Lab values: kidney, liver, heart, drug levels

Kidney and liver tests, cardiac markers, and drug levels

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1 AT A GLANCE

The kidneys, liver and heart each leave their signature in the blood, and drug levels tell you whether a dose is helping or poisoning. The ranges here are general adult values: use your reference lab's ranges.

Kidney tests (general adult ranges)

Test	Normal	Worry when
BUN	6 to 20 mg/dL	**High**: kidney disease, dehydration, heart failure, gut bleeding, shock. **Low** (less common): liver failure, malnutrition, overhydration
★ **Creatinine**	Men about 0.7 to 1.3 mg/dL; women 0.5 to 0.95 mg/dL	**Rising**: the kidneys are failing; only the kidneys remove it. Muscle breakdown, dehydration and a blocked urinary tract raise it too, and some drugs affect the test
★ **eGFR**	About 90 to 120 mL/min/1.73 m², lower in older adults	**Under 60 mL/min/1.73 m² for 3 months or more**: chronic kidney disease. **Under 15 mL/min/1.73 m²**: kidney failure that needs immediate attention

What it changes: Many drugs are cleared by the kidneys, so a rising creatinine may mean a dose needs adjusting. Watch it closely with kidney-toxic drugs, like vancomycin and gentamicin, and report a rise.

Liver tests (general adult ranges)

Test	Normal	Meaning
ALT	About 4 to 36 U/L	Leaks out when liver cells are injured: hepatitis, cirrhosis, fatty liver, alcohol, acetaminophen
AST	About 8 to 33 U/L	Also comes from the heart and muscles: less specific to the liver
Total bilirubin	About 0.1 to 1.2 mg/dL	Around 2 mg/dL, the skin and eyes turn yellow: jaundice
Albumin	About 3.4 to 5.4 g/dL	Holds fluid in the vessels. Low in liver disease: ascites and swelling. Also falls with kidney disease, and when the body doesn't get or absorb enough protein

Liver and the INR: A liver panel includes the PT and INR. Liver disease itself can raise the INR, which raises the bleeding risk.

Ammonia and lactulose

- The liver turns ammonia into urea, so a failing liver lets it build up.
- ★ Ammonia is toxic to the brain: **confusion, low energy, even coma**. That's hepatic encephalopathy.
- Gut bleeding, kidney disease and low potassium can push it higher in liver disease.
- ★ Lactulose lowers it, working in the colon: the dose is adjusted to **2 or 3 soft stools a day**. Count and record stools; report confusion that worsens.

Cardiac markers

Test	When and how	Watch for
★ **Troponin**	The test for heart muscle damage. Drawn for chest pain or worsening angina, then **repeated on the schedule your institution and assay set**	Even a slight rise often means damage. **One normal value early on doesn't rule out a heart attack.** Can stay high 1 to 2 weeks; also rises with fast rhythms, pulmonary embolism, heart failure, myocarditis
BNP	For heart failure signs: breathlessness, swollen legs or abdomen. Often run in the emergency department to tell a heart cause from a lung, kidney or liver cause	**Under 100 pg/mL**: acute heart failure less likely, not impossible, especially with obesity or preserved ejection fraction. Kidney failure, pulmonary embolism and sepsis raise it too

Serial troponins: High-sensitivity pathways retest at, for example, 0 and 1 hour, or 0 and 2; conventional assays differ. Report new or returning chest pain at once, even while you wait for the next result.

Drug levels

Drug	Level	Watch for
★ **Digoxin**	Heart failure: **0.5 to under 0.9 ng/mL**, not the older 0.8 to 2	Toxicity can occur even in range: nausea, vision changes, rhythm problems. Apical pulse for a full minute before every dose. Low potassium makes it more toxic
Lithium	About 0.8 to 1.2 mEq/L for acute mania; drawn 12 hours after the last dose	Early toxicity: diarrhea, vomiting, drowsiness, weakness, poor coordination. Dehydration or a low salt intake raises it
Phenytoin	Total: 10 to 20 mcg/mL (free levels differ)	Above that, confusion appears, so a level is checked at the first sign of toxicity
Gentamicin	Trough under 2 mcg/mL	Protects the kidneys and hearing

Peaks and troughs: A peak is drawn when the drug is at its highest; a trough just before the next dose, at its lowest. Time the dose around the draw, and if a trough isn't back yet, check before you give the next dose.

Educational use only. Not a substitute for clinical judgment, your facility's policy or the provider's orders. Where practice varies, follow facility policy and state law. No patient information.

Lab values: kidney, liver, heart, drug levels

1 AT A GLANCE, CONTINUED

Reading kidney and liver tests

- The eGFR is checked regularly in people at risk: diabetes, high blood pressure, heart disease, or kidney disease in the family.
- Creatinine varies with size and muscle mass, one reason the eGFR also accounts for age and sex.
- Some drugs, like famotidine and trimethoprim, can affect the creatinine test: share the medication list.
- Ammonia: alcohol, diuretics, opioids and valproic acid can affect the test, and the client shouldn't smoke before the draw.
- Most newborns have some jaundice; whether a level is too high depends on how fast it's rising, the baby's age, and prematurity.

Check yourself

- Most specific kidney marker? **Creatinine**: BUN also rises with dehydration, GI bleeding and protein intake.
- eGFR 48 mL/min/1.73 m² for the past 4 months? Chronic kidney disease.
- First troponin normal, 1 hour after chest pain began? Expect **repeat troponins**, not discharge.
- Cirrhosis, confused, high ammonia? Expect lactulose, adjusted to 2 or 3 soft stools a day.

2 PRIORITY AND SAFETY CALLS

★ New or returning chest pain: **report it at once**, even while you wait for the next troponin.

★ A drug level comes back high: **assess for the toxic signs, and report it before the next dose is due**.

A trough drawn after the dose isn't a trough and can't guide dosing: report the timing problem, and arrange a correctly timed trough just before the next dose.

Skipping or doubling a dose isn't the nurse's call.

Digoxin with nausea, halos and a level of 2.6 ng/mL: report the level and symptoms before giving the next dose.

With vancomycin, report ringing in the ears, hearing loss or a rising creatinine.

Read levels with the chemistry: low potassium makes digoxin more toxic; dehydration or a low salt intake raises lithium.

3 EXAM ANCHORS

1. Compare with normal, act, and use the urgency ladder.
2. Classic stems: a rising creatinine on a kidney-toxic drug, confusion with a high ammonia, repeated troponins, a toxic digoxin or lithium level.
3. Traps: a trough drawn after the dose, one normal troponin, and a dose given before a pending level.
4. Creatinine and eGFR track the kidneys; watch them with kidney-toxic and kidney-cleared drugs.
5. Liver disease can raise both the INR and the ammonia; high ammonia means confusion, and lactulose.
6. Troponin is repeated; BNP points to heart failure. Troughs come just before the dose.

4 SELF-QUIZ

1. An eGFR under _____ mL/min/1.73 m² for 3 months or more means chronic kidney disease.
2. A total bilirubin around _____ mg/dL turns the skin and eyes yellow.
3. Lactulose is adjusted to 2 or 3 soft _____ a day.
4. A trough is drawn just _____ the next dose.
5. In heart failure, digoxin now targets 0.5 to under _____ ng/mL.
6. A lithium level is drawn _____ hours after the last dose.
7. A BNP under _____ pg/mL makes acute heart failure less likely, not impossible.

ANSWER KEY 1. 60 · 2. 2 · 3. stools · 4. before · 5. 0.9 · 6. 12 · 7. 100

5 SOURCES

1. MedlinePlus, BUN blood test. medlineplus.gov/ency/article/003474.htm
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8. DailyMed, Lanoxin (digoxin) label. dailymed.nlm.nih.gov/dailymed/drugInfo.cfm
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10. KDIGO, CKD evaluation and management guideline. kdigo.org/guidelines/ckd-evaluation-and-manag…

Built from RN PocketPal course lessons: Lab values II: kidney, liver, heart and drug levels (c06-l03). Every line on this sheet comes from those lesson scripts.

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