

## Acute Patellar Tendon Rupture with Tibial Tubercle Avulsion Repair using Suture Anchors: Tiny Avulsed Fragment which Affects the Strength of Construction - A Case Report

Case Report

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### Abstract

**Introduction:** Patellar tendon is one of the most important component of the knee extensor mechanism, which consisted of quadriceps femoris muscle, quadriceps tendon, patellar bone and patellar tendon. The total disruption of patellar tendon will lead to disability and significant morbidity of the patient, or even worse, the patient disable to walk.

**Case Presentation:** We presented a case of 14-year-old male with acute patellar tendon rupture accompanied by tibial tubercle avulsion after injury during basketball game. We treated by four-strands Krakow's suture that stitched to three sutures anchor, while cancellous screw plus washer introduced as internal fixation of bony avulsion at tibial tubercle.

**Result:** Range of motion and International Knee Documentation Committee (IKDC) score had been followed up within 2 years with good result. Full range of motion and the IKDC score 89.7 were achieved without major complication such as pain and infection. The patient was able to return into sports activities.

**Conclusion:** The combination of cancellous screw with washer and three suture anchors leading into a good result in acute total rupture of patellar tendon with bony avulsion at tibial tubercle.

**Keywords:** Patellar Tendon Rupture; Tibial Tubercle Avulsion; Suture Anchor; Case Report.

### Introduction

Patellar tendon rupture is a challenging case for the orthopaedic surgeons. Until the nineteenth century many literatures describe about conservative treatment, despite sporadic reports of successful surgical repair.[1-3] The patient mostly younger than 40 years old, occur typically in young age and active population, also commonly unilateral.[3] The disruption of extensor mechanism of the knee joint is an essential mechanism that causing inability to maintain standing position with involved extremity. The mechanism of trauma is varied from low velocity, indirect blow, penetrating injury on bending knee position whereas the extensor mechanism in contraction.[4, 2] The rare finding showed a patellar tendon rupture in patient which previously had harvested tendon for ACL reconstruction.[5] Total rupture of patellar tendon interfered the mechanism into disable condition, and leading to morbidity if not treated well.[6, 7] It usually requires a surgical repair by two most common techniques; transosseus tunneling

or suture anchor technique, depends on surgeon preference and experience.[6-8] Suture anchor is the first consideration due to its relatively easy to perform, decrease iatrogenic possibility, great outcome to return into sports activity, range of motion and overall outcome if compared to the other methods of tendon repair.[9, 10] Suture anchors also supports early load bearing rehabilitation by decreasing gap formation and lowering the risk of failure or re-rupture rate of patellar tendon repair.[10]

There were several options of surgical techniques which conducted in many reports, such as trans-osseus tunneling, patellar tendon augmentation with ipsilateral semitendinosus autograft, and suture anchors.[11-13] Although biomechanical studies presented to compare suture anchor versus transosseous tunnel, the similar biomechanical properties was described, and many factors that explained superiority of suture anchor techniques was often reported.[14, 15] Therefore, we aim to evaluate the effectiveness of suture anchors in management of acute patellar tendon rup-

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ture. This case report has been reported in line with the SCARE Criteria.[16]

## Case Presentation

### History taking

A 14-year-old male complained of immediate onset of pain and swollen on the right knee. He noticed while attempting to jump off of both legs to dunk a basketball during a game. He heard and felt the pop sound on his right knee. He was unable to actively fully extend his right knee, while his knee in swollen and pain. He still could not lift his leg afterwards. When he came to our centre, the Thessaly test and Lachmann test were negative. Anterior-posterior and lateral radiograph of right knee was taken with the result of patella height pulled superiorly. Sagittal MRI of the right knee identified the significant high patella (Fig. 1). The patient was diagnosed acute patellar tendon rupture of the right knee. The patient agreed to participate on this report for publication of the images by the informed consent.

### Surgical Technique

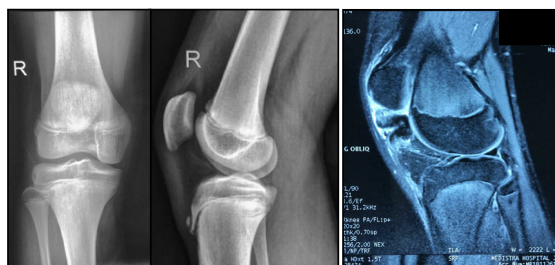
The surgery was performed under spinal anaesthesia and the patient was positioned in supine position. The midline incision is about 12 cm long started from superior border of patella to tibial tubercle to ensure the exposure of all segments of patellar tendon. We decided to perform patellar tendon repair that fixated with

three sutures anchor TWINFIX™ Ti Suture Anchor with two preloaded ULTRABRAID™ 5.0 mm (Smith & Nephew, Andover, MA), and internal fixation of avulsed tibial tubercle using cancellous screw 3.5mm with washer from Synthes® (Oberdorf, Switzerland). Initially, three suture anchors were placed below the avulsed tibial tubercle (Fig. 2).

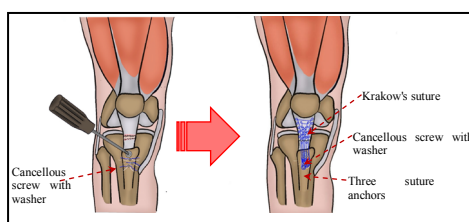
The patellar tendon was sutured in four-strand Krakow's technique with ultra-braided suture from suture anchors (Fig.3). The cancellous screw has the role of fixating the bone fragment to tibial tubercle, as some portion patellar tendon attached to its bone. Thereafter, the avulsed fragment of tibial tubercle was inserted back into its right position and fixed using cancellous screw with washer right in the middle of its initial position. The patient was immobilized with knee brace within 4 weeks, initially full extension. The knee was immobilized with knee brace in full extension. Post-operative radiograph both anterior-posterior and lateral view was taken with good position of the patella (Fig.4).

The brace was used in full extension for three weeks, the amount of knee flexion is increased gradually until full flexion and full weight bearing allowed at 6 weeks after surgery. Within 2 years of followed up, the functional outcome score measured by International Knee Documentation Committee (IKDC) score. The IKDC score was 89.7, which is very good result. The full flexion of knee was regained without pain. The patient is a professional basketball player, eventually he is able return to sport activity.

**Figure 1.** Radiograph anterior-posterior and lateral of the right knee showed soft tissue swelling and bony avulsion on tibial tubercle. The sagittal MRI confirmed the patellar tendon rupture.



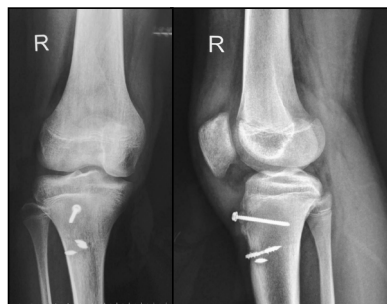
**Figure 2.** The illustration of patellar tendon rupture and initially the three suture anchors was placed below the avulsed tibial tubercle.



**Figure 3.** The cancellous screw 3.5 mm plus washer were inserted to avulsed tibial tubercle with screwdriver. Three suture anchors initially inserted to improve strength of the configuration distally to cancellous screw.



**Figure 4. Post-operative radiograph anterior-posterior and lateral of right knee. The Insall-Salvati ratio and Caton-Deschamps index were measured with good improvement.**



## Results and Discussions

Total rupture of patellar tendon is a condition of disability that caused a significant alteration of the knee extensor mechanism, and if untreated, the result could be a severe disability for the patient. The etiologies were widely used traumatic and atraumatic, which increase in patients younger than 40 years old. [3, 17, 18] The most often traumatic factors are penetrating injury, while simple fall or eccentric patellar tendon contraction is an atraumatic condition, rarely ended with bony avulsion around the tibial tubercle. [6, 8, 10, 19]

The bony avulsion of tibial tubercle were described in many studies. [20, 21] It was vulnerable to injury by the development of apophysis and the growth were in normal traction of patellar tendon. The surgical fixation of bony avulsion was important, while the surgeons chose several techniques with several different implants, but the same principle of internal fixation. The surgery was indicated in bony tibial tubercle fracture. The bony avulsion still attached to the portion of the remaining patellar tendon, which outcomes have generally been satisfactory in many literatures. To allow the early recovery protocol and a successful result, bone-to-bone healing was much better than tendon-to-bone healing.

The current issues of surgical technique in patellar tendon repair were the numerous of condition and level of the rupture during the surgery. The patellar tendon could be separated at distal border of patella, central of patellar tendon or mid-substance, and unexpectedly at the very distal of patellar tendon, often with a small fragment of avulsed tibial tubercle. [6] The two widely used techniques for fixation are transosseous tunnel or suture anchors. [9, 15, 22] The transosseous tunnel which described early before suture anchors, was reported in many studies that has higher re-rupture rate, due to more gap formation during functional loading [6, 7]. Nowadays, more orthopaedic surgeons prefer suture anchors technique to repair acute patellar tendon rupture.

In our case, beside preserving bony avulsion, we prefer to choose suture anchors with bony avulsion preservation to improve the stability of construction. Even though the cancellous screw fixed the bone avulsion with some portion of patellar tendon still attached to avulsed bone fragment, there was rupture of patellar tendon that not directly connected to the bone avulsion. Tibial tubercle avulsion has been fixed for bone-to-bone healing, while tendon-to-tendon healing was achieved by Krakow's sutures. The strength of the suture anchors was explained in many literatures. Lissyetal showed the excellent improvement of functional assessment within 6 months follow up with Krakow's sutures technique based patellar tendon combined with knotless suture anchor to

patella, and vice versa, the knotless suture anchor to tibia. [5] Instead, we use the combination of Krakow's sutures, three suture anchors, and one cancellous screw as a combination method of fixation. The relief of the symptoms and returning to sport activities can be achieved in this case, even though the outcome of patellar tendon rupture with bony avulsion of tibial tubercle is not always satisfactory.

O' Dowd et al [7] evaluated 374 human knees (321 transosseous tunnel and 53 suture anchors) retrospectively, showed significant re-tear rate in 24 of 321 knees (7.5%) of transosseous group and 0 of 53 knees in the anchor group ( $p < 0.05$ ). Biomechanical study reported by Lanzi et al [11] reported 48 porcine knees (12 transosseous group and 12 anchors group, randomly taken with 12 samples in each group) with all specimens of transosseous group failed at knot tied over the proximal pole of the patella. In suture anchors group failed 1 of 2 modes: by pullout from interference around the anchor in the bone (5 specimens) or by suture breaking at the first locking throw in the tendon (7 specimens). Two cadaveric studies by Black et al and Ettinger et al were conducted with different area of outcome; Black et al [15] reported 12 knee of 6 cadavers (6 transosseous group and 6 anchors group whereas suture anchors has no gap formation (2.6 mm gap in transosseous group and 2.19 mm in anchors group), Ettinger et al [22] reported 30 knee cadavers (15 transosseous group and 15 anchors group) that the maximum load to failure was  $301 \pm 114$  N for the transosseous group and  $597 \pm 118$  N for the anchors group ( $p < 0.05$ ).

In the avulsed tibial tubercle type of patellar tendon rupture with suture anchors technique, some factors were contributed to the strength; such as suture material, number of suture anchor, suture technique, and the cancellous screw anchor that only used in this bony avulsion type of rupture. [12, 14, 22, 23]. The surgical technique could be the combination of two or three suture anchors, depending the intraoperative condition. The stability of the knee was examined by passive range of motion and varus - valgus test. In a systematic review by Grondin et al, the recovery procedure after surgery was documented, with 52% to 100% of patients returning to sports activities. [23] Six weeks immobilization with gradually increased of knee flexion are currently reported with great result, without adverse event, and the patient returned to professional basketball player.

Our report suggests that the use of three suture anchors combined with the cancellous screw is effective to fix the acute patellar tendon rupture with tibial tubercle avulsion, and the patient is returned to sport activities without complication. The take home message is the preserve of bony avulsion of tibial tubercle would increase the holding strength of construction.

## Conclusion

The combination of cancellous screw with washer and three suture anchors leading into a good result in acute total rupture of patellar tendon with bony avulsion at tibial tubercle. Therefore, we recommend using suture anchors in treatment of acute patellar tendon rupture.

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## References

- [1]. Matava MJ. Patellar Tendon Ruptures. *J Am Acad Orthop Surg*. 1996 Nov;4(6):287-296. PubMed PMID: 10797196.
- [2]. Siwek CW, Rao JP. Ruptures of the extensor mechanism of the knee joint. *J Bone Joint Surg Am*. 1981 Jul;63(6):932-7. PubMed PMID: 6985557.
- [3]. Enad JG. Patellar tendon ruptures. *South Med J*. 1999 Jun;92(6):563-6. PubMed PMID: 10372848.
- [4]. Sanchez G, Ferrari MB, Sanchez A, Moatshe G, Chahla J, DePhillipo N, et al. Proximal Patellar Tendon Repair: Internal Brace Technique With Unicortical Buttons and Suture Tape. *Arthrosc Tech*. 2017 Apr 24;6(2):e491-e497. PubMed PMID: 28580272.
- [5]. Lissy M, Patel UJ. Surgical Technique: Repair of Patella Tendon Rupture in a Previously Harvested Tendon for an Anterior Cruciate Ligament Reconstruction. *J Orthop Case Rep*. 2019;9(4):34-40. PubMed PMID: 32405484.
- [6]. O'Dowd JA, Lehoang DM, Butler RR, Dewitt DO, Mirzayan R. Operative Treatment of Acute Patellar Tendon Ruptures. *Am J Sports Med*. 2020 Sep;48(11):2686-2691. PubMed PMID: 32757970.
- [7]. O'Dowd JA, Lehoang D, Butler RK, De Witt D, Mirzayan R. Trans-osseous versus Anchor Repair of Acute Patellar Tendon Ruptures. *Orthop J Sports Med*. 2018 Jul 27;6(7 suppl4):2325967118S00133.
- [8]. Andrea C, Federico P, Giovanni G, Alberto B. Patellar and quadriceps tendons acute repair with suture anchors. *Acta Biomed*. 2019 Jan 14;90(1-S):209-213. PubMed PMID: 30715027.
- [9]. Bushnell BD, Tennant JN, Rubright JH, Creighton RA. Repair of patellar tendon rupture using suture anchors. *J Knee Surg*. 2008 Apr;21(2):122-9. PubMed PMID: 18500063.
- [10]. Capiola D, Re L. Repair of patellar tendon rupture with suture anchors. *Arthroscopy*. 2007 Aug;23(8):906.e1-4. PubMed PMID: 17681216.
- [11]. Lanzi JT Jr, Felix J, Tucker CJ, Cameron KL, Rogers J, Owens BD, et al. Comparison of the Suture Anchor and Transosseous Techniques for Patellar Tendon Repair: A Biomechanical Study. *Am J Sports Med*. 2016 Aug;44(8):2076-80. PubMed PMID: 27179054.
- [12]. Woodmass JM, Johnson JD, Wu IT, Krych AJ, Stuart MJ. Patellar Tendon Repair With Ipsilateral Semitendinosus Autograft Augmentation. *Arthrosc Tech*. 2017 Nov 13;6(6):e2177-e2181. PubMed PMID: 29349015.
- [13]. Gaines RJ, Grabill SE, DeMaio M, Carr D. Patellar tendon repair with suture anchors using a combined suture technique of a Krackow-Bunnell weave. *J Orthop Trauma*. 2009 Jan;23(1):68-71. PubMed PMID: 19104306.
- [14]. Yen CY, Tsai YJ, Hsiao CK, Kao FC, Tu YK. Biomechanical evaluation of patellar tendon repair using Krackow suture technique. *Biomed Eng Online*. 2019 May 22;18(1):64. PubMed PMID: 31118104.
- [15]. Black JC, Ricci WM, Gardner MJ, McAndrew CM, Agarwalla A, Wojahn RD, et al. Novel Augmentation Technique for Patellar Tendon Repair Improves Strength and Decreases Gap Formation: A Cadaveric Study. *Clin Orthop Relat Res*. 2016 Dec;474(12):2611-2618. PubMed PMID: 27492687.
- [16]. Agha RA, Franchi T, Sohrabi C, Mathew G, Kerwan A; SCARE Group. The SCARE 2020 Guideline: Updating Consensus Surgical CAse REport (SCARE) Guidelines. *Int J Surg*. 2020 Dec;84:226-230. PubMed PMID: 33181358.
- [17]. Kelly DW, Carter VS, Jobe FW, Kerlan RK. Patellar and quadriceps tendon ruptures--jumper's knee. *Am J Sports Med*. 1984 Sep-Oct;12(5):375-80. doi: 10.1177/036354658401200508. PMID: 6496835.
- [18]. Kuechle DK, Stuart MJ. Isolated rupture of the patellar tendon in athletes. *Am J Sports Med*. 1994 Sep-Oct;22(5):692-5. PubMed PMID: 7810795.
- [19]. Yousef MAA. Combined avulsion fracture of the tibial tubercle and patellar tendon rupture in pediatric population: case series and review of literature. *Eur J Orthop Surg Traumatol*. 2018 Feb;28(2):317-323. PubMed PMID: 28956182.
- [20]. Frey S, Hosalkar H, Cameron DB, Heath A, David Horn B, Ganley TJ. Tibial tuberosity fractures in adolescents. *J Child Orthop*. 2008 Dec;2(6):469-74. PubMed PMID: 19308544.
- [21]. Pereira AL, Faria ÁRV, Campos TVO, Andrade MAP, Silva GMAE. Tibial tubercle fracture associated with distal rupture of the patellar tendon: case report. *Rev Bras Ortop*. 2018 Jun 11;53(4):510-513. PubMed PMID: 30027088.
- [22]. Ettinger M, Dratzidis A, Hurschler C, Brand S, Calliess T, Krettek C, et al. Biomechanical properties of suture anchor repair compared with transosseous sutures in patellar tendon ruptures: a cadaveric study. *Am J Sports Med*. 2013 Nov;41(11):2540-4. PubMed PMID: 23982397.
- [23]. Grondin J, Menu P, Garraud T, Mesland O, Dauty M, Fouasson-Chailloux A. Return to Sport After Patellar Tendon Rupture: a Systematic Review. *Muscles, Ligaments & Tendons Journal (MLTJ)*. 2019 Oct 1;9(4).