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The usage of scale in grading of patients with brain tumors in neurological nurse practice – preliminary report*

Wykorzystanie skal w ocenie chorych z guzem mózgu w praktyce neuropielęgniarskiej – doniesienia wstępne

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A – Study Design, B – Data Collection, C – Statistical Analysis, D – Data Interpretation, E – Manuscript Preparation, F – Literature Search, G – Funds Collection

Summary Background. Brain tumors influence everyday functionality of people diagnosed with them. Progressing tissue proliferation process and applied therapies are also detrimental in this case. The ability to use clinometric make this possible to assess the clinical state and functionality of a patient at every phase.

Objectives. The aim of this work was to check the capacity of patients after the surgery, checking correlations between scores in used scales and whether capacities are influenced by gender or age.

Material and methods. Examined population comprised 251 surgically treated patients with brain tumors in the 10 Wojskowy Szpital Kliniczny with Poliklinika SP ZOZ. Assessment was made using two scales: Karnofsky Scale (KPS) – on the day of admission to the hospital and one day before release; and Glasgow Outcome Scale (GOS) – one day before release.

Results. Functionality capacity after the surgery according to KPS reached the average of 78.6, however in GOS scale 4.21. Average difference was important ($p < 0.0001$). Pearson's correlation factor, which assesses the correlation between KPS and GOS amounted to 0.729 ($p < 0.05000$). Correlation between capacity and age amounted to -0.20 whereas final results and age -0.26 ($p < 0.05000$).

Conclusions. 1. Capacity of patients following the surgery after the release became worse in comparison to the examination before surgery. 2. There was a strong correlation between capacity determined by KPS and GOS five days after operation. 3. Gender has no influence on the capacity of patients, on the final results, however the age does.

Keys words: brain tumor, functional capacity, scale.

Streszczenie Wstęp. Guzy mózgu wpływają na codzienne funkcjonowanie ludzi, u których zostały zdiagnozowane. Postępujący proces rozrostowy oraz zastosowane leczenie jest również nieobojętne w tej kwestii. Możliwość korzystania z klinimetrii pozwala ocenić stan kliniczny chorego oraz funkcjonalność na każdym jego etapie.

Cel pracy. Sprawdzenie wydolności u pacjentów po zabiegu operacyjnym, sprawdzenie istnienia zależności korelacyjnej między ocenami w zastosowanych skalach oraz czy wyniki wydolności zależą od płci i wieku.

Materiał i metoda. Populację badawczą stanowiło 251 pacjentów leczonych operacyjnie z powodu guza mózgu w 10. Wojskowym Szpitalu Klinicznym z Polikliniką SP ZOZ. Oceny dokonano za pomocą dwóch skal: Skali Karnofsky'ego (KPS) – w dniu przyjęcia i w przeddzień wypisu, oraz skali Glasgow Wyników Końcowych (GOS) – w przeddzień wypisu.

Wyniki. Wydolność funkcjonalna po zabiegu operacyjnym według KPS osiągnęła średnią 78,6, natomiast ocena według GOS – 4,21. Średnia różnica okazała się istotna statystycznie ($p < 0,0001$). Współczynnik korelacji Pearsona, badający zależność między KPS i GOS, wyniósł 0,729 ($p < 0,05000$). Zależność między wydolnością a wiekiem wyniosła -0,20, natomiast wyników końcowych a wieku wyniosła -0,26 ($p < 0,05000$).

Wnioski. 1. Wydolność u pacjentów po zabiegu operacyjnym, tuż przed wypisem ze szpitala, uległa obniżeniu w porównaniu z badaniem z okresu przedoperacyjnego. 2. Wykazano silną zależność korelacyjną między wydolnością określoną w skali KPS a GOS po 5 dniach po operacji. 3. Płeć nie miała wpływu na wydolność u chorych, jak również na wyniki końcowe, natomiast wraz z wiekiem ulega obniżeniu wydolność w funkcjonowaniu oraz obniżają się wyniki końcowe.

Słowa kluczowe: guz mózgu, wydolność funkcjonalna, skala.

Background

Brain tumors, according to data published in 2006 for population of Poland, amounted to 6.6/100 thousand for women and 7.9/100 thousand men who became sick with tumors [1–3]. Also, it is important to note that this rate rise according to age, so people about the age of 55 became sick 20/100 thousand a year [1]. The most common endocranial tumors are gliomas (around 60%), meningiomas (from 13–19%) and metastasis tumors (30–35%) [1].

Brain tumors develop insidiously during weeks or years, they are influenced by the degree of malignancy of a given process [4]. Symptoms of this changes may be general and caused by high endocrinal pressure, like also FD connected with placement of a tumor. Among FD symptoms occur wastage (paresis, feeling, vision and speech disorders etc.) and vexation symptoms (partial-onset seizures) [1]. These disorders always influence the functionality and quality of patient's life.

It is important to note that the danger of impairment of functionality happens as a result of proliferation of a tumor, but also as a result of applied treatment (operational, supplemental).

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Patients with neurological deficit especially advanced one always require help and support of the family or hospital personnel. Therapeutically trained team comprising nurses and other people has the opportunity to assess those patients with the use of a number scales (clinical, functional, quality of life). Assessment may also influence, among others, the planning of medical care, dealing with complications, education of patients and their caretakers.

Objectives

The aim of the work was to gain answers for the given questions: 1. What is the capacity of patients after the surgery of brain tumor? 2. Is there any correlation between used scales? 3. Do the results of scale correlate with the chosen demographic factors (age and gender)?

Material and methods

Examinations were carried out on a group of surgically treated 251 patients with brain tumors in 10 Wojskowy Szpital Kliniczny with Poliklinika SP ZOZ in Bydgoszcz. This population comprised 133 women and 118 men aged from 16 to 89 (average age is 46.8 ± 15.2). Average age among women was 49.4 years (± 15.1) and among men 43.9 years (± 14.8).

To assess the patients 2 scales were used: Karnofsky Scale (*Karnofsky Performance Scale* – KPS) [5–7] and Glasgow Scale (*Glasgow Outcome Scale* – GOS) [7, 8]. Patients were assessed with Karnofsky Scale twice: at the day of admission to the clinic and one day before the release while patients were assessed with the other scale one day before the release.

Statistical methods

In the work the authors used parametrical and non-parametrical tests of importance, which helped them to verify hypotheses.

To discover correlations between examined features the factors of Pearson's linear correlation were calculated, and also taking into consideration, in some instances, the lack of normality of distribution, factors of Spearman's ordinal correlation.

In the work the authors used the following statistical tests:

1. Non-parametrical Shapiro-Wilk's test to verify ordinal hypotheses in distribution of examined factors. In instances where value of W – statistics are lower than critical value of W_{kr} (respectively $p < 0.05$) means that distribution of examined factors was significantly different then ordinal distribution.
2. Parametrical z-test according to ordinal distribution comparing the value of average in 2 groups of sufficiently big numerical strength (> 50).
3. Parametrical t -Student test for dependency tests.

As a reliable level of importance to verify hypotheses the authors used $p = 0.05$, for which given values are critical. They also used the p -value values. It is the probability with which they can make a mistake by discarding proved hypothesis. With $p < 0.05$ the difference or correlation is recognized as statistically important, in other instances it is not important.

Results

Capacity of treated patients

Examinations performed by the KPS scale in a given population, in the pre-operational phase reached the average

of 85.9 (minimal note 30, maximal note 100). After the surgery in correlation to the first grading the average dropped to 76.6 (minimal note 20, maximal note 100) (Tab. 1).

Table 1. Capacity according to KPS Scale before and after the surgery

Descriptive statistics	Capacity according to Karnofsky scale		
	Before the surgery	5 days after the surgery	Difference (before-after)
N	251	251	251
Min	30	20	-70
Max	100	100	30
Average	85.9	78.8	-7.09
SD	13.0	18.6	15.6

To compare the average levels of capacity in KPS scale used t -Student test for dependency tests. The average difference in changes (lower capacity) in phase "operation 5-days" was 7.09 and it is important ($p < 0.00001$) (Tab. 2).

Table 2. Comparison between the capacities after and before the surgery according to KPS scale

Variable	T-test for dependency test Marked differences are significant for $p < 0.05000$							
	Average	Standard deviation	Population	Difference	Standard deviation difference	t	df	p
Capacity before the surgery	85.9	13.0						
Capacity after five days	78.8	18.6	251	7.09	15.6	7.21	250	0.0000

After the operation one day before the release from clinic to home the authors performed the assessment of clinical state by the use of GOS scale and an average note was 4.21, with the minimal notes of 2, and maximal 5 (Tab. 3).

Table 3. Results of the treatment according to GOS scale

Descriptive statistics	GOS scale final results
	5 days after surgery
N	251
Min	2
Max	5
Average	4.21
SD	0.70

Correlation between KPS and GOS assessments after the operation

Correlation between KPS and GOS assessment five days after the operation are presented on the Figure 1. Calculated factor of Pearson's correlation was 0.729 and it is important (Tab. 4). It tells about the strong positive correlation between capacity and GOS after five days.

Using Shapiro-Wilk test the authors concluded that the capacity distribution and final results of GOS are signifi-

cantly different than normal distribution (Figures 2 and 3). In accordance to this the authors calculated the Spearman's ranking correlation factor, value of which was close to Pearson's factor of 0.795 (Tab. 5).

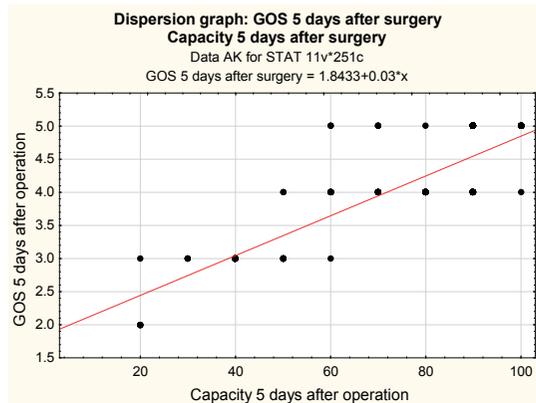


Figure 1. Between capacity in KPS scale and final results in GOS scale 5 days after the surgery

Variable	Spearman's rank correlation order BD deleted in pairs Correlation between significant marked factors with $p < 0.05000$	
	Capacity 5 days after surgery	GOS results 5 days after surgery
Capacity 5 days after surgery	1.000	0.726
GOS results 5 days after surgery	0.726	1.000

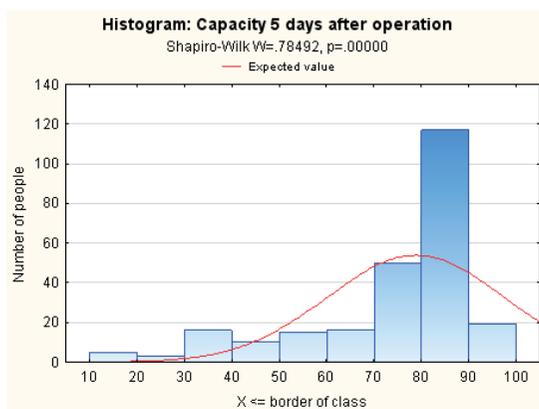


Figure 2. Distribution of capacity according to KPS

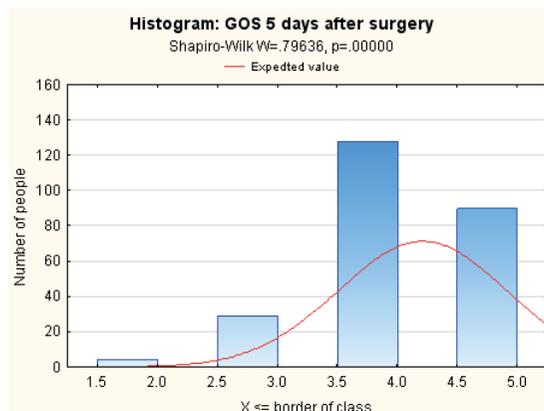


Figure 3. Distribution of final results according to GOS scale

Variable	Correlations Correlation between significant marked factors with $p < 0.05000$ N = 251			
	Average	Standard deviation	GOS results 5 days after surgery	Capacity 5 days after surgery
GOS results 5 days after surgery	4.21	0.70	1.000	0.795
Capacity 5 days after surgery	78.8	18.6	0.795	1.000

Capacity of the patients and the final results vs. chosen demographic factors

Correlation between KPS capacity results and gender

Average rate, with minimal value of 20 and maximal of 100, for women, according to KPS scale was 77.7 whereas for men 80.1. To compare average capacity values in groups of men and women the authors used z-test in accordance to normal distribution (Tab. 6). The analysis did not show any significant differences between populations of men and women.

	Parameters	Compared sub-groups	
		Women	Men
	Capacity according to Karnofsky scale	N	133
	Min	20	20
	Max	100	100
	Median	90	90
	Average	77.7	80.1
	SD	19.1	18.0
Test z ($z_{kr} = 1.96$)	z	1.03	
	p	0.30 (ns)	

Correlation between KPS capacity results and age

Correlation diagram presented on the Figure 4 shows capacity changes in accordance to age in KPS scale.

Discovered little, significant, negative correlation between capacity and the age of patients – the factor of Pearson's linear correlation – was -0.20. It means that the capacity of patients lowers according to age (Tab. 7).

Variable	Correlations Correlation between significant marked factors with $p < 0.05000$ N = 251			
	Average	Standard deviation	Capacity 5 days after surgery	Age
Capacity 5 days after surgery	78,8	18.6	1.00	-0.20
Age	46.8	15.2	-0.20	1.00

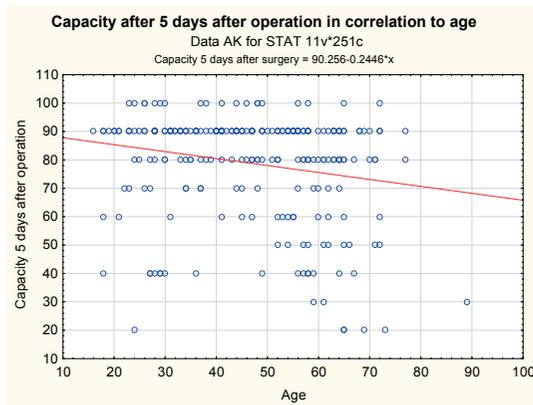


Figure 4. Correlation analysis of capacity in KPS scale and age

It proves that the above mentioned negative result of Spearman correlation is very close to Pearson's factor and it amounts to -0.22 (Tab. 8).

Table 8. Correlation between age and capacity

Variable	Spearman's rank correlation order BD deleted in pairs Correlation between significant marked factors with $p < 0.05000$	
	Age	Capacity 5 days after surgery
Age	1.00	-0.22
Capacity 5 days after surgery	-0.22	1.00

Correlation between final result of GOS scale and gender

Table 9 includes basic parameters of final results in groups of men and women. In women population the average assessment in GOS scale amount to 4.17 while in men population 4.25 when the minimal notes for both groups amount to 2, and maximal to 5.

Z-test, applied because of high numbers, didn't show any significant differences between the final results and groups of men an women.

Table 9. GOS vs. gender

	Parameters	Compared sub-groups	
		Women	Men
	Final results according to GOS scale	N	133
Min		2	2
Max		5	5
Median		4.0	4.0
Average		4.17	4.25
SD		0.71	0.69
Test z ($z_{kr} = 1.96$)	z	0.91	
	p	0.36 (ns)	

Correlation between final result of GOS scale and age

Figure 5 shows diagram which illustrates correlation between the age and GOS scale. Pearson's correlation factor is small and negative (-0.26), but significant ($p < 0.0500$) (Tab. 10). It means that final results of GOS generally decrease with age.

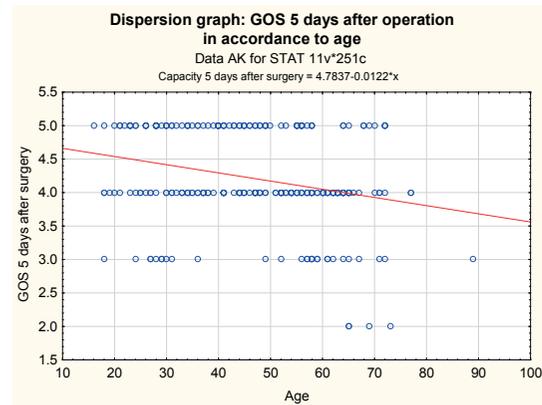


Figure 5. Correlation between age and GOS

Table 10. Correlation between final results according to GOS and age

Variable	Correlations Correlation between significant marked factors with $p < 0.05000$ N = 251			
	Average	Standard devia- tion	GOS results 5 days after surgery	Age
GOS results 5 days after surgery	4.21	0.70	1.00	-0.26
Age	46.82	15.21	-0.26	1.00

As the GOS distribution is distinctly different from normal distribution, the authors also calculated the factor of Spearman's rank correlation, which has the same numeral value as Pearson's (Tab. 11).

Tabela 11. Correlation between final results according to GOS and age

Variable	Spearman's rank correlation order BD deleted in pairs Correlation between significant marked factors with $p < 0.05000$	
	GOS results 5 days after surgery	Age
GOS results 5 days after surgery	1.00	-0.26
Age	-0.26	1.00

Discussion

Publications concerning brain tumors usually present results in Glasgow Outcome Scale or Karnofsky Scale [10, 12, 13].

Karnofsky Scale determines physical, but not psychological or emotional, condition of a patient and is represented by numbers. That scale can be graded by any number between 0 and 100, and the higher the number the better the life of a patient can be [9]. GOS Scale, however, represents the results of applied treatment. It is a tool whose score can only be represented by numbers from 1 to 5 and the higher the value the better results were achieved in a treatment.

In above mentioned examinations it can be seen that during pre-operational phase the average score in KPS was around 86, however five days after surgery it decreased to eighty. Nonetheless it is not a very drastic change of patients' capacity after the treatment; the members of population studied are still independent, however some symptoms of this disease may be visible which was confirmed by the GOS scale outcome that was on average 4.20.

Surgery is the most basic and also the first method of treating brain tumors. The aim of the treatment is to, among others, neutralize a tumor. Constant development in neurosurgical technology makes it possible for neurosurgery to be performed in a less dangerous way [1, 4, 11–13].

The scales, which were used, inform us about the functional state of patients with surgically treated brain tumors. In examinations performed by the authors, statistical analysis showed close positive correlation between patients capacity (KPS) and final results (GOS) in after-operational phase. It can be explained by the similarity in construction and intended use of the tools.

In the present examinations the functional capacity of the patients and their final results were influenced by age – the older the patients the lower their functionality. Also, it is confirmed by examinations performed by Ślusarz. He showed that the examination results of patients under the age of 20 were a lot higher in functional capacity as well as GOS scale than the results of patients above the age of

60 [10]. One should note that the rate of tumors of people above the age of 55 have risen to 20/100 thousand a year [1]. Additionally, the highest rate of malignant tumors (anaplastic astrocytoma, glioblastoma multiforme) fall on the fifth and sixth decade of life [14]. Also, brain metastases fall on the fifth and sixth decade of life [13].

Conclusions

1. When the patient population was about to be released from the hospital their capacity decreased in comparison to the examination in pre-operational phase.
2. The authors found a strong correlation between capacities of KPS and GOS scales 5 days after the operation.
3. Gender has no influence on the patients capacity as well as final results. Age, however, decreases the capacity in life and final results.

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