Int J Endocrinol Metab 2004; 2:78-81

ORIGINAL ARTICLE

Body Mass Index in Turner Syndrome Before and After Growth Hormone Therapy

Vakili R[a], Horri M[b], Mothaghi H[b].

[a]Department of Pediatric Endocrinology and Metobolism, and [b]Department of Pediatric Cardiology, Mashhad University of Medical Sciences, Mashhad, I.R.Iran

Turner syndrome is the most common chromosomal abnormality in females. Girls with Turner syndrome have an abmormal or missing X choromosme that causes short stature, ovarian failure, renovascular and cardiac anomalies. It has been shown that there is a tendency to obesity in the Turner syndrome. This prospective study has been done to evaluate whether body mass index (BMI) is different in girls with Turner syndrome as compared to normal girls and also whether it is affected by growth hormone (GH) therapy.

Materials and methods: BMI (kg/m^2) was calculated for 21 girls with Turner syndrome at baseline (at the diagnosis), and after 6 months treatement with GH 0.1 IU/kg/day subcutaneously at bedtime. The results were analyzed with the SPSS and the statistical significance was established at a $p<0.05$.

Results: The mean age at diagnosis was 11.2±2.9 years. Height and weight were reduced in Turner syndrome as compared to those of normal girls. BMI's was 18.44±3.32 and 18.78±4.21 kg/m^2 before and after 6-month period of GH therapy, respectively. No significant change in BMI was observed ($p=0.334$).

Conclusion: This study documented that short-term hGH administration was not associated with changes in BMI in girls with Turner syndrome.

Correspondence: Rahim Vakili, Emam-Reza Hospital, P.O. Box 91735-348, Mashhad, I.R.Iran
E-mail: r-vakili@mums.ac.ir

Key Words: Turner syndrome, Body mass index, Growth hormone

Introduction

Turner syndrome (TS) is the most common choromosomal abnormality resulting in the loss of all or a part of an X choromosome. The prevalence has been reported between 1/2000 and 1/5000 live-born phenotypic females.[1] This syndrome is characterized by short stature, gonadal failure, low posterior hairline, webbed neck and cubitus valgus.[2]

Girls with TS are thought to be prone to gaining excessive weight, which may be a risk factor for developing diabetes and cardiovascular disease in adult life.[3]

For this reason, we decided to investigate body mass index in 21 girls with TS at baseline (at diagnosis) and again after a 6-month period of growth hormone therapy.

Materials and Methods

This study enrolled 21 girls with TS. The diagnosis of TS was confirmed by choromosomal analysis with peripheral leukocyte karyotype analysis. Height and weight were

measured, using a Seca stadiometer. BMI was calculated as weight in kilograms divided by height in meters squared. We compared the BMI of the patients with NCHS[i] standard curve for BMI by age for girls.[4]

Twenty-one patients recived human growth hormone (hGH) as daily subcutaneous injections at bedtime, at a dose of 0.1 IU/kg/day.

Height and weight were measured every month. Results were expressed as means±SD and analyzed using paired t-test. We processed and interpreted the data using SPSS for windows version 10.0 software and the statistical significance was established at $p<0.05$.

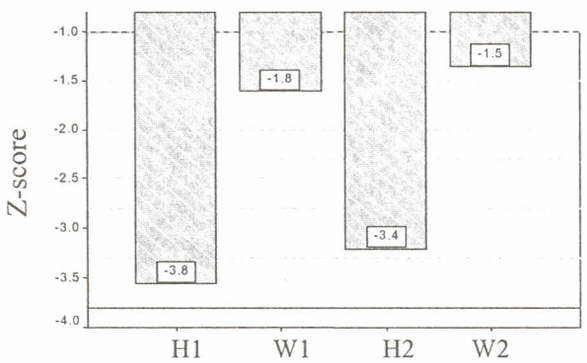

Fig 1. Height and weight SDS before and after treatment with GH in 21 patients with Turner syndrome.
H1, H2: Height before and after GH therapy, respectively.
W1, W2: Weight before and after GH therapy, respectively.

Results

21 girls with TS were studied prospectively; their karyotypes were as follows: X-complete and homogeneous monosomies (45x): 57.14%; X-mosaic monosomies (45x/46xx): 4.76%; and X-structural abnormalities [46xi (xp), 45x/46xi (xp), 45x/46xr, etc]: 38.1%. The mean age at diagnosis was 11.2±2.9, ranging from 4.5 to 17 years.

The mean standard deviation scores were -3.754±1.053 and -1.824±0.87 for height and weight respectively; after treatment these changed to -3.40±0.97 and -1.55±0.97 respectively (Fig. 1).

There was a statistically significant difference in height before and after treatment ($p<0.001$). The mean BMI at diagnosis was 18.44±3.32 and after 6 months of treatment it was 18.78±4.21 kg/m^2. There was no statistically significant difference in BMI SDS before and after treatment.

Discussion

Short stature is one of the most common phenotypic features of Turner syndrome.[1] In the current study, height was reduced in Turner syndrome as compared with NCHS standard curve for normal girls (height z-score was-3.754±1.053).

Growth hormone alone or in combination with oxandrolone can increase adult height in TS, and hGH treatment is now the standard care for girls with TS in many countries.[5,6]

Ranke and co-workers evaluated the factors influencing true height after long-term (1987-2000) GH treatment in TS and concluded that height gain during the first year on GH is indicative of overall height gain. There were no major side effects of hGH in their studies.[7]

Girls with TS are thought to be prone to excessive weight gain, which may be a risk factor for developing diabetes and cardiovascular disease in adult life.[8]

Elsheikh and co-workers compared the clinical and biochemical parameters in women with TS with those in women with normal karyotype, and showed that women with TS may be at increased risk of developing coronary artery disease as a result of the higher frequency of hypertension and obesity.[9]

i- National Center for Health Statistics

Since hGH administration was the standard treatment at the time of this study, we could not use a parallel randomized control group. At the time of diagnosis, BMI was 18.44±3.32, which was the same as normal subjects (18.47±1.64 range 15.20-22.4).

However our results confirm previous observations that older girls with TS are relatively overweight. After 6 months of hGH therapy, BMI was 18.78±4.21 in 21 girls with TS; no significant difference was observed (p=0.334).

Corel and co-workers conducted a longitudinal study of the effect of hGH on weight indices over time in a cohort of TS at different ages and concluded that hGH does not seem to influence the relation between weight and height in normal and underweight children with TS.[10]

Blackett and co-workers studied the effect of hGH on body mass index in TS and their findings suggested that mechanisms specific for TS are responsible for the age related increase in BMI SDS, and this increase was unaffected by GH treatment.[11] In a randomized, double-blind placebo-controlled cross-over study Gravholt and co-workers studied the effect of short-term growth hormone treatment in girls with TS and showed that short-term GH administration was associated with favorable changes in body composition as such reduced at mass especially in the arms and legs and likewise increased total lean body mass primarily in the trunk.[12]

The current study also shows that the diagnosis of TS is unfortunately often delayed (mean age at diagnosis was 11.2±209 and ranged from 4.5 to 17 years). In the Savendahl and Davenport's study, the mean age at diagnosis for the 81 patients with TS was 4.2±5.6 years and ranged from prenatal life to 16.8 years.[13] This may be due to cultural, social and economic factors and necessitates growth monitoring from birth to 18 years in health care centers and schools.

This study documented that short-term hGH administration was not associated with changes in BMI in girls with TS. However BMI in TS women increases with age as expected.

References

1. Lippe BM. Turner syndrome. In: Sperling MA ediror, Pediatric Endocrinology Philadelphia. W.B. Saunders publishing. 1996.p. 387-416.
2. Rapaport R. Disorders of the Gonads. In: Behrman RE, Kliegman RM, Jenson HB, editors. NELSON Textbook of Pediatrics. 16th ed. Philadelphia: W.B. Saunders publishing: 2000. p. 1744-55.
3. Hanaki K, Ohzeki T, Ishitani N, Motozumi H, Matsuda-Ohtahara H, Shiraki K. Fat distribution in overweight patients with Ullrich-Turner syndrome. Am J Med Genet. 1992 Feb 15;42(4):428-30.
4. National Center for Health Statistical. BMI by age for girls. www.cdc.gov.
5. Rosenfeld RG, Attie KM, Frane J, Brasel JA, Burstein S, Cara JF, et al. Growth hormone therapy of Turner's syndrome: beneficial effect on adult height. J Pediatr. 1998 Feb;132(2):319-24.
6. Rosenfeld RG. Turner's syndrome: a growing concern. J Pediatr. 2000 Oct;137(4):443-4.
7. Ranke MB, Partsch CJ, Lindberg A, Dorr HG, Bettendorf M, Hauffa BP, et al. Adult height after GH therapy in 188 Ullrich-Turner syndrome patients: results of the German IGLU Follow-up Study 2001. Eur J Endocrinol. 2002 Nov;147(5):625-33.
8. Gravholt CH, Juul S, Naeraa RW, Hansen J. Morbidity in Turner syndrome. J Clin Epidemiol. 1998 Feb;51(2):147-58.
9. Elsheikh M, Conway GS. The impact of obesity on cardiovascular risk factors in Turner's syndrome. Clin Endocrinol (Oxf). 1998 Oct;49(4):447-50.

Since hGH administration was the standard treatment at the time of this study, we could not use a parallel randomized control group. At the time of diagnosis, BMI was 18.44±3.32, which was the same as normal subjects (18.47±1.64 range 15.20-22.4).

However our results confirm previous observations that older girls with TS are relatively overweight. After 6 months of hGH therapy, BMI was 18.78±4.21 in 21 girls with TS; no significant difference was observed (p=0.334).

Corel and co-workers conducted a longitudinal study of the effect of hGH on weight indices over time in a cohort of TS at different ages and concluded that hGH does not seem to influence the relation between weight and height in normal and underweight children with TS.[10]

Blackett and co-workers studied the effect of hGH on body mass index in TS and their findings suggested that mechanisms specific for TS are responsible for the age related increase in BMI SDS, and this increase was unaffected by GH treatment.[11] In a randomized, double-blind placebo-controlled cross-over study Gravholt and co-workers studied the effect of short-term growth hormone treatment in girls with TS and showed that short-term GH administration was associated with favorable changes in body composition as such reduced at mass especially in the arms and legs and likewise increased total lean body mass primarily in the trunk.[12]

The current study also shows that the diagnosis of TS is unfortunately often delayed (mean age at diagnosis was 11.2±209 and ranged from 4.5 to 17 years). In the Savendahl and Davenport's study, the mean age at diagnosis for the 81 patients with TS was 4.2±5.6 years and ranged from prenatal life to 16.8 years.[13] This may be due to cultural, social and economic factors and necessitates growth monitoring from birth to 18 years in health care centers and schools.

This study documented that short-term hGH administration was not associated with changes in BMI in girls with TS. However BMI in TS women increases with age as expected.

References

1. Lippe BM. Turner syndrome. In: Sperling MA ediror, Pediatric Endocrinology Philadelphia. W.B. Saunders publishing. 1996.p. 387-416.
2. Rapaport R. Disorders of the Gonads. In: Behrman RE, Kliegman RM, Jenson HB, editors. NELSON Textbook of Pediatrics. 16th ed. Philadelphia: W.B. Saunders publishing: 2000. p. 1744-55.
3. Hanaki K, Ohzeki T, Ishitani N, Motozumi H, Matsuda-Ohtahara H, Shiraki K. Fat distribution in overweight patients with Ullrich-Turner syndrome. Am J Med Genet. 1992 Feb 15;42(4):428-30.
4. National Center for Health Statistical. BMI by age for girls. www.cdc.gov.
5. Rosenfeld RG, Attie KM, Frane J, Brasel JA, Burstein S, Cara JF, et al. Growth hormone therapy of Turner's syndrome: beneficial effect on adult height. J Pediatr. 1998 Feb;132(2):319-24.
6. Rosenfeld RG. Turner's syndrome: a growing concern. J Pediatr. 2000 Oct;137(4):443-4.
7. Ranke MB, Partsch CJ, Lindberg A, Dorr HG, Bettendorf M, Hauffa BP, et al. Adult height after GH therapy in 188 Ullrich-Turner syndrome patients: results of the German IGLU Follow-up Study 2001. Eur J Endocrinol. 2002 Nov;147(5):625-33.
8. Gravholt CH, Juul S, Naeraa RW, Hansen J. Morbidity in Turner syndrome. J Clin Epidemiol. 1998 Feb;51(2):147-58.
9. Elsheikh M, Conway GS. The impact of obesity on cardiovascular risk factors in Turner's syndrome. Clin Endocrinol (Oxf). 1998 Oct;49(4):447-50.

10. Corel LJ, Van den Broeck J, Rongen-Westerlaken C, Massa G, Wit JM. Body weight in children with Turner syndrome treated with growth hormone. Int J Obes Relat Metab Disord. 1996 Oct;20(10):957-62.
11. Blackett PR, Rundle AC, Frane J, Blethen SL. Body mass index (BMI) in Turner Syndrome before and during growth hormone (GH) therapy. Int J Obes Relat Metab Disord. 2000 Feb;24(2):232-5.
12. Gravholt CH, Naeraa RW, Brixen K, Kastrup KW, Mosekilde L, Jorgensen JO, et al. Short-term growth hormone treatment in girls with Turner syndrome decreases fat mass and insulin sensitivity: a randomized, double-blind, placebo-controlled, crossover study. Pediatrics. 2002 Nov;110(5):889-96.
13. Savendahl L, Davenport ML. Delayed diagnoses of Turner's syndrome: proposed guidelines for change. J Pediatr. 2000 Oct;137(4):455-9.