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Diffuse Pigmented Villonodular Synovitis of the Knee: Case Report

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Diffuse pigmented villonodular synovitis (PVNS) is an uncommon aggressive synovial proliferative disorder of unknown etiology affecting the joint linings. Though a histologically benign inflammatory process, because of its aggressive growth with bone destruction or recurrence, it is frequently suggested to occur as a low malignant neoplasm. Optimal treatment is surgery, but the local recurrence rate after radical synovectomy for diffuse PVNS is relatively high due to the infiltrative growth pattern. External beam radiotherapy with moderate doses or intra-articular instillation of radioactive isotopes may improve the likelihood of local control and long-term function in patients with incompletely resected or recurrent diffuse PVNS. I report one case of diffuse PVNS of the right knee joint treated with arthroscopic synovectomy and external beam radiotherapy is presented.

Key Words: Diffuse pigmented villonodular synovitis, Arthroscopic synovectomy, Radiotherapy

Pigmented Villonodular Synovitis (PVNS) is a rare destructive fibrohistiocytic proliferation with production of villus and nodular protrusions in synovial membrane. The disease was first described as a distinct entity in 1941.[1)]

The disease is an inflammatory reaction of the synovium: however, some evidence exists that it is a benign neoplastic process. Also, because of its aggressive growth with bone destruction or redivism, it is suspected on neoplasm of low malignant potential.[2)]

Types of PVNS classified the entity into three categories on the basis of clinical presentation by Granowitz et al[3)]; Isolated type, localised and diffuse pigmented villonodular synovitis. In both the localized and diffuse subtypes, the knee is the most commonly affected joint (about 80 percent of patients), followed by the hip, ankle, small joints of the hands and feet, shoulder and elbow.[3)] Patient commonly presents with swelling, locking and local discomfort of chronic duration and insidious in onset. The typical clinical course consists of regions of stiffness, erythema and palpable mass.

Treatment of choice for PVNS is the removal of the affected tissue by open or arthroscopic synovectomy. For diffuse PVNS, relapse rates of 8~56% have been reported,[4)] adjuvant therapy such as radiotherapy are considered, but the role of radiation therapy is not clear. Radiotherapy can be considered in patients with previous adequate resection of disease who experience local relapse and in patients with a large amount of disease in whom complete resection is not possible. This paper report on a case of diffuse pigmented villonodular synovitis patient who underwent radiotherapy after radical synovectomy.

Case Report

A woman first noticed left knee pain in 2004, when she was 37 years of age. Pain began insidiously, without a history of preceding trauma or infection. During the following one and half year, the knee became more painful, with intermittent swelling and locking when she went up and down the stairway. Clinical evaluation was done by her family doctor in April 2006, which include physical exam, laboratory test, radiographs of the both knees and fluid aspiration of the right

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knee. For further evaluation, patient was referred to Dankook University Hospital. On physical examination, swelling and tenderness was observed on the right knee. The results of pre-operative knee X-ray and knee MRI showed joint effusion and thickened joint capsule was located at right knee (Fig. 1). Patient had undergone arthroscopic synovectomy in 10, April 2006. At that time, multiple reddish-brown colored villous nodular synovium was found in the right knee joint, and it was full-filling the joint cavity (Fig. 2). Microscopically, there was mononuclear stromal cell infiltrate in the synovial membrane and hemosiderin-laden macrophages gave the characteristic brown color. Additional cell populations include foam cells and multinucleated giant cells (Fig. 3). So, the final pathologic diagnosis was pigmented villonodular synovitis. Because of obvious residual synovialitic foci, post-operative adjuvant radiotherapy was planned 3 weeks after operation. CT-based three-dimensional treatment planning system was used. Patient underwent radiotherapy in the supine position using a linear accelerator and 6 MV photons. The portals were anterior and two opposed lateral, with field sizes covering the entire joint space, administering 5 fractions of 1.8 Gy per week, total 20 fractions to the right knee lesion. The total dose was 36 Gy, over a period of 36 days and there were no treatment related acute toxicity. After radiotherapy, follow-up evaluation took place monthly for 3 months and then biannually follow-up evaluation, included physical examination, orthopedic examination, determination of blood counts, knee x-ray films, and MRI. On initial knee MRI, 1 month after completion of radiotherapy, there was marked improved evidence of pigmented villonodular synovitis, but was still noted PVNS with hemorrhage in the posterolateral aspect of femur, the remnant site on the synovectomy. The last knee MRI revealed slightly improved PVNS of right knee, but still remained synovial mass with hemorrhage in the same site, compared to previous MRI (Fig. 4). Fourteen months after completion of radiotherapy, there was no relevant long-term

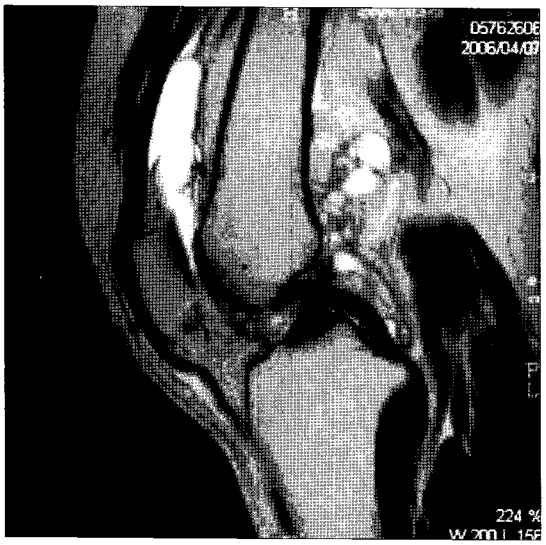

Fig. 1. Initial MR image, Knee MRI shows thickened joint capsule, joint effusion and nodular synovial hypertrophy.

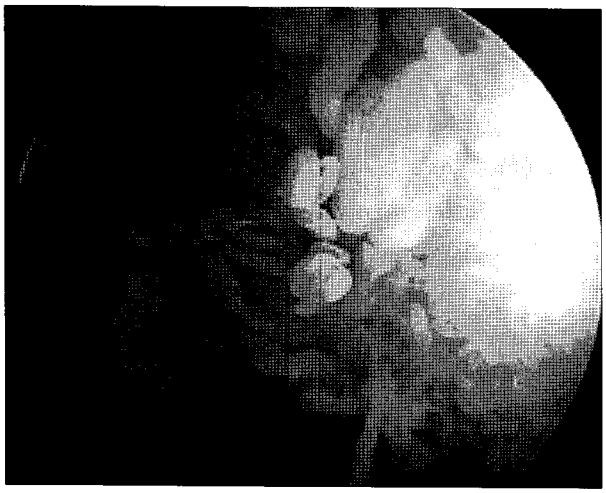

Fig. 2. Arthroscopic image, shows thickened, reddish-brown synovium with numerous villous projections in the knee joint space.

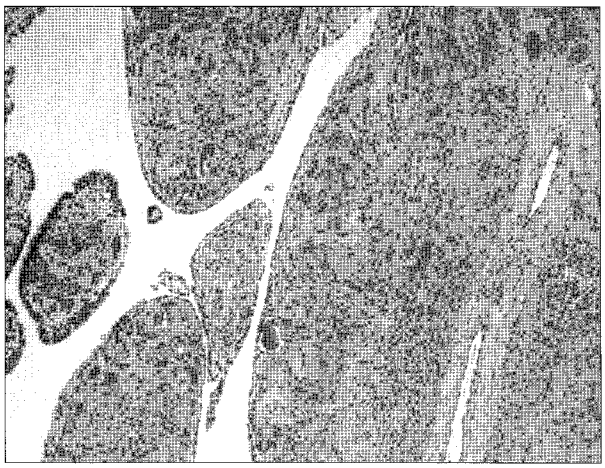

Fig. 3. Microscopic finding of pigmented villonodular synovitis H&E stain (×100); Light microscopic view shows villows structure covered by synovial cells and sheets of rounded synovium-like cells admixed with multinucleated giant cells in stroma.

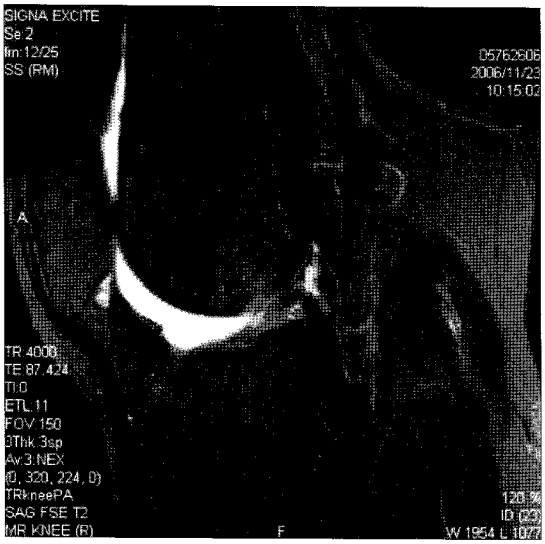

Fig. 4. Six months after completion of radiotherapy. MRI shows marked improvement of synovial thickening and nodularity.

soft tissue complications such as fibrosis. The patient was not required additional treatment and was doing well without limitation of the right knee movement until last follow-up.

Discussion

Pigmented Villonodular Synovitis is an uncomon locally aggressive disease characterized by hyperplastic synovium, large effusions and bone erosion. In 1941 Jaffe, Lichtenstein and Sutro introduced the term.[1] Their paper, based on clinical and pathological experience with twenty cases involving joints, tendon sheaths and bursae, is still the definitive account of the condition. They observed that the nodular and diffuse lesions were histologically similar, and suggested that they were part of the same disease process. The benign course, as well as the histological appearance of the lesions, led them to conclude that the condition was not a tumour, but an inflammatory response to an unknown agent. But recently, some reports suggest that the pigmented villonodular synovitis is a neoplastic origin due to invasive growth and a tendency to recur.[5]

In patients with pigmented villonodular synovitis of the knee, plain radiographs often appear normal. However, radiographic findings in diffuse disease can include a peri-articular soft tissue density (in up to 80 percent of patients), expansion of the suprapatellar pouch and local osseous changes mainly confined to the patellofemoral articulation.[6] The changes at the patellofemoral joint result from abnormal patellar tracking because of the synovial mass lifting and stretching the extensor mechanism, thereby allowing shear forces to act on the articular cartilage. Osteopenia is occasionally found, and degenerative changes may be detected in 30 to 40 percent of the patients.[14] In patients with diffuse pigmented villonodular synovitis of the knee, magnetic resonance imaging (MRI) may show a large effusion, low signal intensity on both T1- and T2-weighted images (because of hemosiderin deposition), hyperplastic synovium and occasional bony erosions.[7]

The diagnosis of pigmented villonodular synovitis is confirmed by biopsy of the synovium. Treatment of choice is synovectomy. Associated bony lesions should be carefully curettaged, and bone grafting should be performed as necessary. Synovectomy may not relieve all symptoms in patients with significant destructive changes in the joint. In these situations, arthrodesis or total joint replacement should be considered. A report on series of 11 patients with active diffuse pigmented villonodular synovitis of the knee treated with synovectomy and total knee arthroplasty showed a local control rate of approximately 70 percent and good to excellent joint function at a mean follow-up period of 10.8 years.[8]

Diffuse pigmented villonodular synovitis has a high rate of local recurrence (8~56%), depending on the resection status.[2,4] Although radiotherapy for diffuse PVNS has been performed for the past 60 years, only small series has been published. Most reports, radiotherapy has been mainly used as a postoperative adjuvant treatment option. Two types of radiotherapy in the form of external beam radiation therapy and intra-articular instillation of radioactive colloids have been described in the literature.

In intra-articular Instillation of radioactive colloids for diffuse PVNS have shown debating outcome. Kat et al, reported on 11 cases treated with synovectomy followed by injection of yttrium-90 (a beta emission colloid) or Re-186. One year after the treatement, 9 of 11 cases (82%) were locally controlled and all cases experienced symptomatic improvement.[9] Sabat et al, reported on 10 cases with diffuse PVNS who underwent resection followed by intra-articular injection of 15 to 25 mCi of yttrium-90. After median 4.5

years follow-up period, local control was obtained in 9 of 10 cases and no severe complications were obsereved.[10] But in the report of Chin et al, the 40 cases treated with open synovectomy alone or followed by 300 mCi intra-articular dysprosium 165 or external beam RT consisted 35 to 45 Gy over 3 to 4 weeks, the local failure rates were 17% and 4 cases (10%) experienced problems with wound healing after surgery.[11] Radiation synovectomy has several advantages over surgical synovectomy. It is a relatively simple, and is more acceptable to patients than operation. Additionally, the risk of complication is less, and hospitalization is reduced. But the value of intra-articular instillation of radioactive colloids has had limited clinical acceptability because of earlier reports of radiation induced chromosomal damage in rheumatoid patients undergoing treatment. Recently used yttrium 90 has more favorable radiophysical characteristics, the absence of gamma radiation as well as good penetration of beta radiation. Also it's side effects are few, predictable, and for the most part, avoidable.[12]

External beam radiotherapy is an alternative to intra-articular instillation radioactive colloids. O'Sullivan et al, reported on 14 cases with residual mass treated with postoperative RT to a total dose 35 Gy in 15 fractions. All cases, except one, had complete remission.[13] In a study by Ustinova et al, 24 cases with diffuse PVNS of the knee underwent radical synovectomy and postoperative adjuvant radiotherapy with a total dose of 16~20 Gy. 23 cases (96%) remained free of recurrence at a follow-up of 6~72 months.[14] In my case, radiotherapy started 3 weeks after arthroscopic synovectomy, and 3 field technique are need to encompass joint space with 6 MV photon. The optimal radiation dose in the PVNS is not established because of the rarity of this disease and randomised trials are lacking. In contemporary reports, radiation dose was in the range of 20~35 Gy. In this case, total of 36 Gy in 20 fractions was delivered to the right knee joint space for grossly remnant mass lesion.

Generally, no definite evidence is available of the superiority of additional radiotherapy compared to surgery alone in the management of diffuse PVNS. Due to it's rarity of this disease, prospective randomised trials are lacking, but some retrospective studies compare surgery alone versus surgery followed by postoperative radiotherapy. Brien et al, reported on 11 cases with PVNS of the foot and ankle treated with surgery alone or surgery followed by postoperative radiotherapy, 5 cases with primary lesions underwent synovectomy; 4 were locally controlled and remaining one case was successively salvaged with a operation. All 5 cases were disease free 3 to 15 years. 6 cases with recurrent PVNS underwent synovectomy alone (2 cases) or additional radiotherapy (36~40 Gy in 20~25 fractions); All 6 cases remained disease free for 18 to 81 months, and no patients experienced a radiotherapy induced complication.[15]

Conclusively, diffuse pigmented villonodular synovitis of the knee is a rare benign, but locally destructive disease with significant potential for severe joint and limb morbidity. The treatement of choice is synovectomy. The indication criteria for the postoperative treatment of diffuse PVNS are vague. But the instillation of radioactive colloids or moderate dose of external beam radiation therapy may improve the possibility of local control for patients with incompletely resected PVNS, unsuitable for surgery or after recurrence. Further multi-institutional investigated publications with regarding this rare disease is needed to determine the optimal dose and indication criteria of the radiotherapy.

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국문초록

무릎 관절의 미만형 색소 융모 활액막염: 증례 보고

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최 상 규

미만형 색소 융모 결절성 활액막염은 관절에 영향을 미치는 원인이 밝혀지지 않은 활액막의 증식성 질환으로 조직학적으로는 양성 염증성 소견을 보이지만 골 파괴나 공격적인 성장, 재발 등의 특성으로 저 등급의 악성 종양으로 간주되기도 하는 질환이다. 활액막 절제술이 가장 표준적인 치료이지만 미만형의 경우 주변조직으로 침윤하며 성장하는 경향 때문에 수술 후 재발률이 상대적으로 높다. 불완전 절제가 시행된 경우, 재발한 경우 저선량의 외부방사선 치료나 방사선 동위원소를 이용한 관절강 내 방사선치료를 시행하여 국소 조절율이나 관절 기능의 향상을 얻을 수 있다고 보고되고 있다. 저자는 우측 무릎 관절에 발생한 미만형 색소 융모 결절성 활액막염으로 관절경을 이용한 활액막 절제술 후 외부 방사선치료를 시행한 1예를 경험하였기에 문헌 고찰과 함께 이를 보고하고자 한다.

핵심용어: 미만형 색소 융모 결절성 활액막염, 관절경적 활액막 절제술, 방사선치료