

SHBG and polycystic ovarian syndrome (PCOS)

Sex hormone binding globulin (SHBG) is a protein that binds to both testosterone and estradiol. Its amount can vary widely in patients, and if the SHBG is either low or high, the amount of active (bioavailable) testosterone can vary widely. Therefore, it is very important to measure SHBG in all patients being evaluated for polycystic ovarian syndrome, as well as other patients such as patients with hypopituitarism.

The assay in women for free testosterone is often inaccurate. However, this can be overcome by measuring the total testosterone and SHBG as well as a bioavailable testosterone. The bioavailable testosterone includes the free testosterone plus what is loosely bound to albumin and is basically what is the active amount of testosterone. This assay for bioavailable testosterone, such as performed at LabCorp or Esoterix, is quite accurate. The bioavailable testosterone then determines how much active testosterone the patient actually sees. The patient may have a normal testosterone but a low SHBG and therefore have a high bioavailable testosterone and may have signs/symptoms of androgen excess, such as hirsutism or acne. On the other hand, the patient may have a high total testosterone and a high SHBG but a normal bioavailable testosterone. Therefore, it is very important to look at the bioavailable testosterone, SHBG, and the total testosterone.

SHBG is reduced in insulin resistance and actually a very good marker for insulin resistance. Many women with polycystic ovarian syndrome have a high-normal or even a normal total testosterone but have a low SHBG because they have insulin resistance. Therefore, their bioavailable testosterone is often on the high side.

On the other hand, birth control pills or other forms of oral estrogen raise the SHBG and would give a higher total testosterone than if the SHBG was normal. These patients often have a normal or low bioavailable testosterone. A recent study found that birth control pills can raise SHBG and even after stopping them for at least a year, the SHBG remains high. Because the SHBG is high, often the bioavailable or active form of testosterone is low, and the female patient often has low libido when on estrogen and even being off of it for a period of time.

SHBG is not affected by transdermal estrogen such as Estrogel or an estradiol patch. It appears that oral progesterone such as Prometrium or Provera may also raise SHBG, although this is probably to a lesser degree than oral estrogen.

SHBG also binds to estradiol and therefore, a high SHBG coupled with a normal estradiol may mean that the amount of bioavailable estradiol is actually on the low side, and a low SHBG may mean a higher bioavailable estradiol. Because of the wide range of estradiol, this is often less important than for testosterone.

Dr. Friedman frequently is trying to figure out whether the patient has hypopituitarism, polycystic ovarian syndrome, or Cushing's syndrome. All these conditions can lead to acne and

hirsutism. However, the testosterone is usually high in polycystic ovarian syndrome, especially the bioavailable testosterone, while it is usually low in Cushing's syndrome or hypopituitarism. Dr. Friedman recently published a paper that a testosterone level above 31 ng/dL (done at Esoterix) is more indicative of polycystic ovarian syndrome, and less than that is more indicative of Cushing's syndrome. If the testosterone is measured in other labs, different cut-offs will be needed.

In conclusion, it is very important to measure bioavailable and total testosterone as well as SHBG in most women being evaluated for hormonal disorders. Dr. Friedman encourages patients to visit his website at www.goodhormonehealth.com for more information.