

GROIN PAIN IN ATHLETES

CLINICAL PATHWAYS AND THE RATIONALE BEHIND THEM

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INTRODUCTION

Groin pain in athletes rarely presents as a single, easily bounded clinical problem. The region is anatomically dense, with muscular, tendinous, ligamentous, articular, and neural structures converging within a small area. Several of these structures share overlapping innervation and biomechanical function, which means pain generated by one structure is frequently felt, described, and even provoked as though it originated from another.

This anatomical overlap has direct clinical consequences. A rigid, one-size-fits-all diagnostic protocol struggles to accommodate the genuine variability seen in daily practice. Two athletes with almost identical pain distribution can present with entirely different underlying pathology, while two athletes with the same underlying pathology can describe strikingly different symptom patterns depending on sport, training load, and individual biomechanics.

The Doha Agreement provided a shared clinical language for this problem, defining adductor-related, iliopsoas-related, inguinal-related and pubic-related groin pain, while recognising hip-related groin pain and other causes¹. That vocabulary has improved both

communication and research reporting. But classification answers only the first part of the clinical problem: knowing which entity best describes an athlete does not, by itself, determine what should happen next. Classification is therefore the starting point of clinical reasoning, not its endpoint. More than one entity may be present in the same athlete², and the clinically dominant presentation may change during rehabilitation, so reassessment may confirm, refine, or redirect the initial clinical interpretation.

For this reason, structured clinical pathways in this field function best as a decision framework rather than a fixed algorithm. This article presents five illustrative, composite cases, developed from patterns commonly encountered at Aspetar's Sports Groin Pain Center, to demonstrate how history and clinical examination determine routing within this framework, and where the evidence supporting each branch is strong, extrapolated, or still emerging.

This account reflects institutional clinical experience rather than a validated external guideline. Where published evidence directly supports a decision point, this is stated explicitly. Elsewhere, the reasoning

reflects accumulated clinical judgement developed through years of running a dedicated groin pain clinic.

FROM CLASSIFICATION TO CLINICAL DECISION-MAKING (Table 1)

Two features of this table deserve early comment. Most entities follow an open-ended rehabilitation course, adjusted according to clinical progress rather than a fixed calendar. The inguinal/nerve-related and Acute PLAC entities, however, carry a structured four-week review built in from the outset rather than left to emerge only if progress stalls in spite of appropriately delivered rehabilitation. At that review, escalation was considered when the predefined institutional criteria had not been achieved.

One clarification applies throughout. Classification identifies the dominant symptomatic presentation and organises diagnostic reasoning, monitoring, and decisions about imaging and intervention. The rehabilitation programme itself is built from the individual athlete's deficits, loading capacity and sport-specific demands rather than from the entity label.

Two further points apply across every branch. Before an athlete enters an entity-

TABLE 1

Entity	First-line management	Reassessment and escalation
Pubic-related	Rehabilitation	Reassessment if progress stalls
Adductor-related	Rehabilitation	Reassessment if progress stalls
Iliopsoas-related	Rehabilitation	Reassessment if progress stalls
Acute PLAC	Rehabilitation	Structured review at four weeks. Escalation considered where the institutional criteria below have not been achieved despite an appropriately delivered rehabilitation programme
Inguinal/nerve-related	Rehabilitation. An ultrasound-guided diagnostic local anaesthetic block may be performed alongside rehabilitation where a meaningful nerve-mediated hypothesis exists	Structured review at four weeks. Escalation considered where the institutional criteria below have not been achieved despite an appropriately delivered rehabilitation programme. Where a nerve-mediated contribution is supported and clinically relevant symptoms persist, an ultrasound-guided perineural corticosteroid injection and specialist surgical review are both reasonable considerations; the balance between them is contextual, including the stage of the season and the recovery time available, rather than a fixed sequence. A negative or equivocal block should prompt diagnostic reconsideration rather than automatic further intervention
Suspected structural inguinal pathology	Rehabilitation.	Reassessment according to clinical progress. Surgical review considered where symptoms persist despite appropriate rehabilitation and history, examination and dynamic imaging are clinically concordant. A posterior wall finding alone does not justify escalation.
Frank direct or indirect inguinal hernia	Direct surgical review	—
Hip-related groin pain	Rehabilitation	Detailed management beyond the scope of this article

Institutional four-week reassessment criteria, applied to both the Acute PLAC and the inguinal/nerve-related branches. If the athlete had not achieved pain-free crossover, a reduction in squeeze pain of more than 3/10 VAS, an adductor limb symmetry index of at least 80%, and symmetrical hip internal rotation, the case was considered appropriate for escalation at our centre. They reflect internal clinical agreement and have not been externally validated as universal thresholds.

Table 1: Overview of clinical entities and default management.

specific pathway, serious, referred and non-musculoskeletal causes should be considered where clinically appropriate: bone stress injury, intra-articular hip pathology, referred spinal symptoms, urogenital or visceral causes, and age-specific pathology.

The Doha framework also recognises ‘other causes’ of groin pain beyond its defined clinical entities. One potentially under-recognised presentation is pelvic floor dysfunction, particularly an overactive or non-relaxing pelvic floor, which should be considered in athletes with otherwise unexplained groin or pelvic pain, especially when pelvic or perineal symptoms coexist with urinary, bowel or sexual symptoms³. In such presentations, targeted pelvic floor assessment may add clinically relevant information and guide an appropriately individualised rehabilitation approach.

And when an athlete does not respond as expected, the appropriate question is not simply “What is the next treatment?” but also “Are we still on the right pathway?” Table 2 summarises the assessment components that inform this reasoning; it is a practical checklist rather than a set of diagnostic criteria.

CASE 1: A HANDBALL PLAYER WITH REPRODUCIBLE ADDUCTION PAIN

A 26-year-old handball player presents with a six-week history of medial groin pain. Onset was gradual, without a specific traumatic event, and symptoms have progressively worsened with cutting movements and change-of-direction drills, both central to his sport.

Palpation reproduces tenderness at the proximal adductor longus and gracilis attachments. The adductor squeeze test

is positive at 0° and 45° of hip flexion. Hip range of motion is otherwise preserved, and there is no radiation, no neurological symptoms, and nothing in the history suggesting systemic involvement.

This presentation corresponds closely to the recognised clinical pattern of adductor-related groin pain. Routing into the adductor-related branch follows directly from these findings. Hölmich's randomised trial demonstrated that structured active exercise substantially outperforms passive treatment in athletes with long-standing adductor-related groin pain⁴, and structured active rehabilitation remains the anchor of management here, although the trial evidence comes from athletes with longer symptom duration.

One point deserves emphasis, because it is easily lost. The adductor-related classification identifies where the athlete's

TABLE 2

Component	What to assess	Why it matters
History	Onset (gradual or discrete event), duration, load or training change, sport-specific provocation, previous groin injury or surgery, response to previous treatment	Mechanism separates acute from overload presentations and frames the differential
Pain location and behaviour	Where the athlete points; deep or superficial; radiation; burning or electric quality; night pain; progression	Localisation and quality guide the dominant presentation and flag neuropathic features
Palpation	Adductor longus origin and musculotendinous junction; pubic symphysis and immediately adjacent bone; pubic tubercle; superficial inguinal ring and inguinal canal; iliopsoas and hip flexor region	Reproduction of the athlete's familiar pain is more informative than tenderness alone
Adductor testing	Squeeze test at 0° and 45°; resisted adduction; adductor strength and limb symmetry	Supports an adductor-related presentation and provides a measure for tracking progress
Iliopsoas / hip flexor	Resisted hip flexion and hip flexor length testing	Iliopsoas-related pain is commonly missed and frequently coexists
Abdominal and inguinal provocation	Resisted abdominal loading; cough and Valsalva; assessment for an apparent inguinal bulge, cough impulse or other feature suggestive of a frank hernia	Supports assessment of an inguinal-related presentation when interpreted with inguinal canal tenderness and the remainder of the clinical examination. Palpation is not a sensitive stand-alone test for sports-related inguinal pathology, and posterior wall bulging under load is not synonymous with a frank inguinal hernia
Hip examination	Passive range of motion, internal rotation symmetry, impingement and provocation testing	Hip-related pain may coexist; preserved range does not exclude intra-articular pathology
Neurological / nerve features	Subjective features: burning or electric pain quality, radiation, numbness or altered sensation, and a recognisable sensory distribution. Sensory testing in ilioinguinal, iliohypogastric and genitofemoral territories	Neuropathic features modify the diagnostic and therapeutic approach within the inguinal/nerve branch. No single feature is specific: provocation by sustained position, for example, also occurs with musculotendinous problems and is read only as part of the wider pattern
Alternative or red-flag pathology	Bone stress injury, intra-articular hip pathology, referred spinal symptoms, urogenital or visceral causes, age-specific pathology	Should be considered where clinically appropriate before committing to an entity-specific pathway

Table 2: Practical clinical assessment checklist (not diagnostic criteria).

familiar symptoms are reproduced; it does not establish why that region became overloaded, and it does not specify a predefined exercise programme. Rehabilitation therefore combined progressive restoration of adductor capacity with attention to the individual biomechanical, load-related and sport-specific contributors relevant to this athlete. The classification informs the starting point of rehabilitation; it does not prescribe the programme.

Recurrence risk was discussed with the athlete as part of the initial consultation, not deferred to a later stage. Previous groin injury is one of the most consistently reported risk factors for subsequent groin problems in athletes^{5,6}. This informed both the rehabilitation goals and the criteria

used to define readiness for return to sport, which required progressive restoration of training intensity and volume and of sport-specific and competition-specific loading, rather than symptom resolution or isolated strength recovery alone.

CASE 2: A DISTANCE RUNNER WITH PAIN RESISTANT TO CATEGORISATION

A 22-year-old distance runner presents with an eight-week history of deep, central groin pain. Onset was gradual, without a specific triggering event, and symptoms have progressed alongside an increase in running volume.

Given the combination of a running athlete, persistent deep groin pain and a recent increase in load, a stress-related bony process was considered and addressed

by imaging before rehabilitation was progressed.

On examination, the pain pattern differs meaningfully from Case 1. Rather than a discrete point of tenderness at a muscle-tendon junction, the athlete describes a deeper, more central discomfort, and palpation confirms this: her familiar pain is reproduced directly over the pubic symphysis and the immediately adjacent bone, rather than at the adductor origin a few centimetres laterally.

Resisted adduction and the squeeze test reproduce only mild, centrally located pubic discomfort rather than the sharply localised adductor pain of Case 1, and the symphysis and adjacent bone remain the clearly dominant site reproducing her familiar symptoms. Palpation of the inguinal canal



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is unremarkable, and coughing and Valsalva do not reproduce her familiar pain. Hip range of motion and rotation are preserved, which makes a dominant hip-joint or iliopsoas contribution less likely, although it does not exclude intra-articular hip pathology.

Taken together, these findings supported a predominantly pubic-related clinical presentation rather than an adductor-related one. Rehabilitation remained individualised, with an initial loading emphasis on restoring tolerance across the symphysis and abdominal wall while progressively reintroducing running volume.

This distinction matters for anyone learning to apply the pathway. The two presentations sit only a few centimetres apart anatomically, and it is common, particularly for less experienced clinicians, to treat them as interchangeable simply because both fall under the broad heading of “groin pain.” Identifying which presentation dominates may influence the initial loading emphasis and how symptoms are monitored during rehabilitation. It does not mean the two require entirely separate programmes: adductor-related and pubic-related presentations frequently share

underlying biomechanical drivers, which is part of why they so commonly occur together, and their rehabilitation content overlaps considerably.

CASE 3: AN ACUTE ADDUCTOR AVULSION WITH A BUILT-IN SAFEGUARD

A 28-year-old footballer experienced a sudden, sharp pain at the pubic attachment of the adductor longus while striking the ball, and was unable to continue playing. Examination the following day identified localised swelling and bruising at the pubic attachment, acute tenderness on resisted adduction, and a palpable defect suggestive of a partial tear at the enthesis.

This acute, traumatic mechanism, with a discrete injury event and localisation at the pubic attachment, routes the athlete into the Acute PLAC pathway. This entity reflects a relatively recent shift in anatomical understanding. For a long time, an acute injury at this location was treated as a simple adductor longus enthesis tear. More recent anatomical work has shown this to be an oversimplification: the adductor longus tendon at its pubic attachment does not act in isolation, but connects directly to the pyramidalis muscle and the anterior

pubic ligament, forming a single functional complex now referred to as the PLAC, the pyramidalis–anterior pubic ligament–adductor longus complex⁷.

This distinction is not merely academic. An injury at this site can involve any combination of these structures rather than one, and six patterns of PLAC injury have been described on MRI, defined by the status of the adductor longus fibrocartilage, the pyramidalis and the pectineus⁸. Isolated adductor longus injury is the exception rather than the rule. Treating every acute injury at this location as an isolated adductor tear therefore risks underestimating what is often a more complex, multi-structure injury. MRI describes the pattern and extent of injury, including whether more than one structure is involved, rather than determining routing, which the mechanism and examination have already established. The patterns are descriptive: they have not been shown to predict recovery trajectory or the need for surgery.

In our institutional pathway, acute PLAC injuries carried a predefined four-week review, providing a scheduled opportunity to confirm that recovery was progressing as expected and to reassess the initial

interpretation. Although these injuries frequently progress well with conservative management, the review provided a structured clinical checkpoint. The four-week review therefore functions as a built-in safeguard against silent stagnation, rather than a routine follow-up appointment or a step on the way to surgery.

Where the criteria have not been achieved despite an appropriately delivered rehabilitation programme, the response is still not automatic escalation. The sequence is to reconsider the extent of injury and the initial clinical interpretation, review the rehabilitation programme, consider whether further imaging or multidisciplinary discussion would add information, and only then consider escalation where clinically justified. Conservative management remains central, and specialist surgical consideration is reserved for selected athletes who do not progress.

CASE 4: WHEN THE PAIN POINTS TOWARD A NERVE, NOT A TENDON

A 29-year-old field hockey player presents with a ten-week history of groin discomfort that has proven difficult to characterise. The pain is described as a burning, electric sensation radiating from the inguinal region

toward the upper medial thigh, worsened by hip extension and by prolonged standing, and occasionally accompanied by localised numbness.

On examination, the picture is dominated more by what is absent than by what is found. Palpation over the inguinal canal produces only mild, poorly localised discomfort, without a clear structural trigger point. Resisted adduction, resisted sit-up testing, and hip flexor strength testing are all unremarkable, making the adductor, pubic, and iliopsoas presentations described in the earlier cases unlikely to be dominant. Sensory examination along the distribution of the ilioinguinal nerve reveals a patch of altered sensation.

Inguinal-related and nerve-related presentations overlap substantially and are managed within a single pathway at our centre; the ilioinguinal, iliohypogastric and genitofemoral nerves traverse this region with considerable individual variation and overlapping sensory territories⁹. Within that pathway, neuropathic features modify assessment and management: burning or electric pain quality, altered sensation, radiation beyond a single muscle group, and a recognisable cutaneous distribution¹⁰. Provocation by sustained positions is often present but is not specific, since

musculotendinous problems may be provoked in the same way. Rehabilitation remains first-line management, and the same structured four-week review applies as in the Acute PLAC branch.

Unlike the previous cases, however, the diagnostic uncertainty here does not need to wait for a rehabilitation trial to run its course. Where the clinical picture already raises a meaningful nerve-mediated hypothesis, as it does here, an early ultrasound-guided local anaesthetic block can be performed before the four-week review, rather than being reserved until the four-week review or subsequent escalation. Rehabilitation proceeds either way; the block is performed alongside it rather than deciding whether it goes ahead. Its value is that clarifying a nerve contribution early informs how the presentation is interpreted and monitored, and which interventional options are relevant.

The block is a diagnostic clarification step rather than a treatment and is interpreted by reassessing the athlete's characteristic symptom or provocative manoeuvre within the expected anaesthetic window. A clear and substantial temporary reduction in the athlete's familiar pain supports a nerve-mediated contribution. No validated numerical threshold was used in this

TABLE 3			
Case	Entity	Imaging finding	Effect on clinical reasoning
1	Adductor-related	MRI: periosteal oedema, mild tendinous signal change, no discrete tear	None on routing. Consistent with the clinical impression already established
2	Pubic-related	MRI: symphyseal bone marrow oedema	None on routing. Used particularly to address a possible stress-related bony process. Marrow oedema should not automatically be regarded as the pain generator
3	Acute PLAC	MRI: describes the pattern and extent of injury and identifies whether more than one structure within the complex is involved	Does not determine routing. Describes injury extent and contributes to multidisciplinary discussion where an athlete is not progressing; descriptive rather than prognostic.
4	Inguinal/nerve-related	MRI and high-resolution ultrasound may visualise the relevant nerves and identify structural nerve pathology. Ultrasound is additionally used in real time to guide the diagnostic block	Supports the clinical hypothesis where positive; normal imaging does not exclude a nerve-mediated contribution
5	Suspected structural inguinal pathology	Dynamic ultrasound under active Valsalva or resisted abdominal contraction: bulging of the inguinal floor under load, static exam unremarkable	Demonstrates an abnormality absent statically. Requires clinical concordance before it justifies surgical assessment

Table 3: Imaging findings and their clinical consequence, by case.

pathway, and a supportive response increases the likelihood of that contribution rather than establishing the diagnosis. Any diagnostic benefit should not be mistaken for a sustained treatment effect.

A supportive block also clarifies the options if conservative management proves insufficient. Where clinically relevant symptoms persist despite appropriate rehabilitation, an ultrasound-guided perineural corticosteroid injection and specialist surgical review are both reasonable considerations, and the balance between them is contextual rather than sequential, depending in part on the response to the treatment already delivered. Where surgery is clinically appropriate and the athlete has adequate recovery time, as in the off-season or a suitable break, it may be recommended directly; in-season, when surgery would remove the athlete from sport for a substantial period, the injection may instead serve as a temporary symptom-modifying measure alongside continued rehabilitation. Neither is a precondition for the other. A negative or equivocal block, by contrast, is equally informative: it prompts reconsideration of the working diagnosis rather than automatic progression toward further injection or surgery.

CASE 5: WHEN DYNAMIC IMAGING ADDS INFORMATION

A 27-year-old ice hockey player presents with an eight-week history of deep inguinal pain, worsened by sprinting and rapid changes of direction, without radiation and without bowel or urinary symptoms. Examination yields little, but not nothing. Resisted abdominal loading reproduces his familiar

deep inguinal discomfort; palpation of the inguinal canal is otherwise unremarkable, scrotal invagination testing is equivocal, and no bulge or cough impulse is identified at rest or with Valsalva. Resisted adduction, hip flexor testing and hip examination are unremarkable, making adductor-, iliopsoas- and hip-related presentations unlikely to be dominant.

The absence of a palpable hernia does not exclude clinically relevant inguinal pathology. An important distinction applies here: posterior wall weakness or bulging is not the same thing as a frank direct or indirect anatomical inguinal hernia, and neither is synonymous with Doha inguinal-related groin pain, a clinical entity defined by inguinal canal tenderness without a palpable hernia. Posterior wall findings have been described in athletes without corresponding symptoms¹¹, and cannot be interpreted in isolation.

Dynamic ultrasound, performed with resisted sit-up and Valsalva manoeuvres, demonstrated bulging of the inguinal floor under load, absent on static examination. Dynamic ultrasound can demonstrate load-dependent abnormalities not apparent on static examination¹². A finding demonstrated under load is not, for that reason, automatically clinically significant.

What justified surgical assessment was not the imaging finding alone, but its concordance with the clinical picture: compatible symptoms and history, an examination that reproduced his familiar pain on abdominal loading, reasonable exclusion of the other entities, and a dynamic abnormality demonstrated under the loading conditions that reproduced his

symptoms. The same finding in an athlete whose symptoms pointed elsewhere would not carry equal weight. This case is therefore not one of imaging replacing clinical reasoning, but of imaging adding information to an already plausible clinical hypothesis.

THE ROLE OF IMAGING ACROSS THE PATHWAY

Across most entities described in this pathway, imaging serves several defined purposes: exclusion of important alternative pathology, characterisation of injury extent or severity where this influences management or prognosis, support for the working clinical interpretation, and documentation of relevant findings. Imaging should be pathway-dependent rather than pathway-defining. It is obtained where history and examination indicate that it will add information, rather than routinely, and it may support the working clinical interpretation, refine it, or challenge it. What it does not do is define the clinical entity or trigger escalation on its own.

This position is grounded in the recurrent observation that positive imaging findings, particularly pubic bone marrow oedema and posterior wall changes on ultrasound, occur commonly in athletes without corresponding symptoms^{11,13,14}. This applies under load as well as at rest: a dynamic abnormality is not automatically more clinically significant than a static one. Allowing imaging findings to drive routing decisions risks systematic over-escalation of athletes who would otherwise respond adequately to rehabilitation (Table 3).



Classification is therefore the starting point of clinical reasoning, not its endpoint.



CONTEXTUAL FACTORS THAT MODIFY THE DEFAULT PATHWAY

Entity classification guides the initial routing decision. It does not, on its own, dictate identical management for every athlete assigned to the same branch (Table 4).

LIMITATIONS

This pathway reflects institutional clinical practice developed at a single centre, rather than a validated, externally

endorsed guideline. Active rehabilitation is central across groin pain management, but the directness of the evidence varies: randomised trial evidence is clearest in long-standing adductor-related presentations, while the evidence across other presentations is less direct and more heterogeneous. The four-week criteria reflect internal clinical agreement rather than externally derived thresholds.

The illustrative cases are composites rather than individual patients, and detailed

management of hip-related groin pain lies outside the scope of this article, although hip pathology remains an important coexisting contributor. How it translates elsewhere depends on caseload, access to imaging and injection expertise, and the monitoring available between reviews; reasonable variation between centres is expected, and several aspects of the pathway remain areas of ongoing refinement rather than settled practice.

These limitations are stated directly rather than implied, in the view that a structured pathway is strengthened, not weakened, by an accurate account of where its evidence is robust and where clinical judgement continues to fill genuine gaps in the literature.

CONCLUSION

Classification gave this field a common language, but it does not determine every subsequent decision. Identifying the dominant presentation tells the clinician where to begin; it does not explain why the region became overloaded, how rehabilitation should be built for that individual, or when the initial interpretation should be revisited. Imaging, where clinically indicated, may support, refine or challenge that interpretation, but is read alongside history and examination rather than in place of them.

None of this removes uncertainty from the consultation. The value of a clinical pathway lies not in eliminating uncertainty, but in providing a structure through which uncertainty can be recognised, reassessed and acted upon. A pathway should guide clinical reasoning without replacing it.

TABLE 4	
Factor	Clinical implication
Recurrence history	<i>A repeated recurrence warrants closer monitoring and careful consideration of the factors contributing to recurrence. Previous groin injury is among the most consistently reported risk factors for a further episode^{5,6}.</i>
Timing within the competitive season	<i>Proximity to an important competition may justify earlier specialist or multidisciplinary discussion, because both intervention and delay carry greater consequences. It does not favour intervention in one direction: where surgery would prevent participation, continued conservative management or a temporary symptom-modifying measure may be preferred. This is particularly relevant to the inguinal/nerve-related branch. Competition timing changes the balance of the decision, not tissue healing</i>
Age and skeletal maturity	<i>Adolescent athletes warrant a lower threshold for imaging to exclude apophyseal involvement. A prospective cohort of academy footballers found long-standing pubic-related pain concentrated almost exclusively within the youngest age group of each squad¹⁵. Older athletes require active exclusion of degenerative hip and lumbar spine contributors</i>
Sport-specific demand	<i>Rehabilitation content should reflect the specific movement pattern the athlete must return to. A kicking-dominant sport and a skating-dominant sport place different demands on the same anatomical structures, even within an identical entity classification</i>
Level of competition and access to follow-up	<i>Structured checkpoints assume a level of monitoring achievable within an elite multidisciplinary setting. This may not translate directly to settings with more limited follow-up capacity</i>
Previous groin or inguinal surgery	<i>Alters both the differential and the interpretation of examination findings, and is particularly relevant where neuropathic features are present</i>
Coexisting entities	<i>Multiple entities frequently coexist within the same athlete². All clinically relevant presentations should be recorded. This does not mean running separate entity-specific programmes: rehabilitation remains built around the athlete's deficits and loading capacity, while the currently dominant or most limiting presentation influences prioritisation, monitoring and interpretation. Coexisting presentations can be addressed in parallel, and reassessment may change which is dominant</i>

Table 4: Contextual factors modifying pathway application.

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