



Case report

Acute patellar tendon rupture with tibial tubercle avulsion repair using suture anchors: Tiny avulsed fragment which affects the strength of construction-a case report

Andri Maruli Tua Lubis^{*}, Ido Prabowo

Department of Orthopaedics and Traumatology, dr. Cipto Mangunkusumo General Hospital, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

ARTICLE INFO

Keywords:

Patellar tendon rupture
Tibial tubercle avulsion
Suture anchor
Case report

ABSTRACT

Introduction and importance: Patellar tendon is one of the most important components 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 is disabled to walk. The incidence of patellar tendon rupture is uncommon and most commonly found in the third to fourth decade of life. We present a case of total patellar tendon rupture in a teenager with primary repair with suture anchor.

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.

Clinical discussion: 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 sport activities.

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

1. Introduction

Patellar tendon rupture is a challenging case for orthopaedic surgeons. Until the nineteenth century many literatures describe about conservative treatment, despite sporadic reports of successful surgical repair [1–3]. The patients are mostly younger than 40 years old, occurring typically in young and physically active population, also commonly found to be unilateral [3]. The disruption of extensor mechanism of the knee joint is an essential mechanism of injury that would cause the involved extremity to be unable to maintain standing position. The mechanism of trauma varies from low velocity, indirect blow to penetrating injury on bending knee position while the extensor mechanism is in contraction [2,4]. The rare finding showed a patellar tendon rupture in patient which previously had underwent surgery of tendon harvesting for ACL reconstruction [5]. Total rupture of patellar tendon would turn the extensor mechanism into being disabled, and lead to morbidities if not treated well [6,7]. It usually requires a surgical

repair by using two of the most common techniques; which are transosseus tunnelling and suture anchor technique, depending on the surgeon's preference and experience [6,8]. Suture anchor is the first choice for consideration due to its relatively easy to perform, low possibility for iatrogenic damage, good outcome in terms of return into sports activity, regaining range of motion and overall outcome if compared to 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 of the repaired patellar tendon [11].

There are several options of surgical techniques which are described in many reports, such as transosseus tunnelling, patellar tendon augmentation with ipsilateral semitendinosus autograft and suture anchors [11–13]. Although many biomechanical studies are presented to compare suture anchor versus transosseus tunnel, many of the similar biomechanical properties between the two were described, many factors that explained superiority of suture anchor techniques was often reported [14,15]. Therefore, this study aims to evaluate the effectiveness

^{*} Corresponding author.

E-mail address: andrilubisresearch@gmail.com (A.M.T. Lubis).

<https://doi.org/10.1016/j.ijscr.2022.107283>

Received 30 April 2022; Received in revised form 4 June 2022; Accepted 5 June 2022

Available online 10 June 2022

2210-2612/© 2022 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

of suture anchors in managing acute patellar tendon rupture. This case report has been written in line with the SCARE Criteria [16].

2. Case presentation

2.1. History taking

A 14-year-old male complained of immediate onset of pain and swelling of 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. Subsequently, he was unable to actively fully extend his right knee, while his knee in swollen and pain. He still could not lift his leg. The patient then came to our centre by himself afterwards. When he came to our centre, the Thessaly test and Lachmann test were negative. Anterior-posterior and lateral radiograph of the right knee was taken with the result of patella height pulled superiorly. Sagittal MRI of the right knee was identified the significant high patella (Fig. 1). The patient was diagnosed with 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.

2.2. Surgical technique

The surgery was performed under spinal anaesthesia and the patient was positioned in supine position. The surgery was carried out at Cipto Mangunkusumo Hospital, Jakarta, Indonesia, and performed by the author (Andri Maruli Tua Lubis), an experienced orthopaedic sport surgeon. 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 3.5 mm 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 fixing the bone fragment to tibial tubercle, as some portions of the patellar tendon are 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 positioned in full extension.

Postoperative radiograph in both anterior-posterior and lateral view was taken with good positioning 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 are 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. The full flexion of knee was regained without pain. The patient is a professional basketball player, eventually he is able return to sport activity similar with his pre-injury capacity. The patient reported satisfied with his current condition.

3. Results and discussions

Total rupture of patellar tendon is a condition of disability that causes 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 known as traumatic and atraumatic, which is increased in patients younger than 40 years old [3,17,18]. Most often traumatic factors are penetrating injuries, 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 was 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 preferred than tendon-to-bone healing.

The current issues of surgical technique in patellar tendon repair were the heterogeneity 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.

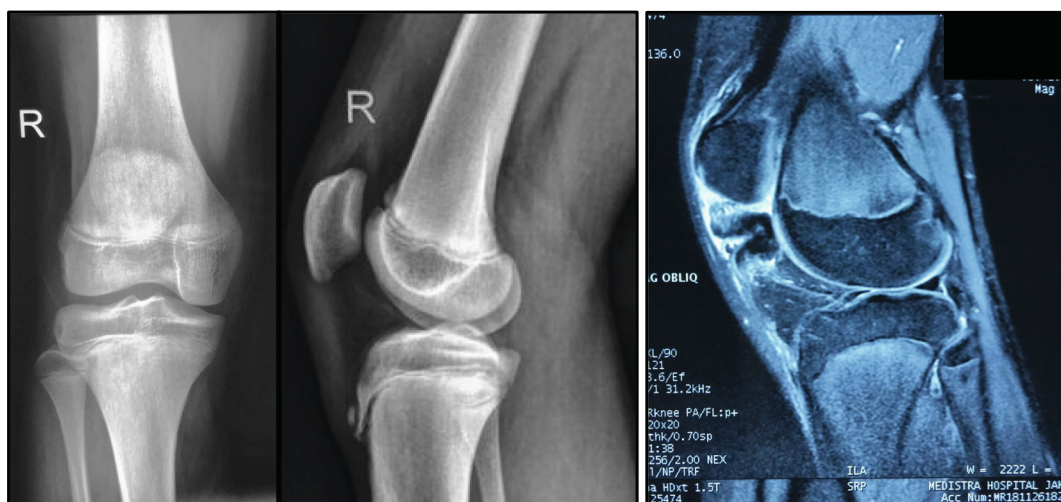


Fig. 1. Radiograph anterior-posterior and lateral of the right knee showed soft tissue swelling and bony avulsion on tibial tubercle. The sagittal MRI confirmed the patellar tendon rupture.

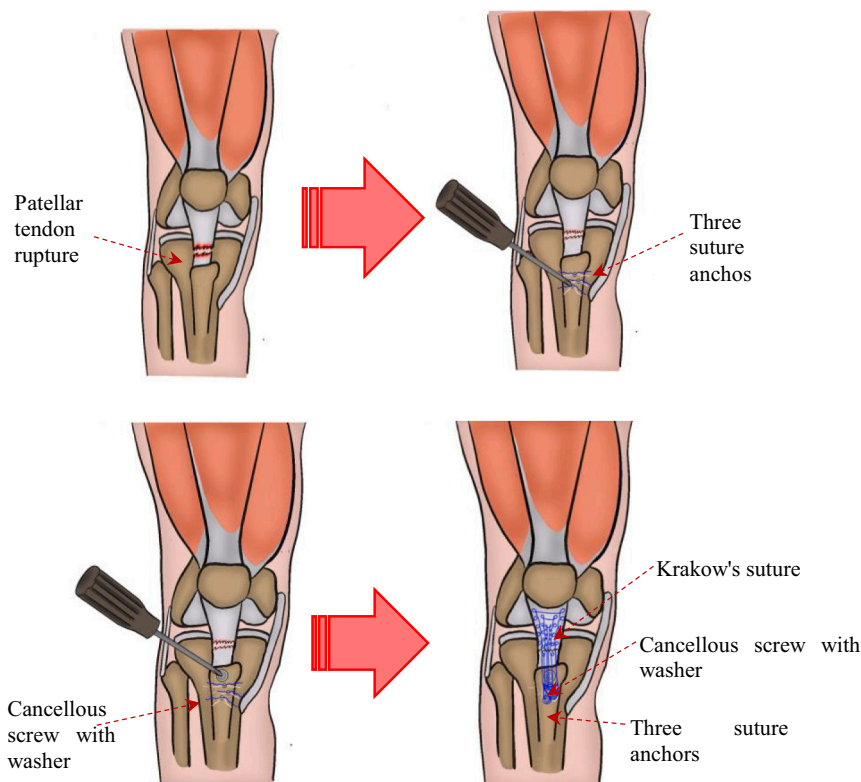


Fig. 2. The illustration of patellar tendon rupture and initially the three suture anchors was placed below the avulsed tibial tubercle.



Fig. 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.

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 was 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

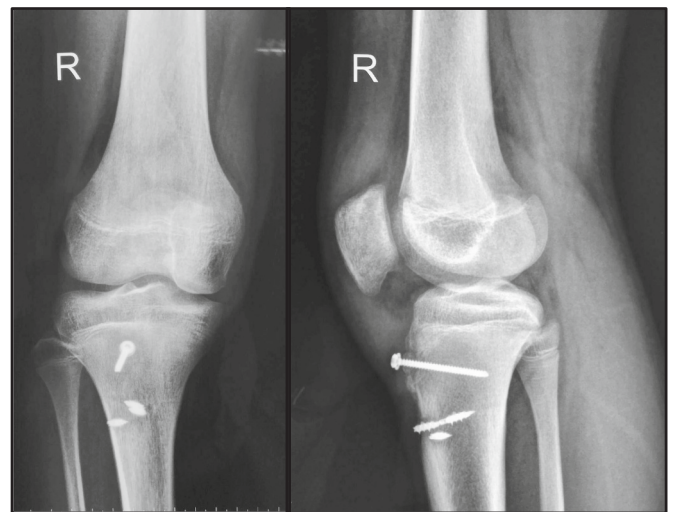


Fig. 4. Post-operative radiograph anterior-posterior and lateral of right knee. The Insall-Salvati ratio and Caton-Deschamps index were measured with good improvement.

by Krakow's sutures. The strength of the suture anchors was explained in many literatures. Lissy et al. 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 out 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 ± 114 N for the transosseous group and 597 ± 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 on 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 return to sport activities without complication. The take home message is the preserve of bony avulsion of tibial tubercle that would increase the holding strength of construction.

4. Conclusion

The combination of cancellous screw with washer and three suture anchors lead to 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. Our procedure allows healing which aid optimal recovery in the patient, and further leads to satisfactory clinical outcomes.

Declaration of competing interest

Nothing to declare.

Acknowledgement

We thank to all staffs, residents, and patients for the support for our study.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Sources of funding

This study is funded privately.

Ethical approval

This case report did not intervene with patients' treatment plans and

hence did not require ethical approval.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Andri MT Lubis: study concept or design, data collection, analysis and interpretation, oversight and leadership responsibility for the research activity planning and execution.

Ido Prabowo: study concept or design, data collection, analysis and interpretation, oversight and leadership responsibility for the research activity planning and execution.

Research registration number

N/A.

Guarantor

Andri Maruli Tua Lubis, MD.

References

- [1] M.J. Matava, Patellar tendon ruptures, *J. Am. Acad. Orthop. Surg.* 4 (1996) 287–296.
- [2] C.W. Siwek, J.P. Rao, Ruptures of the extensor mechanism of the knee joint, *JBJS* 63 (1981) 932–937.
- [3] J.G. Enad, Patellar tendon ruptures, *South. Med. J.* 92 (1999) 563–566.
- [4] G. Sanchez, M.B. Ferrari, A. Sanchez, et al., Proximal patellar tendon repair: internal brace technique with unicortical buttons and suture tape, *Arthrosc Tech* 6 (2017) e491–e497.
- [5] M. Lissy, U.J. Patel, Surgical technique: repair of patella tendon rupture in a previously harvested tendon for an anterior cruciate ligament reconstruction, *J. Orthop. Case Rep.* 9 (2019) 34.
- [6] J.A. O'Dowd, D.M. Lehoang, R.R. Butler, et al., Operative treatment of acute patellar tendon ruptures, *Am. J. Sports Med.* 48 (2020) 2686–2691, <https://doi.org/10.1177/0363546520943879>.
- [7] J.A. O'Dowd, D. Lehoang, R.K. Butler, et al., Trans-osseous versus anchor repair of acute patellar tendon ruptures, *Orthop. J. Sport Med.* 6 (2018).
- [8] C. Andrea, P. Federico, G. Giovanni, B. Alberto, Patellar and quadriceps tendons acute repair with suture anchors, *Acta Biomed. Ateneo Parmense* 90 (2019) 209.
- [9] B.D. Bushnell, J.N. Tennant, J.H. Rubright, R.A. Creighton, Repair of patellar tendon rupture using suture anchors, *J. Knee Surg.* 21 (2008) 122–129.
- [10] D. Capiola, L. Re, Repair of patellar tendon rupture with suture anchors, *J. Arthrosc. Relat. Surg.* 23 (2007) 906–e1.
- [11] J.T. Lanzi Jr., J. Felix, C.J. Tucker, et al., Comparison of the suture anchor and transosseous techniques for patellar tendon repair: a biomechanical study, *Am. J. Sports Med.* 44 (2016) 2076–2080.
- [12] J.M. Woodmass, J.D. Johnson, I.T. Wu, et al., Patellar tendon repair with ipsilateral semitendinosus autograft augmentation, *Arthrosc. Tech.* 6 (2017) e2177–e2181.
- [13] R.J. Gaines, S.E. Grabill, M. DeMaio, D. Carr, Patellar tendon repair with suture anchors using a combined suture technique of a Krackow-Bunnell weave, *J. Orthop. Trauma* 23 (2009) 68–71.
- [14] C.-Y. Yen, Y.-J. Tsai, C.-K. Hsiao, et al., Biomechanical evaluation of patellar tendon repair using krackow suture technique, *Biomed. Eng. Online* 18 (2019) 1–9.
- [15] J.C. Black, W.M. Ricci, M.J. Gardner, et al., Novel augmentation technique for patellar tendon repair improves strength and decreases gap formation: a cadaveric study, *Clin. Orthop. Relat. Res.* 474 (2016) 2611–2618.
- [16] R.A. Agha, T. Franchi, C. Sohrabi, et al., The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, *Int. J. Surg.* 84 (2020) 226–230, <https://doi.org/10.1016/j.ijsu.2020.10.034>.
- [17] D.W. Kelly, V.S. Carter, F.W. Jobe, R.K. Kerlan, Patellar and quadriceps tendon ruptures—jumper's knee, *Am. J. Sports Med.* 12 (1984) 375–380.
- [18] D.K. Kuechle, M.J. Stuart, Isolated rupture of the patellar tendon in athletes, *Am. J. Sports Med.* 22 (1994) 692–695.
- [19] M.A.A. Yousef, 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.* 28 (2018) 317–323.
- [20] S. Frey, H. Hosalkar, D.B. Cameron, et al., Tibial tuberosity fractures in adolescents, *J. Child. Orthop.* 2 (2008) 469–474.

- [21] A.L. Pereira, Á.R.V. de Faria, T.V. de O Campos, M.A.P.de Andrade, Tibial tubercle fracture associated with distal rupture of the patellar tendon: case report, *Rev Bras Ortop* 53 (2018) 510–513.
- [22] M. Ettinger, A. Dratzidis, C. Hurschler, et al., Biomechanical properties of suture anchor repair compared with transosseous sutures in patellar tendon ruptures: a cadaveric study, *Am. J. Sports Med.* 41 (2013) 2540–2544.
- [23] J. Grondin, P. Menu, T. Garraud, et al., Return to sport after patellar tendon rupture: a systematic review, *Muscles Ligaments Tendons J* 9 (2019).