

1 **Clinical Presentation and Outcomes Associated with Fabellectomy in the Setting of Fabella**  
2 **Syndrome**

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30 **Abstract**

31 **Background:** Clinical outcomes pertaining to isolated lateral fabellectomy in the setting of  
32 fabella syndrome are limited to small case reports at this time.

33 **Purpose/Hypothesis:** To assess the most common presenting symptoms, clinical outcomes and  
34 satisfaction following fabella excision in the setting of fabella syndrome.

35 **Study Design:** Case series; Level of evidence, 4.

36 **Methods:** Consecutive patients with minimum 21-months follow-up after isolated fabellectomy  
37 for fabella syndrome were retrospectively reviewed. Clinical outcome scores of the following  
38 domains were collected: Western Ontario & McMaster Universities Osteoarthritis Index  
39 (WOMAC) score and Lysholm Knee Survey along with a simple numeric patient satisfaction  
40 score (1-10 with 10 rated as 'very satisfied'). Statistical analysis was performed with paired t-  
41 tests for all clinical outcomes data.

42 **Results:** Eleven isolated fabella excisions in 10 patients were included with isolated lateral-sided  
43 knee pain in the setting of fabella syndrome (8 male versus 2 female) with an average age of  
44 36.9 years (23-58 years) and follow up average of 2.4 years (range, 21-47 months). A total of 8  
45 patients (80%) were able to return to full desired activities to include sports. There were 5/11  
46 (46%) patients who presented with concomitant lateral femoral condyle cartilage pathology.  
47 There were significant improvements across multiple WOMAC domains and the WOMAC total  
48 score improved from  $28.5 \pm 17.6$  preoperatively to  $11.6 \pm 10.2$  postoperatively ( $p < 0.05$ ).  
49 Lysholm scores significantly improved from  $66.6 \pm 23.1$  preoperatively to  $80.2 \pm 13.9$   
50 postoperatively ( $p < 0.05$ ). Overall patient-reported satisfaction was rated  $8.8 \pm 1.6$ .

51 **Conclusion:** Fabella excision in the setting of fabella syndrome demonstrated improvements in  
52 clinical outcome scores, high rate of returning to preinjury level of activities, and low risk of  
53 complications or need for additional surgical procedures.

54 **Key Words:** fabella syndrome, knee injury

55 **FOR REVIEW PURPOSES ONLY:**

56 **What is known about the subject:** Patients presenting with fabella syndrome often have seen  
57 several physicians prior to obtaining a correct diagnosis. After patients fail conservative  
58 management for fabella syndrome, intervention is typically limited to injections into the site of  
59 tenderness or surgical excision. The results of surgical intervention are limited to small case  
60 reports and small case series with limited follow-up for this relatively rare but debilitating  
61 pathology.

62 **What this study adds to the existing knowledge:** This study reports on the presenting  
63 symptoms and surgical outcomes for the treatment of symptomatic fabella syndrome. Making  
64 an accurate diagnosis for this pathology requires an increased level of awareness from the  
65 clinician. After an accurate diagnosis is obtained and after nonoperative treatment fails, surgical  
66 resection leads to return to desired activities and overall satisfaction of the procedure.

67 **INTRODUCTION**

68 The fabella is a sesamoid bone embedded within the lateral gastrocnemius tendon  
69 being present in 20 to 87% of people.<sup>3,4,9</sup> The fabella can be variably ossified or purely  
70 cartilaginous and can be a persistent source of pain regardless of its **ossification** status.<sup>10</sup>  
71 Furthermore, the presence of a fabella is notably higher in the Asian population.<sup>2</sup>

72 Fabella syndrome involves a constellation of symptoms that typically encompasses  
73 intermittent posterolateral knee pain in the setting of knee extension (compression of the  
74 fabella against the lateral femoral condyle) as well as pain with aerobic activities such as  
75 running and cycling.<sup>10,11</sup> **Acute injuries with associated pain and pathology can be recognized**  
76 **within 6 weeks but conversely, delay in diagnosis (>6 weeks) can occur in the chronic setting**  
77 **both with and without an inciting mechanism. The clinical picture typically consists of focal**  
78 **tenderness and possible localized swelling to the posterolateral gastrocnemius origin on**  
79 **physical examination with the presence of an osseous fabella on plain radiographs and is often**  
80 **overlooked.**<sup>1,7</sup> Obtaining magnetic resonance imaging (MRI) is essential in ruling out other  
81 possible sources of lateral knee pain and can also include chondral pathology that may be the  
82 result of fabella impaction. Furthermore, other MRI findings can demonstrate thickening of the  
83 lateral gastrocnemius tendon, inflammation and grooving of the lateral femoral condyle  
84 cartilage, best seen on axial or sagittal MRI sequences (Figure 1), due to its articulation with the  
85 fabella.



**Figure 1.** Moderate thickening of the lateral gastrocnemius tendon with intrasubstance edema (^) and posterolateral subchondral edema (\*).

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87 Management of fabella syndrome includes nonoperative management followed by  
88 operative intervention if conservative management fails. Nonsurgical management consists of  
89 activity modifications, rest, immobilization<sup>10</sup>, physician guided physical therapy<sup>1</sup> and  
90 corticosteroid injections into the local area.<sup>10</sup> Both open and arthroscopically assisted fabella  
91 excision procedures have been described, but longitudinal follow-up studies are currently  
92 lacking in the literature.<sup>7, 10</sup> Therefore, the purpose of this study was to report on the clinical  
93 characteristics and outcomes of patients following an arthroscopically assisted fabella excision  
94 in the setting of fabella syndrome.

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## 97 **METHODS**

98 *Study Design*

100 This study was exempt from institutional review board approval. Data was retrospectively  
101 gathered from patients who underwent an arthroscopically assisted fabella excision for a  
102 diagnosis of fabella syndrome performed by a single surgeon (*initials blinded for review*)  
103 between January 2011 and March 2017. All patients that were included had a diagnosis of  
104 isolated fabella syndrome and failed an additional eight weeks of conservative management  
105 under the care period of the senior author. Standard radiographs and MRIs were obtained on  
106 all patients to rule out concomitant pathology and to confirm the presence of either a bony or  
107 cartilaginous fabella. Fabella syndrome was made as a diagnosis of exclusion after all other  
108 pathology had been ruled out. Additionally, characteristic MRI findings and tenderness to direct  
109 palpation of the fabella aided in diagnosing isolated fabella syndrome. Inclusion criteria  
110 included patients who underwent arthroscopically assisted fabella excision with a minimum of  
111 21-months follow-up.

#### 112 *Surgical Technique*

113 All included patients underwent an arthroscopically assisted fabella excision with  
114 thorough evaluation of the posterolateral femoral condyle according to a previously described  
115 technique.<sup>7</sup> An 8-10 cm oblique incision was made in the midline of the lateral thigh centered  
116 over the joint line extending to Gerdy's tubercle. The iliotibial band was incised in line with its  
117 fibers 2 cm anterior to its posterior border (taking note to always remain anterior to the long  
118 head of the biceps femoris tendon to avoid iatrogenic injury to the common peroneal nerve).  
119 The triangular interval between the biceps femoris (posterior and inferior), lateral  
120 gastrocnemius origin (posterior and superior) and posterior capsule was exposed with the use  
121 of blunt dissection while also using a Cobb elevator to release adhesions between the  
122 posterolateral joint capsule and lateral gastrocnemius tendon. The fabella was easily palpated  
123 at the junction of the posterolateral capsule and the gastrocnemius tendon.

124 Knee arthroscopy was carried out with the use of standard anterolateral and  
125 anteromedial viewing portals with the use of both a 30° and 70° arthroscope. After this, a spinal  
126 needle is used to demarcate the margins of the fabella to avoid over-resection of the

127 surrounding tissues under direct visualization arthroscopically. The fabella was then secured  
128 with an Alice clamp and excised through the lateral incision sharply with a 15-blade scalpel  
129 under direct arthroscopic visualization attempting to minimize the volume of lateral  
130 gastrocnemius tendon and lateral capsule that was removed. Incisions were closed in a  
131 standard layered fashion.

### 132 *Postoperative Rehabilitation Protocol*

133 Following surgery, all patients were weightbearing as tolerated on the operative  
134 extremity with the use of crutches until they could ambulate without a limp; crutches were  
135 typically required for a total of two weeks. A knee brace was not used and there were no  
136 restrictions on knee range-of-motion postoperatively. Physical therapy began on postoperative  
137 day one with focus on edema control, patellar mobility, and quadriceps activation exercises.  
138 Stationary cycling began at 6 weeks postoperatively and patients were allowed to progress with  
139 resistance training exercises as knee swelling permitted. Return to full activities typically  
140 occurred around 3 to 4 months postoperatively, ensuring adequate time for the capsule and  
141 soft tissue to heal.

### 142 *Patient-Reported Outcomes, Failures, and Complications*

143 All patients who underwent isolated arthroscopically assisted fabella excision with a  
144 minimum of 21-months follow-up were administered subjective questionnaires either at  
145 routine follow-up appointments or by email as part of a routine standard of care at the home  
146 institution, which included the following clinical outcome measures: Lysholm score, the  
147 Western Ontario & McMaster Universities Osteoarthritis Index (WOMAC) score, and patient  
148 satisfaction. Comparison was performed against preoperative outcome scores which are  
149 collected as a routine practice for every surgical patient of the senior surgeon (initials blinded  
150 for review). Patient satisfaction was measured on a scale from 1 to 10, with 10 being 'very  
151 satisfied' and 1 being 'very unsatisfied'. Additionally, patients reported their ability to return to  
152 all activities and sports participated in prior to surgery with this data being obtained from chart  
153 review at routine follow-up visits. Demographic characteristics were recorded including age,  
154 gender, body mass index (BMI), cartilage status, chronicity, and any reported injury was

155 recorded from surgical and clinical notes. Common peroneal nerve (CPN) pathology which has  
156 been associated in prior case reports<sup>5</sup> was also recorded. Due to the retrospective study design,  
157 CPN neuropathy was reported as a binary data point (0 = no, 1 = yes) and the extent of  
158 sensorimotor deficits could not be described in detail. Surgical failure was defined as any  
159 patient requiring revision surgery for recurrent lateral-sided knee pain. **Complications were**  
160 **recorded, including reintervention surgery, continued complaints of CPN neuropathy, deep vein**  
161 **thrombosis, or arthrofibrosis requiring a lysis of adhesions surgery and were identified through**  
162 **chart review.**

### 163 *Statistical Analysis*

164 Preoperative and postoperative outcome scores were compared with two-tailed paired  
165 sample t-tests and significance was set at an alpha level of  $P < 0.05$ . Unless otherwise noted,  
166 means were reported  $\pm$  standard deviation (SD). All statistical analyses were performed by use  
167 of SPSS version 9.4 (Chicago, IL).

## 168 **RESULTS**

### 169 *Patient Demographics, Clinical Characteristics, and Reported Complications/Failures*

170 Demographics of patients diagnosed with fabella syndrome refractory to conservative  
171 management are presented in Table 1. Patient data were collected between 2011 and 2017  
172 with 10 of 11 (91%) patients available for final follow-up at an average 2.4 years postoperatively  
173 (range, 21-47 months). One patient did not complete post-operative questionnaires and was  
174 lost to follow-up. A total of 11 fabellas were excised in 10 patients with complete follow-up.  
175 The average age of this cohort was  $36.9 \pm 11.5$  years of age. The average BMI of this cohort was  
176  $24.8 \pm 2.5$ . All but one patient reported chronic symptoms of lateral sided knee pain without a  
177 distinct traumatic injury. Two (20%) patients presented pre-operatively with common peroneal  
178 nerve symptoms and 5 patients (45%) had lateral femoral condyle cartilage pathology adjacent  
179 to the fabella requiring operative treatment. Representative imaging and arthroscopic view of a  
180 patient with lateral femoral condyle pathology can be seen in Figure 2. On preoperative  
181 radiographs, six fabella's were ossified with the other five consisting of only cartilage. **There**



182 were no reported surgical failures associated with recurrent posterior lateral knee pain and 8 of  
 183 10 patients were able to return preinjury level of activities and sports as determined by their  
 184 chart review.

185 *Complications*

186 A single patient was identified as having a complication being diagnosed with post-operative  
 187 arthrofibrosis requiring an arthroscopic lysis of adhesions.

Table 1. Patient Demographics									
Patient	Age (years)	Sex (male or female)	Laterality (right or left)	BMI (kg/m2)	Chronicity*	LFC defect**	CPN^	B or C ^^	
1	41	M	R	27	chronic	no	no	B	
2	54	M	L	25.6	chronic	yes	no	B	
3	58	F	L	25.1	chronic	yes	no	C	
4	26	F	L	22	chronic	no	yes	C	
5	31	M	R	28.2	chronic	no	no	B	
6	22	M	R	27	chronic	yes	no	B	
6	23	M	L	27	chronic	yes	no	C	
7	39	M	L	25.1	chronic	yes	no	B	
8	35	M	R	24.8	chronic	no	yes	C	
9	33	M	R	20.7	acute	no	no	C	
10	31	M	L	21.2	chronic	no	no	B	

\* Presentation chronicity defined by acute (symptoms less than or equal to 6 weeks) and chronic (greater than 6 weeks)

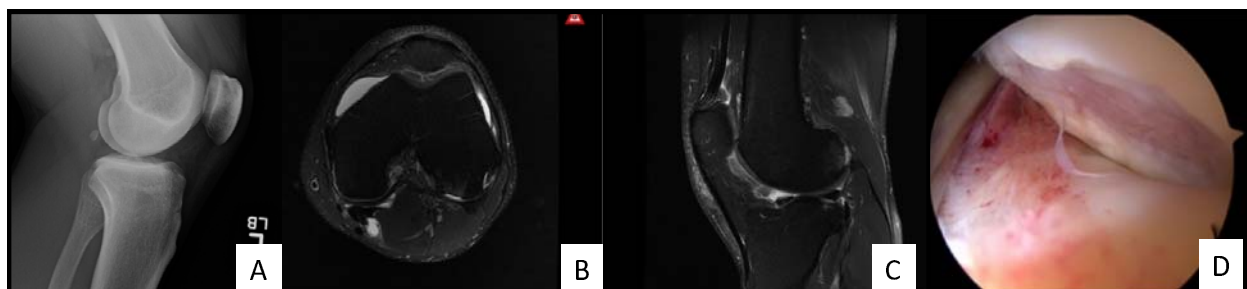
\*\* Concomitant lateral femoral condyle defect requiring operative treatment

^ Common Peroneal Nerve neuropathy (CPN)

^^ Bone or Cartilaginous fabella (B or C)

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**Figure 2.** Representative imaging of patient 7. Chronic left lateral knee pain in the setting of fabella syndrome. Bony fabella identified on preoperative radiographs (A). A notable cartilage lesion was identified on both axial and sagittal T2 MRI on the posterior lateral femoral condyle (B and C). Arthroscopic view from the posterior lateral portal of the chondral defect caused by the fabella impaction (D).

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192 *Patient-Reported Outcomes*

193 Postoperatively, mean WOMAC total scores significantly improved from  $28.5 \pm 17.6$  to  
 194  $11.6 \pm 10.2$  ( $p < 0.05$ ) (Table 2). The WOMAC domains showing significant improvement were  
 195 the WOMAC pain score which improved from  $7.6 \pm 4.3$  preoperatively to  $2.6 \pm 2.0$   
 196 postoperatively; and the WOMAC function score which improved from  $18.5 \pm 12.5$  to  $8.1 \pm 7.8$   
 197 ( $p < 0.01$ ). No differences were seen from preoperative to postoperative status with the WOMAC  
 198 stiffness scale ( $2.3 \pm 2.2$  versus  $0.9 \pm 1.2$ , respectively;  $p = 0.15$ ). The average Lysholm knee  
 199 score significantly improved from  $66.6 \pm 23.1$  to  $80.2 \pm 13.9$  for preoperative to postoperative,  
 200 respectively ( $p = 0.044$ ). The average overall patient-reported satisfaction was  $8.8 \pm 1.6$  at a  
 201 minimum of 21-months postoperatively. Individual component scores can be seen in Table 3.

**Table 2. Mean Preoperative vs. Postoperative Outcome Scores at average 2.4 years**

Score	Pre-Op	Post-Op	P value
<b>WOMAC Total</b>	28.5	11.6	< 0.01*
<b>WOMAC Pain</b>	7.6	2.6	< 0.01*
<b>WOMAC Stiffness</b>	2.3	0.9	0.15
<b>WOMAC Function</b>	18.5	8.1	< 0.01*
<b>Lysholm Knee</b>	66.6	80.2	0.04*

\* Denotes statistically significant difference

202 Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

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**Table 3. Individual Component Scores**

Patient #	SF 12 PCS	SF12 MCS	WOMAC Pain	WOMAC Stiff	WOMAC Function	WOMAC Total	LYS Knee	IKDC	TEGNER	Satisfaction
1	35.2	30.7	5	2	22	29	65	49.4	3	6
2	36.4	64.1	3	0	22	25	82	60.9	4	8
3	50.6	60.4	6	3	14	23	55	71.2	2	10
4	51	58.6	5	0	5	10	80	57.4	3	8
5	56.9	55.6	0	2	2	4	91	70.1	6	10
6	57.8	53	0	0	0	0	95	77	6	10
7	52.7	58.5	2	1	11	14	75	65.5	5	8
8	58.3	55.7	0	0	0	0	94	63.2	8	10
9	52.7	58.5	4	3	16	23	64	73.5	5	5
10	40.3	36.7	6	0	11	17	71	74.7	2	9

204

## 205 DISCUSSION

206 Arthroscopically assisted fabella excision in the setting of fabella syndrome which was  
 207 non-responsive to conservative management demonstrated improvement in subjective

208 outcomes at a minimum of 21-month follow-up. The domains of WOMAC pain, WOMAC  
209 function, WOMAC total, and Lysholm Knee Scores demonstrated significant improvement.  
210 Patients were also able to return to full desired activities after fabella excision.

211 This series found that patients with fabella syndrome often present with vague and  
212 complicated complaints and symptoms. Important findings from this study demonstrate  
213 common presenting symptoms, associated pathologies, and potential perioperative  
214 complications associated with an arthroscopically assisted fabella excision. Similar to the  
215 findings of Weiner et. al., this study demonstrated reliable pain relief and improvement in  
216 outcomes when a diagnosis of fabella syndrome is made.<sup>10</sup> This case series demonstrates  
217 improvement in subjective outcome scores from pre- to post-operation at 21 months without  
218 recurrent pain. The majority of patients reported insidious onset of posterolateral knee pain  
219 with only one patient reporting an acute injury. Also, 2 of the 11 cases presented with  
220 concomitant common peroneal nerve pathology consistent with prior case reports.<sup>5</sup> Our study  
221 demonstrates that the clinician should critically evaluate the exact locations of pain and  
222 tenderness in patients suffering from posterolateral knee pain that is not relieved with  
223 conservative management.

224 This study has limitations. The retrospective study design, lack of control group, and  
225 short-term follow-up limit the internal validity of results. The small sample size and single  
226 surgeon's outcomes limit the external validity to other sample populations. However, the  
227 homogeneity of this sample group is a strength of this study, as we attempted to minimize  
228 confounding variables by including only patients with an isolated painful fabella. Furthermore,  
229 the exact cause or mechanism of the chondral pathology adjacent to the fabella is not possible  
230 to determine; however, the removal of the fabella adjacent to the posterior lateral femoral  
231 condyle does provide pain and symptomatic relief as seen by this study. Although there was no  
232 comparison group to nonoperative management, all patients in this study had presented with  
233 chronic symptoms that failed activity modification, physical therapy, and injections.  
234 Additionally, regardless of duration of symptoms at presentation, the senior author required an  
235 additional 8 weeks of conservative management along with a single corticosteroid intraarticular

236 injection if the patient so desired. Prospective comparative studies with larger cohorts are  
237 required to evaluate the long-term effects of isolated fabella excision in the setting of fabella  
238 syndrome.

239 **Conclusion**

240 Fabella excision in the setting of fabella syndrome demonstrated improvements in subjective  
241 outcome scores, high rate of returning to preinjury level of activities, and low risk of  
242 complications or need for additional surgical procedures.

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