

**Table 8: Adjunctive Testing**

<b>Test</b>	<b>Indication</b>	<b>Clinician Response</b>
Serum Luteinizing Hormone	LH is an appropriate first-line test in conjunction with a repeat testosterone level to determine the etiology of the testosterone deficiency. A low or low/normal LH level points to a secondary, or central hypothalamic-pituitary defect, (hypogonadotropic hypogonadism); while an elevated LH indicates a primary testicular defect (hypergonadotropic hypogonadism). The location of the defect may be an important factor in deciding upon further evaluation of such a patient.	<p>Men with low testosterone and low to low/normal LH, should have a prolactin level measured.</p> <p>Men with low to low/normal LH levels are candidates for the use of SERMs in the management of their testosterone deficiency.</p> <p>Men with very high LH levels (without an obvious cause, such as chemotherapy) are at increased risk for KS, which can be diagnosed using a karyotype.</p>
Serum Follicle-stimulating hormone	Men who are interested in preserving their fertility warrant a baseline FSH prior to the commencement of SERMs, hCG, or AI. The presence of an elevated FSH level suggests abnormal spermatogenesis.	<p>Men with elevated FSH levels should have a semen analysis.</p> <p>Men with very high FSH levels (without an obvious cause, such as chemotherapy) are at increased risk for KS, which can be diagnosed using a karyotype.</p>
Serum HbA1C	While data supporting the link between testosterone deficiency and diabetes is mixed, in the middle-aged or older testosterone deficient man with obesity, metabolic syndrome, or chronic exposure to corticosteroids, measuring a HbA1C level should be considered.	An abnormal HbA1C level should prompt referral (primary care clinician, internist, endocrinologist) for further evaluation and management.
Serum Prolactin	Men with low testosterone level accompanied by a low/low-normal LH level warrant measurement of serum prolactin to investigate for hyperprolactinemia. If prolactin is mildly elevated ( $\leq 1.5$ times the upper limit of normal) a repeat prolactin should be drawn to rule out a spurious elevation.	<p>If the prolactin level is mildly elevated, a repeat prolactin level should be measured to rule out a spurious elevation.</p> <p>For persistently elevated prolactin levels referral to an endocrinologist should be considered.</p>
Serum Estradiol	Serum E2 levels should be measured in a patient with baseline gynecomastia or breast symptoms. For those	If E2 is persistently elevated ( $>40$ pg/mL) at baseline, referral to an endocrinologist should be made.

	men who develop gynecomastia or breast symptoms while on testosterone therapy, measuring a E2 level is optional.	<p>For gynecomastia/breast symptoms that develop while on testosterone therapy, a period of monitoring should be considered, as breast symptoms sometimes abate.</p> <p>If gynecomastia/breast symptoms persist on testosterone therapy and the E2 level is elevated, reduction may be accomplished through dose adjustment of the testosterone therapy if the on-treatment testosterone levels are in the upper range of normal. If the on-treatment testosterone levels are low/normal, E2 level reduction can be accomplished by the use of AIs.</p>
Pituitary MRI	Men with sustained elevated prolactin levels, very low total testosterone levels (<150 ng/dL) and unexplained failure to produce LH/FSH warrant a pituitary MRI to identify sellar (pituitary adenoma, prolactinoma, infiltrative diseases of the pituitary) or parasellar processes.	<p>The clinician may decide to refer such patients to an endocrinologist prior to ordering an MRI or may order the MRI first and refer only for abnormalities.</p> <p>For clinicians experienced in managing prolactinomas, bromocriptine or cabergoline may be prescribed without endocrinology input.</p>
Bone densitometry	Men with testosterone deficiency are at increased risk of bone density loss. Consideration of a baseline dual energy X-ray absorptionometry (DEXA) scan is warranted, particularly in middle-aged or older men with severe testosterone deficiency or in men with a history low trauma bone fracture.	<p>Results are used to assess baseline bone health and if abnormal to follow changes over time whether the patient opts for testosterone therapy or not.</p> <p>Patients with osteoporosis should be referred to an endocrinologist.</p>
Karyotype	A karyotype should be considered in men with unexplained hypergonadotropic hypogonadism. The most common chromosomal abnormality identified is 47,XXY, also known as KS, although other chromosomal abnormalities can also be found.	For those clinicians inexperienced in managing KS, referral to a more experienced clinician is advisable.
Hemoglobin and Hematocrit	Prior to initiation of testosterone therapy, all patients should undergo baseline assessment of Hb/Hct.	<p>If baseline Hct &gt;50%, the clinician should with-hold testosterone therapy until the etiology of the high Hct is explained (polycythemia vera, living at altitude, obstructive sleep apnea, tobacco use).</p> <p>While on testosterone therapy, a Hct <math>\geq</math>54% warrants intervention. In men with high on-treatment testosterone levels, dose adjustment should be attempted as</p>

		<p>first-line management. In men with low-normal on-treatment testosterone levels, measuring a SHBG level and a free testosterone level using a reliable assay such as equilibrium dialysis is suggested. If SHBG levels are low/free testosterone levels are high, dose adjustment of the testosterone therapy should be considered.</p> <p>Men with on-treatment low/normal total and free testosterone levels should be referred to a hematologist for further evaluation.</p>
AI: aromatase inhibitor, E2: estradiol, FSH: Hg: hemoglobin, Hct: hematocrit, KS: Klinefelter syndrome, LH: luteinizing hormone, SERM: selective estrogen receptor modulator, SHBG: sex hormone-binding globulin		