

# The Fibular Collateral Ligament-Biceps Femoris Bursa

## An Anatomic Study\*

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### ABSTRACT

The anatomy of the fibular collateral ligament-biceps femoris bursa is described. The bursa is located lateral to the distal quarter of the fibular collateral ligament and forms an inverted "J" shape around the anterior and anteromedial portions of the ligament. Its most distal margin is just proximal to the fibular head where the fibular collateral ligament inserts, and its more proximal aspect is at the superior edge of the anterior arm of the long head of the biceps femoris muscle. We found this structure in all 50 knees dissected; there was a constant anatomic location of the fibular collateral ligament-biceps femoris bursa in all specimens. Measurement of the anatomic dimensions of the bursa revealed a mean width of 8.4 mm and a mean height of 18 mm. Knowing the prevalence, shape, size, and anatomic location of this bursa may aid the clinician in the differential diagnosis of lateral knee pain.

A number of authors have described bursae around the knee that have clinical significance, including bursae on the medial side of the knee around the tibial collateral ligament<sup>1,3,5,14</sup>; but descriptions of a bursa around the fibular collateral ligament are rare. Although the presence of a bursa in this region is acknowledged, the location of this bursa is not agreed on.<sup>8,10</sup> Furthermore, no description of the size, shape, prevalence, or exact location of such a bursa has been provided. Others have reported on several cases of bursitis in the region of the fibular head<sup>6</sup> and

fibular collateral ligament<sup>2</sup> but without defining the anatomy of this bursa.

In the course of a series of dissections to identify the anatomy and surgical approach of the posterolateral knee,<sup>13</sup> a bursa was consistently identified medial to the anterior arm of the long head of the biceps femoris muscle as it crossed the fibular collateral ligament. The purpose of this study was to identify the prevalence and anatomic size of the fibular collateral ligament-biceps femoris bursa, and to describe its relationship to the surrounding structures.

### MATERIALS AND METHODS

We made thorough dissections of the lateral aspect of the knee in 50 cadaveric knees. No paired specimens were used. There were 25 right and 25 left knees from 27 male and 23 female cadavers. The average age of the donors was 73.7 years. After the skin and subcutaneous tissues of the lateral aspect of the knee were carefully dissected away, the iliotibial band was longitudinally incised in line with its fibers and retracted both anteriorly and posteriorly to expose the more superior aspect of the fibular collateral ligament and the lateral aponeurotic attachments of the long and short heads of the biceps femoris muscle.<sup>8,10</sup> Once the fibular collateral ligament was identified, the iliotibial band was transected axially and retracted both proximally and distally so that the attachment of the fibular collateral ligament on the femur could be identified. Dissection of the lateral aponeurosis of the long head of the biceps femoris muscle from the lateral and posterior aspect of the fibular collateral ligament was then performed for better identification of the margins of the fibular collateral ligament. At this point, the proximal three-fourths of the fibular collateral ligament was exposed. The more distal portion of the fibular collateral ligament was covered by the anterior arm of the long head of the biceps femoris muscle.

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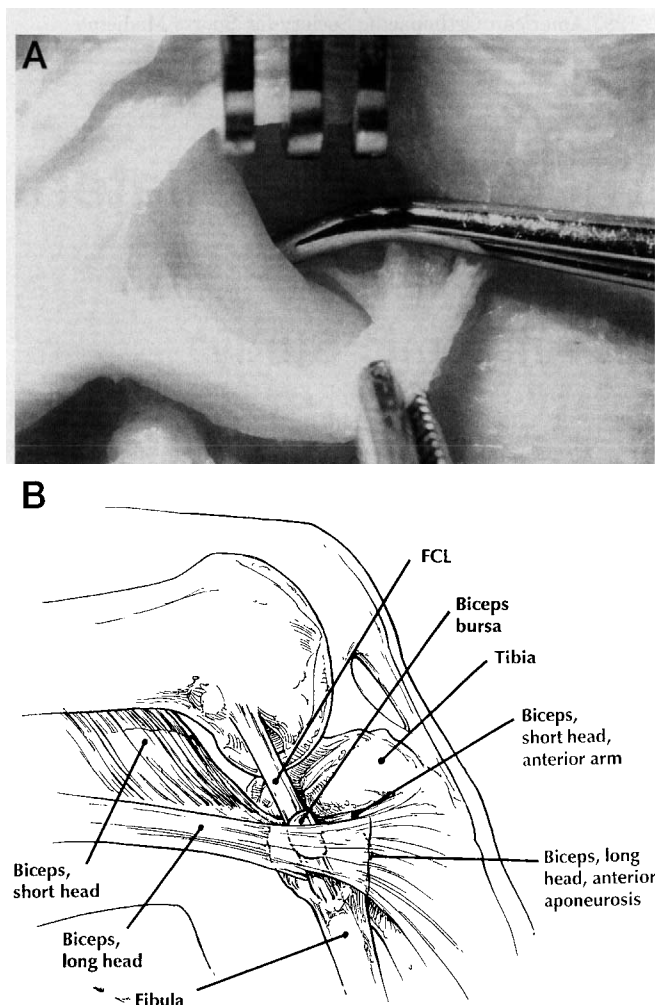
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We identified the fibular collateral ligament-biceps femoris bursa by means of a coronal incision between the anterior arm of the long head of the biceps femoris muscle and its lateral aponeurosis. This incision allowed access to the most superior aspect of the bursa. The interval between the anterior arm and the direct arm attachment of the long head of the biceps femoris muscle was then identified and developed further by a splitting incision between these two structures in the sagittal plane proximal to the bursa. Thus, the anterior arm was dissected sharply away from the direct arm, the main tendinous unit of the long head of the biceps femoris muscle that inserts on the posterolateral aspect of the fibular head just lateral to the fibular styloid.<sup>12</sup> We divided the anterior arm of the biceps approximately 5 cm proximal to the fibular head to separate it from the main tendinous substance of the long head of the biceps femoris muscle, and the anterior arm of the biceps was then retracted distally. This allowed for identification of the dimensions of the fibular collateral ligament-biceps femoris bursa as it lay deep to the anterior arm of the long head of the biceps femoris muscle and superficial to the fibular collateral ligament (Figs. 1 and 2). The attachment of the fibular collateral ligament on the lateral aspect of the fibular head could also be identified at this point.

We recorded measurements for each specimen. The following dimensions were recorded: total length of the fibular collateral ligament (in millimeters); the width between the posterior aspect of the bursa to the posterior aspect of the fibular collateral ligament at the top, middle, and inferior aspect of the bursa (in millimeters); the width between the anterior aspect of the bursa to the anterior aspect of the fibular collateral ligament at the top, middle, and inferior aspect of the bursa (in millimeters); the width of the bursa at its midportion (in millimeters); the total circumferential coverage of the bursa around the fibular collateral ligament (in degrees); and the width of the fibular collateral ligament at its superior aspect, middle, and at the middle of the bursa (in millimeters).

For the histologic portion of the study, we prepared blocks of tissue from the lateral aspect of two knees. We initially examined a tissue block involving the bony attachments of the fibular collateral ligament on the femur and on the fibular head, as well as the overlying biceps expansion. Extraneous tissue was then dissected free. Anatomic landmarks and measurements paralleling those in the cadaveric portion of the study were present in all sectioned specimens processed for histologic staining and were marked for future identification. We placed these specimens into tissue containers. They were subsequently dehydrated and embedded in paraffin blocks. We prepared thin sections using a microtome and evaluated the histologic details by standard hematoxylin and eosin staining procedures. Transverse sections were initially performed at the superior-most portion of the biceps bursa. Under gross examination, the fibular collateral ligament, anterior arm of the biceps tendon, biceps bursa, and inferior lateral geniculate artery could all be identified within each tissue specimen. We also took sections from the dis-

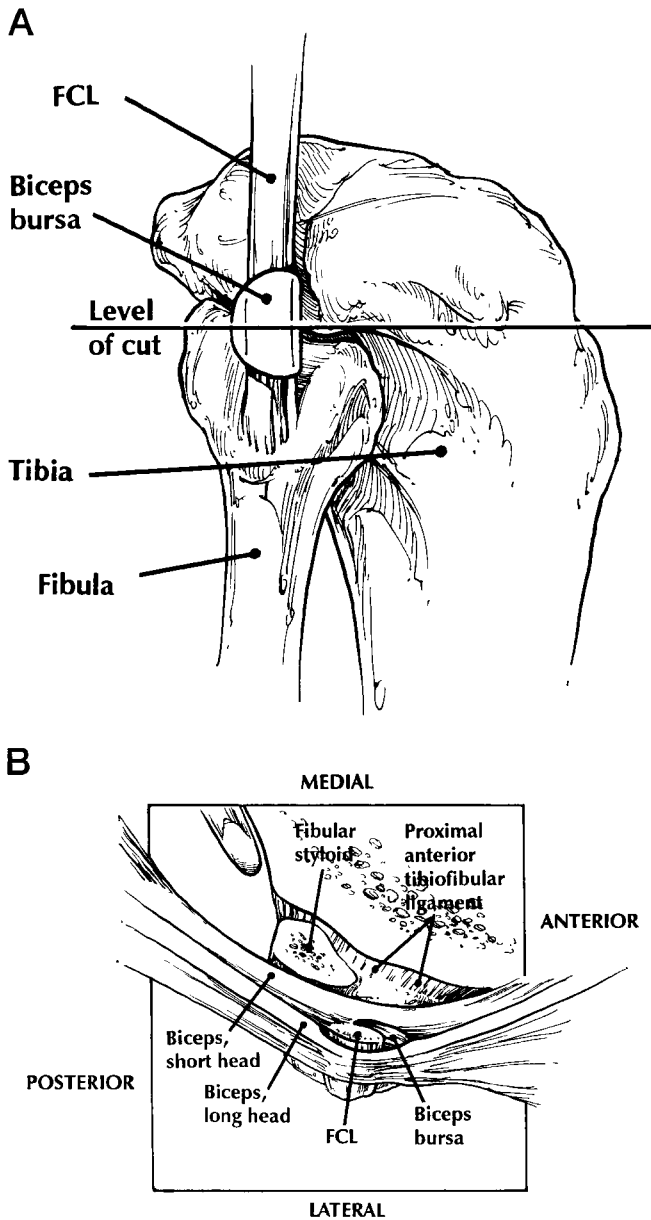


**Figure 1.** The fibular collateral ligament-biceps femoris bursa. A, photograph of the fibular collateral ligament-biceps femoris bursa. The anterior arm of the long head of the biceps femoris muscle is split coronally and retracted. The probe is located (in the bursa) anteromedially to the fibular collateral ligament. B, the fibular collateral ligament (FCL)-biceps femoris bursa and its relationship to adjacent anatomic structures of the lateral knee.

tal-most portion of the biceps bursa. Supplemental sections were obtained in other orientations.

## RESULTS

We identified a sizable fibular collateral ligament-biceps femoris bursa in all 50 specimens. In all specimens, the fibular collateral ligament-biceps femoris bursa was located laterally and anterior-anteromedially to the distal aspect of the fibular collateral ligament, just proximal to the insertion of the fibular collateral ligament onto the lateral aspect of the fibular head. In all cases, the lateral wall of the fibular collateral ligament-biceps femoris bursa abutted the anterior arm of the long head of the biceps femoris muscle where it crossed the fibular collateral lig-



**Figure 2.** The relationship of the fibular collateral ligament (FCL)-biceps femoris bursa to the fibular collateral ligament and the anterior arm of the long head of the biceps femoris muscle. A, lateral view of the knee showing the biceps bursa. The level of the cut is also illustrated. B, transverse section showing the relationship of the biceps bursa to the FCL and the long head of the biceps tendon.

ament (Fig. 1). This bursa formed an inverted "J" shape around the lateral, anterior, and anteromedial aspect of the fibular collateral ligament. The hook of the "J" extended around the anterior edge of the fibular collateral ligament with the long arm of the "J" along the lateral aspect of the fibular collateral ligament. The average circumferential coverage of the bursa around the fibular collateral ligament was 280° (±42°, 1 SD).

The average length of the fibular collateral ligament-biceps femoris bursa measured 18 mm (Table 1). The average length of the fibular collateral ligament from its most proximal origin to its most distal insertion was 71 mm. Therefore, the fibular collateral ligament-biceps femoris bursa covered the distal quarter of the fibular collateral ligament. The average width of the bursa at its midportion was 8.4 mm, with an average of 2.0 mm extending anterior to the fibular collateral ligament, and an average of 2.3 mm extending posteriorly. The anterior extension was more consistently present among specimens (range, 1 to 5 mm) and was part of a pocket that formed anterior to the fibular collateral ligament. The posterior width of the bursa was more variable (range, 2 to 15 mm). The posterior aspect of the bursa did not appear to form a pocket around the fibular collateral ligament; the medial aspect of the anterior arm of the biceps tendon usually attached directly to the posterior border of the fibular collateral ligament.

**Histologic Examination**

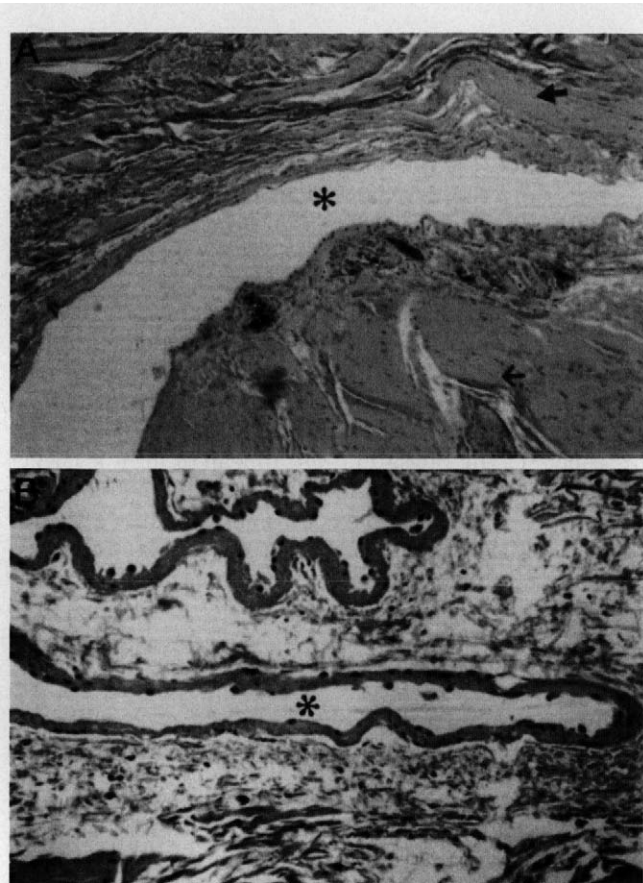
Figure 3A is a photomicrograph (×60) of a hematoxylin and eosin preparation. This is a transverse section through the midportion of the fibular collateral ligament-biceps bursa and the underlying fibular collateral ligament. The fibular collateral ligament is seen in the lower portion of the photograph; the anterior arm of the long biceps muscle is seen in the upper portion. Both the fibu-

**TABLE 1**  
Dimensions of the Fibular Collateral Ligament (FCL)-Biceps Femoris Bursa and Related Structures<sup>a</sup>

Length (mm)	
FCL-Biceps bursa	18.0 ± 4.0 (8-31)
FCL	70.9 ± 7.0 (56-85)
Width (mm)	
FCL-Biceps bursa (midbursa)	8.4 ± 2.9 (4-21)
Bursa anterior to FCL	
Superior	1.9 ± 0.1 (1-4)
Midbursa	2.1 ± 0.1 (1-5)
Inferior	1.6 ± 0.7 (1-4)
Bursa posterior to FCL	
Superior	2.4 ± 3.5 (-2-22)
Midbursa	2.3 ± 2.7 (-2-15)
Inferior	1.5 ± 1.7 (-2-8)
FCL	
Superior	5.2 ± 0.1 (4-7)
Middle	4.5 ± 0.1 (3-6)
Distal (midbursa)	4.0 ± 0.1 (3-6)

<sup>a</sup> Means and 1 SD. Ranges in parentheses.





**Figure 3.** Histologic appearance of the fibular collateral ligament-biceps femoris bursa (hematoxylin and eosin staining). A, transverse section through the bursa ( $\times 60$ ). The fibular collateral ligament (bottom arrow), anterior arm of the biceps muscle (top arrow), and bursa (asterisk) can be identified. B, higher magnification of bursa. Lining cells can be seen in the superficial layer of the bursa ( $\times 160$ ). \*, bursa.

lar collateral ligament and the anterior arm of the long biceps muscle are composed of longitudinally oriented, regular collagen fibrils. The fibular collateral ligament-biceps femoris bursa can be identified surrounding the lateral aspect of the fibular collateral ligament. Approximately  $180^\circ$  of circumferential coverage is seen in this preparation. A synovial-type lining can be seen forming the bursa. There is loose adventitial tissue with a rich vascular network in the subsynovial layer of the fibular collateral ligament-biceps femoris bursa.

Under higher magnification ( $\times 160$ ) (Fig. 3B), lining cells can be seen in the most superficial layer of the bursa. Again, a rich network of arterioles can be seen in the subsynovial layer. The lining of the most superficial layer of the bursa is easily seen. The most predominant cell type is a flat, lining cell with a small nucleus. In addition, a larger cuboidal type of cell with intracellular vacuoles can occasionally be identified. This would indicate an active secretory role of these cells, helping to produce fluid for the lubrication of the bursal surfaces.

## DISCUSSION

Although the existence of the fibular collateral ligament-biceps femoris bursa has been noted previously,<sup>8,10,12</sup> we could not find a precise anatomic description of the structure in the English literature. Neither could we find previous knowledge as to whether the bursa is ubiquitous, as no prevalence was documented in the literature. Sneath<sup>10</sup> described the presence of a synovial bursa over the lower third of the fibular collateral ligament that separated it from the superficial and deep laminae of the biceps femoris tendon. Kaplan<sup>4</sup> reported on a separate bursa located deep to the fibular collateral ligament, between the fibular collateral ligament and the lateral capsule of the knee. The current study found the fibular collateral ligament-biceps femoris bursa located superficial to the fibular collateral ligament and, with the exception of the medial extension of the fibular collateral ligament-biceps bursa, no separate bursa was identified medial to the fibular collateral ligament. Kaplan also noted that the insertion of the biceps muscle completely enveloped the fibular collateral ligament, a finding also refuted in the current study. The fibular collateral ligament-biceps femoris bursa surrounds the distal quarter of the fibular collateral ligament, encompassing up to three-quarters of its circumference. Marshall et al.<sup>8</sup> described the presence of a bursa between the sling-like fascial connection of the biceps femoris muscle as it passed around the fibular collateral ligament. They stated that this bursa separated the biceps femoris muscle from the fibular collateral ligament over approximately the distal fourth of the ligament. The current study found the bursa to be consistently located over the distal quarter of the fibular collateral ligament. The description by Marshall et al. fits the appearance of the fibular collateral ligament-biceps femoris bursa, but they gave no further details.

In a group of 30 dissected knees, Terry and LaPrade<sup>12</sup> found the bursa as currently described present in all specimens. This bursa was noted to cover approximately the distal fourth of the fibular collateral ligament. No precise details of the dimensions and position of the bursa were provided. Many other articles on the anatomy of posterolateral knee structures have *not* noted the presence of this bursa.<sup>7,9,11,15</sup>

Histologic analysis of this structure confirmed it to be a true bursa.<sup>3</sup> Bursae are typically located between surfaces where friction is present when motion occurs. The presence of a bursa at the location described in this study suggests that motion occurs between the anterior arm of the long head of the biceps femoris muscle and the fibular collateral ligament. The functional importance of this bursa is not clear at this time.

Understanding the anatomic location of the fibular collateral ligament-biceps femoris bursa should aid one in the differential diagnosis of pain on the lateral aspect of the knee. The location of the bursa can be consistently found by identifying the proximolateral aspect of the fibular head and then palpating just proximal to this landmark. This is the location where the anterior arm of the long head of the biceps femoris muscle crosses the distal

quarter of the fibular collateral ligament; the bursa is located beneath the anterior arm of the long head of the biceps femoris muscle. Knowing the anatomic location of the bursa may allow one to differentiate pain associated with this bursa from intraarticular lateral compartment problems or other causes of lateral knee pain.

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