Two Stage Surgical Treatment of Acute Traumatic Knee Dislocation

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Purpose: The purpose of this study was to determine the effectiveness of a new two stage surgical treat-
ment for acute traumatic knee dislocation.

Materials and Methods: The study involved 15 knees in 14 patients treated between October 1997
and November 2001. The mean follow-up period was 24 months. In the first surgical stage, medial and/or
lateral ligament complexes were repaired or reconstructed within two weeks of the injury. In the second
surgical stage, once full range of motion was obtained 3-6 months later, anterior or posterior cruciate
ligaments (ACL or PCL) were reconstructed if significant laxity was present. The final outcomes were
assessed using stress X-rays, range of motion and Lysholm score.

Results: There were ten cases of MCL tear and eight cases of LCL tear. All MCL and LCL injuries were
either repaired or reconstructed. All cases had both ACL and PCL tears. Following the first stage of
MCL/LCL surgery, the second stage surgery of ACL or PCL reconstructions was deemed to be neces-
sary in three and seven cases, respectively. Five cases did not require ACL or PCL reconstruction. In
stress X-rays at the last follow up examination, MCL, LCL, ACL and PCL instability was graded as 0 or 1
in 15, 14, 15 and 11 cases, respectively. PCL instability was graded as 2 in four cases. The mean postop-
erative Lysholm score was 87.6 points.

Conclusion: The two stage surgical approach described here resulted in good outcomes for patients
suffering from acute knee dislocation patients in terms of range of motion and stability.

Key Words: Knee dislocation, Two stage surgical treatment

Although acute traumatic dislocation of the knee is unco-
mmon, rapid and accurate diagnosis is required to determine
the extent of injury to soft tissue, ligaments, the popliteal
artery and the tibial and peroneal nerves'.

Surgical treatment has been recommended for multiple
ligament injuries following knee dislocation. The simulta-
eous reconstruction of anterior cruciate ligament (ACL) and
posterior cruciate ligament (PCL) tears and the repair of col-
lateral ligaments or posterior cruciate ligament reconstruc-
tion and the repair of collateral ligaments are usually per-
formed'.

Despite various methods of treating knee dislocation, com-
plications such as instability, joint stiffness, and infection are
common due to the severity of the initial soft tissue damage,
additional operation and immobilization'.

To overcome the complications associated with knee dislo-
cation surgery, we devised a two stage surgical approach. In
the first stage, the collateral ligament complexes including
the posterolateral and posteromedial structures were repaired
or reconstructed. After the patient recovered full range of
motion, the second surgical stage involving ACL and/or PCL
reconstruction was performed, if necessary.

MATERIALS AND METHODS
This study involved 15 knees in 14 patients with acute
knee dislocations treated between October 1997 and November
2001. With a minimum follow-up period 20 months

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(mean 24 months), all cases were diagnosed by physical examination and radiographic imaging. Seven cases had ACL, PCL and MCL complex (MCL and posteromedial structures) ruptures; five cases had ACL, PCL and LCL complex (LCL and posterolateral structures) ruptures; and three cases had ACL, PCL, MCL and LCL complex ruptures. Patients with associated supracondylar femoral fractures and tibial plateau fractures were excluded from this study. Of the 14 patients, 12 were males and two were female. The mean age of the patients at the time of surgery was 30.4 years (range 20-51 years). In addition to knee dislocation, accompanying injuries included contralateral knee trauma (2 cases), head and cervical spine trauma (2 cases), ankle fractures (2 cases), ipsilateral and contralateral femoral fractures (1 case of each), fibula fractures (2 cases), hemothorax (1 case), pelvic bone fracture (1 case), and meniscal injuries (5 cases) (Table 1).

In the first surgical stage, repair or reconstruction of collateral ligaments was performed after swelling had subsided. With regards to the medial collateral complex, injuries to the deep medial collateral ligament (MCL), the superficial MCL and the posterior oblique ligament of the posteromedial structures were repaired. With regards to the lateral collateral complex, injuries to the lateral collateral ligament (LCL), lateral capsule, popliteal tendon, and popliteofibular ligament were repaired if possible, otherwise reconstruction was performed. Treatment for these posteromedial and posterolateral structures is very important for stability of dislocated knees. Rehabilitation after this first stage of surgery included splint immobilization at 40 degrees flexion in a position blocked to prevent posterior subluxation for 3 to 4 weeks followed by progressive knee exercises. Partial weight bearing crutch walking was allowed 6 weeks postsoperatively and full ROM was obtained at approximately 3 months. In case of persistent limitation of motion, arthroscopic adhesiolysis or manipulation under anesthesia was performed.

Once full ROM was obtained (3-6 months after the first surgery), the patient’s symptoms and stability cruciate ligament were reevaluated. Second stage surgery involving arthroscopic ACL or PCL reconstruction was performed only in cases with persistent instability.

Anteroposterior instability was evaluated by physical examination, and for objectivity, stress x-rays were also performed. Translation of less than 5 mm was classified as grade 1 instability, 5 to 10 mm as grade 2, and more than 10 mm was classified as grade 3. Also, ROM and Lysholm score were evaluated at the last follow up examination.

RESULTS

1. Types of ligament injuries

According to anatomical classifications, there were seven cases of ACL/PCL/MCL rupture, five cases of ACL/PCL/LCL rupture, and three cases of ACL/PCL/MCL/LCL rupture (Table 2).

2. Surgical treatment

All cases were reduced after standard reduction measures, with the exception of one case in which an open reduction was performed (Fig. 1). In the first surgical stage, all cases underwent collateral ligament repair (14 cases) or reconstruction (1 case) within 2 weeks of the injury. Of the 15 cases, seven underwent medial collateral complex repair, five underwent lateral collateral complex repair (4 cases) or reconstruction (1 cases), and three underwent both medial and lateral repair. In the second surgical stage, there were three cases of ACL reconstruction and seven cases of PCL reconstruction. No cases required both ACL and PCL surgery, and five cases did not require second stage surgery on either the ACL or PCL.

3. Functional evaluation

Lysholm scores ranged from 65 to 100 points with an average score of 87.6 points. One patient with severe quadriceps atrophy scored 65; when excluding this score, the average

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Table 1. Injuries in addition to knee dislocation

<table>
<thead>
<tr>
<th>Injury</th>
<th>No.</th>
</tr>
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<tbody>
<tr>
<td>Ankle fracture</td>
<td>2</td>
</tr>
<tr>
<td>Femur fracture</td>
<td>2</td>
</tr>
<tr>
<td>Fibular fracture</td>
<td>2</td>
</tr>
<tr>
<td>Hemothorax</td>
<td>1</td>
</tr>
<tr>
<td>Head &amp; C-spine injury</td>
<td>2</td>
</tr>
<tr>
<td>Meniscal tear</td>
<td>5</td>
</tr>
<tr>
<td>Pelvic fracture</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2. Anatomical classification of knee dislocations

<table>
<thead>
<tr>
<th>Injury</th>
<th>No. of cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL+PCL+MCL</td>
<td>7 (47)</td>
</tr>
<tr>
<td>ACL+PCL+LCL</td>
<td>5 (33)</td>
</tr>
<tr>
<td>ACL+PCL+MCL+LCL</td>
<td>3 (20)</td>
</tr>
</tbody>
</table>

ACL, anterior cruciate ligament; PCL, posterior cruciate ligament; MCL, medial collateral ligament; LCL, lateral collateral ligament.
Lysholm score for the remaining patients was 89.2 points. One patient complained of intermittent discomfort during daily activity. Every patient experienced mild pain and swelling during vigorous exercise.

4. Range of motion
All patients recovered full ROM, but three patients who had limited motion of 0-120°, 5-120° and 5-110° required arthroscopic adhesiolysis or manipulation under general anesthesia to recover full ROM.

5. Instability evaluation using stress radiography
In ten cases with initial medial instability, seven cases were classified as grade 0 and three cases were classified as grade 1 on stress x-rays at the last follow-up. In eight cases with initial lateral instability, five cases were classified as grade 0, two cases were classified as grade 1 and one case was classified as grade 2 at the last follow-up examination. In 15 cases with initial anterior instability, 12 cases were classified as grade 0 and three cases were classified as grade 1. In 15 cases with initial posterior instability, three cases were classified as grade 0, eight cases were classified as grade 1 and four cases were classified as grade 2 at the last follow-up examination.

In cases where ACL and PCL instability was not severe and reconstruction was not performed, the results were as follows: In 12 cases with ACL tears, nine cases were classified as grade 0 and three cases were classified as grade 1 instability; In eight cases of PCL tears, two cases were classified as grade 0, three cases were classified as grade 1 and three cases were classified as grade 2 instability on stress radiography at last follow-up examination.

6. Complications
All cases showed no limitation of motion at the last follow-up examination and there were no cases of infection.

DISCUSSIONS
The treatment of acute knee dislocation in the initial stage must include immediate reduction and neurovascular repair. However, there is controversy concerning the classification and treatment of multiple ligament injuries.

Recently, reconstruction of isolated cruciate injuries was standardized, resulting in improved outcomes. This standard treatment has also resulted in better outcomes after applying these principles to cases of dislocation and multiple ligament injuries.

Even though aggressive ligament repair or reconstruction is needed to treat multiple ligament injuries after dislocation, early surgical treatment can lead to limited ROM of the knee joint due to extensive soft tissue damage. Based on these reports and concepts, we devised a two stage surgical approach in which cruciate ligament reconstruction was performed in the second stage only if necessary. Using this two stage procedure, we were able to obtain superior results in terms of ligament stability and ROM recovery. In 2002, Ohkoshi et al. reported similar results using a different two stage procedure. In the first stage, PCL reconstruction was performed at an average of 2 weeks after the injury, and in the second stage,
ACL and collateral ligament reconstruction were performed 3 months later in cases not treated by conservative methods.

It is generally agreed that the PCL shows a better natural healing ability than the ACL. Shelbourne et al. reported that in 40 cases of acute PCL rupture, all mild and moderate injuries underwent natural healing and 19 of 22 severe cases also underwent natural healing of the PCL. In contrast, the ACL has been reported to have no natural healing abilities, which may be due to the findings that the PCL and ACL have different types of fibroblasts. However, ACL ruptures near the femoral attachment have been reported to heal after conservative treatment in some cases. It has also been reported that in some cases (less than 10%) of ACL ruptures, treatment with conservative methods in order to prevent ankylosis resulted in sufficient ligament stability and reconstruction was not necessary.

In this study, using the two stage surgical approach, we successfully treated severe knee instability due to multiple ligament injuries after dislocation. In the first stage, injuries of posteromedial and posterolateral structures along with the collateral ligaments were treated. A posterior block was used to prevent posterior subluxation in order to aid the natural healing of cruciate ligaments and to keep the knee in a proper position. If necessary, in the second surgical stage, reconstruction of the ACL or PCL was performed. The results of this study also suggest natural healing of the cruciate ligaments.

CONCLUSIONS

In treatment of acute knee dislocations, superior results were obtained in ROM and ligament stability recovery using our two stage surgical approach. Following the first stage of repair or reconstruction of the collateral ligament complex, natural healing of the ACL and PCL was allowed to occur. The second stage operation of ACL/PCL reconstruction was only performed in cases where it was deemed necessary. We propose this two stage procedure be considered as an effective approach for treatment of acute traumatic knee dislocation.

REFERENCES

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금성 외상성 슬관절 탈구의 2단계 수술적 치료방법

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목적: 외상성 슬관절 탈구의 치료에서 2단계로 나누어진 새로운 수술원칙의 유용성을 보고하고자 한다.


결과: 모든 예에서 전방, 후방십자인대가 파열되었으며, 내측측부인대는 10예, 외측측부인대는 8예에서 파열되었다. 모든 측부인대 복합체 손상에 대하여 수술 시행하였다. 3예에서 전방십자인대, 7예에서 후방십자인대 재건술을 시행하였으며, 5예에서는 재건술이 필요하지 않았다. 최종 스트레스 방사선 검사에서 내측측부인대는 모든 예에서 0-1도, 외측측부인대는 14예에서 0-1도, 전방십자인대는 모든 예에서 0-1도였으며, 후방십자인대는 11예에서 0-1도, 4예에서 2도였다. Lysholm 점수는 평균 87.6점이었다.

결론: 외상성 슬관절 탈구의 치료시, 첫 단계로 측부인대의 수술을 시행하고, 이후 선택적으로 십자인대 재건술을 시행하는 2단계 치료로 좋은 결과를 얻을 수 있었다.

색인 단어: 슬관절 탈구, 2단계 수술적 치료

Reference: