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Original Article

Factors Influencing Health-related Quality of Life after Total Hip Arthroplasty

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Total hip arthroplasty (THA) is an established treatment approach with which good recovery is expected in patients. However, the postoperative satisfaction of THA patients, and factors that affect their treatment outcomes are unclear. We investigated 125 Japanese patients who underwent a primary THA between January 2011 and August 2013. The posterolateral (PL) and muscle-sparing anterolateral (AL) surgical approaches were used. THA outcomes were evaluated using the Short Form-36 (SF-36) at preoperatively and 1 month, 3 months, 6 months, and 1 year postoperatively. Approach-based comparisons demonstrated a significantly higher mean score for physical functioning after 6 months, role physical at 1 year, and social functioning at 1 year in the AL group. No significant difference was observed for other subscale scores at any survey period. The age-based comparison often indicated significant increases of subscale scores in the younger patient group. Weight-based comparisons were not observed for any of the 8 subscales at any survey period. Surgical approach was not a factor affecting the patients' postoperative quality of life, and the AL approach was not superior to the other surgical approaches involving myotenotomy. Moreover, the THA treatment outcomes were better in the younger patients, and obesity did not affect the outcomes.

Key words: total hip arthroplasty, quality of life, approach

Total hip arthroplasty (THA) is an established treatment approach with which good recovery is expected in patients with hip joint disease. With the recent development of minimally invasive surgery techniques including small skin incision and muscle sparing, improved the THA treatment outcomes such as decreased pain, decreased blood loss, and shortened hospitalization have been reported [1-3].

The posterolateral (PL) approach for THA introduced by Gibson [4] and Moore [5] has been widely used. However, it carries risks of postoperative joint dislocation [6] and sciatic nerve paralysis [7].

The direct lateral (DL) approach for THA introduced by Hardinge [8] and Dall [9] provides exposure of the acetabular cup, but it is also accompanied by risks of superior gluteal nerve damage [10] and pelvic instability due to weakened abductor muscles [11].

Using the space between the gluteus medius and the tensor fascia latae, the muscle-sparing modified Watson-Jones approach [12] is associated with quick recovery because it causes no muscle damage [13]. However, a long learning curve [14] and risk of fracture [15-17] remain.

Good treatment outcomes associated with muscle-sparing approaches primarily in the early postopera-

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tive stage have been reported [17]. A number of reports have demonstrated that these surgical approaches do not affect treatment outcomes at ≥1 year postoperatively [2, 15, 16, 18, 19].

Other than the surgical approach, factors affecting THA outcomes include sex, age, obesity, waiting time for surgery, and complications such as postoperative venous thromboembolism, joint dislocation, nerve damage, and infection [20–26]. While superior postoperative recovery is generally expected with the surgical approaches involving no myotenotomy, the recovery of obese patients may be slow because of the larger skin incision and greater surgical invasion that are necessary.

The objective of the present study was to evaluate the postoperative satisfaction of THA patients, focusing on both a surgical factor, *i.e.*, the usefulness of the anterolateral (AL) approach involving no myotenotomy, and patient factors affecting treatment outcome. We evaluated the THA outcomes by administering the Medical Outcomes Study Short Form-36 (SF-36), a comprehensive assessment tool for patient-reported health-related quality of life (QOL).

Materials and Methods

Between January 2011 (the start of our SF-36 survey collection) and August 2013 when the license of SF-36 was approved, 157 patients underwent their first THA. Of the patients who consented to participate in the questionnaire survey, and were asked to fill out the questionnaire at ≥1 year postoperatively, 133 completed the questionnaire and were included in the study. Patients who did not fill out or complete the questionnaire were excluded. The underlying disorders included osteoarthritis of the hip (n=128), avascular necrosis of the femoral head (n=4), and rheumatoid arthritis (n=1). The surgical approaches used included the PL (n=102), muscle-sparing AL (n=28), and DL approach (n=3).

We also excluded 4 patients with avascular necrosis of the femoral head, one patient with rheumatoid arthritis, and 3 patients in whom the DL approach were was used because of these small numbers of patients and systemic disorders. The final study cohort consisted of 125 patients (115 women and 10 men) with osteoarthritis of the hip. The mean age and body mass index (BMI) values of the cohort were 63 years (41–81 years) and 24 kg/m^2 (18–31 kg/m^2).

All patients were operated on in the lateral position. With the PL approach, the piriformis muscle, superior/inferior gemellus muscles, and obturator internus muscle were incised and then sutured. The modified Watson-Jones approach was used as the AL approach with no myotenotomy. Cementless implants were used for the cup and stem implantation in all patients.

The patients were asked to fill out the questionnaire preoperatively and at 1 month, 3 months, 6 months, and 1 year postoperatively (5 times total). Using the SF-36v2^{TM} scoring program (Excel version, iHope International), The questionnaire results were numerically rated the questionnaire results based on eight subscales: physical functioning (PF), role physical (RP), bodily pain (BP), general health perception (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). The ratings were compared based on age (≥70 years vs. <70 years), BMI (≥25 kg/m^2 vs. <25 kg/m^2), and surgical approach (PL approaches involving myotenotomy vs. AL approach involving no myotenotomy). To compare the mean values between groups, we used Student's *t*-test for data showing equal variance, and Welch's *t*-test for data showing unequal variance. The threshold for statistical significance was set at $p<0.05$. This study was approved by the ethics committee of Kawasaki Medical School.

Results

Among the 125 study patients, the mean scores on all eight SF-36 subscales were significantly increased at 3 months postoperatively (Table 1). The age-based comparison (39 patients aged ≥70 years vs. 86 patients aged <70 years) revealed significant increases in the following mean subscale scores in the younger patient group: PF at 6 months and 1 year, RP at 1 year, BP at 1 year, VT at 6 months and 1 year, RE at 3, 6 months and 1 year, and MH at 6 months and 1 year (Fig. 1). No significant difference in mean GH or SF scores were reported in any of the survey periods.

The weight-based comparison (33 patients with BMI ≥25 kg/m^2 vs. 92 patients with BMI <25 kg/m^2) revealed significant differences in the preoperative SF scores (BMI ≥25 kg/m^2, 72.1±27.4 and BMI <25 kg/m^2, 60.3±32.0; $p=0.04$). However, no signifi-

Table 1 Changes in the eight SF-36 subscale scores among 125 patients who underwent total hip arthroplasty

	Preoperation	1 mo.	3 mos.	6 mos.	1 year
PF	37.7 ± 19.8	57.7 ± 19.3*	63.4 ± 20.2	69.6 ± 18.8	73.9 ± 19.3
RP	47.9 ± 26.4	52.4 ± 21.1	65.3 ± 24.4*	74.9 ± 19.4	79.5 ± 20.3
BP	37.5 ± 16.6	56.8 ± 22.2*	68.9 ± 19.8	72.2 ± 20.4	78.0 ± 19.2
GH	57.6 ± 17.3	65.5 ± 14.5*	63.5 ± 16.3	65.9 ± 16.4	66.4 ± 16.3
VT	54.2 ± 19.9	60.3 ± 21.9*	66.6 ± 16.6	71.4 ± 15.0	72.1 ± 16.1
SF	63.4 ± 31.2	62.8 ± 27.0	76.0 ± 23.5*	81.9 ± 20.2	86.3 ± 20.1
RE	58.9 ± 30.4	66.5 ± 26.3*	77.5 ± 24.2	80.9 ± 22.4	84.6 ± 19.3
MH	62.3 ± 20.5	69.7 ± 21.3*	74.8 ± 16.7	77.9 ± 17.8	79.8 ± 14.5

All data are mean ± SD. The mean scores that were significantly improved compared to the preoperative scores were PF after 1 mo., RP after 3 mos., BP after 1 mo., GH after 1 mo., VT after 1 mo., SF after 3 mos., RE after 1 mo., and MH after 1 mo.

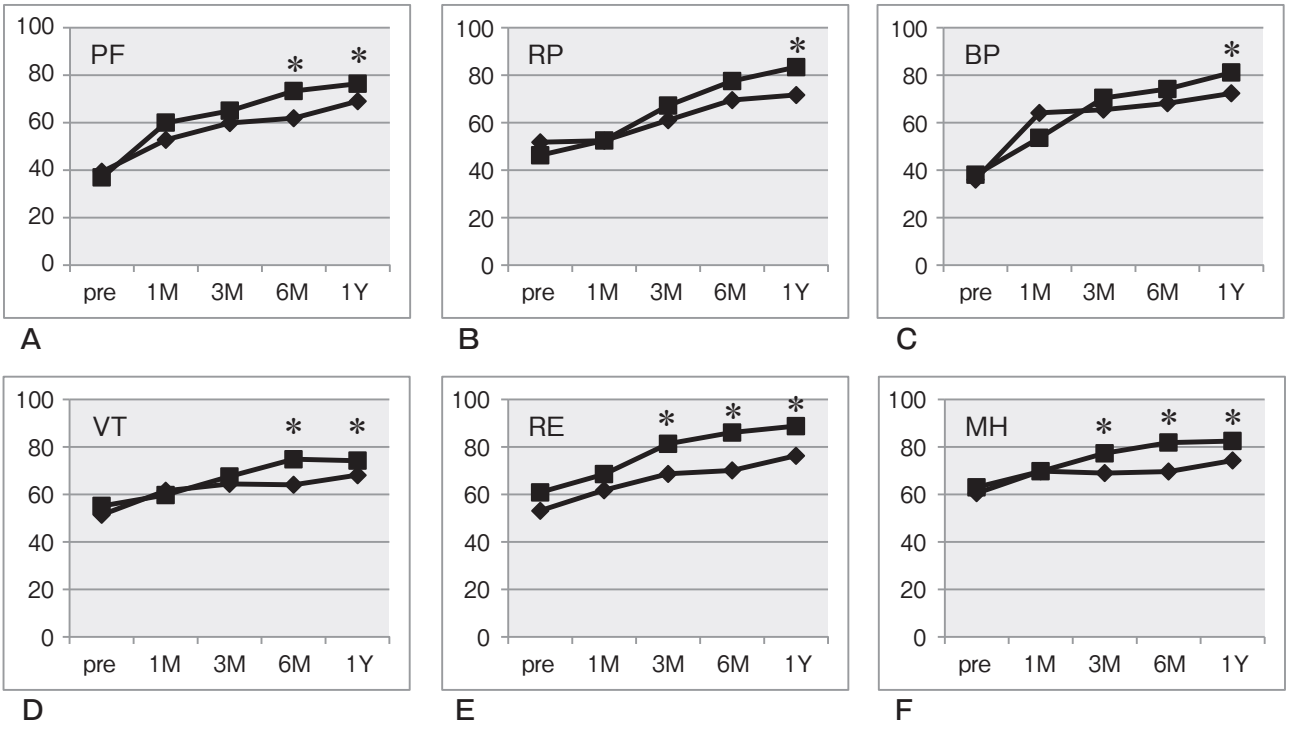

Fig. 1 Changes in postoperative SF-36 scores according to age. ■, patients < 70 years old; ◆, patients ≥ 70 years. Preoperative and 1-month, 3-month, 6-month, and 1-year data are shown. **A**, The mean physical functioning (PF) score among the patients < 70 years was significantly improved at 6 months and at 1 year ($p < 0.01$ and $p < 0.05$, respectively); **B**, The mean role physical (RP) score of the patients < 70 years significantly improved at 1 year ($p < 0.01$); **C**, The mean bodily pain (BP) score of the patients < 70 years was significantly improved at 1 year ($p < 0.05$); **D**, The mean vitality (VT) score of the patients < 70 years significantly improved at 6 months and 1 year. ($p < 0.01$ and $p < 0.05$, respectively); **E**, The mean role emotional (RE) score of the patients < 70 years was significantly improved at 3, 6 months and 1 year ($p < 0.05$, $p < 0.05$ and $p < 0.01$, respectively); **F**, The mean mental health (MH) score of the patients < 70 years was significantly improved at 3, 6 months and 1 year ($p < 0.05$, $p < 0.01$ and $p < 0.01$, respectively).

cant difference was observed for any of the 8 subscales at any survey period (data not shown).

The approach-based comparison (97 patients in the PL group vs. 28 patients in the AL group) demonstrated a significantly higher mean score for PF at 6 months and 1 year, RP at 1 year, and SF at 1 year in

the AL group (Fig. 2). No significant difference was observed for other subscale scores at any survey period (PL group vs. AL group, respectively): BP, 75.9 ± 19.5 vs. 81.9 ± 14.2, $p = 0.07$; GH, 65.8 ± 16.1 vs. 68.2 ± 16.9, $p = 0.51$; VT, 71.1 ± 15.1 vs. 74.5 ± 19.6, $p = 0.42$; RE, 82.6 ± 20.6 vs. 89.4 ± 17.3, $p = 0.10$; MH, 78.8 ± 14.8 vs. 82.1 ± 14.8, $p = 0.31$, at 1 year.

We also compared the female patients aged < 70 years with osteoarthritis of the hip, who had undergone the PL and AL approaches, with adjustment for age. The PL approach was used in 61 such patients, and the AL approach was used in 22. The mean age and BMI did not significantly differ between the 2 treatment groups (age, 58.8 ± 5.7 years [PL] vs. 57.7 ± 7.8 years [AL], $p = 0.88$; BMI, $23.8 \pm 3.2\,kg/m^2$ vs. $23.0 \pm 3.2\,kg/m^2$, $p = 0.41$).

The evaluation of SF-36 scores according to the surgical approach in female patients aged < 70 years with osteoarthritis of the hip revealed no significant difference in any of the subscale scores or survey periods (Table 2). The same analysis in the female patients aged ≥ 70 years with osteoarthritis of the hip (5 patients in the AL group and 27 in the PL group) also indicated no significant difference in any of the subscale scores or survey periods (Mann-Whitney U-test; data not shown).

Discussion

The reliability and validity of the SF-36, a globally used health-related QOL scale developed by Ware and colleagues [27], have been well established. QOL assessment is essential for evaluating a variety of factors affecting the THA outcomes reported in past clinical studies. A number of studies have evaluated factors affecting the change of post-THA QOL. Consistent with the outcomes of past studies using the SF-36 [2, 18, 25, 28, 29, 30], the results of the present study indicated that the patients' QOL was not affected by obesity or surgical approach, but that advanced age appeared to be a poor prognostic factor affecting patient QOL (Table 3).

We hypothesized that the AL approach involving no myotenotomy would produce better outcomes compared with the DL or PL approaches involving myotenotomy. However, no significant difference between the AL and PL approaches was detected in the 1-year postoperative survey period.

This study identified age as a possible factor affecting patient QOL. Müller and colleagues compared the modified DL approach and minimally invasive AL approach in 2 age groups of patients and reported no difference in patients < 70 years but significantly improved clinical outcomes and patient satisfaction with the MIS AL approach in patients ≥ 70 years old [31]. Namba and colleagues compared the mini-one approach (a modified Hardinge approach) and the OCM approach, revealing that the time to stable use of a single cane and the duration of hospital stay were significantly shorter in the OCM group, and that the reductions were likely to be more marked in older than in younger patients [32]. No significant difference was noted between the surgical approaches in

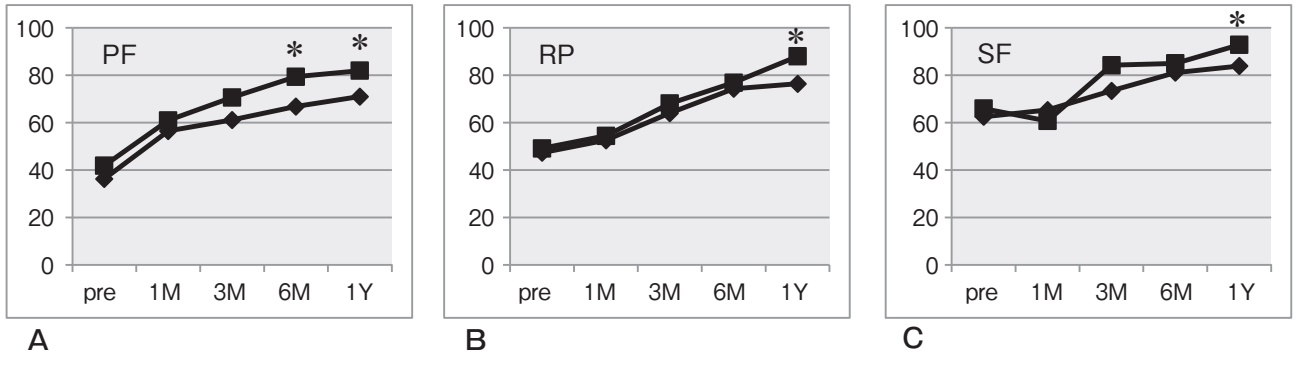

Fig. 2 Change of postoperative SF-36 scores by age. ■, anterolateral (AL) approach; ◆, posterolateral (PL) or direct lateral (DL) approach. Preoperative and 1-month, 3-month, 6-month, and 1-year data are shown. **A**, The mean PF score in the AL group was significantly improved at 6 months and 1 year ($p < 0.01$ and $p < 0.01$, respectively); **B**, The mean RP score in the AL group for RP was significantly improved at 1 year ($p < 0.01$); **C**, The mean BP score in the AL group was significantly improved at 1 year ($p < 0.05$).

Table 2 The characteristics and the scores of the female patients < 70 years old with osteoarthritis of the hip, in accord with the treatment approach used

	Preoperation	1 M	3 M	6 M	1 Y
PF	34.8 ± 20.4 39.8 ± 16.7	58.9 ± 18.5 61.4 ± 18.3	63.9 ± 21.0 70.1 ± 18.2	72.0 ± 18.0 79.4 ± 14.0	73.4 ± 20.4 83.3 ± 13.1
RP	45.9 ± 26.2 46.6 ± 26.0	51.1 ± 21.9 55.5 ± 19.7	68.8 ± 22.7 67.6 ± 26.5	78.2 ± 17.4 76.9 ± 22.0	81.4 ± 20.3 90.6 ± 12.4
BP	38.1 ± 18.4 37.0 ± 14.9	53.7 ± 21.9 51.6 ± 21.6	70.9 ± 18.4 70.4 ± 23.1	78.0 ± 16.3 70.8 ± 27.1	79.3 ± 18.8 85.0 ± 18.7
GH	56.8 ± 16.7 58.0 ± 23.2	67.7 ± 14.1 62.5 ± 16.5	65.1 ± 17.2 61.6 ± 15.8	69.2 ± 14.9 68.5 ± 16.7	69.8 ± 16.3 66.6 ± 16.5
VT	54.3 ± 22.0 57.0 ± 17.1	60.4 ± 21.2 57.7 ± 24.3	66.7 ± 16.6 70.6 ± 13.5	75.4 ± 12.2 74.1 ± 14.2	74.0 ± 13.8 75.3 ± 18.6
SF	59.6 ± 32.3 63.0 ± 28.4	56.1 ± 25.4 56.1 ± 27.4	74.7 ± 23.5 85.9 ± 18.2	84.8 ± 17.1 85.0 ± 24.5	86.6 ± 19.1 93.8 ± 12.5
RE	63.2 ± 30.3 55.9 ± 29.1	66.4 ± 27.7 73.5 ± 25.0	81.0 ± 20.2 85.9 ± 19.9	87.6 ± 14.9 86.2 ± 24.7	87.6 ± 18.0 93.3 ± 10.0
MH	63.0 ± 22.1 63.3 ± 19.4	73.3 ± 18.1 61.2 ± 26.0	77.8 ± 15.2 77.0 ± 15.4	82.7 ± 11.6 81.3 ± 15.7	83.7 ± 11.4 82.8 ± 13.3

Changes in the of eight SF-36 subscale scores; mean ± SD.
Upper row: PL group, Lower row: AL group.

Table 3 Past reports on the effect on SF-36 scores

SF-36	Age	Obesity	Surgical approach
Nilddotter and Lohmander (Rheumatology 2002)	*	NR	NR
Ethgen O, et al. (JBJS Am 2004)	*	NR	NR
Stevens M, et al. (Obes Surg 2012)	NR	n.s.	NR
Quintana JM, et al. (CORR 2009)	*	n.s.	NR
Greidanus NV, et al. (CORR 2013)	NR	NR	n.s. AL vs DL + PL
Inaba Y, et al. (J Arthroplasty 2011)	NR	NR	n.s. AL vs DL
Martin R, et al. (J Arthroplasty 2011)	NR	NR	n.s. AL vs DL
Current Study	*	n.s.	n.s.

NR, not reported, n.s.: not significant.
*: Younger patients significantly gained any SF-36 score than older patients postoperatively.

patients aged ≥ 70 years in the present study, likely because of its small sample size. However, a surgical approach involving no myotenotomy may be useful in older patients.

The PL approach is simple and is currently the most widely used surgical approach. One advantage of the AL approach is its reduced risk of joint dislocation [33, 34]. However, while the risk of this single surgical complication is reduced, the AL approach carries a risk of fracture during femoral manipulation [15-17]. The use of a surgical approach involving no myotenotomy is challenging for inexperienced surgeons because of the small surgical field [14, 35]. In a study by Müller and colleagues comparing the abductor muscle strength between the AL and modified DL approaches based on magnetic resonance images, minor damage of the gluteus medius was observed with both surgical approaches, and damage to the gluteus

minimus was reported in approximate 50% of the patients regardless of the approach [36].

We have seen muscle damage occur during rasping because the femoral manipulation was difficult. Because the PL approach is associated with easier femoral manipulation and less damage to the gluteus medius, the gluteus medius can be better preserved despite the sacrifice of lateral rotators. Intraoperative fracture rarely occurs because no forcible femoral manipulation is required. Thus, the PL approach may be effective for severely osteoporotic patients with a risk of femoral fracture, patients with severe hip subluxation requiring a highly flexible femoral manipulation, and muscular patients in whom the muscles cannot be divided easily.

One limitation of this study is that the AL group included fewer patients compared to the PL group. Future studies should also include more evaluation items. Since each surgical approach has its own advantages and disadvantages, the most appropriate approach for each patient must be evaluated and selected based on individualized needs.

In summary, we observed that the THA treatment outcomes were better in the younger patients, and obesity did not affect the outcomes. Although earlier functional recovery was expected with the AL approach based on past reports, the surgical approach was not identified as a factor affecting postoperative QOL. No difference in QOL was seen in the patients treated with different approaches after 1 month postoperatively. The AL approach was not shown to be superior compared with other surgical approaches. Further study is needed to determine the indications of each surgical approach.

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