



## Original Article

## Symptomatic ganglion cysts of cruciate ligaments of the knee: A series of nine cases



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## ABSTRACT

**Background:** Ganglion cysts of cruciate ligaments of the knee are uncommon, especially because a proportion of them are asymptomatic. Moreover, symptomatic lesions have diverse presentation and are not easily detected in physical examinations. The purpose of this report was to define the relationship between clinical symptoms and the sites of ganglia of cruciate ligaments of the knee.

**Materials and methods:** We conducted a retrospective review of a series of nine patients treated at our institute for intra-articular ganglion cysts of cruciate ligaments of the knee. One patient presented with pain and an inability to fully extend the knee. The remaining eight patients presented with nonspecific pain or pain during knee flexion and/or extension. The diagnosis and definite location of ganglia of cruciate ligaments were confirmed by arthroscopy. All patients were treated by ganglionectomy using arthroscopic techniques.

**Results:** Substantial cyst impingements were observed during knee motion using arthroscopy. At the last follow-up, all but one patient had achieved considerable symptomatic improvement after arthroscopic ganglionectomy.

**Conclusion:** We suggest that depending on cyst location, a more applicable hypothesis for knee joint pain during motion is cyst impingement on the other cruciate ligament or the intercondylar notch.

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## 1. Introduction

Intra-articular ganglion cysts of the knee are uncommon. The reported prevalence is 1.3% using magnetic resonance imaging (MRI) and 0.6% from knee arthroscopy measurements.<sup>1,2</sup> The first case of an asymptomatic ganglion of the cruciate ligament was reported by Caan et al in 1924 after autopsy of an elderly man.<sup>3</sup> In 1948, Levine et al described a ganglion of the anterior cruciate ligament (ACL) in a 23-year-old man who had experienced pain, effusion, buckling, and extension locking of the knee.<sup>4</sup> In 1988, Yasuda and Majima detected a ganglion of ACL using arthroscopy in a 44-year-old woman who had restriction of the last 20° of knee extension. In 1993, Maffulli et al described a ganglion of the ACL that occurred during squatting and/or with direction changes during running in three patients with knee pain. These ganglia were excised using arthroscopy.<sup>5,6</sup> In 1989, Kaempffe et al reported a case of a 12-year-old boy with pain, effusion, and extension locking of the knee; a ganglion at the femoral insertion

of the posterior cruciate ligament (PCL) was detected by arthroscopy.<sup>7</sup> In 1994, Allen et al described a ganglion located anterior to PCL, with impingement on the intercondylar notch that caused blocking of the last 15° of knee extension.<sup>8</sup> In 2006, Kazushige et al reported a ganglion positioned anterior to the proximal third of PCL in a 49-year-old man who experienced pain during both knee extension and flexion.<sup>9</sup> To our knowledge, these cases are the only reported symptomatic intra-articular ganglia of cruciate ligaments that are associated with restricted motion of knee joints.

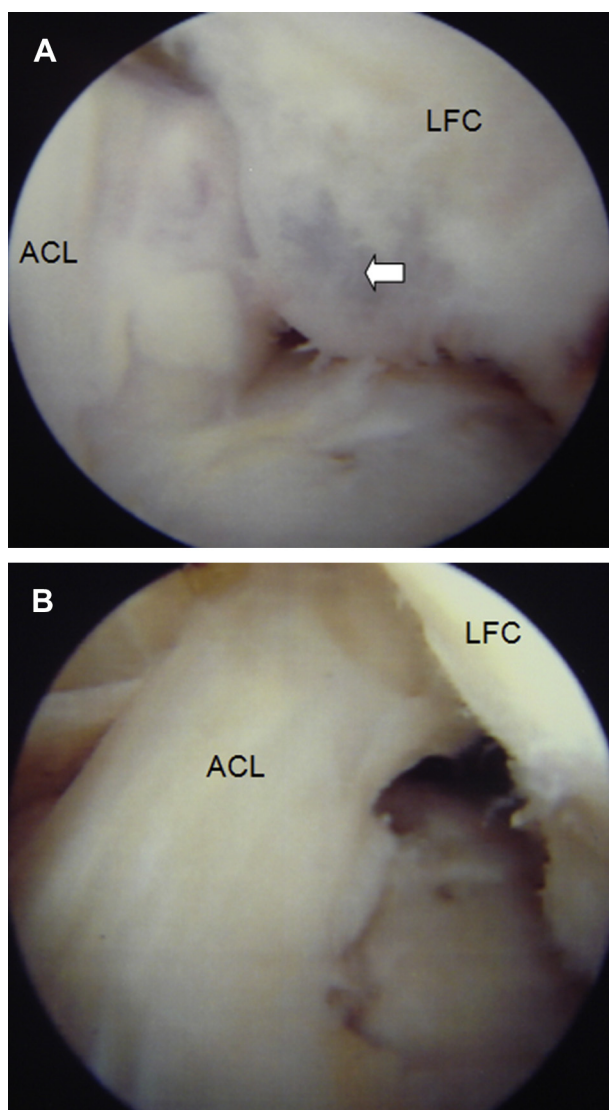
Ganglia usually occur in areas exposed to continuous mechanical stress. Among several hypothetical pathogenic mechanisms, mucinous degeneration of the connective tissue, herniation of the synovial tissue through defects in joint capsules or tendon sheaths, connective tissue degeneration after trauma, and ectopia of synovium have been suggested.<sup>1,8,10,11</sup> The reported symptoms included pain in the joint line, diffuse aching, sensations of discomfort, loss of terminal flexion and/or extension (mechanical locking), and recurrent effusions.<sup>2</sup>

In this study, we examined the relationship between clinical symptoms and the locations of ganglia of cruciate ligaments of the knee, and expected our results to contribute to future diagnosis.

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## 2. Materials and methods

Between 2006 and 2010, two surgeons at our institution treated nine patients with intra-articular ganglion cysts of cruciate ligaments, which were detected incidentally using MRI or arthroscopic examinations of symptomatic knees, and had been recorded in a database. Symptoms included both pain and mechanical block. The database was reviewed and arthroscopic data of six males and three females (average age, 34 years; 16–77 years) indicating definite locations of ganglia associated with cruciate ligaments and clinical presentation were examined. A single radiologist with expertise in musculoskeletal MRI interpreted all images. Diagnoses were confirmed by arthroscopy and histological examinations after arthroscopic ganglionectomy. Near total ganglionectomy was performed, and iatrogenic injury to underlying cruciate ligaments was avoided in all cases (Fig. 1). Patients with meniscal tears at the time of arthroscopy were treated with partial meniscectomy. All patients received biweekly postoperative follow-up care for at least 8 weeks at our outpatient department.



**Fig. 1.** (A) Arthroscopic view from the anterolateral portal showing a cyst along the middle portion of the anterior cruciate ligament. (B) View after arthroscopic ganglionectomy. ACL = anterior cruciate ligament; LFC = lateral femoral condyle; arrow = ganglion cyst.

## 3. Results

Preoperative conditions are shown in Table 1. Four of the nine patients had a history of antecedent trauma to their symptomatic knees, whereas the remaining five developed knee pain without any history of trauma. Pain was the general clinical presentation and was associated with knee extension in two cases, knee flexion in three cases, and nonspecific pain in four cases. Only one case presented with extension block of the affected knee. Four patients had concomitant knee lesions, two of whom had lateral joint line tenderness associated with lateral meniscal tears, one of whom had a positive patellar grind test associated with chondromalacia of the patellofemoral joint, and the remaining one case had diffuse degeneration of cartilage in the knee joint.

The arthroscopic findings showed that ganglia arose from ACL in five of the nine cases and from PCL in the other four cases. Substantial cyst impingement was observed within a certain range of knee motion in all of the nine cases. This finding is compatible with the clinical symptoms of knee pain during flexion and/or extension except the knees with concomitant lesions. The size of the ganglia varied from 6 mm to 26 mm in diameter, and all had thin walls filled with clear fluid that were consistent with preoperative MRI data that showed low signal intensity on T1-weighted images and high signal intensity on T2-weighted images (Fig. 2).<sup>12</sup> Diagnoses of ganglion cysts were confirmed by histology.

Postoperative results during biweekly postoperative follow-up for at least 8 weeks at our outpatient department showed painless knees in eight cases and persistent pain associated with concomitant lesions (chondromalacia of the patellofemoral joint) in the remaining case. No instability of affected knee was mentioned subjectively or revealed by physical examinations using Lachman test and posterior drawer test. The Lysholm score improved significantly from 71.56 to 88.33 after treatment.

## 4. Discussion

Male patients predominated in our series, which was consistent with previous other series.<sup>1,2</sup> PCL cysts have been reported as more common than ACL cysts,<sup>11</sup> and although ACL cysts in this study were found in five of the nine cases, the small number of cases preclude significant assessment of the relative prevalence of cyst locations. In addition, four of the nine cases had a history of antecedent trauma to their symptomatic knees, indicating that the etiology of some ganglia associated with cruciate ligaments may be traumatic. In fact, ganglia are usually located in areas under continuous mechanical stress.<sup>6,13</sup> With repeated activity in these areas, the collagen tissue undergoes mucoid degeneration with the formation of amorphous gelatinous materials.<sup>13</sup> Most cruciate ligaments rupture at midsubstance. Thus, we suggest that the midsubstance of cruciate ligaments is more susceptible to mechanical stress. This hypothesis was verified in our study, as most ganglia arose from the midsubstance of cruciate ligaments. Because the four patients with antecedent trauma to symptomatic knees had ACL cysts, we propose that ACLs are more susceptible to trauma and subsequent cyst formation. Varying percentages of concomitant lesions associated with intra-articular knee ganglia have been reported, although the highest reported prevalence was not more than 50%.<sup>1,2,6</sup> In our arthroscopic series, five of the nine patients did not have concomitant chondral or meniscal lesions in affected knees. Hence, we could not define the relationship between ganglion and other intra-articular knee lesions.

Several symptoms are associated with intra-articular ganglia of the knee.<sup>2</sup> These include pain on the medial and/or lateral joint lines, diffuse aching, mechanical locking, recurrent effusion, and tightness. Pain was a common clinical presentation in our study and was

**Table 1**  
Patients' data.

Case	Sex	Age (y)	Antecedent trauma	Clinical presentation	Ganglion location	Concomitant lesions	MRI	Postoperative outcome
1	Male	16	No	Diffuse pain and lateral joint line tenderness	Anterior to PCL middle portion	Complex tear of lateral meniscus	Positive	Relieved
2	Male	21	Sports injury with knee sprain	Flexion pain	Behind ACL middle portion	No	Positive	Relieved
3	Male	23	Sports injury with knee sprain	Diffuse pain	Anterior to ACL middle portion	No	Positive	Relieved
4	Male	24	No	Extension pain and block at 15°	Anterior to PCL middle portion	No	N/A	Relieved
5	Male	39	Dashboard contusion	Pain especially while climbing stairs	Behind ACL middle portion	Chondromalacia of the patellofemoral joint	Positive	Pain
6	Female	45	No	Flexion pain	Anterior to PCL middle portion	No	Positive	Relieved
7	Female	46	A nasty tumble with contusion	Flexion pain	Behind ACL at both ends	No	N/A	Relieved
8	Female	70	No	Extension pain	Anterior to PCL at the femoral end	Osteoarthritis	Positive	Relieved
9	Male	77	No	Diffuse pain and lateral joint line tenderness	Anterior to ACL at the femoral end	Complex tear of lateral meniscus	N/A	Relieved

ACL = anterior cruciate ligament; MRI = magnetic resonance imaging; N/A = not available; PCL = posterior cruciate ligament.

nonspecific or was associated with knee extension, flexion, motion and/or position. Four patients experienced nonspecific knee pain, one of whom had chondromalacia of the patellofemoral joint, and two of whom had meniscal tears. This observation seems to reveal that the cruciate ligament cysts with the concomitant lesions of the knee are prone to nonspecific symptoms. In the three patients with flexion pain, two had cysts posterior to ACLs, one had a cyst anterior to PCL, whereas none had a concomitant knee lesions. In the two patients with extension pain, cysts were found anterior to PCLs using arthroscopy, with one patient experiencing extension block caused by intercondylar notch impingement of the cyst. Seki et al suggested that cysts located anterior to the cruciate ligaments tended to limit knee extension, whereas those located posteriorly tended to limit flexion.<sup>9</sup> However, these tendencies were not confirmed in our study. In contrast, Girgis et al reported that the anterior portion of PCLs was stretched in the flexed position,<sup>14</sup> suggesting that ganglion cysts

**Fig. 2.** (A) Sagittal and (B) coronal T2-weighted magnetic resonance images of the knee showing a biloculated cystic lesion (arrow) in the intercondylar notch behind the anterior cruciate ligament.

attached anterior to PCL may cause limited motion or pain during flexion. Our results differ from those of Girgis et al. Several other articles have described the causes of knee joint motion pain associated with cruciate ligament cysts. Sumen et al reported that changes in the length and torsion of cruciate ligaments during knee motion may provoke traction or compression of the cyst, which could explain limitations in knee motion.<sup>15</sup> Kim et al suggested that changes in the shape and dimension of the ganglion with knee motion stimulates nerve endings in the synovial membrane, which causes knee pain.<sup>16</sup> In our study, the present observations of knee joint motion pain are that cysts located in the middle portion of cruciate ligaments cause impingement between ACLs and PCLs, or that those located near the femoral end of the ligaments cause impingement between the ligament and intercondylar notch. However, a mechanical block that limited the range of motion was found in only one of our nine cases, suggesting that both location and size of ganglia contribute to mechanical block.

Because of the diverse clinical presentations, we were unable to use a specific physical examination protocol to diagnose the presence of ganglia. Moreover, indicators of ganglia were masked by other intra-articular lesions of the knee in some cases. In our series, six of the nine cases received preoperative MRI of the knees, and all six were found to have intra-articular ganglia of cruciate ligaments. Hence, the positive predictive value of MRI was 100% in our study. To the best of our knowledge, computed tomography (CT) is not as sensitive as MRI in soft-tissue fields and not usually used in evaluating the pathology of the knee. The quality of ultrasound imaging is highly dependent on operator's skill, and the bony structure of the knee may be an obstacle. Therefore, we suggest that MRI is the optimal noninvasive method for diagnosing intra-articular knee ganglia of cruciate ligaments. Early authors reported a good outcome in the arthroscopic ganglionectomy.<sup>10</sup> Besides, CT-guided aspiration has been proposed for the treatment of ganglion cysts and represents a favorable alternative to ganglionectomy.<sup>11,17</sup> It is also likely to be more cost-effective, and to decrease morbidity considerably. However, compared with ganglionectomy, aspiration offers only limited access to deep-seated lesions, might allowing recurrence of ganglia, even if there have been no reports of recurrence. Eight of our nine patients achieved pain relief after arthroscopic ganglionectomy, with the remaining patient experiencing residual pain because of concomitant chondromalacia of the patellofemoral joint. Hence, most patients had excellent short-term results after arthroscopic ganglionectomy. Arthroscopy is also a minimally invasive procedure that allows identification of concomitant lesions and permits necessary treatment to be performed. We therefore consider arthroscopy as the appropriate method for treating ganglion cysts of cruciate ligaments of the

knee. It is well known that ganglia in general are likely to recur by nature of the lesion; however, the recurrence of the lesions is less likely to be observed during our limited follow-up periods. Even though the 8 patients who achieved pain relief after the procedure remained asymptomatic during their respective follow-up periods: 2 months in two cases, 3 months in four cases, and 6 months in two cases.

In conclusion, it is difficult to diagnose the ganglion cysts of cruciate ligaments of the knee because of its lack of specific symptoms and signs, but we found that the observations of cyst impingement, including mechanical block and pain during knee flexion and/or extension, are the useful diagnostic indicators.

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