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The Posteromedial Approach for Harvesting Hamstring Autografts Results in Fewer Incidents of Saphenous Nerve Injury Compared to the Conventional Anteromedial Approach: A Systematic Review and Meta-Analysis

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Background: The hamstring autograft can be harvested using various skin incisions, such as vertical, transverse, and oblique incisions, and from different localizations, including anteromedial and posteromedial harvest sites. The aim of this study was to compare studies on the anteromedial and posteromedial approaches for hamstring autograft harvest in terms of clinical outcomes, saphenous nerve injury, infection, operative time, graft length, incision length, range of motion, and patient satisfaction.

Methods: Following the 2020 Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines, a search was conducted in PubMed and Scopus, focusing on studies comparing anteromedial and posterior approaches for hamstring harvest. This study was registered with the PROSPERO International Prospective Register of Systematic Reviews (CRD42023450249). Methodological quality was evaluated using the Modified Coleman Methodology Score. Odds ratios (ORs) and mean differences (MDs) quantified dichotomous and continuous outcomes, respectively.

Results: Five articles, involving 405 knees, underwent analysis. Four studies were level 3 evidence, while 1 was level 1. The anteromedial hamstring harvest showed higher rates of saphenous nerve injury (OR, 9.77; 95% confidence interval [CI], 2.19–43.65; $p = 0.003$) and longer operative times, with an MD of about 13 minutes (MD, 13.33; 95% CI, 0.68–25.97; $p = 0.04$), compared to the posteromedial approach. The anteromedial method yielded a longer semitendinosus graft, with an MD of about 17 mm (MD, 17.57; 95% CI, 7.17–27.98; $p = 0.0009$). However, no significant differences existed in range of motion, flexion contracture, unintentional graft harvest, infection rates, and patient-reported outcomes. Notably, the posteromedial group reported higher cosmetic satisfaction, with 92% being very satisfied, compared to the anteromedial group with 80% ($p = 0.005$). However, overall satisfaction levels were similar between the 2 groups ($p = 0.35$), with a very satisfied rate of 72% for the anteromedial group and 78% for the posteromedial group.

Conclusions: The anteromedial hamstring harvest showed greater saphenous nerve injury and longer operative times compared to the posteromedial approach, along with a longer graft. However, no significant differences were observed in the range of motion, flexion contracture, graft harvest, infection, or patient outcomes.

Keywords: *Hamstring, Harvest, Anteromedial, Posteromedial, Saphenous nerve injury*

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Conventional hamstring tendon harvesting involves an anteromedial approach on the proximal tibia at the level of the pes anserinus. The majority of surgeons used this type of approach. This approach has been associated with complications, including injury to the infrapatellar branches of the saphenous nerve, premature graft amputation, and unintentional gracilis harvesting when only the semitendinosus tendon is required.[1)] Prodromos et al.[2)] described the posteromedial method for hamstring harvest to avoid common complications associated with the conventional anteromedial approach. The technique has undergone several modifications to reduce complications and improve postoperative outcomes.[2-4)] This approach was believed to simplify the identification of hamstring tendons, reduce saphenous nerve injury, and prevent premature amputation of the tendons.[5)] The process of harvesting hamstrings through the posteromedial approach begins with palpating the hamstring tendons near the posteromedial side of the knee while keeping the knee in a flexed position. Subsequently, an incision is made at the popliteal fold level, and the fascia is opened along the direction of the tendons. The identification, separation, and dissection of the semitendinosus tendon from the gracilis tendon ensue. Then, the intertendinous bands are easily recognized and released. The proximal tendon release is executed at the level of the myotendinous junction using an open-loop tendon stripper, and thereafter, the tendon is detached distally using a closed-loop tendon stripper.[2,5)]

Different graft options are available for ligament reconstruction, such as those obtained from the hamstring tendon, patellar tendon, quadriceps tendon, and peroneal tendon, in addition to several types of allografts.[6-9)] For the reconstruction of the medial patellofemoral ligament (MPFL) and the anterior cruciate ligament (ACL), hamstring tendons are a common choice of graft.[10,11)] The hamstring autograft was found to have a lower rate of complications associated with the donor site.[12)] The hamstring autograft can be harvested using various skin incisions, such as vertical, transverse, and oblique incisions, and from different localizations, including anteromedial and posteromedial harvest sites.[4,13,14)]

The aim of this systematic review was to compare studies on the anteromedial and posteromedial approaches for hamstring autograft harvest in terms of clinical outcomes, saphenous nerve injury, infection, operative time, graft length, incision length, range of motion, and patient satisfaction. The authors hypothesized that the posteromedial approach would yield comparable outcomes to the anteromedial approach for hamstring autograft harvest.

METHODS

Various databases such as PubMed and Scopus were examined to identify comparative studies that evaluated the outcomes and complications of hamstring autograft harvest using anteromedial and posteromedial incisions. The studies included in the review had to be published before July 30, 2023. This review was conducted in accordance with the 2020 Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines[15)] and registered with the PROSPERO International Prospective Register of Systematic Reviews (CRD42023450249). Before commencing the literature search, specific search criteria and outcome measures were defined. The databases were searched using the terms (“Anteromedial” OR “Anterior”) AND (“Posteromedial” OR “Posterior”) AND (“Hamstring” OR “Semitendinosus” OR “Gracilis”) AND “Harvest.”

Two researchers (NT and TI) independently conducted the searches and evaluated the titles and abstracts of the identified articles. Relevant studies meeting the criteria were selected for full-text inclusion screening. The same 2 researchers independently performed data extraction and assessed the methodological quality of the included studies. In cases where differences of opinion arose during the article search and selection process, another author (SK), in conjunction with the 2 researchers, engaged in discussions to reach a consensus. The research process followed a rigorous and collaborative approach to ensure the accuracy and reliability of the findings.

Study Eligibility

The criteria used for selecting eligible studies were as follows: (1) comparative studies with evidence levels

1 to 3; (2) articles published in English; (3) studies directly comparing the anteromedial and posteromedial approaches for hamstring autograft harvest; (4) studies reporting clinical outcomes, saphenous nerve injury, infection, operative time, graft length, incision length, range of motion, and patient satisfaction; and (5) availability of full-text articles. Studies that fell under the following categories were excluded: (1) basic science or biomechanical studies; (2) case series or case reports without a comparative group; (3) review articles; and (4) surgical technique reports.

Data Extraction

Data extraction was independently conducted by 2 researchers (NT and TI). In case of any conflicts, another researcher (DL) resolved them. The information collected from each study encompassed various characteristics, including details about the article, demographic data of the patients, surgical techniques employed, complications encountered, clinical outcome scores, range of motion, operative time, harvest time, graft length, incision length, and patient satisfaction.

Methodological Quality Assessment

The study's methodological quality was assessed independently by 2 researchers (NT and TI) using the Modified Coleman Methodology Score (MCMS).[16] In cases of disagreement, another researcher (TT) made the final decision. The MCMS score, ranging from 0 to 100, evaluates various aspects of the study. Part A of the MCMS primarily focuses on baseline study characteristics, while Part B assesses outcome criteria and enrollment rates. Scores between 85 and 100 indicate excellent quality, 70 and 84 are considered good, 55 and 69 are considered fair, and scores below 55 indicate poor quality.

Statistical Analysis

The data collected underwent analysis using RevMan version 5.4.1 (Cochrane). Continuous outcomes were assessed using mean differences (MDs) with 95% confidence intervals (CIs), while dichotomous outcomes were evaluated using odds ratios (ORs) with CIs in each study. Statistical heterogeneity was determined using the chi-square test, with a significance level of $p < 0.1$ indicating heterogeneity among the included studies. In cases where no evidence of heterogeneity was found, a fixed-effects model was utilized. Conversely, a random-effects model was applied when there was evidence of heterogeneity.

RESULTS

A total of 76 studies were identified based on the search criteria, and 31 duplicate studies were removed using Endnote X9 (Clarivate). After initial screening, 26 of the 45 assessed abstracts did not meet the inclusion criteria. Subsequently, 14 articles were excluded during the full-text review. Eventually, 5 articles comprising 405 knees were included in the final analysis. Among these, 4 studies were categorized as level 3 evidence, while 1 study was classified as level 1 evidence. The methodological quality of the included studies was assessed using the MCMS score, and the scores ranged from 56 to 70, indicating a fair to good level of methodology. Detailed information about the included studies can be found in Tables 1 and 2.[17-21] For an overview of the study selection process, refer to Fig. 1 in the PRISMA flow diagram.

Complications

There were 5 studies[17-21] comparing anteromedial and posteromedial approaches for hamstring harvest that reported occurrences of saphenous nerve injury. The overall occurrences of saphenous nerve injury in the anteromedial and posteromedial techniques for hamstring harvest were 10.2% and 0.4%, respectively. There were significantly higher rates of saphenous nerve injury in anteromedial approaches than in posteromedial approaches (OR, 9.77; 95% CI, 2.19–43.65; $p = 0.003$) (Fig. 2A).

There were 4 studies[17,19-21] comparing anteromedial and posteromedial approaches for hamstring harvest that reported occurrences of infection. The overall infection rate in the anteromedial and posteromedial techniques for hamstring harvest was 2.1% and 0.7%, respectively. There was no statistically significant difference between the 2 techniques (OR, 2.16; 95% CI, 0.37–12.72; $p = 0.39$) (Fig. 2B).

Operative Time and Harvest Time

There were 3 studies[17,19,21] showing the operative time of the ACL reconstruction with hamstring autograft using anteromedial and posteromedial approaches for harvest. The anteromedial approach had a significantly higher operative time than the posteromedial approach, with an MD of about 13 minutes (MD, 13.33; 95% CI, 0.68–25.97; $p = 0.04$) (Fig. 2C). There was 1 study[17] showing the harvest time of hamstring autograft using anteromedial and posteromedial approaches. The posteromedial approach for hamstring graft harvest had an average harvest time of 81 seconds (range, 55–138 seconds), while the anteromedial approach took an average of 315 seconds (range,

Table 1. The Details of Included Studies

First author (year)	LOE	Mean age (yr, Ant/Post)	Mean clinical FU	Operation	Number of patients (Ant/Post)	Outcome	MCMS
Dujardin (2015)[21]	3	28.0 ± 8.2/ 24.0 ± 6.7	6 mo	ACL reconstruction	20/19	Operative time, knee flexion, flexion deformity > 5°, complications, mean strength deficits for quadriceps and hamstrings	60
Franz (2016)[20]	1	31.1 ± 11.9/ 29.2 ± 10.7	3 mo	ACL reconstruction	49/51	Harvest time, complications, saphenous nerve injury, skin incision length, graft length	70
Shu (2019)[19]	3	29.0 ± 6.0/ 26.3 ± 7.3	Ant, 3.2 ± 0.6 yr; Post, 1.6 ± 0.5 yr	ACL reconstruction	22/29	Operative time, knee flexion, flexion deformity, complications, KOOS, WOMAC, IKDC, unintentional graft harvest	56
Aitchison (2022)[18]	3	14.5 ± 1.8/ 14.2 ± 2.2	NR	ACL reconstruction or MPFL reconstruction	26 (ACL, 19; MPFL, 7) / 89 (ACL, 0; MPFL, 89)	Skin incision length, graft length, nerve injury, complications	58
Garcia Hernandez (2022)[17]	3	58.9 ± 7.7/ 57.8 ± 9.2	31 ± 19 mo	ACL reconstruction	50/50	Harvest time, operative time, complications, ROM, cosmetic satisfaction, overall satisfaction	60

LOE: level of evidence, Ant: anteromedial harvesting group, Post: posteromedial harvesting group, FU: follow-up, MCMS: Modified Coleman Methodology Score, ACL: anterior cruciate ligament, KOOS: Knee injury and Osteoarthritis Outcome Score, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, IKDC: International Knee Documentation Committee Subjective Knee Form, NR: not reported, MPFL: medial patellofemoral ligament, ROM: range of motion.

81–552 seconds). The anteromedial approach required on average 234 seconds longer than the posteromedial approach, and this difference was statistically significant (p < 0.01).

Semitendinosus Graft Length and Incision Length

There were 2 studies[18,20] reporting the semitendinosus graft length using anteromedial and posteromedial harvesting approaches. The anteromedial approach had a significantly higher semitendinosus graft length than the posteromedial approach, with an MD of about 17 mm (MD, 17.57; 95% CI, 7.17–27.98; p = 0.0009) (Fig. 3A). There were 2 studies[18,20] reporting the incision length of hamstring autograft harvest using anteromedial and posteromedial approaches. There was no statistically significant difference between the 2 techniques for hamstring harvest with an MD of about 17 mm (MD, 16.73; 95% CI, –6.11 to 39.56; p = 0.15) (Fig. 3B).

Range of Motion

There were 3 studies[17,19,21] reporting the knee flexion motion of hamstring autograft harvest using anteromedial and posteromedial approaches. There was no statistically significant difference between the 2 approaches for hamstring harvest with an MD of about 0.8° (MD, –0.80; 95% CI, –3.58 to 1.98; p = 0.57) (Fig. 3C).

There were 2 studies[19,21] reporting the postoperative knee flexion contracture after ACL reconstruction with hamstring autograft harvest using anteromedial and posteromedial approaches. According to Dujardin et al.,[21] the anteromedial harvest group showed flexion contracture of more than 5° in 2 out of 20 patients at 3 months postoperatively, whereas the posteromedial harvest group had 1 out of 19 patients with similar deformity at the same time point. However, by 6 months postoperative, neither group exhibited any cases of flexion contracture. Shu et al.[19] reported that in the anteromedial harvest group, 1 out of 22 patients exhibited 5° of flexion contracture at a mean follow-up of 3.2 years, while in the posteromedial harvest group, 1 out of 29 patients showed this deformity at a mean follow-up of 1.6 years.

Patient-Reported Outcomes

Shu et al.[19] reported the evaluation of Knee injury and Osteoarthritis Outcome Score (KOOS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and International Knee Documentation Committee Subjective Knee Form (IKDC) following ACL reconstruction with hamstring autograft comparing anteromedial and posteromedial approaches for hamstring harvest. There were no statistically significant differences between anteromedial and posteromedial approaches in KOOS scores (34.0 ± 9.9 and 40.3 ± 21.8, respectively, p = 0.296), WOMAC ratio (–32.3% ± 21.0% and –21.9% ± 12.8%, respectively, p = 0.111), and IKDC scores (46.0 ± 29.8 and 43.9 ± 9.2, respectively, p = 0.773) between the 2 groups.

Table 2. The Details of Included Studies: Inclusions, Exclusions, and Surgical Techniques

First author (year)	Inclusion	Exclusion	Surgical technique (Ant)	Surgical technique (Post)
Dujardin (2015)[21]	· Aged ≥ 18 yr · Complete ACL rupture diagnosed by MRI · Participated in a pivoting sport · Anterior laxity (defined as STSD of 3 mm)	· Collateral ligament injury · Partial ACL tear · Concomitant cartilage or fracture	· Position: NR · Anesthesia: NR · Incision: 3 finger widths below the pole of the patella and 2 finger widths medial to it · Graft choice: quadruple semitendinosus tendon graft · Implant: GraftLink (Arthrex)	· Position: NR · Anesthesia: NR · Incision: immediately below the posterior knee fold · Graft choice: quadruple semitendinosus tendon graft · Implant: double EndoButton (GraftLink, Arthrex)
Franz (2016)[20]	· Isolated ACL tear who underwent arthroscopically assisted ACL reconstruction	· Additional procedures that necessitated changes to our standard postoperative ACL rehabilitation program, i.e., braces or a period of non-weight-bearing · Multiple-ligament knee injury · Concomitant large meniscal tears that required repair	· Position: NR · Anesthesia: NR · Incision: longitudinal incision over the pes anserinus with the knee flexed to 90° · Graft choice: semitendinosus and/or gracilis tendon graft · Implant: TightRope (Arthrex)	· Position: NR · Anesthesia: NR · Incision: transverse incision in line with the skin crease over the semitendinosus tendon in the posteromedial aspect of the popliteal fossa · Graft choice: semitendinosus and/or gracilis tendon graft · Implant: TightRope (Arthrex)
Shu (2019)[19]	· All patients receiving ACL reconstruction with hamstring autografts	· Non-English speaking · Multiple-ligament knee injury · Declined survey participation · Augmented with an allograft	· Position: supine · Anesthesia: NR · Incision: 6 cm distal to the joint line and 4 cm medial to the tibial tubercle · Graft choice: semitendinosus and/or gracilis tendon graft · Implant: TightRope (Arthrex)	· Position: supine · Anesthesia: NR · Incision: horizontal incision over the popliteal crease · Graft choice: semitendinosus and/or gracilis tendon graft · Implant: TightRope (Arthrex)
Aitchison (2022)[18]	· All patients receiving ACL or MPFL reconstruction with hamstring autografts	· Aged ≥ 21 yr · Reconstruction with allograft or an alternate graft choice	· Position: NR · Anesthesia: NR · Incision: oblique incision just medial to the tibial tubercle at the level of the pes anserinus · Graft choice: semitendinosus and/or gracilis tendon graft · Implant: NR	· Position: NR · Anesthesia: NR · Incision: transverse incision in the popliteal fold directly over the tendons · Graft choice: semitendinosus and/or gracilis tendon graft · Implant: NR
Garcia Hernandez (2022)[17]	· Postoperative follow-up of more than a year · Legal age · Complete ACL tear with or without associated meniscal injury	· Multiple-ligament knee injury · Associated secondary stabilization · Revision	· Position: NR · Anesthesia: NR · Incision: oblique incision using the lateral margin of the anterior tibial tuberosity as a reference · Graft choice: semitendinosus and gracilis tendon graft · Implant: dynamic femoral cortical suspension and interference screw in the tibia	· Position: NR · Anesthesia: NR · Incision: transverse incision in the popliteal fold · Graft choice: semitendinosus and gracilis tendon graft · Implant: all-inside technique and dynamic suspension in the femur and tibia

Ant: anteromedial harvesting group, Post: posteromedial harvesting group, ACL: anterior cruciate ligament, MRI: magnetic resonance imaging, STSD: side to side difference, NR: not reported, MPFL: medial patellofemoral ligament.

Strength Deficits for Quadriceps and Hamstring Muscle

There was 1 study[21] that reported the mean strength deficits for the quadriceps and hamstring muscles. Dujardin et al.[21] conducted a study comparing the mean strength deficits for the quadriceps and hamstring muscles after ACL reconstruction with hamstring autograft, using both the anteromedial and posteromedial approaches for harvest. After 3 months, the posteromedial harvest group exhibited a significantly lower quadriceps strength deficit (29%) compared to the anteromedial harvest group (42%) with a p-value of 0.03. The hamstring strength deficit after 3 months was similar between the 2 groups, with a p-value of 0.09. However, after 6 months, no significant difference in strength deficit was observed between the groups for both the quadriceps and hamstrings.

Unintentional Graft Harvest

There was 1 study[19] that reported the unintentional graft harvest after anteromedial and posteromedial approaches. Shu et al.[19] found that in the anteromedial harvest group,

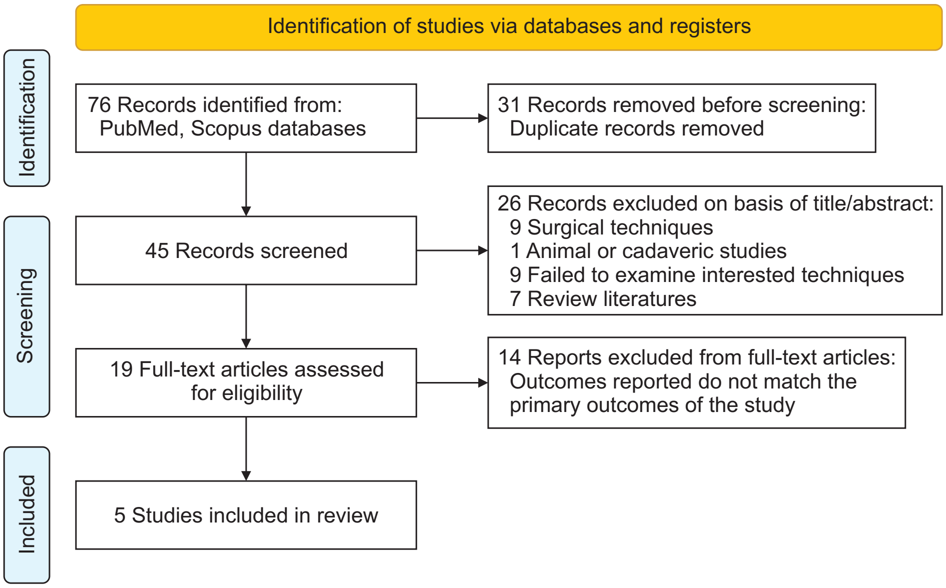

Fig. 1. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flow diagram of the study selection process.

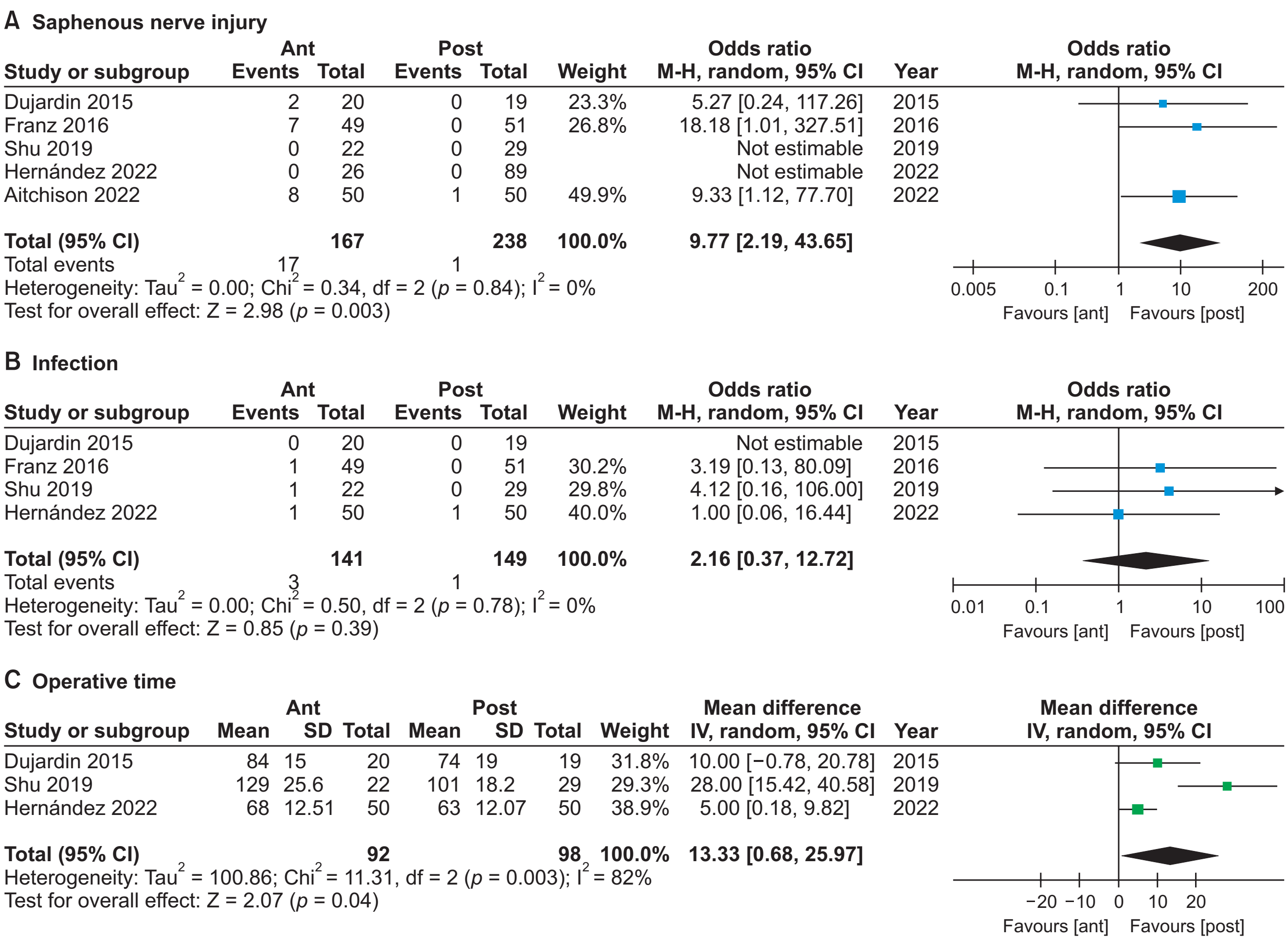

Fig. 2. Forest plots comparing the saphenous nerve injury rate (A), infection rate (B), and operative time (C) between hamstring harvest using anteromedial and posteromedial approaches. Ant: anteromedial approaches, Post: posteromedial approaches, M-H: Mantel-Haenszel, CI: confidence interval, SD: standard deviation, IV: inverse variance.

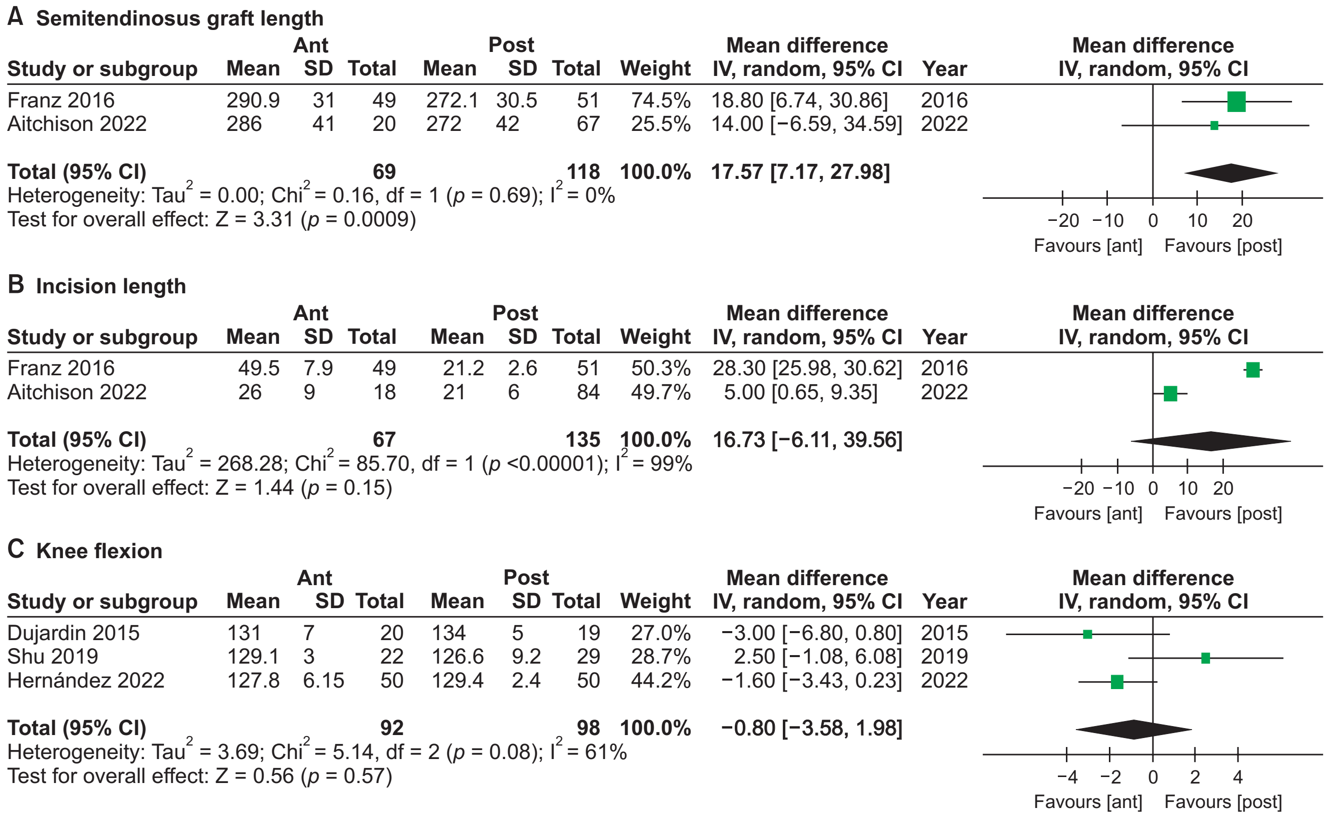

Fig. 3. Forest plots comparing semitendinosus graft length (A), incision length (B), and knee flexion (C) between hamstring harvest using anteromedial and posteromedial approaches. Ant: anteromedial approaches, Post: posteromedial approaches, SD: standard deviation, IV: inverse variance, CI: confidence interval.

2 out of 22 patients (9.1%) experienced unintentional gracilis tendon harvest, while there were no cases of unintentional harvest in the posteromedial group out of 29 patients (0%) ($p = 0.101$).

Cosmetic Satisfaction and Overall Satisfaction

There was 1 study[17] that reported cosmetic satisfaction and patient satisfaction after anteromedial and posteromedial approaches for hamstring harvest. Garcia Hernandez et al.[17] conducted a study in which they reported the cosmetic satisfaction levels of patients undergoing ACL reconstruction with hamstring autograft using both anteromedial and posteromedial approaches for graft harvest. Out of the total 50 patients in each group, 40 patients (80%) in the anteromedial harvest group and 46 patients (92%) in the posteromedial harvest group expressed high levels of satisfaction. Additionally, 16% of the patients in the anteromedial harvest group and 8% in the posteromedial harvest group reported being satisfied, while a smaller proportion of patients (4%) in the anteromedial group expressed being little satisfied. No patients in the posteromedial group reported being little satisfied. None of the patients in either group expressed dissatisfaction. The posteromedial harvest group exhibited a higher level of satisfaction compared to the anteromedial harvest group, with a statistically significant difference ($p < 0.05$).[17]

The overall patient satisfaction revealed that 72% (36 out of 50 patients) in the anteromedial group and 78% (39 out of 50 patients) in the posteromedial group expressed a high level of satisfaction. Furthermore, 24% (12 out of 50 patients) in the anteromedial group and 14% (7 out of 50 patients) in the posteromedial group reported being satisfied, while 4% (2 out of 50 patients) in the anteromedial group and 8% (4 out of 50 patients) in the posteromedial group expressed little satisfaction. There was no statistical difference between the 2 groups ($p = 0.35$).[17]

DISCUSSION

The most important finding of this systematic review and meta-analysis is that anteromedial approaches for hamstring harvest had higher rates of saphenous nerve injury and longer operative times compared to posteromedial approaches. The anteromedial approach also resulted in a longer semitendinosus graft length. However, there were no statistically significant differences between the 2 groups in terms of range of motion, flexion contracture, unintentional graft harvest, infection rates, and patient-reported outcomes. Notably, the posteromedial harvest group reported higher cosmetic satisfaction than the anteromedial harvest group, though overall satisfaction levels were similar between the groups.

Harvesting hamstring grafts comes with inherent risks. The predominant complication associated with this procedure involves regional paresthesia in the leg, often resulting from injury to the infrapatellar branch of the saphenous nerve.[22-24] The saphenous nerve and its infrapatellar branches play a crucial role in the innervation of the anteromedial aspect of the proximal tibia. The saphenous nerve, a branch of the femoral nerve, travels through the adductor canal and becomes superficial as it descends towards the knee.[25] Around the anteromedial side of the proximal tibia, it undergoes significant branching, particularly in the infrapatellar region. The infrapatellar branches of the saphenous nerve innervate the skin and soft tissues around the anterior and medial aspects of the knee, extending towards the proximal tibia. These branches contribute to the sensory innervation of the infrapatellar region, playing a role in pain perception and proprioception in this area.[25] In a study conducted by Ochiai et al.,[23] it was revealed that 21.1% (26 out of 123 patients) experienced postoperative sensory disturbances resulting from damage to the infrapatellar branch of the saphenous nerve during the anteromedial vertical longitudinal skin incision for hamstring harvest. Nevertheless, there were no statistically significant differences observed in the outcomes when comparing the group without sensory disturbances to the group with sensory disturbances.[23] de Padua et al.[24] reported that nearly 60% of patients who underwent hamstring harvest with an anteromedial vertical skin incision experienced an injury to the saphenous nerve. There are several ways to avoid saphenous nerve injury, such as harvesting the graft with the knee in a figure-4 position to reduce tension on the nerve, using an oblique skin incision, or opting for a posteromedial incision for the harvest.[5,26,27] In consideration of the infrapatellar branch's trajectory, it has been found that employing an oblique skin incision on the anteromedial aspect of the proximal tibia results in a lower rate of nerve injury when compared to a longitudinal incision. This finding has been substantiated by the meta-analysis conducted by Ruffilli et al.[22] In the included studies, Franz and Baumann[20] employed a longitudinal incision for the anteromedial approach, while Aitchison et al.[18] and Garcia Hernandez et al.[17] utilized an oblique incision for the same approach. On the other hand, Dujardin et al.[21] and Shu et al.[19] did not provide information on the type of incision used for the anteromedial approach. Due to the variety of surgical techniques among the included studies, caution is advised in the interpretation of the results. In this study, the authors conducted a meta-analysis of the most recent literature and discovered that anteromedial skin incisions result in a higher incidence of saphenous nerve injury compared to posteromedial incisions.

Prodromos et al.[2] proposed the posteromedial technique for hamstring harvest, suggesting that it could help avoid common problems associated with the anteromedial approach and lead to improved cosmetic results. Patients who underwent a posterior approach were less concerned about their scars, and all expressed high satisfaction with the resulting aesthetic appearance. This was attributed to the scars' location on the posteromedial aspect of the knee near the medial popliteal crease, making it scarcely visible. Regarding the incision length, there were 2 studies that compared the anteromedial and posteromedial approaches. Franz and Baumann[20] reported that the mean incision length for the anteromedial approach was 49.5 mm, whereas it was 21 mm for the posteromedial approach. Similarly, Aitchison et al.[18] found that the mean incision length for the anteromedial approach was 26 mm, while it was 21 mm for the posteromedial approach. However, in this meta-analysis, no statistically significant differences were observed between the 2 groups in terms of incision length. Some studies reported positive patient feedback on cosmetic satisfaction following the use of a posterior approach.[3,5] Kodkani et al.[3] reported that the posteromedial approach resulted in enhanced cosmesis. Within 1 month, the surgical scars were barely noticeable, and the scar on the posteromedial side seemed to blend into the skin flexor crease. Patients expressed minimal discomfort regarding the scar on the posterior aspect of the knee and reported high satisfaction with the overall cosmesis. Prodromos[5] reported a high level of satisfaction, with 67% of patients expressing being very satisfied with the cosmetic appearance outcomes of their knees. Notably, a significant number of participants, particularly women, placed considerable importance on the aesthetic appearance of their knees.

The semitendinosus and gracilis tendons merge into a single tendon on the pes anserine, making their identification difficult during the anteromedial approach for hamstring tendon harvest. To differentiate each tendon, the surgeon needs to dissect posteriorly until the tendons are separated, which may increase the risk of unintentional harvest or premature graft amputaion.[28,29] In contrast, the posteromedial incision is made at the popliteal crease, which is proximal to the tendon merging, thus potentially reducing the risk of unintentional harvest and premature graft amputation.[19] In this systematic review, there was 1 study by Shu et al.[19] that found no significant difference in unintentional graft harvest or premature graft amputation between anteromedial and posteromedial approaches. As the proximal release necessitated tenotomy at the myotendinous junction in the posteromedial approach, it differed from the conventional anteromedial approach where the tenotomy was performed at the tibial insertion. Consequently, this led to a shorter graft length in the posteromedial approach, which aligned with our findings. However, the MD was only 18.8 mm and 14 mm in the 2 studies that reported this outcome.[18,20] The posteromedial approach facilitated the easier identification of tendons and the release of intertendinous bands during harvest, potentially resulting in shorter harvesting and operative times.[2] In line with these considerations, the present meta-analysis indicated that the anteromedial approach had a significantly longer operative time than the posteromedial approach, with an MD of approximately 13 minutes. Furthermore, a study[17] examining hamstring autograft harvest times revealed that the anteromedial approach took on average 234 seconds longer than the posteromedial approach, and this difference was statistically significant ($p < 0.01$).

Based on the findings of this study, the authors suggest that the posteromedial approach for hamstring harvest could serve as a viable alternative to the traditional anteromedial approach. This alternative may potentially lead to reduced saphenous nerve injury, shorter operative times, and favorable cosmetic outcomes.

This study has several limitations that should be considered. First, it is possible that some relevant articles were missed due to the specific search terms used, which could potentially introduce bias to the results. Second, the majority of the included studies were categorized as level 3 evidence. Additionally, a substantial number of the reported outcomes were derived from just 1 or 2 studies, representing a significant weakness that adversely affects the reliability of the findings. Third, there were variations in the follow-up times, surgical methods, and patient characteristics among the included studies, making it more challenging to compare their results. Fourth, the use of different outcome measures in the studies makes it difficult to draw direct comparisons between them.

The anteromedial hamstring harvest showed greater saphenous nerve injury and longer operative times compared to the posteromedial approach, along with a longer graft. However, no significant differences were observed in the range of motion, flexion contracture, graft harvest, infection, or patient outcomes.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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