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Mini Review

New modalities of surgery for renal tumors in children: A Mini-Review

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Abstract

Nephroblastoma is one of the most frequent solid tumors in childhood. It is also a classical example of success in oncology achieved by consequent and randomized studies run since mid-XX until now. As systemic treatment is constantly very effective and has not changed markedly since the last 30 years, the development of precise imaging and surgical technique allowed for the introduction of several new operative methods offering intriguing advantages. This paper is based on the literature review limited to the state-of-the-art or corner-stone positions and over 30 years of personal experience of the author. It does not pretend to be a form of a systematic meta-analysis.

Introduction

The most frequent tumor arising from the kidney in children is nephroblastoma (Wilms tumor) with the pick of incidence in the pre-school age [1]. Other tumors, like rhabdoid tumors of the kidney, clear cell sarcoma of the kidney, or renal cell carcinoma are also possible, but rare [2]. Treatment of Wilms tumor became a classical example of the success of multimodal therapy and the advantages brought by large multicentre studies. The majority of the scientific questions in both major studies, NWTS ((National Wilms Tumor Study) currently Children's Oncology Group (COG) in the USA and SIOP RTSG (International Society of Paediatric Oncology, Renal Tumour Study Group) in Europe (recently in many other regions) were asked in a randomized way. The answers achieved that way were reliable and useful in practice. Colleges from the US advocate primary nephrectomy in the majority of patients with unilateral localized disease and post-operative treatment related to histology subtype and stage. Their European Colleges from SIOP RTSG recommend surgery postponed after short neoadjuvant chemotherapy to decrease the risk of tumor rupture and reduce the tumor volume in patients aged over 6 months. Despite excellent results achieved by both groups in the majority of pathology variants even in higher stages, the chemotherapy used for the systemic part of the treatment is composed of nearly the same drugs since 1980-ties. Most of the attention is paid to the risk grouping of patients and risk-adaptation of treatment aggressivity. In the meantime anaesthesiology, imaging and surgical equipment and techniques made remarkable progress. The excellent quality of MRI imaging made planning the surgery easier and more reliable. That decreased the risk of unforeseen events during operations and made interventions safer [3-5].

New techniques

For decades, the recommended surgery for renal tumors of childhood was classical, transabdominal nephrectomy, and regional lymph node sampling. Good imaging and the benefit of preoperative chemotherapy inducing a decrease in tumor volume allowed the introduction of new surgical methods [4-7]. We can divide those ideas into two groups: those intending successfully remove the tumor and spare a part of the functional kidney and those who focus on minimally invasive techniques and the patient's comfort.

Thus far, the nephron-sparing techniques were used

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mainly in the case of unique kidney or bilateral disease. Recent studies showed that in selected patients it may safely be done also in unilateral patients. The argument is the high probability of a long post-treatment life span. Care of good quality of life and preventing renal insufficiency in children with unique kidneys gain new importance. One of the reasons recently raised is a GFR decrease rather than hyperperfusion nephropathy. Unfortunately, larger studies on that issue are few. To my knowledge, some interesting prospective studies are either just running or planned but not concluded yet. In the case of unilateral tumors in patients with healthy contralateral kidneys, nephron-sparing resection should never raise the oncological risk over an expected functional advantage. It is generally accepted, that preserving less than 50% of functional parenchyma, even oncologically successful, seems not well weighted in unilateral disease. Crucial factors influencing the final decision of nephron-sparing resection are the location of the mass and its size. The location should be polar or peripheral and not conflict with renal vessels, or the collective system. An invasion of extrarenal structures is also considered a contraindication. In case of metastasis to the regional lymph nodes, the spared kidney will be irradiated in together with w lymphatics and they may lose the benefit of spared function. It is of great importance to foresee the status of regional lymph nodes before surgery. It seems that a simple and accurate factor is tumor volume at diagnosis. If it is below 300 ml, the risk of regional lymph node positivity is significantly lower [4,6,8,9].

The other group of new modalities of surgery is minimally invasive techniques. Of course, smaller tumors do not cross the midline or even better, do not cover the main vessels and can be successfully removed by the use of a laparoscope. One should remember, however, that if the tumor fulfills the criteria for the nephron-sparing attempt, this is the priority [4]. In practice, smaller, centrally located tumors are the candidates for laparoscopic nephrectomy. Of course, the laparoscopic nephrectomy should follow the same steps as the classical one: ligation/clipping the renal vessels once it is visualized, careful handling of the mass avoiding sharp instruments which could provoke a rupture, and correct sampling of several regional lymph nodes [5,7]. The lymph node sampling rate, uneasy the laparoscopic way, is usually lower in children submitted to this technique. Also, the operative time is markedly longer and complications more frequent [6]. The individual skills of the operating surgeon and his oncological background are of the greatest importance. Patients in whom the status of lymph nodes is unknown are usually considered to have the lymph nodes free and are treated accordingly. This is associated however with an elevated risk of relapse, as the lymph node status is only estimated and not proven [10]. To perform a nephron-sparing tumor resection the minimally invasive way is generally not recommended. Two new factors, both with some added oncological risk at the same time may potentially negatively influence the oncological outcome and make uneasy searching for the reasons. Both described techniques – open classical and laparoscopic, may benefit from augmented reality imaging techniques before surgery and the use of fluorescent dyes like indocyanine green in the near-infrared light to better visualize deeper located tumor, lymphatics, or metastasis in the lung.

Nephron sparing and minimally invasive surgery

Both mentioned novel approaches should be applied only in carefully selected patients and used by experienced teams familiar with the surgical technique they intend to use and the current oncological rules and recommendations.

Please note, that the classical transperitoneal tumor -nephrectomy with early ligation of renal vessels and proper lymph nodes sampling remains the main recommended surgical method used in children with renal tumors [4].

The newest methods like robotic surgery seem not to be the surgery first in-line for this malignancy. Nevertheless, its perspectives are intriguing.

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