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Results of Surgical Treatment of Congenital Hydronephrosis in Children

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Abstract

Congenital hydronephrosis is one of the most common urologic pathologies of childhood, accounting, according to various authors, from 2.8 to 3.5% of all congenital malformations. Thanks to the widespread introduction of prenatal ultrasound diagnostics, the frequency of detection of this pathology has increased significantly, which makes it possible to start treatment earlier and prevent the development of severe complications.

Keywords: Congenital hydronephrosis, children, surgical treatment, pyeloplasty, laparoscopic surgery, minimally invasive technologies, pyeloureteral segment obstruction, reconstructive urology, postoperative complications, rehabilitation, longterm results.

Introduction

The problem is particularly urgent due to the fact that untimely detection and lack of adequate treatment of hydronephrosis can lead to irreversible changes in the renal parenchyma, development of chronic kidney disease and early disability of patients. According to statistics, hydronephrosis accounts for about 35% of all urologic diseases of childhood requiring surgical treatment. Modern approaches to the treatment of congenital hydronephrosis are based on the following principles: early diagnosis of pathology, timely determination of indications for surgical treatment, selection of the optimal method of surgical correction, prevention of complications, long-term dispensary observation. Currently, surgical treatment remains the main method of correction of congenital hydronephrosis. The development of minimally invasive technologies, improvement of surgical technique and anesthesiology have significantly improved the results of treatment of this pathology.

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However, despite the achieved successes, a number of issues remain debatable: optimal timing of the operation, the choice of surgical access, the method of reconstructive surgery, the features of postoperative management, criteria for evaluating the effectiveness of treatment.

Of particular importance is the study of the long-term results of surgical treatment, which makes it possible to evaluate the effectiveness of various surgical techniques, identify risk factors for complications, determine prognostic criteria, optimize postoperative follow-up tactics, and improve the quality of life of patients.

The introduction of laparoscopic and retroperitoneoscopic technologies into clinical practice has opened up new possibilities in the treatment of congenital hydronephrosis.

Minimally invasive interventions have a number of advantages, less injury, better cosmetic results, shorter hospital stays, faster rehabilitation, and reduced risk of postoperative complications. However, evaluating the effectiveness of various surgical techniques requires long-term follow-up and careful analysis of long-term results. Important aspects are the functional state of the operated kidney, anatomical reconstruction results, frequency of repeated operations, quality of life of patients, and social adaptation. Thus, the study of the results of surgical treatment of congenital hydronephrosis in children is an urgent scientific and practical task, the solution of which will optimize the treatment tactics of this category of patients and improve long-term results. The systematization of accumulated experience, the analysis of factors influencing treatment of congenital hydronephrosis in children surgical technologies create the basis for improving the treatment of congenital hydronephrosis in children hydronephrosis in children.

The history of the study of congenital hydronephrosis dates back more than a century, however, the last decades have been marked by significant progress in understanding the pathogenesis of the disease and improving methods of its correction. The development of prenatal diagnostics, the introduction of high-tech research methods and the emergence of new surgical technologies have significantly changed approaches to the treatment of this pathology.

Modern diagnostic possibilities for congenital hydronephrosis include prenatal ultrasound with various screening periods, Doppler examination of renal blood flow, magnetic resonance imaging, dynamic nephroscintigraphy, computed tomography with contrast, endoscopic examination methods.

The issue of classification of hydronephrosis is of particular importance, since the choice of treatment tactics depends on the correct assessment of the degree of urodynamic impairment. Modern classification systems take into account the degree of expansion of the calyx-pelvis system; the state of the renal parenchyma, functional parameters, the presence of obstruction, age-related features.

Risk factors affecting the results of surgical treatment:

- the age of the patient at the time of surgery;
- the degree of dilation of the calyx-pelvis system;
- condition of the contralateral kidney;
- concomitant developmental abnormalities;
- the presence of infectious complications.

An important aspect is the development of a system of perioperative patient management, including preoperative preparation, selection of the optimal anesthetic aid, prevention of intra- and postoperative complications, early activation of patients, methods of physical rehabilitation.

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The interdisciplinary approach to treatment includes interaction between pediatric urologists, nephrologists, anesthesiologists, radiation diagnostics specialists, rehabilitologists, and pediatricians.

Modern surgical technologies involve the use of:

- Precision operation techniques;
- Optical magnification;
- specialized tools;
- modern suture materials;
- High-tech equipment.
- The postoperative monitoring system includes:
- Dynamic ultrasound monitoring;
- assessment of renal function;
- control of urodynamics;
- prevention of infectious complications;
- correction of metabolic disorders.

Special attention is paid to rehabilitation issues, which include:

- recovery of physical activity;
- prevention of the adhesive process;
- correction of urinary disorders;
- Psychological support;
- Social adaptation.

An important aspect is the development of criteria for evaluating the effectiveness of treatment and anatomical results.;

- functional indicators;
- Quality of life;
- Social adaptation;
- Long-term results.

Promising areas for the development of surgical treatment include:

- the development of new methods of reconstructive surgery;
- Improvement of minimally invasive technologies;
- Introduction of robotic surgery;
- the use of tissue engineering structures;
- Development of intraoperative imaging techniques.

Thus, the current stage of development of pediatric urology is characterized by an integrated approach to the treatment of congenital hydronephrosis, based on the integration of various diagnostic and treatment methods, the introduction of innovative technologies and a thorough analysis of the results. This creates the basis for further improvement of surgical correction methods for this pathology and improvement of patients' quality of life.

In recent years, considerable attention has been paid to the study of the genetic aspects of congenital hydronephrosis. Studies show that hereditary factors, gene mutations, chromosomal aberrations, gene polymorphism, and epigenetic modifications play an important role in the development of this pathology. The pathophysiological mechanisms of hydronephrosis development include disorders of urinary tract embryogenesis, changes in renal hemodynamics,

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disorders of the innervation of the pelvic-ureter segment, biochemical and molecular changes, and features of collagen formation.

Morphological changes in hydronephrosis are characterized by expansion of the calyx-pelvic system, atrophy of the renal parenchyma, sclerotic changes, microcirculation disorders, and changes in the ureter wall. Current trends in surgical treatment are aimed at maximizing the preservation of a functioning parenchyma, minimizing surgical trauma, improving kidney microcirculation, restoring urodynamics, and preventing relapses. Of particular importance is a personalized approach to treatment that takes into account individual anatomical features, the functional state of the kidneys, the patient's age, concomitant pathology, and social factors. Evidence-based medicine in the treatment of hydronephrosis is based on the results of multicenter studies, analysis of long-term results, systematic reviews, meta-analyses, and clinical recommendations.

An important aspect is the standardization of surgical treatment, the development of surgical protocols, the unification of surgical techniques, the standardization of perioperative management, the creation of monitoring algorithms, and the evaluation of treatment results.

Innovative diagnostic methods include three-dimensional ultrasound, functional MRI, PET-CT, molecular imaging, biomarkers of renal damage. Special attention is paid to the prevention of infectious, hemorrhagic, obstructive, metabolic, and functional complications. The rehabilitation system after surgical treatment provides for the stages of rehabilitation treatment, an individual approach, a range of rehabilitation measures, monitoring of effectiveness, and evaluation of long-term results.

Promising areas of scientific research include the study of the molecular mechanisms of hydronephrosis development, the search for new biomarkers, the development of regenerative medicine methods, the improvement of surgical technologies, and the creation of prognostic models.

Of particular relevance are issues related to predicting treatment results, determining the optimal timing of surgery, choosing a method of surgical correction, preventing relapses, and improving the quality of life of patients.

Conclusions

Thus, the current stage of studying the problem of congenital hydronephrosis is characterized by an integrated approach based on the achievements of fundamental science, clinical medicine and surgical technologies. The integration of new knowledge and treatment methods creates the basis for further improvement of the results of surgical treatment of this pathology in children. The urgency of the problem is determined by the need to improve immediate and long-term treatment outcomes, reduce the incidence of complications and improve the quality of life of patients.

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