



Review

Endofibrosis and Kinking of the Iliac Arteries in Athletes: A Systematic Review **CME**G. Peach^a, G. Schep^b, R. Palfreeman^c, J.D. Beard^d, M.M. Thompson^a, R.J. Hinchliffe^{a,*}^a St George's Vascular Institute, 4th Floor, St James Wing, St George's Healthcare NHS Trust, Blackshaw Rd, London SW17 0QT, UK^b Department of Sports Medicine, Maxima Medical Centre, Veldhoven, The Netherlands^c Claremont Sports Medicine and Performance Centre, Sheffield, UK^d Sheffield Vascular Institute, University of Sheffield, Regent Court, 30 Regent St, Sheffield S1 4DA, UK

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ABSTRACT

Introduction: Kinking and endofibrosis of the iliac arteries are uncommon and poorly recognized conditions affecting young endurance athletes. Deformation or progressive stenosis of the iliac artery may reduce blood flow to the lower limb and adversely affect performance. The aim of this review was to examine the existing literature relating to these flow-limiting phenomena and identify a clear, unifying strategy for the assessment and management of affected patients.

Methods: A systematic review of the literature was performed. A comprehensive search was carried out using Medline, Embase and The Cochrane Database to identify relevant articles published between 1950 and 2011 (last search date 05/08/2011). This search (and additional bibliography review) identified 413 articles, of which 367 were excluded. 46 articles were then studied in detail. Methodological quality of studies was assessed according to Scottish Intercollegiate Guideline Network criteria.

Results: Focussed history and examination can successfully identify nearly 80% of patients with iliac flow limitation. However, both provocative exercise tests and detailed imaging are also necessary to identify those in need of intervention and establish most appropriate treatment. Provocative exercise tests and duplex imaging can then be used to confirm flow limitation before detailed assessment of abnormal anatomy with MRA and DSA. These multiple imaging modalities are necessary to identify those most likely to benefit from surgery and clarify whether each patient should undergo arterial release, vessel shortening, endofibrosectomy or interposition grafting.

Conclusion: We present a systematic review of the literature together with a proposed algorithm for diagnosis and management of these iliac flow limitations in endurance athletes.

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Introduction

The onset of exercise-induced leg pain in young, otherwise healthy individuals can often lead to diagnostic difficulty, particularly when those affected are high-performance athletes. Since this group is inevitably exposed to the risk of physical injury during training or competition, such symptoms are commonly attributed to musculoskeletal causes. It is often only when symptoms fail to resolve despite standard physiotherapy regimens that other potential causes are sought.

The possibility that these symptoms could be caused by non-atherosclerotic arterial insufficiency was first suggested more

than two decades ago.^{1,2} Despite having no cardiovascular risk factors, highly trained young athletes were found to have localized flow limitation within the iliac arteries. Vessel stenosis was often caused by endofibrosis – a pathological thickening of the vessel intima – or kinking of the iliac artery. However, the number of clearly identified cases of endofibrosis or iliac kinking has remained relatively low – possibly as a result of low awareness of these conditions or due to discrepancies in diagnostic criteria and difficulties in establishing a reliable, reproducible imaging modality.

This review assesses the existing literature on endofibrosis and kinking of the iliac arteries and presents evidence for the aetiology, diagnosis and management of these conditions.

Methods

A comprehensive literature search was performed using Medline, Embase, and The Cochrane Database to identify relevant

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articles published between 1950 and 2011 (last search date 05/08/2011). The following search string was used:

[("endofibrosis" OR "fibrosis" OR "arteriopathy" OR "syndrome" OR "flow").ti,ab OR exp FIBROSIS/ AND ("iliac art*" OR "iliac").ti,ab OR ILIAC ARTERY/] AND [(athlet* OR runn* OR sport* OR cycl* OR bicycl*).ti,ab OR exp SPORTS/ OR exp RUNNING/ OR EXP ATHLETICS/]

Published studies describing pathology, symptoms, diagnosis or management of iliac endofibrosis or iliac artery kinking were considered for inclusion. References of the included papers were also searched to identify any other articles of relevance. No language restriction was made. Review articles were subsequently excluded.

Due to the nature of the papers included there was insufficient homogeneous data to allow meta-analysis. A systematic review was therefore undertaken following PRISMA guidelines.³ The quality of diagnostic and observational studies was assessed using the QUADAS and STROBE tools^{4,5} and evidence graded according to SIGN guidelines:⁶

SIGN levels of evidence

- 1++ High quality meta-analyses, systematic reviews of RCTs or RCTs with a very low risk of bias
- 1+ Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias
- 1– Meta-analyses, systematic reviews, or RCTs with a high risk of bias

- 2++ High quality systematic reviews of case control or cohort studies or high quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal.
- 2+ Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
- 2– Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
- 3 Non-analytic studies, e.g. case reports, case series
- 4 Expert opinion.

Results

407 articles were identified using the above search strategy. Title/abstract review resulted in the exclusion of 339 articles that were not directly relevant. Detailed assessment of the remaining studies resulted in exclusion of a further 28. Review of bibliographies identified another 6 relevant studies for inclusion. 46 articles were therefore assessed in detail (Fig. 1). Though many of these were case reports or very small case series, 17 studies evaluated more than 5 symptomatic limbs (Table 1).

Quality assessment demonstrated that the majority of these studies offer only intermediate-level evidence, with none of the diagnostic studies achieving a SIGN level greater than 2+.⁶ In

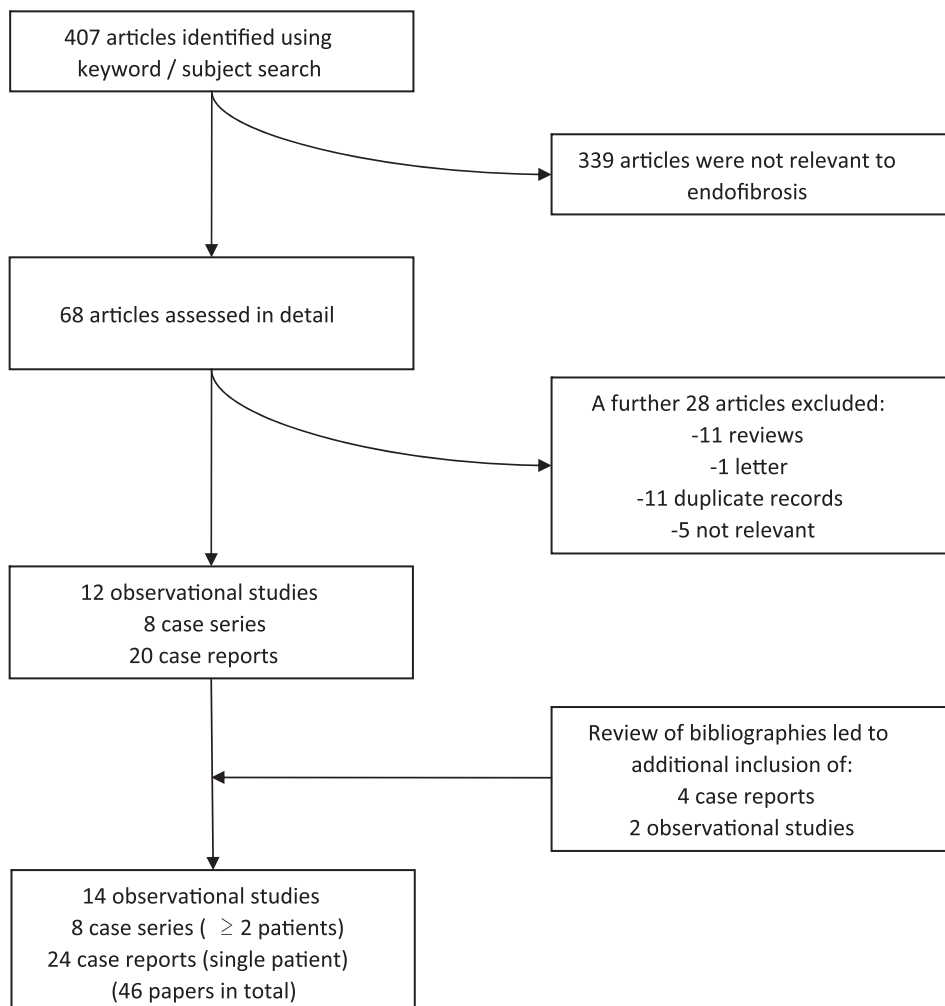


Figure 1. PRISMA flow diagram representing the performed literature search.

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