LUPINE PUBLISHERS

Orthopedics and Sports Medicine: Open Access Journal

DOI: 10.32474/OSMOAJ.2023.06.000240

ISSN: 2638-6003

Research Article

Outcomes Following Combined Medial Patellofemoral Ligament Reconstruction and the Roux-Goldthwait Procedure for Pediatric Patellar Instability

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Received: July 31, 2023 **Published:** August 14, 2023

Abstract

Background: The Roux-Goldthwait procedure and medial patellofemoral ligament (MPFL) reconstruction represent two surgical treatment options for pediatric patients with refractory patellar instability, but there are no published studies describing patient outcomes following their use in combination for pediatric patients with multiple anatomic risk factors. This study's purpose was to describe clinical outcomes for pediatric patients undergoing combined physeal-sparing MPFL reconstruction and Roux-Goldthwait procedure.

Methods: We performed a retrospective case series at a single academic institution of 9 pediatric patients <18 years of age that underwent physeal-sparing MPFL reconstruction with a combined Roux-Goldthwait procedure. We obtained Banff Patellofemoral Instability Instrument 2.0 scores at a minimum of 12 months post-operatively.

Results: Average age was 13.6 years, average TT-TG distance was 21.7 mm, and average CDI was 1.3. 63.7% of patients had evidence of trochlear dysplasia. 45% of subjects completed BPII 2.0 questionnaires at minimum 12 months follow up, with an average score of 87.8. 80% of responding subjects returned to previous level of sport/activity.

Conclusions: Satisfactory post-operative disease-specific outcomes can be achieved for pediatric patients with patellar instability following combined MPFL reconstruction with Roux-Goldthwait procedure. These findings can be used to help surgeons in their medical decision making as well as setting appropriate post-operative expectations for patients.

Keywords: Patellar Instability; Pediatrics; Mpfl Reconstruction; Roux-Goldthwait

Introduction

Patellar instability is a common knee disorder in children that can be associated with recurrent episodes that have a detrimental impact on the ability to return to sport and other activities [1]. A prospective study found the annual incidence of acute patellar dislocation to be 43/100,000 in children under 16 years old, with 39% of patients having associated osteochondral fractures [2]. After a patellar dislocation, patients with a prior history of patellar instability had a 7 times higher odds of subsequent instability episodes [3]. Findings of a randomized clinic trial in adolescent patients with acute patellar dislocations without previous history of substantial knee injury found recurrence rates to be as high as 71% [4]. There are numerous surgical techniques that have been developed to address recurrent patellar instability, but pediatric patients warrant unique treatment considerations given their skeletal immaturity [5]. In patients without significant osseus dysmorphology or malalignment, isolated reconstruction of the medial patellofemoral ligament (MPFL) using physeal-sparing technique is a successful treatment strategy [6]. However, isolated MPFL reconstruction may have higher rates of failure in patients

with trochlear dysplasia, elevated tibial tubercle-trochlear groove (TT-TG) distance, or patella alta. Osseous realignment procedures such as a tibial tubercle osteotomy can be a good solution in adult patients but risk damage to the proximal tibia physis in skeletally immature patients [5]. The Roux-Goldthwait procedure is similar to the tibial tubercle osteotomy in that it medializes the patellar tendon insertion to decrease the quadriceps (Q) angle. However, by shifting the soft tissue insertion rather than the bone, it is acceptable for use in skeletally immature patients. A systematic review from 2019 found that the Roux-Goldthwait procedure was performed in isolation 8.6% of the time, and most commonly was performed with open lateral retinacular release 64.5% of the time [7]. Although MPFL reconstruction and Roux-Goldthwait procedure have each been described in isolation, there are no published studies describing patient outcomes following their use in combination. Thus the purpose of this study was to describe clinical outcomes for pediatric patients undergoing physeal-sparing MPFL reconstruction combined with the Roux-Goldthwait procedure. This study aims to guide providers in pre-operative decision-making and setting post-operative expectations for their patients.

Methods

Institutional review board approval was obtained prior to initiation of the study from the authors' institution (IRB00001996). We utilized a retrospective chart review to identify pediatric patients (<18 years of age) with patellar instability who underwent combined Roux-Goldthwait procedure with physeal-sparing MPFL reconstruction and had at least 12 months of post-operative follow up. Patients without at least 12 months of post-operative follow up were excluded. Pre-operative baseline characteristics were collected via chart review and MRI review, including patient age at the time of surgery, tibial tubercle to trochlear groove (TT-TG) distance, Caton-Deschamps index (CDI), and evidence of trochlear dysplasia on MRI Dejour classification. Through telephone interview, we assessed patient-reported disease-specific quality of life measures via the Banff Patellofemoral Instability Instrument 2.0 (BPII 2.0) at final follow up, numeric analog scale pain scores, and the ability to return to sport. The BPII 2.0 has been validated in the pediatric population as a disease-specific health related quality of life measure [8]. Descriptive statistical assessment was used.

Results

We identified 9 patients who met our inclusion criteria. Two of the patients underwent staged bilateral procedures, resulting in 11 knees for inclusion. Baseline pre-operative characteristics are summarized in table 1. The average age at the time of surgery was 13.6 years. The average TT-TG distance was 21.7mm. The average CDI measurement was 1.3. 63.7% of knees had evidence of trochlear dysplasia.BPII 2.0 assessments were completed for 5 of 11 knees at average follow up of 1.6 years post-operative. The average cumulative BPII 2.0 score was 87.8 with a standard deviation of 16.3 (Table 1). The rate of return to previous level of sport was 80% (Table 2). When looking at individual question assessments within the BPII 2.0, the average pain score with prolonged activity was 91.6 (with 100 being no pain at all and 0 being severe pain) with a standard deviation of 12.7. Lowest scores were seen on the cost of the knee injury creating financial hardship for the family (average score 80 with standard deviation 27.3, with 0 being severe financial hardship and 100 being no financial hardship).

Table 1: Pre-operative baseline characteristics.

Age at time of surgery (years)	**13.6**
TT-TG distance (mm)	21.7
CDI (ratio)	1.3
Percentage of patients with trochlear dysplasia (%)	63.7
Abbreviations: TT-TG, tibial tuberosity-trochlear groove; CDI, Caton-Deschamps Index	

Table 2: Post-operative outcomes following physeal-sparing MPFL reconstruction with the Roux-Goldthwait procedure.

Average BPII 2.0 (+/- standard deviation)	**87.8 +/- 16.3**
Percentage return to previous sport/activity (%)	80
Abbreviations: BPII 2.0: Banff Patellofemoral Instability Instrument 2.0	

Discussion

In this series of pediatric patients with patellar instability and anatomic risk factors for recurrence, high BPII 2.0 scores were achieved following physeal-sparing MPFL reconstruction and Roux-Goldthwait procedure, and most patients were able to return to their prior level of sport. Previous studies have demonstrated similar post-operative BPII 2.0 values for patellar instability surgery, although none have examined the combined effects of MPFL reconstruction with Roux-Goldthwait procedure. Balcarek et al noted an increase in BPII 2.0 values from 35.6 pre-operatively to 79.6 post-operatively following MPFL reconstruction with either tibial tubercle osteotomy or femoral osteotomy in patients

with an average age of 20 years [9]. Similarly, Holliday et al found that BPII 2.0 scores increased from 26.1 to 71.8 following MPFL reconstruction in patients aged 9-50 years [10]. Our post-operative BPII 2.0 values were similar to these post-operative values obtained in the literatures, suggesting that pediatric patients who undergo physeal-sparing MPFL reconstruction with the Roux-Goldthwait procedure might expect similar disease-specific outcomes to their skeletally mature counterparts. The primarily limitation of this study is the low response rate for completion of the BPII 2.0 score. Additionally, there is no control group for comparison, and thus our statistical assessment was only descriptive. The retrospective nature of this study also meant that there were no pre-operative BPII 2.0 scores for comparison to our post-operative scores. These limitations illustrate the importance of future work involving prospective patient populations so changes in these outcome measures can be determined. In summary, this study is the first to describe pre-operative characteristics and post-operative disease-specific outcome measures for pediatric patients with patellar instability following combined physeal-sparing MPFL reconstruction with the Roux-Goldthwait procedure. These findings can be used to help surgeons in their medical decision making and in setting appropriate post-operative expectations for their patients.

Acknowledgements

All authors have no conflicts of interest to disclose as it relates to this work. There are no sources of funding to be acknowledged for this work.

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DOI: 10.32474/OSMOAJ.2023.06.000240