MoCA test and general anesthesia for a two different surgical techniques

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ABSTRACT:

Introduction Postoperative cognitive dysfunction (POCD) is defined as a new cognitive impairment shown after operation. Many factors may contribute to POCD and has potentially two different patterns: acute cognitive dysfunction, known as postoperative delirium and a later onset and more persistent POCD. The reported incidence vary depending on the group of patients studied, the test used, the time of testing and the choice of control group. POCD can only be diagnosed and measured using tests both pre- and postoperative. In our research we use Montreal Cognitive Assessment (MoCA) test. It is a widely used screening assessment for detecting cognitive impairment. **Materials and Methods** The prospective study included 30 patients who were treated at the University Hospital Centre Zagreb. They were anaesthetized for radical prostatectomy using the TIVA technique and divided into two groups: 19 patients who underwent classical surgery and 11 patients who underwent laparoscopic surgery. The MoCA test was analysed pre-operatively and 48 hours after surgery. Parametric tests were not used due to deviations of individual distributions from normal, as determined by Shapiro-Wilk tests (p <, 05) and due to the small number of participants. Precise p-values were calculated, except for the Spearman correlation coefficient, which does not use them. Two-way tests and an alpha value of 5% were used. **Results** Patients who underwent laparoscopic prostatectomy did not have statistically significantly different MoCA test results before surgery than those who underwent classical prostatectomy (U = 59.9, z = 1.96, p = .052). After the operation, patients undergoing laparoscopic prostatectomy achieved statistically significantly higher results (U = 46.0, z = 2.54, p = .011), with a moderate effect (r = .463). The results of the MoCA test were statistically significantly higher after surgery than before surgery (W = 346.5, z = -3.81, p <.001; not in the table), with a strong effect size (r = .696). The amount of improvement in MoCA test results was not statistically significantly different for laparoscopic and classical prostatectomy (U = 78.0, z = 1.16, p = .268). **Conclusion** Postoperative values of the MoCA test are higher than the preoperative in both groups- laparoscopic and classical prostatectomy. The results of the research can be explained by the fact that anxiety and concern about the upcoming operation affect the results of the examination pre-operatively. Other observed parameters did not affect the MoCA test results.

Keywords: MoCA test, anaesthesia, POCD

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Sažetak:

MoCA test i opća anestezija kod dviju kirurških tehnika

Uvod Postoperativna kognitivna disfunkcija (POCD) definira se kao novokognitivno oštećenje uočeno nakon operacije. Mnogi čimbenici mogu doprinijeti POCD-u,te ima potencijalno dva različita obrasca: akutnu kognitivnu disfunkciju, poznatu kao postoperativni delirij i kognitivne promjene dužeg trajanja, poznate kao POCD . Incidencija varira ovisno o ispitivanoj skupini bolesnika, korištenom testu, vremenu testiranja i izboru kontrolne skupine. POCD se može dijagnosticirati i mjeriti samo pomoću testova učinjenih prije i poslije operativnog zahvata. U našem istraživanju koristimo Montreal Cognitive Assessment (MoCA) test. To je široko korišten test za otkrivanje blagih kognitivnih oštećenja.

Materijali i metode U prospektivno istraživanje uključeno je 30 pacijenata koji su se liječili u KBC Zagreb. Anestezirani su za radikalnu prostatektomiju TIVA tehnikom. Podijeljeni su u dvije grupe: 19 pacijenata koji su operirani klasičnom tehnikom te 11 pacijenata operiranih laparoskopski. MoCA test je analiziran preoperativno te 48 sata nakon operativnog zahvata. Parametarski testovi nisu korišteni zbog odstupanja pojedinačnih distribucija od normalne, što je utvrđeno Shapiro-Wilkovim testovima (p <,05) i zbog malog broja sudionika. Izračunate su precizne p-vrijednosti, osim Spearmanovog koeficijenta korelacije koji ih ne koristi. Korišteni su dvosmjerni testovi i alfa vrijednost od 5%.

Rezultati Bolesnici koji su bili podvrgnuti laparoskopskoj prostatektomiji nisu imali statistički značajno različite rezultate MoCA testa prije operacije od onih koji su bili podvrgnuti klasičnoj prostatektomiji (U = 59,9, z = 1,96, p = ,052). Nakon operacije bolesnici podvrgnuti laparoskopskoj prostatektomiji postigli su statistički značajno veće rezultate (U = 46,0, z = 2,54, p = ,011), uz umjereni učinak (r = ,463). Rezultati MoCA testa bili su statistički značajno viši nakon operacije nego prije operacije (W = 346,5, z = -3,81, p <,001; nije u tablici), s jakom veličinom učinka (r = ,696). Količina poboljšanja u rezultatima MoCA testa nije bila statistički značajno različita za laparoskopsku i klasičnu prostatektomiju (U = 78,0, z = 1,16, p = ,268).

Zaključak Postoperativne vrijednosti MoCA testa su više nego preoperativne, u obje grupe- laparoskopskoj i klasičnoj prostektomiji. Rezultate istraživanja možemo objasniti činjenicom da anksioznost i zabrinutost oko nadolazeće operacije utječu na rezultate ispitivanja preoperativno. Ostali promatrani parametri nisu utjecali na vrijednosti MoCA testa.

Ključne riječi: MoCA test, anestezija, postoperativni kognitivni poremećaj

Introduction

Postoperative cognitive dysfunction (POCD) is defined as a new cognitive impairment arising after anaesthesia and surgery (1). Studies identify factors that contribute to POCD: general anaesthesia, hyperventilation, hypotension, hypoxia, psychoactive drugs, patient-related factors – including ageing, genetic polymorphism (APOF4) and co-morbidities such as cancer and underlying neurodegenerative and neurovascular diseases (2). POCD broadly follows two different patterns: acute cognitive dysfunction, known as postoperative delirium and a later onset and more persistent POCD. The reported incidence vary depending on the group of patients studied, the definition of POCD used, the test used ,the time of testing and the choice of control group (3). POCD can only be diagnosed and measured using tests both pre- and postoperative. Currently there are no biomarkers, neuroimaging correlates or other clinical criteria which can distinct POCD from other impairment. Neurophysiological tests are sensitive and objective tools designed to identify and measure cognitive abilities. They are designed to assess multiple cognitive domains including general function, memory, attention/concentration, processing speed and executive function.(4). Longitudinal assessments with mental status scales may provide additional insight into a patient's clinical status (worsening, remaining stable or improving).Many tests are for this purpose, but two scales with moderate assessment times, the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) have been studied most frequently. Changes on MMSE and MoCA are less sensitive in detecting longitudinal decline in cognition than formal neurophysiological testing (5). Furthermore, such scales have limitation. So, MoCA may be better for detecting decline in minimal cognitive impairment, while the MMSE may be better for detecting decline in mild to moderate dementia (6). The Montreal Cognitive Assessment (MoCA) is a widely used screening assessment for detecting cognitive impairment. It was created in 1996 by Ziad Nasreddine in Montreal, Quebec (7). This test consists of 30 points and takes part in 10 minutes from the individual. The Montreal test is performed in seven steps (its English version), which may change in some countries dependent on education and culture. The basics of this test include short-term memory, executable performance, attention, focus and more.

Materials and methods

The prospective study included 30 patients who were treated at the University Hospital Centre Zagreb. They were anaesthetized for radical protectorate using the VITA technique and divided into two groups: 19 patients who underwent classical surgery and 11 patients who underwent arthroscopic surgery. The Coma test was analysed pre-operatively and 48 hours after surgery. Statistical methods Parametric tests were not used due to deviations of individual distributions from normal, which was determined by Shapiro-Wilk tests ($p < .05$) and due to the small number of participants. Precise p-values were calculated, except for the Spearman correlation coefficient, which does not use them. Two-way tests and an alpha value of 5% were used. Statistical processing was performed in the SPSS program, version 26.0 (2018, IBM Corp., Armonk, N.Y., USA). Descriptive data on numerical variables are presented in median and quartile. The statistical significance of differences in the expression of numerical variables between the two groups was examined by Mann-Whitney In tests. The difference in the severity of the MoCA test results before and after surgery was investigated by the Wilcoxon equivalent pair test. The statistical significance of the difference in the incidence of hypotension with respect to the type of prostatectomy was calculated by the chi-square independence test. The relationships between the numerical variables were calculated by the Spearman correlation coefficient. No analysis was performed for ASA status because few patients had status other than 2 (ASA-1 - 3 patients, ASA-2 - 25, ASA-3 - 2).

Results

Patients who underwent laparoscopic prostatectomy did not have statistically significantly different MoCA test results before surgery than those who underwent classical prostatectomy ($U = 59.9$, $z = 1.96$, $p = .052$). After the operation, patients undergoing laparoscopic prostatectomy achieved statistically significantly higher results ($U = 46.0$, $z = 2.54$, $p = .011$), with a moderate effect ($r = .463$). The results of the MoCA test were statistically significantly higher after surgery than before surgery ($W = 346.5$, $z = -3.81$, $p < .001$; not in the table), with a strong effect size ($r = .696$). The amount of improvement in MoCA test results was not statistically significantly different for laparoscopic and classical prostatectomy ($U = 78.0$, $z = 1.16$, $p = .268$). Patients undergoing laparoscopic prostatectomy had statistically significantly lower blood loss than those undergoing classical prostatectomy ($U = 55.5$, $z = -2.37$, $p = .018$), with a moderate effect size ($r = .432$), while no significant differences in age were found. patients ($U = 88.0$, $z = -0.71$, $p = .497$) and duration of surgery ($U = 59.5$ $z = -1.95$, $p = .052$).

Table 1. Descriptive statistics of numerical variables for laparoscopic prostatectomies, classical prostatectomies and the whole sample and results of Mann-Whitney U tests

Dependent variable		Lap. (n = 11)	Classical (n = 19)	All (N = 30)	U	z	r	p
MoCA pre-op.	Q1	24	22	23	59.9	1.96	.357	.052
	C	25	23	24				
	Q3	27	25	26				
MoCA post-op.	Q1	25	23	24	46.0	2.54	.463	.011
	C	28	25	26				
	Q3	29	27	28				
MoCA difference	Q1	1	1	1	78.0	1.16	.212	.268
	C	3	2	2				
	Q3	3	3	3				
Blood loss (ml.)	Q1	200	300	200	55.5	-2.37	.432	.018
	C	300	500	400				
	Q3	400	800	700				
Age	Q1	57	58	57	88.0	-0.71	.130	.497
	C	60	63	62.5				
	Q3	69	65	65				
Duration of surgery(min.)	Q1	160	120	140	59.5	-1.95	.355	.052
	C	180	150	165				
	Q3	210	205	210				

Note: n - subgroup size, C - median, Q1 and 3– first and third quartiles, U - Mann-Whitney test amount, z - z-value, r - effect size, p - precise statistical significance of the test.

No statistically significant differences were found between patients who did and those who did not have hypotension in the results of the MoCA test before surgery (U = 66.5, z = -1.91, p = .056), after surgery (U = 84.0, z = -1.17, p = .241) and in the improvement from the first test to the second (U = 112.0, z = 0, p = 1).

Table 2. Descriptive statistics of numerical variables for the number of hypotensive episodes and results of Mann-Whitney U tests

Dependent variable		No hypotension (n = 14)	Hypotension (n = 16)	U	z	r	p
MoCA pre-op.	Q1	22	23	66.5	-1.91	.349	.056
	C	24	25				
	Q3	25	26.5				
MoCA post-op.	Q1	24	25	84.0	-1.17	.214	.241
	C	26	27				
	Q3	28	29				
MoCA difference	Q1	1	1	112.0	0	0	1
	C	2	2				
	Q3	3	3				

Note: n - subgroup size, C - median, Q1 and 3– first and third quartiles, U - Mann-Whitney test amount, z - z-value, r - effect size, p - precise statistical significance of the test.

No statistically significant correlations were found between MoCA test results and blood loss, age or duration of surgery before surgery, after surgery, or improvement in test results (p> .05).

Table 3. Spearman coefficients of correlation of MoCA test results with blood loss, age and duration of surgery (N = 30)

		Blood loss	Age	Duration of surgery
MoCA pre-op.	r_s	0.045	-0.344	0.182
	p	0.812	0.063	0.337
MoCA post-op.	r_s	-0.044	-0.313	0.130
	p	0.818	0.092	0.495
MoCA difference	r_s	-0.086	0.107	-0.040
	p	0.651	0.574	0.832

Note: rs - effect size, p - statistical significance of the test.

No statistically significant differences were found in the incidence of hypotension with respect to the type of prostatectomy ($\chi 2$ (1) = 2.63, V = .296, p = .142).

Table 4. Contingency table of the type of operation on the presence of hypotension and the results of the hi-square test

		Prostatectomy		Total
		Laparoscopic	Classical	
No hypotension	f	3	11	14
	%	27.3%	57.9%	46.7%
Hypotension (one or two)	f	8	8	16
	%	72.7%	42.1%	53.3%
Total	f	11	19	30
Hi-square:		χ^2 (1) = 2.63, V = .296, p = .142		

Note: f - frequency,% - percentage of the total number of this type of operations.

Discussion

Several studies have demonstrated that performance on screening tests is influenced by socio demographic variables. It has been widely reported that age and educational level have a significant effect on cognitive screening test performance. (8,9) The influence of health variables on performance MoCA test has also been reported in the literature. Co-morbidity of depressive symptoms and cognitive decline is common, and several studies have aimed to clarify the complex interaction between these conditions (10). Additionally, also there is a significant association between anxiety and depressive disorders, which further raises questions about the complex relationship between affective symptoms and memory. Anxiety and concerns about the forthcoming operation can influence test results if performed too close to the day of surgery which increases the risk of overlooking a possible cognitive decline after surgery (11).

Therefore, this may be the explanation for the results we obtained in our study. Namely, postoperative patients resolved significantly better MoCA test than preoperative. And such results were recorded in both groups whether they were operated classically or laparoscopically. Perioperative blood transfusion of more than 3 units of RBCs is an independent risk factor for POCD in aged patients following total hip replacement surgery (12). The risk factors for early POCD after gastroenterectomy included a high resting VAS score on the first day after surgery and alcohol exposure. High VAS score, preoperative WBC levels ≥10 × 10*9, blood loss ≥500 ml, NLR ≥2, and history of hypertension were independent risk factors for major POCD among which VAS score was one of the important predictors. (13). Due to the data published in various papers, we also recorded the amount of blood lost, duration of surgery, type of surgical technique, hypotensive episodes, age, ASA qualification. All these variables were not statistically related to MoCA results postoperatively.

The objection to our research is that we did not measure the time required to perform the MoCA test. Research of Buckley R.A. et al. (14) demonstrates that the variable dCDT (digital clock drawing test) time significantly increased postoperatively in patients with suspected cognitive impairment. These results add to the growing literature suggesting that anaesthesia and surgery impact on patients with cognitive impairment. In this study, the clock scores (based on the MoCA scoring criteria) were not shown to significantly change from pre to postoperatively, indicating that the MoCA clock score criteria alone may have limited utility for monitoring cognitive changes for day admissions at discharge.

Therefore, all of the above can only be a guide in our further clinical and scientific work, and a note that we must take into account the long-term consequences of our actions.

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