Osteochondritis dissecans (OCD) is defined as a focal lesion of subarticular bone in which articular cartilage is characterized by fragmentation and possible separation in a joint. The etiology is uncertain, although trauma and ischemia have been implicated. It most commonly affects the knee joint, followed by the elbow and the ankle joints. OCD typically occurs during adolescence or early adulthood, with joint pain and swelling that worsens with activity. From January 2001 to December 2008, 11 patients with OCD were diagnosed using conventional radiographs and magnetic resonance imaging (MRI). There were seven lesions affecting the knee joint, two lesions in the elbow and two lesions in the ankle, respectively. According to MRI results, two cases were classified as stage I; two cases were classified as stage II; three cases were classified as stage III; and four cases were classified as stage IV. All lesions were confirmed by arthroscopy and pathology.

MATERIALS AND METHOD

Magnetic resonance imaging (MRI) records of eleven patients with osteochondritis dissecans of different joints from January 2001 to December 2008 were collected. The age of these patients ranged from 13 yr to 35 yr (mean age: 24 yr). Ten patients were male, and one was female. All patients had received conventional radiographs (anteroposterior and lateral views) and MRIs (Siemens Magnetom Symphony, 1.5T) without intravenous injection of contrast medium. MRIs were configured on T1-weighted spin-echo (520–700/12–20; repetition time in sec/echo time in sec) and T2-weighted spin echo (2900–3200/96–108). Conventional radiography images and MRIs were compared.

RESULTS

Among the 11 patients, there were seven lesions in the knee, two in the elbow, and two in the ankle. No patient had multiple lesions in our study. Seven lesions were completely detected and free in the joint.
(five in the knee and two in the ankle). Two lesions were incompletely detected (both in the elbow). Two lesions were in situ (both in the knee). The right knee was affected more often than the left at a ratio of 5 to 2. Six of the lesions occurred on the lateral aspect of the medial femoral condyle. One lesion in the lateral femoral condyle occurred on the weight-bearing surface (Fig. 1). The OCDs in the elbow were located at the lateral condyle of distal humerus of the right elbow. Two lesions in the left ankle were located at the medial aspect of talar dome (Table 1).

The clinical symptoms of these patients included joint pain or discomfort and swelling and locking that limited the motion of the joint.

Radiographic features revealed well-circumscribed areas of sclerotic subchondral bone separated from the remainder of the epiphysis by a radiolucent zone.

MRIs can provide information about the size, stability, and viability of the subchondral fragments. High signal intensity between the fragment and the subchondral bone on T2-weighted (T2W) images signified separation of osteochondral fragment and host bone by synovial fluid.

All lesions were proven to be OCD by arthroscopy or surgery.

**DISCUSSION**

The incidence of OCD in the general population is estimated to be 15 to 30 cases per 100,000 persons. Although rare, it is recognized as an important cause of joint pain in active adolescents [2].

The clinical condition known as osteochondritis...
Table 1. Eleven cases of OCD recorded between January 2001 and December 2008.

<table>
<thead>
<tr>
<th>Case</th>
<th>Med history</th>
<th>Clinical symptoms</th>
<th>X-ray</th>
<th>MRI</th>
<th>Treatment</th>
<th>Surgical findings</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>33 yr M</td>
<td>Motor cycle accident 6 mo prior</td>
<td>Acute right knee tenderness for 2 weeks</td>
<td>Sclerotic subchondral bone separated from the epiphysis by a radiolucent line</td>
<td>Unstable OCD of the lateral femoral condyle with high SI line and cystic area beneath the fragment noted in sagittal T2WI. The lesion was demarcated from underlying subchondral bone with apparent separation of the articular surface. (Stage III)</td>
<td>Operation</td>
<td>A 1-cm defect of the lateral femoral condyle. Free bone fragment in the joint space. Joint effusion. Subtle subchondral fracture.</td>
</tr>
<tr>
<td>#2</td>
<td>15 yr M</td>
<td>Trauma (knee) during playing basketball 1 yr prior</td>
<td>Right knee pain for 2 mo</td>
<td>No significant finding</td>
<td>Subchondral defect with high SI noted in coronal T2WI. Intact articular mantle was noted. Depressed osteochondral fracture. (Stage I)</td>
<td>Cast</td>
<td>N/A</td>
</tr>
<tr>
<td>#3</td>
<td>16 yr M</td>
<td>Runner with trauma history ~2 yr prior</td>
<td>Right knee swelling and rigidity for 3 mo</td>
<td>Sclerotic subchondral bone separated from the epiphysis by a radiolucent line</td>
<td>A focal defect in the cartilage and subchondral bone region of the medial femoral condyle of the right knee. Markedly joint effusion was found. (Stage IV)</td>
<td>Operation</td>
<td>A 1.5-cm defect of the medial femoral condyle. Free bone fragment in the joint space. Subchondral fracture. PCL partial tear.</td>
</tr>
<tr>
<td>#4</td>
<td>13 yr M</td>
<td>No significant trauma history</td>
<td>Right knee tenderness for 1 mo</td>
<td>No significant finding</td>
<td>Subchondral defect with high SI noted in coronal T2WI. Intact articular mantle was noted. Depressed osteochondral fracture. (Stage I)</td>
<td>Cast</td>
<td>N/A</td>
</tr>
<tr>
<td>#5</td>
<td>20 yr M</td>
<td>Traffic accident 3 yr prior</td>
<td>Right knee painful swelling for 6 mo. Range of motion was limited.</td>
<td>Sclerotic subchondral bone separated from the epiphysis by a radiolucent line</td>
<td>T2WI sagittal view shows large focal defect in the weight-bearing portion of the articular surface of the right knee. (Stage IV)</td>
<td>Operation</td>
<td>A 1-cm defect noted at the medial femoral condyle. Free bony fragment in the joint. Joint effusion</td>
</tr>
<tr>
<td>#6</td>
<td>22 yr M</td>
<td>Soccer player: ACL Injury 2 yr prior (treated with cast)</td>
<td>Left knee swelling, stiffness for 1 mo</td>
<td>Sclerotic subchondral bone separated from the epiphysis by a radiolucent line</td>
<td>T2WI sagittal view shows high SI lines at the articular surface of an articular fracture. Ill-defined line of high SI beneath the OCD lesion. Loose body noted in the joint space on T2WI. (Stage IV)</td>
<td>Operation</td>
<td>A 0.6-cm free bone fragment in the joint space. Joint effusion. Medial collateral ligament tear, partial.</td>
</tr>
<tr>
<td>#7</td>
<td>15 yr M</td>
<td>No known trauma history</td>
<td>Left knee rigidity for 3 mo</td>
<td>Sclerotic subchondral bone separated from the epiphysis by a radiolucent line</td>
<td>Large focal defect over the articular surface and subchondral region noted by T2WI with coronal and sagittal view. Loose body noted in the joint space on T2WI (Stage IV)</td>
<td>Operation</td>
<td>A 1.2-cm bony fragment freely in the joint space. Bony defect noted at the medial femoral condyle. Joint effusion.</td>
</tr>
<tr>
<td>#8</td>
<td>18 yr M</td>
<td>Injury playing basketball 2 yr prior</td>
<td>Right elbow swelling and off for 2 yr</td>
<td>Radiolucency of the lateral portion of capitellum</td>
<td>T2WI coronal MR image shows transchondral fracture of the capitellum. No evidence of osteochondral fragment displacement is present. Partial detachment of the fragment seen on T2WI. (Stage II)</td>
<td>Cast. Limitation of extension</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Osteochondritis dissecans imaging features of osteochondritis dissecans

Osteochondritis dissecans connotes the development of an osteochondral fragment of an articular cartilage on the underlying bone at the superficial surface of a diarthrodial joint [3, 4, 5]. The osteochondral fragment may be in situ, incompletely detached, or completely detached and free within the joint. In our study, seven lesions were completely detached and floated free within the joint. The affected patients were most frequently males in the second decade of life. The most commonly affected joint was the knee joint; however, other less common sites included the capitellum of the elbow and the talar dome of the ankle. Although lesions in the shoulder, hand, wrist, and hip joints have also been reported, such lesions are rare [2, 6, 7, 8]. Within the knee, OCD lesions occur at the medial femoral condyle (80–85% of cases), the lateral femoral condyle (10–15% of cases), and the patella (5% of cases) [5, 8]. Within the medial femoral condyle, the lesion is most commonly observed on the lateral, non-weight-bearing surface. In our study, six of the lesions occurred on the lateral aspect of the medial femoral condyle, one in the lateral femoral condyle on the weight-bearing surface. In the elbow joint, the commonly affected area is the anterolateral aspect of the capitellum. Singer and Roy proposed that repeated valgus stress and a tenuous blood supply within the capitellum explain the frequent occurrence of OCD in this location [9]. In the ankle joint, OCD occurs more frequently in the talus followed by the tibial plafond at a ratio of 4 to 44. The usual sites of OCD of the talar dome occur in the posteromedial aspect (56% of cases) and the anterolateral aspect (44% of cases) of the talus. Occasionally, opposing osteochondral defects in the talus and distal tibia may occur, suggesting trauma as a potential cause of both lesions.

There are many etiologic theories or associated factors regarding OCD. Genetic predisposition, ischemia, repetitive trauma, and abnormal ossification...
have all been proposed as causes of OCD [3, 6, 8, 10]. While the etiology remains unclear, it is commonly believed the cause might be multifactorial, with repetitive shear and compressive forces playing primary roles. While trauma may be the starting point for the development of OCD, it is likely that vascular insufficiency ultimately leads to OCD. In rapidly growing bone, the blood supply in the epiphysis and secondary ossification center can be tenuous [1,6], and a single traumatic event or repetitive microtrauma may interrupt the vascular supply.

Symptoms typically present with poorly localized, aching pain and swelling starting after the injury. Symptoms of “locking” or “giving way” in a joint may develop as the disease progresses. Extension disability of the extremity may be the most important clinical sign. On physical examination, joint effusion, crepitus, and joint-line tenderness may be present. Patients with OCD in the knee may walk with external tibial rotation, and Wilson’s sign may be positive. The latter is elicited by flexing the knee to 90°, internal rotation of the tibia, and extending the knee, thus provoking pain [2].

Radiographically, OCD often has an associated characteristic roentgenographic appearance. Typically, the lesion consists of a round, well-defined radiolucency in subarticular bone (Fig. 1a, 2a). OCD in the posterior aspect of the medial femoral condyle may be missing on the anteroposterior film alone [2]. It is necessary to obtain at least three views—anteroposterior, lateral, and tangential—to localize the defect and to assess the size of the involved area. The older the patient and the longer the duration of the symptoms, the higher the likelihood that

Figure 3. Anteroposterior and lateral views of right ankle radiographs show osteochondritis dissecans lesions (arrows) in the medial talar dome (arrows).

4a

Figure 4. a. T1 weighted sagittal image shows a hypointense OCD in the dome of talus (arrow). b. MRI scan sagittal image shows hyperintense signal in the dome of talus (arrow) consistent with osteochondritis dissecans.

4b
the roentgenographic changes may progress to the occurrence of an osteodense zone in the base of the defect with irregularity or separation of the fragment with an irregular articular surface.

MRI is an effective imaging modality for evaluating the lesions because of its multiplanar capability and because it is an accurate method for staging the lesions (Fig. 1a, 2a). In our study, two lesions were staged; in situ lesions were not diagnosed by plain radiographic film.

MRI is able to delineate the fragment, the overlying cartilage, and the interface between the fragment and the parent bone. Unstable fragments visible using MRI may include one or more of the following findings on T2W or on short T1 inversion recovery (STIR) images: (1) linear, high signal intensity surrounding the fragment, (2) 5-mm or larger cystic changes between the fragment and the host bone, (3) a high signal intensity linear defect in the overlying cartilage, or (4) a focal, 5-mm or larger, cartilage defect.

MRI has been demonstrated to be helpful in preparative planning, to be useful as a prognostic indicator, and to have 97% percent sensitivity in detecting unstable lesions [11]. The T2W sequence is a sensitive method for evaluating the stability of an OCD [11]. Osteochondritis dissecans should be distinguished from acute chondral fracture and subchondral injury.

All cases of OCD should be staged for stability with radiography and MRI; stages I and II represent stable lesions, while stage III and IV represent unstable lesions where in cartilage is breached and synovial fluid separates the fragment and the underlying bone.

In our study, management of OCD included conservative treatment for stable lesions and surgical removal of fragment and mosaicplasty in unstable lesions. Arthroscopy is generally accepted for initial surgical management both as a diagnostic and/or a therapeutic means.

In this study, we correlated the radiographic and clinical findings of 11 cases of OCD and found that imaging modalities facilitated accurate diagnosis of OCD. The combination of the imaging modalities is helpful in both preoperative assessment and postoperative follow-up.

REFERENCES
分割性骨軟骨炎之影像表現

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分割性骨軟骨炎是一種發生在局部關節骨頭及其上軟骨的病變，它會造成分割性骨軟骨的
分裂或甚至分離，此疾病真正的原因未明，外傷及血流供應不足都是可能的原因，分割性骨軟
骨炎最常發生於膝關節，有時也會發生在腳踝和手肘。典型的症狀是青少年或青年的不明原因
關節腫痛，特別是在運動過後，我們收集了本院11位經由傳統X光和磁振造影診斷的病人，
其臨床症狀，顯位影像，核磁影像特徵及分期比較並列表。本篇文章將討論並呈現分割性骨軟
骨炎的影像學特徵以及臨床的表現。