

ROUTINE LAB STUDIES

Routine Clinic Lab Studies

With all lab studies, a Tacrolimus or Cyclosporine level will be obtained. These drug levels are routinely assessed to ensure that there is enough or not too much anti-rejection medicine within the blood stream. Here are the general guidelines for all blood draws:

- The Tacrolimus or Cyclosporine level is assessed at its lowest level just before the next dose of medicine. This is called a “trough level.” This means that you need to have the lab studies drawn within 12 hours after the last dosage of medicines. An example of this is if you gave your child his Prograf at 8:00 p.m. the night before clinic, you need to have your child’s labs drawn by 8:00 a.m. the next day.
- **DO NOT** give your child either the Tacrolimus or Cyclosporine **before** the blood draw. Once the blood has been drawn, then give your child his/her medicine. This means you must bring it with you.
- For all lab studies that will be drawn on a clinic appointment day, the lab slip will already be faxed to all of the blood stations in the Outpatient Building. The labs will be sent STAT. Many times, the transplant team may have the lab results available for you before leaving clinic that day. However, the Tacrolimus or Cyclosporine level will not be ready for review until later that day.
- For all routine local lab studies, the transplant coordinator will provide you a lab requisition or lab slip for you to take to the local lab. The lab slip will be good for six months and will be updated with each clinic visit. The transplant coordinator will also inform you about the needed frequency of the routine lab studies. It is important to mark the date needed for the lab studies on your calendar for review.
- The local lab will draw and fax the results to the transplant center for review. Some local lab centers are not able to process either the Tacrolimus or Cyclosporine level. In that case, the transplant coordinator will provide you some mailing boxes to have **ONLY** one purple tube of blood to be sent to the University of Michigan for processing. There will be no cost to you for mailing the blood specimen to the hospital. You **MUST** make sure that the tube of blood has your child’s full name, date of blood draw, date of birth and UM Hospital ID number. Without the proper identification, the blood specimen will not be processed.
- Once your child has had the local lab studies drawn, please notify the transplant office. There are some lab centers that will need to be called for the results.
- The transplant office **will not** contact you if your child’s lab studies are within a normal range. If you would like either a copy or information regarding the lab results, you may contact the transplant office.



Laboratory Test Flow Sheet – Explanation of the Tests and Abbreviations

1	2	3	4	5	6	7	8	9	10	11	12
CsA NG/ML	Tacro NG/ML	Rapa NG/ML	Na+ MEQ/L	K+ MEQ/L	Cl- MEQ/L	CO2 MEQ/L	BUN MG/DL	Creat MG/DL	Gluc MG/DL	Prot GM/DL	Alb GM/DL

13	14	15	16	17	18	19	20	21	22	23	24
Ca++ MG/DL	PO4 MG/DL	Mg+ MEQ/L	Amyl IU/L	Lip IU/DL	Cbili MG/DL	Ubili MG/DL	TBili MG/DL	ALK0 IU/L	AST IU/L	ALT IU/L	Chol MG/DL

25	26	27	28	29	30	31	32	33	34	35
Trig MG/DL	HDL MG/DL	LDLC MG/DL	URIC MG/DL	PT SEC	INR	PTT SEC	WBC K/MM3	Hgb GM/DL	Hct %	Plat K/MM3

Calcineurin Inhibitors

1. CsA – cyclosporine (Neoral; Gengraf)

This is a medicine used to prevent rejection. This type of medicine is also called an immunosuppressant or a calcineurin inhibitor. The levels are measured in blood samples in units called nanograms (ng) per milliliter (ml) abbreviated ng/ml. We check this level to make sure you are not on too much or too little medicine to help avoid both rejection and side effects of the medicine. You are usually taking either this medicine or tacrolimus.

2. Tacro – tacrolimus (Prograf)

This is a medicine used to prevent rejection. The levels are measured in blood samples in units called nanograms (ng) per milliliter (ml) abbreviated ng/ml. This type of medicine is also called an immunosuppressant or a calcineurin inhibitor. We check this level to make sure you are not on too much or too little medicine to help avoid both rejection and side effects of the medicine. You are usually taking either this medicine or cyclosporine.

Other Immunosuppressants

3. Rapa – rapamycin (Sirolimus)

This is a medicine used to prevent rejection. The levels are measured in blood samples in units called nanograms (ng) per milliliter (ml) abbreviated ng/ml. This type of medicine is also called an immunosuppressant but it is **not** a calcineurin inhibitor. We check this level to make sure you are not on too much or too little medicine to help avoid both rejection and side effects of the medicine. Most individuals do not use this medicine so it is likely you will never use it.

Tests to Check for Side Effects of Medicines (Calcineurin Inhibitors) or Dehydration

4. Na⁺ – sodium

This is one of the important salts in your body that is necessary for proper growth and normal function of your body's cells. This test can be abnormal if your liver is not working well, you are dehydrated, or if you have problems with drugs or other glands in your body. This will be normal in most people after transplant.

5. K⁺ – potassium

This is a salt that is important for many parts of your body to work well. Calcineurin inhibitors (CSA and Tacro) can change how your kidney handles potassium and lead to it being too high (above the normal range). This is more common early after transplant or after an episode of rejection when you are on higher doses of these medicines. It only occasionally is high enough to need treatment.

6. Cl⁻ – Chloride

This chemical helps keep your cells and your blood balanced and can change if you are having lots of vomiting or diarrhea. It is most directly associated with the level of your CO₂ (bicarbonate) the next test on the list. This level can also be affected by calcineurin inhibitors because of their effect on kidney function.

7. CO₂ – carbon dioxide (bicarbonate)

This is a reflection of how much acid you have in your body and blood stream. If you have diarrhea, this can be very low. If you have vomiting, it can be high. When you are on calcineurin inhibitors, they can change how your kidney works and lead to your body having too much acid in it which could be called a kidney tubular (part of the kidney that helps make urine) acidosis (too much acid), type 4 (caused by medicine).

Kidney Screening Tests (and for Dehydration)

8. BUN – Blood urea nitrogen; (kidney test)

This is related to your protein intake and metabolism. It can be very high when you are dehydrated or when you have problems with your kidney. When you are taking CsA or Tacro, you can be very sensitive to even mild dehydration (for example, not drinking enough in the summer when you are outside more, sweating more, and drinking less than you need). If this is above 20 mg/dl, you will often receive a call from the office asking you to increase your water intake.

9. Creat – creatinine; (kidney test)

This helps us monitor how your kidneys are working. It can be affected by a number of factors, but if it is higher than would be expected based on your size and age, it raises concern that your kidneys may not be working as well as they should. If it is high, you may need more testing to decide if you need a different treatment or a change in medicine.

General Health Tests

10. Glucose – (blood sugar)

Some individuals can develop diabetes after a transplant. This is especially true if other members of your family have problems with diabetes or you are very overweight. This level can also be affected by when you last ate something (not fasting), by being overweight, or by medicines (like prednisone).

11. Prot – protein

Total protein; this test measures the combination of albumin and immunoglobulins (antibodies) in your blood. In some individuals with illnesses like autoimmune hepatitis or hepatitis C, this level can be very high because of the high level of immunoglobulins.

12. Alb – albumin

This is one of the main proteins made by the liver that circulates in the blood. Once it is made by the liver, it stays in the blood for weeks. This helps us know that you are well nourished and that the liver has been working well over the last several weeks.

Bone Tests

13. Ca⁺⁺ – calcium

This mineral is important for muscles to work correctly and for your bones to grow normally. Its level is affected by having too little in your diet, by losses in your stool or from the kidney, or by Vitamin D deficiency. Mild Vitamin D deficiency is common, especially in the winter in Michigan when there is very little exposure to sunlight.

14. PO₄ – phosphorus

This is important for normal bone formation. This will be balanced with calcium under most circumstances. This level can be abnormal if your kidneys are sick, you have Vitamin D deficiency, parathyroid problems, or bone problems.

Side Effects of Medicine (Calcineurin Inhibitors)

15. Mg⁺ - magnesium

This metal is important for many processes in the body including muscle function. If your magnesium is low, your calcium can also be low. In individuals taking calcineurin inhibitors (CSA or tacro), magnesium can be low because of losses from the kidney. You can also lose magnesium in your stool if you have severe diarrhea. Many individuals require supplements after transplant.

Tests Not Routinely Measured

16. Amylase – pancreatic enzyme (also in salivary glands)

Not a common test after liver transplant, but can be high in some individuals who have inflammation of the pancreas.

17. Lipase – pancreatic enzyme

Probably more sensitive in most individuals for pancreatic inflammation; not commonly measured.

Bile Duct Problem Screening Tests

18. Cbil – conjugated bilirubin (in some labs called direct bilirubin).

If this is high, it raises concern about liver disease or bile duct problems. Some medicines can also cause increases in this type of bilirubin. We more commonly follow the total bilirubin as the first indicator of a possible problem.

19. Ubil – unconjugated bilirubin (in some labs called indirect bilirubin).

In many labs, this number is the result of subtracting the direct bilirubin from the total bilirubin. This type of bilirubin results from the breakdown of hemoglobin (carries oxygen in your red blood cells) when red blood cells die. It can be high if you have increased breakdown of your red blood cells or if you have an enzyme that works more slowly than in most people in converting unconjugated bilirubin to the conjugated form. In some people this is called Gilbert's syndrome which is not a disease. It is only a problem with certain rare drugs, like the drug irenotecan, which is used to treat some cancers.

20. Tbil – total bilirubin

The total of both conjugated and unconjugated bilirubin. This is the usual test we follow for screening for a potential problem with bile ducts or the liver after transplant.

21. Alk0 – alkaline phosphatase

This is an enzyme that is present in bile ducts, intestine, and bone. We use it as a screening test for possible problems in bile ducts after liver transplant, but it is more commonly elevated because of growth (comes from bone) in young children or adolescents. It can also be high from intestinal injury associated with diarrhea in younger children. If we are concerned about possible bile duct problems, we will often measure another test called a GGT, or gammaglutamyl transpeptidase, which is more specific for bile ducts in younger children.

Liver Enzymes

22. AST – aspartate aminotransferase

Called a liver enzyme but is in greater abundance in muscle and red blood cells. Can be elevated in circumstances where no liver disease is present or because of viral infections which do not reflect long-term problems with the liver. However, this test is used to screen for the possibility of liver disease, that is, liver cell (hepatocytes) injury or rejection. Also called SGOT at some other labs.

23. ALT – alanine aminotransferase

Called a liver enzyme but is also present in muscle and red blood cells but to a lesser degree than the AST. This enzyme is called liver specific as there is more of this enzyme present in the liver than AST. The most common reason for it to be elevated is a viral infection. It is used as a test to screen for the possibility of liver injury or disease (rejection). Also called SGPT at some other labs.

Heart Disease Risk Screening

24. Chol – cholesterol

This can be increased by medicines, being overweight, and by family history (tendency you inherit from your parents). Because liver transplant works so well, we monitor this to make sure we recognize any risks you might have for heart disease. Then we can suggest changes in lifestyle (like more exercise and change in diet) and/or medicines if necessary.

25. Trig – triglycerides

Elevations of this fat related molecule can be seen with diabetes, in certain families, and on certain medicines. Consistently high fasting levels can increase the risk for heart disease.

26. HDL – subtype of cholesterol

Good cholesterol

27. LDL – subtype of cholesterol

Bad cholesterol

28. Uric – uric acid

Not a routine lab after liver transplant, but is sometimes useful for helping determine kidney function, dehydration, or certain types of diseases.

Liver Synthetic Function (Does it Make the Right Proteins)

29. PT – prothrombin time

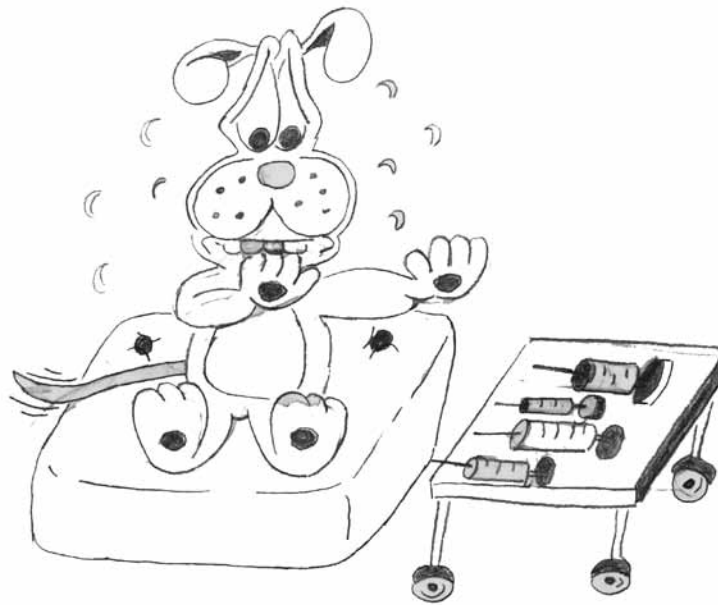
This is a measure of how well your blood clots. Many proteins necessary for this to be normal are made by the liver. If you do not have a normal amount of Vitamin K in your body, this test can be abnormal (the most common reason.) If the liver stopped making these proteins in a few hours, this test would become abnormal as you need a constant supply from the liver.

30. INR

This is a ratio that allows us to compare a PT test done anywhere in the world to those done in our laboratory. Then we know if your test is normal or abnormal.

31. PTT

Another clotting test. This is usually not important for monitoring your liver function, but is sometimes drawn in conjunction with the PT.



By Brandon Cof

Complete Blood Count

32. WBC – white blood cell count

These are the cells in your body that fight off infections. Steroids (like prednisone) can make this count rise. Medicines like Cellcept and Valcyte can make this count lower than normal. The count can also be low if your spleen is overactive, like when you have severe liver disease with portal hypertension and a large spleen. These are also the cells responsible for rejection.

33. Hgb – hemoglobin

This is a measure of whether or not you have iron deficiency or anemia. This molecule carries oxygen in the red blood cells to your tissues.

34. Hct – hematocrit

This is the percent of your blood that is made up of red blood cells. If it is too low you have anemia. The most common reason is because of iron deficiency.

35. Plat – platelets.

These pieces of cells (come from megakaryocytes) are important for clotting. They can be low because of some medicines or because of an overactive spleen.