

The concentrations of testosterone and estradiol in girls with adolescent idiopathic scoliosis

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Abstract

AIM: The role of hormones in development and progression of scoliosis, although suggested, remains unclear. The purpose of this study was to evaluate the level of steroid sex hormones in girls with adolescent idiopathic scoliosis (AIS).

METHODS: A group of 27 girls, aged 12–17 years (mean±SD = 14.8±1.5 years) in whom right thoracic scoliosis was diagnosed (Cobb angle was from 10° to 55°, mean±SD = 30±13.8°; Risser test was in the range from 2 to 4, mean±SD = 3.7±0.2) was examined. The control group included 7 girls, aged 13–17 years (mean±SD = 14.3±1.8 years) with slight lumbar functional scoliosis 10° to 20° to the left (mean±SD = 11.4±3.8°). In both groups the concentrations testosterone was tested on 8th day of menstrual cycle, whereas estrogen concentrations were measured on 8th and 20th day of the cycle.

RESULTS: Increased testosterone level above the reference values was found in girls with AIS. The observed differences in both groups in estrogen levels in follicular and luteal phase were not statistically significant.

CONCLUSIONS: Possibly, the evaluation of testosterone level could be an important prognostic factor for scoliosis progression. The studies to be continued.

INTRODUCTION

Despite numerous reports, the role of hormones in the development and progression of scoliosis has not been explained yet. Increased level of growth hormone and somatomedin was observed in girls with idiopathic scoliosis in the period of rapid growth [1,2]. Experimental evoking of scoliosis in chickens and rats after pinealectomy seemed to be promising. However, recent studies on the level of melatonin in subjects with idiopathic scoliosis did not confirm the role of this hormone in the develop-

ment of scoliosis or their results were unequivocal [3]. The role of glucocorticoids the development and progression of scoliosis has not been explained. Their influence on the formation of skeletal system, including spine, lies in a significant effect on the level of osseous mass, increase in length and modelling in the period of growth. Short stature and osteoporosis were observed in patients with hyperadrenalism or treated for a long time with steroids. Faggiano et al. [4] found the occurrence of scoliosis in 72% of patients with Cushing's disease/syndrome. The role of sex hormones, particularly of the equilibrium of

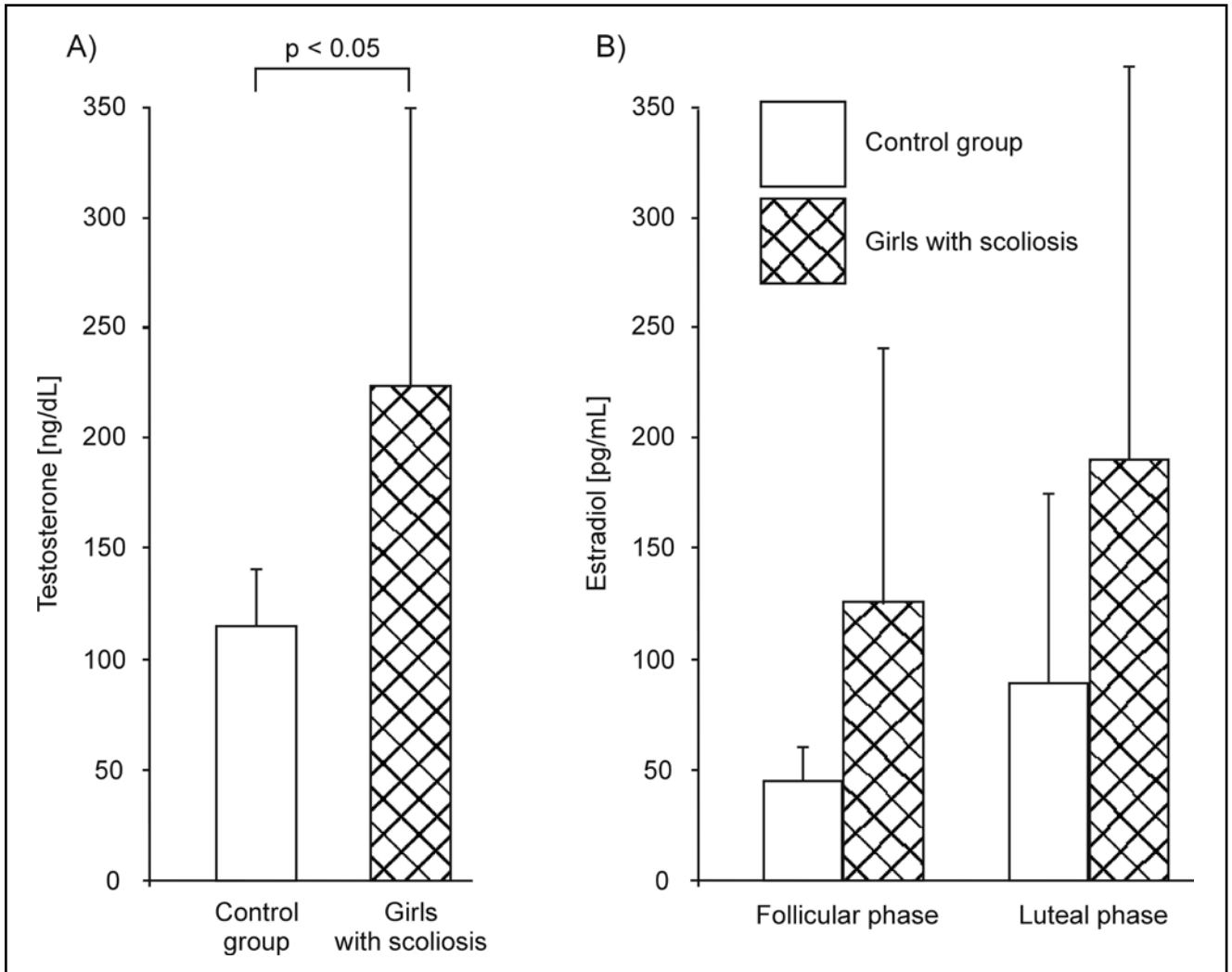


Figure 1. Concentrations of testosterone (A) and estradiol (B) in follicular and luteal phase of menstrual cycle in girls with adolescent idiopathic scoliosis and in control group.

estrogen and testosterone level in girls may also be of importance in AIS etiopathogenesis. Fisher et al. [5] described the occurrence of scoliosis in girls with congenital vaginal agenesis (Mayer-Rokitansky-Kuster-Hauser syndrome) in which very high levels of testosterone and skeletal deformations including scoliosis appear together with endocrinological and gynaecological symptoms.

PATIENTS AND METHODS

The study comprised 27 girls, aged 12–17 years (mean±SD = 14.8±1.5 years) treated conservatively due to diagnosed adolescent idiopathic scoliosis. All the examined girls started menstruation. In all of them right thoracic scoliosis was diagnosed. Cobb angle was from 10° to 55° (mean±SD = 30± 13.8°). Risser test was in the range from 2 to 4 (mean±SD = 3.7±0.2)

The control group included 7 girls, aged 13–17 years (mean±SD = 14.3±1.8 years) with slight lumbar functional scoliosis 10° to 20° to the left (mean±SD = 11.4±3.8°).

In both groups the concentrations of estrogens and testosterone was tested on 8 day of menstrual cycle. On the 20 day of the cycle the measurement of estrogen level was repeated. The determinations were performed by chemiluminescence method using immunoenzymatic analyser IMMULITE. The testosterone level reference range was from 10 to 144 ng/dL. Reference ranges for estradiol level were 20 to 160 pg/mL in follicular phase and 27 to 240 pg/mL in the cycle luteal phase.

Comparison of the investigated group and the controls was performed with Mann-Whitney U test at the level of significance $p=0.05$.

RESULTS

The concentrations of testosterone oscillated in the studied group from 50.0 to 475.0 ng/dL (mean±SD = 222.2±125.9 ng/dL), whereas in the control group those were from 54.4 to 132.0 ng/dL (mean±SD = 111.5±26.2 ng/dL). In girls with scoliosis the estra-

diol levels in follicular phase ranged from 20.0 to 537.0 pg/mL (mean±SD=127.0±115.8 pg/mL), and in the luteal phase from 26.8 to 924.0 pg/mL (mean±SD=192.0±178.4 pg/mL), while in the control group the estradiol concentrations amounted in follicular phase from 20.0 to 61.3 pg/mL, (mean 45.1±15.5 pg/mL) and in luteal phase – from 20 to 266 pg/mL (mean±SD=90.2±85.6 pg/mL).

In girls with AIS the testosterone concentrations were significantly higher than in the control group (Figure 1A). The observed differences in estrogen levels in follicular and luteal phase were not statistically significant in both groups (Figure 1B).

No hyperandrogenism was detected in any of the tested girls in a clinical trial. Regularity of menstruation was within the normal limit for the age of the examined girls.

DISCUSSION

Idiopathic scoliosis is a complex problem concerning directly osseous parts of spine and its ligamentous – capsular apparatus as well as muscular system. Thus, the search for the causes of idiopathic scoliosis is related to all these three parts, to possible disorders in the spine biomechanics and growth, dysontogenesis, disturbed metabolism of tissues forming motor system and hormonal disorders [1,2].

Steroid sex hormones have a significant, although not fully explained, effect on bone homeostasis. Their abnormal secretion or biological activity leads to osseous mass abnormalities, developmental and bone modelling disorders. The role of estrogens consists in indirect inhibition of bone resorption by affecting calcitonin and parathormone secretion. Furthermore, the effect of estrogens on bone formation was also noticed [6,7].

The role of androgens in bone and muscles physiology is of great importance. They directly and by transformation to estrogens affect bone modelling (e.g. testosterone aromatization to estradiol). Androgens cause increased bone resorption and are responsible for the increase of muscle mass. They also affect collagen synthesis and the development of articular cartilage. Collagen structural and functional abnormalities are an important part of idiopathic scoliosis picture [1,6,8,9,10].

It results from the clinical observation of the studied group, that girls with high and very high level of testosterone demonstrated significant tendency to scoliosis progression. Scoliosis did not progress in girls with normal testosterone level or only slightly exceeding the norm.

CONCLUSIONS

The role of steroid sex hormones in the etiology and progression of scoliosis is constantly discussed. Nevertheless, their role in the formation of the whole motor system is extremely important. Transient increase in testosterone level in the studied group was most probably an impulse for scoliosis progression. The material presented in this study concerned only a small group of girls. Thus, it is necessary to continue the studies on a larger population and in many centres. Determination of the level of testosterone may be an important prognostic indicator of possible risk of progression.

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