

MAZGA, Małgorzata, OSTOJSKA, Magdalena, STRĘK, Wojciech, MAŚLANA, Marianna, BOGOŃ, Aleksandra and WOŹNIAK, Magdalena Maria. Increasing abdominal circumference in children – does it require diagnosis? Assessment of the incidence of Wilms tumor among children at the University Children’s Hospital in Lublin. Quality in Sport. 2024;15:52217. eISSN 2450-3118. <https://dx.doi.org/10.12775/QS.2024.15.52217> <https://apcz.umk.pl/QS/article/view/52217>

The journal has had 20 points in Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.

Has a Journal's Unique Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).

Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.

Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

© The Authors 2024;

This article is published with open access at Licensee Open Journal Systems of Nicolaus Copernicus University in Torun, Poland Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author (s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non commercial license Share alike. (<http://creativecommons.org/licenses/by-nc-sa/4.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited.

The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 01.06.2024. Revised: 20.06.2024. Accepted: 01.07.2024. Published: 07.07.2024.

Increasing abdominal circumference in children – does it require diagnosis? - Assessment of the incidence of Wilms tumor among children at the University Children’s Hospital in Lublin

1. Małgorzata Miazga, Students’ Scientific Society at the Department of Pediatric Radiology, Medical University of Lublin, Poland, Aleje Raławickie 1, 20-059 Lublin
<https://orcid.org/0009-0005-1174-1597>
malgorzatam97.mm@gmail.com
2. Magdalena Ostojka, Students’ Scientific Society at the Department of Pediatric Radiology, Medical University of Lublin, Poland, Aleje Raławickie 1, 20-059 Lublin
<https://orcid.org/0000-0002-2946-9318>
magdalenaostojka.mo@gmail.com
3. Wojciech Stręć, Students’ Scientific Society at the Department of Pediatric Radiology, Medical University of Lublin, Poland, Aleje Raławickie 1, 20-059 Lublin
<https://orcid.org/0009-0000-5416-6602>
wojciech.strek@gmail.com

4. Marianna Maślana, Students' Scientific Society at the Department of Pediatric Radiology, Medical University of Lublin, Poland, Aleje Raławickie 1, 20-059 Lublin
<https://orcid.org/0009-0007-8975-0551>
marianna.maslana@o2.pl

5. Aleksandra Bogoń, Students' Scientific Society at the Department of Pediatric Radiology, Medical University of Lublin, Poland, Aleje Raławickie 1, 20-059 Lublin
<https://orcid.org/0009-0002-1295-2423>
bogon.aleksandra@gmail.com

6. MD, PhD Magdalena Maria Woźniak, Department of Pediatric Radiology, Medical University of Lublin, Poland, Aleje Raławickie 1, 20-059 Lublin
<https://orcid.org/0000-0001-7436-2432>
magdalena.wozniak@umlub.pl

Corresponding author: Małgorzata Miazga, malgorzatom97.mm@gmail.com

ABSTRACT

Introduction and purpose: Wilms tumor, also known as nephroblastoma, is the most prevalent malignant tumor of the kidney in the pediatric population. 90% of them are diagnosed in children before the age of 6. This tumor is more common in girls, and usually occurs unilaterally. The purpose of the study is to analyse and present the incidence of the patients with Wilms tumor in University Children's Hospital in Lublin in comparison to other studies published on PubMed.

Material and methods: The study included 34 patients with the Wilms tumor in the past medical history. They were selected among patients who had a computed tomography (CT) scan in the Department of Pediatric Radiology between November 2012 and October 2021.

Results: The average diagnostic age of Wilms tumor patients was 3 years and 9 months. The unilateral occurrence of the tumor was more common, also, the presence of a tumor in the left kidney was more frequent than in the right one. Metastases were mainly located in the lungs and liver. The less common sites of metastasis were pleural recesses and paraaortic lymph nodes. Treatment was mostly based on nephrectomy and chemotherapy, and less frequently, on

radiotherapy. In the majority of patients, treatment resulted in regression of cancer lesions. Only a few recurrences of the disease were reported.

Conclusions: Successful treatment protocols for Wilms tumor (pre-operative chemotherapy and surgery) ensure a high survival rate. It is important to monitor the patient after treatment due to the risk of recurrence. During diagnostics, chest and abdominal CT should be considered because of the high incidence rate of lung and liver metastases.

Key words: Wilms tumor; nephroblastoma; treatment; metastasis

INTRODUCTION

Wilms tumor, also known as nephroblastoma, is the most common malignant kidney tumor in the pediatric population [1, 2]. Furthermore, it is the second (after neuroblastoma) most frequent solid neoplasm located out of the central nervous system [3]. This represents 5% of all the tumors found in the pediatric population and appears with the frequency that equals 1:10000 children. This ratio is said to be 2.5 times higher among the black race.

Almost 90% of Wilms tumor is diagnosed in children under the age of 6. Moreover, among the adult population, this neoplasm is rare and represents worse prognosis [2, 4]. Due to the National Registry of Neoplasm in Poland, the number of the annual new cases of Wilms tumor fluctuates between 70 and 80. Nephroblastoma originates from the mesodermal blastema cells, epithelium and mesenchymal stromal tissue [5]. Etiology of the disease is related to the impaired embryonic development of the kidney [2]. Usually nephroblastoma is located in the kidney parenchyma. Post-renal form occurs in 0.5-1% of the cases, and is typically located in the retroperitoneal and inguinal areas [6]. Wilms tumor is circumscribed and has a pseudocapsule [5]. Cases of nephroblastoma can be divided into unilateral, and occurring less frequent, bilateral, which is also related to the presence of specific genetic syndromes [3]. Furthermore, bilateral Wilms tumors occur synchronically (in two kidneys at the same time) or metachronically (in two kidneys but at different times) [7]. Contrary to genetic predisposition, extrinsic factors contributing to the development of neuroblastoma have not yet been identified [8].

Cancer qualification system of Children's Oncology Group (COG) differentiates three categories of Wilms tumors according to the presence of anaplasia: favourable histology (no anaplasia), focal anaplasia and diffuse anaplasia. Tumors with a favourable histology are the most common type and account for 75% of all the cases [9]. The other two types, with features of anaplasia, are related to worse prognosis, weaker response to treatment and shorter survival time [5].

The first - visible for parents- manifestation of nephroblastoma in children is an increasing abdominal circumference related to presence of the mass in the abdomen [5]. Only 20% of patients report symptoms such as malaise, fever, pain, hematuria and/or renal hypertension [10]. Diagnosis of nephroblastoma is based on imaging studies. Abdomen ultrasonography is the preliminary examination used for assessment of the size, morphology of nephroblastoma, presence of calcification, infiltration of the surrounding tissues or lymph nodes. When the findings in ultrasonography are unclear, further evaluation, such as using computed tomography (CT) or magnetic resonance imaging (MRI) is indicated [11, 12]. A characteristic radiological sign in Wilms tumors of renal origin is the claw sign, in which the enlarging tumor mass displaces the enhancing renal parenchyma and the renal parenchyma forms sharp angles on either side of tumor mass. CT or MRI also assess the extent of renal involvement, metastases and vascular invasion (renal vein, inferior vena cava) which allows determining the staging of the cancer and implementing appropriate treatment [13].

AIM OF THE STUDY: The aim of the study is the statistical analysis of the medical history data obtained from patients of the Department of Pediatric Radiology, University Children's Hospital in Lublin, the characteristics of pediatric patients with Wilms tumor living in the lubelskie region, as well as, the comparison between obtained results and the literature available in the Pubmed database.

MATERIAL AND METHODS: We retrospectively analyzed the data of patients with Wilms tumor in medical history. They had a computed tomography scan performed at the Department of Pediatric Radiology, University Children's Hospital in Lublin between November 2012 and October 2021. Based on CT scan descriptions, we qualified a total of the 34 pediatric patients (18 female and 16 male) aged from 1.5 months to 9 years and 11 months, to be included in our study.

RESULTS

Demographic analysis

Among the 34 analyzed pediatric patients, 53% of them were female and 47% - male. At the time of the study, the average diagnostic age of pediatric patients with Wilms tumor was 3 years and 9 months. At the time of CT scanning, the youngest patient was 1.5 months old, whereas, the oldest participant was 9 years and 11 months old. Infants constituted 12% of all the analyzed cases.

Medical history

In the vast majority of cases, family medical history was not clinically significant. The study presented only one case of the familial occurrence of Wilms tumor among two sisters. In the older girl, Wilms tumor was bilateral and diagnosed at the age of 3 years and 4 months. Meanwhile, the younger girl was diagnosed with unilateral Wilms tumor at 12 months old.

Imaging examination - computed tomography scan

Among the analyzed cases, 6% of the patients had bilateral Wilms tumor. In the remaining children, this tumor occurred more often in the left kidney (52%) than in the right one (48%).





Figure 1. Unilateral form of Wilms tumor and multiple metastatic lesions in the liver.

In the computed tomography scan, we also assessed the presence of metastases, which were found in 9 patients (26% of the cases). Metastatic lesions were most common in the lungs (8 patients) and the liver (4 patients). The co-occurrence of metastatic lesions in both organs (lungs and liver) was observed in 3 patients. In the vast majority of cases, pulmonary metastatic lesions affected both lungs (7 out of 9 patients). However, in only one patient the metastasis was noted in the posterior recess of the right pleural cavity, adjacent to the liver. Moreover, one patient had significantly enlarged para-aortic lymph nodes, which caused modelling and right sided displacement of the aorta. Based on the computed tomography scan results, it was defined as metastatic lesions.

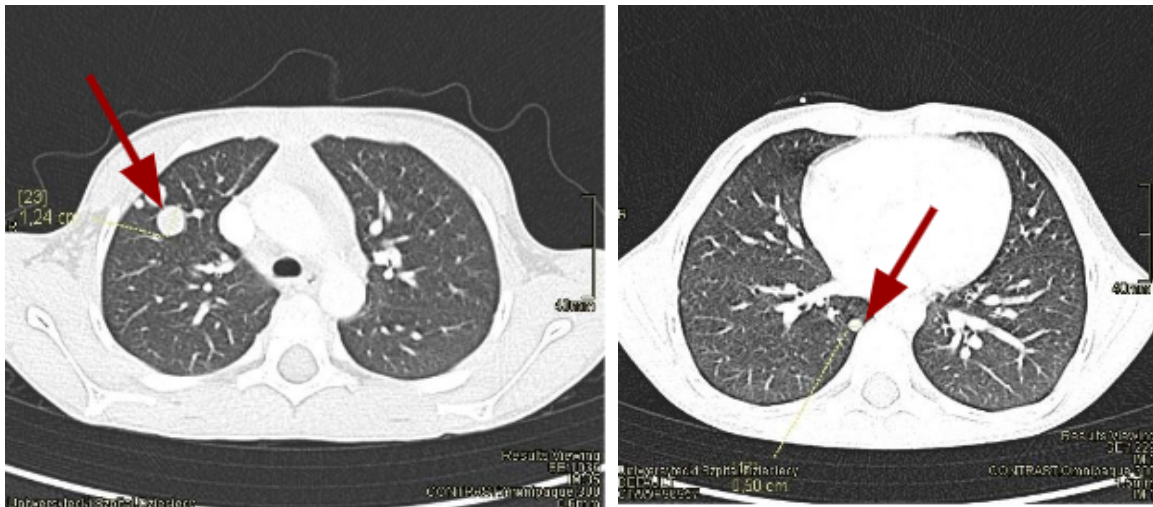


Figure 2. Metastatic lesions of Wilms tumor in the lungs.

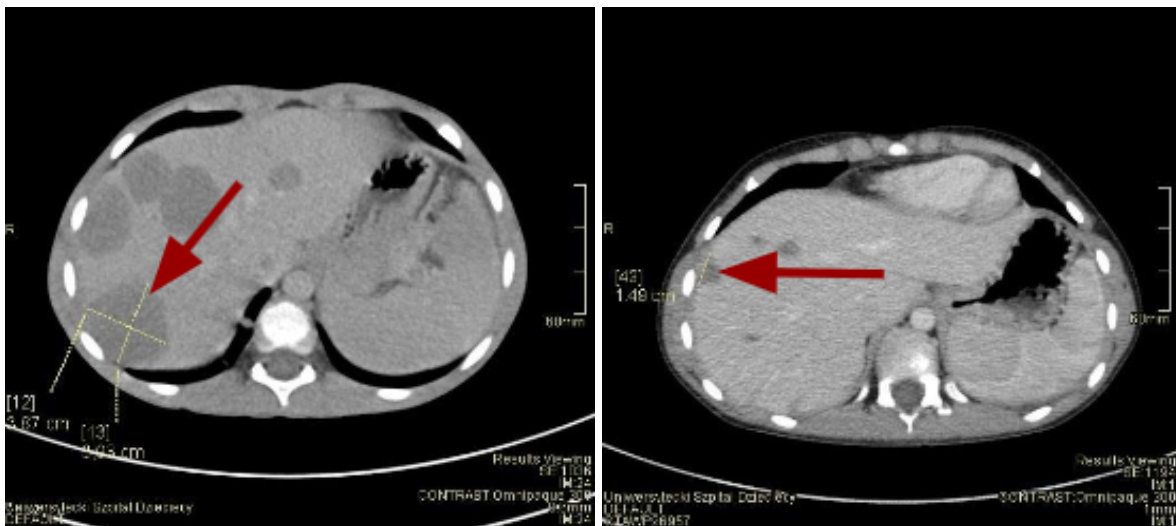


Figure 3. Multiple metastatic lesions of Wilms tumor in the liver.

Treatment of Wilms tumor

In our group of pediatric patients, the most common method, which was used to treat Wilms tumor, was partial or total nephrectomy (71% of our patients were treated with the usage of said method). In comparison, chemotherapy was administered to 41% of the patients. In order to reduce the metastatic lesions, radiotherapy was administered to 3 patients. In two cases of children, it was radiotherapy of the lungs and in one patient, it was radiotherapy of the abdominal cavity. Surgical procedure to remove part of the metastatic lesions in the lungs was performed in two patients. Whereas, in one patient, metastatic lesions were surgically removed from the liver.

Prognosis

In the vast majority of analyzed patient cases, treatment with the above-mentioned methods, in various combinations (nephrectomy, chemotherapy, radiotherapy, metastasectomy) resulted in regression of lesions (92%). Relapses occurred in 3 patients and involved the adrenal glands, lungs and liver.

DISCUSSION

Many studies showed that there is no difference between the disease frequency of Wilms tumor among women and men [2, 14]. In contrast, the American Cancer Society reports that girls suffer from Wilms tumor more frequently than boys [14]. In some Asian countries, women are affected more commonly than men (4:1) [13]. Research showed that bilateral Wilms tumor occurs more often in girls regardless of their origin place [5]. Among the pediatric patients qualified for this study, there was a slight predominance of girls compared to boys (18 vs.16). Wilms tumor occurs mainly among pediatric patients [15]. 90% of the cases of this cancer are diagnosed in children before the age of 6 [5] and approximately 95% of the patients are diagnosed before the age of 15 [15]. The peak incidence of Wilms tumor occurs in children aged 2 to 4 years [4, 11]. According to the Children's Oncology Group (COG), the average age of onset is 38 months. Additionally, in girls, the onset of Wilms tumor occurs 6 months later than in boys [13]. Another study reported that the mean age at diagnosis in patients with unilateral and bilateral Wilms tumor was 44 months and 31 months, respectively [16]. Research provided that the median age at diagnosis is 3.5 years [5]. In our study group, the onset age of Wilms tumor ranged from 1.5 months to 9 years and 11 months. The average age of onset was 3 years and 9 months. According to researchers, a higher age of onset of the patient (especially over 2 years) is associated with an increased risk of recurrence and overall worse prognosis [3, 5].

In our group of pediatric patients, two sisters were diagnosed with Wilms tumor. It should be mentioned that this cancer occurs in families in about 1-2% of all the cases. This form is the result of germline (constitutional) mutations which are located within: the WT1 gene, the WT2 region, the FWT1 locus on 17q, the FWT2 locus on 19q and others [17, 18]. According to the available literature, unilateral forms of Wilms' tumor are predominant. In contrast, it is estimated that both kidneys are affected in approximately 5-10% of the children at the time of diagnosis [3]. The male to female ratio for unilateral tumors is 0.92. Whereas, it stands at 0.6 for bilateral tumors [13]. Bilateral forms of nephroblastoma are more often associated with the occurrence of genetic syndromes [3]. Researchers prove that approximately

10% of the Wilms tumor cases in children are related to a genetic predisposition. The most common genetic syndromes are: Beckwith-Wiedemann syndrome, Denys-Drash syndrome, WAGR syndrome (Wilms tumor, congenital absence of the iris, congenital defects of the urogenital system and mental retardation) and Simpson-Golabi-Behmel syndrome [9, 19]. Some genetic markers, associated with nephroblastoma predisposition, include changes in the following genes: WT1, CTNNB1, WTX, TP53 and MYNC [5]. However, it should be remembered that currently a significant number of genes which predispose to Wilms tumor are still unknown [20]. Children with a genetic predisposition to Wilms tumor are usually diagnosed at a younger age [9]. For this reason, children with genetic syndromes or genetic markers should be subjected to tumor screening programs. This involves regular ultrasound examinations (usually every 3 months) at least until the age of 8. Screening enables earlier diagnosis of Wilms tumor (stage I or II, without metastatic lesions) and improves patient prognosis. In such cases, kidney-sparing therapy may be sufficient [16].

Wilms tumors are rarely associated with the presence of metastases at the time of diagnosis [13]. Distant metastases are present in 10-20% of the patients with Wilms tumor [1]. The dominant site of the metastasis are the lungs. About 80% of metastases are located there. Bilateral metastases predominate. Chest computed tomography scan is one of the preferred imaging methods in diagnostics [2, 21, 22, 23]. If there are no evident lung lesions in the CT scan, it is advisable to perform a biopsy of such lesions (at least 2) to confirm the presence of metastases. Treatment includes systemic therapy and whole-lung radiotherapy, regardless of the response of the metastatic nodules [10]. A follow-up chest computed tomography scan is also recommended after 6 weeks of therapy to determine the treatment response. Four-year event-free survival is 85.4% for patients with histologically favourable Wilms tumor and lung metastases. However, overall survival rate is estimated at 95.6% [2, 21, 22, 23]. Another and less common site of metastasis is the liver (10%), which is assessed during the initial computed tomography examination of the abdomen and pelvis [21]. Extrapulmonary and extrahepatic metastases (located in the bone, skin, urinary bladder, large intestine, central nervous system, contralateral kidney) are very rare. These metastases are more often observed in patients with Wilms tumor and features of anaplasia [8, 4]. Bone metastases are a poor prognostic factor and they usually develop later, as a recurrence of the disease [5].

One of the potential sites of Wilms tumor metastasis are regional lymph nodes [24]. After detecting metastatic foci in the para-aortic lymph nodes, local radiotherapy should be implemented [25].

In our group of patients with Wilms tumor, there was one case of a child with metastasis in the posterior recess of the right pleural cavity. The literature reports that metastases located in the pleural cavity are extremely rare. For this reason, appropriate recommendations for the treatment of this type of metastases are yet to be developed. Some cases, of patients described in the literature, were successfully treated with chemotherapy and chest radiotherapy. Nonetheless, there are also evidences of preferable avoidance of the thoracic irradiation in patients with a rapid initial response to chemotherapy, due to the toxicity of radiotherapy and long-term negative sequelae of treatment [26].

Currently, there are two approaches to treatment of Wilms tumor, which are developed by the International Society of Paediatric Oncology (SIOP) and the Children's Oncology Group (COG). This protocol applies to children with primary renal tumors and is based on the results of previous national and international trials and studies. According to the COG guidelines, which are used mainly in the USA and Canada, in the first stage of treatment, children with Wilms tumor should undergo immediate surgery and then postoperative chemotherapy and/or radiotherapy (if it is necessary) [13, 27, 28]. In turn, guidelines for the treatment of Wilms tumor in Europe are included in the UMBRELLA SIOP-RTGS 2016 protocol developed by the Renal Tumor Study Group of the International Society of Pediatric Oncology (SIOP-RTSG). According to these recommendations, after obtaining a clinical and radiological diagnosis, preoperative chemotherapy (lasting 4 or 6 weeks) should be used in the first stage of treatment. Its aims are to reduce the size of the tumor, increase the chance of complete tumor resection and reduce the risk of tumor rupture during surgery [10, 27, 28]. Tumor biopsy is not recommended, because of the dissemination risk and the possibility of the rupture or disruption of the lesion capsule [29]. The next stage of treatment for Wilms tumor is nephrectomy. In most cases, radical nephrectomy is necessary. But if Wilms' tumor does not invade the renal hilum, the nephron sparing surgery involving removal of only the mass of tumor with a surrounding margin of healthy tissue is sufficient. Precise conditions for the nephron sparing surgery in unilateral non-syndromic Wilms tumor are presented in the UMBRELLA SIOP-RTGS 2016 protocol. The next stages of the procedure (as in the COG protocol) depend on the results of histopathological examination, clinical stage, response to preoperative chemotherapy and the presence of molecular markers. Depending on these factors, postoperative chemotherapy and/or radiotherapy may be necessary [28, 30]. An important aspect which differentiates treatment approaches using the above-mentioned protocols is the risk for intraoperative tumor spillage.

In patients treated according to SIOP-RTSG (with preoperative chemotherapy), this risk is lower compared to patients treated with COG (3% vs. 10%) [10].

In our study, 71% of the patients underwent nephrectomy and chemotherapy was implemented in 41% of the patients. Radiotherapy was administered to three patients with liver and lung metastases.

Nephron-sparing surgery can be performed using two different methods, depending on the size, location, number of tumor lesions in the kidney. There are: partial nephrectomy (tumor resection with a normal tissue margin) and tumor enucleation (tumor resection without a normal tissue margin) [31]. It has been shown that since 2010, the percentage of patients treated with nephron-sparing methods has been gradually increasing (from 4% to 8%). One of the reasons for this is the fact that currently these cancers can be detected at an earlier staging using screening and monitoring of pediatric patients from risk groups [32]. Apart from obtaining a positive result of oncological treatment, the most important goal of nephron sparing surgery is the preservation of as much functioning renal parenchyma as possible [33]. In turn, the main advantages of radical nephrectomy are reducing the risk of incomplete tumor resection and leaving positive surgical margins. Whereas, the analysis of adult patients who had in childhood radical nephrectomy showed that this type of surgery is associated with a higher risk of long-term complications such as hyperfiltration syndrome, hypertension and proteinuria. According to Spreafico et al., during choice of surgical treatment strategy for Wilms tumor, we should take into account issues such as: the presence of a genetic predisposition to Wilms tumor, type of tumor (unilateral or bilateral), clinical characteristics of patient (symptoms of tumor, other diseases) and family history indicating a predisposition to kidney failure [20]. Chen et al. conducted a meta-analysis which differentiated, among others, the survival rate of children with Wilms tumor depending on the type of surgery which was performed. This rate was higher in patients after nephron sparing surgery (n = 293) compared to patients after radical nephrectomy (n = 4623) and amounted to $95.1 \pm 5.9\%$ and $90.6 \pm 8.7\%$, respectively. The mean follow-up periods were 5.9 ± 3.4 years for nephron sparing surgery and 5.9 ± 3.5 years for radical nephrectomy. Moreover, in the long-term observation, children with nephron sparing surgery were characterised by a lower relapse rate of Wilms tumor and a higher estimated glomerular filtration rate compared to children after radical nephrectomy [34]. In a more recent study, Wu et al conducted a retrospective cross-sectional study of 1,825 pediatric patients (less than 14 years of age) with unilateral Wilms tumor receiving adjuvant chemotherapy. This study compared the survival rate and prognosis of patients after nephron-sparing surgery (n = 83) and

after radical nephrectomy (n = 1,742). The researchers did not reveal a statistically significant difference between the 10-year overall survival of patients after conserving and radical surgery (93.26% vs. 92.17%) [32]. Additionally it should be remembered that currently minimally invasive surgical methods for Wilms tumor are becoming more and more common. Laparoscopic radical or partial nephrectomy can be dedicated to tumors limited to the kidney with good hilar vessels exposure [10].

The prognosis for Wilms tumor with properly selected treatment is promising. Survival rates for most patients exceed 90% [29, 35]. Still, despite complete recovery, patients with the tumor recurrence have been reported. In a study conducted for the Polish Research Group for Solid Cancers and Children, recurrences occurred in 11.8% of the patients [36]. Contrary, in our group of patients, recurrences occurred in 8% of the children. Researchers reveal that most cases of Wilms tumor recurrence are located in the lungs, abdomen and liver. According to the COG, standard-risk cases of recurrent Wilms tumor are treated with surgery, chemotherapy and/or radiotherapy. In patients with high and very high risk of recurrence, an additional treatment option is hematopoietic stem cell transplantation [14].

It should be mentioned that the methods of Wilms tumor treatment may increase the risk of long-term iatrogenic complications. The most common of them are: a renal dysfunction (including leading to proteinuria or hypertension), a pulmonary dysfunction, a congestive heart failure (especially after administration of anthracyclines), liver damage (in particular after chemotherapy which included vincristine and actinomycin D), hormonal dysfunction, infertility, premature ovarian insufficiency, secondary malignant neoplasms (mainly hepatocellular carcinoma, bone, breast, colon/rectal or thyroid cancer), musculoskeletal abnormalities (including epiphyseal growth dysfunction), neurocognitive impairment and physical dysfunction. Due to the risk of long-term complications after completion of Wilms tumor therapy, patient monitoring is recommended. Routine monitoring includes, among others: physical examinations, laboratory tests and imaging examinations (X-ray, ultrasound examination or contrast-enhanced computed tomography). Follow-up examinations should be performed for all patients every 3 months for the first year and every 6 months for the next 2 years. In the following years, despite a significant reduction in the risk of recurrence of Wilms' tumor, annual check-ups are recommended [13, 16].

CONCLUSIONS

Wilms tumor is the most common malignant renal tumor in the pediatric population. Using effective treatment protocols, which mainly consist of preoperative chemotherapy and

surgical treatment, the survival rate is high. Yet, due to the risk of the disease recurrence, it is essential to monitor the health condition of patients after completing the treatment process. Additionally, during the diagnostic procedure, computed tomography of the chest and abdominal cavity should be used, because of the possible metastases to the lungs and liver.

In this study, we presented the characteristics of patients with Wilms tumor treated at the University Children's Hospital in Lublin. Despite the small group of subjects, which included the pediatric population from the Lublin region, the presented analysis of clinical data is comparable to the results available in the literature. In the future, the presented analysis might be extended nationally in cooperation with other centres of Wilms tumor treatment.

Author's contribution:

Conceptualization: MD PhD Woźniak M., Miazga M., Maślana M.; Methodology: Maślana M.; Software: Stręk W.; Check: Maślana M., Bogoń A.; Formal analysis: Stręk W., Bogoń A., Miazga M.; Investigation: Ostojcka M., Bogoń A.; Resources: MD PhD Woźniak M., Ostojcka M.; Data curation: Stręk W.; Writing- rough preparation: Miazga M., Ostojcka M; Writing - review and editing: Miazga M., Ostojcka M, MD PhD Woźniak M ; Visualization: Ostojcka M.; Supervision: MD PhD Woźniak M.; Project administration: MD PhD Woźniak M, Miazga M.

All authors have read and agreed with the published version of the manuscript.

Funding Statement: No funding received.

Institutional Review Board Statement: Not applicable. The study was conducted in accordance with the Declaration of Helsinki. In accordance with the law in force in the Republic of Poland, retrospective studies do not require the opinion or consent of the Bioethics Committee, as they are not a medical experiment in which human organisms would be interfered with. For this reason, we did not seek the consent of the Commission. What's more, the results of the study did not affect the management of patients at any stage, so the above-mentioned procedure was followed.

Informed Consent Statement: Not applicable. The study was retrospective and was conducted on the basis of collected medical documentation.

Data Availability Statement: The data presented in this study are available on request from the first author.

Acknowledgments: Not applicable

Conflicts of Interest Statement: The authors declare no conflict of interest.

References:

1. Pater, L., Melchior, P., Rube, C., Cooper, B. T., McAleer, M. F., Kalapurakal, J. A., & Paulino, A. C. (2021). Wilms tumor. *Pediatr Blood Cancer.*, 68 Suppl 2, e28257.
Available from: <https://doi.org/10.1002/pbc.28257>
2. Benlhachemi, S., Abouqal, R., Coleman, N., Murray, M. J., Khattab, M., & El Fahime, E. (2023). Circulating microRNA profiles in Wilms tumour (WT): A systematic review and meta-analysis of diagnostic test accuracy. *Noncoding RNA Res.*, 8(3), 413-425.
Available from: <https://doi.org/10.1016/j.ncrna.2023.05.007>
3. Nelson, M. V., van den Heuvel-Eibrink, M. M., Graf, N., & Dome, J. S. (2021). New approaches to risk stratification for Wilms tumor. *Curr Opin Pediatr.*, 33(1), 40-48.
Available from: <https://doi.org/10.1097/mop.0000000000000988>
4. Modi, S., Tiang, K. W., Inglis, P., & Collins, S. (2016). Adult Wilms' Tumour: Case Report and Review of Literature. *J Kidney Cancer VHL.*, 3(2), 1-7.
Available from: <https://doi.org/10.15586%2Fjkcvgl.2016.52>
5. Leslie, S. W., Sajjad, H., & Murphy, P. B. (2023). Wilms Tumor. In: *StatPearls* [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
6. Karim, A., Shaikhyzada, K., Abulkhanova, N., Altyn, A., Ibraimov, B., Nurgaliyev, D., & Poddighe, D. (2023). Pediatric Extra-Renal Nephroblastoma (Wilms' Tumor): A Systematic Case-Based Review. *Cancers (Basel).*, 15(9), 2563.
Available from: <https://doi.org/10.3390/cancers15092563>
7. Charlton, J., Irtan, S., Bergeron, C., & Pritchard-Jones, K. (2017). Bilateral Wilms tumour: a review of clinical and molecular features. *Expert Rev Mol Med.*, 19, e8.
Available from: <https://doi.org/10.1017/erm.2017.8>
8. Spreafico, F., Fernandez, C. V., Brok, J., Nakata, K., Vujanic, G., Geller, J. I., Gessler, M., Maschietto, M., Behjati, S., Polanco, A., Paintsil, V., Luna-Fineman, S., & Pritchard-Jones, K. (2021). Wilms tumour. *Nat Rev Dis Primers.*, 7(1), 75.
Available from: <https://doi.org/10.1038/s41572-021-00308-8>
9. Servaes, S. E., Hoffer, F. A., Smith, E. A., & Khanna, G. (2019). Imaging of Wilms tumor: an update. *Pediatr Radiol.*, 49(11), 1441-1452.

Available from: <https://doi.org/10.1007/s00247-019-04423-3>

10. Theilen, T. M., Braun, Y., Bochenek, K., Rolle, U., Fiegel, H. C., & Friedmacher, F. (2022). Multidisciplinary Treatment Strategies for Wilms Tumor: Recent Advances, Technical Innovations and Future Directions. *Front Pediatr.*, 10, 852185.

Available from: <https://doi.org/10.3389/fped.2022.852185>

11. de Carvalho, L. G., Kobayashi, T., Cypriano, M. D. S., Caran, E. M. M., Lederman, H. M., Alves, M. T. S., & Abib, S. C. V. (2021). Diagnostic Errors in Wilms' Tumors: Learning From Our Mistakes. *Front Pediatr.*, 9, 757377.

Available from: <https://doi.org/10.3389/fped.2021.757377>

12. Cancers in children - Wilms tumor, National Cancer Registry in Poland.

Available from: <https://onkologia.org.pl/pl/nawotwory-u-dzieci-guz-wilmsa-czym-jest> [access: 11.03.2024]

13. Bhutani, N., Kajal, P., & Sharma, U. (2021). Many faces of Wilms Tumor: Recent advances and future directions. *Ann Med Surg (Lond.)*, 64, 102202.

Available from: <https://doi.org/10.1016/j.amsu.2021.102202>

14. Key statistics for Wilms tumors, American Cancer Society.

Available from: <https://www.cancer.org/cancer/types/wilms-tumor/about/key-statistics.html> [access: 11.03.2024]

15. Vallejo Yepes, C., Bermudez, M., Camacho-Nieto, D., Mesa, J., & Bruges, R. (2021). Adult Wilms' Tumor: Case Report and Literature Review. *Cureus.*, 13(6), e15524.

Available from: <https://doi.org/10.7759/cureus.15524>

16. PDQ Pediatric Treatment Editorial Board. Wilms Tumor and Other Childhood Kidney Tumors Treatment (PDQ®): Health Professional Version. (2024). In: PDQ Cancer Information Summaries [Internet]. Bethesda (MD): National Cancer Institute (US); 2002–.

17. Tołoczko-Grabarek, A., Jakubowska, A., Górski, B., Cybulski, C., Kamieńska, E., Lubiński, J., Zajączek, S., & Dębniak, T. (2002). Hereditary tumors in children - nephroblastoma. *Contemporary Oncology/Współczesna Onkologia.*, 6(5), 300-307.

18. Begum, Z., Sharieff, S., & Attar, A. H. (2013). Familial occurrence of nonsyndromic wilms tumor-a report in two siblings. *Indian J Surg.*, 75(Suppl 1), 99-102.

Available from: <https://doi.org/10.1007/s12262-011-0357-8>

19. Sze, S.K. (2021). Neonatal Renal Tumors. *Clin Perinatol.*, 48(1), 71-81.

Available from: <https://doi.org/10.1016/j.clp.2020.11.004>

20. Spreafico, F., BIASONI, D., & Montini, G. (2024). Most appropriate surgical approach in children with Wilms tumour, risk of kidney disease, and related considerations. *Pediatr Nephrol.*, 39(4), 1019-1022.

Available from: <https://doi.org/10.1007/s00467-023-06213-4>

21. Davidoff, A. M. (2012). Wilms tumor. *Adv Pediatr.*, 59(1), 247-67.

Available from: <https://doi.org/10.1016/j.yapd.2012.04.001>

22. Lv, L., Yu, B., Zhai, Y., Zhao, H., Guo, R., Xu, H., & Zhang, S. (2022). Surgical removal of bilateral lung metastases from Wilms tumor via subxiphoid approach video-assisted thoracic surgery: a case report. *Transl Pediatr.*, 11(8), 1408-1414.

Available from: <https://doi.org/10.21037/tp-22-102>

23. Artunduaga, M., Eklund, M., van der Beek, J. N., Hammer, M., Littooij, A. S., Sandberg, J. K., Schenk, J. P., Servaes, S., Singh, S., Smith, E. A., Srinivasan, A., & Khanna, G. (2023). Imaging of pediatric renal tumors: A COG Diagnostic Imaging Committee/SPR Oncology Committee White Paper focused on Wilms tumor and nephrogenic rests. *Pediatr Blood Cancer.*, 70 Suppl 4(Suppl 4), e30004.

Available from: <https://doi.org/10.1002/pbc.30004>

24. Balis, F., Green, D. M., Anderson, C., Cook, S., Dhillon, J., Gow, K., Hiniker, S., Jasty-Rao, R., Lin, C., Lovvorn, H., MacEwan, I., Martinez-Agosto, J., Mullen, E., Murphy, E. S., Ranalli, M., Rhee, D., Rokitka, D., Tracy, EL., Vern-Gross, T., Walsh, M. F., Walz, A., Wickiser, J., Zapala, M., Berardi, R. A., & Hughes, M. (2021). Wilms Tumor (Nephroblastoma), Version 2.2021, NCCN Clinical Practice Guidelines in Oncology. *J Natl Compr Canc Netw.*, 19(8), 945-977.

Available from: <https://doi.org/10.6004/jnccn.2021.0037>

25. Linni, K., Urban, C., Lackner, H., & Höllwarth, M. E. (2003). Nephron-sparing procedures in 11 patients with Wilms' tumor. *Pediatr Surg Int.*, 19(6), 457-62.

Available from: <https://doi.org/10.1007/s00383-003-0957-x>

26. Al-Hadidi, A., Lapkus, M., Novotny, N. M., Gowans, L. K., Chen, P. Y., & Stallion, A. (2020). Wilms Tumor with Pleural Metastasis. *Glob Pediatr Health.*, 7, 2333794X20952292.

Available from: <https://doi.org/10.1177/2333794x20952292>

27. Vujanić, G. M., Gessler, M., Ooms, A. H. A. G., Collini, P., Coulomb-l'Hermine, A., D'Hooghe, E., de Krijger, R. R., Perotti, D., Pritchard-Jones, K., Vokuhl, C., van den Heuvel-Eibrink, M. M., & Graf, N. (2019). International Society of Paediatric Oncology–Renal Tumour Study Group (SIOP–RTSG). The UMBRELLA SIOP-RTSG 2016 Wilms tumour pathology

and molecular biology protocol. *Nat Rev Urol.*, 15(11), 693-701. Erratum in: *Nat Rev Urol.* 2019, 16(9), 563.

Available from: <https://doi.org/10.1038%2Fs41585-018-0100-3>

28. Vujančić, G. M., Parsons, L. N., D'Hooghe, E., Treece, A. L., Collini, P., & Perlman, E. J. (2022). Pathology of Wilms' tumour in International Society of Paediatric Oncology (SIOP) and Children's oncology group (COG) renal tumour studies: Similarities and differences. *Histopathology*, 80(7), 1026-1037.

Available from: <https://doi.org/10.1111/his.14632>

29. Saltzman, A. F., Cost, N. G., & Romao, R. L. P. (2023). Wilms Tumor. *Urol Clin North Am.*, 50(3), 455-464.

Available from: <https://doi.org/10.1016/j.ucl.2023.04.008>

30. Pietras, W., Kobos, J., & Godziński, J. (2019). Standards of diagnostic and therapeutic management in kidney tumors in children. *Przegląd Pediatryczny*, vol. 48, no. 3, 109-111.

31. van den Heuvel-Eibrink, M. M., Hol, J. A., Pritchard-Jones, K., van Tinteren, H., Furtwängler, R., Verschuur, A. C., Vujanic, G. M., Leuschner, I., Brok, J., Rübe, C., Smets, A. M., Janssens, G. O., Godzinski, J., Ramírez-Villar, G. L., de Camargo, B., Segers, H., Collini, P., Gessler, M., Bergeron, C., Spreafico, F., & Graf, N. (2017). International Society of Paediatric Oncology — Renal Tumour Study Group (SIOP–RTSG). Position paper: Rationale for the treatment of Wilms tumour in the UMBRELLA SIOP-RTSG 2016 protocol. *Nat Rev Urol.* 2017, 14(12), 743-752.

Available from: <https://doi.org/10.1038/nrurol.2017.163>

32. Wu, X. W., Zhou, P. P., & Dong, Q. (2024). Survival assessment of nephron-sparing surgery or radical nephrectomy in children with unilateral Wilms tumor receiving adjuvant chemotherapy: a retrospective cross-sectional study. *Eur Rev Med Pharmacol Sci.*, 28(3), 1095-1102.

Available from: https://doi.org/10.26355/eurrev_202402_35346

33. Taghavi, K., Sarnacki, S., Blanc, T., Boyer, O., & Heloury, Y. (2024). The rationale for nephron-sparing surgery in unilateral non-syndromic Wilms tumour. *Pediatr Nephrol.*, 39(4), 1023-1032.

Available from: <https://doi.org/10.1007/s00467-023-06099-2>

34. Chen, H., Yang, S., & Qian, C. (2020). Effectiveness of Nephron Sparing Surgery and Radical Nephrectomy in the Management of Unilateral Wilms Tumor: A Meta-Analysis. *Front Oncol.*, 10, 1248.

Available from: <https://doi.org/10.3389/fonc.2020.01248>

35. Lopes, R. I., & Lorenzo, A. (2017). Recent advances in the management of Wilms' tumor. *F1000Res.*, 6, 670.

Available from: <https://doi.org/10.12688/f1000research.10760.1>

36. Niedzielska, E., Bronowicki, K., Pietras, W., Sawicz-Birkowska, K., Trybucka, K., Rapała, M., Karpińska-Derda, I., Kurylak, A., Marciniak-Stępak, P., Panasiuk, A., Nurzyńska-Flak, J., Peregud-Pogorzelski, J., Pietrys, D., Rurańska, I., Sobol, G., Stefanowicz, J., Szymik-Kantorowicz, S., Zubowska, M., & Godziński, J. (2014). Clinical factors in relapses of Wilms' tumor--results for the Polish Pediatric Solid Tumors Study Group. *Adv Clin Exp Med.*, 23(6), 925-31.

Available from: <https://doi.org/10.17219/acem/37340>