Histopathological Evaluation of posterior cruciate ligaments in patients with RA undergoing total knee arthroplasty
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Introduction: Many surgeons use Posterior substituted type (PS) total knee arthroplasty (TKA) for the treatment of knee joint in patients with rheumatoid arthritis (RA), because posterior cruciate ligament (PCL) may not have sufficient functions due to its degenerative changes. Laskin and O’Flynn suggested that CR design is not appropriate for TKA in RA patients since a long- term follow up has shown the higher rate of instability in their knees. Furthermore, histopathological and biomechanical study proved that PCLs in OA and RA knee is vulnerable to a mechanical force. Therefore, selection of prosthetic design (PS or CR type) for the treatment of knee joints in patients RA is still controversial. However, favorable long-term outcomes are reported using cruciate retaining (CR) type prosthesis. Therefore, selection of prosthetic design (PS or CR type) for the treatment of knee joints in RA patients is still controversial. The purpose of this study is to test the hypothesis that PCLs with degenerative RA knees has histological and biomechanical study proved that PCLs in OA and RA knee is vulnerable to a mechanical force. Therefore, selection of prosthetic design (PS or CR type) for the treatment of knee joints in patients RA is still controversial. However, favorable long-term outcomes are reported using cruciate retaining (CR) type prosthesis. Therefore, selection of prosthetic design (PS or CR type) for the treatment of knee joints in patients RA is still controversial. The purpose of this study is to test the hypothesis that PCLs with degenerative RA knees has histological normal ligaments.

Materials and Methods: From 2003 to 2007, 24 knees, 14 for right and 10 for left with degenerative changes in 21 RA patients were treated with TKA using Scorpio Superflex PS (Stryker, USA). Three patients were treated with bilateral TKA. The patients composed of 2 male and 19 female. The mean age of the patients at the time of surgery was 66±8 (range, 51-77) years. The mean duration of RA disorder was 14±7 (range, 4-24) years. No patients had previous knee injuries prior to TKA.

The surgery was performed using midvastus approach. After total synovectomy and bone cutting, components were implanted with cement. ACLs and PCLs were harvested from the femur and tibia at the closest to the attachment site. These specimens were fixed with 10% formalin and were paraffin embedded. Histological sections were longitudinally sliced. Histology was performed under the light microscopy using Hematoxylin-eosin staining. The degenerative changes of PCLs were classified based on following histopathological findings; 1. proliferation of synovium around the ligament parenchyma; 2. cell infiltration into the ligament; 3. proliferation of the vascular tissues in the ligament; and 4. disrupted fiber formations and/or organization of lymphoid follicles in the ligament. These specimens were classified into two groups; Group A was defined as specimens with none or one microscopic finding as described above. Group B, which was decided to have considerable inflammatory changes, was of specimens with two or more findings. Clinical data of the Group A including age at the operation, disease duration of RA, age at the onset of RA, radiographic findings of knee joints, biochemical testing were compared with that of Group B to assess the impact of the degenerative change on the ligament. Degeneration change in the Radiograph was evaluated by the Larsen’s grade and biochemical tests for peripheral blood including C-reactive protein (CRP) and serum matrix metalloproteinase-3 (MMP-3) was investigated.

Results: There were 8 (33%) knees in Group A and 16 knees (67%) in Group B. There were no ruptured PCL ligaments in macroscopic findings, although, microscopic findings showed ligaments of the Group B had strong inflammatory changes compared to that of Group A. The mean duration of disease period with RA was 14±5.7 (range, 7-22) years in Group A and 15±8.3 (range, 4-28) years in Group B. The mean age at the time of onset with RA was 46±10 (range, 30-58) years in Group A and 54±11 (42-73) years in Group B. The mean duration of RA and age at the onset of RA had no significant differences between two groups (p=0.89 and 0.10 respectively). However, Mean age at the time of operation in group B (69±7, range50-67: p<0.05). The biochemical testing showed following results; CRP was 3.3±3.0 in Group A and 3.4±3.3 in Group B, there were no significant differences between two groups, however, MMP3 in Group B (598±115) was higher than that of group A (228±43) (p<0.05). Radiograph of the two groups were evaluated by using Larsen’s Grade. In Group A, there were 2 knees in stage3, 3 knees in stage4, and 3 knees in stage5. In Group B, there were 6 knees in stage3, 10 knees in stage4, and 6 knees in stage5. Radiograph evaluation between two groups had no significant differences.

Discussion: CR designed TKA has some advantages including femoral normal roll back movement, quadriceps power retention, and normal gait on stair ascending and descending, and bone retention. In this study, the percentages of the PCLs that have degenerative changes of RA were 67%. We suggest that good outcomes seemed to be obtained by the surgeon’s proper selection of patients. This study indicates high levels of serum MMP3 and advanced age may be associated with the risk factor of the PCL insufficient knee. Distractive knees of the patients with advanced age that has high level of serum MMP3 should be treated with PS type prosthesis to avoid following instability. However, CR type TKA may be the alternative option to treat RA knee in young patients who have good clinical course by the medical therapy as to the biological agent.

References: