Annals of Clinical and Medical Case Reports

Case Report

ISSN 2639-8109 | Volume 13

Minimally Invasive Implant Free Transphyseal Pullout Technique for Medial Meniscus Posterior Root Repair in Pediatric Patients, A Case Report

Franco P[1], Jolly A[2], Baumert P[3,4], Fink C[3,4] and Abermann E[3,4*]

[1]Department of General Orthopedic, University of Florence, A.O.U. Careggi CTO, Florence, Italy

[2]Department of Orthopaedics, FMHS, SGT University, Gurugram, India

[3]Gelenkpunkt-Sports-and Joint Surgery, FIFA Medical Centre of Excellence, Innsbruck, Austria

[4]Research Unit for Orthopaedic Sports Medicine and Injury Prevention (OSMI), Medical Informatics and Technology, Private University for Health Sciences, Hall, Austria

[*]Corresponding author:

Elisabeth Abermann,
Gelenkpunkt-Sports-and Joint Surgery, FIFA Medical Centre of Excellence, Innsbruck, Research Unit for Orthopaedic Sports Medicine and Injury Prevention (OSMI), Medical Informatics and Technology, Private University for Health Sciences, Hall, Austria

Received: 16 May 2024
Accepted: 20 June 2024
Published: 25 June 2024
J Short Name: ACMCR

Citation:

Abermann E, Minimally Invasive Implant Free Transphyseal Pullout Technique for Medial Meniscus Posterior Root Repair in Pediatric Patients, A Case Report. Ann Clin Med Case Rep. 2024; V13(20): 1-4

Keywords:

Meniscus; Root lesion; Knee; Physis; Pediatric

1. Abstract

Medial meniscal posterior root (MMPR) tears have become increasingly recognized in adults. The consequences of meniscal root tears are severe with a subsequent risk of developing rapid end-stage osteoarthritis. Literature is raising awareness about possible pediatric involvement in this pathology. Although there are no studies demonstrating the long-term effects of an MMPR avulsion in pediatric patients, knowing the dramatic effects of this injury, treating this pathology is crucial to preserve knee physiology. Some substantial modifications to the conventional technique for MMPR repair in paediatric patients are needed. This case report presents a new technique to treat MMPR in pediatric using an implantfree minimally invasive trans-physeal bitunnel tibial pull-out.

2. Introduction

Medial meniscal posterior root (MMPR) tears have become increasingly recognized in the past decade. As a result, the reported consequences of unaddressed meniscal root tears have been well established, including increased tibiofemoral contact forces, meniscal extrusion and consequential risk of developing rapid end-stage osteoarthritis.[1–5] MMPR tears typically affect the middle-aged patients, but recent literature is raising more awareness about possible pediatric patient involvement in this pathology. [6,7] MMPR may occur without any involvement of the central pivot, conversely to the lateral meniscus root lesion. That could mean a more tricky and more difficult diagnosis.[8] Although there are no studies demonstrating the long-term effects of an MMPR avulsion in paediatric patients, knowing the dramatic effects of such an injury in adults, common sense should guide us to treat this pathology to preserve knee physiology especially in the growing patient. Still, some utmost important modifications to the conventional technique for MMPR in peadiatric patients need to be applied. At date there is no recognized technique that has been proved to be superior to the others. This case report shows a new technique to treat MMPR in pediatric patients with an implantfree minimally invasive trans-physeal bitunnel tibial pull-out.

3. Case Report

A 10 years old male presented to the clinic after an acute trauma of hyper-extension of the knee, with landing from a jump. At first clinical examination modest swelling of the knee, no central pivot or other ligamentous damages were evocable, and just some tenderness on the medial joint space. The MRI showed a MMPR injury, visible at the sagittal and coronal sequences. (Figure 1) Surgical

intervention for MMPR repair was scheduled.

4. Surgical Technique

The patient is positioned supine with dangling leg, and thigh tourniquet inflated at 250mmHg. An electric leg holder (Maquet, Rastatt, Germany) has been used; the positioning must allow knee motion between 0° and 120° of ROM. AL and AM standard arthroscopic portal are made. MMPR is checked for stability with a hook. No associated lesion has been found. The MMPR repair has been performed with an implantfree trans-physeal bitunnel tibial pull-out technique with the use of monofilament absorbable PDS wire. First the posterior horn of medial meniscus is debrided from any degenerative tissue. In the desired tibial footprint where the MM will be re-inserted, the cartilage is removed with a ring scraper, inserted via trans-notch through the AL portal. A special curved MRR tibial aimer (Smith&Nephew, USA), open at 60°, is inserted and a 2.4mm K-wire is pull until it's visible intra-articular with the camera. The procedure is repeated twice, so two parallel bone tunnels about 5mm apart in sagittal plane, are obtained. For this procedure a pie-crusting of the MCL in its meniscofemoral part may be needed to get the guide at the footprint of MMPR on the tibial plateau, to avoid any significant damage of the cartilage. A Knee Scorpion Suture Passer (Arthrex, Naples, USA) is used to pass two FiberWire No. 2/0 (Arthrex, Naples, USA) in two different holes into the posterior horn of the meniscus. The two holes are positioned strategically: the first one is slightly posterior in sagittal plain and as lateral as possible in coronal plain, the second hole is at the conjunction of the posterior root with the posterior horn of the meniscus and slightly anterior in sagittal plain. Both FiberWire are then substituted with a PDS absorbable suture and a cinch configuration is created. A Nitinol suture carrier is passed through the tibial tunnels and it's retrieved from the AM portal; the PDS sutures are then pulled through the tibial tunnels respectively. (Figure 2) The sutures are tightened and tied up together over the cortical tibial bone bridge.

Figure 1: Pre-operative MRI left knee, STIR sequence, 1a coronal view 1b sagittal view. In both images it can be seen MMPR tear, and open growing plates.

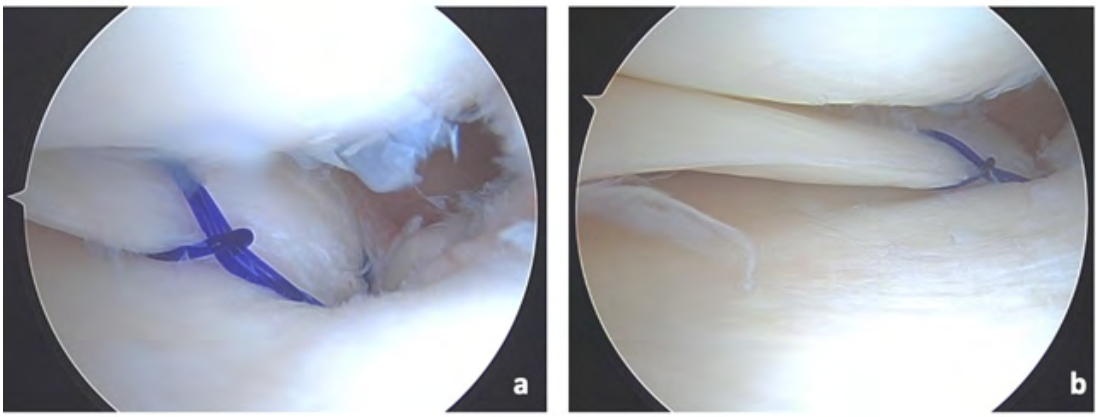

Figure 2: Intraoperative arthroscopic images show how the stiches have been placed on the meniscus. The first stich stays in the lateral edge of the debrided MMPR, and the PDS suture will stay in the more posterior bone tunnel (2a). The second stich is placed more medial, toward the MM body and it's anterior to the previous stich. The second stich will be retrieved and the suture will stay in the more anterior tunnel. The strategic position of the stiches allows load sharing between the two and regain the tension of the meniscus reduced on its anatomical insertion (2b)

5. Post Pperative Protocol

The use of the crutches is recommended with touch weight bearing for the first four weeks, then partial weight bearing until the sixth week when the patient may abandon the crutches. A knee brace with limited range of motion 0-90° is applied for the first six weeks. Running is prohibited until the third month post-op, and pivoting physical activities are not recommended for six months post-op.

6. Follow up

The patient repeated MRI of the knee joint after 2.5 months from surgery. On (Figure 3) it can be seen that meniscus healing has occurred. The patient has continued the rehabilitation program, after 2 months from operation no ROM deficit can be detected, no episode of effusion of the knee joint has occurred and the patient is pain free. After 6 months post-op he is back in skiing and soccer playing without any subjective limitations.

Figure 3: 2.5 months post-operative MRI, STIR sequence coronal view (3a) and sagittal view (3b). The pictures show the healing process of the meniscus and the resulting stability of the construct, which is evident from the fact that the posterior root of the meniscus has remained attached to the tibial plateau

7. Discussion

MMPR avulsion in pediatric patients is a niche topic, as there is little literature describing this pathology. Given the severity of the possible consequences for an untreated injury of this kind, it is always good to suspect it in the pediatric patient presenting with a blurred meniscal symptomatology, and proceed with an MRI. [3,6] Surgical treatment of MMPR avulsion in pediatric patients represents a double challenge for the surgeon in the arthroscopic technique due to the size of the knee and in avoiding undesirable iatrogenic damage of the physis. De Philippo et al. in 2020 described a technique of tibial pull-out for MMPR avulsion without crossing the growth cartilage.[9] The authors preferred to use a trans-physial technique, because the potential iatrogenic damage

given by the previous technique, if poorly executed, would lead to growth arrest over the entire medial half-plate of the tibia. The iatrogenic damage to the physis with the described technique is kept to a minimum [10]. The use of a pullout with a double tibial tunnel was first described by Chahla et al. in 2016[11], and the presented technique shares the mechanical stability of the double anchorage site on the meniscus. However, some modification from the original technique has been made: the site the two the sutures in the meniscus and the use of absorbable sutures for the fixation to avoid a partial suture epiphysiodesis of the posterior growth plate. The choice of the PDS suture has been made since it's the slowest absorbing suture, within twelve weeks, so it can provide mechanical stability while the meniscus is healing. In a pediatric patient the meniscus is smaller than in an adult, so two consecutive holes which are too close to one another may impair the meniscus structure. Moreover, authors believe that a more medial suture, towards the body of the meniscus, may help in regaining the tension of the meniscus, which may prevent meniscal extrusion, and consequently affect the surgical outcome of the technique by not recreating the physiological hoop stress of the medial meniscus under load [12]. A tempting alternative would have been a split gracilis autograft for the meniscus repair, as it would fulfil the request not to get through the physis with non-absorbable foreigner material [13,14] However, the gracilis tendon has not been used since it would have been too bulky for the pediatric meniscus, with higher chance of iatrogenic rupture of the meniscus itself. Moreover, the use of the gracilis tendon would have required a bigger trans-physeal tunnel.15

8. Conclusion

MMPR avulsion leads to degenerative changes in the knee joint whenever it's not addressed. The history and the clinical examination of these patients may be blurred. This could have particular adverse effects in peadiatric patients. So, it's of utmost importance to suspect that lesion, do an MRI and treat it surgically if confirmed.

Surgery can be challenging and it must be performed with minimally invasive techniques both of the meniscus and of the physis. At date, the presented technique, to the best knowledge of the authors, represents a meniscal tissue sparing technique and the trans-physeal tunnel dimension is reduced to the minimum. Like this two tunnels can be applied, which could provide more mechanical stability for enhanced meniscus healing and still causing only a minor injury to the physis.

References

1. Lee JI, Kim DH, Yoo HJ, Choi HG, Lee YS. Comparison of the Predicting Performance for Fate of Medial Meniscus Posterior Root Tear Based on Treatment Strategies: A Comparison between Logistic Regression, Gradient Boosting, and CNN Algorithms. Diagnostics. 2021;11(7):1225.
2. Moon HS, Choi CH, Jung M, Lee DY, Hong SP, Kim SH. Early Surgical Repair of Medial Meniscus Posterior Root Tear Minimizes the Progression of Meniscal Extrusion: 2-Year Follow-up of Clinical and Radiographic Parameters After Arthroscopic Transtibial Pull-out Repair. Am J Sports Med. 2020; 48(11): 2692-2702.
3. LaPrade RF, Floyd ER, Carlson GB, Moatshe G, Chahla J, Monson JK. Meniscal root tears: Solving the silent epidemic. Journal of Arthroscopic Surgery and Sports Medicine. 2021; 2: 47.
4. Kawada K, Furumatsu T, Tamura M, Higashihara N, Yokoyama Y, Ozaki T. Longitudinal changes in medial knee joint space narrowing after medial meniscus posterior root repair: A 2-year follow-up study. Knee. 2024; 47: 92-101.
5. Hurmuz M, Ionac M, Hogea B, Miu CA, Tatu F. Osteoarthritis Development Following Meniscectomy vs. Meniscal Repair for Posterior Medial Meniscus Injuries: A Systematic Review. Medicina (B Aires). 2024; 60(4): 569.
6. Magee LC, Mehta NN, Wright ML, Leska TM, Ganley TJ. Surgical/Technical Tips Management of Pediatric Meniscal Root Tears.; 2020.
7. Salman R, Ditzler MG, Jadhav SP, Schallert EK, McKay SD, Kan JH. Medial meniscal posterior horn tears and ramp lesions in pediatric patients: lessons learned. Pediatr Radiol. 2023; 53(12): 2345-2354.
8. Geffroy L. Meniscal pathology in children and adolescents. Orthopaedics and Traumatology: Surgery and Research. 2021; 107(1).
9. DePhillipo NN, Dean RS, LaPrade RF. Medial Meniscus Root Repair in Patients With Open Physes. Arthrosc Tech. 2020; 9(6): e723-e728.
10. Nagra KK, Jones RH, Gross PW, et al. Transosseous Repair of Isolated Posterior Medial Meniscal Root Injuries in Children and Adolescents. Arthrosc Tech. 2024; 13(5): 102951.
11. Chahla J, Moulton SG, LaPrade CM, Dean CS, LaPrade RF. Posterior Meniscal Root Repair: The Transtibial Double Tunnel Pullout Technique. Arthrosc Tech. 2016; 5(2): e291-e296.
12. Yoon KH, Bae BS, Ahn JH, Hwang SH. More than 3 mm of preoperative medial meniscal extrusion is identified as a key risk factor for varus progression in limb alignment after arthroscopic repair of medial meniscus posterior root tear. Knee Surgery, Sports Traumatology, Arthroscopy. Published online May 15, 2024.
13. Li H, Nie S, Lan M. Medial meniscus posterior root tear reconstructed with gracilis autograft improve healing rate and patient reported outcome measures. BMC Musculoskelet Disord. 2022;23(1).
14. Holmes SW, Huff LW, Montoya KJ, Durkin MW, Baier AJ. Arthroscopic Medial Meniscal Root Reconstruction With Gracilis Autograft Is Safe and Improves 2-Year Postoperative Patient-Reported Outcomes. Arthrosc Sports Med Rehabil. 2022; 4(4): e1339-e1346.
15. Holmes SW, Huff LW, Barnes AJ, Baier AJ. Anatomic Reinforced Medial Meniscal Root Reconstruction With Gracilis Autograft. Arthrosc Tech. 2019; 8(3): e209-e213.