Effects of Leg Length, Sex, Laterality, and the Intermediate Femoral Cutaneous Nerve on Infrapatellar Innervation

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Background: An iatrogenic injury to the infrapatellar branch of the saphenous nerve (IPBSN) is a common precipitant of postoperative knee pain and hypoesthesia.

Purpose: To locate potential safe zones for incision by observing the patterns and pathway of the IPBSN while examining the relationship of its location to sex, laterality, and leg length.

Study Design: Descriptive laboratory study.

Methods: A total of 107 extended knees from 55 formalin-embalmed cadaveric specimens were dissected. The nerve was measured from palpable landmarks: the patella at the medial (point A) and lateral (point B) borders of the patellar ligament, the medial border of the patellar ligament at the patellar apex (point C) and tibial plateau (point D), the medial epicondyle (point E), and the anterior border of the medial collateral ligament at the tibial plateau (point F). The safe zone was defined as 2 SDs from the mean.

Results: Findings indicated significant correlations between leg length and height ($r_P = 0.832$; $P < .001$) as well as between leg length and vertical measurements ($\geq 45^\circ$) from points A and B to the IPBSN (r_P range, 0.193-0.285; P range, .004-.049). Male specimens had a more inferior maximum distance from point A to the intersection of the IPBSN and the medial border of the patellar ligament compared with female specimens (6.17 vs 5.28 cm, respectively; $P = .049$). Right knees had a more posterior IPBSN from point F compared with left knees (–0.98 vs–0.02 cm, respectively; $P = .048$). The majority of knees (62.6%; n = 67) had a nerve emerging that penetrated the sartorius muscle. Additionally, 32.7% (n = 35) had redundant innervation, and 25.2% (n = 27) had contribution from the intermediate femoral cutaneous nerve (IFCN).

Conclusion: We identified no safe zone. Significant innervation redundancy with a substantial contribution to the infrapatellar area from the IFCN was noted and contributed to the expansion of the danger zone.

Clinical Relevance: The location of incision and placement of arthroscopic ports might not be as crucial in postoperative pain management as an appreciation of the variance in infrapatellar innervation. The IFCN is a common contributor. Its damage could explain pain refractory to SN blocks and therefore influence anesthetic and analgesic decisions.

Keywords: knee; peripheral nerve injuries; lower extremity; anesthesia/pain management; general sports trauma; anatomy; injury prevention

The saphenous nerve (SN), which innervates the skin on the medial aspect of the lower leg, ankle, and foot,[16] is the longest in the human body.[18] After coursing through the adductor canal with the femoral artery and vein, it exits through the anteromedial intermuscular septum along with the descending genicular artery and penetrates the fascia lata between the sartorius and gracilis muscles. The SN gives rise to the infrapatellar branch of the SN (IPBSN), which contributes to the peripatellar plexus and provides sensory innervation to the anteromedial aspect of the leg, inferior to the patella. The location of penetration of the IPBSN through the fascia lata is highly variable, with several studies providing conflicting findings. Both Arthornthurasook and Gaew-Im[2] and Mochida and Kikuchi[15] found penetration primarily posterior to the sartorius muscle (SM), while LeCorroller et al[14] and Ackmann et al[1] identified the majority of the branches penetrating through the SM. Meanwhile, Kalthur et al[11] documented the exit predominantly anterior to the SM.

The history of iatrogenic injuries to the SN and IPBSN after various arthroscopic knee procedures, including meniscectomy,[19] anterior cruciate ligament reconstruction,[3] and total knee arthroplasty[10] as well as saphenous vein

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harvesting,[6] has been well-documented. Damage to this nerve can result in hypoesthesia[13] and painful neuromas.[7]

Numerous studies have successfully documented the course and features of the IPBSN. Arthornthurasook and Gaew-Im[2] identified the variations of SN penetration through the fascia lata relative to the SM and measured from the medial femoral epicondyle. Horner and Dellon[9] investigated the number and patterns of branching. Mochida and Kikuchi[15] recorded the pathway of the IPBSN as it crossed the joint line relative to the patella and patellar tendon. Ebraheim and Mekhail[4] in the extended position, followed by Kerver et al[12] in the flexed position, mapped the trajectory more precisely using angulation from the point where the patellar apex meets the medial aspect of the patellar tendon. Tifford et al[20] analyzed the vertical distance of the IPBSN from various patellar landmarks.

However, literature searches have failed to reveal existing investigations into relationships between the location of the IPBSN and the length of a patient's leg. Additionally, while the comparison of the IPBSN in men and women as well as bilateral differences have been previously examined, data comparing male and female patients as well as left and right knees are currently sparse.

The purpose of the study was to generate comprehensive data to more accurately delineate potential safe zones for incision and portal placement, thereby avoiding iatrogenic injuries. In addition, we wanted to use similar existing methods to compare previous findings including pathways, dimensions, and bilateral relationships. We aimed to address the following questions:

1. Does the length of a patient's leg (and subsequently the patient's height) correlate with paths of the IPBSN?
2. Are there significant differences in paths and branching patterns between male and female patients?
3. Are there significant differences in paths and branching patterns between left and right legs?

We hypothesized that there would be a direct positive correlation between leg length and the course of the IPBSN and no significant difference between men and women or left and right legs.

METHODS

The study protocol was approved by the Institutional Biosafety Committee at Kansas City University and conducted in accordance with university policy. All specimens examined were donated to their respective university anatomy programs. We performed a bilateral dissection of knees from 25 formalin-preserved cadaveric specimens (16 male and 9 female) at the Kansas City University–Kansas City anatomy laboratory, 18 specimens (9 male and 9 female) at the Kansas City University–Joplin anatomy laboratory, and 12 specimens (6 male and 6 female) at the Creighton University School of Dentistry. Specimens with unilateral knee surgery were documented but not included in the statistical analysis involving left-to-right comparisons.

In total, 55 cadaveric specimens (31 male) and 107 knees (55 left and 61 male) were utilized for the study. There were 3 knees that had undergone prior right-sided knee surgery, reflecting the difference in right and left limbs. The mean age of the specimens was 75.9 years. The characteristics of the specimens are summarized in Table 1.

TABLE 1
Specimen Characteristics[a]

	KCU-KC	KCU-J	CRE	Total
Specimens	25 (45.5)	18 (32.7)	12 (21.8)	55 (100.0)
Male	16 (64.0)	9 (50.0)	6 (50.0)	31 (56.4)
Female	9 (36.0)	9 (50.0)	6 (50.0)	24 (43.6)
Mean age, y	71.0	77.0	84.5	75.9
Knees	48 (44.9)	35 (32.7)	24 (22.4)	107 (100.0)
Left	25 (52.1)	18 (51.4)	12 (50.0)	55 (51.4)
Right	23 (47.9)	17 (48.6)	12 (50.0)	52 (48.6)
Male	31 (64.6)	18 (51.4)	12 (50.0)	61 (57.0)
Female	17 (35.4)	17 (48.6)	12 (50.0)	46 (43.0)

[a]Data are reported as n (%) unless otherwise indicated. CRE, Creighton University School of Dentistry; KCU-J, Kansas City University–Joplin; KCU-KC, Kansas City University–Kansas City.

All cadaveric specimens were preserved with the knees in extension. Therefore, all dissections were performed in this position. With the lower extremity abducted and externally rotated, an incision through the skin and subcutaneous tissue was made inferiorly on the posteromedial aspect of the midthigh and continued to approximately 4 inches inferior to the tibial tuberosity. Medial-to-lateral incisions across the midthigh and midleg followed, and to minimize the disruption of the cutaneous nerves, the skin flap was reflected inferolaterally (the same general direction of the IPBSN). The infrapatellar nerves were located within the subcutaneous tissue, carefully traced proximally to their respective exit points from the fascia lata, and their

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Ethical approval for this study was obtained from Kansas City University.

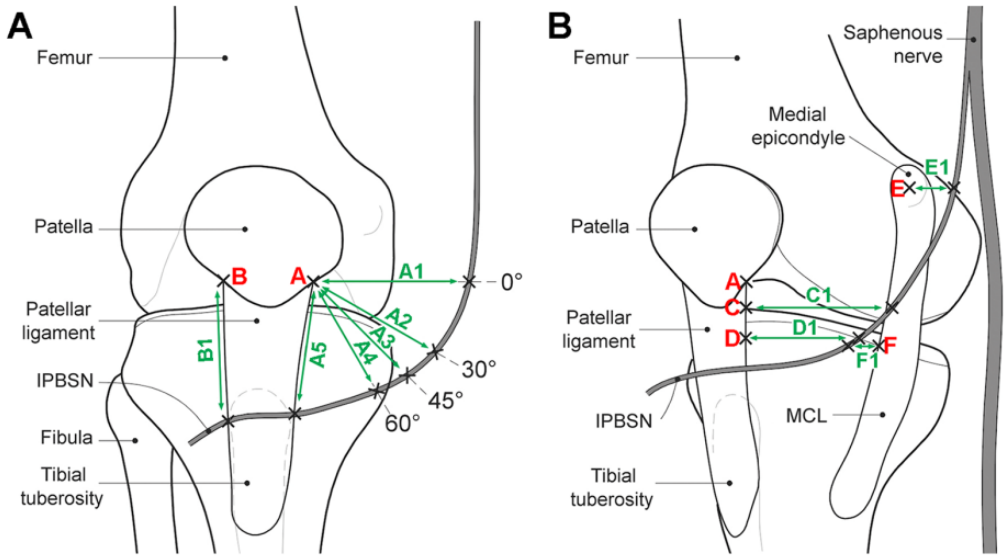

Figure 1. Landmarks (red) and distances (green) utilized to identify the position of the infrapatellar branch of the saphenous nerve (IPBSN) in (A) anterior and (B) anteromedial views. Point A: patella at the medial border of the patellar ligament. Point B: patella at the lateral border of the patellar ligament. Point C: medial border of the patellar ligament at the patellar apex. Point D: medial border of the patellar ligament at the tibial plateau. Point E: medial epicondyle. Point F: anterior border of the medial collateral ligament at the tibial plateau. Distances A1 to A5 were from point A to the IPBSN at 0°, 30°, 45°, 60°, and the intersection of the IPBSN and the patellar ligament, respectively; distance B1 was from point B to the intersection of the IPBSN and the lateral border of the patellar ligament; and distances C1-F1 were the horizontal distances from points C-F to the IPBSN.

location documented (anterior, penetrating, posterior, or other) in relation to the SM. Next, we located the SN distal to the SM and followed into the adductor canal. The branches of the IPBSN were then carefully dissected to their termination.

Location and Measurement of the IPBSN

The pathway and location of the IPBSN were described in relation to palpable landmarks including the patella, patellar ligament, medial epicondyle of the femur, and medial collateral ligament. Pins were placed at 6 points (Figure 1) to aid with measurement and documentation. Point A was located at the intersection of the medial border of the patellar ligament and patella. Point B was located at the intersection of the lateral border of the patellar ligament and the patella. Point C was located on the medial border of the patellar ligament at the level of the patellar apex. Point D was located on the medial border of the patellar ligament at the level of the tibial plateau. Point E was the most prominent portion of the medial epicondyle, and point F was located at the anterior border of the medial collateral ligament at the level of the tibial plateau. The distance from point A to the IPBSN was documented at 5 lines of reference: 0° (horizontal), 30°, 45°, 60°, and the intersection of the IPBSN and the medial border of the patellar ligament (distances A1-A5 in Figure 1A). Additionally, the distance from point B to the intersection of the IPBSN and the lateral border of the patellar ligament (B1) as well as the horizontal distances from points C-F to the IPBSN (C1-F1) were recorded. Branches posterior to points E and F

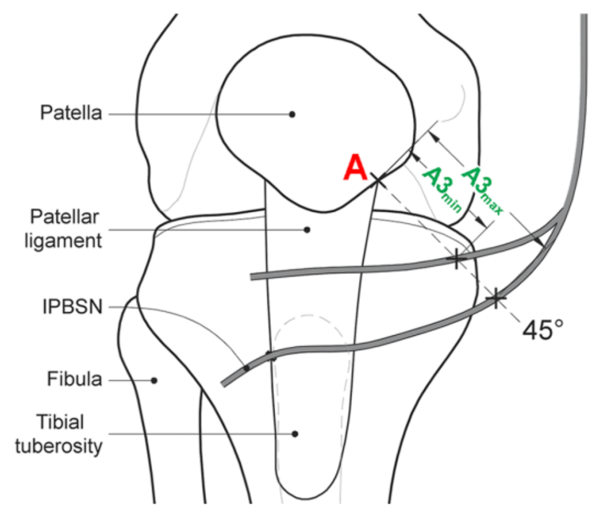

Figure 2. In specimens with multiple branches of the infrapatellar branch of the saphenous nerve (IPBSN), the minimum (most superior) and maximum (most inferior) distances were documented from all points of reference. Shown are the minimum and maximum distances for distance A3 (green).

were recorded as negative measurements (eg,–2.1 cm). For specimens that had multiple branches, the distances to the most superior (minimum measurement) and most inferior (maximum measurement) branches of the IPBSN were documented from all points of reference (Figure 2). For those without multiple branches, the minimum and maximum distances were documented as equal.

To determine the length of the leg, the distal tip of the medial malleolus was palpated, and a pin was placed to demarcate the location. The tibial plateau at the intersection with the medial collateral ligament was located, and another pin was placed. The distance between the pins was measured. Height was provided from donor intake documentation.

Distances were measured using a flexible measuring tape with tick marks in 1-mm increments to account for the curvature of the limb and documented in centimeters to 1 decimal point. A goniometer was utilized for all angular measurements. All measurements were performed by the same author (K.S.J.) for consistency, and 5 cadaveric specimens (10 knees) were remeasured by another author (K.H.) to determine the interrater reliability coefficient.

Statistical Analysis

Reliability was calculated from 138 measurements of 10 different specimens, each measured by the 2 reviewers. The resulting intraclass correlation coefficient was 0.999 ($P < .001$), indicating excellent interrater reliability,[5] and a clinical measures rating,[17] indicating a high reliability for measures.

We utilized the independent-samples t test to compare the means of 2 groups, the chi-square test to assess the frequency of categorical variables, and the Pearson correlation (r_P) to measure linear correlation between continuous data. $P < .05$ was selected as an indicator of statistical significance. Statistical calculations were performed using SPSS Version 26 software (IBM).

RESULTS

The mean ± SD length of the tibia was 37.6 ± 3.0 cm, and the mean height of the cadaveric specimens was 170.7 ± 10.6 cm.

Pathway

The overall location of the IPBSN in relation to anatomic landmarks is summarized in Table 2. There was a significant and strong correlation between leg length and height ($r_P = 0.832$; $P < .001$). Additionally, there was a significant but weak correlation between leg length and several measurements, including $A3_{min}$ ($r_P = 0.193$; $P = .049$), $A4_{min}$ ($r_P = 0.196$; $P = .045$), $A4_{max}$ ($r_P = 0.233$; $P = .017$), $A5_{max}$ ($r_P = 0.285$; $P = .004$), and $B1_{max}$ ($r_P = 0.210$; $P = .047$). However, an examination of the statistical relationship between height and location of the IPBSN revealed that there was no significant correlation with any measurement.

A comparison of results by sex revealed that only $A5_{max}$ was significantly different (male vs female: 6.17 vs 5.28 cm, respectively; $P = .049$) (Table 3). Examining results by side revealed a significant difference only for $F1_{max}$ (left vs right:–0.02 vs–0.98 cm, respectively; $P = .048$) (Table 4).

TABLE 2
Overall Measurements of IPBSN Location[a]

Distance[b]	No. of Knees	Minimum	Maximum
Anterior			
A1	96	6.10 ± 2.57	7.15 ± 2.30
A2	106	4.48 ± 2.44	6.05 ± 2.25
A3	105	3.82 ± 2.17	5.43 ± 2.09
A4	105	3.55 ± 2.05	5.23 ± 1.99
A5	102	3.74 ± 2.28	5.78 ± 2.28
B1	90	4.41 ± 2.11	6.35 ± 2.28
Anteromedial			
C1	100	5.06 ± 2.90	6.24 ± 2.49
D1	101	3.91 ± 3.05	5.35 ± 2.56
E1	95	–0.40 ± 2.02	–1.10 ± 1.96
F1	102	0.94 ± 2.71	–0.49 ± 2.46

[a]Data are reported as mean ± SD (in cm) unless otherwise indicated. IPBSN, infrapatellar branch of the saphenous nerve.
[b]See Figure 1 for distance definitions.

Emergence of Infrapatellar Innervation

Ultimately, 4 locations of emergence of infrapatellar innervation were revealed in this study, described as type A (anterior), type B (penetrating), type C (posterior), and type D (intermediate femoral cutaneous nerve [IFCN]) (Figure 3). Type B was the most common location of emergence, with 62.6% (n = 67) of the knees having a nerve emerging that penetrated the SM. Additionally, while previous studies had only described specimens with solitary innervation, 67.3% (n = 72) of the knees in this investigation revealed a single nerve serving the infrapatellar area, while 30.8% (n = 33) were dually innervated, and 1.9% (n = 2) had 3 infrapatellar nerves.

These previously undescribed patterns of innervation were henceforth designated according to the emergence of the nerves in a superior-inferior sequence. For example, if a knee had dual innervation with the superior nerve penetrating the SM (type B) and the inferior nerve emerging posterior to the SM (type C), the pattern was designated as "type BC." The observed patterns and their respective frequencies are described in Table 5.

Symmetrical emergence patterns were seen in 38.2% (n = 42) of the knees, while 59.6% were asymmetrical (n = 62). Chi-square analysis revealed no significant difference between male and female sex in regard to symmetry. Additional chi-square analysis indicated that there was no significant difference between male and female sex or between left and right knees in regard to emergence patterns.

DISCUSSION

This investigation revealed that there were no true safe zones along the anteromedial aspect of the knee in part because of the substantial contribution from the IFCN. Additionally, we found significant but inconsistent correlations between leg length, sex, and laterality on the pathway of infrapatellar innervation. Lastly, emergence pattern findings were consistent with several previous studies.

TABLE 3
Measurements of IPBSN Location by Sex[a]

Distance[b]	Male			Female		
	No. of Knees	Minimum	Maximum	No. of Knees	Minimum	Maximum
Anterior						
A1	54	5.90 ± 2.30	7.10 ± 2.18	42	6.35 ± 2.90	7.21 ± 2.47
A2	60	4.44 ± 2.55	6.28 ± 2.36	46	4.53 ± 2.31	5.76 ± 2.09
A3	59	3.82 ± 2.28	5.61 ± 2.14	46	3.82 ± 2.05	5.19 ± 2.02
A4	59	3.58 ± 2.21	5.52 ± 2.02	46	3.51 ± 1.85	4.86 ± 1.90
A5	57	3.70 ± 2.47	**6.17 ± 2.34**	45	3.81 ± 2.04	**5.28 ± 2.13**
B1	49	4.35 ± 2.02	6.74 ± 2.28	41	4.47 ± 2.24	5.89 ± 2.21
Anteromedial						
C1	56	4.97 ± 2.67	6.30 ± 2.37	44	5.18 ± 3.19	6.16 ± 2.65
D1	57	3.73 ± 2.92	5.31 ± 2.58	44	4.13 ± 3.22	5.40 ± 2.56
E1	54	−0.14 ± 2.05	−1.05 ± 1.95	41	−0.73 ± 1.96	−1.16 ± 2.01
F1	58	1.30 ± 2.88	−0.32 ± 2.63	44	0.46 ± 2.43	−0.72 ± 2.23

[a]Data are reported as mean ± SD (in cm) unless otherwise indicated. Bolded values indicate a statistically significant difference between sexes ($P < .05$; independent-samples t test). IPBSN, infrapatellar branch of the saphenous nerve.
[b]See Figure 1 for distance definitions.

TABLE 4
Measurements of IPBSN Location by Side[a]

Distance[b]	Left			Right		
	No. of Knees	Minimum	Maximum	No. of Knees	Minimum	Maximum
Anterior						
A1	49	6.30 ± 2.48	7.08 ± 2.40	47	5.89 ± 2.48	7.22 ± 2.21
A2	55	4.78 ± 2.42	5.71 ± 2.27	51	4.15 ± 2.44	6.43 ± 2.19
A3	54	4.15 ± 2.32	5.09 ± 2.14	51	3.47 ± 1.96	5.78 ± 1.99
A4	54	3.85 ± 2.22	4.96 ± 2.09	51	3.23 ± 1.82	5.52 ± 1.84
A5	51	3.88 ± 2.36	5.55 ± 2.56	51	3.61 ± 2.21	6.00 ± 1.97
B1	48	4.35 ± 2.08	5.96 ± 2.32	42	4.48 ± 2.17	6.81 ± 2.18
Anteromedial						
C1	51	5.19 ± 2.84	6.01 ± 2.62	49	4.93 ± 2.98	6.48 ± 2.34
D1	51	4.02 ± 2.88	5.08 ± 2.65	50	3.79 ± 3.24	5.62 ± 2.47
E1	46	−0.31 ± 2.01	−0.93 ± 2.15	49	−0.48 ± 2.06	−1.26 ± 1.78
F1	52	0.55 ± 2.53	**−0.02 ± 2.58**	50	1.34 ± 2.86	**−0.98 ± 2.25**

[a]Data are reported as mean ± SD (in cm) unless otherwise indicated. Bolded values indicate a statistically significant difference between sides ($P < .05$; independent-samples t test). IPBSN, infrapatellar branch of the saphenous nerve.
[b]See Figure 1 for distance definitions.

According to existing studies, the danger zone is an area defined by 2 SDs from the mean measurements. Consequently, any area outside these boundaries is considered to be within the safe zone for incision. Superior to the IPBSN, the boundaries were defined by the minimum measurements at points A and B (Figure 4). For point A, with the exception of measurement A1, the danger zone enveloped the origin of the measurement, and therefore to prevent damage to the IPBSN, incisions would need to be superior and lateral to the landmark, which precludes the avoidance of anteromedial and anterolateral portals. Inferiorly, the boundaries of the danger zone were defined by the maximum measurements for points A and B. The danger zone extended inferior to the tibial tuberosity and therefore outside the area of common incisions. Medially, the boundaries were defined by points C through F. Similar to the anterior measurements, the danger zone enveloped the origin of the measurement, indicating no medial safe zone for incision. However, injuries secondary to portal placement may be minimized with the increasing use of nanoscopes in sports medicine arthroscopic surgery.

Regarding infrapatellar innervation, previous anatomic studies have only described the involvement of the IPBSN while omitting the contribution of the IFCN. The inclusion of the IFCN in this analysis has influenced the determination that there is no safe zone for incision. Of the 27 knees (25.2%) that bore involvement from the IFCN, the IFCN was the most superior and lateral branch 77.8% (n = 21) of the time and the only nerve in 5 knees (4.7%). Therefore, this relationship relative to the IPBSN extended the danger

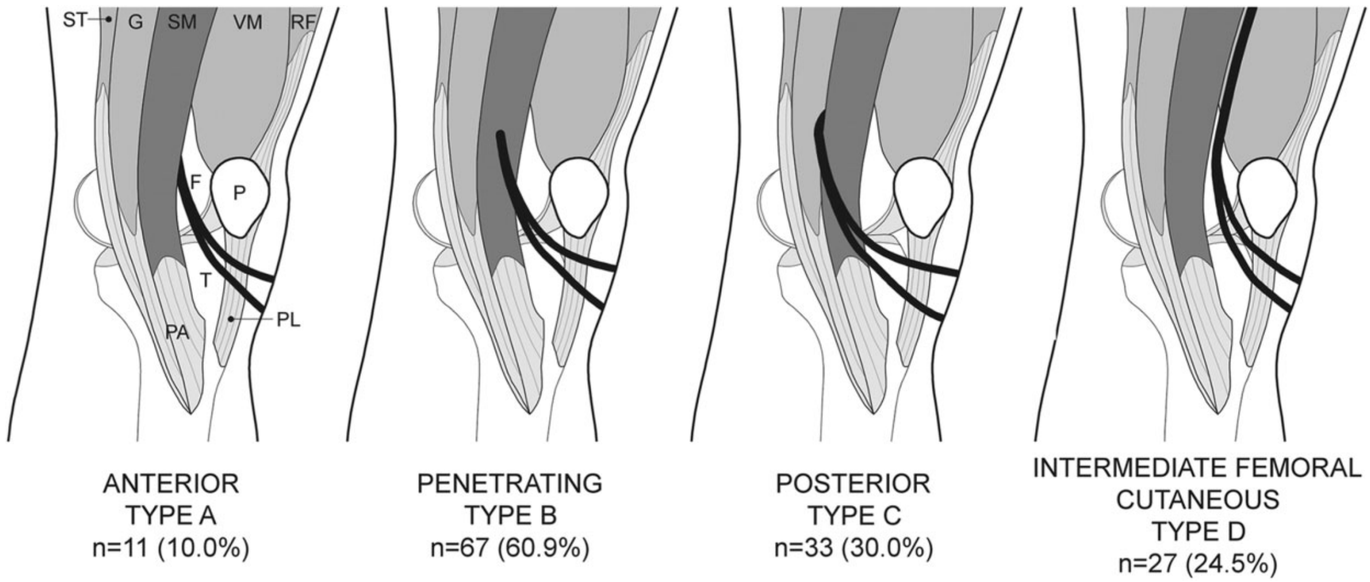

Figure 3. Emergence and frequency of the infrapatellar branch of the saphenous nerve (IPBSN) relative to the sartorius muscle (SM). F, femur; G, gracilis; P, patella; PA, pes anserinus; PL, patellar ligament; RF, rectus femoris; ST, semitendinosus; T, tibia; V, vastus medialis.

TABLE 5
Patterns of Emergence of Infrapatellar Nerves[a]

Type	n (%)
B	44 (41.1)
C	18 (16.8)
DC	8 (7.5)
A	5 (4.7)
D	5 (4.7)
BB	5 (4.7)
BD	5 (4.7)
DB	5 (4.7)
BC	3 (2.8)
BA	2 (1.9)
AB	1 (0.9)
AC	1 (0.9)
CB	1 (0.9)
DA	1 (0.9)
DD	1 (0.9)
BDC	1 (0.9)
DAC	1 (0.9)

[a]A, anterior to the sartorius muscle; B, penetrating the sartorius muscle; C, posterior to the sartorius muscle; D, intermediate femoral cutaneous nerve.

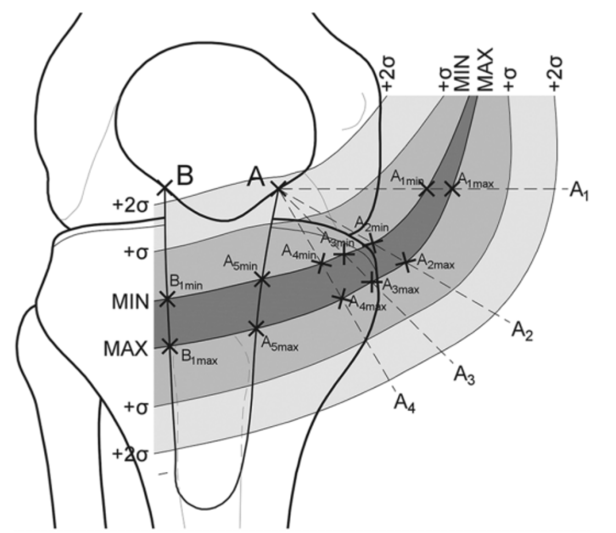

Figure 4. Minimum and maximum mean location (dark gray), ±1 SD (medium gray), and ±2 SDs (light gray) indicating the danger zone of the infrapatellar branch of the saphenous nerve (IPBSN) in relation to points A and B.

zone superiorly and laterally, essentially nullifying safe areas.

As previously stated, the investigation into the relationship between leg length and nerve pathway revealed significant but inconsistent correlations. Longer legs had no correlation with the horizontal measurements (A1, A2, and C1-F1) to the IPBSN but a significant correlation to the vertical dimensions (A3-A5 and B1). Specifically, longer legs revealed an absence of a significant relationship with the minimum measurements but a significant correlation with the maximum dimensions. Therefore, patients with longer legs will have an equal risk of iatrogenic damage during joint line incisions required for portal placement but potentially a decreased risk of iatrogenic damage during low incisions required for certain procedures including patellar ligament autograft harvesting or tibial tunnel drilling. Similarly, only $A5_{max}$ was significantly different when investigating the pathways between male and female sex, revealing that male patients may also be at a decreased risk

TABLE 6
Prevalence of IPBSN Emergence[a]

Author (Year)	Country	n	Prevalence, %			
			Anterior (Type A)	Penetrating (Type B)	Posterior (Type C)	IFCN (Type D)
Current study	USA	107	10.3	62.6	30.8	25.2
Henry et al[8] (2017)	Poland	156	15.4	42.9	41.7	—
Ackmann et al[1] (2014)	Germany	30	26.7	50.0	23.3	—
Kalthur et al[11] (2015)	India	32	68.8	28.1	3.1	—
LeCorroller et al[14] (2011)	France	30	0.0	66.7	33.3	—
Arthornthurasook and Gaew-Im[2] (1988)	Thailand	37	2.7	21.6	75.7	—

[a]Dashes indicate that this contribution to infrapatellar innervation was not described by or included in previous studies. IFCN, intermediate femoral cutaneous nerve; IPBSN, infrapatellar branch of the saphenous nerve.

during low incisions. However, considering that male specimens had longer tibias than female specimens (39.4 ± 2.6 vs 35.3 ± 1.7 cm, respectively), the apparent effect due to sex may actually be a result of increased leg length. An examination of bilateral differences revealed a 0.96-cm more posterior location of the IPBSN relative to the anterior border of the medial collateral ligament and the tibial plateau on the right side. However, the clinical significance of the difference is debatable, as the length and location of the primary incision for medial collateral ligament repair could potentially transect the nerve with a similar likelihood.

Regarding emergence, this investigation revealed a comparable distribution (Table 6) to LeCorroller et al[14] and similar results to Henry et al[8] and Ackmann et al.[1] These findings lend support to Henry et al's[8] assertion of a genetic/geographic influence on the location of emergence, as the specimens in this investigation were predominately White. As mentioned previously, however, preceding studies failed to identify specimens with multiple emergence points or contributions from the IFCN. Therefore, neither patterns of emergence nor the impact of infrapatellar innervation originating proximal to the SN have yet to be described.

Clinically, the importance of these findings is 2-fold. First, an appreciation of possible redundancy (32.7% in this study) in innervation of the infrapatellar area should lead to continued careful dissection after initial identification of the IPBSN, potentially preventing iatrogenic damage to additional nerves. Second, an awareness that cutaneous infrapatellar innervation can originate outside the adductor canal could potentially explain pain refractory to subsartorial nerve blocks. Finally, it may influence decision-making when choosing between femoral and adductor canal nerve blocks for operative anesthesia or postoperative analgesia.

Limitations

The limitations to this study are as follows. Because of body positioning during the preservation process, the specimens were essentially "locked" into full extension of the knee. Manipulation of the lower extremity to a flexed position was not possible without substantial disruption of surrounding tissue. This is the most significant limitation because, in practice, incisions are made with the knee inflected, and the location of the nerve may be changed in knee flexion. As with all anatomic studies, the complete avoidance of disruption during dissection cannot be attained; however, we believe that the magnitude of disruption is minimized by the large number of specimens included in this investigation.

CONCLUSION

Damage of the IPBSN during arthroscopic knee procedures has been well-documented. This anatomic study revealed that the IPBSN is not the only structure to be considered in patients with postoperative neurogenic pain, as a substantial proportion of specimens had contributions from the IFCN in the infrapatellar area. This additional supply of cutaneous innervation also affects potential safe areas of incision described in previous studies. With the inclusion of this nerve and defined as 2 SDs from the mean, we identified no safe zone. We believe that surgeons should be aware of this nerve's presence as an additional point of consideration for patient education, procedural planning, and postoperative pain management. Further investigation comparing the pathways, locations, and relationships between the individual nerves may be warranted.

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