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PATIENT PREPARATION IN THE CT DEPARTMENT

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Many steps are taken before the patient ever sets foot into the imaging facility. Tasks such as scheduling the examination, selecting the appropriate examination protocol, obtaining pertinent medical history, and preparing the CT examination room are often done in collaboration with technologists, clerical staff, and radiologists. The exact order of the steps and what staff member will perform what task varies widely from facility to facility. This article considers the tasks that must occur before scanning a patient.

EXAMINATION INITIATION

All CT examinations must be initiated by a clinician with appropriate credentials. In addition to physicians, clinicians who may order diagnostic tests include nurse practitioners (NP) and physician assistants (PA). In outpatient settings, the order is often written by the clinician in his or her private office, and the clerical staff will then phone the scheduling division of the imaging facility to arrange an appointment. Scheduling staff then transmit the appointment to the CT department. This process introduces the potential for transcription errors at several points; therefore, it is recommended that the original requisition written by the ordering clinician be faxed or electronically transmitted to the imaging facility. In any case, it is essential that before any CT examination is performed, a copy of the original order requisition is available to the technologist so that she can verify that the appropriate examination has been planned. Ideally, some patient screening should occur at the time the examination is scheduled. This will help to schedule patients more efficiently by adequately planning for issues such as contrast media allergies and claustrophobia.

The process for initiating inpatient examinations is different than that for outpatients but may also include opportunities for transcription errors. The most accurate method for transmitting orders to the radiology department is via an electronic system in which the ordering clinician places the electronic order herself. Generically called computerized physician order entry (CPOE), these systems eliminate the transcription errors that can arise when an intermediary (e.g., clerk or nurse) must read a hand-written order and translate it into an electronic order. They also ensure that the order is legible. However, in many institutions CPOE is not available. Whenever the original order is transcribed by someone other than the ordering clinician, the process must include, as a final step, the technologist verifying the original clinician's order against that of the scheduled examination. This is often accomplished by having the patient's chart accompany the patient to the CT department.

PROTOCOL SELECTION

Once an order for an examination has been received by the CT department, a specific examination protocol must be agreed on. The proper selection of protocol is the purview of the radiologist, often with a technologist's input. In some instances, protocol selection is constrained by a specific scanner's capabilities. The overarching goal is to select the protocol that will answer the clinical question(s) posed with the least risk to the patient. Risks to the patient include those attributed to radiation exposure, contrast media reactions, or complications such as bleeding or infection that may arise from procedures such as biopsies or fluid drainage. The protocol selected must consider the patient's ability to tolerate the examination.

In some institutions radiologists review each CT request, consider the patient's medical history, and assign a specific protocol. Technologists will then carry out the selected protocol unless their review of the actual patient (rather than just the paperwork) brings up questions or concerns.

In other facilities radiologists set up specific algorithms for technologists to follow. These might include matching specific clinical indications to specific examination protocols. For example, a clinician's order for a CT Head with the clinical indication of new-onset right facial droop may be mapped to a routine CT examination of the head without the use of intravenous contrast media. These algorithms most often require the technologist to review a number of criteria from the patient's

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medical history (e.g., laboratory values related to renal function, allergies) before selecting the appropriate protocol. Technologists then only need to seek the radiologists' advice when uncertainties arise.

In either situation it is imperative that technologists understand the criteria used to determine when various protocols are appropriate. They should carefully review the requisition, reading all clinical data provided by the referring clinician. This is an important patient safeguard in that technologists can identify potential errors before an examination is performed.

ROOM PREPARATION

Before bringing the patient to the examination room, it should be appropriately prepared. Scanner calibrations and tube warm-up procedures should be done while the room is free of both patients and CT staff. The room should be checked for cleanliness, items from previous patients discarded, and supplies stocked and in their designated location. The appropriate equipment, such as head holder or foot extension, should be attached. Positioning devices such as angle sponges should be clean and readily accessible. Appropriate safety equipment, such as thyroid or breast shields, should be ready for use. On the infrequent occasion that someone other than the patient will remain in the scan room during the examination, appropriate safety equipment (e.g., lead aprons or a lead screen) must be provided.

MEDICAL HISTORY

An appropriate medical history is a vital aspect of any CT examination. It will help to ensure a patient's safety, guide the selection of examination protocol, and offer the radiologist valuable diagnostic information. Figure 1 is an example of a patient history form used to collect data for a CT examination.

At first contact with the patient the technologist must be careful to accurately identify the patient. Many cases have occurred in which technologists confused patients with similar sounding names and performed the wrong examination. When such errors are made, not only is the patient exposed to radiation from an unnecessary examination, there are risks from associating the wrong historical data to the patient (such as administering iodinated contrast to a patient who is known to be allergic to it) and, if the error is not discovered, from having a patient's treatment based on incorrect diagnostic information. At least two methods of verifying a patient's identity is required. For instance the technologist might call the patient by his full name and then ask the patient to recite his birth date and year so that it can be checked against the CT order. Methods such as checking a patient's armband and verifying identity with family members accompanying the patient can be used when the patient is unable to communicate. Hospital patients should not be identified by room number or by the name posted above the patient's bed or on the door of the patient's room.

DEPARTMENT OF RADIOLOGY IN PATIENT QUESTIONNAIRE FOR CT Date: __________ Height/Weight __________	Birthdate: Age: Name: Reg No:

Patient history of any of the following:	From Patient Chart			Confirmed by Patient
	Yes	No	Not found	
IV Contrast allergy	☐	☐	☐	☐
Severe food or medication allergy	☐	☐	☐	☐
Pregnant	☐	☐	☐	☐
Breast feeding	☐	☐	☐	☐
Active kidney disease, kidney failure, or dialysis	☐	☐	☐	☐
	Creatinine: value ______ date ______ BUN: value ______ date ______			
Thyroid cancer or hyperthyroidism	☐	☐	☐	☐
Myasthenia gravis	☐	☐	☐	☐
Taken Interleukin-2 in the past 2 weeks	☐	☐	☐	☐
	☐	☐	☐	☐
Currently taking Metformin (e.g. Glucophage, Glucovance)				☐
Current order for asthma medication				☐

Signature of person completing questionnaire ____________ Date ____________

Signature of technologist performing the exam ____________ Date ____________

FIGURE 1. An example of a patient history form used to collect data for a CT examination is shown.

PATIENT SAFETY

The administration of contrast media is contraindicated in some situations. In other situations, contrast media is administered only after a patient is premedicated to reduce the risks of an adverse event. Patients are questioned regarding renal impairment and previous allergies to assess whether they can safely be given an intravenous contrast agent. Knowing a patient's previous allergies is also necessary should an unexpected reaction occur that necessitates immediate pharmaceutical treatment. Questions regarding hyperthyroidism and other diseases of the thyroid also relate to whether the patient can safely receive an iodinated contrast agent.

A fetus, exposed to ionizing radiation in utero, is particularly sensitive to its harmful effects. Female patients within childbearing age must be questioned as to the possibility that they may be pregnant. If the woman is uncertain, the examination should be delayed while pregnancy status is determined. In the event that the patient is pregnant a careful analysis of the risks and benefits of the examination must be considered. This discussion should include the patient, the referring doctor, and the radiologist.

PROTOCOL SELECTION

Ideally, enough patient information is provided by the ordering clinician to guide the selection of examination protocol. In addition, some institutions offer electronic health records, or offer readily accessible paper records that can be used to supplement the information provided on the order requisition. Unfortunately, this is not always the case. In many situations, information obtained from the patient once he or she arrives at the imaging center will determine what examination protocol is applied. Questions regarding the symptoms that a patient is experiencing, whether the symptoms are new or chronic, and the onset of those symptoms are frequently used to select the appropriate protocol. Previous examinations should also be noted as these may also influence the protocol selected, or they may be needed as a comparison once the examination is completed.

DIAGNOSTIC INFORMATION

Many diseases or conditions have similar findings on CT images. A medical history can often aide the radiologist in narrowing down, or pinpointing exactly, the disease or condition from which the patient suffers. For example, because scarring caused by radiation therapy can mimic lung disease, it is helpful to note previous oncology treatments. Questions that include the patient's past surgeries, significant medical issues, and current symptoms augment other clinical data in helping radiologists to accurately interpret CT images.

LABORATORY VALUES

The laboratory values most frequently reviewed before routine CT examinations are blood urea nitrogen (BUN) and serum creatinine. Both of these values provide information about a patient's kidney function, which is important if the patient will receive an intravenous (IV) contrast agent. The normal range of these values can vary slightly from laboratory to laboratory, and also among adult men, adult women, and children. Laboratory reports typically provide guidance as to when a value is outside of the normal limit for a specific patient. However, as a general guide the normal range for BUN is typically between 7 and 25 milligrams per deciliter (mg/dL), and the normal range for serum creatinine is 0.6 to 1.7 mg/dL. Many institutions have a policy for when a radiologist is consulted before intravenous contrast medium is administered to patients in whom the BUN is greater than 30 mg/dL or the creatinine value is greater than 2 mg/dL.

Examinations such as biopsies and fluid drainage carry the risk of excessive bleeding. Before these examinations are performed it is important to check laboratory values that indicate whether there are any problems with the blood's ability to form clots (coagulate). Tests most often used are prothrombin time (PT), partial thromboplastin time (PTT), and platelet count. Again, although the normal range may vary slightly from laboratory to laboratory, a typical range for PT is 11 to 14 seconds, PTT is 25 to 35 seconds, and platelet count is 150,000 to 400,000 cubic millimeters (mm^3). Many health conditions (e.g., stroke, heart disease) are treated with medications that inhibit coagulation. Common anticoagulant medications include warfarin (Coumadin), heparin, Plavix, and aspirin. To reduce the risk of excessive bleeding, anticoagulation medications are often temporarily discontinued before an interventional procedure.

Table 1 lists laboratory values relevant to CT examinations and their approximate normal ranges.

TABLE 1. Lab Values

Lab Test	Approximate Normal Range*	Indicates
Blood Urea Nitrogen (BUN)	7 to 25 mg/dL	Renal function
Serum Creatinine	0.6 to 1.7 mg/dL	Renal function
Prothrombin Time (PT)	11 to 14 seconds	Blood coagulation ability
Partial Thromboplastin Time (PTT)	25 to 35 seconds	Blood coagulation ability
Platelet Count	150,000 to 400,000 mm^3	Blood coagulation ability

*The range of normal values varies slightly from lab to lab and, in many cases, between adult men, adult women, and children. Lab reports typically indicate whether a specific value is out of range for that lab and that particular patient.

PATIENT EDUCATION AND INFORMED CONSENT

CT technologists have a professional responsibility to provide patient education. The patient has the right to know about any radiologic procedure they will undergo, and most often it is the technologist who provides this information. Another aim in providing patient education is to increase patient compliance and facilitate the efficient completion of a high-quality examination.

At a minimum, the technologist should describe

- How the procedure is carried out (e.g., "you will lie on your back on a cushioned table that will move in and out of the CT scanner, which resembles a large donut")
- The approximate length of the procedure
- Whether contrast agents will be administered; if they are planned, then an explanation of how they will be administered (e.g., oral, IV) and any potential side effects is required

- What is expected of the patient (e.g., hold your breath when you hear the command, remain very still, remove metallic objects, change into a patient gown)
- Any follow-up necessary after the examination has been completed

The practice of obtaining consent from a patient before providing a healthcare service stems from the patient's legal and ethical rights to determine what shall be done with his or her own body. When a patient has not provided consent for an examination the technologist who performs the examination may be liable for battery (defined as the nonconsensual touching of another) and the facility may be vulnerable to a malpractice claim. In the medical context, the person committing battery does not have to intend harm.

Basic (or simple) consent involves letting the patient know what you plan to do and asking them whether they agree. Basic consent is appropriate for most types of radiologic procedures.

The practice of obtaining written consent from the patient for the CT examination, particularly when an intravenous contrast material is to be administered, is common in many facilities. Acquiring a signed consent form documents that the procedure and its associated risks were discussed with the patient. The practice is not universally accepted for routine CT examinations. Opponents believe that the process of reading and signing a consent form can increase patient anxiety and increase the likelihood of an adverse reaction. Further, they believe that the forms offer little protection in cases of litigation.

The goal of informed consent is to provide the patient an opportunity to be an informed participant in his healthcare decisions. It is generally accepted that complete informed consent includes a discussion of the following elements:

- The nature of the procedure
- Reasonable alternatives to the proposed intervention
- The relevant risks, benefits, and uncertainties related to each alternative
- Assessment of the patient's understanding
- The acceptance of the intervention by the patient

In the case of CT examinations of a more invasive nature, such as biopsies, there is universal agreement that a signed consent form is necessary. For the patient's consent to be valid, he must be considered competent to make the decision at hand and his consent must be voluntary. Therefore, when a consent form is required it must be signed by the patient before the administration of any medication used for pain relief or sedation. In the case of pediatric patients, a parent or legal guardian must sign the consent form. Figure 2 is an example of a consent form.

IMMOBILIZATION AND PATIENT RESTRAINT DEVICES

A variety of immobilization and restraint devices are used in CT for both patient safety and to improve the quality of the examinations. Oftentimes straps are used to protect patients from falling from the CT table and to remind them to remain still during the procedure. Bean bags can be placed alongside lower limbs to prevent motion that will degrade the CT images. Technologists should be sensitive to the patient's feeling regarding such devices. Before using any immobilization or restraining device the technologist must explain to the patient (or the patient's guardians) the need for the device and show them exactly how it will be used in their care. Whenever possible, basic consent for the use of the device should be given. In some situations consent cannot be obtained, such as for an unaccompanied patient who is unconscious, delirious, or mentally disabled. Technically, a clinician's order is required to use a restraining device for a patient who cannot provide consent. However, the short-term use of restraints to complete an imaging examination is often done without consulting the patient's physician. When restraining devices are used in CT, the following rules should be strictly adhered to:

- The patient must be allowed as much mobility as is safely possible.
- The areas of the body to which immobilizers are applied must be padded to prevent injury to the skin beneath the device.
- Normal anatomic position must be maintained.
- Knots that will become tighter with movement are prohibited.
- The immobilizer must be easy to remove quickly if necessary.
- Neither circulation nor respiration must be impaired by the immobilizer.
- If leg immobilizers are necessary, wrist immobilizers must also be applied to prevent the patient from either unfastening the device or, in an attempt to leave the table or gurney, unintentionally hanging themselves.

<<FACILITY NAME>>
Request and Consent to Medical, Surgical, Radiological or Other Procedures
Page 1 of 2

1. I have spoken with my doctors and I understand my diagnosis and condition.
2. My doctors have recommended the procedures listed on page 2 for diagnosis and/or treatment of my condition. I understand the potential benefits of these procedures. I understand the risks of not having these procedures.
3. I understand there are risks to me if the recommended procedures are done. These risks were explained to me and I understand them. They are listed on page 2.
4. The approximate location of my surgery or other procedures (operative field) has been explained to me and identified on the illustrations (if applicable). Procedures are categorized for identification and marking as follows:

   Operative Field—all procedures involving right/left distinction of the incision, multiple structures such as fingers or toes and self-identifying skin lesions such as single large lesions (eg, single café au lait).

   Specific Surgical Site—all procedures requiring specific surgical site verification, such as lymph nodes, non-self-identifying skin lesions, or breast masses; or identification on the day of surgery, such as cochlear implants, donor nephrectomies, or transplants.

   Intraoperative Surgical Site—all procedures requiring intraoperative surgical site verification, such as cochlear implants requiring EEABR (Electrical Evoked Auditory Brainstem Response) testing, spinal level procedures requiring confirmation by x-ray or stereotactic Neurosurgery and other surgical procedures requiring intraoperative site marking such as plastic reconstructive procedures.

   Excluded Sites—The following sites do no require marking: mid-line sternotomy for open heart surgery, C-Sections, laparotomy and laparoscopy that do not involve left/right distinction of the incision, interventional procedures for which the site of insertion is NOT predetermined, such as cardiac catheterization, endoscopic procedures where the scope passes through the oropharynx, nasopharynx, urethra or rectum, transvaginal or transrectal surgery, procedures of the genitalia, penile, scrotal, testicular, or vulvar areas, and breast biopsy with wire localization and dental procedures.
5. I understand that sometimes during a procedure, the doctors may decide that related or additional procedures are also necessary. I request and authorize the <<facility name>> and the providers responsible for my treatment to perform any necessary additional procedures.
6. I understand that there are risks in addition to those listed in any procedure or in the administration of an anesthetic or sedation analgesia. These include severe blood loss, infection, damage to teeth, mouth, throat, or vocal cords, nerve or eye damage, drug reaction, slowing or stopping of breathing, failure of the anesthetic or sedation analgesia, cardiac arrest, risks that cannot be predicted, permanent disability or even death. Knowing these risks, I consent to the recommended and any additional procedures. I also consent to the use of any anesthetic or sedation analgesia that my doctors or the anesthetists believe is necessary.
7. My doctors have explained the possible alternatives to the recommended surgery or other procedure and their risks. I have decided to proceed with the recommended surgery or other procedure.
8. I hereby donate and authorize <<facility name>> to won, retain, preserve, manipulate, analyze, or dispose of any excess tissues, specimens or parts of organs that are removed from my body during the procedures described above and are not necessary for my diagnosis or treatment. <<Facility name>> may use or retransfer these items for any lawful purpose, including education and retrospective research on anonymous specimens.
9. I request and authorize <<facility name>> and such doctors, nurses, medical residents and other trainees, technicians, assistants or others as may be assigned to my case to participate in the diagnosis and treatment of my condition. I understand this may also include representatives of companies that sell equipment that may be used in my surgery or procedure. I also understand that <<facility name>> is a teaching facility and that medical and other students can and do participate in procedures as part of their education. By signing this form, I am agreeing to allow medical or other students to participate in my surgery or procedure. This may include performing an examination under anesthesia that is relevant to my operation.
10. I understand that the practice of medicine and surgery is not an exact science. I have been informed of the probability of success but no promises or guarantees have been made or can be made to me about my surgery or procedure.

List any exceptions under the Exceptions section located on page 2.

FIGURE 2. An example of a consent form. A signed consent form is necessary before a CT examination of a more nvasive nature, such as a biopsy, is performed.

Date: ______________ Time: _________ A.M. / P.M.

BIRTHDATE

NAME

Reg No.

PLEASE PRINT CLEARLY WHEN COMPLETING THIS SECTION.

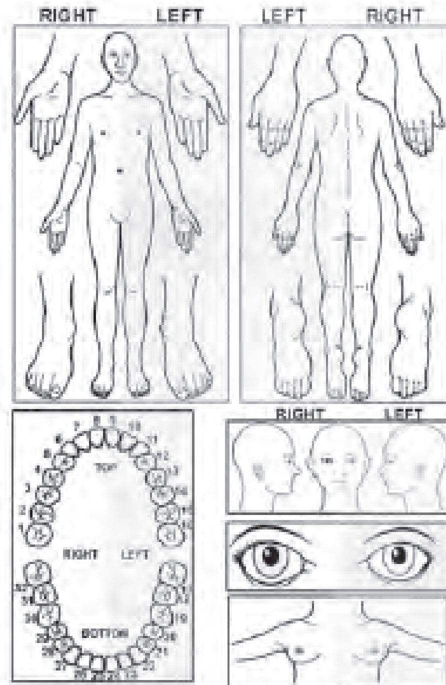
1. My diagnoses/conditions are:

2. My recommended procedures have been explained by (Physician) __________________________ **ID#:** ____________

They are:

3. My risks include:

4. I understand the approximate location of my procedure or surgical incision (operative field) as identified on the illustrations.



I have read all of the attached information. I have been given the chance to ask any questions. I understand the answers and have no other questions. I consent to the following:

PROCEDURE(S)

☐ I consent to the procedure(s) listed in #2 above (please initial).

Exceptions (to be completed by Provider ONLY): _______________

____

____

____

____

BLOOD TRANSFUSIONS

X Transfusion is not applicable to my operation

MUST CHECK ONE BOX BELOW:

☐ **Operative Field:** Check here if the site will be marked preoperatively on the day of surgery by the Preoperative Nurse/patient (see page 1).

Attending performing procedure must initial here to verify operative field. → ☐

If not initialed, the Attending will be paged to mark the site preoperatively on the day of the procedure.

☐ **Specific Surgical Site:** Check here if the site will be marked preoperatively on the day of surgery by the Attending. The Attending will be paged on the day of surgery (see page 1).

☐ **Intraoperative Surgical Site:** Check here if the site will be determined in the operating room on the day of surgery based on intraoperative testing or intraoperative site marking (see page 1).

☐ **Excluded Sites:** Check here if the operative site is considered an excluded site (see page 1).

____

Signature of Patient or Legally Authorized Representative (if patient is a minor or unable to sign)

____

Consent Obtained By:

____

Date:

FIGURE 2. (continued)

ASSESSMENT AND MONITORING VITAL SIGNS

Technologists should begin to assess the patient when they first introduce themselves. It is important to notice the patient's breathing, skin coloration, and overall health before the patient ever lies on the CT table. This will help the technologist notice signs should adverse effects occur during the scan process. Throughout the CT examination the patient should be monitored visually and spoken to frequently using the scanner's intercom system. This reassures the patient and allows the technologist to intervene quickly should problems arise.

Special monitoring devices are not generally required for routine CT examinations performed on stable patients. However, patients from inpatient units may arrive in the CT department already connected to equipment such as monitors or a respirator. Unstable patients and the equipment they arrive with must be watched carefully while in the CT department. Because the CT technologist must focus on the tasks necessary to perform a high-quality examination, a nurse (or other health professional with appropriate training) should accompany these patients to provide the necessary monitoring and intervene should the need arise.

It is obvious that many of the patients cared for in the CT department are quite ill. In addition to the medical symptoms that necessitated the examination, patients may also have adverse reactions to the intravascular contrast agent used for the examination. Although rare, serious adverse reactions are, for the most part, random and totally unpredictable. Therefore, technologists must be alert for physiologic changes in their patients. The best early indicators of a problem are changes in body temperature, pulse, respirations, and blood pressure. Collectively these are called the vital signs (or cardinal signs). The normal range of vital signs may vary somewhat with age, sex, weight, exercise tolerance, and condition. Other important indicators include pain, pulse oximetry values (indicates blood oxygenation), and pupil size, equality, and reactivity.

BODY TEMPERATURE

Body temperature is most often taken by placing the thermometer in the mouth, the ear (using a tympanic infrared thermometer), the axilla, or the rectum. In the CT department, the thermometer is most often an electronic, battery-operated device with disposable protective sheaths. Other options are tympanic thermometers (also with disposable protective sheaths); disposable, single-use chemical strip thermometers (such as the 3M Tempa-Dot); mercury-free, glass thermometer (a blue tip typically denotes an oral thermometer whereas a red tip denotes a rectal thermometer). Oral, rectal, and tympanic temperature measurements are higher than axillary measurements because the measuring device is in contact with the mucous membrane. Table 2 lists the average temperature and the normal range for each temperature site.

TABLE 2. Average and Normal Range of Body Temperature

Route	Average	Normal Range
Oral	98.7º F (37. 0º C)	96.8º to 100.4º F (36.0º to 38.0º C)
Rectal	99.1º F (37. 7º C)	97.2º to 100.8º F (36.7º to 38.7º C)
Axillary	97.7º F (36.4º C)	95.8º to 99.4º F (35.4º to 37.4º C)
Tympanic*	Calibrated to oral or rectal scales	

*Research is inconclusive as to the accuracy of readings and correlations with other body temperature measurements.[1]

PULSE

Each time the heart contracts it forces blood into an already full aorta. The elasticity of the arterial walls allows them to expand to accept the increase in pressure. Pulse is defined as the alternate expansion and recoil of an artery. By counting each expansion of the arterial wall in a given time frame the pulse rate can be determined.

In general, the pulse can be felt wherever a superficial artery can be held against firm tissue, such as a bone. Some of the specific locations where the pulse is most easily felt are as follows (Figure 3):

- Temporal pulse (superficial temporal artery)—just anterior to the ear
- Facial pulse (facial artery)—the lower margin of the mandible, about one third anterior to the angle
- Carotid pulse (carotid artery)—along the anterior aspect of the neck, to the right or left of midline
- Brachial pulse (brachial artery)—on the medial side of the elbow cavity, located between the biceps and triceps muscle, frequently used in place of the carotid pulse in infants
- Radial pulse (radial artery)—at the thumb side of the wrist
- Femoral pulse (femoral artery)—in the groin
- Popliteal pulse (popliteal artery)—behind the knee
- Pedal pulse (dorsalis pedis artery)—top of the foot
- Pedal pulse (tibialis posterior artery)—posterior ankle, behind medial malleolus

The patient's blood pressure will impact the ease of palpability of a pulse. If his systolic blood pressure is

less than 90 mm Hg, the radial pulse will not be palpable. Less than 80 mm Hg, the brachial pulse will not be palpable. Less than 60 mm Hg, the carotid pulse will not be palpable. Because systolic blood pressure rarely drops that low, the lack of a carotid pulse usually indicates cardiac arrest.

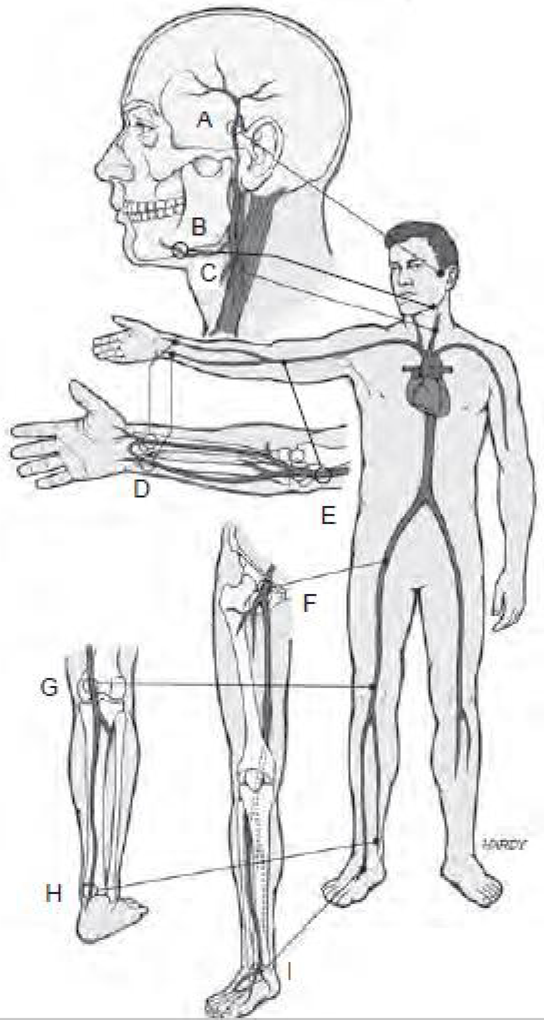


Figure 3. Locations where pulse can be taken where: A) temporal pulse; B) facial pulse; C) carotid pulse; D) radial pulse; E) brachial pulse; F) femoral pulse; G) popliteal pulse; and H/I) pedal pulses.

The average adult pulse rate ranges from 60 to 100 beats per minute. However, in athletic adults, a normal pulse rate can range between 45 and 60 beats per minute. The average pulse rate for a child ranges from 95 to 110 beats per minute; infants, from 100 to 160 beats per minute. When a pulse is being counted, the rate, rhythm, and volume should be noted. An irregular pulse is one that has a period of normal rhythm broken by periods of irregularity or skipped beats. The volume (or strength) of the pulse is often described as full and bounding if it seems regular and with good force, or if it is difficult to palpate and irregular it is often described as weak or thready.

RESPIRATIONS

The respiratory rate is the number of breaths a person takes per minute. It is usually measured when the patient is at rest and simply involves counting the number of breaths for 1 minute by counting how many times the chest rises. Normal respiratory rates vary according to age. Commonly accepted normal ranges are as follows: adults, 14 to 20; adolescent youth, 18 to 22; children, 22 to 28; infants, 30 or greater. The ratio of respiration to pulse is fairly constant at approximately 1 breath to 4 heart beats.

BLOOD PRESSURE

Blood pressure may be defined as the pressure exerted by circulating blood on the walls of the vessels. The term blood pressure generally refers to arterial pressure, that is, the pressure measured in the larger arteries. The pressure is determined by the force and amount of blood pumped, and the size and flexibility of the arteries. Blood pressure is continually changing depending on activity, temperature, diet, emotional state, posture, physical state, and medications used. Blood pressure is most commonly measured by a sphygmomanometer (often condensed to sphygmometer), which uses the height of a column of mercury to reflect the circulating pressure. Although many modern blood pressure devices no longer use mercury, values are still universally reported in millimeters of mercury (mm Hg).

The systolic pressure is defined as the peak pressure in the arteries, which occurs near the beginning of the cardiac cycle; the diastolic arterial pressure is the lowest pressure (at the resting phase of the cardiac cycle). Although there are large individual variations, typical values for a resting, healthy adult are approximately 120 mm Hg systolic and 80 mm Hg diastolic. This would be written as 120/80 mm Hg, and spoken as “one twenty over eighty.” Hypertension refers to blood pressure that is abnormally high, whereas hypotension refers to blood pressure that is abnormally low. In children the observed normal ranges are lower; in the elderly, they are often higher, largely because of reduced flexibility of the arteries. Sex and race also influence blood pressure values. Debate exists over the optimal blood pressure values that will reduce the risk of cardiovascular disease. However, in the CT department blood pressure is used as an indicator of acute problems; therefore, the technologist need only be concerned about measurements that fall outside of a relatively broad range of values considered “normal.” For adults, the normal range of systolic pressure is 90 to 140 mm Hg, diastolic, 60 to 90 mm Hg. For children, the normal range of systolic pressure is 65 to 130 mm Hg, diastolic, 45 to to 85 mm Hg.

In radiology, blood pressure is most commonly measured by the auscultatory method that uses a stethoscope and a sphygmomanometer. An inflatable cuff that

is attached to a manometer is placed around the upper arm at roughly the same vertical height as the heart. The technologist should take care to use a cuff of the appropriate size (i.e., small cuffs for pediatric patients, larger cuffs for obese patients). The cuff is manually inflated by repeatedly squeezing a rubber bulb until the artery is completely occluded (i.e., gauge reads at least 180 mm Hg). Listening with a stethoscope at the brachial artery at the inside of the elbow, the technologist slowly releases the pressure in the cuff. When blood begins to flow again in the artery the turbulent flow creates a "whooshing" sound. The pressure at which this sound is first heard is the systolic blood pressure. The cuff pressure continues to be released until no sound can be heard. This point is the diastolic pressure.

SUMMARY

Many critical steps in the CT process occur before the first image is acquired. Safe, clinically useful examinations can only be performed after an appropriate medical history has been taken, the patient has been accurately identified, the examination explained, and the patient consents to the procedure. Safe and effective patient care also necessitates the technologist's understanding of assessment and monitoring techniques.

The steps taken can be summarized as followed:

1. Prepare room
2. Verify order
3. Verify patient identity
4. Obtain medical history
5. Explain examination and obtain consent
6. Continually assess patient

REFERENCE

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PATIENT PREPARATION IN THE CT DEPARTMENT POST TEST

Expires: August 15, 2012 Approved for 1 ARRT Category A Credit.

1. Regarding an order for a CT exam, all of the following statements are true EXCEPT:

a. CT exams can only be ordered by a physician.
b. Before beginning any exam the technologist must verify that the correct exam is planned by checking the clinician's order.
c. In many facilities clinician orders for CT exams are transcribed clerks; this process introduces the potential for transcription errors.
d. Ideally, some patient screening should occur at the time the exam is scheduled.

2. All of the following are reasons for obtaining a history before a CT exam is performed EXCEPT:

a. to verify that the patient has not exceeded his radiation limit.
b. to select the appropriate protocol.
c. to be sure the exam can be performed safely.
d. to aid the radiologist in their interpretation of the CT exam.

3. Computerized physician order entry systems reduce, or eliminate, what type of errors?

a. Incorrect identification of the patient
b. Transcription errors
c. Excessive radiation dose from the incorrect selection of scan parameters
d. Referring clinicians ordering an incorrect exam for the clinical indication

4. Scanner calibrations and tube warm-up procedures should be done

a. after the scout image has been obtained.
b. before beginning each patient exam.
c. after completing each patient exam.
d. while the room is free of both patients and CT staff.

5. Which of the following is NOT an acceptable method of verifying a patient's identity?

a. Call the patient by his full name and then ask the patient to recite his birth date and year, so that it can be checked against the CT order.
b. Use the patient's armband to check the patient's name and medical record number.
c. Ask family members that accompany the patient to verify the patient's name and address and check that against the CT order.
d. Use the sign on the door of the patient's room or ask the patient what hospital room they are assigned to.

6. In many institutions a radiologist is consulted before intravenous contrast medium is administered to patients where the creatinine value is greater than
   a. 0.4 mg/dL.
   b. 0.8 mg/dL.
   c. 2.0 mg/dL.
   d. 8.0 mg/dL.

7. Why is a patient questioned regarding whether they have a history of an overactive thyroid?
   a. To select the correct protocol
   b. To determine whether an iodinated contrast agent can be administered intravenously
   c. To help the radiologist diagnose a goiter
   d. To determine whether a female patient could be unknowingly pregnant

8. Blood urea nitrogen (BUN) and serum creatinine provide information about a patient's
   a. thyroid function.
   b. kidney function.
   c. risk of allergy to iodinated contrast media.
   d. cardiac function.

9. For which of the following exams is it common to check lab results from prothrombin time (PT), partial thromboplastin time (PTT), and platelet count?
   a. Coronary CT angiography
   b. Post-myelography CT studies
   c. CT-guided biopsy
   d. CT abdomen and pelvis

10. You complete the CT exam and will remove the intravenous catheter. Which of the following medications may necessitate holding pressure on the puncture site for a longer period?
   a. Coumadin®
   b. Benadryl®
   c. Tylenol®
   d. Synthyroid®

11. In the CT setting, which describes the concept of basic (or simple) consent?
   a. Prior to the CT exam, the technologist explains the procedure to the patient and asks him if he agrees.
   b. A written document is given to the patient or guardian (or read to him, if necessary). The document lists all of the potential complications of the procedure. The patient must sign the form to acknowledge that he understand both the risks and benefits of the exam.
   c. Consent that is inferred from signs or action. For example, if a patient holds out his arm so that you can start an intravenous line, it can be implied that he gives his consent to the procedure.
   d. The requirement that, for minors, one or more parents must consent to the procedure.

12. Which of the following is a TRUE statement regarding signed consent forms?
   a. In most states, a signed consent form is required before any CT exam.
   b. Once a patient signs a consent form they can no longer file a malpractice claim.
   c. If written consent is required it must be signed by the patient prior to the administration of any medication for pain relief or sedation.
   d. A signed consent form is not necessary for any CT exams.

13. All of the following are true statements regarding patient restraints EXCEPT:
   a. The immobilizer must be easy to remove quickly if necessary.
   b. Patients are restrained primarily as a convenience for the technologist.
   c. If leg immobilizers are necessary, wrist immobilizers must also be applied.
   d. A doctor's order is necessary when a patient is to be restrained against his will.

14. Why is it important for the technologist to note the patient's breathing, skin coloration and overall health before the exam begins?
   a. The technologist must accurately document each of these factors on the patient's chart.
   b. It will help determine if the patient is healthy enough to proceed with the study.
   c. If a patient has even a small problem in any of these areas they will not be given IV contrast material.
   d. It will help the technologist notice signs should adverse effects occur during the scan process.

15. Which of the following is NOT considered one of the vital signs?
   a. Weight
   b. Pulse
   c. Respirations
   d. Blood pressure

16. Pulse is defined as the
   a. pressure exerted by circulating blood on the walls of the vessels.
   b. alternate expansion and recoil of an artery.
   c. peak pressure in the pulmonary vein.
   d. level of blood oxygenation.

17. Where is a pedal pulse felt?
   a. Behind the knee
   b. Along the dorsal aspect of the great toe or arch of the foot
   c. Anterior ankle
   d. Posterior ankle or top of the foot

18. What is the normal range for the respiratory rate of an adult?
   a. 14 to 20
   b. 21 to 26
   c. 26 to 30
   d. 30 to 34

19. The normal ranges of blood pressure in children are

a. lower than adults.
b. about the same as adults.
c. about the same as the elderly.
d. is twice that of either adults, or the elderly.

20. Blood pressures values are universally reported in

a. milliequivalents (mEq).
b. milligrams per deciliter (mg/dL).
c. millimeters of mercury (mm Hg).
d. cubic millimeters (mm^3).

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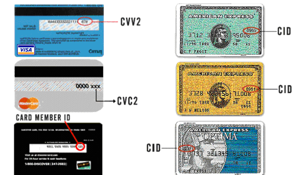

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