



Beijing Beilu Pharmaceutical Co., Ltd

Norms for Safe Use of Iodine Contrast Agents

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At the radiology department, the treatment process of enhanced CT patients is roughly divided into three stages:

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1. Before examination
 2. Enhanced scans
 3. After examination



Key contents before enhanced examinations



Before using an iodine contrast agent, the following preparations need to be made:

- (1) Exclusion of contraindications
- (2) Assessment of risks/benefits
- (3) Informed consent
- (4) Iodine allergy test
- (5) Sufficient hydration
- (6) Contrast agent pretreatment
- (7) Contrast agent selection
- (8) Others



Exclusion of contraindications	Prohibited in patients with untreated hyperthyroidism
Assessment of risks/benefits	(1) Patients who have had moderate or severe allergic reactions to iodine contrast agents in the past, or have a history of allergies requiring treatment; (2) Iodine contrast agents can cause acute kidney injury, especially in patients with preexisting kidney disease or diseases that affect kidney function (diabetes, hypertension, etc.); (3) Drugs in use (ACEI, β -blockers, proton pump inhibitors, etc.);
Informed consent	Inform the patients of indications and contraindications of the use of iodine contrast agents Possible adverse reactions and precautions.
Iodine allergy test	There is no need to carry out the test routinely, unless specifically stated for some drugs.
Sufficient hydration	Hydration is required within 6-12 h before to 24 h after the use of an iodine contrast agent; (1) Arterial use: The patient should be given intravenous infusion of 0.9% normal saline or 5% glucose + 154 mmol/L sodium bicarbonate solution 6-12 h before the contrast agent injection. ≥ 100 mL/h, continue for 24 h after injection. (2) Intravenous use: The patient should orally drink water or normal saline 4-6 hours before the contrast agent injection and continue until 24 hours after injection, with a dosage of 100 mL/h.
Contrast agent treatment	Heat the iodine contrast agent to 37 °C
Contrast agent selection	It is recommended to use non-ionic hypotonic or isotonic contrast agents
Establishment of an infusion pathway	It is recommended to use indwelling needles or high-pressure-resistant dual-lumen PICC needles for contrast agent injection; correctly fix; clearly mark.
Others	(1) Use iodine contrast agents after nephrotoxic drugs have been stopped for ≥ 24 h; (2) For those with severe renal insufficiency, try to use a test method that does not require iodine contrast agents. If iodine contrast agents must be used, those receiving elective examinations should have their serum creatinine tested 7 days before the examination. If serum creatinine is elevated, it is required to prevent kidney damage 24 hours before the examination, but serum creatinine may not be tested if emergency examination is required; (3) It is recommended to use the minimum dose of iodine contrast agents to achieve diagnostic purposes; (4) Avoid repeated use of iodine contrast agents within a short period of time. If repeated use is required, there should be an interval ≥ 14 d; (5) Avoid using mannitol and diuretics; (6) Biguanides should be stopped 48 hours before the use of an iodine contrast agent, and can be used again 48 hours after the use only if the kidney function has returned to normal or baseline level;



Key contents during enhanced examinations

Key point 1 during enhanced examinations: contrast injection protocol

Device parameters, patient disease, and scanning location all affect the scanning protocol. The degree of organ imaging enhancement depends on the total iodine load, and angiography depends on the iodine delivery rate.



Organ imaging

Total Iodine Load
Total iodine load
521 mg/kg



CT angiography

Iodine Delivery Rate
Recommended
1.5-2.0 g iodine/s

Iodine delivery rate (IDR) = contrast agent concentration \times contrast agent injection rate
Total iodine load (TIL) = contrast agent concentration \times contrast agent injection rate \times time
= Contrast agent concentration \times contrast agent volume



Key point 1 during enhanced examinations: contrast injection protocol

- Under a fixed injection protocol, use high-concentration contrast agents to improve image quality and diagnostic value (by increasing iodine delivery rate or total iodine load).
- Under individualized injection protocols, the use of high-concentration contrast agents can achieve the same image quality (by maintaining a constant iodine flow rate or total iodine load) at a lower injection rate and contrast agent dosage.

Expert consensus recommends that the lowest dose of iodine contrast agents should be used under the premise of meeting imaging/diagnostic purposes. For the maximum dosage of iodine contrast agents, please refer to Cigarroa's calculation formula: $[5 \text{ mL} \times \text{body weight (kg)}/\text{serum creatinine (mg/dL)}]$ (total dose shall not exceed 300 mL)



Key point 1 during enhanced examinations: contrast injection protocol

Guidelines recommend the use of non-ionic hypotonic or isotonic iodine contrast agents:

(1) High concentration: to ensure the clinical requirements for development quality;

(2) Low viscosity (10.0 mpa*s/37 °C):

- a. Does not damage the patient's microcirculation;
- b. Can meet the requirements of rapid injection and infusion;
- c. Reduce the stagnation of the contrast agent in the renal tubules, thereby reducing the damage to kidney function;

(3) Low osmotic pressure (770mOsm/kg H₂O)

Reduce or avoid the following conditions: vascular pain, endothelial injury, thrombosis and thrombophlebitis, blood-brain barrier disorders, increased pulmonary circulation pressure, bradycardia (during cardiovascular angiography). In these cases, they are the preferred iodine contrast agent s.



Key point 2 during enhanced examinations: nursing and care during infusion



- (1) **Checking:** Check the basic information of the patient again (name, age, gender, examination site, examination method, etc.)
- (2) **Communication:** Instruct the patient to take an appropriate position according to the examination site, inform the patient of the precautions, such as breathing coordination and avoidance of coughing, and normal reactions and adverse reactions that may occur, and give the patient psychological comfort.
- (3) **Access:** Connect the high-pressure syringe line, exhaust, confirm that there is no air bubble in the high-pressure line, and then connect the patient's venous access. The nurse first manually tests the fluid, and then the technician tests the fluid under high pressure. Be sure to “look first, touch next, feel then and inquire finally” to ensure the unobstructed and safe connection between the high-pressure syringe and the blood vessel pipeline.
- (4) **Guidance:** The technician guides the patient to cooperate with the examination step by step, strengthens training, and gives encouragement and comfort.
- (5) **Setting:** The technician sets the optimal dose and rate according to the patient's age, body mass index, examination site and type of contrast agent.
- (6) **Observation:** Observe the patient closely for local or systemic symptoms during the infusion of a contrast agent to prevent the occurrence of adverse reactions and ensure timely detection and timely treatment; dynamically observe the dynamic changes in the enhanced images after the contrast agent enters the human body, and reduce the occurrence of extravasation .
- (7) **Separation:** After the examination, inquire the patient, observe the patient for discomfort, first clamp the indwelling needle sealing tube clamp, and then disconnect the high-pressure syringe's connection tube.



Key contents after enhanced examinations

Key point 1 after enhanced examinations: stay for observation

The medical staff tells the examinee to rest for 30 minutes in the observation area and inform the medical staff in time if there is any discomfort; the medical staff regularly patrols the observation area, inquires the examinee if there is discomfort, and promptly discovers and treats adverse reactions, if any.

	Contrast agent adverse reactions are mostly mild reactions.
	Serious adverse reactions can initially manifest as mild to moderate, and almost all occur immediately or within 30 minutes after injection of the contrast agent. The patient should not be left alone and must be observed closely in the observation room/area within 20 minutes after the examination.
	After 15-20 minutes, pull out the indwelling needle, press the puncture point for 10 minutes, and continue with hydration. The patient can leave then if there is no abnormality.

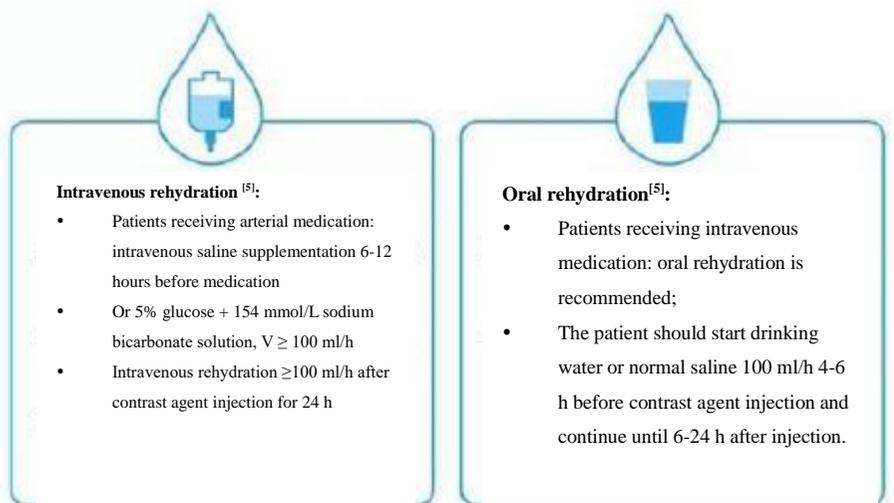


Key point 2 after enhanced examinations: hydration

The medical staff instructs the examinee to drink plenty of water (not less than 100 mL per hour) to facilitate the discharge of the contrast agent. The urine color can be used to simply determine whether the hydration is sufficient to prevent contrast-induced nephropathy.

Domestic and foreign guidelines all recommend hydration for patients to prevent CIAKI:

ACR	6-12 h before injection	4-12 h after injection
ESUR	6 h before injection	6 h after injection
Chinese guides	6-12 h before injection	24 h after injection



The infographic consists of two rounded rectangular boxes. The left box is titled 'Intravenous rehydration [5]:' and features an icon of a drip chamber. The right box is titled 'Oral rehydration [5]:' and features an icon of a glass of water. Both boxes contain bulleted text detailing clinical recommendations.

Intravenous rehydration [5]:

- Patients receiving arterial medication: intravenous saline supplementation 6-12 hours before medication
- Or 5% glucose + 154 mmol/L sodium bicarbonate solution, $V \geq 100$ ml/h
- Intravenous rehydration ≥ 100 ml/h after contrast agent injection for 24 h

Oral rehydration [5]:

- Patients receiving intravenous medication: oral rehydration is recommended;
- The patient should start drinking water or normal saline 100 ml/h 4-6 h before contrast agent injection and continue until 6-24 h after injection.

Note:

- The combination of intravenous and oral administration is advocated to improve the effect of preventing contrast-induced nephropathy.
- Dialysis patients do not need or only require very little oral rehydration.



Key point 3 after enhanced examinations: hydration: timely detection and treatment of adverse reactions

Contrast agent extravasation

Studies have shown that the incidence of contrast agent extravasation in intravenous high-pressure infusion is 0.1% to 0.9%, and contrast agent extravasation may occur during both manual infusion and high-pressure infusion.

- (1) Mild extravasation does not require special treatment. Instruct the patient to keep observing. If extravasation worsens, the patient should timely notify the medical staff; individuals with significant pain can be topically given cold and wet compresses.
- (2) In case of moderate and severe extravasation, the patient should raise the affected limb to promote blood back-flow; Use 50% magnesium sulfate moisturizing cold compress in the beginning, and after 24 h change to magnesium sulfate moisturizing hot compress; or use mucopolysaccharide ointment for topical application; or use 0.05% dexamethasone for local hydrophatic compress. Those with severe contrast agent extravasation should be given oral dexamethasone 5 mg/time tid for 3 consecutive days on the basis of topical drug use. If necessary, consult a clinician about medication.



Key point 3 after enhanced examinations: hydration: timely detection and treatment of adverse reactions

Anaphylactoid reaction

- (1) For mild anaphylactoid reactions, closely observe for 30 min (the time may be extended if necessary), monitor the patient's vital signs, and tell the patient to drink plenty of water. Generally, no drug treatment is required.
- (2) For moderate anaphylactoid reactions, give active symptomatic drug treatment, and closely monitor the patient's vital signs until the reactions completely subside. Establish venous access and give high-flow mask oxygen.
- (3) For severe anaphylactoid reactions that can endanger the patient's life, the patient must be closely observed, and the reactions must be quickly identified and treated. If the patient's allergy manifests as unresponsiveness or no arterial pulsation, then follow the regular CPR procedure for rescue.

