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Equal Failure, Unequal Timelines: Re-Rupture and Return-to-Sport After ACL Reconstruction Across Hamstring, Patellar, and Quadriceps Grafts in Elite Male Footballers

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Systematic Review

Keywords: anterior cruciate ligament (ACL) reconstruction, bone-patellar tendon-bone graft, graft re-rupture, graft selection, hamstring tendon autograft, professional footballers, quadriceps tendon autograft, return to sport

Posted Date: July 9th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10284341/v1

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Additional Declarations: The authors declare no competing interests.

Abstract

Anterior cruciate ligament (ACL) rupture is a career-threatening injury in elite male football, with major athletic and financial consequences. Hamstring (HT) and bone-patellar-tendon-bone (BPTB) autografts are long established, whereas the quadriceps tendon (QT) has become popular as a primary graft despite limited sport-specific evidence. This review brought together re-rupture and return-to-sport (RTS) outcomes for HT, BPTB, and QT autografts in elite male footballers. Following a prospectively registered PROSPERO protocol (CRD420261436169) and PRISMA 2020 guidance, we searched the English-language literature (2010 onward) for studies reporting graft re-rupture and/or RTS after primary ACLR in male professional, semi-professional, or competitive-elite footballers, with a minimum 12-month follow-up. Comparative and single-arm cohorts were eligible. Methodological quality was appraised with the MINORS instrument. Event proportions were summarised with Wilson 95% confidence intervals, and a narrative synthesis was performed. The search was restricted to PubMed/MEDLINE, and a planned meta-analysis was not undertaken owing to clinical heterogeneity and pooled graft reporting. Five studies (371 primary ACLRs; Level IV evidence; Fair-to-Good MINORS quality) were included. Ipsilateral graft re-rupture was uniformly low across all grafts, staying within a narrow 5 to 8 percent band (aggregated HT 6.2 percent, 95 percent CI 3.1 to 12.3; PT-versus-HT cohort 8.2 percent; combined BPTB-plus-QT cohort 7.4 percent), with widely overlapping confidence intervals. An independent QT re-rupture rate could not be derived, because the only QT cohort reported its events pooled with BPTB. RTS exceeded 92 percent in every cohort (aggregated HT 95.5 percent, 95 percent CI 90.0 to 98.1). Time to return differed by graft: roughly 6 to 8 months for HT versus 8.4 to 10.5 months for bone-block and QT reconstructions. The certainty of evidence was very low (GRADE) for all three outcomes. In elite male footballers, the hamstring, patellar-tendon, and bone-patellar-tendon-bone autografts all yield low re-rupture rates and high RTS. The comparative safety of the quadriceps tendon, however, remains unestablished. It is obscured by pooled reporting in a single small cohort, and this represents an urgent evidence gap that will require large-scale, graft-stratified registry data to close.

Introduction

Anterior cruciate ligament (ACL) rupture is one of the most consequential injuries in professional football. For the elite male player, a torn ACL means the loss of an entire competitive season and a long, uncertain rehabilitation. In a career whose peak spans only a handful of years, it can also threaten the player's livelihood. The consequences reach well beyond the individual. For the club, losing a key player carries several costs at once: the tactical disruption of being without a squad asset for nine months or more, the financial burden of a salary paid against no return on the pitch, and the depreciation of a multi-million-euro transfer investment. In an era of congested fixture calendars and rising physical demands, ACL injury has become a defining medical and economic problem of the elite game, and the operation that treats it, ACL reconstruction (ACLR), is one of the most scrutinised decisions in sports medicine. [1–4]

Central to that decision is the choice of graft. For three decades the field has relied on two workhorses: the hamstring-tendon (HT) autograft, favoured for its low harvest-site morbidity [5], and the bone-patellar-tendon-bone (BPTB) autograft, long regarded as the benchmark for secure fixation and rapid bone-to-bone healing [6–7]. The relative merits of these two grafts have dominated the literature for a generation, weighing the anterior knee pain and extensor-mechanism morbidity of BPTB against concerns about hamstring strength deficits and graft slippage with HT. More recently, a third option has become popular. The quadriceps-tendon (QT) autograft, once used mainly for revision surgery, has been adopted quickly as a primary graft, on the strength of its large and consistent cross-sectional area, its favourable biomechanical and load-to-failure profile, and reports of lower harvest-site morbidity than its established counterparts [8–11]. In many high-volume sports-medicine centres the quadriceps tendon is now a first-line choice.

This enthusiasm has outpaced the sport-specific evidence. The biomechanical and general-population data supporting the quadriceps tendon are increasingly strong, but the environment in which an elite footballer places a reconstructed knee is unlike any laboratory model or recreational cohort. It involves repeated high-load pivoting, deceleration, and cutting, sustained across a professional season and under constant pressure to perform. Whether the favourable properties attributed to the QT graft translate into an acceptable re-rupture rate under these specific demands is, at present, largely a matter of extrapolation and clinical impression. Its safety profile in professional male football has not been isolated, and much of what is assumed rests on data pooled with other grafts or borrowed from populations that bear little resemblance to the elite athlete [12].

The purpose of this systematic review is to address that deficit directly. We synthesise the published evidence on ipsilateral graft re-rupture and return-to-sport outcomes across the three principal autografts, hamstring, bone-patellar-tendon-bone, and quadriceps tendon, specifically in elite male footballers. The population was defined narrowly to preserve the homogeneity that the clinical question demands. Our aim is both to describe how these grafts perform where the evidence allows, and to set out clearly the gaps that remain, chief among them the true comparative risk of the quadriceps-tendon graft in the very population in which it is increasingly used.

Materials and Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement [13] and was prospectively registered with the International Prospective Register of Systematic Reviews (PROSPERO; CRD420261436169). The eligibility criteria applied here match those registered in the protocol. Three components of the registered analysis plan were modified during the review, as detailed below and revisited in the Discussion.

Search Strategy

A systematic search of PubMed/MEDLINE was performed (last run on 29 June 2026) to identify studies reporting graft re-rupture and return-to-sport outcomes following primary ACL reconstruction in male football (soccer) players. The search combined terms for the population (professional, elite, or competitive football/soccer players), the intervention (anterior cruciate ligament reconstruction and its graft variants: hamstring, bone-patellar-tendon-bone, and quadriceps tendon), and the outcomes of interest (graft re-rupture, graft failure, revision, and return to sport or play). The search was limited to studies published from January 2010 onward, to reflect contemporary surgical and rehabilitation practice, and to English-language reports. Reference lists of included studies and relevant reviews were hand-searched for additional eligible reports. After de-duplication, records underwent title and abstract screening, and studies retained at this stage were assessed in full against the eligibility criteria.

Eligibility Criteria

Studies were eligible if they met the following criteria: (1) enrolled male professional, semi-professional, or competitive-elite footballers, including players competing in first-, second-, or third-division leagues; (2) reported outcomes following primary ACL reconstruction using a hamstring-tendon (HT), bone-patellar-tendon-bone (BPTB), or quadriceps-tendon (QT) autograft; (3) reported ipsilateral graft re-rupture and/or return to sport as an outcome; (4) had a minimum follow-up of at least 12 months; and (5) were published in English from 2010 onward. Both comparative (head-to-head) and single-arm cohort studies were eligible, the latter provided the whole cohort received a single graft type. Exclusion criteria were female-only cohorts, mixed-sex cohorts in which eligible male players could not be extracted separately, youth or academy-only populations, recreational or amateur cohorts below competitive-elite level, non-football sporting populations, revision or multiligament index procedures, and biomechanical, cadaveric, or non-clinical studies.

Two features of the registered protocol are worth noting. The eligibility thresholds applied above, a minimum follow-up of 12 months and the admission of cohorts with more than 85% male participants where sex-disaggregated outcomes could not be extracted separately (one included study met this provision at 88.9% male), were pre-specified in the registered protocol to make the most of the limited elite-football evidence base, rather than introduced after the fact. During the review, however, three components of the registered plan were not carried out as registered. First, the planned quantitative meta-analysis, a Freeman-Tukey double-arcsine random-effects pooling of event proportions stratified by graft type, was replaced by a narrative synthesis with descriptive Wilson 95% confidence intervals. This was because the two comparative studies did not report graft-disaggregated event counts, and the between-study heterogeneity in surgical technique, adjunctive procedures, rehabilitation, and outcome definition made a pooled effect estimate uninterpretable. Second, the electronic search was confined to PubMed/MEDLINE, whereas the registered protocol had also specified Embase and the Cochrane Central Register of Controlled Trials; hand-searching of reference lists was used to reduce the effect of this narrowing. Third, the pre-planned GRADE certainty-of-evidence appraisal was completed and is

reported below. These departures are acknowledged as deviations from the registered protocol and are revisited in the Discussion.

Data Extraction

Data were extracted by a single reviewer using a standardised, piloted extraction form; extracted values were subsequently checked for internal and arithmetic consistency. Extracted variables were: study identifiers (first author, year, journal, country); study design and level of evidence; population characteristics (competition tier, cohort size, proportion male, mean age at surgery); graft type and number of reconstructions per graft arm; surgical technique and use of adjunct lateral extra-articular procedures; the primary outcome of ipsilateral graft re-rupture (event counts and proportions); and secondary outcomes including return to sport (rate, level, and time to return), contralateral and second-ACL injury, reoperation, and follow-up duration. Where event counts were reported only as proportions, integer numerators were back-calculated from the reported denominator. Discrepancies or ambiguities in the reported data were resolved by consensus, and values that could not be disaggregated by graft arm were recorded as such rather than imputed. The unit of analysis throughout was the individual knee (reconstruction); where a study reported both a player count and a knee (reconstruction) count, the knee count was used as the denominator for all event proportions to maintain consistency across cohorts.

Quality Assessment

The methodological quality and risk of bias of the included studies were appraised with the Methodological Index for Non-Randomized Studies (MINORS) [14]. MINORS was chosen over the Newcastle-Ottawa Scale because three of the five included cohorts were single-arm case series, which cannot be scored on the comparability domains the latter instrument requires. Although the registered protocol also specified the Cochrane RoB 2 tool for randomised trials, no randomised controlled trials met the eligibility criteria; RoB 2 was therefore not applied, and all five included observational studies were appraised with MINORS. The MINORS tool was applied in its two matched forms: the eight-item non-comparative version (ideal score 16) for single-arm series, and the twelve-item comparative version (ideal score 24) for comparative cohorts. Each item was scored 0 (not reported), 1 (reported but inadequate), or 2 (reported and adequate). Total scores were expressed as a percentage of the applicable maximum and categorised as Good/High (at least 75%), Fair/Moderate (50–74%), or Poor/Low (below 50%). Given the expected heterogeneity in graft arms, surgical technique, and outcome definitions, and the single-arm nature of several cohorts, a narrative synthesis was planned in advance; event proportions were summarised descriptively with Wilson 95% confidence intervals and were not combined into a meta-analytic effect estimate. The certainty of the body of evidence for each outcome was then rated with the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework, in which observational evidence begins at low certainty and is downgraded for risk of bias, inconsistency, indirectness, imprecision, and publication bias.

Results

Study Selection and Characteristics

The database search identified 308 records after de-duplication. Title and abstract screening excluded 289 records, leaving 19 reports for full-text assessment. A further 14 were excluded: eight for a non-eligible population (mostly recreational, mixed-tier, or non-football cohorts), four because female or mixed-sex outcomes could not be disaggregated, one for a non-relevant outcome, and one non-comparative registry report. This yielded five studies for qualitative synthesis (Fig. 1). No additional study was recovered through citation searching that changed this count.

The five included cohorts comprised 371 primary anterior cruciate ligament reconstructions (ACLRs) in male professional, semi-professional, or competitive-elite footballers. Three were single-arm hamstring-tendon (HT) series [15–17], one was a comparative patellar-tendon (PT) versus HT cohort [18], and one was a comparative bone-patellar-tendon-bone (BPTB) versus quadriceps-tendon (QT) series [19]. For clarity, PT denotes the patellar-tendon graft used in the former cohort, which is reported separately from the bone-block BPTB graft of the latter; the two are treated as distinct graft types throughout. Cohort size ranged from 21 to 232 knees. Participants were young (weighted mean age roughly 23–25 years) and, apart from one cohort that was 88.9% male [18], exclusively male. All five studies were retrospective or prospective observational designs corresponding to Level IV evidence.

Methodological quality, appraised with MINORS, was Fair to Good. Scores ranged from 10/16 to 13/16 for the non-comparative series and from 15/24 to 18/24 for the comparative studies (Fig. 2). The same limitations recurred across the evidence base: no study performed an a priori sample-size calculation, endpoint ascertainment was seldom blinded (graft failure was often confirmed by telephone questionnaire or public media rather than independent adjudication), and most cohorts did not achieve a loss to follow-up below 5%. The shared strengths were an explicit aim, enrolment of consecutive patients, and follow-up appropriate to the research question in every study.

Primary Outcome: Ipsilateral Graft Re-Rupture

Ipsilateral graft re-rupture was reported in all five studies and stayed within a narrow 5–8% band, regardless of graft or study (Fig. 3). Aggregated across the three hamstring series by simple summation of events and knees, which is not a meta-analytic pooling, the re-rupture rate was 6.2% (7/112; 95% CI 3.1–12.3). The comparative PT-versus-HT cohort reported 8.2% (19/232; 95% CI 5.3–12.4), and the combined BPTB-plus-QT cohort reported 7.4% (2/27; 95% CI 2.1–23.4). The confidence intervals overlapped almost entirely; the interval for the QT-containing cohort sat wholly within that of the aggregated hamstring estimate, giving no signal of a graft-specific difference in early graft failure.

One feature of the evidence base limits any graft-level inference, and it is the main knowledge gap this review was designed to expose. No independent re-rupture proportion could be derived for the

quadriceps tendon. The only elite-football cohort to use QT [19] reported its two re-ruptures across the combined 27-player cohort (17 BPTB and 10 QT) without attributing either event to a specific graft arm. Likewise, the larger comparative cohort [18] reported a single pooled rate without a per-graft (PT versus HT) breakdown in the available data. As a result, although QT-inclusive outcomes were numerically similar to the hamstring and BPTB figures, the QT arm rests on only ten players and two undifferentiated events. That is far too small a sample, and too confounded by graft pooling, to detect a between-graft difference large enough to influence graft selection. The comparative re-rupture performance of the quadriceps tendon in elite male footballers therefore remains undetermined. In addition, both comparative cohorts included a proportion of players who underwent concomitant lateral extra-articular tenodesis (LET), an adjunct known to reduce graft re-rupture independently of graft choice. Because LET use was not reported in a graft-stratified manner, its contribution to the observed re-rupture rates cannot be separated from that of the graft itself.

Secondary Outcomes: Return to Sport and Contralateral Injury

Return to sport (RTS) was uniformly high and did not differ by graft, exceeding 92% in every cohort. Rates ranged from 92.6% (25/27) in the BPTB/QT series to 95.7% (222/232) in the PT-versus-HT cohort, with an aggregate hamstring estimate of 95.5% (107/112; 95% CI 90.0-98.1) (Fig. 3). Return to the same or a higher level of competition, where reported, stayed high in the medium term but fell over successive seasons. In one hamstring cohort it dropped from 95% at one year to 62% at four years [17], reflecting the wearing demands of elite football rather than early graft failure.

The grafts differed in the time to return, not in the eventual rate of return. The hamstring cohorts returned players to competition at a mean of roughly 6 to 8 months (return to play 6.4 months and return to official match 7.5 months [15]; first official match 8.0 months [16]; 6.1 months [17]). The bone-block and quadriceps-tendon cohorts returned players more slowly, at a median of 8.4 months for the BPTB/QT series [19] and a mean of 10.5 months for the PT-versus-HT cohort [18]. This 2- to 4-month difference fits the slower tendon-to-bone or tendon graft-site maturation expected from bone-block and soft-tissue quadriceps harvests, though the differing harvest sites, rehabilitation protocols, and single-surgeon practices across the series mean the delay cannot be attributed to graft type alone. Several hamstring cohorts thus returned players, on average, before the nine-month threshold associated with a markedly elevated re-injury rate in the general athletic literature [20–21], although none reported the proportion of players returning before this point.

Contralateral and second-ACL injury were reported inconsistently and could not be pooled. The most fully characterised cohort documented a 15.8% second-ACL injury rate, made up of the 5.3% ipsilateral revision rate reported above and a 10.5% contralateral injury rate, alongside a 28.1% overall reoperation rate [15]. This underlines that the burden of further knee injury in this population extends well beyond ipsilateral graft failure. Patient-reported outcome measures registered as secondary outcomes, including the IKDC, Lysholm, and Tegner scores, were reported too inconsistently across the included studies to allow structured synthesis and are therefore not presented as a separate outcome.

Certainty of Evidence (GRADE)

The certainty of evidence, assessed with GRADE, was very low for all three outcomes (Table 1). Because every included study was a Level IV observational cohort, the body of evidence began at low certainty and was downgraded further for serious risk of bias (unblinded outcome ascertainment, frequent reliance on telephone or public-media surveillance, loss to follow-up commonly above 5%, and no a priori sample-size calculation) and for inconsistency, given the variation in surgical technique, adjunctive procedures, and outcome definitions that prevented pooling. It was also downgraded for imprecision, arising from small cohorts and correspondingly wide confidence intervals. For the re-rupture outcome, the pooling of graft arms within the two comparative studies and the inability to isolate a quadriceps-tendon estimate compounded this imprecision, and imprecision was rated very serious on that outcome. No outcome qualified for upgrading. The resulting very-low certainty means the true effects may differ substantially from the descriptive estimates reported here, and these findings should be read as hypothesis-generating rather than confirmatory.

Table 1. *GRADE evidence profile for the three review outcomes. All estimates derive from Level IV observational cohorts. Certainty begins at low for observational evidence and is downgraded for serious risk of bias (unblinded ascertainment, media or telephone surveillance, loss to follow-up above 5%, no a priori sample-size calculation), serious inconsistency, and serious to very serious imprecision (small cohorts, wide confidence intervals). No outcome qualified for upgrading. The symbol denoting one filled and three empty circles indicates very low certainty.*

Outcome (studies; participants)	Design	Risk of bias	Incon-sistency	Indirect-ness	Impre-cision	Certainty
Ipsilateral graft re-rupture (5 studies; 371 ACLRs)	Observational (Level IV)	Serious (−1)	Serious (−1)	Not serious	Very serious (−2)	●○○○ Very low
Return-to-sport rate (5 studies; 371 ACLRs)	Observational (Level IV)	Serious (−1)	Serious (−1)	Not serious	Serious (−1)	●○○○ Very low
Time to return to sport (5 studies; 350 knees)	Observational (Level IV)	Serious (−1)	Serious (−1)	Not serious	Serious (−1)	●○○○ Very low

Discussion

The main finding of this systematic review is that, among elite male footballers undergoing primary ACL reconstruction, ipsilateral graft re-rupture is uniformly low, staying within a narrow 5–8% band across every autograft studied, while the time needed to return to competition differs markedly by graft type. Aggregated hamstring re-rupture (6.2%), the patellar-tendon-versus-hamstring (PT-versus-HT) cohort (8.2%), and the combined bone-patellar-tendon-bone (BPTB) and quadriceps-tendon (QT) cohort (7.4%) showed closely similar re-rupture rates, with widely overlapping confidence intervals [15–19]; no formal statistical comparison between grafts was performed, and this similarity should therefore be read as descriptive rather than as evidence of equivalence. Return to sport (RTS) was correspondingly high and did not differ by graft, exceeding 92% in every cohort. Against this background of equivalent structural and participation outcomes, the one dimension along which the grafts separated, time to return, ranging

from about six months for hamstring to more than ten months for bone-block reconstructions, becomes the clinically decisive variable. It is also the outcome most likely to be influenced by non-biological factors specific to professional football.

The Quadriceps-Tendon Evidence Gap

Over the past decade the quadriceps tendon has risen from a niche revision option to a mainstream primary graft, promoted for its large cross-sectional area, low harvest-site morbidity, and favourable biomechanical profile [9–11]. Yet this enthusiasm has clearly outpaced the sport-specific evidence, and nowhere more than in elite football. This review shows how deep that deficit runs: across 371 reconstructions, only a single cohort of ten players used the quadriceps tendon, and even there its outcomes could not be isolated. Both re-rupture events in that series were reported across a pooled BPTB-and-QT population without attribution to a graft arm, which makes an independent QT failure rate impossible to derive. The comparative safety of the quadriceps tendon in professional footballers therefore rests, at present, on very limited evidence. The available figures are numerically reassuring but statistically uninformative, as they are obscured by the pooled reporting that characterises the small comparative series in which QT currently appears.

This is not a gap that further small single-centre cohorts can close. Detecting a clinically meaningful difference in re-rupture, an event that occurs in fewer than one in ten athletes, against the low baseline documented here would require sample sizes far beyond the reach of any single institution treating this small population. The way forward is large-scale, graft-stratified registry data, ideally built into existing league and federation injury-surveillance frameworks [22], in which quadriceps-tendon outcomes are captured and reported as a discrete arm rather than combined with other bone-block or soft-tissue grafts. Only prospectively collected, adequately powered, and graft-resolved data will turn the current numerical reassurance into genuine evidence. Until such data exist, choosing the quadriceps tendon for an elite footballer remains an extrapolation from adjacent populations rather than a decision grounded in sport-specific outcomes.

The Time-to-RTS Paradox and Career Pressure

The two- to four-month difference in return time, about six to eight months for hamstring reconstructions versus 8.4 to 10.5 months for the bone-block and quadriceps cohorts, is biologically coherent and fits the slower graft-site incorporation expected when a bone or tendon plug has to remodel [23]. Its clinical meaning, though, cannot be separated from the economic environment in which elite football operates. Professional careers are short, playing contracts are finite, and squad places depend on availability. The pressure from clubs, coaching staff, and expiring contracts to get a high-value asset back on the pitch is intense and well documented [24]. In this setting, the graft with the fastest nominal return is liable to be chosen, and its rehabilitation compressed, for reasons that are commercial as much as clinical.

This raises a possibility that the present data cannot rule out and that warrants explicit statement: one hypothesis worth stating is that the six-month returns seen in the hamstring cohorts may reflect an

industry demand for rapid reintegration rather than the completion of biological graft maturation. A graft that allows earlier return is not necessarily a graft that is ready earlier. The capacity to return and the readiness to return are different things, and the first is easier to measure and more commercially rewarded than the second. If accelerated timelines are driven by contractual and competitive pressures that outrun ligamentisation, players may be exposed to a period of raised, and largely unmeasured, re-injury risk [20–21]. This inference is drawn from general athletic cohorts and stands in apparent contrast to the low short-to-medium-term re-rupture rates observed here; whether the two can be reconciled by incomplete follow-up or by genuinely lower risk in this population cannot be determined from the available data. The apparent equivalence of grafts on structural outcomes should not, therefore, be taken as permission to optimise graft selection for speed alone. Whether the earliest returners are being served or endangered by that speed is, on current evidence, unknown, and it is a research question every bit as pressing as the graft comparison itself.

Limitations

The limitations of this review come mainly from the evidence it synthesises, as the Fair-to-Good MINORS appraisal reflects. All five included studies were Level IV observational designs; three were single-arm hamstring series with no internal comparator, which prevents any within-study contrast between grafts and leaves the hamstring estimate anchored but uncontrolled. Across the evidence base, endpoint ascertainment was rarely blinded, as graft failure was often confirmed by telephone contact or public-media surveillance rather than independent clinical adjudication, and loss to follow-up commonly exceeded the 5% threshold. Both raise the risk of under-ascertainment of re-rupture. No study performed an a priori sample-size calculation. At the level of the synthesis, the heterogeneity of surgical technique, adjunct lateral extra-articular procedures, rehabilitation protocols, and outcome definitions, combined with the pooling of graft arms within the two comparative studies, prevented a valid meta-analytic effect estimate; the event proportions presented here are descriptive and were not combined in a random-effects model. The deliberately narrow eligibility criteria, male, elite-tier football, that give this review its specificity also limit how far its conclusions generalise to female, recreational, and multi-sport populations. The electronic search, moreover, was confined to PubMed/MEDLINE; although the registered protocol had also specified Embase and the Cochrane Central Register of Controlled Trials, these were not searched, and the reference lists of included studies and relevant reviews were hand-searched to reduce, but not remove, the risk of missed reports. Two components of the registered analysis plan were therefore not carried out as pre-specified: the planned Freeman-Tukey random-effects meta-analysis was replaced by the narrative synthesis reported here, and the single-database search departed from the registered multi-database strategy. Both are disclosed as deviations from the registered protocol. The pre-planned GRADE certainty appraisal was completed and is reported above. Data extraction was performed by a single reviewer, with independent arithmetic verification but without a second independent extractor, which may introduce a risk of selection or transcription error. Finally, the inability to separate the effect of concomitant lateral extra-articular tenodesis from that of graft type, and the absence of any formal statistical comparison between grafts, further constrain the strength of any between-graft inference.

Conclusions

Among elite male footballers undergoing primary ACL reconstruction, the hamstring (HT), patellar-tendon (PT), and bone-patellar-tendon-bone (BPTB) autografts all deliver low re-rupture rates and high rates of return to professional competition, and on current evidence each remains a defensible choice. The comparative risk profile of the quadriceps tendon, however, cannot be established from the existing literature. Its outcomes in this population rest on a single small cohort in which they are inseparable from those of other grafts, which leaves its true safety profile an urgent and unresolved knowledge gap. Given the accelerating use of the quadriceps tendon in sports medicine, and the strong commercial incentives that shape both graft choice and return-to-play timing in professional football, there is a pressing need for large-scale, graft-stratified, prospectively collected registry data that can isolate quadriceps-tendon outcomes and separate the capacity to return from genuine biological readiness. Until such evidence exists, graft selection for the elite footballer should be made with explicit acknowledgement of what remains unknown.

Declarations

Conflicts of Interest

The author declares no conflicts of interest. No funding was received for this work.

Acknowledgements

The author thanks Tuncay Koc for independent arithmetic verification of the extracted data. The data extracted and analysed in this systematic review were obtained entirely from previously published studies and are available from the corresponding author on reasonable request. AI-based tools were used solely for language editing and consistency checking; the study design, literature search, data extraction, analysis, and interpretation were performed entirely by the author.

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Figures

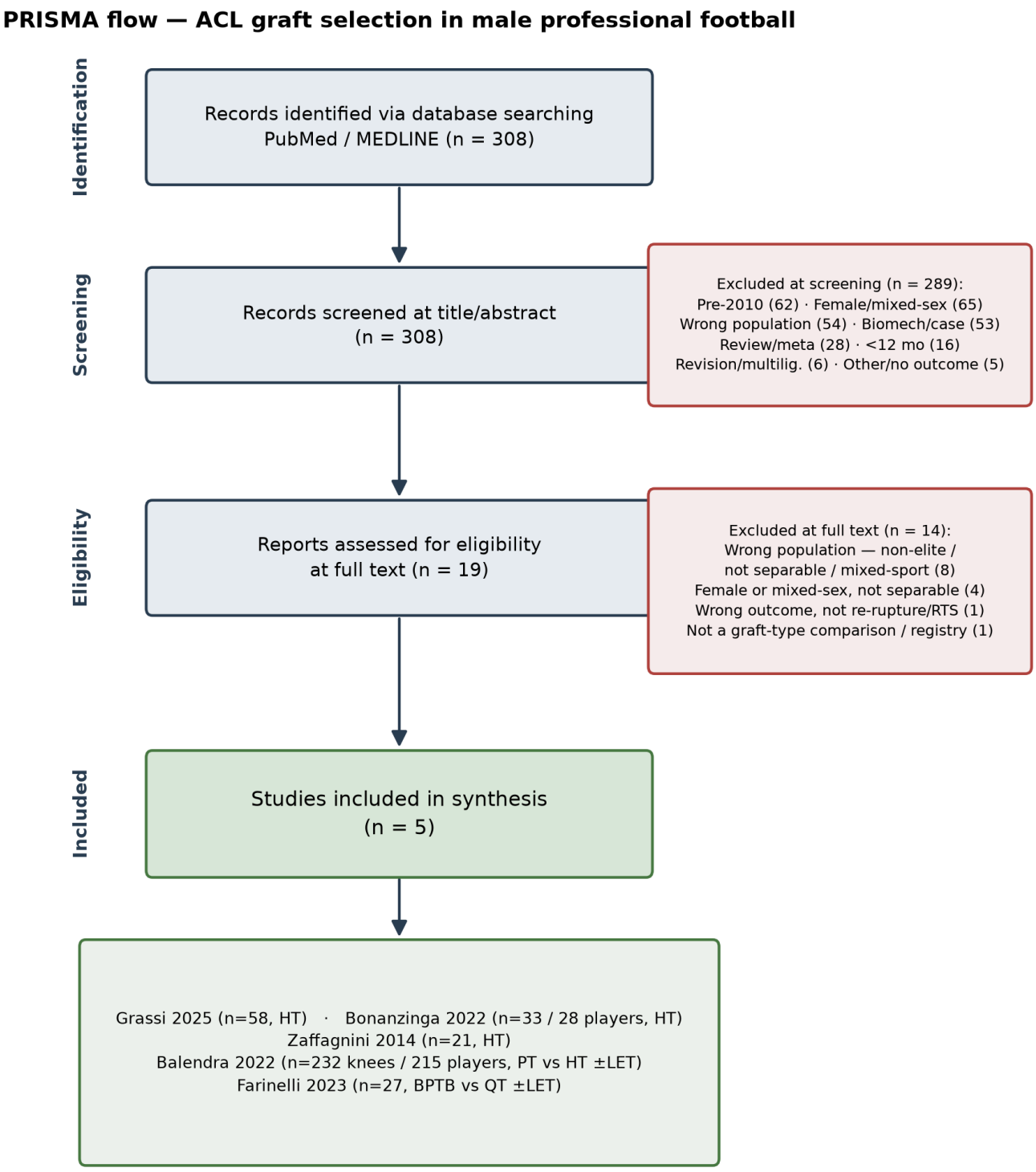


Figure 1

PRISMA 2020 flow diagram of study selection. From 308 de-duplicated records identified through PubMed/MEDLINE, 289 were excluded at title and abstract screening and 14 at full-text assessment, yielding 5 studies for qualitative synthesis. Exclusion reasons at full text were non-eligible population (n=8), female or mixed-sex outcomes that could not be disaggregated (n=4), non-relevant outcome (n=1), and a non-comparative registry report (n=1).

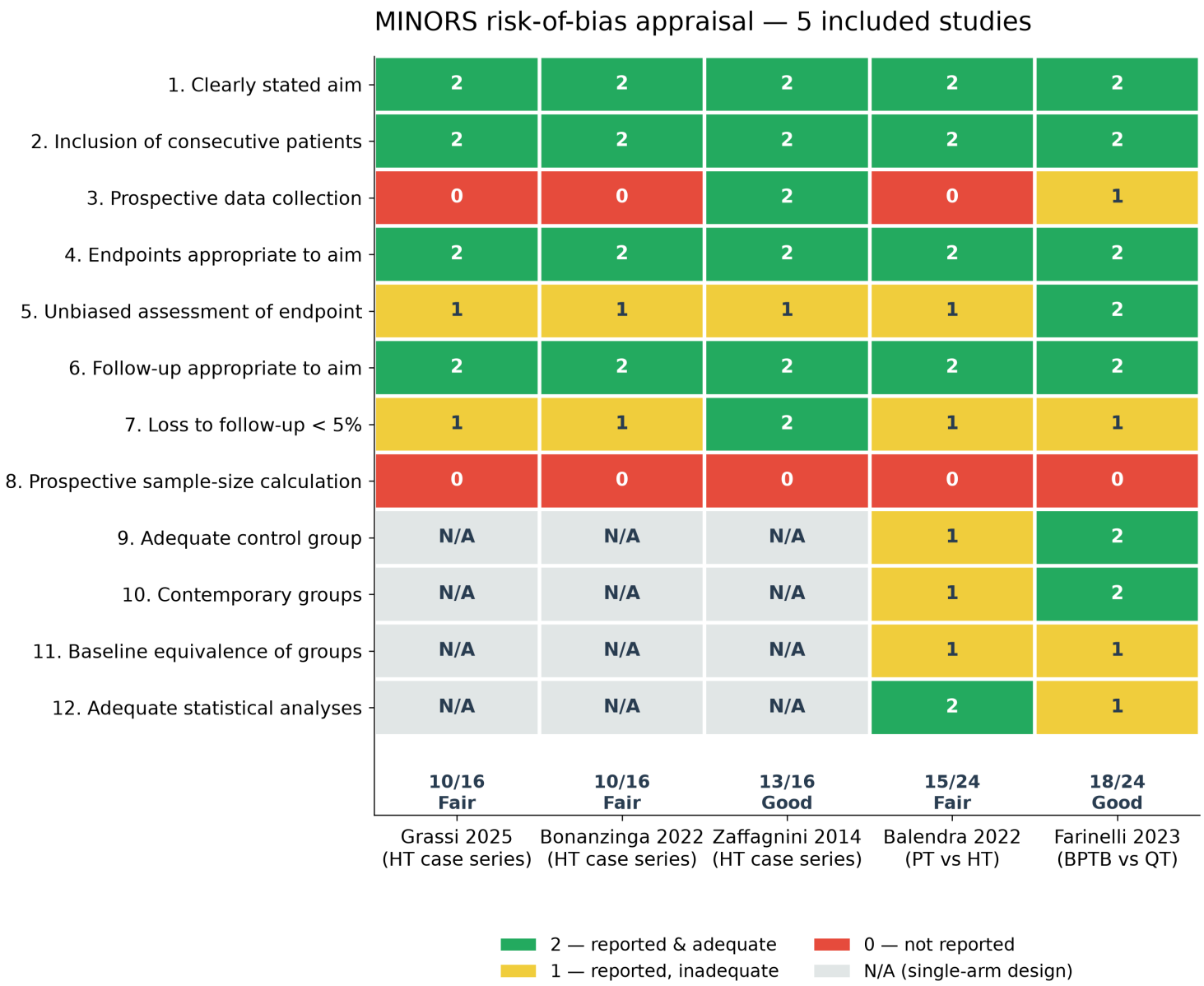


Figure 2

MINORS methodological quality appraisal of the included studies. Each item was scored 0 (not reported), 1 (reported but inadequate), or 2 (reported and adequate). Single-arm case series were scored on 8 items (ideal score 16) and comparative cohorts on 12 items (ideal score 24). Total scores and Good/Fair/Poor ratings are shown for each of the five included studies. Recurrent limitations across the evidence base were the absence of an a priori sample-size calculation and unblinded endpoint ascertainment.

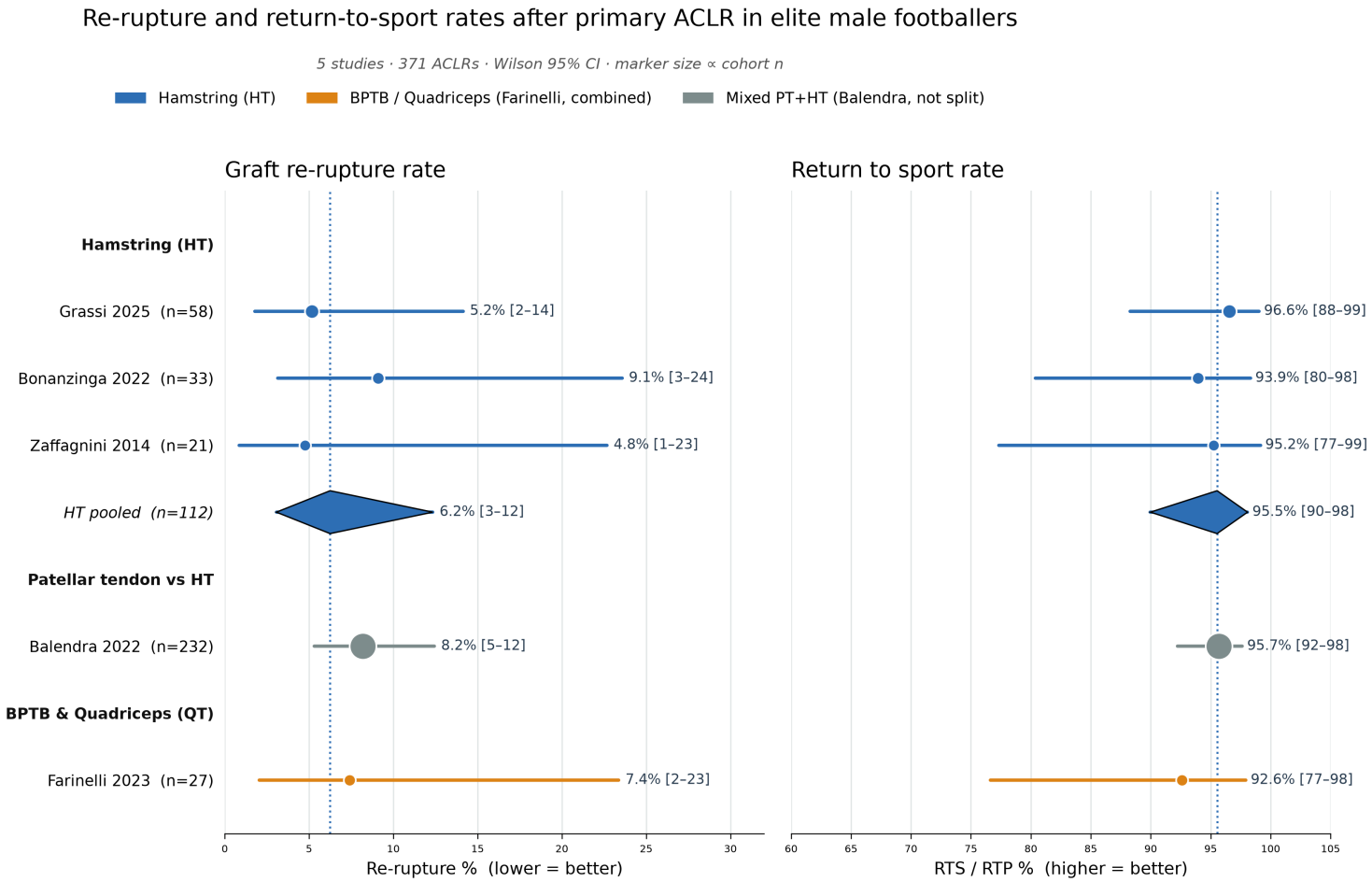


Figure 3

Forest plot of ipsilateral graft re-rupture and return-to-sport proportions by graft type. Proportions are shown with Wilson 95% confidence intervals, grouped by graft. Marker size is proportional to cohort size, and the diamond denotes the aggregated hamstring estimate. Re-rupture rates lie within a narrow 5-8% band across all grafts. The quadriceps-tendon arm is reported combined with bone-patellar-tendon-bone and cannot be isolated. Return-to-sport exceeded 92% in every cohort.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- DataExtraction.csv