

THEORIES REGARDING THE APPEARANCE OF VERTEBRATIC STATIC DISORDERS- A MULTIFACTORIAL APPROACH

BUGHIRICĂ-GEORGESCU MAGDALENA¹, OLTEAN ANCA MARIA¹

Abstract

Aim. The purpose of this theoretical research is to collect information from various studies and literature on the importance of the factors that determine the occurrence of this pathology in children and adolescents. This research also aims to highlight and classify the causes of spinal static disorders.

Methods. In this retrospective study we collected and analyzed data from various studies and literature. The data were obtained by disseminating and analyzing the results obtained by numerous specialists in the field. The data collected wanted to bring a multifactorial approach to the occurrence of vertebral static disorders among children and adolescents.

Results. Several theories are considered regarding the occurrence or determination of this pathology. From a genetic point of view, it is considered that between 30% and 50% of patients with these diseases inherit the disease from a relative that can be traced up to the 3rd degree (Jianu.M., 2010).

Hormonal factors have been addressed by a number of authors to see their relationship on the onset and worsening of this pathology. Melatonin and its relationship to idiopathic scoliosis have fascinated researchers since the middle of the last century, with the studies of Thillard M.J. who observed the appearance of a scoliosis similar to adolescent scoliosis following the removal of the pineal gland in chickens (Herdea, A., et al, 2016). During growth, estrogen plays a very important role, and through its hormonal effect will generate a series of changes that can indirectly lead to the appearance of vertebral static disorders.

Conclusions. Changes in the structure and shape of the spine depend very much on our genetic material, the normal functioning of the endocrine glands, other associated diseases, the type of constitution and the type of superior nervous activity.

Keywords: vertebral disorders, etipopathogenesis, children, adolescents.

Introduction

Currently, a great importance is given to research on the factors that determine the occurrence of this pathology among children and adolescents. These factors that determine the appearance of vertebral static disorders are multiple. Most often they are known (congenital, infectious, tumor, etc.) or unknown (in idiopathic scoliosis).

The issue of vertebral static disorders in children and adolescents remains a current, controversial topic. The incidence of this disease is increasing every year. Current studies show that nationwide vertebral static disorders are the third most common disease among children and adolescents. (National Public Health Report, 2017).

Disorders of vertebral static cause deviations from normal, in the shape and physical functions of the body, which triggers adverse effects on the body, preventing its proper functioning, and decreasing physical performance. These deviations from normal can change the shape of the body and its physical functions globally or partially. Most often they are accompanied by muscle imbalances (muscle stiffness and weakness) and compromise the normal course of movement.

Vertebral static disorders can occur at all ages, but their most spectacular frequency and evolution is during pubertal and post-pubertal growth and active development in both girls and boys. Numerous studies on this pathology in the school population in Romania have highlighted that there is an increased incidence of this pathology (Ciovică et al, 2016).

The National Institute of Public Health in turn exposes the prevalence of the first 10 categories of chronic diseases dispensed in school medical offices, the deformities gained of the spine in 2018 ranked third. The impact of this incidence is major, as it mainly concerns the young population. In the school communities, on the occasion of the findings made at the beginning of the school year, they complain that approximately 80% of the schoolchildren deviate from the ideal attitude of the body. (Antonescu et al. 2017).

Methods. For the elaboration of this research I consulted the specialized literature and various studies.

With the information collected, we wanted to bring arguments about the many reasons of the occurrence of vertebral static disorders among children and adolescents. We discussed a

¹National University of Physical Education and Sports, 140 Constantin Noica Street, Bucharest, Romania

Corresponding author: magdabughirica@yahoo.com

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multifactorial approach to the etiopathogenesis of this pathology.

The data were obtained by disseminating and analyzing the results obtained by numerous specialists in the field. Theories regarding the occurrence of vertebral static disorders are presented in the extensor below.

Topic addressed

Several theories are approached regarding the occurrence or determination of this pathology.

The theory of heredity. Heredity is one of the important factors that can be discussed, related to the occurrence of vertebral static disorders. The inherited character is transmitted from one generation to another, according to the laws of genetics.

It is considered that genetically, between 30% and 50% of patients with these diseases inherit the disease from a relative that can be removed up to the 3rd degree (Jianu, 2010), especially in the case of idiopathic scoliosis. In family predispositions, it has been shown that in a couple with two partners with scoliosis there is a chance in 10% of cases to give birth to a child with scoliosis, which is 50 times more likely for a couple with both partners healthy (Antonescu, 2020). A higher incidence of scoliosis has also been observed in families with scoliotics or neuropsychically treated family members (plagiocephalic, mentally debilitated) (Duma, E., 1997). Boury discovered in 1963 morphological changes of chromosome 5 in idiopathic scoliosis. It follows that a scoliotic mother can give birth to a scoliotic child from 3 children, "Hereditary predispositions do not always manifest themselves from birth, but may manifest later, by the tendency towards a growth deficiency, or may not manifest at all, and in this case growth and development take place normally. The descendants have morphological and functional similarities with their ascendants and collaterals - brothers, sisters and close relatives. This is even more evident when the constitutional type and environmental conditions of the subject are similar to those of the ascendants." (Duma, E., 1997, p.33). Lordosis can occur due to malformations in the vertebral bodies and localized intervertebral joints. Kyphosis can also occur due to congenital malformations in the vertebral bodies (atrophy, flattening, cuneiform vertebrae), intervertebral joints (narrowing discs, vertebral block) or in the ribs (atypical ribs, supernumerary).

Musculo-ligament theory. The capsulo-ligament hyperlaxity is considered a favorable factor in the appearance of vertebral static disorders. Ligament hyperlaxity is characteristic of female puberty, the period with the most changes in the shape and structure of the spine. Low joint mobility, joint hyperlaxity and movements in abnormal planes and axes can cause both functional and pathological deficiencies (Duma, 1999). Children with too much

joint mobility adopt asymmetrical positions in orthostatism and relaxing positions in sitting that favors the appearance of scoliosis and kyphotic or round back, respectively. Muscles are active and indispensable elements of the musculoskeletal system, can often be the cause of morphological or functional deficiencies through various pathological changes in their structure and function such as: decreased muscle tone, decreased muscle volume and strength. Spinal muscle imbalance can be caused by: asymmetric muscle hypertension of congenital or acquired origin (spastic paralysis); hypertension of the short muscles (the transverso-spinous system) which triggers a vertebral rotation; muscular hypotonia caused by polio. When the deviations of the spine are caused by the change of tone itself - the changes of tone are primary (they appear first), the changes of the spine being secondary, they appear after the changes of muscle tone. When spinal deviation has a cause other than muscle (for example after a trauma, herniated disc, pleurisy, etc.), the change in muscle tone is secondary, it occurs as a result of changes in the spine.

Vicious posture theory. Contemporary life is characterized by hypokinesia and long-term overload of the locomotor system in disadvantageous positions that produce postural disorders (Rusnák et al, 2019). Attitude lordosis occurs during early childhood due to ligament hyperlaxity, manifested between 1-5 years by maintaining the defective position of accentuated lumbar lordosis followed by bulging abdomen. Lordosis of prepubertal and pubertal age occurs due to lack of voluntary control.

This theory mainly involves the wrong school attire, adopted by children for long periods of time. During school, the child has a higher demand, with intellectual and physical fatigue, adopting and maintaining defective positions for hours in often uncomfortable benches, or at home in the study office, which favors the appearance and evolution of spinal deviations and deformities. of the thorax. The vicious and long positions of the child in the school bench; Improper carrying of the backpack (too heavy for the child's age and stature) can trigger the wrong postural attitude which in the long run and not treated properly can turn into a deficiency. Too much weight of the backpack, although at first sight it does not seem a problem, can cause changes in the spine over time, especially during the growth and development of the child.

The vicious posture of the body towards the child, not noticed in time and not treated properly can be permanent and turn into a structured deficiency of the spine (kyphosis, lordosis, scoliosis, etc.). Therefore, it is important to pay more attention to parents and educators as well as to the control and self-control of children's position, early detection

and appropriate treatment of spinal deficiencies during school hours.

Obesity or disease of the century as it is also called by nutritionists, leads to the appearance of vertebral static disorders. It is a complex, multifactorial disease, influenced by many factors: genetic, physiological, socio-economic and psychological. It can occur at any age, and its prevalence increases with age.

In children, obesity is one of the worst public health challenges of the 21st century. The problem is global and constantly affects many low- and middle-income countries, especially in urban areas (Antwi et al, 2012). Obesity leads to comorbidities, such as: respiratory disorders, cardiovascular disorders, metabolic disorders, sleep apnea, disorders severe in the spine (O'Connor et al, 2017). A US study shows that approximately 32% of children and adolescents are overweight or obese (Ogden, 2014). Cypholordoses have an increased incidence in corpulent persons with enlarged thoracic and abdominal perimeter. The accentuation of lordotic curvature and lumbar disc degeneration, once increased in adults, has also been observed in children with back pain associated with or without sciatic nerve involvement. A study by Samartzis et al, 2011 confirms that with increasing global obesity, along with lack of physical activity and other risk factors, the incidence of spinal disorders and LBP (low back pain) will continue to increase in young people.

More than 60% of children who reported LBP also noticed that their parents had LBP. It is important to understand the history and risk factors of a child who has LBP, as well as the importance of somatoscopic assessment.

Asthma and allergies. Abnormal posture is shaped in children with asthma symptoms. Asthma is also a serious public health problem globally. The World Health Organization (WHO) Global Asthma Report 2014 estimates that 334 million people worldwide currently suffer from asthma. In the United States, asthma currently affects about 25 million people. Although asthma can occur at any age, it often manifests at an early age and is the most common noncommunicable disease in children. About 14% of the world's children have asthma. In the United States, 7.1 million children have asthma (Walter et al, 2015). In the study by Brzęk et al, 2019, several deviations from normal postural values in the thoracic part of the transverse plane in active asthmatic children were highlighted. The comparison of the percentage of subjects that fall within the norms of normal body posture clearly indicates a higher value than in the group of actively classified subjects. In the group of participants diagnosed with asthma, the percentage differences of participants with good body posture (no posture defects) were statistically significant. Among

healthy children, the percentages of participants were higher in active children than in inactive children. Body posture is directly related to asthma attacks. Prevention of body posture abnormalities deserves to be promoted in groups of children, also with various diseases, including asthma and allergy symptoms (Brzęk et al. 2019). The aim of the study was to investigate how body posture is formed in children diagnosed with asthma symptoms. The research was conducted in collaboration with parents, doctors, nurses and teachers. Body position is characterized by variability and individuality (Gasser et al, 2013), which was confirmed in studies and had similar relevant references.

The theory of endocrine disorders. The hormonal system with an important role in regulating the growth of the body is responsible for the occurrence of vertebral static disorders. Any damage to the endocrine glands represented by the hypothalamus, pituitary, epiphysis, thyroid, parathyroid, adrenal glands, etc. it can cause a dysfunction: a hypofunction (a hormonal deficit) or a hyperfunction (a hormonal excess). Hormonal factors have been addressed by a number of authors to see their relationship on the onset and worsening of this pathology. The thyroid hormones represented by thyroxine (T4) and triiodothyronine (T3) are responsible for: growth, normal and harmonious development of the body, controls the metabolism of carbohydrates, proteins, lipids and energy production of the body. Some authors have reported an increased secretion of pituitary hormones in children aged 7-12 years, diagnosed with idiopathic scoliosis (Antonescu, 2020). Hormonal factors have been taken into account by a number of authors to observe their relationship on the onset and worsening of scoliosis (Kikanloo et al, 2018) and (Leboeuf et al, 2009). The increase in folliculin intake (folliculinemia) during puberty in women has an undisputed role in the pathogenesis of joint imbalances of the spine (Duma, 1997). Gonadotropic hormone dysfunction, thyroid dysfunction can promote the onset of idiopathic scoliosis. Melatonin, a natural hormone produced by a small gland located between the two hemispheres, called the pineal gland, has fascinated researchers since the middle of the last century, with the study of Thillard M.J. who observed the appearance of a scoliosis similar to adolescent scoliosis following the removal of the pineal gland in chickens (Herdea, 2016).

The different physiological endocrine conditions of the woman's periods can be incriminated in the appearance and especially in the evolution of idiopathic scoliosis. The onset of the first menstruation in girls correlates with the prevalence of idiopathic scoliosis, noting that as menarche appears later, there is a higher risk for the patient to develop scoliosis (Leboeuf et al, 2009). The

endocrine system is a complex chemical messenger, with feedback mechanisms between hormones produced by the endocrine glands. The effect of these hormones is systemic throughout the body. Any disruption of this system can have repercussions, some even serious.

Theory of metabolic disorders. Metabolic diseases present disorders that target a complex of nutritional factors, often characterized by abnormal chemical reactions that can cause various changes in the metabolic process. These conditions can be detected from birth or can be caused by diseases that occur during life. Metabolic factors intervene in the formation of tissue which is the resistance factor of the vertebral bodies. In certain diseases, such as Ehlers-Danlos syndrome, a connective tissue disorder is present. This disorder is also stipulated in the appearance of scoliosis. In Scheuermann's disease, the mechanical strength of the vertebrae is low due to a deficiency in the formation of collagen fibers in the vertebral plates (Antonescu, 2020).

The double neuro-bone theory proposed by the Nottingham School supports the idea that, during its evolution, man developed a double system of growth control, related to the somatic and autonomic nervous system. It was found that the autonomic nervous system, through the hypothalamic neuroendocrine control of puberty, skeletal growth and menarche in girls has an important role in the etiopathogenesis of idiopathic scoliosis. We know very well that any dysfunction of the sympathetic nervous system has harmful repercussions that can cause deviations of the spine. This system together with the neuroendocrine mechanisms contributes to the skeletal maturation, the skeletal growth, the low body mass index can be determined genetically and by the contribution of sympathoactivation, etc. (Antonescu, 2020).

The somatic nervous system ensures a physiological balance between skeletal growth and the postural mechanism during the normal growth of the child. This system determines the neuro-bone moment of maturation of the postural mechanism, which is specified to occur around the age of 12 for both sexes. The hypothesis of this double theory specifies that the etiopathology of idiopathic scoliosis in females is determined by a dysfunction of both mechanisms, involved in trunk growth. The discordance of development between the somatic and the autonomic system is manifested at the level of the trunk and the spine, being generated hormonally, which determines an accentuated skeletal growth. Understanding these mechanisms that contribute to the occurrence and evolution of vertebral static disorders is important for therapists (Antonescu, 2020).

The relationship between dento-maxillary anomalies and postural dysfunctions. It was found that the postural anomaly respects the dental

anomaly (Gavrilă-Ardelean, et al, 2019). The study had an integrative approach in the oral-maxillo-dental pathology of various etiology, so that starting from the dental anomaly to prevent somatic imbalances by rebalancing the postural tonic system (STP). The study emphasizes that this desideratum can be treated only in a multidisciplinary therapeutic team, composed of the dentist, the specialist in medical and neuromuscular recovery, the orthopedist and the primary care physician. The etiological treatment is practically the one that prevents somatic changes in the spine and not the symptomatic therapy (Gavrilă-Ardelean et al, 2009).

Osteopenia and low bone density have been observed in patients diagnosed with idiopathic scoliosis. Low levels of Calcium and Vitamin D are considered by the authors as part of the etiopathogenesis of this disease in adolescents (Balioglu et al, 2017) (Herdea et al, 2020). Regarding the risk factors for the development of kyphosis, these are osteoporosis or low bone density or a family history of kyphosis. Osteoporosis can be prevented by a diet that includes fish, eggs and vegetables, as well as supplements with fish oil and vitamin D3, which ensure the fixation of calcium in the body.

Constitutional type and type of superior nervous activity. The longilin type has tendencies towards kyphosis due to the increase in height too high, compared to the brevilin type with height below the average age and gender that has a clear tendency towards lordosis. The weak and unstable nervous type expresses a relaxing attitude, in flexion, compared to the strong type who has a rigid, tense, extension attitude. In nervous children, neuropsychic kyphosis occurs, they have a sudden onset followed by violent pain and muscle contracture in the back. Disappears during sleep or after the onset of nervous breakdown. According to Antonescu, 2020, another study finds a prevalence of 21% of idiopathic scoliosis in girls with a very high waist, compared to 3 % in the normal population. "Anthropometric studies performed on the population of northern Europe, Israel, China and Yugoslavia shows that scoliotic patients were taller than the non-scoliotic control population" (Antonescu, 2020, p.50).

Poor nutrition. The metabolic deficit in rickets is incriminated in the onset of vertebral static disorders. Artificial feeding in general may be a factor that facilitates the earlier clinical manifestation of a scoliosis. (Duma, 1999).

Nervous system disorders. The central or peripheral nervous system, through fatigue, overload, or various diseases-encephalitis, meningitis, polio can cause deformities in the spine that can go to infirmities (Duma, 1997).

Age and gender theory. According to some authors, the prognosis of vertebral static disorders is

worse the younger the age of the disease. Diagnosis of scoliosis made at the age of 4 years has a probable evolution of 13 years, while a scoliosis detected at 14 years has a period of active evolution of maximum 3 years until the end of bone maturity (Antonescu, 2020). Bone maturity occurs around the age of 17 in girls and 19 in boys. Numerous authors have analyzed the link between skeletal age and chronological age in girls with idiopathic scoliosis. A skeletal maturation was observed before the age of 13 (Antonescu, 2020). Also, a discrepancy was found between chronological age and bone age in many cases in children diagnosed with essential scoliosis, the bone age being lower than the chronological one (Antonescu, 2020). Juvenile scoliosis has a tendency to progress during the growth plateau (5-10 years) and rather than a rapid progression during growth. Due to this trend of continuous progression, the natural course of juvenile idiopathic scoliosis is much more aggressive than that of adolescent idiopathic scoliosis (Coillard et al, 2010). Between 70 and 95% of the curves of patients with juvenile scoliosis progress and require treatment; about half of these patients will need surgery (Mannherz et al, 1988) and (Figueiredo et al, 1981).

The causes of spinal deficiencies act more or less specifically in relation to the gender of children. Experts say that girls, who generally have greater joint mobility than boys, are more likely to have deficiencies in the spine caused by incorrect positions, relaxing, resting, or adopted for modest reasons (Duma, 1997), (Negrini et al 2011).

Age and occupation are cumulative factors of personal pathological history in the osteoarticular system. Occupational risk factors cause pathological suffering of the spine is 2 times higher in employees who have more than 5 years of work experience compared to those with a minimum age of less than 3 years. The correlation between joint and muscle suffering with work experience shows the importance of exposure to existing risk factors in the occupational environment rather than the natural link between the increase in frequency, intensity and impact of low back pain with age. All workstations included in the study were ergonomically evaluated, from the point of view of manual handling of masses (lifting, pushing, carrying, pulling, repetitive movements (Bunescu, 2014). US Health and Nutrition Examination Specific monitoring following a study conducted over a period of 5 years, approximately 47.8% of the adults examined had a history or symptoms of chronic osteo-musculoskeletal disorders, firstly cervical, dorsal and especially lumbar vertebral disorders, followed by hip disorders, scapulo-humeral joint and fingers (Bacîzu, 2017).

Discussions Current studies show that nationwide vertebral static disorders are the third most common disease among children and adolescents.

Adequate nutrition of the mother during pregnancy is important in preventing the birth of this disease in the newborn. Throughout the child's growth and development, due attention should be paid to daily posture, correction of calcium deficiencies, anemia, metabolic diseases, etc.

We must not forget the importance of age-appropriate physical activity as an ally in preventing this condition. The child's health also depends a lot on the parent's attitude towards approaching this pathology. Being a parent is a real joy, but also a great responsibility. Parents should be more responsible, to go regularly with the child to specialized medical examinations. The correct attitude of the body is a sign of physical and mental balance. Spinal static disorders set in over time, most can be treated.

Spinal deformity is visible in the early / middle stages, but it is not the aesthetic aspect that requires the establishment of treatment measures, but the evolution of the deformity and, especially, the consequences of these changes in vertebral statics. The success of the treatment depends on: when the diagnosis was made, the type of deficiency, the multidisciplinary team, the patient's awareness and participation in the therapeutic act.

Conclusions

Changes in the spine depend very much on our genetic material, the normal functioning of the endocrine glands, food intake, as well as the type of constitution and the type of higher nervous activity.

Vertebral static disorders can be caused by hormonal disorders. Hormones, as we well know, influence the development and functioning of connective tissue (from which the joints are formed). Disorders of the endocrine system cause tissue changes and even the appearance of joint diseases. An excess of growth hormones leads to the appearance of gigantism in children, with notable repercussions on the spine.

Hormonal changes during puberty lead to relaxation and weakening of the ligaments, joints and muscles of the spine, and the pressure of the weight of the backpack does nothing but accentuate the condition already installed.

It is essential to educate the population about the awareness of spinal pain among children, as well as to develop solid methods for managing patients with severe spinal disorders due to excess weight (Hwang et al, 2019).

In the prevention of these pathologies it is recommended a healthy lifestyle with a balanced diet and maintaining a body mass index within normal limits. We must not neglect the role played by environmental factors in shaping the influence of genetic factors.

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