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Understanding Your Lab Results

Introduction:

As a general rule, most often a single test result does not equal a specific diagnosis. It may support a given diagnosis, especially when that is a suspected diagnosis based upon the physician evaluation of the patient's history, exam and previous lab tests or imaging test results. But often, an abnormal test may be just a "false positive" test result, which means that it is not really representative of an actual problem, but just an isolated abnormal test result. This is why your doctor will often ask you to repeat an abnormal test on another day, or may want some other tests performed before they are certain that you have a particular diagnosis. That is also why this FAQ section does **NOT** replace the need for you to sit down face-to-face with your doctor (in a scheduled office visit) to review your test results.

Please also bear in mind that this general advice may not apply equally to very single individual; the art of medicine is how your doctor helps interpret information from multiple tests into a cohesive holistic assessment of the problem and helps you to understand what is happening so together you may arrive at a treatment plan that makes sense. But here are some general notes about some of the specific tests you may have done at URA and what they may mean:

Blood tests:

Endocrine (hormone) tests - common:

Estradiol units are pg/ml. This is a very complicated one, as levels vary greatly throughout the menstrual cycle. With menses, or after suppression with pills or injections of Lupron, we expect low levels (< 50). During follicle growth we see varying levels but they usually peak just prior to ovulation at anywhere from 100-300 per follicle. So for example a fertility drug cycle in which 3 follicles develop will likely have a peak estradiol level of 300-900 or so. Extremely high levels (> 3,000) are usually seen only in some high-responding IVF patients, and carry with them a greater risk of ovarian hyperstimulation syndrome (OHSS) – see IVF orientation class elsewhere on this site for more information on OHSS.

Progesterone units are ng/ml. This is a complicated one. Levels of 3.5 or greater are consistent with prior ovulation. Levels before ovulation are 1.5 or less. Levels of 1.6-3.4 suggest that ovulation may

occur in the near future. Levels one week after ovulation are at their peak and usually reach 8-10 or higher; pregnancy levels should also be in at least the same range (8-10).

FSH (follicle-stimulating hormone) units are mIU/ml. This is a complicated one. Basal levels (menstrual cycle days 2-4) should normally be < 10. Levels 10-15 suggest borderline ovarian reserve and levels over 15 suggest poor ovarian reserve. Ovarian reserve refers to how many eggs a woman has left in her ovaries, and also how likely they are to fertilize and develop into healthy babies. During stimulation

with oral or injectable fertility drugs, FSH levels are frequently checked to guide therapy; that is to help determine whether the medications are being absorbed well, if a higher or lower dose is required, etc.

The FSH goal during stimulation is typically 15-30, although there are great individual differences in what level a particular woman will need to respond adequately. Persistent levels over 25 in a woman NOT using fertility drugs usually indicates menopause or impending menopause.

LH (Luteinizing hormone) units are mIU/ml. This is a very complicated one. Throughout most of the menstrual cycle, LH levels remain low (3-9). Levels over 14 in a natural cycle may indicate impending ovulation in about 24 hours, although LH is a pulsatile hormone so occasionally blood is drawn during a peak and ovulation is not imminent. Women with polycystic ovary syndrome/chronic anovulation (PCOS) may have LH levels which are 14 or higher throughout most of the month, and LH levels may also remain high persistently in menopausal women. During stimulation with oral or injectable fertility drugs, LH levels are frequently checked to make sure that premature ovulation is not happening.

BHCG (beta subunit of human chorionic gonadotropin) units are mIU/ml. Levels under 5.3 are negative. Occasionally very low levels (5.3-15) are seen after a trigger injection of HCG (Pregnyl, Ovidrel) which represent a false positive test as it may take several weeks to be removed from circulation. During pregnancy, levels are usually 50 or greater and levels in early pregnancy usually rise by at least 50% every two days, although much faster raises are seen frequently.

AMH (anti-Mullerian hormone) units are mIU/ml. Levels vary by age; normal ovarian reserve is 2 or greater, 1-2 is borderline and levels under 1.0 are consistent with poor ovarian reserve. Women with polycystic ovary syndrome/chronic anovulation (PCOS) usually have levels over 5-6. Women with hypothalamic amenorrhea (no menses because of dysfunction of the hypothalamus-pituitary often seen in runners and very thin women) may have inappropriately low AMH levels despite having good ovarian reserve.

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TSH (thyroid stimulating hormone) units are mIU/ml. Normal levels are 0.4 - 4.4. In women with diagnosed hypothyroidism (or positive anti-thyroid antibodies) who are planning pregnancy, thyroid replacement medications are adjusted to reach a TSH goal of 0.4-2.5.

Free T4 (free thyroxine) units are ng/dL. Normal levels are 0.8 – 1.8. Levels below normal suggest hypothyroidism with the need for more thyroid replacement medication, and levels above normal may indicate hyperthyroidism or a need to lower the dosage of thyroid replacement medication.

Endocrine (hormone) tests – less common:

Prolactin: units are ng/ml. Normal levels are 3-30 in women and 3-20 in men. Prolactin controls breast milk production, and at high levels can suppress pituitary function and sex hormones in both men and women. Low levels have no clinical significance, but high levels may require a morning fasting repeat level and MRI imaging of the pituitary gland if persistently high. Management is usually medication.

Testosterone: units are ng/dl. Normal female levels are 20-80, although some women with polycystic ovary syndrome/chronic anovulation (PCOS) may have mildly elevated levels 80-120. Lower levels have no clinical significance, but levels of 200 or greater require imaging to rule out possible testosterone-producing tumors. Normal male levels are 300-800, lower levels may be associated with reduced libido and require medication. High levels have no clinical significance.

DHEAS: units are mcg/dL. Normal levels are 18-391. This is a weak androgen (male hormone) which all women make in low quantities. Higher levels may reflect excessive stress or an adrenal gland problem. This is test is often sent when female excess hair growth (hirsutism) is present.

17 alpha-hydroxyprogesterone: units are ng/dL. Normal levels are 23 - 300, although levels are normally higher after ovulation. For this reason, it is usually best to check these levels within the first 10-12 days of the menstrual cycle (follicular phase). Low levels have no significance. High levels may reflect deficient function of an enzyme called 21-hydroxylase, which is an important step in how the body makes cortisol. Deficient function in this enzyme often leads to excess male hormone production (DHEAS and/or testosterone).

Cortisol: units are mcg/dL. Normal levels in the morning are 4.0 – 22.0. Both deficient and excess cortisol levels may lead to illness. Further confirmatory testing -which is too complicated to explain here - is always required to make a diagnosis of a cortisol problem.

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Prenatal tests (testing suggested prior to getting pregnant):

Rubella (German measles) titer: IU/ml Positive levels indicate immunity, while low levels indicate susceptibility to infection. Acquiring an active rubella infection while pregnant may cause serious birth defects in the baby (blindness, deafness). To prevent this outcome, a repeat vaccination with MMR during menses is advised, followed by a month of effective contraception or abstinence to avoid pregnancy until immunity develops. A repeat titer 4 weeks after the MMR vaccine to document immunity is advised.

Varicella (Chickenpox) titer: IU/ml Positive levels indicate immunity, while low levels indicate susceptibility to infection. Acquiring an active varicella infection while pregnant may cause serious birth defects in the baby (blindness, deafness). Titers only show immunity after natural exposure to the virus, but they do not turn positive after vaccination. Therefore, repeat vaccination is not required if a woman has already received the two vaccine series. If they have not, then vaccination with the varicella (VZ) vaccine during menses twice one month apart is advised, followed by a month of effective contraception or abstinence to avoid pregnancy after each vaccination until immunity develops. A repeat titer to demonstrate immunity is not required.

CBC (complete blood count): White blood cells (WBCs) are elevated with infections or inflammation. Hemoglobin/hematocrit show how many red blood cells you have; when levels are low you are anemic. Platelets allow blood to clot properly, very low levels can be associated with abnormal bleeding.

Blood type and antibody screen: normal results are A, B, AB or O negative or positive with negative antibody screening. Women with Rh negative blood types (about 10% of the population) will need Rhogam injections during pregnancy to prevent Rh factor iso-immunization which may lead to fetal anemia.

Cystic fibrosis carrier status: units are negative or positive carrier. Positive carriers will need to have their partners tested, if both partners are carriers there is a 25% chance of a child having the disease of

cystic fibrosis, which causes severely think mucus leading to lung problems, intestinal blockages and a shortened lifespan.

SMA (spinal muscular atrophy) carrier status: units are 1-4 copies. Two and above are normal. One copy is a positive carrier for SMA. Sometime there are two copies but a positive test for a specific marker which increases the chances that someone's two copies may both be on the same chromosome, in which case a baby might get the chromosome which has zero copies. These patients are treated as if they are carriers with one copy and their partners are tested to see if they are carriers too. If and only if both partners providing the biological material (eggs and sperm) are carriers, then 25% of the offspring will have the disease SMA, which can be quite severe.

FMR (Fragile X syndrome): normal is < 30 copies of the repeat sequence. Fragile X causes mental retardation in boys, and premature menopause in women. Pre-mutations carriers have 30-80 copies of the XXXX, while affected people have > 80 copies. This condition is unusual in that it can propagate, meaning that a woman with a pre-mutation may pass on a more serious full mutation through her eggs.

Other blood tests:

Anti-thyroglobulin or anti-thyroid peroxidase antibodies: normal results is negative. A positive test indicates autoimmune thyroid disease, usually Hashimoto's hypothyroidism.

SMAC/CMP (complete metabolic profile): This is a conglomeration of multiple tests, interpretation of all of which is beyond the scope of this document. BUN and creatinine levels reflect kidney function, while AST and ALT reflect liver function. Often one of the multiple tests is slightly abnormal, but unless the level is more than twice the upper limit, it is usually a false positive.

ESR (erythrocyte sedimentation rate): normal result is under 30. ESR is another indicator of infection/inflammation.

Chlamydial antibody titer: normal result is negative or a titer of < 1:8. Positive results suggest prior exposure to chlamydia, which increases the chance of pelvic adhesions.

Karyotype (chromosome analysis): typically done for couples with recurrent miscarriage (both partners), women with early onset diminished ovarian reserve/premature ovarian insufficiency, or men with very low sperm counts oligospermia. Normal results are 46 XX for women and 46XY for men.

Urine and other tests:

GC (Gonorrhea): normally negative, a positive result may indicate an active infection with gonorrhea. Although false positive tests are seen, it is considered safer to treat both partners anyway with antibiotics.

Chlamydia: normally negative, a positive result may indicate an active infection with gonorrhea. Although false positive tests are seen, it is considered safer to treat both partners anyway with antibiotics.

Urinanalysis: normally negative, small/trace amounts of blood maybe seen during menses, small amounts of bacteria are frequently seen without any active infection, large amounts of bacteria - particularly when seen with large amounts of WBCs, positive nitrites, and/or positive leukocyte esterase – may indicate an active urinary tract infection. Large amounts of blood without large bacteria may indicate a kidney stone or other urologic problem which may need more workup.

Urine culture and sensitivity: normal bacteria has less than 100,000 colonies, although in very symptomatic women 10,000 may represent a urinary tract infection requiring treatment. In cases with > 100,000 bacterial colonies seen, the sensitivity analysis should come back a day or two later, indicating to which antibiotics the bacteria are sensitive. If you are taking an antibiotic to which that strain of bacteria are resistant, you will likely need to change antibiotics to clear up the infection.

PAP smear +/- HPV screening: normal result is negative for intraepithelial lesion or malignancy (NILM) and high risk HPV (human papilloma virus) negative. Inadequate specimens require a repeat sample, and any other positive test requires a conversation with your doctor and is too complex to explain here.

Ultrasound for ovarian reserve:

AFC (antral follicle count): Normal is 10-20 adding the counts from both ovaries, or 5-10 in women with a single ovary. Levels of 6-9 are considered borderline ovarian reserve and levels of 0-5 suggest poor ovarian reserve. Ovarian reserve refers to how many eggs a woman has left in her ovaries, and also how likely they are to fertilize and develop into healthy babies. Women with polycystic ovary syndrome/chronic anovulation (PCOS) usually have at least one ovary with 12 or more antral follicles;

their total AFC may reach 30-40 or higher. These women are also at risk for over-response to fertility drugs.

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Semen analysis:

(Keep in mind that you cannot make a diagnosis from one semen sample: a true assessment of a man's fertility potential requires at least two semen analyses, done at least 2 weeks apart)

Volume is normally 1 ml or greater. Low volume may indicate a partial blockage, not getting all of the sample in the specimen cup, or less abstinence that is requested for the test (2-7 days).

Count is how many sperm are there and should be 15 million/ml or more. Lower counts may indicate male factor infertility. A zero count indicates either obstructive (where the ejaculatory ducts are blocked like in a vasectomy) or non-obstructive azoospermia (NOA), where there is a partial or complete failure of sperm production.

Motility is what % of sperm are moving. Only living sperm move and fertilize eggs. Motility should be 40% or higher, lower levels may indicate male factor infertility or improper specimen handling (taking more than 45 minutes to bring the sample to the lab or keeping it too cold (body temperature is best).

Morphology is what % of sperm have a normal oval shape. This should be at least 4% on the Kruger strict morphology scale (or 30% if using the older WHO scale), although we at URA find 4-7% to be a borderline range in terms of sperm fertility function. At 8% and above, we rarely see problems with sperm fertilization.

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