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## Quality of life at 3 to 5 years after surgical treatment of renal cell carcinoma – a pilot cross-sectional study

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**Introduction.** The predicted distant health-related quality of life is one of the key elements in the long-term assessment of the effectiveness of therapy and a factor to be taken into account when deciding upon the choice of therapeutic options in modern cancer surgery. To assess the quality of life of patients having undergone surgical treatment for renal cell carcinoma.

**Material and methods.** This cross-sectional study was carried out in a group of 44 (17 NR, 27 NSS) patients having received surgical treatment for renal cell carcinoma at the Department of Urology of the University Hospital no. 2 in Bydgoszcz. The control group consisted of 24 subjects within a matching age range. The standardized WHOQOL BREF questionnaire was used as the study tool.

**Results.** No statistically significant differences ( $p > 0.05$ ) were observed with regard to the subjectively assessed quality of life depending on the type of surgery performed, i.e. RN vs. NSS. A positive correlation was observed between the higher scores within the Social ( $p = 0.0453$ ) and Environmental ( $p=0.0156$ ) domains and the laparoscopic approach. Lower scores within the somatic ( $p = 0.0023$ ), environmental ( $p = 0.0189$ ) and emotional ( $p = 0.0356$ ) scale domains were observed in female patients. A statistically significant inverse relationship was observed between the cancer stage and the self-assessed overall health scores ( $p = 0.0025$ ).

**Conclusions.** Minimally invasive surgical techniques open up the potential for the achievement of better quality of life of patients after surgery. Clinical and demographic variables influence the long-term health-related quality of life scores.

**Key words:** cancer, nephrectomy, nephron-sparing surgery, quality of life

## **Introduction**

Renal cell carcinoma accounts for 3% of all malignancies diagnosed among adult patients in Poland. Epidemiological data indicate that the disease most frequently develops between 50 and 70 years of age. It contributes to approximately 3% and 2% of deaths in male and female subpopulations, respectively. The multifactorial etiology of renal cell carcinoma points to the genetic and environmental background of the disease [1, 2]. Surgery including complete (radical nephrectomy, RN) or partial (nephron-sparing surgery, NSS) resection of the kidney is the primary treatment method. Radical nephrectomy involves the resection of kidney, perirenal fat, lymph nodes, and adrenal glands. This approach had been the standard of treatment for many years; however, nephron-sparing surgeries involving tumor enucleation or partial nephrectomy have been used with increasing frequencies in recent years. The development of minimally invasive surgical techniques has resulted in the laparoscopic approach becoming the most common treatment as being associated with shorter convalescence [3–5].

Regardless of its location, cancer may be responsible for numerous adverse changes in the daily functioning of patients, affecting the physical, emotional, and social domains of their lives [6]. The diagnosis and the need for immediate treatment are by themselves stress factors that impair the health-related quality of life (HRQoL) [5]. Therefore, due to the continuously increasing rates of 5-year survival in patients with urogenital cancers, the predicted HRQoL is taken into account as one of the key elements in the assessment of therapeutic effectiveness when deciding upon the choice of therapeutic options. Sociodemographic and clinical variables such as postoperative complications, time since the procedure, and cancer stage strongly influence numerous facets of patient's functioning, and therefore it is extremely important that they be taken into account in research planning [7, 8]. The main objective of this study was to assess the quality of life of patients having undergone unilateral complete or partial resection of kidney due to renal cell carcinoma cancer 3 to 5 years after surgery as compared to the control group of healthy subjects.

## Material and methods

This cross-sectional study was carried out in a group of 44 patients with the diagnosis of renal cell carcinoma who had received surgical treatment at the Department of Urology of the University Hospital no. 2 in Bydgoszcz in years 2016–2018. The patients were divided into 2 groups, depending on the type of surgical procedure: 17 patients had been subjected to unilateral radical nephrectomy (NR), while the other 27 patients had been qualified for nephron-sparing surgery (NSS). All patients had normal contralateral kidney function. The quality of patients' life was assessed after 3 to 5 years from the surgery. A control group was also established, which consisted of 24 people of similar age and no history of the aforementioned procedures. The control group was recruited from among the students of the Third Age University at the WSG University in Bydgoszcz. A diagnostic survey method was used to collect study data, with the validated WHOQOL BREF questionnaire being used as the research tool.

The WHOQOL-BREF questionnaire is a tool designed to assess health-related quality of life regardless of the disease entity. It can be used in both sick and healthy individuals. In this paper, a brief version of the questionnaire was used, consisting of 26 questions assessing physical, environmental, social, and emotional functioning as well as the overall quality of life and health of patients. The respondents provided answers to individual questions using a scale of 1 to 5 points. Summary scores were calculated separately for each of the domains, with the minimum and maximum scores amounting to 4 and 20 points, respectively. With regard to the interpretation of the results, the higher the mean score, the better was the patients' subjective assessment of the quality of life within a particular domain. In addition, a proprietary questionnaire had been developed to evaluate demographic variables, i.e. age, gender, educational background, area of residence, number of children, marital status, and economic status of patients. Medical documentation of patients was analyzed to collect clinical data. Information on body weight, height, BMI, laterality of the surgery, postoperative complications, cancer stage, type of surgery, and the duration of hospital stay were extracted from medical documentation for the purposes of statistical analysis. The research project was approved by the Bioethics Committee at the Nicolaus Copernicus University in Toruń (no. 179/2022). Participation in the study was voluntary. Each participant was informed about the study purpose, method and conditions.

Inclusion and exclusion criteria had been defined to establish a homogeneous study group.

The inclusion criteria included:

- written consent to participate in the study,
- histopathologically confirmed stage I–IV renal cell carcinoma,

- overall Eastern Cooperative Oncology Group (ECOG) performance status of 0–1 at the time of the study,
- history of unilateral complete or partial resection of kidney due to renal cell carcinoma as performed 3–5 years prior to the study at the Department of Urology of the University Hospital No. 2 in Bydgoszcz,
- age of 18 or above at the time of qualification for the surgery.

The exclusion criteria included:

- an active cancer disease,
- uncontrolled mental disorders,
- other serious diseases (ASA IV),
- others invasive, abdominal, surgical procedure in observed time,
- other malignant tumor in observed time.

In years 2016–2018, a total of 108 complete unilateral kidney resections and 151 unilateral partial kidney resections had been performed at the Department of Urology of the Bziel University Hospital No. 2 in Bydgoszcz. Telephone contact was obtained with 144 patients (RN: 63, NSS: 81); 91 of these patients expressed willingness to participate in the project, and a total of 79 patients reported at a predefined date to take part in the study combined with a follow-up visit at the Department of Urology of the Bziel Hospital in Bydgoszcz. The inclusion criteria were met by 44 patients. Overall, 44 patients constituting the study group and 24 subjects constituting the control group were included in the statistical analysis. Details are presented in figure 1.

### ***Statistical analysis***

Statistical analyses were carried out using the PQStat software package (version 1.8.4.152). Fisher's exact test was used in the analysis of qualitative scale scores within the compared groups. Quantitative scale scores were compared between the study groups using the Kruskal-Wallis test and the post-hoc Dunn's test with the Bonferroni correction. Mann-Whitney's U-test was used in the analysis of hospital stay times. For  $k=2$ , the quality of life within the compared groups was analyzed using the Man-Whitney's U-test, whereas the Kruskal-Wallis test and the post-hoc Dunn's test with the Bonferroni correction as well as the Jonckheere's trend test were used for  $k > 2$ . A probability value of  $p < 0.05$  was used as the significance level and  $p < 0.01$  was used as the high significance level.

## Results

The study sample was characterized in terms of demographic variables, i.e.:

- age,
- weight,
- height,
- BMI,
- educational background,
- area of residence,
- employment status,
- number of children,
- marital status,
- sociodemographic status,
- gender.

Statistical analysis revealed no statistically significant differences ( $p > 0.05$ ) between the study groups with respect to all the demographic variables with the exception of gender, height, and area residence.

The distribution of the area of residence was significantly related to the study group ( $p = 0.2526$ ). Urban residents accounted for 66.67% of the RN group as compared to 94.12% in the NSS group and 95.83% in the control group. Height was significantly higher in patients with complete resection than in the control group ( $p < 0.01$ ). Gender distribution was also significantly dependent on the study group ( $p < 0.01$ ), with female patients accounting for 22.22%, 52.94%, and 87.5% of subjects within the RAN, NSS, and control groups, respectively. Detailed results are presented in tables I and II.

The study sample was also characterized using selected clinical data, such as the laterality of the surgery, postoperative complications, cancer stage, type of surgery, body weight, height, BMI, and hospital stay duration. Statistically significant differences ( $p < 0.05$ ) were observed between the groups in relation to cancer stage and type of surgery.

A significant difference ( $p = 0.0334$ ) was noted between the study groups in relation to cancer stage. In the NSS group, stage I cancer accounted for 88.24% of cases whereas stage II cancer accounted for the remaining 11.76% of cases. In the RN group, stage I cancer accounted for 48.15% of cases, stage II cancer for 18.50%, stage III for 18.52%, and stage V cancer for 14.81% of cases.

A significant difference ( $p = 0.0298$ ) was also noted between the study groups in relation to the type of surgical approach. In the NSS group, laparoscopic surgery was performed in 82.35% of patients as compared to 48.15% of patients in the RN group (tab. III, IV).

Next, the quality of life of patients within the study groups was assessed using the WHOQOL-BREF questionnaire. Detailed results on the overall global quality of life, self-assessed health status, and scores within the somatic, emotional, social and environmental domains are presented in figure 2. No statistically significant differences ( $p > 0.05$ ) were observed in the statistical analysis in relation to the type of surgery performed, i.e. NR vs. NSS.

In the next stage, the impact of demographic and clinical variables on the quality of life was analyzed within all domains of the BREF questionnaire. Patients' gender was the only demographic variable responsible for significant differences as observed in RN vs. NSS groups in the QoL scores within the somatic ( $p = 0.0023$ ), environmental ( $p = 0.0189$ ) and emotional ( $p = 0.0356$ ) scale domains. Lower results, and thus worse self-assessed quality, were reported in these domains by female subjects. With regard to clinical variables, the clinical stage of cancer had a highly significant ( $p = 0.0025$ ) impact on the differences in the overall health scores as reported by study groups; the differences followed a highly significant inverse trend, i.e. the higher was the stage of the disease, the lower were the health scores. In addition, significant differences were observed within the social ( $p = 0.0453$ ) and the environmental ( $p = 0.0156$ ) domains depending on the surgical approach: laparoscopic vs. open surgery. Better scores translating to better quality of life were significantly correlated with the laparoscopic method. Detailed results are presented in figures 3 and 4.

## **Discussion**

The present study assesses health-related quality of life among patients operated on for renal cell carcinoma at 3–5 years after surgery. The effect of the clinical and demographic variables on the subjective health-related quality of life (HRQoL) scores was also analyzed. Included in this cross-sectional study were patients having undergone complete renal resection (NR) and partial renal resection (NSS). An age-matched group of healthy controls was also included. The study tools included the standardized WHOQOL-BREF questionnaire as well as a proprietary form to evaluate socioeconomic variables. Clinical data as extracted from the medical documentation of patients were also included in statistical analysis.

Many authors have pointed out the need for appropriate studies assessing the quality of life in patients with the diagnosis of renal cell carcinoma who had been subjected to various therapeutic options [9–11]. Our study revealed no statistically significant differences within the environmental,

emotional, social and physical dimensions of the health-related quality of life, as well as the overall subjective health and quality of life assessments among patients subjected to total and partial renal resection, which is in line with the results previously obtained by other authors [8, 12]. The purpose of NSS was to preserve kidney function, and it is this preservation rather than the mere difference in the surgical option (RN vs. NSS) that had been pointed out by other authors as a factor with significant impact on HRQoL scores [12]. On the other hand, other studies had provided evidence of the somatic symptoms, such as i.e. fatigue, insomnia and pain, being less severe, and the scores within the physical domain being higher in patients after NSS [8, 10], including as late as 4 years after the procedure [13]. The perioperative and distant benefits of NSS were also confirmed by the results of a systematic review by MacLennan et al. who highlighted the impact of “non-oncological” QoL-related outcomes on patients satisfaction with medical care received [14].

Maximization of the health-related quality of life in patients undergoing treatment for renal cell carcinoma is possible owing to our understanding of factors which closely intervene in the process. The increased awareness of the determinants of poor HRQoL may facilitate customized support being provided to high-risk patients [8, 14]. In our study, the impact of clinical and demographic variables on the distant quality of life was assessed. Minimally invasive surgical techniques were shown to open up the potential for the achievement of better quality of life within the social and environmental domains. Other authors had shown that laparoscopic surgery was associated with significantly less pain in the early postoperative period as well as faster (42 vs. 62 days) return to daily activities as compared to the open method ( $p = 0.04$ ). This difference was not observed several months after the procedure [15]. In addition to the physical component, the positive impact of laparoscopy vs. open method was demonstrated in relation to subjective emotional health assessments [16]. The beneficial effect of laparoscopy on the multifaceted HRQoL self-assessment was also confirmed by other studies which had proven that the technique was associated with shorter hospitalization times, lower blood loss, and faster recovery. However, no statistically significant relationships were observed with regard to the incidence of postoperative complications, pain levels, and physical functioning [17]. The perioperative and distant benefits of minimally invasive surgical techniques were also demonstrated in a meta-analysis of 37 studies as published in 2017 [18]. MacLennan et al. confirmed that laparoscopy was associated with better perioperative outcomes while no evidence could be provided for any difference between the retroperitoneal and transperitoneal access [14].

According to Rossi et al., in patients undergoing surgical treatment for renal cell carcinoma, clinical variables such as tumor size, clinical stage, age, BMI, occupational status, education level, and



comorbidities are the determinants of health-related quality of life [8]. In our study, similar results were obtained, revealing that in addition to the open vs laparoscopic method, the clinical stage of cancer at the time of surgery had also a significant impact on the long-term quality of life assessment. A statistically significant relationship between the higher stages of cancer and lower self-assessed overall health scores was confirmed despite the lack of distant metastases or the recurrence of the disease.

Another aspect of the statistical analysis consisted in the determination of the relationship between demographic variables and the assessment of the quality of life within all dimensions of the BREF questionnaire. There was a statistically significant relationship between reduced health-related quality of life within the somatic, emotional, and environmental scales and the female gender. Quderi et al. also demonstrated a significant relationship between the female gender and the lower HRQoL scores in the course of oncological treatment [19]. The conclusions of the 2020 study carried out by Beisland indicate that demographic and psychological variables, including personality traits and educational background, may be predictive of the quality of life scores whereas factors related to cancer itself appear to be of secondary importance [11]. Other studies also confirm the impact of demographic and clinical variables on the quality of life of patients undergoing cancer treatment regardless of the location and stage of cancer [20, 21]. Prehabilitation also seems to be an important issue in oncological surgery, which not only aims to improve physical condition through rehabilitation and nutritional support, but also focuses on the psychological aspects of the recovery process. This is of considerable importance in the self-assessment of health-related quality of life. [22, 23].

The strengths of our research consist in the use of a standardized, international research tool and in a thorough analysis of the medical documentation of patients and a fact, that all patients was operated in single, specialized center. In addition, few studies on the long-term outcomes of renal cell carcinoma are available in the literature. However, despite the unquestionable epistemic value, the study has been fraught with some limitations. Firstly, these include the retrospective character of the study, making it impossible to establish the baseline quality of life levels for re-measurement and comparison after the surgery in a pretest-posttest design. Notably, the available literature on this subject is also mainly retrospective, and includes studies conducted in small, heterogeneous samples. Secondly, this was a pilot study in which the size of the sample had not been established so as to achieve good external validity. Inclusion of other centers and a design including prospective measurements of a single variable at different stages of cancer treatment would be helpful in order to be able to generalize the results to the entire population of patients with renal cell carcinoma.

## Conclusions

1. The type of procedure, namely NR vs. NSS, is not a factor differentiating the subjective health-related quality of life assessments.
2. However, even after all this time laparoscopic surgery is associated with an opportunity to achieve better quality of life scores, particularly within the social and environmental aspects 3 to 5 years after operation.
3. The analysis of correlations with clinical data 3 to 5 years after surgical treatment revealed a significant relationship between the stage of cancer and the subjective assessment of the quality of life within the overall health domain. The higher the cancer stage, the worse the subjective sense of physical well-being.
4. Demographic variables affect the long-term QoL results. A statistically significant impact on reduced health-related quality of life within the somatic, emotional, and environmental scales was demonstrated for the female gender.

**Conflict of interest:** none declared

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**Figure 1.** Scheme describing the exclusion of patients from the study

259 259 pts receiving treatment at the Department of Urology of the Dr. Jan Biziel University Hospital No. 2 in Bydgoszcz in years 2016–2018

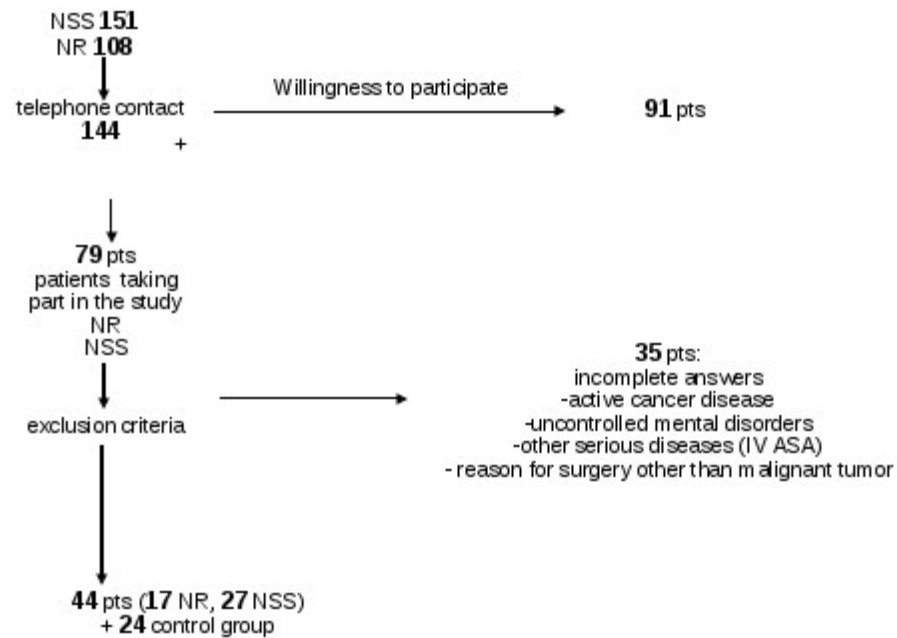
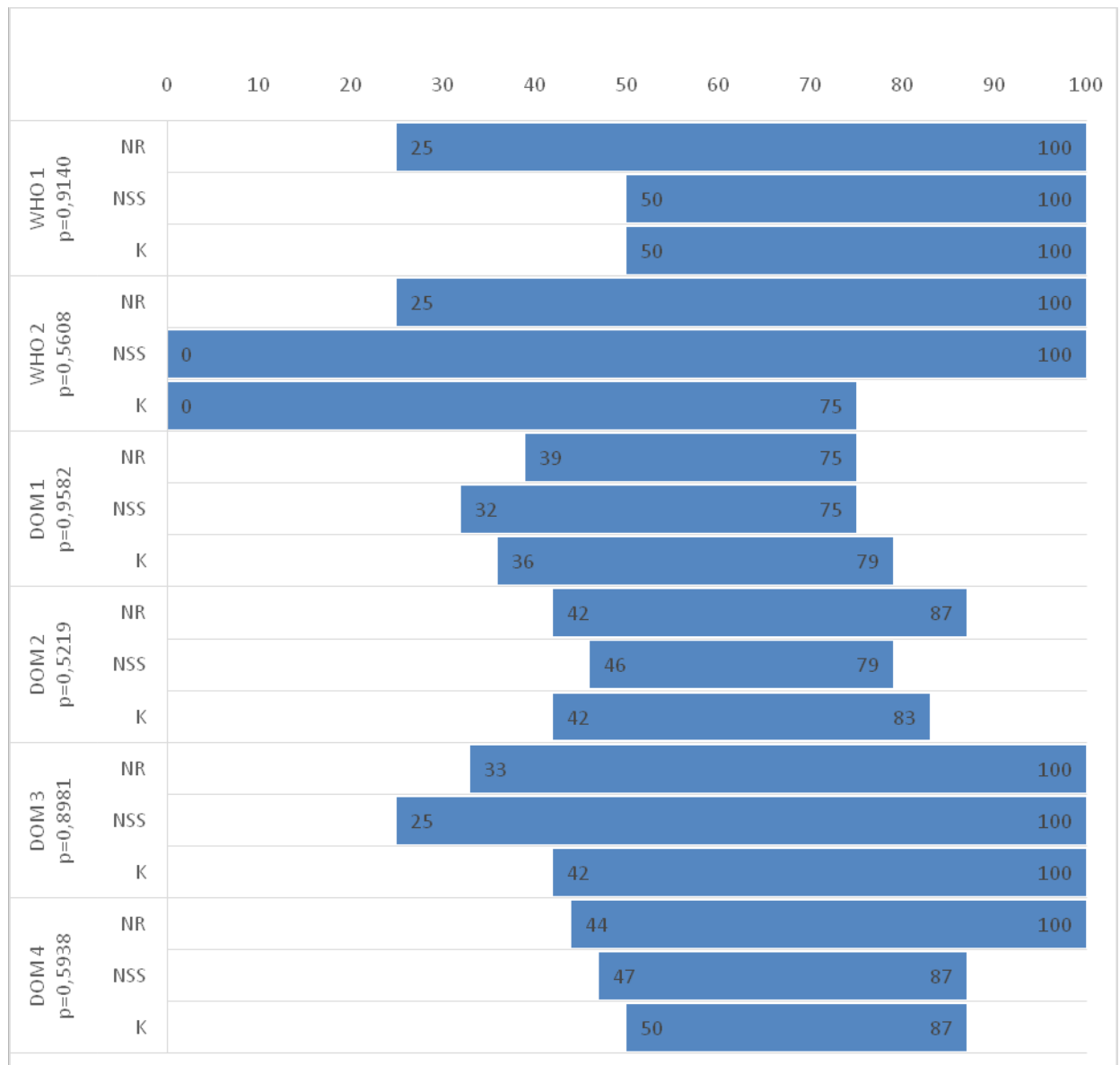
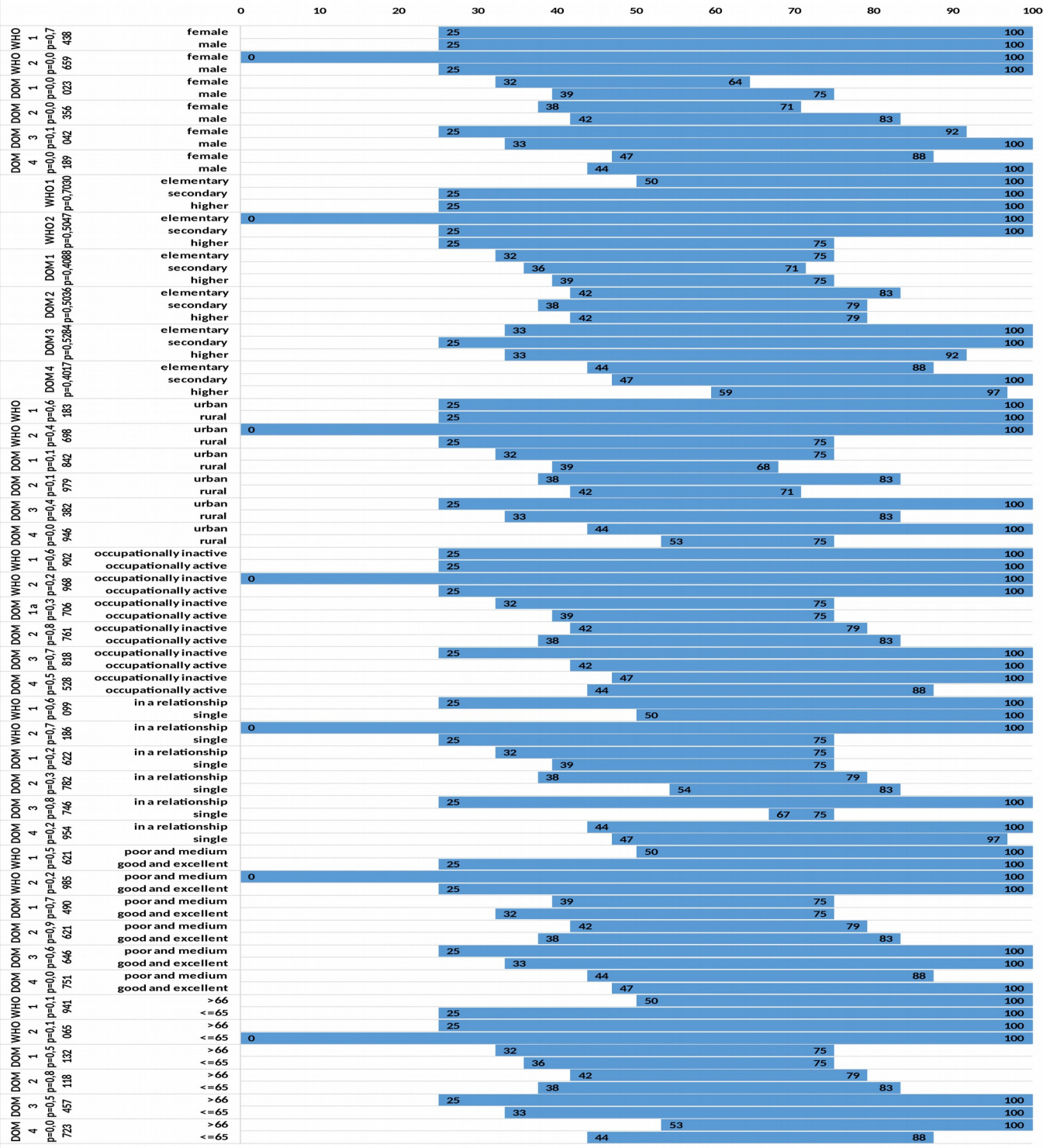


Figure 2. Quality of life in the compared treatment groups as based on the WHOQOL-BREF scores



WHO 1- Overall quality of life score; WHO 2 - Overall health score; DOM 1 - somatic domain; DOM 2 - emotional domain; DOM 3 - social domain; DOM 4 - environmental domain; NSS - nephron-sparing surgery; NR - radical nephrectomy; K - control group; p - statistical significance

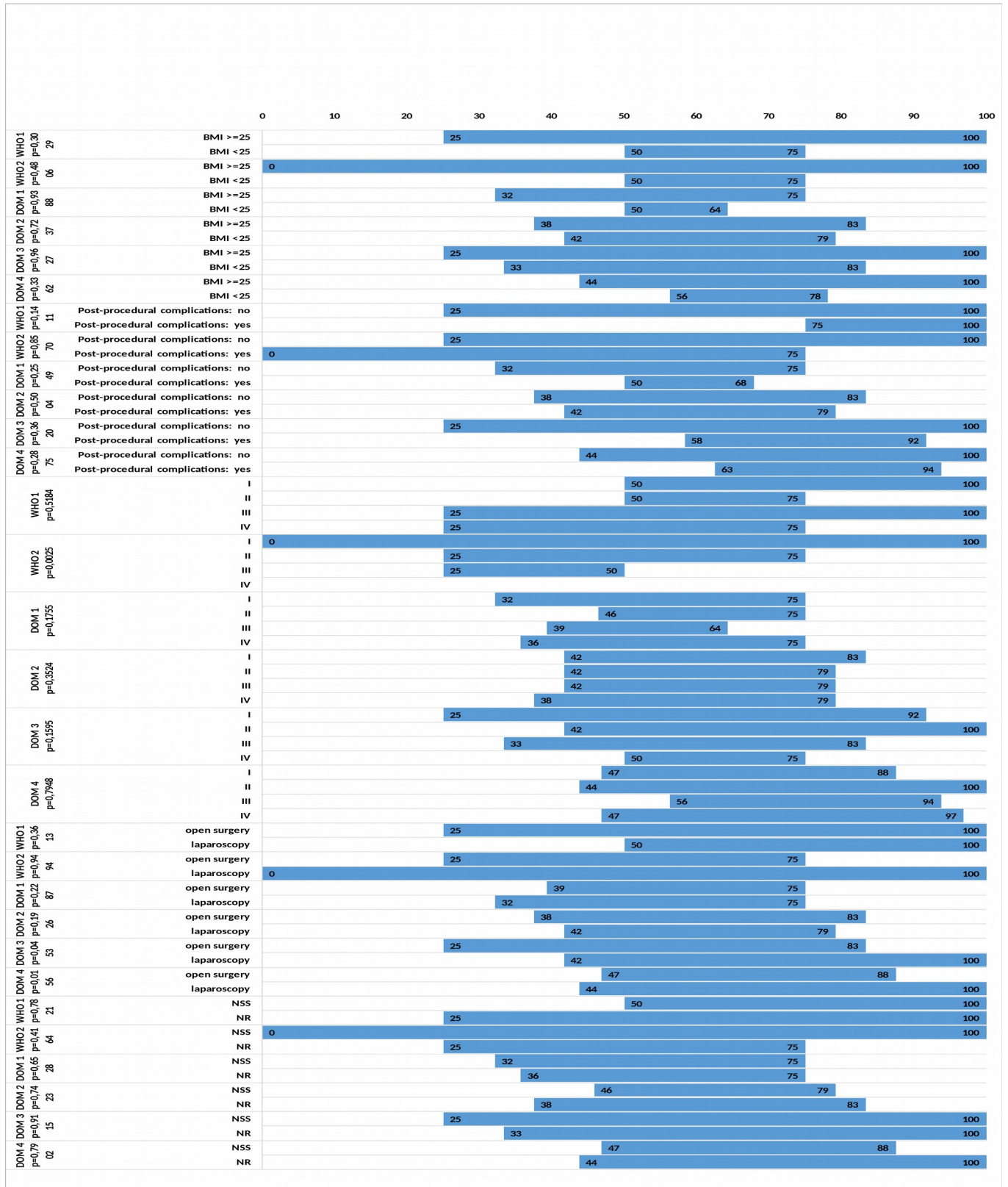
**Figure 3.** The impact of demographic variables on the quality of life within the compared groups





WHO 1- Overall quality of life score; WHO 2 - Overall health score; DOM 1 - somatic domain; DOM 2 - emotional domain; DOM 3 - social domain; DOM 4 - environmental domain; p - statistical significance

**Figure 4.** The impact of clinical variables on the quality of life within the compared groups



WHO 1- Overall quality of life score; WHO 2 - Overall health score; DOM 1 - somatic domain; DOM 2 - emotional domain; DOM 3 - social domain; DOM 4 - environmental domain; p - statistical significance

**Table I.** Age and body build within the compared groups

		Age			Body weight			Height			BMI		
		RN	NSS	K	RN	NSS	K	RN	NSS	K	RN	NSS	K
M		66.0	60.3	66.5	84.4	81.4	74.9	169.0	165.3	163.8	29.5	29.9	28.0
Me		67	66	68	83	78	76.5	170	163	160	29.4	29.9	27.0
SD		9.5	14.2	7.3	18.9	11.0	11.5	6.2	9.05	7.2	6.2	4.2	4.8
Kruskal-Wallis test	df	2			2			2			2		
	H	1.1248			3.429			9.6665			1.768		
	p	0.5698			0.1801			0.008			0.4131		
POST-HOC Dunn-Bonferroni	RN		1	1		1	0.227 2		0.089 7	0.009 9		1	1
	NSS	1		0.933	1		0.585 6	0.089 7		1	1		0.552 1
	K	1	0.933		0.227 2	0.585 6		0.009 9	1		1	0.552 1	
homogeneous groups		a	a	a	a	a	a	b	ab	a	a	a	a

M - arithmetic mean; Me - median; SD - standard deviation; RN - radical nephrectomy; NSS - nephron-sparing surgery; K - control group; p - statistical significance

**Table II.** Sociodemographic characteristics of the compared treatment groups

	Group	Fisher's exact
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		RN		NSS		K		test
		N	%	N	%	N	%	
educational background	vocational	6	35.29%	7	25.93%	2	8.33%	p = 0.3381
	higher	4	23.53%	7	25.93%	8	33.33%	
	secondary	7	41.18%	12	44.44%	14	58.33%	
	elementary	0	0%	1	3.7%	0	0%	
area of residence	rural	9	33.33%	1	5.88%	1	4.17%	p = 0.0117
	urban	18	66.67%	16	94.12%	23	95.83%	
employment status	own business	1	3.7%	0	0%	1	4.17%	p = 0.2526
	regular job	6	22.22%	6	35.29%	2	8.33%	
	disability pension	1	3.7%	1	5.88%	0	0%	
	retirement	19	70.37%	10	58.82%	20	83.33%	
	unemployed	0	0%	0	0%	1	4.17%	
number of children	4	2	7.41%	0	0%	0	0%	p = 0.6423
	3	5	18.52%	2	11.76%	2	8.33%	
	2	14	51.85%	7	41.18%	13	54.17%	
	1	4	14.81%	5	29.41%	7	29.17%	
	0	2	7.41%	3	17.65%	2	8.33%	
marital status	single	4	14.81%	2	11.76%	7	29.17%	p = 0.3587
	in a relationship	23	85.19%	15	88.24%	17	70.83%	
socioeconomic	poor	0	0%	1	5.88%	1	4.17%	p = 0.1395

status	medium	9	33.33%	11	64.71%	10	41.67%	
	good	17	62.96%	4	23.53%	11	45.83%	
	excellent	1	3.7%	1	5.88%	2	8.33%	
gender	male	21	77.78%	8	47.06%	3	12.5%	p< 0.0001
	female	6	22.22%	9	52.94%	21	87.5%	

RN - radical nephrectomy; NSS - nephron-sparing surgery; K - control group; p - statistical significance

**Table III.** Clinical data recorded within the compared treatment groups

		Group				Fisher's exact test
		RN		NSS		
		N	%	N	%	
laterality	bilateral	0	0%	2	11.76%	p = 0.0605
	right-sided	14	51.85%	4	23.53%	
	left-sided	13	48.15%	11	64.71%	
post-procedural complications	yes	3	11.11%	3	17.65%	p = 0.6619
	no	24	88.89%	14	82.35%	
stage	IV	4	14.81%	0	0%	p = 0.0334
	III	5	18.52%	0	0%	
	II	5	18.52%	2	11.76%	
	I	13	48.15%	15	88.24%	
surgical approach	open	14	51.85%	3	17.65%	p = 0.0298

	laparoscopic	13	48.15%	14	82.35%	
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RN - radical nephrectomy; NSS - nephron-sparing surgery; p - statistical significance

**Table IV.** Duration of hospital stays in the compared treatment groups

		Group		
		RN	NSS	K
M		7.963	9.3529	-
Me		7	8	-
SD		3.4248	3.8881	-
Mann-Whitney's U test	Z	1.1281		
	p	0.2593		

M - arithmetic mean; Me - median; SD - standard deviation; RN - radical nephrectomy; NSS - nephron-sparing surgery; K - control group; p - statistical significance; Z - Z-statistic