1 Assessment

One of the first tasks a computed tomography (CT) technologist encounters is patient assessment. From the moment a CT technologist meets the patient, they should be visually assessing the patient's current state (e.g. skin coloration, respiratory rate, dilation of the eyes, and overall health) and watching for any changes while the patient is in their care. This monitoring often incorporates both visual and verbal assessment. Aspects of assessment include obtaining a medical history and consent, monitoring vital signs, transferring patients, documenting, and communicating with other members of the healthcare team.

Obtaining Medical History and Consent

- The technologist must have good communication skills to obtain a thorough medical history and consent from patients.
- Communication with patients should be professional, respectful, attentive, and focused.
- Interactive communication allows the patient to feel safe, valued, and involved in their care.

- The technologist should aim to personalize care to the specific needs of the patient.
- Effective communication enables technologists to work efficiently while fostering a safer, more trusting environment that reduces risks and enhances patient's perception of care.[1–3]

Verification

When obtaining a medical history, it is imperative to verify the patient's identity before starting the exam.

- Identify the patient using two forms of unique information:
  - Name
  - Date of Birth (DOB)
- Review the physician's order and ensure it aligns with the patient's medical history.
- Obtain verbal or written consent depending on the invasiveness of the exam (consent).

Medical History

Providing the interpreting radiologist with a detailed medical history offers essential context for the patient's images, aiding accurate image interpretation.

- Use focused questions to help the patient provide relevant information.
- Review previous imaging in the area, if available. Matching previous protocols for reoccurring issues allows for reproducibility and easier comparison between previous and current images.
- Prior surgeries should be noted in patient history and communicated to the radiologist.

- Ask about any history of primary cancer or metastatic disease.
- If contrast is to be administered, verify the patient does not have any contraindications for contrast media (Chapter 2).

Consent: Informed Consent

Studies have a well-established link between effective communication and reducing medical malpractice claims.[3,4] Patients feel more satisfied with their care when they are fully informed. Effective communication helps reduce the likelihood of a malpractice claim because it reduces misunderstandings, builds trust, enhances team coordination, encourages transparency, and provides a means to document key interactions and informed consent.

- **Types of Consent**
  - **Verbal**: An agreement given by the patient's word. Also referred to as basic consent; the technologist explains the procedure to the patient and asks if they agree.
  - **Written**: A more formal type of consent in which a form must be signed (usually with more invasive procedures, contrast administration, etc.).
  - **Implied**: When a patient needs lifesaving care and there is no "do not resuscitate" (DNR) order in place. It is primarily utilized in trauma situations.
- **Requirements for Informed Consent**
  - The patient must be of legal age and deemed mentally competent. If not met, then a parent or legal guardian must provide consent.
  - Consent must be voluntary. The patient cannot be forced or coerced.

- All risks and alternatives of the procedure must be discussed.
- Allow the patient time to ask questions prior to signing or providing their decision.

Monitoring Vital Signs

A CT technologist requires knowledge of vital signs and how to accurately assess them on patients. Vital signs are key early indicators of significant physiologic changes in the patient, making it important to know how to measure, recognize when they should be recorded, and distinguish them as normal versus abnormal.

- **Blood Pressure**
  - Blood pressure measures the pulses of heart systole (ventricular contraction) and diastole (atrial contraction/ventricular relaxation) and is reported in millimeters of mercury (mmHg).
  - Blood pressure is measured using a sphygmomanometer. If measuring blood pressure manually, a stethoscope is also necessary.
  - Hypertension refers to high blood pressure.
  - Hypotension refers to low blood pressure.
  - Blood pressure can vary based on age and sex (Tables 1.1[5], 1.2[6], and 1.3[6] for adult, age, and gender blood pressures, respectively).
- **Pulse**
  - Pulse (heart rate) is the measurement of arteries expanding and recoiling, assessed by counting the number of heart beats per minute (bpm). A variety of arteries can be accessed for this measurement, but the most commonly used are radial and carotid arteries.

Table 1.1 Adult Blood Pressure Values

Category	Systolic (mmHg)	Diastolic (mmHg)
Normal	<120	<80
Elevated	120–129	<80
Hypertension Stage 1	130–139	80–89
Hypertension Stage 2	140+	90+
Hypertensive crisis	>180	>120
Hypotension	<90	<60

Table 1.2 Normal Blood Pressure Ranges by Age

Age	Systolic (mmHg)	Diastolic (mmHg)
Newborn–1 month	60–90	20–60
Infants (1–12 months)	87–105	53–66
Toddlers (1–5 years)	95–105	53–66
Children (6–13 years)	97–112	57–71
Adolescents (14–18 years)	112–128	66–80
Adults (18–39)	95–135	60–80
Adults (40–59)	110–145	70–90
Adults (60+)	95–145	70–90

Table 1.3 Normal Blood Pressure Ranges by Sex as Assigned at Birth

Age	Female (Systolic/ Diastolic) (mmHg)	Male (Systolic/ Diastolic) (mmHg)
18–39 years	110/68	119/70
40–59 years	122/74	124/77
60+ years	139/68	133/69

- Other arteries used for measuring pulse include the temporal, brachial, femoral, popliteal, tibialis posterior, and pedal (dorsal pedis) arteries.
- In addition to the pulse rate, rhythm can indicate a normal or abnormal heart function (arrhythmias), which are typically diagnosed with electrocardiograms (ECGs).
- An adult heart rate above 100 bpm is tachycardia.
- A heart rate below 60 bpm is bradycardia.
- Heart rate varies based on age (Table 1.4).

- **Respiration Rate**
  - Respirations refer to the number of breaths taken per minute.
  - One respiration is noted as the rise and fall of the chest or abdomen.
  - Respirations can be manipulated by the patient, so best practice is to assess without the patient's awareness.
  - When recording respirations, also note the descriptive nature of the breathing (i.e. labored, shallow)
  - Respiration rates vary based on age (Table 1.5).

Table 1.4 Normal Heart Rates by Age

Newborn	100–205 bpm
0–1 year	100–180 bpm
3–5 years	80–120 bpm
5–12 years	75–118 bpm
13–18+ years	60–100 bpm
Athletic	45–60 bpm

Table 1.5 Respiration Rates by Age

0–1 year	30–60 breaths/minute
1–3 years	24–40 breaths/minute
3–6 years	22–34 breaths/minute
6–12 years	18–30 breaths/minute
12–18 years	12–16 breaths/minute
18+ years	10–20 breaths/minute
60+	May increase to 28 breaths/minute

- **Body Temperature**
  - Body temperature can be measured from the forehead, mouth (oral), ear, axilla, or rectum. Rectal provides the most accurate measurement while axillary provides the least accurate.
  - The site of measurement may vary with patient age. For example, rectal is more appropriate for infants than adults.
  - Body temperature varies with the time of day, with cooler temperatures measured in the morning, and higher temperatures in the late afternoon/evening.
  - Patient age primarily determines the normal range for body temperature (Table 1.6).

Patient Transfers

All patients who enter the CT suite must be placed on the CT table. Some patients can transition to the table themselves, but many require additional assistance. If ever unsure of performing a transfer alone, always request help from

Table 1.6 Normal Body Temperature by Age

°F	0–2 years	3–10 years	11–65 years	65+ years
Core	97.5–99.0	97.5–100.0	98.2–100.2	96.6–98.8
Forehead	95.9–99.5	95.9–99.5	97.6–99.6	96.4–98.5
Oral	N/A	95.9–99.5	97.5–99.6	96.4–98.5
Rectal	97.9–100.4	97.9–100.4	98.6–100.6	97.1–99.2
Axillary	94.5–99.1	96.6–98.0	95.3–98.4	96.0–97.4
Ear	97.5–100.4	97.0–100.0	96.6–99.7	96.4–99.5

another healthcare provider. This is for the safety of both the patient and technologist. Modes of patient transfer include the following:

- **Ambulatory**: A patient who is able to walk, move, and get on/off the CT table independently and without assistance. However, the CT technologist must stay nearby to assist the patient and provide positioning instructions. Comfort items should be provided as necessary.
- **Wheelchair**: When transferring a patient between a wheelchair and the CT table, the patient's stronger side must be determined and the following steps should be taken for a successful wheelchair pivot assist transfer.
  - Bring the wheelchair close to the table at a 45° angle, with the patient's strong side nearest the transfer point. This reduces travel distance and helps the patient assist in the transfer.
  - Lock both wheels on the wheelchair.
  - Move both foot pedals out of the way to avoid them becoming a tripping hazard.
  - Communicate the transfer to the patient, allowing them to actively participate.
  - Support the patient to a standing position.

- Assist the patient in pivoting until the back of their knees touch the CT table.
- Assist the patient to a sitting position.
- Help the patient to a recumbent position by simultaneously supporting their back and legs to maintain spinal alignment.
- Comfort items provided as necessary.

- **Stretcher**: Moving a patient from a stretcher can be done using draw sheets and/or a slider board. This transfer requires at least two individuals. The following steps should be taken for a successful stretcher transfer:
  - Ensure the CT table and stretcher are at the same height/level.
  - Instruct the patient to cross their arms across their body to prevent arms from getting caught during the transfer.
  - If a sheet is already under the patient, it can be retrieved by both healthcare providers. One person pushes and the other pulls. The individual performing the pull at the patient's head is deemed the leader of the transfer. All team members must be aware of the agreed-upon signal when initiating the transfer.
  - If there is not a sheet under the patient, a log-roll technique can be used to place a sheet under the patient. To do this, one individual will roll the patient toward them, while the other places the sheet as far under the patient as possible. The patient is then rolled back to the supine position and the sheet pulled through to the other side. Resume transfer using sheet.
  - If the patient is in a c-collar, a dedicated individual is required to maintain head and neck alignment during the roll and transfer.
  - To use a slider board, use a sheet to roll the patient. While the patient is rolled, one team member

pushes the slider board under the patient. The slider board provides a slick surface for which the patient can then be slid across from stretcher to CT table.

- **Mechanical Lift**: Moving a patient with a mechanical lift can be beneficial when the patient is unable to assist with the move and/or may be too large to lift safely manually. CT technologists must be properly trained on using their facility's mechanical lift(s) to ensure patient safety.

Documentation

Documentation is an important step in the CT workflow. The technologist must provide the requisition for the imaging exam, notes from patient history, pertinent lab values, documentation of any contrast administration, medication reconciliation, radiation dose summaries, and any other relevant information in how the exam was performed to the patient's medical record.

- Documentation of contrast administration must include (Chapter 2):
  - Type of contrast administered.
  - Route given (i.e. oral and intravenous)
  - Time the contrast was administered.
  - Patient verification.
  - Volume of contrast administered.
  - Any reactions must document care given for any necessary remediation and name of whom reactions were reported (i.e. radiologist and ordering physician).
- Radiation dose summaries involve (Chapter 3):
  - Dose length product (DLP) and computed tomography dose index (CTDIvol) are commonly reported and included in the patient's chart.
  - Some institutions are working on integrating a standardized system to track DLP and CTDIvol to track a patient's lifetime cumulative dose.

Intercommunication Within Healthcare Team

Communication within the healthcare team is crucial to providing high-quality care to patients. The CT technologist must effectively communicate with ordering physicians, radiologists, nurses, and other healthcare professionals involved in the patient's care.

- **Ordering Physician**
  - The ordering physician assesses the patient and determines necessary imaging orders.
  - Computerized order entry (COE) may be used to enter the order by the physician or their office staff.
  - COE is not always entered correctly because physicians may not be familiar with all available CT protocols. Therefore, the technologist should review the physician's order and reason for exam.
  - If the reason for exam does not match the COE, the technologist must confirm the correct order with the ordering physician.
- **Radiologist**
  - Regular communication between the radiologist and CT technologist is crucial for an effective CT suite.
  - The technologist and radiologist must establish a relationship of trust when communicating.
  - The technologist often communicates with the radiologist regarding imaging protocol variations, changes, and procedures.
  - Further imaging may be necessary, and the technologist should know when to call the radiologist to determine necessity before dismissing the patient.
  - Post-processing protocols vary based on facility. Some facilities require CT technologists to perform

post-processing, whereas some have dedicated technologists, and some may be completed by the radiologist. Communication to determine responsibility for any post-processing is essential.

- **Nurses**
  - In the hospital setting, nurses are assigned to patients and are an integral part of the healthcare team.
  - The CT technologist is required to interact and communicate with nurses in the emergency department (ED), on the floor (inpatients), from outpatient clinics, intensive care units (ICU), and within the radiology department.
  - CT technologists must perform a proper hand-off with the patient's assigned nurse prior to and after performing a CT examination to prevent gaps in care.
  - The radiology nurse will be part of various CT procedures.
- **Other**
  - CT technologists must be able to efficiently and effectively communicate as a team within the CT suite, so they can help with any part of the exam.
  - If labs are ordered on the patient, establishment of an IV line can be used to draw blood for lab orders; communication with laboratory technologists may be necessary.
  - CT is often used in medical emergencies. Emergency medical technicians (EMTs), surgeons, and/or respiratory therapists may be additional team members within the CT suite. Effective communication within this team dynamic improves speed and productivity during such critical exams, particularly when timing is important.