



Is reconstruction the best management strategy for anterior cruciate ligament rupture? A systematic review and meta-analysis comparing anterior cruciate ligament reconstruction versus non-operative treatment



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ABSTRACT

Aims: The purpose of this study was to determine the optimal clinical and cost-effective strategy for managing people following ACL rupture.

Methods: A systematic review of the published (AMED, CINAHL, MEDLINE, EMBASE, PubMed, psycINFO and the Cochrane Library) and unpublished literature (OpenGrey, the WHO International Clinical Trials Registry Platform, Current Controlled Trials and the UK National Research Register Archive) was conducted on April 2013. All randomised and non-randomised controlled trials evaluating clinical or health economic outcomes of isolated ligament reconstruction versus non-surgical management following ACL rupture were included. Methodological quality was assessed using the PEDro appraisal tool. When appropriate, meta-analysis was conducted to pool data.

Results: From a total of 943 citations, sixteen studies met the eligibility criteria. These included 1397 participants, 825 who received ACL reconstruction versus 592 who were managed non-surgically. The methodological quality of the literature was poor. The findings indicated that whilst reconstructed ACL offers significantly greater objective tibiofemoral stability ($p < 0.001$), there appears limited evidence to suggest a superiority between reconstruction versus non-surgical management in functional outcomes. There was a small difference between the management strategies in respect to the development of osteoarthritis during the initial 20 years following index management strategy (Odds Ratio 1.56; $p = 0.05$).

Conclusions: The current literature is insufficient to base clinical decision-making with respect to treatment opinions for people following ACL rupture. Whilst based on a poor evidence, the current evidence would indicate that people following ACL rupture should receive non-operative interventions before surgical intervention is considered.

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1. Introduction

Anterior cruciate ligament (ACL) rupture is a common sporting injury which occurs during contact and non-contact multi-directional activities [1]. It is most frequently seen in young and physically active individuals [2]. The principle function of the ACL is to limit anterior-posterior translation of the tibia on the femur.

Considerable debate remains within the literature regarding the optimal means of managing individuals following an ACL rupture. Some authors have advocated early ACL reconstruction to restore the

kinematics of the tibiofemoral joint, reduce the risk of joint instability thereby decreasing the possibility of secondary joint damage and the development of osteoarthritis [3]. Such proponents suggest that only surgical intervention will provide an active, physically demanding individual with adequate stability to permit pivotal sporting activities [3]. However, others have suggested that a rigorous neuromusculoskeletal rehabilitation programme will provide an effective recovery for this population, without increasing the risks of degenerative damage in the longer term [4]. Furthermore, the increased risk of operative complications such as arthrofibrosis, infection, graft failure and donor site morbidity, pain, and surgical costs associated with operative intervention, may be considered a disadvantage compared to non-surgical management [3].

Whilst uncertainty has existed regarding the optimal management for this population, no recent systematic review or meta-analysis has

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been performed to compare the outcomes of operative compared to non-operative treatment. A previous Cochrane review has been undertaken [5], however this is now over nine years old, with considerable subsequent data being published. Therefore there remains uncertainty, based on the current literature, regarding the superiority of ACL reconstruction to non-operative management of this population. The purpose of this study was to test the null hypothesis that there is no statistically or clinically significant difference between ACL reconstruction and non-operative treatment for the management of ACL rupture. Through this, the paper will determine the optimal clinical and cost-effective strategy for managing people following this knee injury.

2. Materials and methods

The methods adopted for this review were based on the recommended PRISMA checklist guidelines [6].

2.1. Search strategy

The primary search strategy was of published literature from the electronic databases: AMED, CINAHL, EMBASE, Pubmed, psycINFO, MEDLINE and the Cochrane Library, searched from their inception to 1st April 2013. Secondary search strategies included reviewing the unpublished and trial registry electronic databases OpenGrey, the WHO International Clinical Trials Registry Platform, Current Controlled Trials and the UK National Research Register Archive. Finally, the reference lists of each included study and review papers on this topic were reviewed.

2.2. Eligibility criteria

Studies were deemed eligible if they were randomised or non-randomised controlled trials evaluating clinical or health economic outcomes of surgical versus non-surgical management of ACL rupture. Studies were included if they either randomised participants to surgical or non-surgical management, or compared clinical outcomes in a matched-cohort study design.

Surgical management was considered undertaken when participants underwent ligament reconstruction (hamstring/quadriceps/Achilles tendon/bone-patella-tendon-bone grafts or allografts). Studies where an ACL ligament repair was performed were excluded. Conservative (non-surgical) management consisted of any intervention which was non-invasive in nature. Therefore physiotherapy, physical therapy and rehabilitation programmes consisting of exercise, bracing, taping, electrotherapy and muscle stimulation interventions and graded return to exercise and activities were included. Interventions such as diagnostic arthroscopy were considered non-surgical interventions.

Anterior cruciate ligament rupture was defined if the study provided a convincing report of diagnosis based on history, clinical presentation and/or radiological investigation (Magnetic Resonance Imaging (MRI) or arthroscopy). Furthermore, studies where participants sustained a meniscal or collateral ligament injury were included, however studies which included patients who also underwent meniscal repair or collateral ligament reconstruction were excluded. Studies where ACL and posterior cruciate ligaments were ruptured together were excluded. Both childhood and adult populations were included although were planned to be analysed separately.

All studies were included irrespective of publication language, year of publication or quality of the methods. Animal studies or biomechanical cadaveric studies were excluded.

2.3. Identification of eligible studies

The titles and/or abstracts of each identified citation were reviewed independently by two reviewers (TS/KP). The full text of each potentially eligible paper was ordered, and subsequently reviewed. If the full-text of

the paper satisfied the eligibility criteria, this was included in the final review.

2.4. Data extraction

Data extraction from each included study was performed by two reviewers independently (KP/FP). Data extracted included: sample size, cohort age, gender-mix, duration from injury to intervention, concomitant injuries, surgical and post-surgical interventions, non-surgical interventions, follow-up period and outcomes.

2.5. Outcome measures

The primary outcome measure was functional outcome as measured with reliable and valid patient-reported outcome measures such as the Lysholm Knee Score [7], International Knee Documentation Committee Score [8] or Tegner Activity Score [9] for example. The primary endpoint was the 12 month follow-up assessment for these measures.

Secondary outcomes include: time to return to sport/occupational pursuits; functional performance as measured by tests such as timed agility tests, hop-test or step tests; health economic analysis; and complications including reduced range of motion, muscle atrophy, residual pain, ACL re-rupture and requirement for secondary operations.

2.6. Critical appraisal

Each included study was appraised using the PEDro Critical Appraisal Tool. This is a validated and reliable appraisal tool for clinical trials [10,11]. It consists of 11 questions assessing the recruitment, allocation, power, blinding and data analysis aspects of clinical trials. Each included study was assessed using this tool by two reviewers (KP/FP) independently.

Any disagreement between the two independent reviewers in paper eligibility, data extraction or critical appraisal evaluation was resolved through discussion. If consensus could not be reached, this was resolved by a third reviewer (TS).

2.7. Data analysis

Initially inter-study heterogeneity was assessed visually using the data extraction table and forest-plot results. If inter-study homogeneity was demonstrated in participant characteristics, intervention, follow-up period and data collection methods, a meta-analysis was deemed appropriate (Table 1).

Table 1
MEDLINE search strategy.

1. exp Anterior Cruciate Ligament/
2. exp (Reconstructive Surgical Procedures/or reconstruction*.mp.) and (cruciate or ACL).mp.
3. exp Surgical Procedures, Operative/
4. surg\$.tw.
5. operat\$.tw.
6. OR/3–5
7. exp Rehabilitation/
8. exp Physical Therapy Modalities/
9. "Physical Therapy (Specialty)"/
10. Braces/
11. Immobilization/
12. rehabilitat\$.tw.
13. physiotherapy.tw.
14. physical therapy.tw.
15. (non-surg\$ or nonsurg\$ or non-operat\$ or nonoperat\$ or conserv\$).tw.
16. (immobilis\$ or immobiliz\$ or therap\$ or exercis\$ or brace or bracing).tw.
17. OR/7–16
18. ((randomized controlled trial or controlled clinical trial).pt. or randomized.ab. or placebo.ab. or drug therapy.fs. or randomly.ab. or trial.ab. or groups.ab.)
19. AND/1,2,6,17,18
20. (animals not (humans and animals)).sh.
21. 20 NOT 19

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