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Pre-operative psoas muscle mass and post-operative gait speed following total hip arthroplasty for osteoarthritis

Muscle volumes of the gluteus medius, gluteus maximus, and tensor faciae latae assessed by a computed tomography (CT) scan were greater in men than women and not different between the left and the right side after total hip arthroplasty (THA).[1] Body mass index, sex, age,[2] and ambulatory status[3] affected functional outcome after THA. However, the effects of psoas muscle mass and muscle quality on functional outcomes after THA are unknown. The purpose of this study was to investigate the association between pre-operative psoas muscle mass, muscle quality assessed by a pelvic CT scan, and post-operative gait speed following THA.

A retrospective cohort study was conducted on 135 consecutive hip osteoarthritis patients who received unilateral THA (right/left: 83/52). We measured psoas muscle area (PMA) and psoas muscle attenuation (PMT in Hounsfield Units) by pre-operative (median 32 days) pelvic CT to assess the hip joint at the level of the fourth lumbar vertebra using Slice-O-Matic software (v.5.0; Tomovision, Magog, Quebec, Canada). Post-operative gait speed was measured by a 10 m walk test at discharge.

Body mass index, PMA, skeletal muscle index (SMI) calculated by PMA/body height^2 (cm^2/m^2), and PMT were larger in men, and post-operative gait speed was faster (*Table* 1). PMA, SMI, and PMT were larger in the contralateral non-operated (NOP) side (*Table* 2). A significant association was found between post-operative gait speed, PMA, SMI, PMT on the NOP side, and age (*Table* 3).

A stepwise multiple linear regression analysis of post-operative gait speed adjusted by age, sex, post-operative length of stay, SMI, and PMT on the NOP side revealed that age, postoperative length of stay, and SMI were independently associated with post-operative gait speed (gait speed = 0.070 × SMI on the NOP

Table 1 Baseline characteristics and statistical analysis between men and women

	Total $N = 135$	Men $N = 11$	Women $N = 124$	P value
Age, years, mean ± SD	67 ± 10	65 ± 9	68 ± 10	0.392[a]
BMI, kg/m^2, mean ± SD	24.0 ± 3.9	26.6 ± 4.8	23.8 ± 3.7	0.021[a]
Post-operative length of stay, median (interquartile range)	18 (16–22)	18 (15–19)	18 (16–22)	0.250[b]
PMA, cm^2, mean ± SD	12.10 ± 3.97	20.44 ± 6.19	11.36 ± 2.70	0.001[a]
SMI, cm^2/m^2, mean ± SD	5.23 ± 1.54	7.94 ± 2.43	4.99 ± 1.18	0.002[a]
PMT, HU, mean ± SD	36.2 ± 9.4	42.0 ± 10.6	35.7 ± 9.2	0.032[a]
Postoperative gait speed, m/s, median (interquartile range)	0.67 (0.50–0.87)	0.94 (0.67–1.20)	0.66 (0.46–0.83)	0.012[b]

BMI, body mass index; HU, Hounsfield Unit; PMA, psoas muscle area; PMT, psoas muscle attenuation; SD, standard deviation; SMI, skeletal muscle index.
[a]*t*-test, [b] Mann–Whitney *U*-test.

Table 2 Statistical analysis of psoas muscle between the total hip arthroplasty side and the contralateral non-operated side: *t*-test

	THA	NOP	P value
PMA, cm^2, mean ± SD	5.34 ± 2.00	6.76 ± 2.33	<0.001
SMI, cm^2/m^2, mean ± SD	2.31 ± 0.80	2.92 ± 0.91	<0.001
PMT, HU, mean ± SD	34.6 ± 10.6	40.4 ± 9.1	<0.001

HU, Hounsfield Unit; NOP, contralateral non-operated side; PMA, psoas muscle area; PMT, psoas muscle attenuation; SD, standard deviation; SMI, skeletal muscle index; THA, total hip arthroplasty side.

Table 3 Gait speed, psoas muscle mass, and muscle quality: Spearman rank correlation

	PMA THA	PMA NOP	SMI THA	SMI NOP	PMT THA	PMT NOP	Age	BMI
Gait speed	0.140	0.381*	0.004	0.249*	0.072	0.249*	−0.440*	−0.108
PMA THA		0.458*	0.946*	0.409*	0.359*	0.175*	−0.072	0.273*
PMA NOP			0.354*	0.932*	0.068	0.354*	−0.191*	0.250*
SMI THA				0.408*	0.376*	0.135	0.055	0.263*
SMI NOP					0.091	0.325*	−0.058	0.256*
PMT THA						0.581*	−0.142	−0.258*
PMT NOP							−0.230*	−0.253*
Age								−0.054

*means P value < 0.05.
BMI, body mass index; HU, Hounsfield Unit; NOP, contralateral non-operated side; PMA, psoas muscle area; PMT: psoas muscle attenuation; SMI, skeletal muscle index; THA, total hip arthroplasty side.

side − 0.011 × age − 0.006 × post-operative length of stay + 1.322, $p < 0.001$, $R^2 = 0.255$). In contrast, PMT on the NOP side was not independently associated with post-operative gait speed.

Skeletal muscle index on the NOP side was independently associated with postoperative gait speed. Core muscle size measured as the psoas area from the CT scan provides a good measure of overall muscle mass and sarcopenia.[4] Psoas muscle mass on the NOP side rather than the THA side seems to reflect overall muscle mass, because psoas muscle mass on the THA side is regionally affected by severe osteoarthritis. As sarcopenia often occurs in rehabilitation settings, rehabilitation nutrition as a combination of both rehabilitation and nutrition care management for sarcopenia with osteoarthritis may improve functional outcome after THA.[5]

In conclusion, pre-operative psoas muscle mass on the NOP side is independently associated with post-operative gait speed following THA for osteoarthritis. A pre-operative pelvic CT scan of the hip joint can be useful to assess psoas muscle mass and to predict the post-operative functional outcome following THA.

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