

Athletic groin pain: a systematic review and meta-analysis of surgical versus physical therapy rehabilitation outcomes

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ABSTRACT

Background Athletic groin pain (AGP) is an encompassing term for the multitude of chronic conditions presenting as pain in the inguinal region.

The purpose of this review was to compare the return to play rates (RTPrate) and return to play times (RTPtime) between surgical and rehabilitation interventions in the treatment of AGP.

Methods A systematic review of English language peer review journals was carried out between 1980 to June 2013 using PubMed, Embase, CINAHL and Google Scholar searching for all papers relating to AGP (and its various pseudonyms) and all surgical and rehabilitative interventions which reported RTPrate and/or RTPtime.

AGP literature has been subdivided by many eponymous diagnoses but anatomical diagnostic groupings of (1) abdominal wall, (2) adductor and (3) pubic related pain were used in this review. Meta-analysis was then carried out on the data to compare results between the surgical and rehabilitation groups.

Results Fifty-six papers out of the 561 discovered in the initial search were included in the review with 3332 athletes included. Evidence was mostly level IV. Using the Black and Downs checklist we found poor study quality overall with a high risk of bias especially among surgical studies. The results showed comparable RTPrate between surgical and rehabilitative interventions within the three diagnostic groups. Rehabilitation had significantly quicker RTPtime for pubic related groin pain compared to surgery (10.5 weeks and 23.1 weeks respectively). The abdominal group had the fastest return of the three groups for the rehabilitation and surgery.

Conclusions The review suggested better outcomes with rehabilitation for pubic-related groin pain with no difference between the adductor and abdominal groups. The review highlighted the poor quality and risk of bias in the literature making accurate comparison difficult.

INTRODUCTION

Athletic groin pain (AGP) describes a chronic injury to the inguinal region (junction of torso and lower limb) in a physically active population. The literature reports an incidence of between 3 and 23%,^{1–4} commonly affecting athletes in soccer,^{5,6} Australian rules football,⁴ Gaelic football,² ice hockey⁷ and rugby union football^{8,9} and the increase incidence over time¹⁰ may be related to increased training load and intensities.^{11,12} It is associated with significant morbidity in sport.¹³

The differential diagnosis is challenging,^{14–17} in part due to the complex anatomy of the region, but also to the panoptic use of eponymous names such as Gilmore's groin, Sportsman's hernia and Hockey

groin in studies to describe possible pathologies of the external obliques, posterior abdominal wall and the surrounding abdominal structures. A recent systematic review reported 33 different terminologies used in 72 studies.¹⁸ There is little agreement in the literature in grouping subcategories of presentation beyond the broad regions of abdominal wall, adductors, hip flexors and pubic bone.^{16,19}

Surgical and rehabilitation management approaches are described for AGP. Surgery may be divided according to procedures designed to tension structures around the groin, or to detensioning these same structures. Detensioning interventions include adductor tenotomy, rectus aponeurosis tenotomy and inguinal ligament release.^{20,21} Tensioning interventions are targeted at potential 'weakness' or 'bulging' of the posterior inguinal wall and Gilmore,²² Mushawek and Berger,²³ and Brannigan *et al*²⁴ describe interventions in detail to mesh, suture or a combination of both. Rehabilitation approaches are commonly described as conservative including massage and mobilisation,²⁵ electrotherapy²⁶ and flexibility,²⁷ but also an increasing focus on resistance training and strength^{28,29} which has demonstrated benefit in other conditions.³⁰

There is no published review comparing the efficacy of surgery with rehabilitation in athletes with groin pain. Thus, we reviewed studies of AGP surgery and rehabilitation and their influence on return to play rates (RTPrate) and/or return to play times (RTPtime).

METHODOLOGY

An English-language literature search was conducted using PubMed, Embase, CINAHL and Google Scholar from 1980 to 30th June 2013. The review was confined to athletic populations (those who were returning to sporting activities) and limited to studies who had surgical or rehabilitation interventions for groin pain with stated athlete RTPrate and/or RTPtime. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for systematic reviews.³¹ The search terms were broken into two categories. Group 1 related to the various differential diagnoses that fall under AGP. Group 2 related to the various surgical and physical/exercise therapy interventions associated with AGP (table 1).

Article reference lists were then reviewed for missing references and conference proceedings and personal lectures were searched where available through the authors' own contacts. Two reviewers (EK, EF) checked the eligibility of articles according to our review terms and divergence was reviewed



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Table 1 Review search terms

Search groupings	
Group 1	(Groin Pain) OR (Groin Injury) OR (Athletic Groin Pain) OR (Chronic Groin Pain) OR (Osteitis Pubis) OR (Adductor Tendinitis) OR (Athletic Pubalgia) OR (Symphysis Syndrome) OR (Hockey Groin) OR (Iliopsoas Dysfunction) OR (Pubic Bone Stress) OR (Incipient Hernia) OR (Occult Hernia) OR (Gilmore's Groin) OR (Posterior Inguinal Wall) OR (Conjoint Tendon Disruption) OR (Adductor Related Groin Pain)
Group 2	(Rehabilitation) OR (Physiotherapy) OR (Physical Therapy) OR (Manual Therapy) OR (Surgical Repair) OR (Conservative Treatment) OR (Tenotomy) OR (Surgical Intervention) OR (Management)
Group 1 and Group 2=561 articles.	

by a third reviewer (JW). Inclusion was determined after discussion and unanimous agreement between all (EK, EF, JW).

We included evidence of levels 1–4 according to The National Health and Medical Research Council hierarchy of evidence template.³² Methodological quality and bias in the papers was assessed using the Downs and Black's checklist,³³ which assesses the quality of randomised and non-randomised studies that covered all included in the review. A data extraction form was used for surgical and rehabilitation papers, created by a single reviewer (EK) and reviewed by the authors to ensure all relevant information was collected. Complete data extraction and collation from all relevant articles was carried out by a single reviewer (EK) and reviewed by a second reviewer (AFM) for completeness. Data extracted included subject numbers, RTPrate, RTPtime and type of intervention used.

Papers were subdivided into three diagnostic groups.^{18–19} (1) The pubic group related to diagnosis and interventions to the pubic symphysis and adjacent bone. (2) The adductor group included diagnosis and interventions relating to the adductor tendons most commonly adductor longus. (3) The abdominal group included diagnosis and interventions relating to the abdominal region (posterior abdominal wall, rectus abdominis, oblique and transversus muscles and their tendinous insertions). No papers were found that related to rehabilitation or surgical intervention in hip flexor related dysfunction (iliopsoas) in an athletic population as described by Holmich and coauthors.¹⁸ A number of papers studied the effect of surgery to the abdominal region and concurrently performed an adductor tenotomy. For the purposes of the review, these papers were separated and sub-analysed although the abdominal surgery was the primary intervention. The rehabilitation papers described a variety of treatments (largely exercises), but were divided into the three anatomical groups (above) according to region identified as being the source of the pain.

Meta-analysis was carried out using R (V3.0.2, R Foundation for Statistical Computing). A random effects model was used when analysing the RTPrate, as it could not be presumed that the treatment effect was the same in each group and sample sizes were taken into account in all analysis. An alternative, more conservative model was used on the RTPtime meta-analysis as there was less accurate data available in the published papers. When mean and SDs were not reported, they were estimated using formulae previously outlined by Hozo *et al.*³⁴ Conservative 95% CIs for the RTPtime for each study were constructed using Chebyshev's inequality ($\text{mean} \pm (20)^{0.5} (\sigma) / \sqrt{(n)}$, where $\sigma = \text{SD}$ and $n = \text{sample size}$). This approach does not assume that data came from any particular distribution. Further, the overall 95% CIs for the RTPtime were also constructed using the Chebyshev inequality.

RESULTS

The initial search strategy produced 561 articles; the strategy is summarised on [figure 1](#) using the PRISMA template. Forty three surgical papers, 13 rehabilitation papers and a single paper comparing a surgical and conservative treatment³⁵ met inclusion criteria. All of these studies reported RTPrate with 27 of them reporting RTPtime.

There were 3332 patients included in the 57 studies the majority of them were male (99%) [table 2](#). The largest diagnostic group was pathology involving the abdominal wall.

The primary outcome of analysis was RTPrate postintervention and RTPtime (see online supplementary file 1).

Level of evidence and methodological quality

Level of evidence

The overall level of evidence in the review was low; only one surgical paper was rated at level III evidence³⁶ and the rest level IV [table 3](#). Among rehabilitation papers, 2 contributed level I evidence^{29–37} and 11 we rated as level IV papers. The single comparative paper was level I.³⁵

Methodological quality

There was large variation in the methodological quality of the papers reviewed (see online supplementary file 2). Downs and Black's checklist was used to rate the overall methodological quality of the papers but also the validity (presence of bias and confounding) of the studies included. The total score of 31 includes a possible score of 7 if there is a low probability of bias. Overall the rehabilitation papers had higher average scores for overall methodological quality and lower risk of bias.

Return to play rates

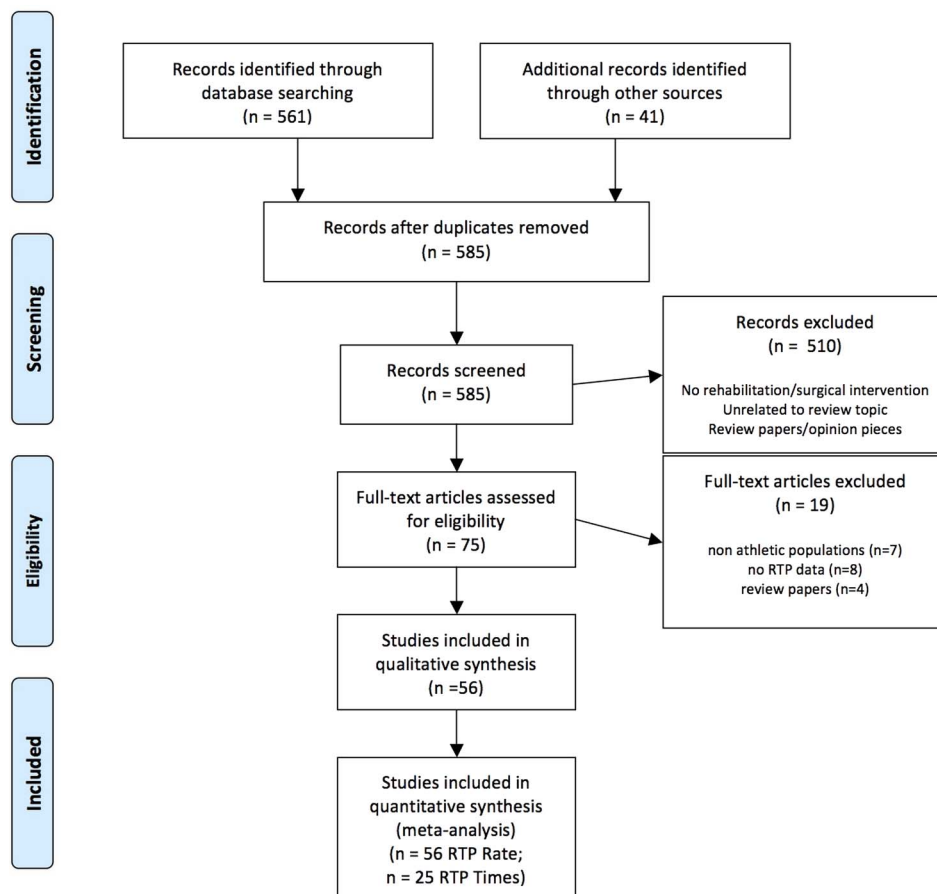
The pubic group showed comparable outcomes between rehabilitation and surgery (91% and 86% respectively, [table 4](#)). The meta-analysis of RTPrate highlighted high statistical heterogeneity (χ^2) in the abdominal and adductor groups along with wide confidence intervals meaning comparison of results and their interpretation should be proceeded with caution. This may be due in part to the large difference in subject numbers between the two abdominal groups, or indeed different underlying diagnosis attributed to the bone. The RTPrate were comparable across the three groups. The comparative paper by Paajanen *et al*³⁵ reported RTPrate of 97% with their surgical intervention in comparison to 50% in their rehab group treating abdominal-related symptoms.

Return to play times

Owing to insufficient reporting of summary statistics in a number of papers (means, ranges, SDs) a smaller subset of papers ($n=27$) reviewed were included in the meta-analysis of RTPtime. The results are summarised in [table 5](#) and the total RTPtime across all groups are collated in forest plots in [figures 2](#) and [3](#). CIs are (0,0) in the plots for the cases where the sample size is one. Plots were drawn using the *r* package *metafor*, and the function *forest*.

These results demonstrated that recovery times for rehabilitation in the pubic group were half of those of the surgical group, a statistically significant 12.6 weeks faster (no overlap of CIs, effect size 1.3). There was a clinical difference (greater than a week) between the two groups in the adductor group but this was not significant (effect size 0.37). There was no difference in the abdominal group but, as with the RTPrate analysis there is a significant difference in the subject numbers between the two

Figure 1 Review results using PRISMA template. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; RTP, return to play.



groups (effect size -0.12). The abdominal findings should be interpreted with caution as may be underpowered due to subject numbers. The abdominal groups in the surgery and rehabilitation were notably faster than the pubic and adductor groups in recovery times.

Interventions used

Of the abdominal surgical papers 10 were laparoscopic^{38–47} and 17 were carried out via open incision^{20 23 24 47–64} with the paper by Ingoldby³⁶ comparing the two and reporting faster RTPtime in the laparoscopic group (3 weeks (1–9) vs 5 weeks (1–6) ($p < 0.05$)). All the papers had a common aim of reinforcing the abdominal musculature although there was variability in the description of the exact pathological site. Six abdominal papers also included tenotomy of adductor longus during the procedure.^{20 49 52 55 59 63} There was a common approach to the adductor surgical papers with release of the adductor longus proximal tendon. Surgical intervention to the pubic region involved curetage or debridement of the pubic symphysis,^{65–68} arthrodesis⁶⁹ and mesh repair.⁷⁰

Eight of the rehabilitative papers took a multimodal approach including manual therapy, electrotherapy, exercise therapy,

cryotherapy and acupuncture with the common approach of restoring strength and flexibility to the hip muscles and improving lumbopelvic control.^{25 26 71–76} One paper was a well-organised randomised control trial (RCT) comparing a supervised exercise programme to physiotherapy and another compared a manual therapy technique to an exercise programme with both finding the exercise programme providing superior results.^{29 37}

DISCUSSION

Overall the quality of the evidence available in the surgical and rehabilitation interventions in AGP is low and subject numbers are small (1–162 subjects; 1 paper reporting 1200²²). There is also a high risk of bias in the literature particularly among the surgical papers (average bias score 2.07 for surgical papers, 3.75 for rehabilitation). As a result, comparison of the two methods is challenging.

Our results show a similar RTPrate and faster RTPtime for rehabilitation of the pubic group over surgical intervention. There is little difference shown between the two treatment

Table 2 Overview of subjects

	Male	Female	Total	Abdominal	Adductor	Pubic
Surgical	2995	13	3008	2760	202	46
Rehabilitation	257	7	264	4	190	70
Comparative	52	8	60	60		
Total	99.1%	0.9%	3332	2824	392	116

Table 3 Level of evidence

	Rehabilitation	Surgery	Comparative	Total
Level I	2	0	1	3
Level II	0	0	0	0
Level III	0	1	0	1
Level IV	11	42	0	53
Total	13	43	1	57

Table 4 Meta-analysis of RTP rates in surgical and rehabilitation papers for AGP

Region	Group	Papers	Subjects	RTP rates %	CI 95%	I ² (%)	τ ²
Pubic	Surgery	6	46	86	0.73 to 0.94	0	0
	Rehabilitation	7	60	91	0.76 to 0.97	0	0
Abdominal	Surgery	27	2206	96	0.94 to 0.98	73	1.189
	Rehabilitation	2	4	83	0.35 to 0.98	0	0
Adductor	Surgery	4	202	84	0.7 to 0.92	71.10	0.4751
	Rehabilitation	4	190	81	0.57 to 0.93	88.20	1.157
Abdominal+adductor	Surgery	6	554	96	0.94 to 0.97	0	0
	Rehabilitation	NA	NA				

I² and τ² reflect the heterogeneity across the results.

AGP, athletic groin pain; NA, not applicable; RTP, return to play.

methods for patients in the adductor group for either RTP rate and RTP time. Similarly, there was no difference but large heterogeneity in the subject numbers and results in the abdominal group.

The similarity in RTP rate between surgical and physical therapy intervention along with the faster RTP time in the rehabilitation group (for pubic pain) raises a number of questions about the diagnostic rationale for surgical intervention in many cases. The diversity of anatomical structures injured and varied surgical techniques in use, highlights a lack of clarity around the diagnosis and ultimately the basis for treatment. This was particularly evident in patients/athletes who present with pain in the abdominal region where a large spectrum of anatomical pathologies are described and multiple interventions recommended. These include resecting the ilioinguinal or genitofemoral nerve^{23 52 54 57} which potentially diminishes sensation without addressing the underlying problem. Holmich¹⁶ and Jansen *et al*⁷⁷ reported that in many cases, multiple painful structures are isolated at the time of presentation. This highlights the perilous nature of treating a single joint, muscle, tendon or nerve and makes a case for treatment that attempts to correct causal factors for this injury.

Studies with direct comparison of surgery and physical therapy

There was little evidence directly comparing surgical and physical therapy for AGP. The one comparative paper that met the review criteria by Paajanen *et al*³⁵ showed a much higher RTP rate for surgical intervention (90%) compared with conservative management (50%) for abdominal related pathology.

Table 5 Meta-analysis of RTP times in surgical and rehabilitation papers for AGP

Region	Group	Papers	Subjects	RTP time (weeks)	CI 95%
Pubic	Surgery	4	36	23.1	15.04 to 31.21
	Rehabilitation	5	8	10.5	7.81 to 13.19
Abdominal	Surgery	8	283	7.2	5.69 to 8.77
	Rehabilitation	2	4	7.9	7.42 to 8.38
Adductor	Surgery	2	77	18.3	16.71 to 19.91
	Rehabilitation	3	157	16.9	15.02 to 18.68
Abdominal +adductor	Surgery	2	112	21.9	13.6 to 30.22
	Rehabilitation	n/a			

AGP, athletic groin pain; RTP, return to play.

However, the conservative intervention was limited to 2 months of total rest, 'active physiotherapy,' steroid injections into the painful area and oral anti-inflammatory analgesics followed by a gradual return to sports activity. There was no outline of what 'active physiotherapy' entailed, the type or frequency of steroid injections or outcome measures used to guide rehabilitation.

Despite the intended differing surgical approaches to AGP, they are broadly tensioning or de-tensioning the lower abdominal, inguinal and adductor complexes. Where a meticulously defined strength intervention, focused on the adductor grouping, was applied it was successful.²⁹ Given the same detail, a strength intervention aimed at the offload of the abdominal, adductor and inguinal regions could allow a direct comparison to the detensioning surgical procedures and allow a more homogenous classification. To make an appropriate comparison of surgical and rehabilitation interventions this would require an RCT comparing a targeted strength training programme to each surgical approach.

Hip morphology and femoroacetabular pathology may play an important role in AGP. The literature, however, suggests that hip morphological changes are prevalent in asymptomatic as well as symptomatic athletic populations,⁷⁸ which these changes poorly correlate with clinical examination⁷⁹ and that hip morphology has yet to demonstrate an impact on the long-term outcome of intervention for AGP.^{80 81} It was the decision of the authors that a comparison of surgical and rehabilitation for hip joint related pain warranted separate review.

Limitations of this review include the inconsistency of reporting of outcome measures across the surgical and rehabilitation groups. This is marked by the lack of accurate reporting of RTP time in both types of interventions (surgery and rehabilitation). A differentiation between RTP and pain free RTP was not provided in many cases. In our clinical experience this is an extremely significant difference in end point as we feel athletes who return to play prior to complete resolution of symptoms have a higher relapse rate (unpublished data).

The use of RTP as an outcome measure itself is not without difficulties. There is marked variation in the standards that are set regarding when an athlete can return to play and this is also influenced by the fact that athletes suffering AGP can return without being entirely symptom free. The use of a validated outcome measure such as the Copenhagen Hip and Groin Outcome Score⁸² would allow for much more robust analysis and comparison of the efficacy of intervention. Furthermore, the development of a validated set of progressive neuromuscular challenging physical tests for multidirectional athletes would allow clear return to play assessment to be completed and benchmarked.

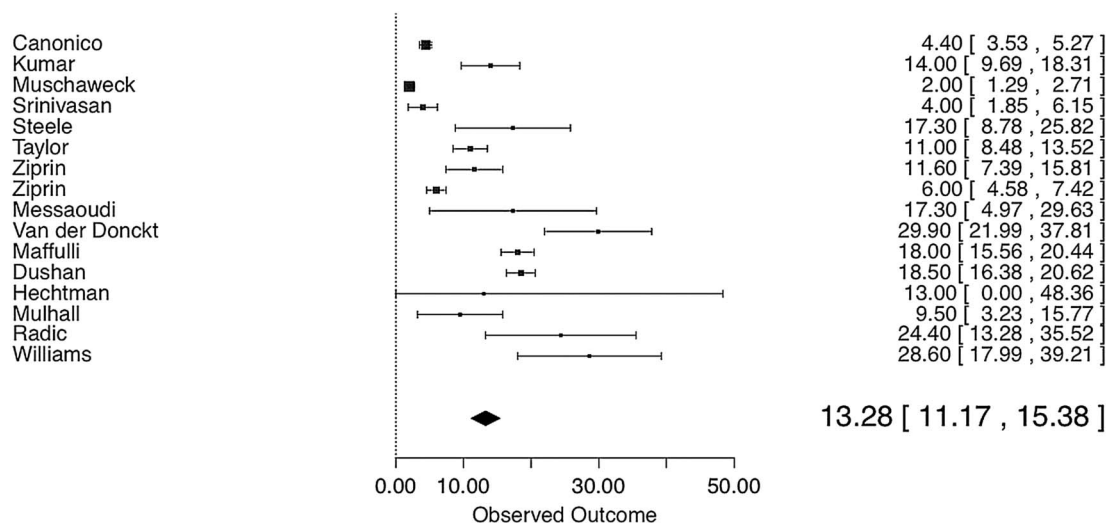


Figure 2 Total summary surgical return to play times.

The standard of evidence was low among the surgical and physical therapy interventions making the application of the results less robust. Coupled with this there were varying degrees of methodological quality in the papers reviewed and low bias scores overall, more notably in the surgical papers. The large disparity in subject numbers in the abdominal group makes meaningful comparison very difficult in this area. There were also no surgical or rehabilitation papers outlining intervention for iliopsoas related groin pain. This is despite the fact that its involvement in pain production in the region has been previously highlighted by some authors in the literature.^{16 83}

SUMMARY

Rehabilitation has demonstrated a superior RTPtime when compared with surgery for pubic-related groin pain and there is little difference between the two in the abdominal and adductor groupings in RTPrate and RTPtime. There is a paucity of quality research in the area making accurate comparison challenging. Although the majority of the literature relates to surgery, this review challenges the belief that surgery offers a markedly superior RTPrate and time across all categories. Detailed prescription of resistance training and rehabilitation interventions in each category of AGP, and appropriately designed randomised controlled trials should be carried out comparing rehabilitation and surgical intervention to definitively guide best practice in the future. Work to further agree on the categories of AGP has begun,⁸⁴ but the relevance of these to targeted intervention and

subsequent RTP outcomes require further study as to their importance.

What are the new findings?

- ▶ Rehabilitation has significantly quicker return to play times for pubic related athletic groin pain (AGP).
- ▶ There is little difference in return to play rates between surgical and rehabilitation interventions for abdominal and adductor groups in AGP.
- ▶ The quality of research in the area of AGP is poor and comparison between surgical and rehabilitation approaches is difficult.

How might it impact on clinical practice in the near future?

- ▶ This review suggests rehabilitation should be the primary intervention for AGP especially in the pubic group.
- ▶ It highlights the variations in prognosis and time to recovery depending on the region that is affected.

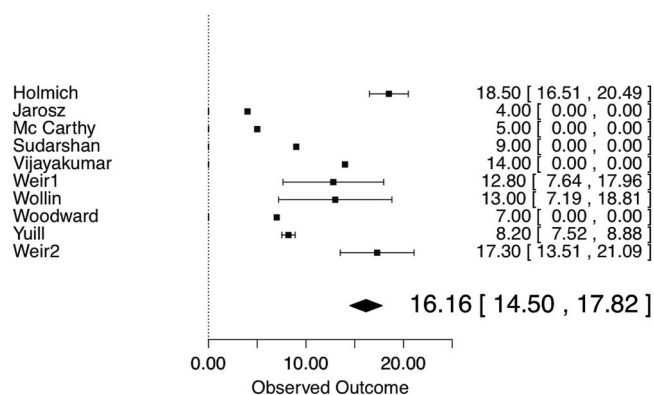


Figure 3 Total summary rehabilitation return to play times.

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Contributors EK: planning as to content and direction of review, data mining, drafting and editing. JW: planning as to content and direction of review, literature review and editing. LS: statistical analysis and editing. EF: planning as to content and direction of review, review of papers to be included and editing. AFM: planning as to content and direction of review, data extraction review and editing.

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