Efficacy of Surgical Interventions for a Bipartite Patella

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**educational objectives**

As a result of reading this article, physicians should be able to:

1. Identify common presenting characteristics of a symptomatic bipartite patella.
2. Evaluate the most common surgical interventions used in the management of a symptomatic bipartite patella.
3. Assess relief of symptoms and return to preoperative activity levels after surgical management of a bipartite patella.
4. Identify complications from surgical management of a bipartite patella.

**ABSTRACT**

Bipartite patella is a relatively rare phenomenon. This anomaly is typically asymptomatic but can become painful with overuse, strenuous activities, or trauma, which is why it is typically seen in a young, athletic population. Although nonsurgical management is the initial treatment, if symptoms persist, surgical intervention may be necessary. Multiple surgical options exist, such as excision or fixation of the fragment or release of lateral soft tissue structures. The authors report the efficacy of various surgical interventions on a symptomatic bipartite patella, with outcomes related to symptom relief...
and ability to return to preoperative levels of activity. A systematic review was performed using multiple databases. Studies reporting outcomes of symptom relief or ability to return to activity following surgical intervention for a bipartite patella were included. Surgical technique, type of bipartite, and complications were recorded. Twenty-four articles with a total of 122 patients and 127 knees were included and reviewed. Relief of pain was achieved in 84.1% of patients, with 98.3% able to return to their preoperative activity levels after surgery. For patients with a symptomatic bipartite patella, return to preoperative activity levels with zero to minimal pain can be achieved with excellent results using any of the reported surgical methods. [Orthopedics. 2014; 37(9):623-628.]

Bipartite patella is typically an asymptomatic abnormality. This patellar anomaly gains clinical significance once it becomes painful, generally after sports activities, overuse, or injury. The ossification of the patella begins between ages 4 and 6 years at several locations that begin to fuse rapidly. As the central ossification center expands, irregularity can lead to several accessory ossification sites between ages 8 and 12 years, most commonly at the superolateral margin. These accessory ossification centers may result in a bipartite patella if fusion does not occur. Despite osseous interruption, cartilaginous continuity exists between the patella and accessory fragment. The bipartite patella is classified into 3 types: type I, located at the inferior patellar pole (5%); type II, located at the lateral margin of the patella (20%); and type III, located at the superolateral pole (75%).

Conservative management with limiting sports activities and prescribing anti-inflammatory medications, physical therapy, and local corticosteroid injection is the initial treatment for the symptomatic bipartite patella. If symptoms persist, surgical intervention should be considered. Current surgical options include excision of the accessory fragment, lateral retinacular release (LRR), release of the vastus lateralis insertion on the patellar fragment, and open reduction and internal fixation (ORIF) of the fragment.

To the current authors’ knowledge, there has been no review to date on the efficacy of surgical options for relieving symptomatic bipartite patella and on the return of patients to their previous activity levels. Given the number of surgical options and excellent outcomes for a symptomatic bipartite patella, the authors sought to determine relief of symptoms and return to activity postoperatively. A secondary objective was to identify any long-term complications that may arise postoperatively.

**Materials and Methods**

To assess return to activity and pain relief following surgical intervention on a bipartite patella, a systematic review of the literature was performed. The search was performed in August 2013. The following databases were used: PubMed, MEDLINE, Scopus, and CINAHL. Search terms used were bipartite patella, surgery, fixation, excision, and corrective procedure. All studies with level I to IV evidence (according to the Oxford Centre for Evidence-Based Medicine used by the Journal of Bone and Joint Surgery, American volume) that met the inclusion criteria were included. All articles and their references were manually reviewed for potentially inclusive articles missed by the initial search.

The inclusion criteria included (1) evidence of either unilateral or bilateral bipartite patella, (2) surgical intervention of symptomatic bipartite patella, (3) data involving outcomes of postoperative symptoms or return to activity, (4) level I to IV evidence, (5) English language, and (6) all ages and sexes. The exclusion criteria included (1) nonsurgical intervention, (2) fractures of the patella, (3) multiple osteochondroses in sites other than knee, and (4) a language other than English.

The initial search of the literature yielded 124 articles. After elimination of articles based on the exclusion criteria, a total of 24 articles describing a surgical intervention for a symptomatic bipartite patella with outcomes were reviewed (Figure).

**Results**

A total of 122 patients (127 knees) with a symptomatic bipartite patella underwent a surgical intervention (Table). Mean patient age was 28.7 years (range, 10-69 years). There were 106 (83.5%) males and 21 (16.5%) females. Ninety (70.9%) knees underwent excision of the symptomatic bipartite fragment, with 5 undergoing arthroscopic excision and 85 undergoing open excision. Seventeen (13.4%) knees underwent a vastus lateralis release, and 16 (12.6%) knees underwent LRR. Four (3.1%) patients underwent ORIF of the fragment. According to the Saupe classification, 1 (0.8%) knee was type I, 15 (11.4%) were type II, and 114 (86.4%) were type III.
Two (1.5%) patients had an unclassified bipartite patella. One had a fragment from the medial margin of the patella and the other reported a horizontal bipartite patella.

Complete pain relief was achieved in 95 (84.1%) patients. Continued pain was seen in 18 (15.9%) patients, although 16 stated that it was occasional pain that did not affect their ability to return to preoperative activities, except in 1 patient who required a patellectomy secondary to chondromalacia found at the time of surgery.

Of the articles reporting return to activity, 116 (98.3%) of 118 patients were able to return to their preoperative activity levels, yielding a 1.7% risk of failure to return to activity postoperatively.

A total of 14 (11%) of the 127 knees had complications. Acute complications included 1 patient with wound dehiscence after falling onto the knee, 2 patients with transient synovitis requiring 2 aspirations, 1 patient with a superficial wound infection treated with antibiotics, 6 patients with knee effusions requiring arthrocentesis, and 2 patients with removal of symptomatic metal wires after ORIF. Weckström et al reported long-term complications of Kellgren-Lawrence grade 1 osteoarthritic changes in 2 patients.

**Discussion**

Bipartite patella is a rare occurrence, with a reported incidence ranging from 0.2% to 6% and almost 50% occurring bilaterally. Less than 2% become symptomatic, requiring medical intervention. The current authors sought to determine the efficacy of surgical treatment for symptomatic bipartite patella, measured by relief of symptoms and return to preoperative activity levels.

Painful bipartite patella fragments present either gradually as overuse injuries or as sudden onset after trauma, which was how the overwhelming majority of patients presented in this review. Pain associated with a bipartite patella typically localizes over the accessory fragment, although patients can present with generalized anterior knee pain. Nonsurgical management is the initial treatment option. However, if symptoms persist, limited extension of the knee due to pain occurs, resulting in quadriceps atrophy.

This can further delay a patient’s ability to return to activities, especially sporting activities. Indications for operative treatment are typically defined by a continued decrease in activity levels for greater than 3 months with nonsurgical management.

Seventy-one percent of surgical treatments for the symptomatic bipartite patella in this review involved excision of the bipartite fragment. Of those, more than 94% used an open-knee incision, whereas almost 6% were performed arthroscopically. The open procedure produced excellent results, with 98% of patients returning to preoperative activity levels and 85% of patients having complete pain relief postoperatively. Arthroscopic excision of the bipartite patellar fragment has many advantages. This procedure has excellent outcomes, with all patients having complete symptom relief and returning to preoperative levels of activity in the articles reviewed. Arthroscopy is a less invasive procedure, offering a decreased hospital stay, decreased recovery time with early postoperative rehabilitation, and fewer theoretical long-term complications such as quadriceps atrophy.

Soft tissue procedures for the correction of bipartite patella include vastus lateralis release and LRR. These procedures preserve the bipartite fragment, thereby preserving articular cartilage. Adachi et al compared 2 techniques involving release of the vastus lateralis: arthrotomy and arthroscopy. Complete bony union was achieved in 64.7% of patients at 6 months postoperatively, with no statistical difference between open procedures and arthroscopy. Vastus lateralis release from the fragment minimizes the release when compared with a conventional LRR, thereby reducing potential abnormal patellofemoral tracking postoperatively. Mori et al performed a modified LRR with extension of the excision to the proximal attachment of the separated fragment. Complete bony union was achieved in 94% of patients at 8 months postoperatively. Both groups had a 100% return to preoperative sports, although 5 patients undergoing LRR continued to have occasional pain.

Open reduction and internal fixation procedures reported by Peek and Barry and Tauber et al required 6 weeks of splinting before rehabilitation could begin. They also had continued tenderness that required reoperation for hardware removal. However, the occasional pain did not limit their return to preoperative activity levels. Although prolonged immobilization and hardware removal can be viewed as limitations to ORIF procedures, radiographic bony union was achieved in both cases, preserving articular cartilage.

Because of cartilaginous continuity between the bipartite fragment and the patella, a theoretical long-term complication with excision of the fragment is osteoarthritis. Ishikawa et al reported that an excision of the fragment can help avoid late complications of osteoarthritis. However, data in the literature lack long-term follow-up to make conclusions about patellofemoral arthritis formation once a bipartite fragment is excised. Bourne and Bianco found no patellofemoral degenerative changes at 7-year follow-up. Weckström et al found 2 patients with osteoarthritic changes during follow-up, in one case 17 years after surgery.

Limitations to this review exist due to the heterogeneity of the reporting among studies. Some studies reported the earliest return to activity and relief of symptoms, whereas others reported this during their last follow-up appointment. It is difficult to elicit exactly when patients experienced symptom relief and when they returned to preoperative activities. Only a few studies provided lengthy follow-up. Given the limited length of follow-up, it is difficult to draw long-term comparisons.
### Studies Included in Systematic Review

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of Knees (M/F)</th>
<th>Mean Age (Range), y</th>
<th>Mean Follow-up (Range)</th>
<th>Saupe Classification</th>
<th>Surgical Correction</th>
<th>Postop Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iossifidis and Brueton</td>
<td>9b (4/3)</td>
<td>30 (21-46)</td>
<td>10 mo (3-36 mo)</td>
<td>Type III (n=9)</td>
<td>Open excision of fragment</td>
<td>No pain (n=4); occasional pain (n=3); return to previous activity (n=7)</td>
</tr>
<tr>
<td>Weaver</td>
<td>21 (17/4)</td>
<td>19 (10-42)</td>
<td>&gt;1 y</td>
<td>Type III (n=21)</td>
<td>Open excision of fragment</td>
<td>Surgical group: No pain (n=13) and occasional pain (n=3); Nonsurgical group: occasional pain (5/5); return to previous activities (20/21)</td>
</tr>
<tr>
<td>Bourne and Bianco</td>
<td>16 (12/4)</td>
<td>14.5 (11-19)</td>
<td>7 y (1-15 y)</td>
<td>Type III (n=16)</td>
<td>Open excision of fragment</td>
<td>No pain (n=13); occasional pain (n=2); no relief of pain (n=1); return to previous activity level at mean 2 mo (n=15)</td>
</tr>
<tr>
<td>Adachi et al</td>
<td>17b (15/0)</td>
<td>14.3 (10-18)</td>
<td>12 mo</td>
<td>Type III (n=17)</td>
<td>Vastus lateralis release: open incision over bipartite fragment</td>
<td>No pain within 4 wk (n=15); return to previous sports activities at mean 3.1 mo (n=15)</td>
</tr>
<tr>
<td>Mori et al</td>
<td>16h (9/6)</td>
<td>16.6 (13-24)</td>
<td>21 mo (12-34 mo)</td>
<td>Type II (n=7); type III (n=9)</td>
<td>Modified LRR with extension to proximal attachment of separated fragment</td>
<td>No pain (n=10); occasional pain (5 knees); return to sport (n=15)</td>
</tr>
<tr>
<td>Weckström et al</td>
<td>25 (25/0)</td>
<td>20 (18-27)</td>
<td>15 y (10-22 y)</td>
<td>Type II (n=6); type III (n=19)</td>
<td>Open excision of fragment</td>
<td>Continued pain at 22 y (n=1); return to previous activities after mean 3 wk (range, 1-13 wk) (n=25)</td>
</tr>
<tr>
<td>Carney et al</td>
<td>1 (1/0)</td>
<td>19</td>
<td>6 mo</td>
<td>Type III</td>
<td>Arthroscopic excision of fragment</td>
<td>No pain at 6 mo; return to previous sport activities at 6 mo</td>
</tr>
<tr>
<td>Ishikawa et al</td>
<td>9 (9/0)</td>
<td>16.8 (14-21)</td>
<td>60 mo (21-145 mo)</td>
<td>Type III (n=9)</td>
<td>Open excision of fragment</td>
<td>Return to previous sport activities at mean 33.9 d (n=9)</td>
</tr>
<tr>
<td>Azarbod et al</td>
<td>1 (1/0)</td>
<td>26</td>
<td>6 wk</td>
<td>Type III</td>
<td>Arthroscopic excision of fragment</td>
<td>No pain at 6 wk; full recovery at 6 wk</td>
</tr>
<tr>
<td>Felli et al</td>
<td>1 (0/1)</td>
<td>22</td>
<td>1 y</td>
<td>Type III</td>
<td>Arthroscopic excision of fragment</td>
<td>No pain at 1 y; return to previous sport activities</td>
</tr>
<tr>
<td>Yoo et al</td>
<td>1 (1/0)</td>
<td>37</td>
<td></td>
<td>Type II</td>
<td>Arthroscopic excision of fragment</td>
<td>No pain; return to previous activities</td>
</tr>
<tr>
<td>Peek and Barry</td>
<td>1 (1/0)</td>
<td>12</td>
<td></td>
<td>Type I</td>
<td>ORIF of fragment with a tension-band wire</td>
<td>Tenderness related to wires that were removed at 4 mo</td>
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<tr>
<td>Tauber et al</td>
<td>1 (0/1)</td>
<td>18</td>
<td>29 mo</td>
<td>Unclassified horizontal bipartite</td>
<td>ORIF of fragment with 2 tension-band wires</td>
<td>Occasional pain; return to sport activities at 29 mo</td>
</tr>
<tr>
<td>Canizares and Selesnick</td>
<td>1 (1/0)</td>
<td>32</td>
<td>12 mo</td>
<td>Type III</td>
<td>Open excision of fragment</td>
<td>No pain at 4 wk; return to previous sport activities at 7 wk</td>
</tr>
<tr>
<td>Green</td>
<td>3 (3/0)</td>
<td>14.3 (13-15)</td>
<td>2.1 y (5 mo to 3 y)</td>
<td>Type III (n=3)</td>
<td>Open excision of fragment</td>
<td>No pain (n=2); weaker than contralateral leg (n=1); return to previous sport (n=3)</td>
</tr>
<tr>
<td>Halpern and Hewitt</td>
<td>1 (0/1)</td>
<td>20</td>
<td>1 y</td>
<td>Unclassified medial fragment</td>
<td>Open excision of fragment</td>
<td>No pain at 1 y</td>
</tr>
</tbody>
</table>
between the procedures performed and to determine whether long-term complications, such as osteoarthritic changes, develop postoperatively.

**Conclusion**

Surgical management of a symptomatic bipartite patella allows for return to preoperative activities with excellent symptom relief. Many surgical options exist, and any one of them can be used with excellent results. Studies with long-term follow-up are needed to determine whether complications such as patello-femoral arthritis occur.

**References**


