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# Investigation of Pain in Hip Disease Patients before and after Arthroplasty

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**Abstract.** [Purpose] This study examined pain in patients with hip disease before and after arthroplasty and whether the pain was induced in the hip joint itself. [Subjects and Methods] Fifty-two patients presenting with hip disease who did not exhibit dementia, disease of the lower limbs or lumbar disease were included in this investigation. Regional pain, the site of maximum pain and Visual Analogue Scale (VAS) of the site of maximum pain before and after arthroplasty were evaluated. [Results] Groin displayed the highest incidence of pre-operative pain (28 cases, 53.8%); that number decreased post-operatively. Post-operative VAS was significantly smaller than pre-operative VAS. Six patients (11.5%) demonstrated pain below the knee pre- and post-operatively. [Conclusions] The present results suggest that hip arthroplasty is effective in terms of reduction of pain in the hip joint itself. However, instances in which pain persists in remote areas of the hip joint following arthroplasty occur, and the reason for this is uncertain. Clinicians must consider an appropriate rehabilitation program to address this pain.
**Key words:** Hip disease, Pain, Arthroplasty

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## INTRODUCTION

Locomotive diseases, e.g., osteoarthritis (OA), frozen shoulder and spinal canal stenosis, cause pain. Moreover, this pain is a serious issue as it impacts the activities of daily living (ADL) of patients. OA of the hip and knee joints is by far the most prevalent joint disease[1,2)].

OA exerts detrimental effects on patient physical function, affects synovial joints, is a major cause of musculoskeletal pain, reduces quality of life and leads to disability[3,4)]. In a population recruited from general practice, an association between morbidity count and pain or quality in life of patients with hip OA was established[5)]. Physical therapy is recommended as the first line of treatment for hip OA[6)]. Evidence supporting the effectiveness of physical therapy is well documented; however, physical therapy can only delay the progress of hip OA; it cannot reverse the course of the disease.

Joint surgery is the standard treatment for hip OA. The objectives of surgery include prevention of disease progress and the improvement of pain. The specific surgical technique is selected primarily with respect to the objective: if the purpose is to prevent the progress of the disease, hip osteotomy, e.g., rotational acetabular osteotomy (RAO) or chiari osteotomy, is preferred; if the purpose is to improve pain, total hip arthroplasty (THA) is the method of choice. Moreover, consideration of patient age is necessary when hip osteotomy or THA is indicated. The former method is used to treat young patients, whereas the latter is used to treat older patients. Hip pain is a common complaint, especially in older adults[7)]. It was reported that the symptom of hip OA occurs in 3% of the elderly[8)]. In general, older patients with hip OA undergo THA for the reduction of pain, and the results of THA are excellent[9,10)]. THA permits full weight bearing during the early post-operative period. Consequently, acquisition of standing and/or gait is observed early. Therefore, many patients with hip OA can realize improved ADL due to surgery although relief from the pain is not a simple matter.

It is well known that referred pain which occurs not only in the hip joint but also in the thigh or knee is a characteristic of hip disease[7)]. In short, OA generally causes

significant chronic pain and disability, especially in the lower extremities[2]. Khan and Woolson reported that 73% of patients with primary hip disease had pain in the groin, and 27% of patients had the referred pain of the knee that spread to the groin[11].

THA may not affect referred pain if the referred pain is not the origin of the hip disease. Kawada et al. reported that referred pain observed in severe hip OA patients may initially be triggered by the hip joint itself, but prolonged referred muscle pain may become a possible generator for the triggering and maintenance of a mal-pain circuit[12]. Mike reported that a women who presented with hip OA and deep knee pain had no pain after a Birmingham hip replacement, but deep knee pain came back[13]. Clinically, many patients with hip disease are satisfied with the outcome of THA; however, cases do occur in which the pain persists following surgery. Furthermore, if the patient exhibits pre-operative musculoskeletal pain unrelated to hip disease, it is reasonable to conclude that this pain may continue post-operatively. The condition of pain prior to and following surgery in patients with hip disease has not been examined in previous studies. Through our clinical experience, we know that pain may continue post-operatively, but evidence to support our hypothesis that such pain may be unrelated to hip disease is lacking. The objective of this investigation was to evaluate the areas of pain in patients with hip disease before and after arthroplasty and to determine whether the pain was induced in the hip joint itself.

## SUBJECTS AND METHODS

Ethics approval for this study was granted by the Nagasaki University Graduate School of Biomedical Sciences Ethics Board (No; 08062695). Informed consent was obtained from all participants.

Subjects were selected from among inpatients presenting with hip disease for whom arthroplasty was scheduled at the Nagasaki University Hospital or the Japanese Red Cross Nagasaki Genbaku Hospital between June 2008 and February 2010. Patients with dementia, disease of the lower limbs (except the hip joint) and lumbar disease were excluded. Table 1 summarizes subject's data. The total number of participants was 52 (women; n=44, men; n=8); mean values of age, height, weight and body mass index (BMI) were 64 (±11.5; SD) years of age, 154.1 (±6.8) cm, 56 (±8.4) kg and 23.6 (±3.3) kg/m$^2$, respectively. Diagnoses were as follows: hip OA (n=47) and osteonecrosis of the femoral head (n=5). Scheduled arthroplastic procedures were THA (n=49), Bipolar Hip Arthroplasty (BHA, n=2) and Birmingham Hip Resurfacing (BHR, n=1). Furthermore, the average period of continuing pain was 6.1 (±8.1) years.

**Table 1.** Summary of subjects data

| | |
|---|---|
| Age(years) | 64(±11.5) |
| Gender | |
| women | 44 |
| men | 8 |
| Height(cm) | 154.1(±6.8) |
| Weight(kg) | 56.0(±8.4) |
| BMI(kg/m$^2$) | 23.6(±3.3) |
| Diagnosis | |
| osteoarthritis of the hip | 47 |
| osteonecrosis of femoral head | 5 |
| Operation | |
| THA | 49 |
| BHA | 2 |
| BHR | 1 |
| Duration of pain(years) | 6.1(±8.1) |

Mean (±SD)

From our clinical experience, we understood that many patients with hip diseases complain of pain when in motion, e.g., standing up or walking, rather than at rest. Therefore, we examined the motion pain in this study. Evaluation items of pain consisted of regional pain, the site of maximum pain and pain was assessed using the visual analogue scale (VAS) at the site of maximum pain. These data were collected pre- (before 1.3±0.6 days) and post-operatively (after 18.2±5.1 days). Moreover, the target leg was the operative side. Assessment of regional pain was based on the previous report of Kawada et al.[12]. To be certain, each subject was asked to identify regions of pain on a body chart from the lumbar area to the lower limbs. Based on the body charts, regions of pain were classified into lumbar, groin, glutealis, greater trochanter, anterior thigh, lateral thigh, medial thigh, posterior thigh and below the knee. Patients were asked to identify the part of maximum pain on a body chart of pain that they had drawn. VAS of the specific body part was evaluated by a patient drawing a vertical line on a 10 cm horizontal line: 0 cm is equivalent to no pain, and 10 cm defines the strongest pain in the individual's experience. Subsequently, the length of the line drawn by each patient was measured with a ruler. The difference in pre- and post-operative VAS was analyzed utilizing the paired Student's t-test. Values were considered statistically significant at $p<0.05$.

## RESULTS

Table 2 summarizes the frequency of regional pain. Fifty-one pre-operative (98.1%) and 41 post-operative (78.8%) cases complained of pain. Pre-operatively, the groin (31 cases, 59.6%) exhibited the highest incidence of pain followed by the glutealis (23, 44.2%), the greater trochanter and below the knee (18, 34.6%). Post-operatively, the groin exhibited the highest incidence of pain (15, 28.8%), followed by the greater trochanter (13, 25%) and below the knee (11, 21.2%). Among eighteen cases (34.6%) that complained of pain below the knee pre-operatively, in twelve cases (23.1%) it disappeared post-operatively, but in remained in six cases (11.5%).

Table 3 summarizes the frequency of the region of maximum pain and VAS data. Pre-operatively, the groin

**Table 2.** Frequency of regional pain

| | lumbar | groin | greater trochanter | glutealis | thigh (anterior) | thigh (posterior) | thigh (lateral) | thigh (medial) | below knee |
|---|---|---|---|---|---|---|---|---|---|
| pre-operative | 9(17.3) | 31(59.6) | 18(34.6) | 23(44.2) | 10(19.2) | 2(3.8) | 8(15.4) | 3(5.8) | 18(34.6) |
| post-operative | 1(1.9) | 15(28.8) | 13(25) | 7(13.5) | 8(15.4) | 4(7.7) | 9(17.3) | 7(13.5) | 11(21.2) |

number of cases (%)

**Table 3.** Frequency of maximum regional pain and VAS

| | pre-operative | | post-operative |
|---|---|---|---|
| part | groin 28(53.8%), greater trochanter 12(23.1%), glutealis 7(13.5%), thigh(anterior) 3(5.8%), thigh(lateral) and below knee 2(3.8%) | | greater trochanter 12(23.1%), groin 9(17.3%), thigh(lateral) 7(13.5%), thigh(anterior) 6(11.5%), glutealis 5(9.6%), thigh(posterior) 4(7.7%), below knee 3(5.8%), thigh(medial) and lumbar 1(1.9%) |
| VAS | Range 1.3–9.9<br>Average 6.6±2.2 | * | Range 0.3–6.9<br>Average 3.1±2.0 |

number of cases (%) mean±SD *:$p<0.001$

displayed the highest incidence of maximum pain (28 cases, 53.8%), followed by the trochanter (12, 23.1%) and the glutealis (7, 13.5%). The pre-operative VAS range was 1.3–9.9 cm and the mean ± SD of VAS was 6.6 ± 2.2 cm. On the other hand, post-operatively, the greater trochanter exhibited the highest incidence of maximum pain (12, 23.1%), followed by the groin (9, 17.3%) and the lateral thigh (7, 13.5%). The post-operative VAS range was 0.3–6.9 cm and the mean ± SD of VAS was 3.1 ± 2.0 cm. Post-operative VAS was significantly smaller than pre-operative VAS.

## CASE STUDY

This section describes two cases characterized by both pre- and post-operative pain below the knee.

Case 1:

Case 1 was a 55-year-old woman (height, 144 cm; weight, 62 kg; BMI, 29.8 kg/m$^2$) with a diagnosis of right hip OA. Anamnesis revealed thyroid cancer; however, previous surgical intervention had resulted in complete recovery. The patient's job consisted of carrying goods in a supermarket. She complained of pain in the area of the hip joint while walking, beginning five years earlier. Furthermore, this pain extended to the knee joint. Pre-operative evaluation disclosed pain in the groin, glutealis, greater trochanter and below the knee. Only knee pain remained 21 days after THA; this pain was present upon standing and walking.

Case 2:

Case 2 was a 62-year-old housewife (height, 142 cm; weight, 58.2 kg; BMI, 28.9 kg/m$^2$) with a diagnosis of right hip OA. Anamnesis was unremarkable. The patient experienced hip pain over a period of 20 years. She underwent RAO of the right hip joint in 1990. However, slight pain persisted in the right hip joint; moreover, the pain increased with the passage of time. Recently, pain in the left hip joint intensified rapidly, and the progress of the pathogenesis of the left hip OA was remarkable. As a result, the patient underwent THA in 2008. Consequently, the pain in the left hip joint disappeared, but pain in the right hip and knee joints continued. At this point, THA was scheduled for the right hip joint. Pre-operative evaluation revealed pain in the groin, knee joint and ankle joint. Following THA, pain in the groin disappeared, whereas pain in the knee and ankle joints persisted. Additionally, pain appeared in the posterior thigh when walking. The patient characterized the pain below the knee as strong; she experienced difficulty sleeping due to the pain.

## DISCUSSION

Numerous studies have documented the pain associated with hip disease; however, most of these studies were concerned with pre-operative pain. To the best of our knowledge, this research is the first to compare pre- and post-operative pain in hip disease patients.

The majority of patients experienced pain in the hip region, and pain below the knee exhibited the highest frequency pre-operatively. Kawada et al.[12] examined regions of pain in severe hip joint disease (29 cases, 36 joints). They noted that 14% of the joints demonstrated pain below the knee. Our findings regarding frequency of pain below the knee were higher than those of Kawada; however, both of these findings suggest that pain in patients with hip disease occurs not only in the hip joint region but also in remote areas. We speculated that this symptom is caused by referred pain which originates in the hip joint itself. Nakamura reported that knee pain is more common in the diagnostic delay group of hip OA patients and recommended the differential diagnosis of hip pathology for in elderly patients with unexplained knee pain, which should be assumed to be referred pain[14]. Hip disease is known to cause referred pain in the hip joint as well as in

the thigh and the knee joint. This pain type, much like the referred pain that originates in hip disease, has been explained with reference to patterns of dermatomal, myotomal and sclerotomal segments. However, enormous individual variation exists in these segments as well as in presenting symptoms[15]. Farrell et al. noted that the mechanism governing referred pain may be attributable to sensitization of spinal cord neurons; however, the details remain unclear[16].

Arthroplasty, e.g., THA, is effective at reducing pain[11]. Therefore, if referred pain from the hip joint induces pre-operative pain below the knee, we hypothesized that arthroplasty would lead to a reduction in pain. In the current study, the number of patients exhibiting pre-operative pain in the groin, greater trochanter and glutealis decreased following surgery. Additionally, the number of patients describing maximum groin pain post-operatively decreased from the pre-operative number. Furthermore, post-operative VAS was significantly smaller than the pre-operative value. These results suggest that hip joint arthroplasty is effective in terms of reduction of pain in the hip joint itself.

In eighteen cases there was pre-operative pain below the knee, and it disappeared in 12 cases post-operatively. In short, pre-operative pain below the knee in those cases may have been referred pain of hip joint origin. However, the most remarkable data in this study was obtained from six cases (11.5%) involving both pre- and post-operative pain below the knee. Moreover, two cases introduced in this investigation were classic examples of this symptom. None of the subjects in this study had diseases with leg symptoms besides the hip joint. We think that pre-operative pain below the knee of the 6 cases was not induced by knee OA etc, since the pain below the knee remained even though the hip pain in the 6 cases was improved by the operation. These cases do not support our hypothesis that post-operative pain below the knee is referred pain from the hip joint.

A recent report cited numerous investigations regarding intractable chronic pain, e.g., complex regional pain syndrome (CRPS). The mechanism governing chronic pain has not been clarified; however, the sensitization of spinal cord neurons due to decreased pain threshold, and one of the causes was that the pain stimulation continues. Hip disease is consistent with pain that persists long term. On the other hand, a previous study assessing pain following THA reported that poor pre-operative function might impact recovery unfavorably, which might lead to prolonged pain[17]. Moreover, Troy reported that the maintenance of referred muscle pain usually depends on ongoing noxious inputs from the site of primary muscle pain[18]. The current study was unable to clarify the details of pain origin; however, as understood from the results of the sample cases, subjects in this investigation displayed continuing hip pain over several years, which might have accounted for the pre- and post-operative pain below the knee. The possibility exists that physical functions prior to surgery and muscle pain also influence the continuation of pain and future examination of these points is necessary.

This study had one major limitation. Post-operative evaluation was initiated approximately three weeks after surgery; thus, the possibility exists that the influence of the surgical wound is reflected in this data. Therefore, we believe that a future follow-up survey is necessary.

We conclude that instances in which pain persists in the remote regions of the hip joint following arthroplasty occur although the cause is uncertain. Clinicians must consider the most appropriate rehabilitation program with respect to this pain.

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## REFERENCES

1) Zhang W, Jones A, Doherty M: Does paracetamol (acetaminophen) reduce the pain of osteoarthritis? A meta-analysis of randomized controlled trials: Ann Rheum Dis, 2004, 63: 901–907.
2) Rosemann T, Joos S, Szecenyi J, et al.: Health service utilization patterns of primary care patients with osteoarthritis. BMC Health Serv Res, 2007, 7: 169.
3) Domonick KL, Ahern FM, Gold CH, et al.: Health-related quality of life and health service use among older adults with osteoarthritis. Arthritis Rheum, 2004, 51: 326–331.
4) Perrot S, Poiraudeau S, Kabir M, et al.: Active or passive pain coping strategies in hip and knee osteoarthritis? Results of a national survey of 4,719 patients in a primary care setting. Arthritis Rheum, 2008, 59: 1555–1562.
5) Dijk GM, Veenhof C, Shellevis F, et al.: Comorbidity, limitations in activities and pain in patients with osteoarthritis of the hip or knee. BMC Musculoskelet Disord, 2008, 9: 95.
6) Zhang W, Moskowitz RW, Nuki G, et al.: OARSI recommendations for the management of hip and knee osteoarthritis, part I: critical appraisal of existing treatment guidelines and systematic review of current research evidence. Osteoarthritis Cartilage, 2007, 15: 981–1000.
7) VanWye WR: Patient screening by a physical therapist for nonmusculoskeletal hip pain. Phys Ther, 2009, 89: 248–256.
8) Hernandez-Molina G, Reichenbach S, Zhang B, et al.: Effect of therapeutic exercise for hip osteoarthritis pain: results of a meta-analysis. Arthritis Rheum, 2008, 59: 1221–1228.
9) Hess WE, Umber JS: Total hip arthroplasty in chronically dislocated hips. Follow-up study on the protrusion socket technique. J Bone Joint Surg Am, 1978, 60: 948–954.
10) Mont MA, Marker DR, Smith JM, et al.: Resurfacing is comparable to total hip arthroplasty at short–term follow–up. Clin Orthop Relat Res, 2009, 467: 66–71.
11) Khan NQ, Woolson ST: Referral patterns of hip pain in patients undergoing total hip replacement. Orthopedics, 1998, 21: 123–126.
12) Kawada T, Ushida T, Ikeuchi M, et al.: Clinical study of hip joint referred pain. Pain Research, 2006, 21: 127–132.
13) Cummings M: Referred knee pain treated with electroacupuncture to iliopsoas. Acupunct Med, 2003, 21: 32–35.
14) Nakamura J, Oinuma K, Suzuki C, et al.: Frequency distribution of pain in osteoarthritis of the hip. Clin Orthop Surg, 2006, 41: 991–994.
15) Galea MP: Neuroanatomy of the nociceptive system. In: Pain; a Textbook for Therapists. Philadelphia: Elsevier, 2002, pp 13–41.
16) Farrell MJ, Gibson SJ, McMeeken JM, et al.: Increased movement pain in osteoarthritis of the hands is associated with A beta-mediated cutaneous mechanical sensitivity. J Pain, 2000, 1: 229–242.
17) Johansson HR, Bergschmidt P, Skripitz R, et al.: Impact of preoperative function on early postoperative outcome after total hip arthroplasty. J Orthop Surg, 2010, 18: 6–10.
18) Rubin TK, Gandevia SC, Henderson LA, et al.: Effects of intramuscular anesthesia on the expression of primary and referred pain induced by intramuscular injection of hypertonic saline. J Pain, 2009, 10: 829–835.