17 Alpha Hydroxylase Deficiency

17 alpha hydroxylase deficiency is a rare genetic disorder caused by a deficiency of the enzyme 17 alpha hydroxylase in the steroid biosynthesis pathway. Normally, this enzyme is necessary to convert pregnenolone to 17-hydroxypregnenolone and progesterone to 17-hydroxyprogesterone, which are necessary for sex hormone and cortisol production. Deficiency of this enzyme therefore leads to decreased cortisol and sex hormone synthesis. Low levels of cortisol causes increased ACTH stimulation of the steroid biosynthesis pathway prior to the 17 hydroxylase reaction which results in increased activity of the mineralocorticoid pathway, leading to increased mineralocorticoid accumulation such as 11-deoxicorticosterone (DOC). The elevated DOC levels from the zona glomerulosa can lead to salt retention, volume expansion, hypertension, hypokalemia, and down-regulation of the renin-angiotensin axis. This secondarily inhibits aldosterone production, which typically is virtually absent in affected patients. Loss of sex hormone synthesis results in males with XY chromosomes to be externally phenotypically female but lack internal reproductive structures like the uterus and fallopian tubes due to the presence of Mullerian Inhibitory Factor. Females with XX chromosomes remain externally phenotypic females with normal internal sex organs but lack secondary sexual characteristics, commonly called sexual infantilism.

PLAY PICMONIC

Decreased Cortisol
Down-arrow Court-judge-sun
Normally, 17 alpha hydroxylase enzyme is necessary to convert pregnenolone to 17-hydroxypregnenolone and progesterone to 17-hydroxyprogesterone, which are necessary for sex hormone and cortisol production. Deficiency of this enzyme therefore leads to decreased cortisol and sex hormone synthesis.

Decreased Sex Hormones
Down-arrow Harmonica with Sex-signs
Normally, 17 alpha hydroxylase enzyme is necessary to convert pregnenolone to 17-hydroxypregnenolone and progesterone to 17-hydroxyprogesterone, which are necessary for sex hormone and cortisol production. Deficiency of this enzyme therefore leads to decreased cortisol and sex hormone synthesis.

Increased Mineralocorticoids (DOC)
Up-arrow Mineral-steroid-rings and DOCtor
17 alpha hydroxylase deficiency results in a back up of mineralocorticoids such as 11 deoxycorticosterone (DOC). The elevated DOC levels from the zona glomerulosa can lead to salt retention, volume expansion, hypertension, hypokalemia, and down-regulation of the renin-angiotensin axis. This secondarily inhibits aldosterone production, which typically is virtually absent in affected patients.

Hypertension
Hiker-BP
DOC stimulates the reabsorption of sodium, secretion of potassium, and increased water retention in the kidneys. Therefore, increased DOC and mineralocorticoid levels result in hypertension and hypokalemia.

Hypokalemia
Hippo-banana
DOC stimulates the reabsorption of sodium, secretion of potassium, and increased water retention in the kidneys. Therefore, increased DOC and mineralocorticoid levels result in hypertension and hypokalemia.

XY Externally Phenotypic Female
XY above Externally Phenotypic Female
Loss of sex hormone synthesis results in males with XY chromosomes to be externally phenotypically female but lack internal reproductive structures like ovaries and uterus due to the presence of Mullerian Inhibitory Factor.

No Internal Reproductive Structures Due to Mullerian Inhibitory Factor
Mule
Loss of sex hormone synthesis results in males with XY chromosomes to be externally phenotypically female but lack internal reproductive structures like the uterus and fallopian tubes due to the presence of Mullerian Inhibitory Factor. Mullerian inhibitory factor, also called Anti Mullerian Hormone, inhibits the development of Mullerian ducts in the male embryo which develop to form the Fallopian tubes, uterus, cervix, and upper two third of the vagina in females.

XX Externally Phenotypic Female

XX above Externally Phenotypic Female

Females with XX chromosomes remain externally phenotypic females with normal internal sex organs.

Sexual Infantilism

Women with small breasts in a diaper

Females with XX chromosomes remain externally phenotypic females with normal internal sex organs but lack secondary sexual characteristics, commonly called sexual infantilism.