

External Tube Identification Curriculum



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External Tube Identification Curriculum

This curriculum and accompanying products will help students learn about cardiovascular, respiratory, gastrointestinal, and genitourinary tubes used in a medical setting.

Curriculum Structure

The External Tube Identification Curriculum is composed of the following lessons. Approximate lesson times are included.

Lesson	Title	Approximate Time
One	FOCUS: Vocabulary Pre-Quiz	10 minutes
One	LEARN: Slide Presentation	30 minutes
One	REVIEW: Identification Activity	20 minutes
	Total	1 hour

Lesson Structure

Each lesson begins with a Lesson Overview, Lesson Objectives, and a Lesson at a Glance table which lists the lesson activities, materials required, suggested preparation steps, and approximate class time.

Lesson Sections

The actual lesson follows the overview, which will contain some of the sections described below.

FOCUS

Every lesson begins with a FOCUS activity intended to capture participants' attention. This may be in the form of a small or large class discussion, a game, a review of previous lesson information, or a demonstration. During this activity, participants are introduced to the topic of the lesson.

LEARN

The LEARN activity in each lesson varies in its presentation mode. It may be a slide presentation, group activity, or demonstration.

REVIEW

The majority of lessons end with a REVIEW activity intended to briefly review the lesson's key messages or main points.

Lesson One – External Tube Identification

Lesson Overview

In this lesson, students will learn about common tubes used in a medical setting.

Lesson Objectives

After completing this lesson, participants will be able to:

- Identify the locations, structural differences, and uses of:
 - Nasogastric (NG) tubes
 - Percutaneous endoscopic gastrostomy (PEG) tubes
 - Urinary catheters (Foley)
 - Surgical drains
 - Tracheostomy tubes
 - Chest tubes
 - Peripherally inserted central catheters (PICC)
 - Intravenous (IV) catheters
 - Pulmonary artery catheters
 - Implanted ports
 - Arterial catheters

Lesson at a Glance

Activity	Materials	Preparation	Approximate class time
FOCUS	• <i>External Tube Identification Vocabulary Pre-Quiz</i> • <i>External Tube Identification Vocabulary Pre-Quiz – Answer Key</i>	1. Print/photocopy <i>External Tube Identification Vocabulary Pre-Quiz</i> (one per participant)	10 minutes
LEARN	• <i>External Tube Identification</i> slide presentation • Gastrointestinal/Genitourinary System Models • Cardiovascular/Respiratory System Models	1. Prepare <i>External Tube Identification</i> slide presentation for viewing	30 minutes
REVIEW	• <i>External Tube Identification Activity</i> • Gastrointestinal/Genitourinary System Models • Cardiovascular/Respiratory System Models	1. Print/photocopy <i>External Tube Identification Activity</i> (one per participant)	20 minutes

Lesson One – External Tube Identification

FOCUS: Vocabulary Pre-Quiz

10 minutes

Purpose:

Students will learn common anatomical terms used in the description of medical tubes.

Materials:

- *External Tube Identification Vocabulary Pre-Quiz*
- *External Tube Identification Vocabulary Pre-Quiz – Answer Key*

Facilitation Steps:

1. Distribute the *External Tube Identification Vocabulary Pre-Quiz* prior to or at the start of the class.
2. Have the *External Tube Identification Vocabulary Pre-Quiz – Answer Key* available for instructor reference.
3. Have students complete the pre-quiz.
4. After completion, have students pair up and compare answers, or review answers as a class.

Name: _____ Class: _____

External Tube Identification Vocabulary Pre-Quiz

Match the medical terminology with the correct definition.

A. nasogastric
B. percutaneous
C. endoscopic
D. gastrostomy
E. tracheostomy
F. intravenous
G. arterial
H. peripheral

	Situated, performed, or occurring within, or entering by way of a vein
	Effected, occurring, or performed through the skin
	Of, relating to, involving the surface of the body
	Relating to, or performed by means of an illuminated usually fiber-optic flexible or rigid tubular instrument for visualizing the interior of a hollow organ or part
	The surgical formation of an opening into the trachea through the neck to allow the passage of air
	Of or relating to an artery
	Being or performed by intubation of the stomach through the nasal passages
	The surgical formation of an opening through the abdominal wall into the stomach

Definitions from <https://www.merriam-webster.com/medical>

External Tube Identification Vocabulary

Pre-Quiz – Answer Key

Match the medical terminology with the correct definition.

A. nasogastric
B. percutaneous
C. endoscopic
D. gastrostomy
E. tracheostomy
F. intravenous
G. arterial
H. peripheral

F	Situated, performed, or occurring within, or entering by way of a vein
B	Effected, occurring, or performed through the skin
H	Of, relating to, involving the surface of the body
C	Relating to, or performed by means of an illuminated usually fiber-optic flexible or rigid tubular instrument for visualizing the interior of a hollow organ or part
E	The surgical formation of an opening into the trachea through the neck to allow the passage of air
G	Of or relating to an artery
A	Being or performed by intubation of the stomach through the nasal passages
D	The surgical formation of an opening through the abdominal wall into the stomach

Definitions from <https://www.merriam-webster.com/medical>

Lesson One – External Tube Identification

LEARN: Slide Presentation

30 minutes

Purpose:

Participants will learn about the various tubes that are used in medical settings

Materials:

- *External Tube Identification* slide presentation
- Gastrointestinal/Genitourinary System Model
- Cardiovascular/Respiratory System Model

Facilitation Steps:

1. Distribute Tube Identification Models 1 and 2 to students. Students may work in pairs or groups if needed.
2. Encourage students to locate the tube discussed in lecture
3. Share the following information with students as you show the PowerPoint presentation.

Slide 1: Introduction Slide

Slide 2: At the end of this lecture, you should be able to identify the location of common medical tubes as well as the differences between them. You should also be able to explain the purpose of the tubes.

Slide 3: The first tube that to discuss is the nasogastric tube, otherwise known as an NG tube. It is lubricated, inserted through a nostril, and dropped down the esophagus to the stomach (and sometimes, even into the intestine). The tube is made of polyurethane, silicone, or rubber. This tube comes in sizes 4 French to 18 French, with 12-18 Fr being common size for adults. *For items measured in French, the larger the number, the larger the diameter.* NG tubes can be up to 50 inches long.

Slide 4: NG tubes are used to place material in the stomach (gavage) or remove it (lavage). For patients who are unable to swallow, the tube is the route for hydration, nutrition, and medication. This is why NG tubes are commonly referred to as feeding tubes. For patients whom we need to empty to the stomach, NG tubes can be connected to

suction. Patients with an NG tube need to have a functioning gastrointestinal system.

Here is a list of patients that could have an NG tube. Which ones are gavage versus lavage?

Slide 5: To give you a better perspective of the size of the tube, this is a 36-inch 8 Fr tube next to a pen. This tube is used for gavage. The end that remains outside the body will have ports (*pink end*) and a guide wire that is removed after insertion. The end that is in the stomach or intestine has holes in it. Make note of the measurement marks on the tube. This is documented in the patient's chart as reference in case the tube's placement changes. Tubes used for lavage typically will have a larger diameter and may have an air vent attached. NG tubes are inserted at bedside by nurses according to a health care provider's order.

Slide 6: In order to make sure the NG tube is in the correct spot a chest x-ray is taken. The guide wire will show up via x-ray and placement can be confirmed. After the initial verification, before any gavage or lavage procedures, the placement is verified again. Fluid from the stomach or intestine is aspirated using a syringe and the pH is tested. The length of the tube is also measured to ensure that it has not moved.

Since the NG tube creates an opening in the sphincters entering the stomach, any fluid in the stomach can move up into the esophagus (reflux) and potentially into the lungs (aspiration). This is why the head of bed must be kept at least 30 degrees inclined or higher.

Due to the risks, NG tubes are for short-term use only (less than 30 days).

Slide 7: A percutaneous endoscopic gastrostomy (PEG) tube is a small polyurethane or silicone tube that is surgically inserted through the abdominal wall into the stomach. It is internally secured with a balloon or bumper. Lengths and sizes can vary depending on the patient.

Slide 8: Similar to NG tubes, PEG tubes can be used for gavage and lavage. It is the preferred route of nutritional support in patients who require long-term, tube-supported nutrition. Patients who have a PEG tube must have a functioning gastrointestinal system.

Slide 9: Although shorter than an NG tube, the features of a PEG tube are similar. The external end has ports for administration of fluids while the internal end has a large opening. Marks for measurement are present for documentation of placement.

Slide 10: PEG tubes are inserted by endoscopy, radiological imaging, or surgical technique without the need for general anesthesia. The tract will start to mature 1-2 weeks after placement and be well formed in 4-6 weeks. The PEG tube can remain, if free of complications, for 2-3 years.

Like any surgery, there can be complications such as bleeding, internal organ injury, and/or infection. Aspiration pneumonia can also occur in patients with a PEG tube, but the rates are much lower than with an NG tube.

Slide 11: An indwelling urinary catheter (also known as a Foley catheter) is a silicone or latex tube that is inserted through the urethra and into the bladder. The internal end is secured in place by a balloon filled with sterile water while the external end is attached to an external drainage bag. Catheters can come in many sizes, but 14-16 Fr is the common adult size. Catheters can be inserted at bedside by nurses with a healthcare provider's order.

Slide 12: Catheters are used to drain urine from the bladder for waste or as specimen. Urine can be measured to ensure proper output. This may be needed in conditions that result in urine retention (inability to empty the bladder), such as prostate enlargement, or nerve-related bladder dysfunction, such as multiple sclerosis or spinal cord injuries. It can also be placed during routine surgeries to prevent incontinence.

Slide 13: The external portion of the catheter contains the ports. The balloon port will have the recommended volume of fluid to inflate the balloon on the internal end. In this picture, a syringe of 10mL sterile water would be connected to the balloon port to inflate the balloon. The other

external port would be connected to a drainage bag. Internally, the balloon prevents the catheter from exiting the urethra. The opening on the tip allows urine to flow through the tube. All tubing needs to be below the level of the bladder, otherwise urine will backflow into the bladder.

Slide 14: Fredric Foley was an American urologist who designed the first catheter with a balloon in 1930 with the availability of latex.

There are different types of indwelling catheters. The Coudé catheter has firmer curved tip for use in patients with an enlarged prostate. The 3-way catheter has the standard 2 ports, but it also has a third port for the insertion of medications and fluids, which is needed after bladder surgeries.

According to the Centers for Disease Control and Prevention, urinary tract infections are the most common healthcare-associated infection. 75% of them are caused by urinary catheters. Risk factors include prolonged use and lack of sterile technique during insertion.

Slide 15: Surgical drains are placed during surgery into the surgical wound area. Drains vary on size and type. Once the drain is placed, it is secured with stitches to prevent accidental removal. The drains can either be open or closed. Closed drains use devices to draw fluid away from the wound by producing negative pressure.

Slide 16: Wounds need moisture to heal, but too much can impede healing. Drains remove the excess fluid. As a wound heals, the drainage will change color and consistency. It is important for healthcare providers to identify signs of infected drainage or excessive bleeding early in the healing process. Surgical drains are frequently used after procedures on the thyroid, abdomen, and breast area, as well as after joint replacements.

Slide 17: Prior to suturing the incision, the trocar (sharp metal end) is punched through the skin near the incision. The metal end is cut off, leaving the drain portion present. Note the small holes for drainage collection in the picture. The drain is placed or looped around the operative area. The external portion is then connected to the drainage collection device or left open.

Slide 18: Drains are classified by the amount of pressure used. Low pressure drains are more

commonly used than high. Complications of drains include accidental removal, infection of drain site, blocking off in the tube, and pain at the site.

Slide 19: A tracheostomy tube is inserted through the neck into the trachea. They are measured by internal and external diameter. There are multiple formulas to determine the correct size for a patient. The formula depends on age of patient and type of tracheostomy tube to be used.

Slide 20: Before we talk about why a tracheostomy tube is used, it is important to know the parts. The external part you see is the outer cannula. The neck flange has two side openings to be attached to material that goes around the neck to hold it in place. Inside the outer cannula is the inner cannula. The obturator is a solid piece used to guide the outer cannula into place prior to the insertion of the inner cannula. Tracheostomy tubes can come with or without a cuff (balloon), which is controlled by a cuff port. The cuff is filled with air. Tubes may or may not also have a hole in them. Those with a hole are called fenestrated tubes.

Slide 21: All tracheostomy tubes are used to maintain the airway, but different tubes are used for different patients. Cuffed tracheostomy tubes seal off the trachea and are anchored well enough for mechanical ventilation. Because no air goes above the tube, no air goes through the vocal cords and patients are unable to speak normally. There is a speaking valve that can be attached to the outer cannula to allow speaking but patient needs to be able to tolerate the valve and not have the need for constant ventilation. Fenestrated tubes have a hole that allows air up to the vocal cords, allowing speaking to occur. Since cuff-less tubes are only anchored by the neck flange, they are used when patients are towards removal.

Slide 22: Creating an opening in the trachea for the purpose of breathing is one of the oldest surgeries. There are even references to it in Egyptian artifacts. It was not until 1909 that tubes were introduced to maintain the opening. These tubes were made of metal through the 1960s. Tracheostomies can be done in the operating room or at bedside by a surgeon. Complications can include bleeding and damage to the esophagus during surgery. After placement, the cannula can become clogged with secretions. Due to this complication, patients with

tracheostomy tubes are closely monitored. Infection and accidental removal are also possible.

Slide 23: Chest tubes are inserted between the ribs into the pleural space. They are made of clear plastics such as silicone. Sizes range from 8 to 40 French, with 24-32 French being the average size for adults. The size of the tube used is based on the patient's age and condition.

Slide 24: Chest tubes drain air, fluid, and blood from the pleural space. Removing air, fluid, and blood allows the lung to re-expand and the patient to breathe better. A small tube size is needed for removing air, a medium size for fluid, and large size for blood or pus.

Slide 25: Chest tubes are inserted using a trocar like a surgical drain has or using a guidewire. Holes are at the internal end to allow drainage. The external end is connected to the drainage system.

Slide 26: Chest tubes can be placed in surgery but can also be placed bedside with the patient awake. Numbing agents and pain medications are used. The exact location depends what is being removed.

Ask students why sites for air are higher than fluid (air goes up!)

Chest tubes have a very low complication rate compared to other tubes. Pain, bleeding, and infection are the most common.

Slide 27: Intravenous (IV) catheters are inserted at bedside into a peripheral vein usually in the upper extremities. The lower extremities and scalp are used in infants and newborns. IV catheters are measured in gauges: the lower the number, the wider the diameter of the catheter. Vein selection is based on location, condition of vein, and purpose of the IV. The size is based on the vein selected and the purpose of the catheter.

Slide 28: Approximately 80% of patients in hospitals receive IV therapy. IVs are used to provide fluids, medications, blood, and nutrition.

Slide 29: Catheters are color-coded based on the gauge. The needle portion is to only gain entrance to the vein. After in the vein, the needle is removed leaving the plastic catheter in place. Since the catheter is short, accidental removal or misplacement of the IV is common.

Slide 30: According to the Centers for Disease Control and Prevention, IVs should only be used if needed less than 6 days and there is no need to replace peripheral catheters more frequently than every 72–96 hours. Phlebitis, infiltration, bleeding, and infection are possible complications.

Slide 31: A peripherally inserted central catheter (also known as a PICC) is inserted into a large vein in the upper arm and threaded through into the superior vena cava using a guide wire. Anything added into this catheter goes straight to the heart. It can be placed at bedside by specially trained nurses, physician assistants, and practitioners. Common sizes are 4-6 French and 25-60 cm in length.

Slide 32: PICCs are used to give fluids, blood transfusions, chemotherapy, nutrition, and other medications. They are also used for taking blood samples.

Slide 33: PICCs come in single, double, or triple lumen (channel) types. The one pictured is a double lumen PICC. The multiple lumens allow the administration of multiple fluids at the same time. For example, a patient could get medication in one lumen and blood in another lumen. The internal end has holes for fluid to exit and the external end has needleless injection ports. Clamps may or may not be present. If there are clamps present, the tube needs to be clamped when not in use so air does not get in and transported to the heart, which could be fatal.

Slide 34: Prior to use, the placement needs to be confirmed by x-ray. PICCs can stay in use for approximately a year, as long as the catheter is not clotted and there are no other complications. Clotting is the most common complication, but the PICC can be unclogged using clot dissolving medications.

Slide 35: A pulmonary artery catheter is inserted into a large vein then through the superior or inferior vena cava into the right atrium of the heart. From there, the catheter is advanced through the tricuspid valve, right ventricle, and pulmonary valve until the tip lies in the pulmonary artery. The catheter size can range from 60 to 110 cm in length and 4F to 8F in diameter. Pulmonary artery catheterization can be done under fluoroscopy or at the bedside with use of ultrasound and echocardiography.

Slide 36: Pulmonary artery catheters are common in intensive care units for diagnostic purposes. They can help assess the severity of conditions and guide treatment options.

Slide 37: Pulmonary artery catheters have five ports. The blue lumen or central venous pressure port (#1) exits in the right atrium. It can be used to infuse medications, assessment of central venous pressure and right atrial pressure. The white or clear lumen (#2) ends close to the blue lumen in the right atrium. This port is used for infusion of medications or fluids. The thermistor (#3) is a temperature-sensitive wire that rests in the main pulmonary artery. The external end is connected to a monitor that reads the cardiac output of the heart. The yellow lumen (#4) terminates in the pulmonary artery and measures the pulmonary artery pressure. The red port (#5) is the balloon port. Air is introduced to inflate the balloon and removed when needs to be deflated.

Slide 38: In 1956, Drs. Forssmann, Cournand, and Richards received the Nobel Prize in Medicine for their use of the pulmonary artery catheter. Drs. Swan and Ganz created the first pulmonary artery catheter with a balloon in 1970. Because of all the diagnostics it can provide, it was highly used and still is today. Complications are similar to a PICC.

Slide 39: A venous access port is inserted under the subcutaneous tissue on the chest. The catheter is inserted into a central vein (usually the jugular vein or subclavian vein) and ends in the superior vena cava or upper right atrium. It may stay in place for weeks or months. Ports can also be in the arms, upper thigh, and abdomen.

Slide 40: Ports are used for long-term, frequent IV therapies. Patients with ports include those receiving treatment for cancer, blood disorders, and immune disorders.

Slide 41: The portal is typically made from plastic, stainless steel, or titanium with a center of silicone or polyurethane. It appears as a small bump under the skin. The portal can be punctured by a needle repeatedly before the strength of the material is compromised. Its design contributes to a very low risk of infection. An adult portal chamber can take about 2,000 punctures on average.

Slide 42: Implantable catheters emerged in 1972 when Dr. Belin described implanting a catheter for

nutrition infusion. Trials with implantable devices were popular in the 1980s. Complications are low with ports because no part of the device is outside the body. There is a chance of infection, clotting of the catheter, or misplacement of catheter during insertion.

Slide 43: Arterial catheters (also known as arterial lines, art lines, or a-lines) are placed into arteries instead of veins. They are common in intensive care and operating room settings. There are a variety of sites, but the radial, ulnar, axillary, brachial, and femoral are the most popular.

Slide 44: There are clinical situations that require constant monitoring of blood pressure. The catheter is connected to a transducer device and monitor that displays continuous systolic, diastolic, and mean arterial blood pressures. The arterial pressure is also displayed as a waveform. The catheter can be used obtain arterial blood samples to check partial pressure oxygen, carbon dioxide, and pH of the blood.

Slide 45: Arterial catheters come in a kit that contains an 18 or 20 gauge, 1.5- or 3-inch needle, a guide wire which is 3-4 times the length of the catheter, and catheter. Radial catheters are 4.45cm in length while femoral is 16 cm. The “wings” on the catheter are for two suture stitches to secure it.

Slide 46: Unlike venous catheters, arterial catheters are not used for injecting medications. This can cause tissue damage, cell death, and possible amputation of the limb. To obtain accurate readings, the transducer must be kept at heart level. The most common complication is infection and inflammation. In case of accidental dislodgement, pressure must be applied to site to stop the bleeding.

Ask students why accidental dislodgement could be an emergency. Arterial pressure is higher than venous, thus bleed out quickly.

Slide 47: As you can see, there are many different tubes and catheters used in healthcare. It is very important to understand what they are, where they are, and how they work externally and internally.

Slide 48: Closing Slide

Lesson One – External Tube Identification

REVIEW: Identification Activity

20 minutes

Purpose:

Participants will work in groups to complete a card-matching activity with models, testing their knowledge of tube and catheter identification.

Materials:

- *External Tube Identification Activity*
- Gastrointestinal/Genitourinary System Model
- Cardiovascular/Respiratory System Model

Facilitation Steps:

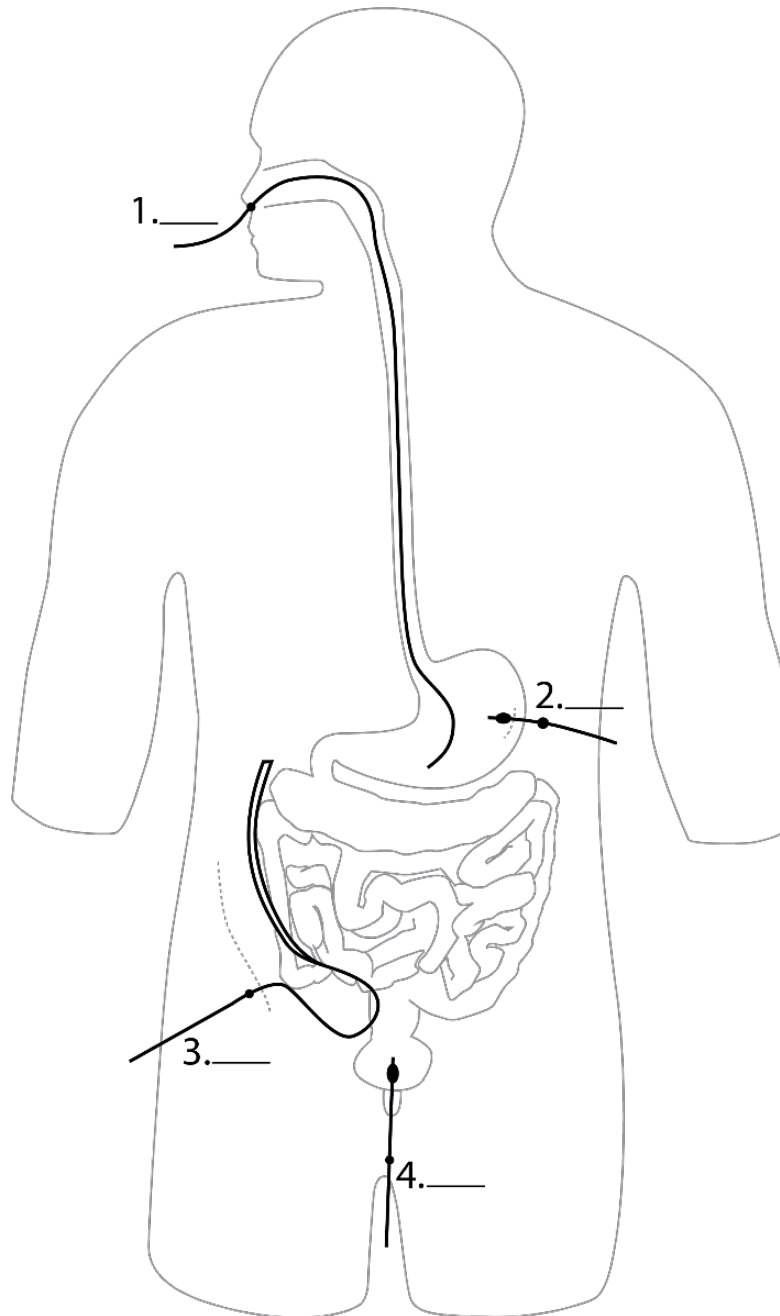
1. Set up the tube identification models and have students look at the real tubes up close
2. Distribute the *External Tube Identification Activity* to students.
3. Have students complete the activity.
4. After completion, have students pair up and compare answers or review answers as a class.

Name: _____ Class: _____

External Tube Identification Activity

Label the drawing of the Gastrointestinal/Genitourinary System Model with the corresponding letter that correlates to the proper tube:

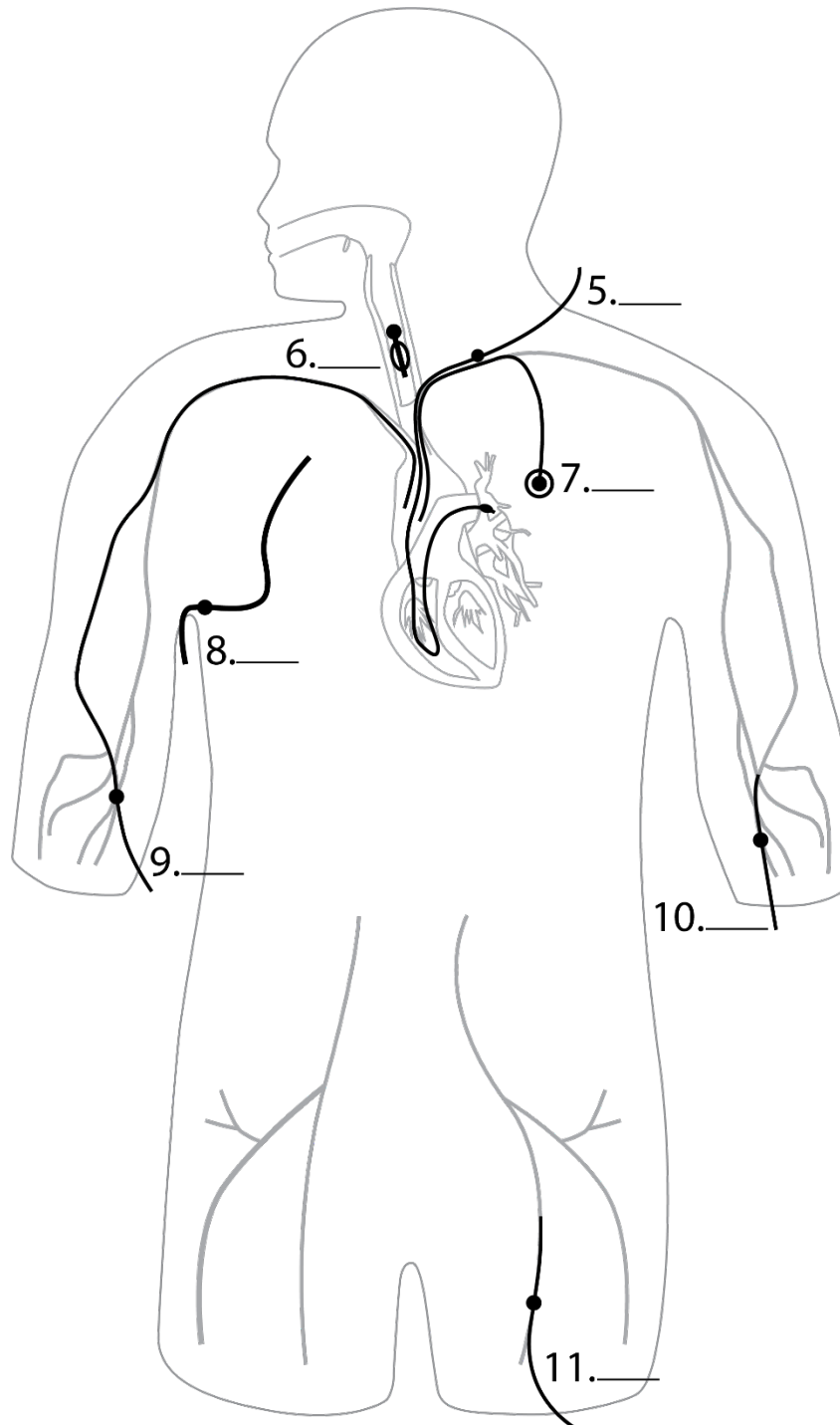
- | | |
|---|-----------------------------|
| A. Nasogastric tube (NG tube) | C. Urinary catheter (Foley) |
| B. Percutaneous endoscopic gastrostomy (PEG) tube | D. Surgical drain |



External Tube Identification Curriculum

Label the drawing of the Cardiovascular/Respiratory Model with the corresponding letter that correlates to the proper tube:

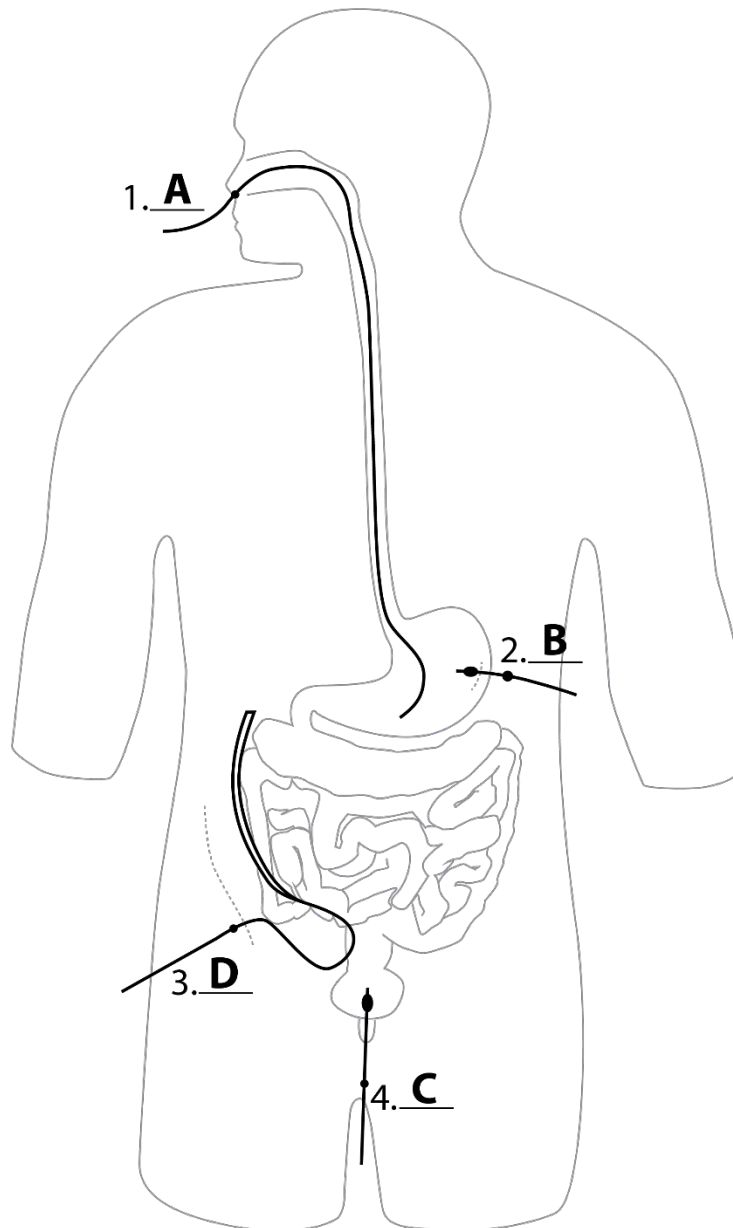
- | | |
|---|-----------------------|
| E. Chest tube | I. Porta cath |
| F. IV catheter | J. Swan-Ganz catheter |
| G. Arterial catheter | K. Tracheostomy tube |
| H. Peripherally inserted central catheters (PICC) | |



External Tube Identification Activity – Answer Key

Label the drawing of the Gastrointestinal/Genitourinary System Model with the corresponding letter that correlates to the proper tube:

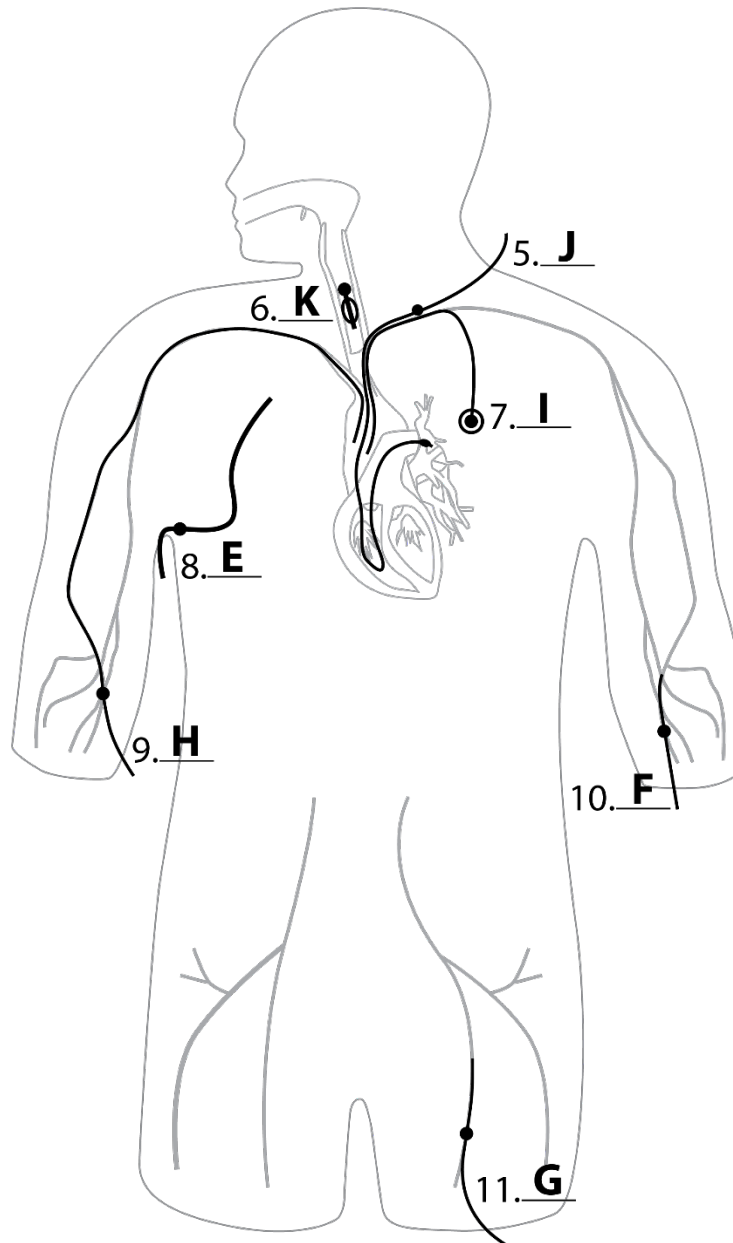
- | | |
|---|-----------------------------|
| A. Nasogastric tube (NG tube) | C. Urinary catheter (Foley) |
| B. Percutaneous endoscopic gastrostomy (PEG) tube | D. Surgical drain |



External Tube Identification Curriculum

Label the drawing of the Cardiovascular/Respiratory Model with the corresponding letter that correlates to the proper tube:

- | | |
|---|-----------------------|
| E. Chest tube | I. Porta cath |
| F. IV catheter | J. Swan-Ganz catheter |
| G. Pulmonary artery catheter | K. Tracheostomy tube |
| H. Peripherally inserted central catheters (PICC) | |



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