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THE ROLE OF STRESS FACTORS IN SEVERE CONGENITAL ANOMALIES OF THE UROGENITAL SYSTEM DURING ORGANOGENESIS IN CHILDREN

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Abstract

The aim of this study was to investigate the impact of parental, particularly maternal, stress experienced during pregnancy on the development of severe congenital anomalies of the urogenital system. A total of 118 children aged 1 to 15 years with various forms of epispadias and bladder exstrophy were clinically examined. Analysis of anamnestic data revealed that 104 patients (88.1%) were exposed to different types of stress during the organogenesis period of fetal development. The obtained results indicate that psycho-emotional factors play a significant role in the development of severe congenital anomalies of the urogenital system, especially those complicated by urinary incontinence. Intense and prolonged stress during pregnancy may negatively affect normal fetal development, leading to structural and functional abnormalities of the urinary and reproductive systems. [2]Therefore, reducing stress factors in pregnant women, ensuring psychological stability, and strengthening early preventive measures are essential for decreasing the risk of congenital anomalies.

Keywords

Congenital anomalies, urogenital system, epispadias, bladder exstrophy, maternal stress, pregnancy, organogenesis, fetal development, urinary incontinence, risk factors, psycho-emotional stress.

Introduction.

Congenital anomalies of the urogenital system represent a significant medical and social problem due to their high impact on the quality of life, long-term disability, and the need for complex surgical and rehabilitative interventions. Among these anomalies, epispadias and bladder exstrophy are considered among the most severe forms, often associated with functional impairments such as urinary incontinence and abnormalities of the external genitalia[1]. These conditions not only require multiple stages of surgical correction but also lead to psychological and social challenges for affected children and their families. The etiology of congenital malformations is multifactorial, involving genetic predisposition, environmental influences, and maternal health conditions during pregnancy. In recent years, increasing attention has been paid to the role of psycho-emotional factors, particularly maternal stress, as a potential contributor to abnormal fetal development. Stress during pregnancy, especially in the critical period of organogenesis, may disrupt normal embryological processes through neuroendocrine and hormonal pathways, leading to structural and functional abnormalities.Organogenesis, which occurs during the early weeks of gestation, is a highly sensitive period when the foundations of all major organ systems are formed[4]. Any adverse influence during this stage, including severe emotional stress, can have profound and lasting effects on fetal development. Activation of the maternal hypothalamic-pituitary-adrenal axis, increased cortisol levels, and altered placental function are among the mechanisms through which stress may negatively influence the developing fetus. Despite the growing body of evidence on the impact of stress on pregnancy outcomes, its specific role in the development of severe urogenital anomalies such as epispadias and bladder exstrophy remains insufficiently studied[6].Understanding this relationship is crucial for developing preventive strategies and improving maternal care during pregnancy. Therefore, this study aims to investigate the influence of parental, particularly maternal, stress during

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pregnancy on the occurrence of severe congenital anomalies of the urogenital system, with a focus on epispadias and bladder exstrophy[5].

Materials and Methods.

This study was carried out on 118 pediatric patients aged from 1 to 15 years who were diagnosed with severe congenital anomalies of the urogenital system, including various forms of epispadias and bladder exstrophy. The patients were examined and treated in specialized pediatric surgical departments. Inclusion criteria consisted of confirmed clinical diagnosis of epispadias (total or subtotal forms) and/or bladder exstrophy, while patients with incomplete medical records or unclear prenatal history were excluded from the study. A comprehensive clinical assessment was performed for all patients, including physical examination, evaluation of urinary function, and assessment of associated anomalies of the urogenital tract. Additional diagnostic methods such as ultrasound examination, where necessary, were used to уточнить anatomical features and severity of the condition.The primary focus of the study was the analysis of maternal and parental history, particularly the course of pregnancy. Detailed anamnesis was obtained through structured interviews with parents, with special emphasis on the organogenesis period [6]. Information regarding psycho-emotional stress experienced by the mother during pregnancy was carefully documented. Stress factors were categorized into acute stress (such as severe emotional shock, loss of a close relative, or traumatic events) and chronic stress (including prolonged family conflicts, financial difficulties, or ongoing psychological tension). The intensity, duration, and frequency of stress exposure were assessed qualitatively based on maternal reports and classified into mild, moderate, and severe categories. In addition, the timing of stress exposure in relation to critical stages of fetal development was taken into account. Particular attention was given to stress occurring during early gestation, when organogenesis is most active and the fetus is most vulnerable to external influences. For analytical purposes, patients were divided into groups depending on the presence or absence of maternal stress during pregnancy. The proportion of patients exposed to stress during organogenesis was calculated, and its association with the occurrence of severe urogenital anomalies was evaluated. Statistical analysis was performed using descriptive statistical methods. Quantitative data were expressed as percentages and proportions. The prevalence of stress exposure among mothers of affected children was analyzed to identify potential correlations and trends. Although the study was primarily observational, the findings allowed for an assessment of the possible role of psycho-emotional stress as a contributing factor in the development of congenital anomalies of the urogenital system [4]. Ethical considerations were observed throughout the study. Informed consent was obtained from the parents or legal guardians of all participants, and confidentiality of patient information was strictly maintained.

Results and Discussion.

The analysis of clinical and anamnestic data showed that out of 118 examined patients with severe congenital anomalies of the urogenital system, 104 cases (88.1%) were associated with maternal exposure to psycho-emotional stress during pregnancy, particularly in the critical period of organogenesis. Only 14 patients (11.9%) had no reported history of significant stress factors during fetal development. The results indicate a high prevalence of stress exposure among mothers of children with epispadias and bladder exstrophy. In most cases, stress factors were characterized as moderate to severe and included acute emotional trauma, prolonged psychological tension, family conflicts, and socioeconomic difficulties. Notably, a considerable proportion of mothers reported experiencing stress during the first trimester, which is a crucial stage for the formation of the urogenital system. These findings suggest a potential association between maternal stress and the development of severe congenital anomalies. From a pathophysiological perspective, stress-induced activation of the hypothalamic-pituitary-adrenal

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axis leads to increased levels of cortisol and other stress hormones, which may negatively affect placental function and fetal development. Disruptions in hormonal balance and uteroplacental blood flow during organogenesis can contribute to abnormal differentiation and morphogenesis of fetal tissues, including the urinary and reproductive systems[3]. Furthermore, chronic stress may influence gene expression through epigenetic mechanisms, thereby increasing the susceptibility of the fetus to developmental abnormalities. This supports the hypothesis that environmental and psycho-emotional factors, in addition to genetic predisposition, play an important role in the etiology of congenital malformations. However, it should be noted that this study is observational in nature and does not establish a direct causal relationship. The reliance on retrospective anamnesis may introduce recall bias, as maternal reporting of stress is subjective and may vary in accuracy. Despite these limitations, the high proportion of stress exposure observed in this cohort highlights the need for further prospective and controlled studies. In conclusion, the results of this study emphasize the significant role of maternal psycho-emotional stress during pregnancy, particularly during organogenesis, as a potential contributing factor in the development of severe congenital anomalies of the urogenital system. These findings underline the importance of psychological support, stress management, and comprehensive prenatal care in reducing the risk of such conditions.

Conclusion.

Maternal psycho-emotional stress during pregnancy, particularly during the critical period of organogenesis, represents an important and potentially modifiable risk factor in the development of severe congenital anomalies of the urogenital system. The fact that 88.1% of examined cases were associated with stress exposure highlights a strong relationship between adverse emotional conditions during early gestation and the occurrence of anomalies such as epispadias and bladder exstrophy. It was determined that stress, regardless of its origin—acute or chronic, emotional or social—has a detrimental effect on the maternal organism. These effects are mediated through neuroendocrine mechanisms, including activation of the hypothalamic-pituitary-adrenal axis and increased secretion of stress hormones such as cortisol. Such physiological changes can impair placental function, alter uteroplacental blood flow, and disrupt normal embryogenesis, ultimately affecting the proper formation of the urogenital system. Furthermore, prolonged or intense stress may influence fetal development not only through direct physiological pathways but also via epigenetic modifications that alter gene expression[7]. This suggests that psycho-emotional factors, in combination with genetic predisposition and environmental influences, contribute to the multifactorial etiology of congenital anomalies. The findings of this study emphasize the necessity of a multidisciplinary approach to prenatal care[6]. Special attention should be given to the psychological health of pregnant women, including early identification of stress factors, provision of psychological support, and implementation of stress-reduction strategies. Preventive measures such as counseling, social support programs, and improved maternal healthcare services may significantly reduce the incidence of severe congenital anomalies[8]. At the same time, it is important to acknowledge the limitations of the present study, including its retrospective design and reliance on subjective anamnesis, which may introduce bias. Therefore, further large-scale, prospective, and controlled studies are required to establish a clearer causal relationship and to better understand the underlying biological mechanisms. In conclusion, ensuring maternal psychological well-being during pregnancy is not only essential for the health of the mother but also plays a crucial role in the normal development of the fetus. Addressing stress as a significant risk factor may contribute to the prevention of severe congenital anomalies and improve long-term health outcomes in children.

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