Life’s simple 7 score is independent risk factor for postoperative delirium following total knee arthroplasty

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INTRODUCTION:

Life’s Simple 7 score is a new measure of cardiovascular health (CVH) published by the American Heart Association (AHA) in 2010 to track health status in relation to a 2020 strategic goal to improve CVH of Americans. Life’s Simple 7 is based on 4 modifiable health behaviors, including nonsmoking, healthy diet, physical activity, and body mass index (BMI), and 3 modifiable biological factors, including blood pressure (BP), total cholesterol, and fasting glucose (Table 1). The aim of this retrospective study was to determine whether Life simple 7 score may be associated with postoperative delirium after total knee arthroplasty(TKA). We hypothesized that POD would occur at a higher rate among patients who had low Life’s simple 7 score.

METHODS:

The data described in this study was limited, because it was retrospectively obtained from medical chart review. We enrolled 1061 patients who had undergone TKA from January 2012 to January 2020. We excluded patients who underwent TKA bilaterally and those undergoing revision TKA. Finally, a total of 973 out of 1061 eligible patients were included in the study.

RESULTS:

A total of 973 patients were included in the study. Table 2, 3 outlines several differences in categorical variable analysis between the two groups. As a result of Chi-squared test & Fisher’s exact test, sex(male), type of anesthesia(nerve block), preoperatively duloxetine administration, postoperatively transfusion, intraoperatively hypotension and intraoperatively hypothermia were found to be statistically significant. Among the underlying disease, statistically significant results were found in HTN, DM, renal disease, solid tumor, Parkinson's disease, and insomnia. Table 4 shows the T-test results for continuous variable analysis, and statistically significant results were obtained in age, life simple 7 score, charlson comorbidity index, BUN, and Cr.

As a result of obtaining the odds ratio for each variable through multivariate logistic regression analysis (table 5), statistically significant results were found in differences in type of anesthesia (comparing general anesthesia and nerve block), preoperatively duloxetine administration, Parkinson's disease, intraoperatively hypotension, age at surgery, and life simple 7 score. Among them, the largest odds ratio was obtained from the difference in anesthesia method comparing general anesthesia and nerve block (244,637) so it was significantly associated with postoperative delirium. Next, Age (1.074), Life simple 7 score (0.446), Intraop hypotension (0.194), Duloxetine (0.171), Parkinson's disease (0.126) in that order Odds ratio is high.

DISCUSSION AND CONCLUSION:

In the present study, type of anesthesia (comparing general anesthesia and nerve block), preoperatively duloxetine administration, Parkinson's disease, intraoperatively hypotension, age at surgery, and life simple 7 score were identified as independent risk factors for postoperative delirium following a TKA. In particular, type of anesthesia (comparing general anesthesia and nerve block) was most significant risk factor for postoperative delirium.

The second factor with the highest odds ratio was the age of the patient at the time of surgery. It is explained that this occurs as the brain ages, the brain capacity declines, which causes anatomical changes of loss of synapses of nerve cells and changes in neurotransmitters occur, resulting in difficulties in memory and concentration which can result in the symptom of delirium.

The life simple 7 score, the hypothesis of this study, was the third highest odd-ratio factor. High cardiovascular health (CVH) can be thought of as lowering the risk of postoperative delirium.

Preoperative duloxetine administration is associated with increased POD

Underlying Parkinson’s disease is predictors for POD.

Table 1

Component	Ideal (2 Points)	Intermediate (1 Point)	Poor (0 Points)
Smoking	Never or former >1 year	Former ≤1 year	Current
Healthy diet score	4 to 5 points	2 to 3 points	0 to 1 points
Physical activity	≥4 bouts per week of intense physical activity sufficient to work up a sweat	1 to 3 bouts per week of intense physical activity sufficient to work up a sweat	No intense physical activity sufficient to work up a sweat
Body mass index	<25 kg/m²		
Blood pressure	<120/80 mmHg untreated	SBP 120 to 139 or DBP 80 to 89 mmHg or treated to ideal level	SBP ≥140 or DBP ≥90 mmHg
Total cholesterol	<5.18 mmol/L (<200 mg/dl) untreated	5.18 to 6.19 mmol/L (200 to 239 mg/dl) or treated to ideal level	≥6.22 mmol/L (≥240 mg/dL)
Fasting glucose	<5.55 mmol/L (<100 mg/dl) untreated	5.55 to 6.94 mmol/L (100 to 125 mg/dl) or treated to ideal level	≥6.99 mmol/L (≥126 mg/dL)

Table 2

Factors	Group1 (n = 40) (Deliri,m)	Group2 (n = 913) (Non Deliri,m)	P value
Sex			0.001
Male	17	120	
Female	43	793	
Anesthesia			0.660
General	48	885	
Spinal	8	28	
Nerve block	6	0	
Alcohol			0.087
<4 / week	58	889	
5-9 / week	2	4	
>9 / week	0	10	
ASA grade			0.370
1	2	14	
2	44	707	
3	14	191	
Duloxetine (%)	17 (28.3)	191 (11.1)	0.000
Gabapentin or Pregabalin (%)	13 (21.7)	182 (21.0)	0.827
Preop opioid (%)	41 (68.3)	605 (34.8)	0.137
Postop opioid (%)	54 (90.0)	771 (64.7)	0.262
PCA (%)	58 (96.7)	882 (97.1)	0.810
Tramfulcon (%)	45 (75.0)	788 (66.1)	0.010
BMD coprac (%)	3 (5.0)	50 (5.5)	0.247
BMD rhpt (%)	3 (5.0)	44 (4.9)	0.977
Intraop hypotension (%)	12 (20	57 (6.2)	0.001
Intraop hyperthermia (%)	11 (18.3)	59 (6.5)	0.002

Table 3

Factors	Group1 (n = 40) (Deliriom)	Group 0 (n = 913) (Non Deliriom)	P value
Underlying disease			
HTN (%)	52 (86.7)	635 (69.5)	0.003
DM (%)	37 (61.8)	373 (13.5)	0.000
COPD (%)	1 (1.7)	14 (1.5)	1.000
Asthma (%)	1 (1.7)	17 (1.9)	1.000
Arrhythmia (%)	1 (1.7)	30 (3.3)	0.716
CI (%)	8 (13.3)	72 (7.9)	0.166
MI (%)	7 (11.7)	51 (5.6)	0.060
Renal disease (%)	6 (10.0)	30 (3.3)	0.019
Liver disease (%)	4 (6.7)	27 (3.0)	0.110
Solid tumor (%)	7 (11.7)	43 (4.7)	0.023
Dementia (%)	1 (1.7)	8 (0.9)	0.122
Parkinson's disease (%)	1 (0.5)	8 (0.9)	0.001
Insomnia (%)	2 (3.5)	1 (0.1)	0.000

Table 4

Factors	Group 1 (n = 40) (Deliriom)	Group 0 (n = 913) (Non Deliriom)	P value
Age	76.68 ± 5.28	69.90 ± 7.08	0.000
Op time	103.93 ± 34.65	101.20 ± 32.22	0.975
Height	152.66 ±9.56	156.70 ± 9.26	0.960
Bwt	62.29 ± 11.27	62.21 ± 10.25	0.961
Life simple 7	6.88 ±1.25	8.85 ± 1.66	0.000
Charlson comorbidity Index (CCI)	4.22 ± 1.78	5.48 ± 1.71	0.000
Preop lab			
Hb	12.1 ± 1.82	12.2 ± 1.38	0.687
Hct	37.56 ± 4.84	38.42 ± 4.00	0.071
Alb	3.79 ± 0.46	3.88 ± 0.35	0.149
BUN	17.67 ± 5.86	15.80 ± 5.41	0.013
Cr	0.82 ± 0.23	0.72 ± 0.47	0.001
Na	140.36 ± 2.71	140.70 ± 3.01	0.720
K	4.15 ± 0.37	4.13 ± 0.40	0.795
Cl	103.80 ± 2.62	104.28 ± 3.38	0.285
P	3.54 ± 0.58	3.62 ± 0.66	0.986
Ca	8.81 ± 0.57	8.91 ± 0.51	0.191

Table 5

Factors	Odds ratio	Odds ratio 95% CI		P value
		Low	High	
Sex	0.690	0.296	1.630	0.413
Anesthesia (General – Nerve block)	244.617	12.247	4886.654	0.000
Duloxetine	0.171	0.072	0.405	0.000
Ventilation	1.583	0.577	2.667	0.505
HTN	0.690	0.233	1.574	0.304
DM	1.860	0.647	5.346	0.249
Renal disease	0.902	0.229	3.560	0.855
Solid tumor	0.532	0.151	2.151	0.175
Parkinson's disease	0.126	0.022	0.715	0.019
Insomnia	0.070	0.001	1.872	0.100
Intraop hypotension	0.194	0.075	0.505	0.001
Intraop hyperthermia	0.496	0.178	1.384	0.180
Age	1.074	1.005	1.148	0.035
Life simple 7 score	0.686	0.511	0.921	0.000
CCI	1.351	0.948	1.927	0.098
BUN	0.907	0.858	1.042	0.179
Cr	1.641	0.651	4.089	0.255

Figure 1