

# Growth, Development, Puberty and Adult height of patients with Multiple Pituitary Hormone Deficiency

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## Introduction

In most publications no differentiation is made between patients with congenital MPHD and acquired MPHD.

## Aim of study

To evaluate the effects on growth and development in 29 patients with congenital MPHD (cMPHD), during hGH replacement therapy alone and combined with sex hormones.

## Subjects

Twenty nine patients (14 males, 15 females) with cMPHD were followed from early childhood until end of puberty. The majority of patients originate from the Middle East. 15 patients belong to consanguineous families.

## Results

### Birth and early development

The mean birth weight of full term neonates was  $3292 \pm 510$  g (m),  $2949 \pm 461$  g (f).

Mean birth length in 7 full term neonates was  $50.5 \pm 0.7$  cm (m),  $48.3 \pm 0.6$  cm (f).

### Head circumference (HC)

Mean HC (SD) before treatment was  $-1.9 \pm 0.9$ . During hGH treatment the HC increased to  $-1.5 \pm 1.3$ , and to  $-0.6 \pm 1.8$  during hGH+sex hormone treatment ( $p < 0.001$ ).

### Puberty

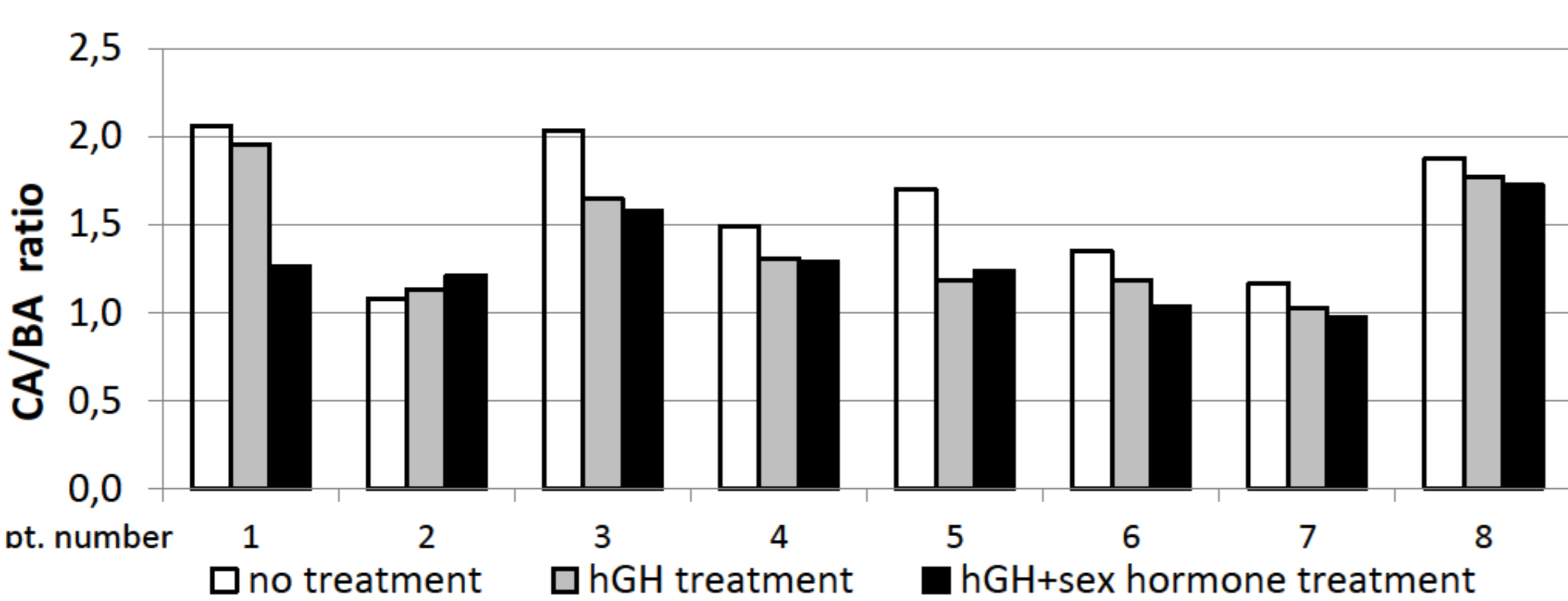
Testicular volume in 9 males were smaller than normal before treatment, with a mean volume ( $\pm$ SD) of  $1.2 \pm 0.2$  ml. Testicular volume at end of hGH treatment was  $2.2 \pm 2.2$  ml ( $p = 0.21$ ), denoting the absence of sex hormone.

Both GH but mainly sex hormone treatment increased penile size. The mean  $\pm$ SD penile length at end of puberty was  $10.7 \pm 1.9$  cm.

### Chronological age/bone age (CA/BA) ratio

(CA/BA) ratio increased from  $1.6 \pm 0.4$  before treatment to  $1.4 \pm 0.3$  after hGH treatment, and to  $1.3 \pm 0.2$  during hGH+sex hormone treatment ( $p < 0.001$ ), more evident in males (Figure 1).

Figure 1- The (CA/BA) ratio before and during therapy



## Final height

The response to GH without and in combination with sex hormones is summarized in Table 1.

Eighteen patients (10 males, 8 females) reached normal heights ranging between the 3<sup>rd</sup> to 45<sup>th</sup> centiles.

There was a negative correlation between age at referral and adult height SDS in females ( $r = -0.552$ ,  $p = 0.05$ ) and between age at initiation of hGH treatment and adult height SDS in the males ( $r = -0.525$ ,  $p = 0.065$ ). In both males and females there was a positive correlation between height SDS at initiation of sex hormone treatment and the adult height SDS ( $r = 0.765$ ,  $p < 0.001$ ).

## Adipose tissue

We found a positive correlation between duration of treatment to the subscapular skinfold ( $r = 0.71$ ,  $p = 0.014$ ) (Figure 2).

Figure 2 - Percent change in subscapular skinfold thickness (SST) during of hGH treatment

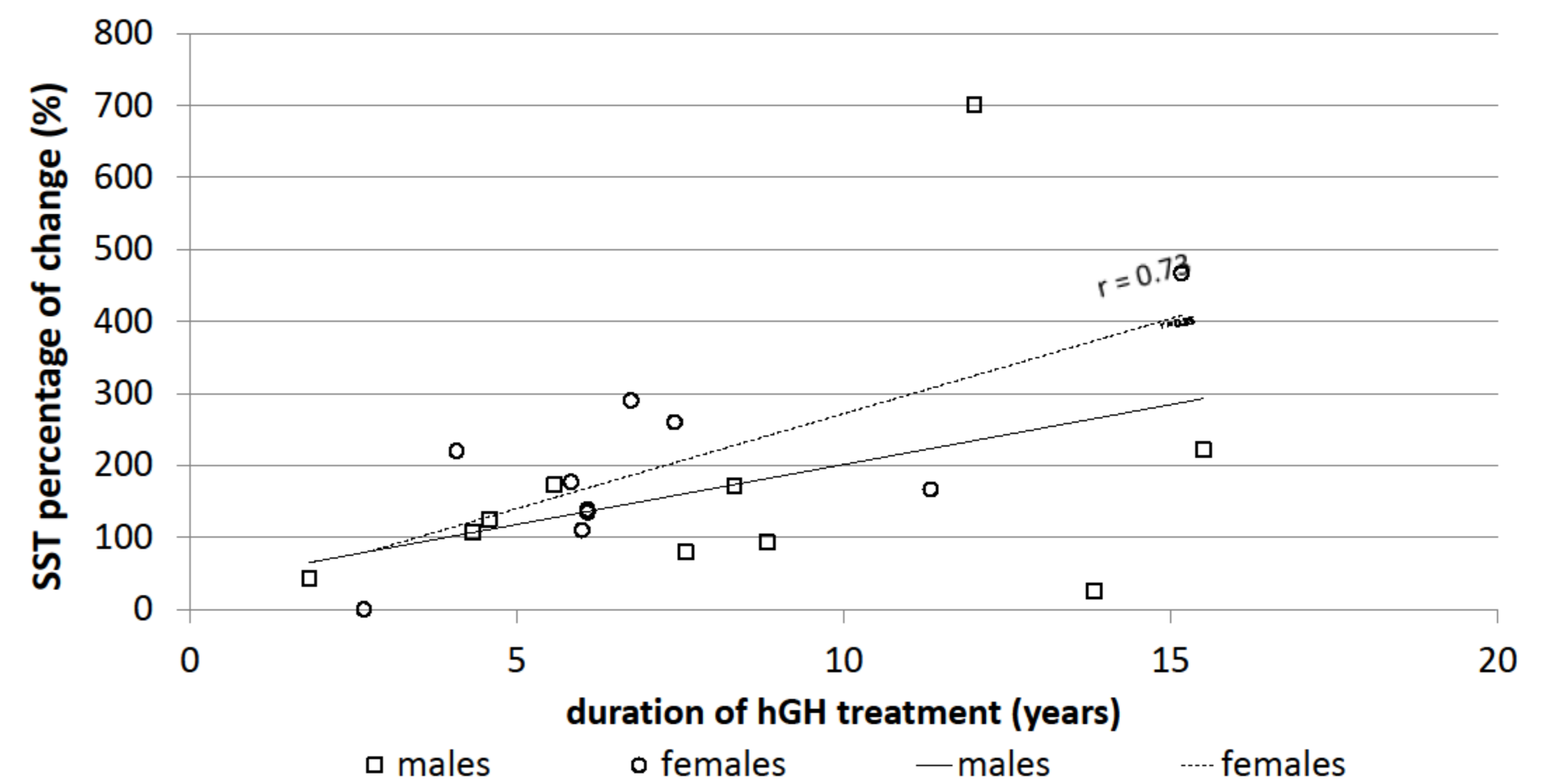


Table 1 - Linear growth before and during therapy

	Males (n=14)		Females (n=15)		P value	
	M $\pm$ SD	Range	M $\pm$ SD	Range		
Age at referral (years)	9.5 $\pm$ 7.0	0.3-21.4	6.7 $\pm$ 3.5	1.4-15.1	0.17	
Age at initiation of hGH treatment (years)	9.9 $\pm$ 6.7	0.5-22.5	10.3 $\pm$ 4.2	0.8-16.5	0.85	
Bone age at initiation of hGH treatment (years)	6.0 $\pm$ 4.4	0.0-12.0	8.0 $\pm$ 2.2	3.5-11.3	0.20	
Length of treatment (years)	9.8 $\pm$ 5.2	1.8-16.5	6.5 $\pm$ 3.6	2.1-15.2	0.08	
Height SDS	At start of hGH	-2.8 $\pm$ 1.0	-4.4(-0.9)	-2.8 $\pm$ 1.0	-4.8(-1.7)	0.99
	1 <sup>st</sup> year of hGH Rx	-2.3 $\pm$ 0.9	-3.8(-1.1)	-2.6 $\pm$ 1.1	-4.0(-1.3)	0.43
Growth velocity (cm/year)	before hGH Rx	4.0 $\pm$ 2.7	0.6-9.1	3.8 $\pm$ 1.2	1.7-5.3	0.84
	1 <sup>st</sup> year of hGH Rx	9.1 $\pm$ 2.8	5.0-13.8	8.2 $\pm$ 2.2	4.8-11.7	0.39
	2 <sup>nd</sup> year of hGH Rx	7.2 $\pm$ 2.7	4.0-13.5	6.2 $\pm$ 2.9	0.1-13	0.39
Age at initiation of sex hormone Rx (years)	17.0 $\pm$ 3.5	13.1-23.8	17.1 $\pm$ 2.3	13.8-21.9	0.88	
Bone age at initiation of sex hormone Rx (years)	12.3 $\pm$ 2.1	7.0-16.0	13.0 $\pm$ 1.3	11.3-16.0	0.33	
Height SDS	at start of sex hormone Rx	-1.9 $\pm$ 0.9	-3.5(-0.5)	-1.6 $\pm$ 0.8	-3.0(-0.5)	0.38
	1 <sup>st</sup> year of sex hormone Rx	-1.6 $\pm$ 0.9	-2.8(-0.1)	-1.4 $\pm$ 0.6	-2.5(-0.5)	0.48
Growth velocity (cm/year)	1 <sup>st</sup> year of sex hormone Rx	6.2 $\pm$ 1.9	1.5-8.9	2.6 $\pm$ 1.9	0.0-5.2	0.001
	2 <sup>nd</sup> year of sex hormone Rx	5.0 $\pm$ 2.5	0.5-8.8	1.7 $\pm$ 1.3	0.0-5.2	<0.001
Adult height	Ht SDS	-1.1 $\pm$ 0.6	-0.2(-2.4)	-1.1 $\pm$ 0.6	-0.2(-2.2)	0.93
	Ht cm	165.5 $\pm$ 6.6	152.5-174.5	153.0 $\pm$ 5.6	143-161.6	<0.001

## Conclusion

Early diagnosis and treatment of cMPHD and late induction of puberty enables normal or near normal adult height.

## References

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