



Long-Term Outcome After Surgical Treatment of Acute and Chronic Quadriceps Tendon Rupture

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Abstract

Background: Quadriceps tendon ruptures (QTR) are uncommon injuries of knee extensor mechanism. Although immediate repair is necessary to re-establish knee extensor continuity, favorable outcome of QTR reconstruction even several years after injury is reported.

Objectives: The outcome of acute and chronic QTR is rarely investigated. The current study aimed at evaluating the objective and subjective measures of outcome following the surgery of acute and chronic QTR.

Methods: A total of 6 QTR injuries, 3 acute and 3 chronic cases, in subjects with the mean age of 31.66 ± 12.7 years and mean follow-up of 4.3 ± 2.5 years were retrospectively evaluated. Pre- and post-operative subjective measures including international knee documentation committee (IKDC), modified Cincinnati knee scores, and objective measures including range of motion (ROM) and extension lag were used to evaluate the outcomes.

Results: ROM improvement was 36.6° in acute and 33.3° in chronic injuries. Extension lag improvement was 28.3° in acute and 26.7° in chronic injuries. IKDC improvement was 72.8 in acute and 62.4 in chronic injuries. Improvement of modified Cincinnati was 72.6 in acute and 64.7 in chronic injuries. No post-operative complications were observed in the studied series, while all cases re-established their pre-operative activity level.

Conclusions: According to the current study results, delayed repair of QTR injury adversely affected the outcome of surgery. Meanwhile, surgical reconstruction of chronic QTR is still warranted regarding the considerable post-surgical improvement of the outcome measures.

Keywords: Quadriceps Tendon Rupture, Knee Extensor Mechanism, Chronic, Surgical Management, Outcome

1. Background

Quadriceps tendon rupture (QTR) is considered as an uncommon injury of the knee (1), which is most often observed in over 40-year-olds (2). Indirect trauma by forceful quadriceps contraction is the usual mechanism of rupture in quadriceps tendon. Systemic diseases such as chronic renal failure, diabetes mellitus, rheumatoid arthritis, gout, hyperparathyroidism, systemic lupus erythematosus, and obesity, as well as drugs such as corticosteroid, systemic use or local injection, and fluoroquinolone antibiotics may predispose QTR (2, 3).

Although the diagnosis is easily suggested by inability to actively extend the knee, these injuries are often overlooked, resulting in delayed diagnosis and treatment (4). Immediate repair is required to re-establish knee extensor continuity and allow early motion. According to the study by Scuderi, repair should be performed in the first 48 - 72 hours post-injury to achieve a successful outcome (1).

Based on the present evidence, chronic QTR usually results in significant disability. Due to proximal migration and contracture of quadriceps muscle, surgical treatment is technically very difficult, and functional outcome following the delayed surgery of the knee extensor mechanism is suboptimal (1, 5). However, favorable outcome of QTR reconstruction even 8 years after occurrence is reported (4, 6).

2. Objectives

Although management of QTR is now well codified, the outcome of acute and chronic QTR is rarely investigated, mainly due to their uncommon occurrence. The current study aimed at evaluating the surgical outcome of acute and chronic QTR in 6 patients.

3. Methods

A total of 8 consecutive patients with an acute or chronic QTR who underwent surgical treatment referred to the under study institute from 2001 to 2013. Clinical and demographic characteristics of the patients were gathered through retrospective review of the patients' medical records, calling, and visiting them for complementary evaluations. Surgical treatments within 2 weeks from the incidence of injury were considered as acute repair, while surgeries performed after 2 weeks were considered as late or chronic repair (7, 8).

Pre- and post-operative subjective measures including international knee documentation committee (IKDC) (9), modified Cincinnati knee scores (10), and objective measures including range of motion (ROM) and extension lag were used to evaluate the outcome of the surgeries; 2 patients missed the final assessments and were excluded from the study. Thus, the final analysis was performed on the remaining 6 patients including 3 acute and 3 chronic injuries. Lateral knee radiography was performed to evaluate patellar position. Any complications including infection, knee stiffness, re-rupture, hospitalization for manipulation, or surgical release was recorded.

The current study was approved by the Institutional Review Board of Iran University of Medical Sciences and informed consent was obtained from all patients in order to use their data for publication.

3.1. Surgical Technique

Under the general or regional anesthesia, after routine prep and drape, tourniquet was inflated. All cases were treated with open surgical repair. Longitudinal midline incisions over anterior surface of knee with appropriate length were used in all patients. In acute cases, direct repair of QTR was performed. Based on tendon quality, the surgeon decided whether to use autologous or allogenic tendon graft. In chronic cases after release of tendons from scar tissue and mobilization, direct repair was performed and subsequently augmented with allogenic or autogenous tendon graft (Figure 1). Tourniquet was deflated and careful homeostasis was maintained. After Hemovac drain placement, wound was repaired in the usual manner. A long leg cast in extension was applied.

3.2. Post-Operative Care

Isometric quadriceps exercise was started immediately after recovery from anesthesia. Hemovac drain was removed 1 day after the surgery and the patient was allowed to walk with walker or double crutches and weight bearing as much as tolerated. Cast was removed after 4 weeks and hinged knee brace that allowed progressive knee range of motion was fitted.

4. Results

In total, 6 patients with QTR were included in the study, which consisted of 3 chronic and 3 acute injuries. The mean age of the patients was 31.66 ± 12.7 years (ranging from 16 to 52 years). The mean follow-up time of the patients was 4.3 ± 2.5 years (ranging from 0.5 to 8 years). The mean follow-up time was 4 ± 1 and 4.5 ± 3.8 years for acute and chronic QTR groups. The mean time before surgery was 24.7 ± 8 and 1.5 ± 0.5 weeks for chronic and acute injuries. Falling was the most frequent mechanisms of injuries. Clinical and demographic characteristics of patients are demonstrated in Table 1.

The mean pre-operative ROM was $81.7^\circ \pm 7.5^\circ$, which improved to $116.7^\circ \pm 5.2^\circ$ post-operatively. The mean pre-operative extension lag was $28.4^\circ \pm 4^\circ$, which decreased to $0.83^\circ \pm 2^\circ$ after the surgery. The mean IKDC was 22.6 ± 10.1 before the surgery and increased to 90.2 ± 3.4 afterward. The mean pre-operative modified Cincinnati was 21.5 ± 4.7 and increased to 90.2 ± 4.6 after operation. Pre-operative and post-operative outcome measures of each patient are demonstrated in Table 2.

ROM improvement was 36.6° in acute and 33.3° in chronic injuries. Extension lag improvement was 28.3° in acute and 26.7° in chronic injuries. IKDC improvement was 72.8 in acute and 62.4 in chronic injuries. The improvement of modified Cincinnati was 72.6 in acute and 64.7 in chronic injuries.

4.1. Post-Operative Complications

No post-operative complications such as infection, knee stiffness, requiring manipulation or surgical release, re-rupture or patellar fracture were observed in the current series. All cases re-established their pre-operative activity level.

5. Discussion

The extensor mechanism can be impaired either by a fracture of the patella, disruption of the quadriceps or patellar tendons. Disruptions of quadriceps tendon are more frequent than those of the patellar tendon, which result in a profound limitative impairment from actively extending the knee and resisting passive flexion (7, 11). Early diagnosis and surgery is important, since delay in surgical repair generally affects the outcome adversely (1, 12). In contrast, successful restoration of QTR is reported to be achievable even several years after tendon rupture, though with more difficulty (4, 6).

The current study results showed a considerably better outcome of QTR in acute injuries, especially in subjective measures. In this regard, objective measures such as ROM



Figure 1. Anteroposterior (A) and Lateral (B) Pre-Operative Knee Radiographs Showing Distally Displaced Patella After Quadriceps Tendon Rupture; Anteroposterior (A) and Lateral (B) Post-Operative Knee Radiographies

and extension lag were slightly superior in acute group, while subjective measures including IKDC and modified Cincinnati were considerably superior in acute injuries.

The outcome of acute and chronic QTR was investi-

gated in other studies, as well. Rasul and Fischer evaluated the long-term outcomes of 19 patients diagnosed with QTR; in total, 17 patients in their study had early repair within 5 days from injury, and 2 patients had delayed repair, one

Table 1. The Clinicodemographic Characteristics of the Patients with Acute or Chronic QTR

ID	Age, Y	Gender	Involved Leg	Acute/Chronic	QTR	Time to Surgery, week	Follow-up, Y	Mechanism of Injury
1	31	Male	Right	Chronic	QTR	16	5	Contact sport
2	16	Male	Left	Chronic	QTR	32	0.5	Falling
3	40	Male	Left	Acute	QTR	2	4	Falling
4	26	Female	Right	Acute	QTR	1	5	Falling
5	25	Female	Left	Acute	QTR	1.5	3	Direct trauma
6	52	Male	Right	Chronic	QTR	26	8	Motor vehicle accident

Abbreviation: QTR, Quadriceps Tendon Rupture.

Table 2. Pre- and Post-Operative Evaluation of Outcome Measures in Patients with Acute or Chronic QTR Injury

ID	Pre-op ROM, °	Post-op ROM, °	Pre-op Extension Lag, °	Post-op Extension Lag, °	Pre-op IKDC	Post-op IKDC	Pre-op Modified Cincinnati	Post-op Modified Cincinnati
1	90	120	30	0	35.6	85.1	27	91
2	80	120	30	0	34.5	88.5	26	82
3	70	110	30	5	17.2	88.5	16	90
4	80	110	30	0	19.5	92	24	96
5	80	120	30	0	18.4	93.1	18	90
6	90	120	20	0	10.3	94	18	92

Abbreviations: IKDC, International Knee Documentation Committee; ROM, Range of Motion.

at 4 weeks and the other at 10 weeks after the injury. According to their report, repair of the chronic cases was difficult due to scar contraction, formation, and soft tissue retraction. While patients with early repair were able to walk unaided with a mean range of movement of 0° to 116°, and had no muscle atrophy at 6 months; poorer outcome was observed in 2 patients with delayed repair (13).

Siwek and Rao also assessed the outcome of 30 patients with a ruptured quadriceps tendon who underwent immediate repair and 6 who were diagnosed late and underwent delayed repair (range, 2 - 14 weeks after the injury). The outcomes in the chronic group were much less satisfactory than those undergone immediate surgical repair (7).

The current study results were in accordance with the results of earlier investigations, showing an inferior outcome of delayed QTR repair. Based on the current study results, performing active straight leg raising test is suggested for patients with a history of eccentric load of knee extensor mechanism. In case the patient is unable to perform this test perfectly, extensor mechanism rupture should be strongly considered and further evaluations should be performed. In challenging cases, such as patients not referred in acute phase, imaging studies such as plain radiography, ultrasonography and magnetic resonance imaging (MRI) should be used to rule out the diag-

nosis of extensor mechanism rupture (12).

It is noteworthy that the current study had some limitations. The biggest limitation of the study was the small number of patients, which did not allow statistical analysis of the data.

5.1. Conclusion

Observations in the current study revealed the inferior outcome of QTR with delayed repair. Based on the obtained results, adverse effects of delayed QTR repair were more evident in subjective measures of outcomes. In spite of this inferiority, considering the significant postoperative improvement observed in both objective and subjective measures of outcomes in chronic injuries, surgical reconstruction of chronic QTR was still warranted, and preoperative knee extension lag was not a sign of unfavorable outcome after the surgery.

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