtained during right and left heart catheterization.

Pediatric Cardiac Catheterization

At the end of the course the student should be able to:

1. Interpretate accurately the RT Heart catheterization and pulmonary angiography during different transcatheter intervention of congenital defects and valvular lesions.
2. Setup the devices and equipments used in pediatric cardiac Cath Lab.
3. Measure accurately cardiac output and intracardiac shunts.

Advanced Adult Cath 2

At the end of the course the student should be able to:

1. Prepare the devices, equipment and monitors used in EPS cardiac Cath Lab.
2. Analyze different types of tachyarrhythmias, bradyarrhythmias and programming parameters of pacemakers.
3. Interpret the results of Tilt table test in patients with syncope.

Advanced Cardiac Perfusion 1

At the end of the course the student should be able to:

1. Evaluate accurately the results and findings obtained during open heart surgeries.
2. Install accurately the bypass heart, lung machine.
3. Adjust anticoagulation doses and their antidots.

Pediatric Cardiac Perfusion

At the end of the course the student should be able to:

1. Interpret accurately with the results of right heart catheterization findings of congenital defects and valvular lesions.
2. Prepare the devices and equipment used in pediatric heart surgery.
3. Assess accurately ABGs and anticoagulation in operative theater.
4. Prepare pediatric patients for Deep hypothermia and circulatory arrest.

Advanced Cardiac Perfusion 2

At the end of the course the student should be able to:

1. Interpret accurately the results of ABGs and acid base balance during bypass.
2. Install accurately the Extra-corporeal Membrane oxygenation (ECMO).
3. Calculate the doses of different CV drugs, vasopressors, vasoactive drugs, anti-arrhythmia as well as IV diuretics.

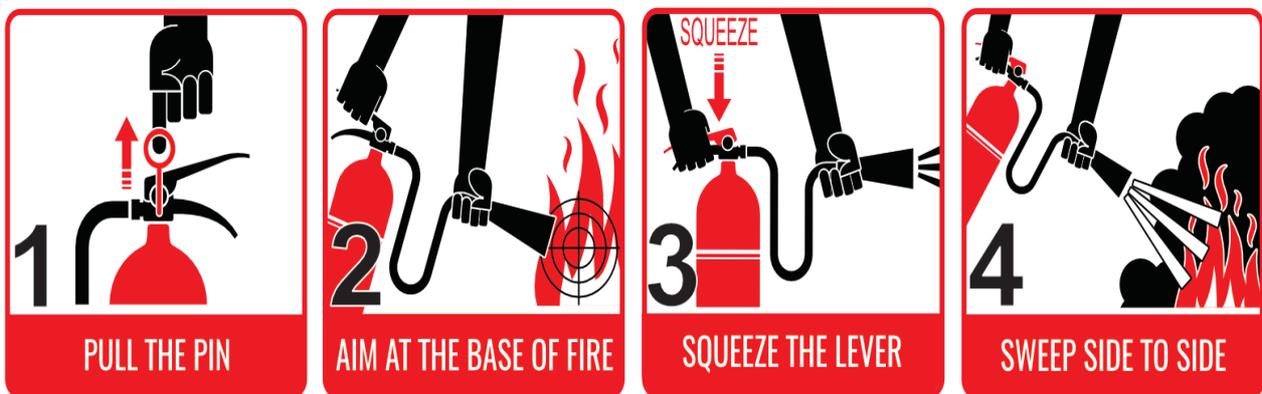
GENERAL USER GUIDELINES

1. Prioritize safety at all times.
2. Dress appropriately for laboratory sessions by wearing a scrub suit and lab coat.
3. Familiarize yourself with emergency procedures and the location of safety equipment like fire extinguishers and first aid kits.
4. Handle equipment and resources with care.
5. Report any malfunctioning or damaged equipment to the laboratory staff or instructors promptly.
6. Familiarize yourself with relevant guidelines and standard operating procedures.
7. Keep the simulation laboratory clean and organized.
8. Ensure that all equipment and work areas are properly cleaned and sanitized before and after each use.
9. Properly dispose any waste materials following the provided guidelines.
10. Practice clear and effective communication skills during simulation lab sessions. Be respectful and professional when interacting with instructors, peers, and simulated patients.
11. Document your activities, observations, and findings accurately and comprehensively. This includes documenting the steps performed during simulations, any interventions made, and observations of simulated patient responses.
12. Seek guidance when needed: Don't hesitate to seek guidance from instructors or laboratory staff if you have any questions or concerns.

SAFETY PRECAUTIONS AND RISK MANAGEMENT

Fire Safety Guidelines

1. Familiarize yourself with collage evacuation plan and assembly points.
2. Locate the fire/emergency exit, fire alarm and the best evacuation route.
3. Locate the fire extinguisher, perform PASS technique (As illustrated in the figure below)

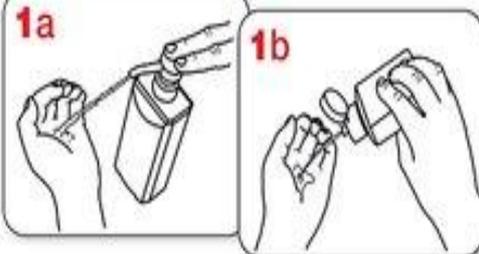


Hand Washing Guidelines

1. Remember, hand washing or rubbing should be done:
 - Before entering the laboratory and after leaving.
 - Before handling any equipment or instruments.
 - After touching potentially contaminated surfaces or objects.
 - After removing gloves.
 - After coughing, sneezing, or blowing your nose.
2. Antibacterial foam hand soap shall be used for hand washing.
3. Antibacterial hand sensitizer shall be used for hand rubbing.

How to handrub?

WITH ALCOHOL-BASED FORMULATION



Apply a palmful of the product in a cupped hand and cover all surfaces.



Rub hands palm to palm



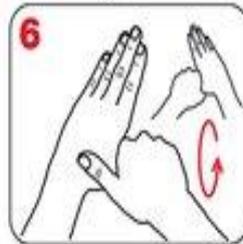
right palm over left dorsum with interlaced fingers and vice versa



palm to palm with fingers interlaced



backs of fingers to opposing palms with fingers interlocked



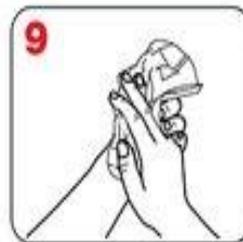
rotational rubbing of left thumb clasped in right palm and vice versa



rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa



rinsing hands with water



dry thoroughly with a single use towel



use towel to turn off faucet

How to handwash?

WITH SOAP AND WATER



Wet hands with water



apply enough soap to cover all hand surfaces.

Handling Sharp Objects And Needles Guidelines

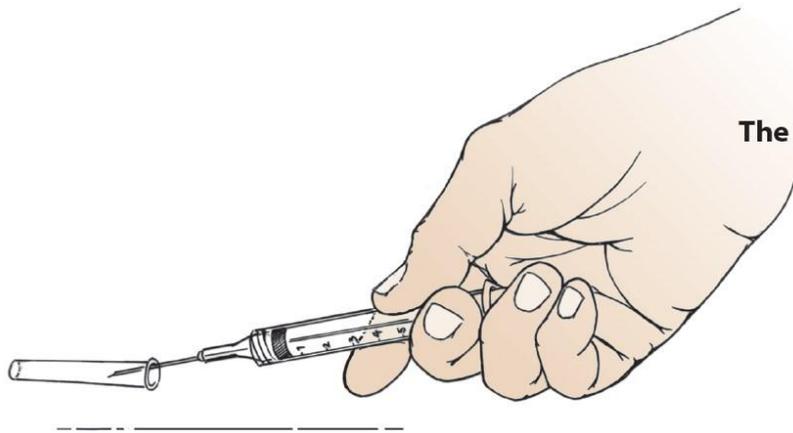
1. Wear appropriate PPE, such as gloves when handling these objects.



2. Dispose used needles and other sharp objects immediately after use in designated sharp containers or holders.



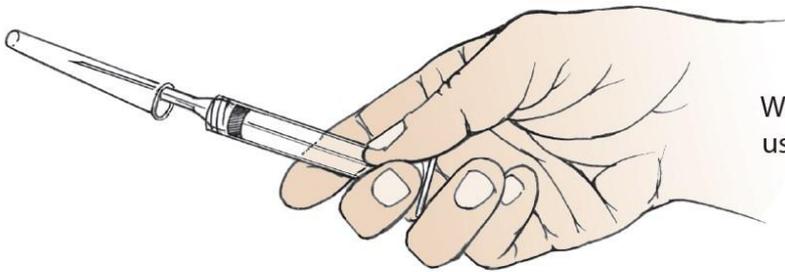
3. Do not recap needles by two hands (use the technique illustrated below) and avoid bending or breaking any sharp objects.



The One-Handed Needle Recapping Method

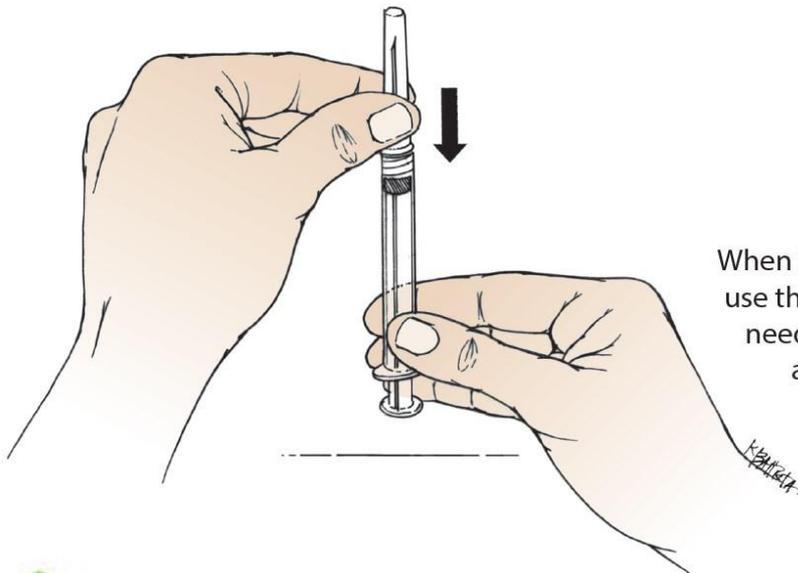
Step 1

Place the cap on a flat surface then remove your hand from the cap



Step 2

With one hand, hold the syringe and use the needle to "scoop up" the cap



Step 3

When the cap covers the needles completely, use the other hand to secure the cap on the needle hub. Be careful to handle the cap at the bottom only (near the hub)

4. Minimize the handling of sharp objects and needles whenever possible. Only handle them when it is necessary for performing a procedure or when instructed by your instructors.

5. Report incidents: If you accidentally sustain a needlestick injury or cut yourself with a sharp object, report it to your instructor or the laboratory supervisor. They will guide you through the necessary first aid steps (as illustrated below), assessing the injury, and seeking appropriate medical attention.





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