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Clinical Prognosticators for the Efficacy of Retinacular Release Surgery to Treat Patellofemoral Pain

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The purpose of this prospective study was to identify clinical, pathologic, and roentgenographic factors that might serve as prognosticators for acceptable results after a lateral retinacular release for treatment of patellofemoral pain unresponsive to conservative measures. Fifty-two knees in 45 patients were studied. The data indicated that acceptable results can be expected in patients who have a negative mal-loose sign (no evidence of patellar malalignment or hyperlaxity) or a positive Sage sign (tight lateral parapatellar soft-tissue structures). Poorer results are predictable in patients with patellar hypermobility.

Management of patellofemoral pain unresponsive to conservative measures remains controversial. Many factors have been identified as possible predisposing causes for this pain syndrome. They can be divided into problems with (1) patellofemoral bony or cartilaginous configuration, (2) patellofemoral soft-tissue support, and (3) lower extremity alignment.^{5,14} All of these factors must be examined in order to properly evaluate patellofemoral problems.

The surgical procedures for treatment of patellofemoral pain unresponsive to conservative measures can be divided into: (1) lat-

eral parapatellar soft-tissue release; (2) proximal patellar realignment; (3) distal patellar realignment; (4) patellar resurfacing; and (5) patellectomy.^{3,12,14,18} The distinct advantage of the lateral retinacular release is its low morbidity. Most of the studies to date concerning lateral retinacular release have not identified any statistically significant prognosticators for the results of lateral retinacular release.^{2,7,15,17,20,22} The purpose of this prospective study was to identify clinical, pathologic, or roentgenographic factors that might serve as prognosticators for a successful result after a lateral retinacular release for treatment of patellofemoral pain syndrome.

MATERIALS AND METHODS

This is a prospective study of lateral retinacular release surgery performed on 52 knees in 45 patients with patellofemoral pain recalcitrant to conservative management. These patients were treated at the senior author's institution from April 1982 to April 1984 (Table 1).

Patient selection included all patients with patellofemoral pain unresponsive to conservative treatment. The patients exhibited the classic symptoms of pain with activity, while ascending or descending stairs, or after sitting for a prolonged period of time. All patients exhibited a positive patellar inhibition test. This is performed by having the patient first perform a straight-leg raising exercise with a strong quadriceps contraction. The patient is next instructed to repeat the quadriceps contraction while the examiner exerts distally directed fingertip pressure on the superior pole of the patient's patella. In a positive test, this

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TABLE I. Postoperative Grade and Clinical Findings

| Knee No. | Postop. Grade | Sage Sign | Increased Q Angle | General Laxity | Patellar Hypermobility | Mal-L. Sign |
|----------|---------------|-----------|-------------------|----------------|------------------------|-------------|
| 1 | 2 | + | - | - | - | - |
| 2 | 2 | + | - | - | - | - |
| 3 | 3 | + | + | - | - | + |
| 4 | 3 | - | + | - | + | + |
| 5 | 3 | - | + | - | - | + |
| 6 | 1 | + | - | - | + | - |
| 7 | 3 | + | - | - | + | + |
| 8 | 4 | - | - | - | + | + |
| 9 | 3 | - | + | - | + | + |
| 10 | 3 | + | - | - | + | + |
| 11 | 2 | + | - | - | - | - |
| 12 | 2 | + | + | - | - | + |
| 13 | 1 | + | - | - | - | - |
| 14 | 3 | + | - | - | - | + |
| 15 | 3 | - | - | + | + | + |
| 16 | 2 | - | - | - | - | - |
| 17 | 2 | - | - | - | - | - |
| 18 | 1 | + | - | - | - | - |
| 19 | 1 | - | + | - | + | + |
| 20 | 1 | - | - | - | - | + |
| 21 | 3 | + | + | - | - | + |
| 22 | 3 | + | - | - | - | - |
| 23 | 1 | - | - | - | + | + |
| 24 | 3 | - | - | - | + | + |
| 25 | 3 | - | + | + | + | + |
| 26 | 2 | + | - | - | + | + |
| 27 | 4 | - | + | - | - | + |
| 28 | 2 | + | - | - | - | - |
| 29 | 1 | + | + | - | + | + |
| 30 | 2 | + | - | - | - | - |
| 31 | 2 | - | + | - | + | - |
| 32 | 1 | - | - | + | + | + |
| 33 | 4 | - | - | + | + | + |
| 34 | 3 | - | - | - | + | + |
| 35 | 4 | - | - | - | + | + |
| 36 | 3 | - | - | + | - | + |
| 37 | 2 | - | - | + | + | + |
| 38 | 1 | + | - | - | - | - |
| 39 | 1 | + | - | - | - | - |
| 40 | 2 | + | - | - | - | - |
| 41 | 3 | - | + | - | - | - |
| 42 | 1 | - | - | - | - | + |
| 43 | 2 | + | + | - | + | - |
| 44 | 2 | + | - | - | - | + |

Postop. Grade: 1 = excellent; 2 = good; 3 = fair; and 4 = poor.

maneuver incites severe knee pain that precludes or inhibits the patient from contracting the quadriceps a second time against the applied pressure.

If by three to six months of carefully monitored conservative therapy, a patient's symptoms did

not abate, a lateral retinacular release was performed. Patients with previous knee surgery or with additional nonpatellofemoral pathology were excluded from the study. Patients with more extensive procedures, such as abrasion arthro-

Final Findings

| Patellar Hypermobility | Mal-Loose Sign |
|---------------------------|-------------------|
| - | - |
| - | - |
| - | + |
| + | + |
| - | + |
| + | - |
| + | + |
| + | + |
| + | + |
| + | + |
| + | + |
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| - | - |

lateral retinacular release was performed with previous knee surgery or isolated patellofemoral pathology in the study. Patients with more severe signs, such as abrasion arthro-

plasty, were also excluded from the study. The lateral retinacular release was performed either arthroscopically (nine knees) or during open surgery (42 knees) using a 3-cm lateral parapatellar incision.

The postoperative regimen consisted of using a Jones-type compression dressing for one week with weight bearing as tolerated. This was followed by removal of the dressing and active range-of-motion exercises. Quadriceps isometric exercises were performed at full extension along with hip abduction and adduction isotonic exercises. Once a patient became asymptomatic and had a negative patellar inhibition test, short arc (0°-30°) quadriceps isotonic exercises were instituted.

Pre- and postoperative evaluation consisted of subjective, objective, and roentgenographic evaluation. Special attention was given to signs and symptoms of: (1) a tight lateral parapatellar structure^{6,11}; (2) patellar hypermobility; and (3) severe structural malalignment.^{4,9}

The age, gender, side (right versus left), occupation, activity level, and symptoms were recorded. The symptoms evaluated included the following: (1) severity of pain; (2) swelling; (3) stiffness; (4) giving way or buckling; (5) feeling of instability; (6) locking or catching; and (7) grinding with or without pain. Patellar subluxation or dislocation documented by medical personnel or reliably described by the patient was noted.

During the physical examination, the following signs were evaluated: (1) tenderness; (2) effusion; (3) excessive patellar mobility; (4) increased generalized joint laxity; (5) increased femoral anteversion; (6) increased genu varum greater than 0°, valgum greater than 15°, or recurvatum greater than 10°; (7) abnormal tibial torsion greater than 45°; (8) increased foot pronation; (9) increased Q angles greater than 20°; (10) tight lateral patellofemoral bands; (11) apprehension sign; (12) inhibition sign; and (13) Sage sign.

The Sage sign is named after John Y. Sage, an Australian orthopedic surgeon, who demonstrated this finding of lateral soft-tissue tightness to the senior author.²¹ To perform the test, the patient is supine with the lower extremity relaxed and the involved knee supported in 15°-20° of flexion. A medially directed fingertip force is applied manually by the examiner. Medial patellar excursion of less than one-quarter of the greatest patellar width is considered a positive Sage sign. This is an indication of tight lateral parapatellar soft-tissue structures.

A careful evaluation of a group of clinical findings designated as mal-loose signs was performed. Mal-loose signs included the following: (1) increased Q angle; (2) generalized joint hyperlaxity;

(3) patellar hypermobility; (4) excessive genu varum, valgum, or recurvatum; (5) increased femoral anteversion; (6) increased external tibial torsion; or (7) abnormal foot pronation. A present mal-loose sign indicates the patient has one or more of the above-listed signs present on his physical examination. Others have noted an association of more than one of these signs in certain types of individuals with patellofemoral pain.^{8,14}

The roentgenographic evaluation consisted of: (1) patella alta on a lateral roentgenogram taken with the knee in 30° of flexion¹¹; (2) skyline views with special attention to the 20° view for evaluation of the lateral patellofemoral angle, patellar displacement, and patellar index¹⁶; and (3) 45°-60° skyline roentgenograms for patellar tilt, sulcus and congruence angles, morphology, and evidence of excessive lateral pressure syndrome.⁵

Evaluation of operative findings included grading and dimension measurement of chondromalacia changes: Grade 0, normal appearance; I, softening; II, fibrillation; III, partial thickness loss (crabmeat); and IV, full-thickness defect.

A postoperative evaluation was performed with a minimum 21-month follow-up time. An extensive personal examination or phone interview was performed by one of the present authors. Factors evaluated were: (1) function; (2) preinjury activity level; (3) return to preinjury activity level; (4) patellofemoral pain activity restriction; (5) use of nonsteroidal antiinflammatory agents; (6) use of a neoprene sleeve; (7) adherence to an exercise regimen; and (8) satisfaction with the procedure, namely whether the patient would have the procedure again.

Postoperative grading was divided into four categories: (1) excellent: complete relief of pain and instability with unrestricted athletic activity, not only at the desired level but also at the preinjury level; (2) good: occasional pain with unrestricted athletic activity at the preinjury level; (3) fair: intermittent pain or instability inhibiting the patient from returning to his preinjury activity level; and (4) poor: continuous or worse pain with restricted activity. A score of excellent or good was considered an acceptable or satisfactory result. It should be noted that to obtain an acceptable rating, the patient must attain his or her preinjury activity level.

Statistics were performed using a Fisher exact probability test when using a 2-x-2 contingency table or a chi-square (x²) test when the samples were divided into three or more groups.¹³

RESULTS

A total of 52 knees from 45 patients (seven bilateral procedures) were included in the

study. Eight knees (seven patients) were lost to follow-up studies, leaving a total of 44 knees in the study. There were 34 female and 10 male knees. The average age was 17 years (range, 13 to 46 years). The average follow-up time was 29 months (range, 21-48 months). There were 25% excellent and 32% good results (57% acceptable) and 34% fair and 9% poor results (43% unacceptable). Seventy-five percent of the patients were satisfied with the procedure. The wide variation in presenting symptomatology precluded statistical analysis of symptoms. Their prognostic value appears limited. Roentgenographic follow-up studies were available for 26 patients. Except for patella alta, other observed roentgenographic changes were not consistently quantifiable.

When compared to postoperative grade, the following were of no significant prognostic value: (1) symptom evaluation; (2) roentgenographic evaluation; (3) chondromalacia changes; and (4) a clinical diagnosis of recurrent patellar subluxation or dislocation.

Though evidence of severe patellofemoral joint surface damage, such as large osteochondral fractures or large areas of full-thickness cartilage loss, portends a poor outcome, most of the lesions encountered in the study were in the 1-cm range. There was no correlation between chondromalacia changes and postoperative grade. This concurs with most other studies.^{1,9,19} Of note, the positive Sage sign was reversed intraoperatively in all 22 patients in whom it was positive preoperatively.

The following were of significant prognostic value: (1) a positive Sage sign (tight lateral parapatellar soft-tissue structures), which was associated with better results at $p < 0.1$; (2) patellar hypermobility, associated with poorer results at $p < 0.05$; (3) the absence of mal-loose signs, associated with better results at $p < 0.01$.

Seventy-three percent (16/22) of the patients with a positive Sage sign exhibited excellent or good results after a lateral retinacular release, while only 41% (9/22) of pa-

tients with a negative Sage sign had excellent or good results after a lateral retinacular release ($p < 0.1$). Seventy-two percent (18/25) of the patients without patellar hypermobility had excellent or good postoperative grades, while only 37% (7/19) of the patients with patellar hypermobility had excellent or good results postoperatively ($p < 0.05$). Ninety-four percent (17/18) of patients with a negative mal-loose sign exhibited excellent or good postoperative results, while only 31% (8/26) with a positive mal-loose sign had an excellent or good postoperative grade ($p < 0.01$). More than 90% (17/18) of the patients with a negative mal-loose sign without a positive Sage sign had excellent or good results. Only 25% (4/17) of the patients with a positive mal-loose sign and a negative Sage sign and 44% (4/9) of patients with a positive mal-loose sign and a positive Sage sign had excellent or good postoperative grades ($p < 0.01$).

DISCUSSION

The Sage sign is a convenient and reproducible measure of lateral parapatellar soft-tissue tightness. A positive Sage sign indicates abnormal lateral soft-tissue tightness that may be associated with patellofemoral pain. Presumably, this abnormal lateral tightness causes the patella to track more laterally and creates an abnormal increase in pressure on the lateral patellar and trochlear facets, an abnormal traction tension on the lateral soft-tissue structures, or lateral patellar subluxation.^{3,6} A lateral retinacular release might be expected to solve these problems. This study exhibited an obvious trend of improved results in patients with a positive Sage sign after a lateral retinacular release.

Other authors have noted an association between the mal-loose signs and poorer surgical results after a lateral retinacular release.^{4,8-10,21} When examined individually, only patellar hypermobility is associated with statistically significant poorer results in the study (Table 1). A larger study might

negative Sage sign had excellent results after a lateral retinacular release. Seventy-two percent (18/25) without patellar hypermobility or good postoperative results; only 37% (7/19) of the patients with hypermobility had excellent or postoperatively ($p < 0.05$). Ninety percent (17/18) of patients with mal-loose sign exhibited excellent postoperative results, while only 31% with a positive mal-loose sign had an excellent postoperative grade ($p < 0.05$). More than 90% (17/18) of the patients with a negative mal-loose sign with or without a positive Sage sign had excellent or good postoperative results, while only 25% (4/17) of the patients with a positive mal-loose sign and a negative Sage sign had excellent or good postoperative results, while only 44% (4/9) of the patients with a positive mal-loose sign and a positive Sage sign had excellent or good postoperative results.

DISCUSSION

The Sage sign is a convenient and reproducible indicator of lateral parapatellar soft-tissue tightness. A positive Sage sign indicates lateral soft-tissue tightness associated with patellofemoral malalignment. Typically, this abnormal lateral tightness causes the patella to track more laterally, which creates an abnormal increase in lateral patellar and trochlear traction tension on the lateral structures, or lateral patellofemoral malalignment.^{5,6} A lateral retinacular release is expected to solve these problems. Patients who exhibited an obvious trend toward better results in patients with a positive Sage sign after a lateral retinacular release.

Other studies have noted an association between mal-loose signs and poorer results after a lateral retinacular release. When examined individually, hypermobility is associated with significant poorer results in Group I. A larger study might

demonstrate statistical significance of the other signs individually. Examining these signs collectively revealed highly significant data. Patients possessing none of the mal-loose signs had a significantly improved chance of obtaining acceptable results after a lateral retinacular release compared to patients possessing any one or more of the above signs ($p < 0.01$). This was evident whether or not tight lateral parapatellar soft structures were present. Presumably, when there is no significant hyperlaxity or malalignment, the lateral release allows the patella to track more normally in the femoral trochlea and decreases pressure on the lateral patellar or femoral trochlear facets.^{5,6}

Since patellofemoral pain is a multifactorial problem, it is important to examine the interaction of all of the elements affecting the patellar extensor mechanism. A significant correlation between the Sage sign and the mal-loose group signs and postoperative grade was identified. The knees were divided into four groups depending on whether they had a positive or negative Sage sign and a present or absent mal-loose sign. Group I consisted of knees with negative mal-loose and negative Sage signs; Group II, negative mal-loose and positive Sage signs; Group III, positive mal-loose and negative Sage signs; and Group IV, positive mal-loose and positive Sage signs.

In Groups I and II, the postoperative grade was acceptable (good or excellent) in 100% (5/5) of the patients in Group I and 92% (12/13) in Group II. Again, the improved results in the negative mal-loose group knees may be explained by the lateral release allowing the patella to track more normally in the patellofemoral groove. The release may also relieve lateral compressive forces or denervate the patella or lateral retinaculum enough to alleviate the patellofemoral pain.^{5,6}

Group III fared poorly after a lateral release. Releasing the lateral structures when they are not significantly tethering the patella would not be expected to help. The hyper-

laxity and/or malalignment would not be corrected.

Group IV demonstrated approximately 50% acceptable results. In patients in whom the more significant problem was the tight lateral structures, the surgery might be expected to help. In those in whom the malalignment or hyperlaxity was the more significant problem, the lateral release was probably not sufficient to normalize patellar tracking.

In conclusion, it should be emphasized that the hallmark of patellofemoral pain treatment still remains conservative nonsurgical therapy. It is imperative to underscore the fact that patellofemoral pain is a multifactorial problem. Careful attention must be given to patellofemoral bony and cartilaginous configuration, patellofemoral soft-tissue structure support, and lower extremity alignment, both individually and in concert.

This study has shown improved lateral retinacular release results in patients who exhibited an absent mal-loose sign (no evidence of patellar hyperlaxity or malalignment) or a positive Sage sign (tight lateral parapatellar soft-tissue structures). Poorer results were noted in the presence of patellar hypermobility.

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