

Evaluation of clinical results and quality of life after surgical reconstruction for rheumatoid cervical spine

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Abstract

Background Context: The EuroQol (EQ-5D) is a widely used comprehensive measure of health-related quality of life. There has been no study that evaluated health-related QOL before and after surgical reconstruction of rheumatoid arthritis (RA) cervical spine lesions using EQ-5D.

Purpose: The present study aimed to evaluate the improvement of quality of life before and after surgical reconstruction of rheumatoid cervical spine using EQ-5D, and the surgical outcomes of cervical spine affected by RA.

Study Design: A retrospective study of the patients who underwent surgical reconstruction of cervical disorders in RA.

Patient Sample: 25 patients (seven males, 18 females, mean age 62.2 years) who underwent surgical reconstruction of cervical disorders in RA were enrolled.

Outcome measures: Japanese Orthopaedic Association (JOA) score and EQ-5D.

Methods: Clinical symptoms were evaluated before surgery and at two years after surgery by measurement of JOA score. We also investigated health-related QOL before surgery and outcome at two years after surgery using the EQ-5D questionnaire.

Results: Mean observation period was 46.3 months. Mean JOA score was significantly

improved from 9.1 ± 4.5 points before surgery to 12.4 ± 2.8 at the two years after surgery ($p=0.0001$). All the EQ-5D data were improved at the two years after surgery, compared to before surgery; especially, pain ($p=0.005$), usual activity ($p=0.005$), mobility ($p=0.008$), and anxiety/depression ($p=0.02$) were significantly improved. Utility weight was 0.37 ± 0.27 before surgery and 0.56 ± 0.26 at the two years after surgery, showing significant improvement at the two years after surgery compared to before surgery ($p=0.002$).

Conclusions: The surgical reconstruction of rheumatoid cervical spine has been demonstrated to improve patients' health-related quality of life.

Key words:

EuroQol, Japanese Orthopaedic Association score, rheumatoid arthritis, cervical disorder, cervical reconstruction, health-related quality of life

Introduction

Complications of the cervical spine are common in patients with rheumatoid arthritis (RA) often resulting in anatomical deformities, particularly those of the upper cervical spine [1]. Both clinical and radiological signs of rheumatoid changes of the cervical spine are present in up to 86% of all RA patients [2, 3]. Isolated atlantoaxial subluxation (AAS) is present in the early stage of the disease. With further progression, osseous destruction of the joints can lead to vertical instability. Although the involvement of the middle and lower cervical spine can cause subaxial instability, neurological deficits can occur at any time [4]. These disorders produce myelopathy and severe occipital/neck pain, and reduce the quality of life (QOL) of these patients [5-7]. Furthermore, these disorders occasionally lead to quadriplegia and respiratory muscle paralysis. Cervical reconstruction surgery may be indicated and produce an improvement in the QOL of these patients.

The EuroQol-5D questionnaire (EQ-5D) is a widely used comprehensive measurement of health-related QOL and can be used to generate a single index value or utility [8, 9]. The EQ-5D is used in various patient groups including those with spine diseases. However, no study has used the EQ-5D to evaluate the health-related QOL before and after surgical reconstruction of RA cervical spine lesions. The objectives of

this study were to evaluate QOL using the EQ-5D before and after surgical reconstruction of cervical disorders in RA and investigate the utility of the performed surgery. Furthermore, we assessed the surgical outcomes of cervical spine affected by RA.

Materials and Methods

After approval by the investigational review board of our hospital, 25 patients [7 males, 18 females; mean age, 62.2 ± 7.8 years (mean \pm S.D.)] who underwent surgical reconstruction of cervical disorders in RA from January 2002 to November 2007 were studied. The mean patient height was 151.6 ± 7.7 cm (range, 135–166 cm), and mean weight was 46.3 ± 9.0 kg (range, 32–73 kg). All consecutive patients with follow-up durations 2 years or more were included in this study.

The fusion areas of these patients were as follows: 7 cases (2 males, 5 females; mean age, 55.9 ± 5.7 years) of C1–C2, 6 cases (all females; mean age 66.4 ± 7.6 years) of C0–C2 or C3, 8 cases (4 males, 4 females; mean age, 64.4 ± 8.2 years) of C0–C4 to T2, and 4 cases (1 male, 3 females; mean age, 62.3 ± 5.5 years) of other levels of cervical or

cervicothoracic fusion. The mean RA duration was 15.7 ± 8.0 years. Patients' details are shown in Table 1.

The following surgical procedures were performed: C1–C2 transarticular screw fixation (Magerl and Brooks procedure) [10] in AAS patients and cervicothoracic fusion using transpedicular screws in subaxial subluxation and occipitocervical or occipitothoracic fusion in AAS, vertical subluxation, and subaxial subluxation patients [9].

We evaluated health-related QOL before surgery and 2 years after surgery using the EQ-5D questionnaire. The EQ-5D questionnaire consists of 5 sections covering the health domains of mobility, self-care, usual activity, pain, and anxiety/depression [8, 11]. Each domain is rated according to 3 levels of severity: no problems (1 point), some or moderate problems (2 points), and severe problems (3 points). Utility weights can then be attached to the EQ-5D health state provided by the questionnaire; these weights lie on a scale wherein full health and death are represented by scores of 1 and 0, respectively. Some severe health states are given negative scores, meaning that from a social perspective, being in these states is regarded as worse than death. The validity and reliability of this instrument has been indicated previously [11-18].

Clinical symptoms were studied before and 2 years after surgery according to

Japanese Orthopaedic Association (JOA) scores [19]. The data were analyzed using the Wilcoxon signed rank sum test using SPSS software (SPSS Japan Inc., an IBM company, Tokyo, Japan). The level of significance was set at $p < 0.05$.

Results

The patients' follow-up periods ranged from 24–108 months (mean 61.3 ± 24.3 months). None of the 25 patients died at the final follow-up. The EQ-5D scores before and 2 years after surgery were as follows: mobility, 2.17 ± 0.56 and 1.88 ± 0.61 ; self-care, 2.21 ± 0.78 and 2.13 ± 0.80 ; usual activity, 2.38 ± 0.65 and 1.92 ± 0.65 ; pain, 2.38 ± 0.65 and 1.79 ± 0.72 ; anxiety/depression, 1.88 ± 0.72 and 1.46 ± 0.59 ; and utility weight, 0.37 ± 0.27 and 0.56 ± 0.26 , respectively (Fig. 1). The EQ-5D scores for mobility, usual activity, pain, anxiety/depression, and utility weight was significantly improved 2 years after surgery compared to those before surgery ($p = 0.008, 0.005, 0.005, 0.02, \text{ and } 0.002$, respectively). However, the EQ-5D score for self-care was improved 2 years after surgery compared to that before surgery, although this improvement was not significant ($p = 0.59$). Utility weight by Steinbrocker's stage and

class are shown in Table 2; utility weight improved in all Steinbrocker's stages and classes, although not significantly except for stage IV and class IV.

The mean JOA scores (full score: 17 points) before and 2 years after surgery were 9.1 ± 4.5 (range, -1–14.5) and 12.4 ± 2.8 points (range, 5.5–15.5), respectively; the mean JOA score 2 years after surgery was significantly improved compared to that before surgery ($p = 0.0001$) (Fig. 1). The recovery rate of JOA score was $39.2 \pm 21.1\%$. The JOA subscores in the upper limbs (full score: 4 points) before and 2 years after surgery were 1.9 ± 1.1 and 2.8 ± 1.0 points, respectively. The JOA subscore in the upper limb 2 years after surgery was significantly improved compared to that before surgery ($p = 0.0001$). The mean JOA subscores in the lower limbs (full score: 4 points, i.e., gait disturbance) before and 2 years after surgery were 1.3 ± 0.9 and 1.8 ± 0.9 points, respectively. The JOA subscore in the lower limb 2 years after surgery was significantly improved compared to that before surgery ($p = 0.001$) (Fig. 1).

We investigated the EQ-5D and JOA scores by fusion area (Table 3). The JOA scores improved significantly in all patients except in those with cervical or cervico-thoracic fusion. The utility weight of the EQ-5D scores improved by fusion area, although this improvement was not significant.

Discussion

Cervical disorders in RA can result in severe symptoms including occipital/neck pain, quadriplegia, and respiratory muscle paralysis. In such cases, cervical or occipitocervical reconstruction and neurological decompression are performed. However, the natural course of conservative therapy for RA patients accompanied with myelopathy is unfavorable and reported to result in persistent paralysis and bedridden state [20].

The EQ-5D is a generic health-related QOL instrument that has been indicated to be valid and reliable in the general population and various patient groups [21-23]. It consists of a 5-component index including mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Some previous studies have evaluated various diseases in patients using the EQ-5D. The EQ-5D has also been used to evaluate patients who have undergone spine surgery. Jansson et al. studied health-related QOL in patients before and after surgery for herniated lumbar disc and lumbar spinal stenosis; they report that the post-surgery EQ-5D utility weight improved from 0.29 (preoperatively) to 0.70 in herniated lumbar disc and from 0.36 to 0.64 in lumbar spinal

stenosis [24, 25]. However, to our knowledge, no study has evaluated health-related QOL using the EQ-5D before and after surgical reconstruction for cervical disorders in RA. Therefore, we evaluated health-related QOL using the EQ-5D before and after surgical reconstruction for cervical rheumatoid lesions. Our EQ-5D results indicated improvements in the pain ($p = 0.005$), usual activity ($p = 0.005$), mobility ($p = 0.008$), anxiety/depression ($p = 0.02$), and self-care ($p = 0.589$) domains in that order. In particular, surgical procedures for rheumatoid cervical lesions improve the pain caused by cervical instability.

Wolfe et al. report a mean EQ-5D utility weight of 0.57 in 1372 RA patients [26], whereas Ariza-Ariza et al. [27] report a value of 0.53 in 300 RA patients. In our study, the mean EQ-5D utility weight improved from 0.38 before surgery to 0.58 at the final follow-up, which is similar to that report in other studies. Therefore, our results indicate that the surgical reconstruction of rheumatoid cervical spine improved RA patients' health-related QOL. Utility weight improved in all Steinbrocker's stages and classes, although not significantly except for stage IV and class IV; this is due to the small number of cases for statistical analysis. However, the pre-operative utility weight was lower with the progression of Steinbrocker's stage and class.

The mean JOA score improved significantly after surgical reconstruction of rheumatoid cervical spine. Furthermore, there was a significant difference in the JOA subscores of upper- and lower-limb performance. Surgical procedures for rheumatoid cervical lesions not only improved upper-limb performance, but lower-limb performance as well. This explains the significant improvement of gait in the EQ-5D scores. Fujiwara et al. [28] report that the subsets of RA patient's diseases could be useful for predicting the terminal features of cervical lesions. Disease activity and the systemic extent of RA were both severe in patients with cervical myelopathy. Patients in the mutilating disease subset had a high risk for the development of neurologic deficits. In our study, the EQ-5D and JOA scores before surgery in the patients with C0–<4 fusion that almost fit into the mutilating disease subset were lower than those of patients with other fusion areas. However, the JOA scores of the patients in the mutilating disease subset improved significantly after surgery.

The limitations of this study include the lack of a control group, small sample size, and its retrospective design. Although we informed the patients of the surgical indications for rheumatoid cervical spine lesions found during evaluation, some refused operation. However, those patients comprised a very small proportion of the overall study population. Recently, most patients have not been opting for surgical intervention

because effective biological drugs can be prescribed. We conducted standard follow-up examinations at 2 years but continued to follow patients until the final follow-up because we wanted to observe the long-term outcomes of the reconstruction of the rheumatoid cervical spine on the QOL of patients. The number of joints considered in our study including knees, hips, ankles, wrists, elbows, and shoulders may have affected our results. Also, the number of destroyed joints was not considered in the results of the study. The diversity of procedures is another limitation. The variation in medications is a limitation as well. Although it may be better to assess the QOL using both the Euro-Qol and SF-36, the results of the Euro-Qol were similar to those of the JOA in our study. Therefore, we believe that the Euro-Qol is sufficient for evaluating the QOL. Despite these limitations, our results indicate that surgical reconstruction of the rheumatoid cervical spine can improve the QOL in RA.

Conclusion

Using the EQ-5D, we evaluated the health-related QOL before and after surgical reconstruction of the rheumatoid cervical spine. Evaluated items of health-related QOL

using the EQ-5D indicated improvements in the pain, usual activity, mobility, anxiety/depression, and self-care domains in that order. Therefore, surgical reconstruction of the rheumatoid cervical spine can improve RA patients' health-related QOL.

References

- [1] Halla JT, Hardin JG, Vitek J, et al. Involvement of the cervical spine in rheumatoid arthritis. *Arthritis Rheum* 1989;32:652-9.
- [2] Pellicci PM, Ranawat CS, Tsairis P, et al. A prospective study of the progression of rheumatoid arthritis of the cervical spine. *J Bone Joint Surg Am* 1981;63:342-50.
- [3] Smith PH, Benn RT, Sharp J. Natural history of rheumatoid cervical luxations. *Ann Rheum Dis* 1972;31:431-9.
- [4] Kothe R, Wiesner L, Ruther W. Rheumatoid arthritis of the cervical spine. Current concepts for diagnosis and therapy. *Orthopade* 2002;31:1114-22.
- [5] Clark CR. Rheumatoid involvement of the cervical spine. An overview. *Spine* 1994;19:2257-8.
- [6] Ranawat CS, O'Leary P, Pellici P. Cervical spine fusion in rheumatoid arthritis. *J Bone Joint Surg Am* 1979;61:1003-10.
- [7] Sharp J, Purser DW, Lawrence JS. Rheumatoid arthritis of the cervical spine in adult. *Ann Rheum Dis* 1958;17:303-13.
- [8] EuroQol Group. EuroQol--a new facility for the measurement of health-related quality of life. The EuroQol Group. *Health Policy* 1990;16:199-208.
- [9] Takahashi J, Shono Y, Nakamura I, et al. Computer-assisted screw insertion for

- cervical disorders in rheumatoid arthritis. *Eur Spine J* 2007;16:485-94.
- [10] Magerl F, Seemann PS. Stable posterior fusion of the atlas and axis by tranarticular screw fixation. In: Kehr P, Weidner A, eds. *Cervical Spine I*. Vienna, Austria: Springer-Verlag, 1987:322-7.
- [11] Rabin R, de Charro F. EQ-5D: A measure of health status from the EuroQol Group. *Ann Med* 2001;33:337-43.
- [12] Coons SJ, Rao S, Keininger DL, et al. A comparative review of generic quality-of-life instruments. *Pharmacoeconomics* 2000;17:13-35.
- [13] Dorman P, Slattery J, Farrell B, et al. Qualitative comparison of the reliability of health status assessments with the EuroQol and SF-36 questionnaires after stroke. United Kingdom Collaborators in the International Stroke Trial. *Stroke* 1998;29:63-8.
- [14] Fransen M, Edmonds J. Reliability and validity of the EuroQol in patients with osteoarthritis of the knee. *Rheumatology (Oxford)* 1999;38:807-813.
- [15] Hurst NP, Kind P, Ruta D, et al. Measuring health-related quality of life in rheumatoid arthritis: validity, responsiveness and reliability of EuroQol (EQ-5D). *Br J Rheumatol* 1997;36:551-9.
- [16] König HH, Ulshofer A, Gregor M, et al. Validation of the EuroQol questionnaire in

- patients with inflammatory bowel disease. *Eur J Gastroenterol Hepatol* 2002;14:1205-15.
- [17] Schweikert B, Hahmann H, Leidl R. Validation of the EuroQol questionnaire in cardiac rehabilitation. *Heart* 2006;92:62-7.
- [18] Unal G, de Boer JB, Borsboom GJ, et al. A psychometric comparison of health-related quality of life measures in chronic liver disease. *J Clin Epidemiol* 2001;54:587-96.
- [19] Japanese Orthopaedic Association. Scoring system for cervical myelopathy. *J Jpn Orthop Assoc* 1994;68:490-503.
- [20] Sunahara N, Matsunaga S, Mori T. Clinical course of conservatively managed rheumatoid arthritis patients with myelopathy. *Spine* 1997;22:2603-8.
- [21] Brooks R. EuroQol: the current state of play. *Health Policy* 1996;37:53-72.
- [22] Luo N, Chew LH, Fong KY, et al. Validity and reliability of the EQ-5D self-report questionnaire in English-speaking Asian patients with rheumatic diseases in Singapore. *Qual Life Res* 2003;12:87-92.
- [23] Schrag A, Selai C, Jahanshahi M, et al. The EQ-5D -a generic quality of life measure-is a useful instrument to measure quality of life in patients with Parkinson's disease. *J Neurol Neurosurg Psychiatry* 2000;69:67-73.

- [24] Jansson KA, Németh G, Granath F, et al. Health-related quality of life (EQ-5D) before and one year after surgery for lumbar spinal stenosis. *J Bone Joint Surg Br* 2009;91:210-6.
- [25] Jansson KA, Németh G, Granath F, et al. Health-related quality of life in patients before and after surgery for a herniated lumbar disc. *J Bone Joint Surg Br* 2005;87:959-64.
- [26] Wolfe F, Hawley DJ. Measurement of the quality of life in rheumatic disorders using the EuroQol. *Br J Rheumatol* 1997;36:786-93.
- [27] Ariza-Ariza R, Hernández-Cruz B, Carmona L, et al. Assessing utility values in rheumatoid arthritis: a comparison between time trade-off and the EuroQol. *Arthritis Rheum* 2006;55:751-6.
- [28] Fujiwara K, Fujimoto M, Owaki H, et al. Cervical Lesions Related to the Systemic Progression in Rheumatoid Arthritis. *Spine* 1998;23(19):2052-6.

Figure Legends

Fig. 1: EQ-5D and JOA score evaluation

(a) Mobility, pain, anxiety/depression, and utility weight scores improved significantly 2 years after surgery compared to those before surgery. (b) Mean JOA score 2 years after surgery improved significantly compared to that before surgery. Upper and lower limb JOA subscores improved significantly after surgery.

Table 1. Clinical profile and details of surgical procedures

Case	Age at surgery (years)	Gender	height (cm)	Weight (kg)	RA duration (years)	Steinbrocker (stage, class)	Medication	Cervical disorders	Fusion area	Laminectomy or Laminoplasty	Follow-up (months)
1	54	M	165	50	7	I, II	GST, Actarit	AAS	C1-2	N	108
2	56	F	150	37	15	IV, IV	PSL, Mizoribine	AAS, VS, SAS	C0-T2	C3-5	84
3	63	F	146	50	16	IV, III	MTX	AAS, VS, SAS	C0-T1	N	78
4	72	M	155	50	9	III, III	Salazosulfapyridine, PSL	AAS, VS, SAS	C0-T1	C3-7	48
5	62	M	160	42	11	IV, III	PSL	non union	C0-7	C1	98
6	54	M	157	44	14	III, III	MTX, PSL	AAS	C1-2	N	83
7	62	F	147	43	26	IV, II	GST	AAS, VS	C0-5	C1	87
8	58	F	150	49	13	IV, II	PSL	SAS	C6-T2	C7-T1	83
9	78	F	150	32	N/A	IV, IV	Bucillamine	AAS, VS, SAS	C0-T1	C1	72
10	67	F	135	45	11	N/A	PSL	AAS	C1-2	N	77
11	54	F	141	36	20	III, III	MTX, PSL	AAS, VS	C0-2	C1	81
12	63	F	146	40	25	III, III	Salazosulfapyridine, PSL	AAS, VS	C0-2	C1	74
13	53	M	166	50	11	III, IV	MTX, PSL	AAS, VS, SAS	C0-7	C1, C3-6	36
14	51	F	156	45	7	III, IV	MTX	AAS	C1-2	N	54
15	57	F	159	53	7	II, II	MTX	SAS	C3-4	C3-6	60
16	51	F	163	73	23	III, IV	MTX	AAS	C1-2	N	60
17	54	F	146	46	24	III, II	Salazosulfapyridine, PSL	AAS	C1-2	N	58
18	68	F	147	50	23	IV, III	MTX	AAS, VS	C0-3	C1	60
19	76	F	149	45	23	IV, II	MTX	AAS, VS	C0-3	C1	54
20	67	M	154	64	5	I, I	PSL	SAS	C3-5	C3-5	45
21	67	F	148	37	32	III, IV	PSL	SAS	C3-5	C3-6	24
22	72	F	148	38	13	III, III	MTX, PSL, Infliximab	AAS, VS	C0-2	C1	36
23	60	F	150	43	1	II, II	Bucillamine	AAS	C1-2	N	24
24	69	M	160	56	24	III, II	GST, Salazosulfapyridine, PSL	AAS, VS	C0-5	N	24
25	66	F	142	39	17	IV, IV	Etanercept	AAS, VS	C0-3	C1	24
Mean	62.2		151.6	46.3	15.7						61.3

GST: Gold sodium thiomalate, MTX: Methotrexate, PSL: Prednisolone,

AAS: atlantoaxial subluxation, VS; vertical subluxation, SAS: subaxial subluxation, N: no

Table 2. Utility weight by Steinbrocker's stage and class

Stage	Before surgery	2 years after surgery	p-value
I	0.632	0.763	0.317
II	0.351	0.767	0.180
III	0.387	0.579	0.128
IV	0.299	0.464	0.028

Class	Before surgery	2 years after surgery	p-value
I	0.533	0.795	N
II	0.447	0.605	0.173
III	0.499	0.720	0.080
IV	0.140	0.352	0.043

N: no

Table 3. EQ-5D and JOA score by fusion area

Fusion area		Before surgery	2 years after surgery	Significance (P)
C1-2	JOA score	11.7	14	0.034
	Euro-Qol	0.55	0.56	0.715
C0-C2 or C3	JOA score	9.2	12.4	0.043
	Euro-Qol	0.5	0.69	0.173
C0-below 4	JOA score	7	11.3	0.012
	Euro-Qol	0.22	0.4	0.068
Cervical fusion or	JOA score	8.4	12	0.068
Cervico-thoracic fusion	Euro-Qol	0.16	0.68	0.068

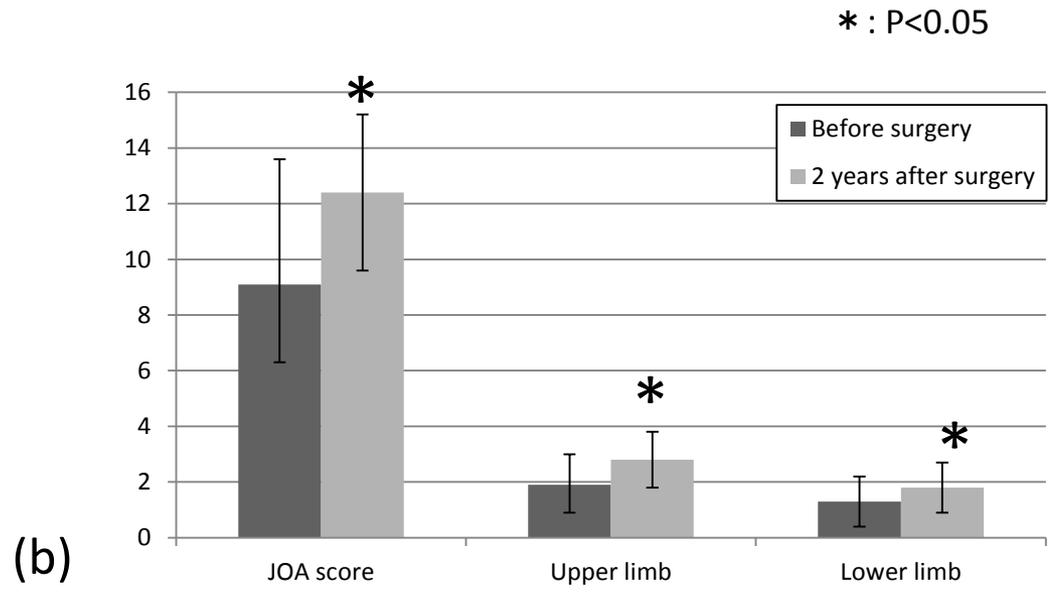
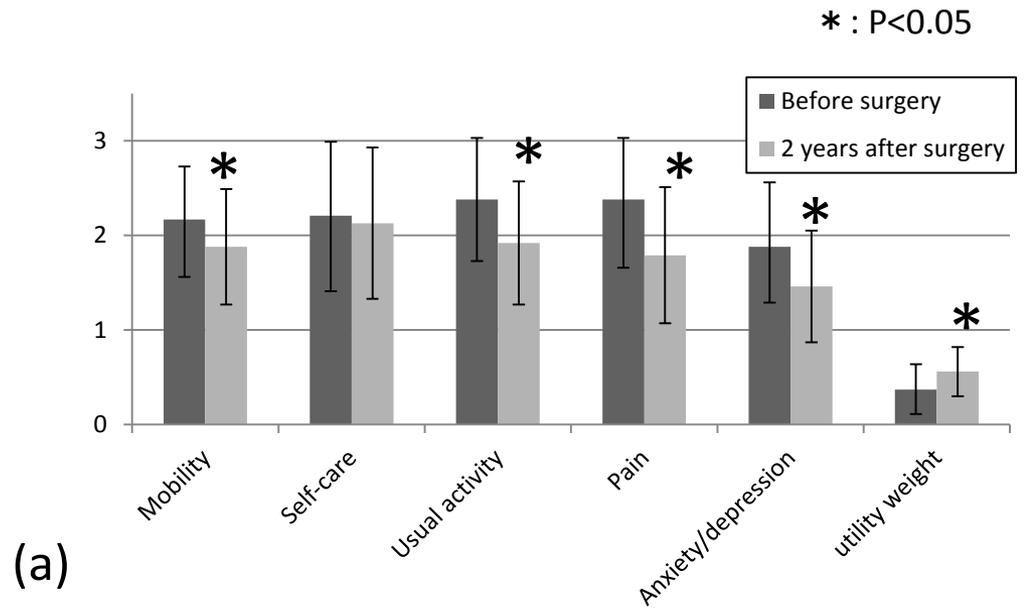


Fig. 1