

노인재활

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Functional outcomes after clinical pathway for inpatient rehabilitation of total knee arthroplasty

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Objective

This study was undertaken to investigate short-term functional outcomes after clinical pathway for inpatient rehabilitation of total knee arthroplasty (TKA) and to examine group effects of unilateral and bilateral TKA patients.

Methods

In this retrospective cohort study, A total of 184 patients (57 males and 127 females; average age 71.5±5.9 years) who had received unilateral and bilateral TKA were followed up from preoperative to postoperative 3 months. Clinical pathways for inpatient rehabilitation included early, intensive individualized rehabilitation (progressive resistance exercise using air resistance machines at 30% of their one-repetition maximum, for three sets of 15 repetitions, progressive gait training using anti-gravity treadmill starting from a workload of 50% bodyweight (BW) and a speed of 2.0 km/hr, and aerobic exercise using ergometer) twice a day, five times a week for 2-week period. Patients completed performance-based physical function tests including stair climbing test (SCT), 6-minute walk test (6MWT), timed up and go test (TUG), isometric knee flexor and extensor strength of the surgical knee, gait speed, range of motion of knee flexion and extension. Self-reported physical function and pain were measured using the Western Ontario McMaster Universities Osteoarthritis Index (WOMAC) and Visual Analog Scale (VAS), and self-reported quality of life was measured using the EuroQOL five dimensions (EQ-5D) questionnaire. These evaluations were performed preoperatively, 1 month and 3 months postoperatively, respectively.

Results

The various performance-based and self-reported physical function and quality of life measures improved nonlinearly over time. Specifically, 6MWT, TUG, gait speed, WOMAC-pain, WOMAC-function, VAS, EQ-5D scores showed significant improvements in the first 1 month post-TKA, and SCT, peak torque (PT) of the extensor and flexor of the surgical knee, WOMAC-stiffness scores showed gradual, but, substantial improvements over the

3-month observational period. Group difference (unilateral and bilateral TKA groups) influenced the time course of various functional measures including SCT, 6MWT, TUG, VAS, WOAMC-stiffness, and WOMAC-function. Unilateral TKA group showed steeper improvements in TUG, WOMAC-function, and VAS scores during the first 1 month post-TKA, and in 6MWT and WOMAC-function scores during the 3-month post-TKA than bilateral TKA group. In addition, SCT scores exhibited significantly slower values in the bilateral TKA group than in the unilateral TKA group at 1 month postoperatively, and preoperative WOMAC-stiffness values were significantly higher in the bilateral TKA patients than in the unilateral TKA.

Conclusions

This study confirmed that patients underwent clinical pathway for early intensive inpatient rehabilitation showed significant improvements in various functional measurements during the first 3 months after TKA, with group difference observed in the several functional measures

Table 1. Demographic and Disease-Related Characteristics of the Subjects (N=184)[Ⓢ]

Variables [Ⓢ]	Values [Ⓢ]
Age (years) [Ⓢ]	71.5 ± 5.9 [Ⓢ]
Sex, males/females [Ⓢ]	26 (14.1) / 158 (85.9) [Ⓢ]
BMI (kg/m ²) [Ⓢ]	26.1 ± 3.1 [Ⓢ]
Unilateral / Bilateral [Ⓢ]	127 (69.0) / 57 (31.0) [Ⓢ]
K-L grades [Ⓢ]	[Ⓢ]
Grade 3 [Ⓢ]	34 (14.1) [Ⓢ]
Grade 4 [Ⓢ]	207 (85.9) [Ⓢ]
Lesion side [Ⓢ]	[Ⓢ]
Right [Ⓢ]	135 (56.0) [Ⓢ]
Left [Ⓢ]	106 (44.0) [Ⓢ]
Comorbidities [Ⓢ]	[Ⓢ]
Hypertension [Ⓢ]	125 (67.9) [Ⓢ]
Diabetes mellitus [Ⓢ]	35 (19.0) [Ⓢ]
Degenerative spine disease [Ⓢ]	24 (13.0) [Ⓢ]
Osteoporosis [Ⓢ]	93 (50.5) [Ⓢ]
Presarcopenia [Ⓢ]	10 (5.8) [Ⓢ]

Values represent mean ± standard deviation or number (%) of cases[Ⓢ]

Abbreviations: BMI, Body Mass Index, K-L, Kellgren-Lawrence[Ⓢ]

Table 2. Postoperative Outcomes of Performance-based and Self-reported Physical Function, and Quality of Life by Repeated Measure of ANOVA[†]

Variables [‡]	Values [‡]		
	Preop. [‡]	Postop. 1M [‡]	Postop. 3M [‡]
SCT-ascent(sec) [‡]	14.14±5.71 [‡]	16.41±5.26 ^{a‡}	10.82±3.86 ^{ab‡}
SCT descent(sec) [‡]	16.90±5.81 [‡]	17.67±6.35 [‡]	12.13±4.03 ^{ab‡}
6MWT(m) [‡]	314.48±100.60 [‡]	366.65±81.40 ^{a‡}	444.04±95.36 ^{ab‡}
TUG(sec) [‡]	12.00±3.45 [‡]	11.28±2.94 ^{a‡}	9.31±1.75 ^{ab‡}
PT Ex of surgical knee (N·m·kg ⁻¹ BW) [‡]	[‡]	[‡]	[‡]
PT Flx of surgical knee (N·m·kg ⁻¹ BW) [‡]	[‡]	[‡]	[‡]
Gait speed (m/sec) [‡]	0.89±0.17 [‡]	1.02±0.15 ^{a‡}	1.22±0.76 ^{ab‡}
ROM-knee flexion [‡]	127.72±13.32 [‡]	114.36±15.16 ^{a‡}	121.49±12.65 ^{ab‡}
ROM-knee extension [‡]	-7.1±5.88 [‡]	-2.45±4.40 ^{a‡}	-6.76±5.37 ^{b‡}
WOMAC-pain [‡]	9.58±3.16 [‡]	6.57±2.5 ^{a‡}	4.7±2.15 ^{ab‡}
WOMAC-stiffness [‡]	2.92±1.36 [‡]	2.68±1.09 [‡]	1.95±0.91 ^{ab‡}
WOMAC-function [‡]	29.58±8.83 [‡]	26.29±8.54 ^{a‡}	18.72±8.16 ^{ab‡}
VAS [‡]	6.98±1.70 [‡]	3.67±1.21 ^{a†}	2.50±2.21 ^{ab†}
EQ5D [‡]	0.58±0.15 [‡]	0.73±0.06 ^{a‡}	0.81±0.08 ^{ab‡}

Values represent mean ± standard deviation [‡]

Abbreviations: WOMAC, Western Ontario McMaster Universities Osteoarthritis Index, SCT, stair climbing test, 6MWT, 6-minute walk test, TUG, timed up and go, EQ-5D, EuroQOL five dimensions, PT, peak torque, BW, body weight, Ex, extensor, Flx, flexor[‡]

^aSignificant difference between preoperatively and 1month postoperatively, between preoperatively and 3 months postoperatively (p<0.05) [‡]

^bSignificant difference between 1 month postoperatively and 3 months postoperatively (p<0.05)[‡]

Table 3. Postoperative Outcomes of Physical Performance, Physical Function, and Quality of Life. Subgroup analysis between unilateral and bilateral TKA groups.

Variables	Values		
	Preop.	Postop. 1M.	Postop. 3M.
WOMAC-pain			
Unilateral	9.53±3.07	6.33±2.53*	4.40±2.19 ^{ab}
Bilateral	9.75±3.36	7.02±2.37*	5.20±2.01 ^{ab}
WOMAC-stiffness			
Unilateral	3.10±1.53	2.69±1.10*	1.82±0.92 ^{ab}
Bilateral	2.65±0.95*	2.68±1.07	2.19±0.81 ^{ab}
WOMAC-function			
Unilateral	29.35±8.72	25.22±8.66*	17.65±8.39 ^{ab}
Bilateral	30.26±9.10	28.39±7.98*	20.82±7.39 ^{ab}
SCT-ascent(sec)			
Unilateral	14.33±5.90	15.52±4.79	11.12±4.16 ^{ab}
Bilateral	13.78±5.38	18.34±5.76*	10.27±3.17 ^{ab}
SCT-descent(sec)			
Unilateral	16.66±5.71	16.37±5.09	12.29±3.97 ^{ab}
Bilateral	17.50±6.06	17.50±6.06*	11.90±4.21 ^{ab}
6MWT(m)			
Unilateral	311.63±99.77	367.56±86.54 ^a	428.82±97.54 ^{ab}
Bilateral	318.60±103.68	363.25±70.90*	474.91±84.10 ^{ab}
TUG(sec)			
Unilateral	12.00±3.38	10.91±2.55*	9.38±1.86 ^{ab}
Bilateral	12.05±3.67	12.12±3.58*	9.17±1.50 ^{ab}
EQ5D			
Unilateral	0.59±0.15	0.74±0.64*	0.81±0.08 ^{ab}
Bilateral	0.56±0.16	0.72±0.04*	0.80±0.08 ^{ab}
ROM-knee flexion			
Unilateral	127.56±11.04	114.10±17.71*	122.35±11.69 ^{ab}
Bilateral	129.69±9.92	115.12±11.90*	122.35±12.88 ^{ab}

ROM-knee extension	-7.63±5.80	-3.75±5.25*	-7.91±5.52 ^b
Unilateral	-7.58±6.23	-1.23±3.02*	-6.63±5.42 ^b
Bilateral			
VAS			
Unilateral	7.03±1.60	3.52±1.28*	2.55±1.34 ^{ab}
Bilateral	6.93±1.85	4.04±0.97*	2.41±0.93 ^{ab}
Gait speed			
Unilateral	0.88±0.17	1.02±0.15 ^a	1.23±0.91 ^{ab}
Bilateral	0.90±0.18	1.02±0.15*	1.19±0.21 ^{ab}
PT Ex of surgical knee (N·m·kg ⁻¹ ·BW)			
Unilateral	72.50±27.80	53.00±21.70*	80.71±25.24 ^{ab}
Bilateral	78.44±33.26	57.69±22.42*	89.55±27.03 ^{ab}
PT Flex of surgical knee (N·m·kg ⁻¹ ·BW)			
Unilateral	49.07±14.84	48.52±13.30	53.07±13.89 ^{ab}
Bilateral	45.87±14.58	46.48±15.08	50.53±13.71 ^{ab}

Values represent mean ± standard deviation.

Abbreviations: WOMAC, Western Ontario McMaster Universities Osteoarthritis Index, SCT, stair climbing test, 6MWT, 6-minute walk test, TUG, timed up and go, EQ-5D, EuroQOL five dimensions, PT, peak torque, BW, body weight, Ex, extensor, Flex, flexor.

*Significant difference between preoperatively and 1 month postoperatively, between preoperatively and 3 months postoperatively (p < 0.05).

^aSignificant difference between 1 month postoperatively and 3 months postoperatively (p < 0.05).

^{ab}Significant difference between unilateral and bilateral TKA groups (p < 0.05).