

Hamstring Tendon Autograft for Chronic Patellar Tendon Rupture- A Series of Ten Cases

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ABSTRACT

Patellar Tendon (PT) rupture is an uncommon injury of the knee extensors. Majority of the PT ruptures occur at the insertion site, on the inferior pole of the patella as an avulsion injury, mostly in males of <40 years of age and involving sports persons or accidental cases. A case series of 10 cases of neglected PT rupture were managed with primary repair along with augmentation with semitendinosus and gracilis (Hamstring tendons) graft. Patient follow-up was done postoperatively at 2nd week, 6th week, 3 months, 6 months, and then yearly. A knee brace was given to the patient postoperatively to immobilise the knee for two weeks. Static quadriceps strengthening exercises were started from postoperative day two. Assisted quadriceps strengthening exercises were allowed after two weeks postoperatively. Active quadriceps strengthening exercises were initiated after four weeks postoperatively. Partial weight bearing was allowed after four weeks and full weight bearing was allowed after eight weeks postoperatively. Postoperatively functional scoring was done using the International Knee Documentation Committee (IKDC) and Lysholm scores, simultaneously checking the knee range of motion, Insaal-Salvati ratio and quadriceps girth. Total of 8 males and 2 females were present with the mean age 43.9 years ranging from 38-53 years. The average period of follow-up was 25.5 months (range 12-39 months). Results were excellent with faster recovery and regain their normal physically active life around 8 months after reconstruction.

Keywords: Injury, Graft, International Knee Documentation Committee, Patella, Tendon

INTRODUCTION

The PT rupture is an uncommon injury of the knee extensors. Most PT ruptures occur at the insertion site as an avulsion injury, mostly in males of <40 years of age and involving sports persons or accidental cases [1-3]. An acute injury is from road traffic accidents while chronic cases are due to diabetes mellitus [4,5]. For acute injuries, the primary repair is the treatment of choice but for chronic cases, the primary repair is often challenging and does not produce desired results due to poor tissue quality and quadriceps atrophy [6,7]. After PT injury, patella migrates proximally due to quadriceps contracture with poor quality remnant of PT leading to scar formation and knee stiffness, which are the main problems with delayed reconstruction [8-10]. In neglected cases surgical intervention is quite challenging, various reconstruction techniques were proposed ranging from the use of semitendinosus auto grafts with or without gracilis tendon, quadriceps tendon autograft, achilles tendon allografts, implants, and synthetic materials [11-14]. Here a case series of 10 patients is presented, diagnosed clinically and radiographically with chronic PT rupture and treated with a reconstruction technique using hamstrings tendon auto graft while keeping their distal insertions intact. This unique technique has an advantage of being simple and cost-effective in addition to providing early knee mobilisation without foreign body sensation.

CASE SERIES

A case series of 10 patients diagnosed with chronic neglected PT rupture (neglected defined as > 6 weeks after ruptures) and operated with Hamstrings tendon autograft reconstruction technique, from January 2017 to January 2021. Before proceeding with surgery written and informed consent were taken after explaining the pros and cons of the surgery to the patients.

Generally, patients were presented with an inability to extend the knee (mostly between 0-40 degrees), weakness in the knee, difficulty while standing from a sitting position, difficulty while climbing upstairs, and frequent fall and buckling of the knees. Extensor lag

(mostly between 0-40 degree) and passive range of motion (mostly between 0-130 degree) were measured by goniometer. Medical Research Council (MRC) grading of power was used (in all patients it was <3/5) to assess the strength of quadriceps, and quadriceps wasting was measured by inch tape using mid-thigh girth [15]. The diagnosis of patellar rupture was made clinically with a palpable gap noted below the patella, high riding patella, and inability to extend the knee in almost all cases. Confirmation of PT rupture was made radiologically with plain X-rays showing patella alta (Insaal-Salvati ratio [Table/Fig-1]) and Ultrasonography (USG) of the affected knee showing chronic patellar rupture and clinically with high riding patella [Table/Fig-2].



[Table/Fig-1]: This is plain radiograph of right knee (Antero-posterior and lateral view), high riding patella on lateral view radiograph (marking with orange line) with high insall-salvati ratio in preoperative radiographic film.

Surgical Technique

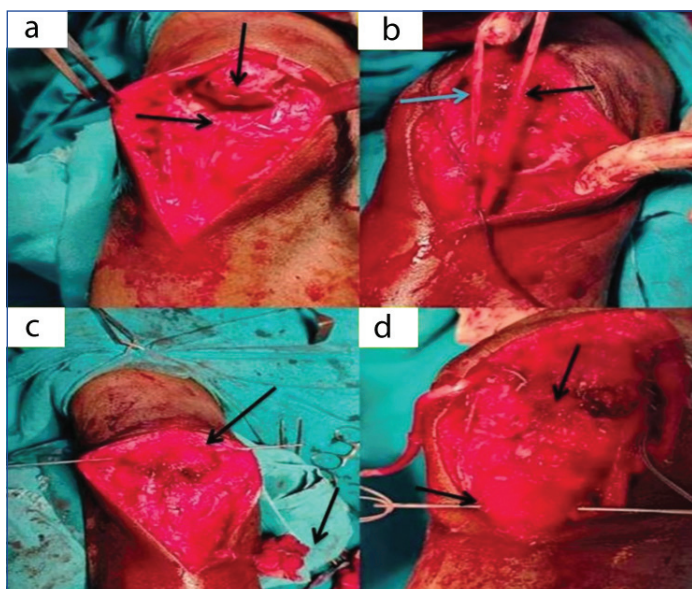
Surgery was performed under spinal anaesthesia with the patient in supine position on a standard operating table. An anterior midline longitudinal incision was made, just proximal to the patella and extending distally up to the medial flare of tibia. Quadriceps tendon, patella bone, ruptured PT, and tibial tuberosity was exposed.



[Table/Fig-2]: Preoperative (patella alta right knee) and postoperative (normal in position) comparison of both knees with patellar position.

Step 1: Primary repair of the PT. It was imperative to repair the tendon primarily, however, the tissue condition was very poor with scar tissue. The scar tissue was removed and the tendon edges were freshened. The remnants were approximated and repaired with ethibond sutures without tension.

Step 2: Harvesting the semitendinosus and gracilis tendon [Table/Fig-3]. Through the same anterior midline incision, the ends of the semitendinosus and gracilis tendons were identified and exposed. Using an open-ended tendon strip the grafts were harvested, keeping their distal insertion intact.



[Table/Fig-3]: Intraoperative pictures showing: (a) Ruptured Patellar Tendon (PT) from inferior pole of patella and frail tendon inferiorly; (b) after harvesting the tendon of hamstring, isolating the semitendinosus (black arrow) and below arrow is showing tendon is wrapped in wet gauze piece; (c) making the tibial tunnel (above arrow showed that after trimming the ruptured Patellar Tendon (PT) repaired with ethibond).

Step 3: Preparing the patellar and tibial tunnel [Table/Fig-3].

A) Tibial tunnel: A horizontal tunnel was made at a level of 1cm posterior to the tibial tuberosity. Initially, an anterior cruciate ligament tibial guide was placed and used to drill a horizontal eyelet pin from medial to lateral through the tubercle and then over-reamed with a 4.5-mm endo-button reamer.

B) Patellar tunnel: After identifying the medial and lateral edges of the patella, at the upper one-third of the patella, about a cm anterior to the articular cartilage, the tibial anterior cruciate ligament guide was placed to drill a horizontal eyelet pin through the patella followed by over reaming with a 4.5 mm endo-button reamer.

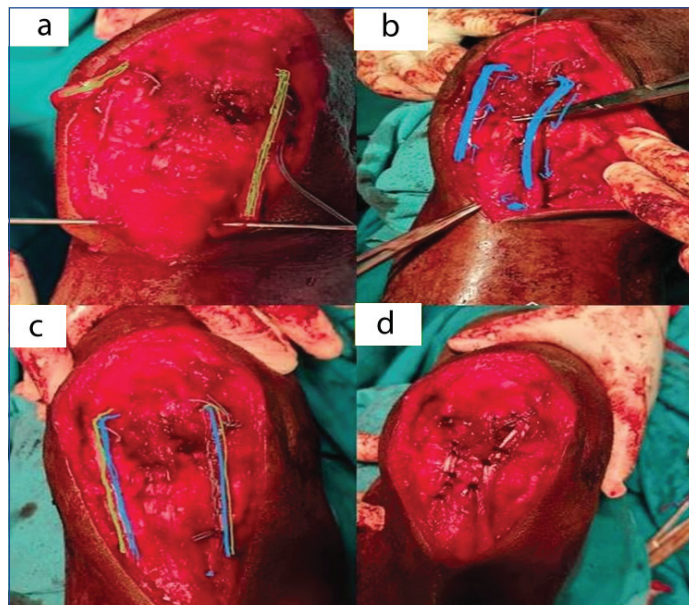
Step 4: Tunnelling of the semitendinosus and gracilis tendon [Table/Fig-4], both the tendons were cleaned of any residual muscle or fat tissue.

A) Gracilis tendon: The gracilis tendon was passed first from the patellar tunnel from medial to lateral. All throughout, it courses along the primarily repaired PT.

B) Semitendinosus (ST) tendon: The ST tendon follows the opposite path as that of the gracilis tendon. It was passed first from

the tibial tunnel from medial to lateral and then passed through the patellar tunnel lateral to medially. All throughout, it courses along the primarily repaired PT.

Step 5: Tensioning the ST and Gracilis tendon. The ST and gracilis tendon were sutured to one another followed by suturing to the PT in a circumferential manner [Table/Fig-4]. It is imperative that the semitendinosus and gracilis tendons are sutured to the PT at the appropriate tension. Any excessive tension will lead to stiffness of the knee and decreased range of motion and simultaneously laxity will lead to extensor lag.



[Table/Fig-4]: (a) Intraoperative picture depicting the gracilis tendon being passed from patellar tunnel; (b) showing the semitendinosus tendon passed from tibial tunnel; (c) both tendon brought lateral in circumferential manner and sutured with each other using ethibond; (d) showing hamstring tendon then sutured with side of repaired PT.

Postoperative protocol and follow-up: Patient follow-up was done postoperatively at 2nd week, 6th week, 3 months, 6 months, and then yearly. A knee brace was given to the patient postoperatively to immobilise the knee for two weeks. Static quadriceps strengthening exercises were started from postoperative day two. Assisted quadriceps strengthening exercises were allowed after two weeks postoperatively. Active quadriceps strengthening exercises were initiated after four weeks postoperatively. Partial weight bearing was allowed after 4 weeks and full weight bearing was allowed after 8 weeks postoperatively. Postoperatively functional scoring was done using IKDC and Lysholm scores, simultaneously checking the knee range of motion, Insaal-Salvati ratio and quadriceps girth [16-18].

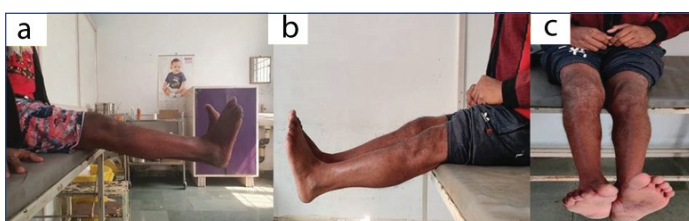
The mean age of subjects was 43.9 years with ages ranging from 38 years to 53 years. Out of 10 patients, eight patients were males, and two females. The mean duration of injury was 8.5 months ranging from 4 months to 13 months with road traffic accidents being the most common cause of the rupture. There was no associated injury seen in any of the patients [Table/Fig-5]. The reason behind the delayed treatment was a sedentary life style and showing to the local practitioners or quacks.

The average period of follow-up was 25.5 months (range 12-39 months). They regain the average active knee range of motion of 128 degrees (120-135 degrees), and they regain almost normal power compare to the opposite knee (5/5 MRC grading) without any extension lag [Table/Fig-6]. Pre-operative and postoperative findings are given in the [Table/Fig-7,8], respectively.

Excellent improvement of IKDC 78-92 (average-85) and Lysholm 82-97 (average-89.5) scores [Table/Fig-8], Insaal-Salvati ratio also reduced from average 1.7 to 1. Quadriceps bulk took time to regain

Case number	Mode of injury and side	Age and Sex	Duration of injury
1	Road traffic accident/ left knee	53/male	11 months
2	Fall on sharp edge/ right knee	40/female	7 months
3	Road traffic accident/ right knee	41/male	9 months
4	Road traffic accident/ right knee	52/male	13 months
5	Assault/right knee	42/male	4 months
6	Road traffic accident/left knee/right knee	47/male	6 months
7	Road traffic accident/ left knee	44/male	12 months
8	Fall on sharp edge/left knee	50/male	13 months
9	Assault/right knee	38/male	9 months
10	Road traffic accident/ left knee	39/female	11 months

[Table/Fig-5]: Demographic details of patients.



[Table/Fig-6]: A four-month-old follow-up case showing excellent knee extension with power 5/5 (MRC).

Case no.	Quad-riiceps strength	Extension lag	Mean IKDC score	Mean Lysholm score	Passive Range Of Motion (ROM) in degree	Insall-Salvati ratio	Quad-riiceps wasting (in cm)
1	2/5	Not able to lift	42	54	0-130	1.5	2 cm
2	3/5	40 degree	44	52	0-135	1.6	1.5 cm
3	3/5	30 degree	45	48	0-135	1.4	1.5 cm
4	2/5	Not able to lift	38	60	0-125	1.9	3 cm
5	3/5	40 degree	41	66	0-135	1.8	1 cm
6	2/5	Not able to lift	57	48	0-130	1.6	1 cm
7	2/5	Not able to lift	52	56	0-125	2.0	1.5 cm
8	3/5	20 degree	39	58	0-130	1.5	1.5 cm
9	2/5	Not able to lift	40	60	0-130	1.6	1.2 cm
10	2/5	30 degree	47	70	0-130	1.4	1.6 cm

[Table/Fig-7]: Preoperative findings.

Case no.	Quadriceps strength	Extension lag	Mean IKDC score	Mean Lysholm score	Active ROM (Range of Motion) In degree	Insall-Salvati ratio	Quadriceps wasting (in cm)	Outcome	Follow-up In months
1	5	Absent	92	94	0-130	0.9	1 cm	Excellent	24
2	5	Absent	91	92	0-125	1.1	nil	Excellent	36
3	5	Absent	92	97	0-130	1.0	nil	Excellent	18
4	4/5	10 Degree	93	82	0-120	1.1	1.5 cm	Good	24
5	5	Absent	96	91	0-130	1.1	nil	Excellent	28
6	5	Absent	91	92	0-125	0.8	nil	Excellent	22
7	5	Absent	91	94	0-130	0.9	nil	Excellent	12
8	4/5	Absent	78	91	0-125	1.2	nil	Good	27
9	5	Absent	92	88	0-130	1.0	nil	Excellent	39
10	5	Absent	92	92	0-130	1.0	nil	Excellent	16

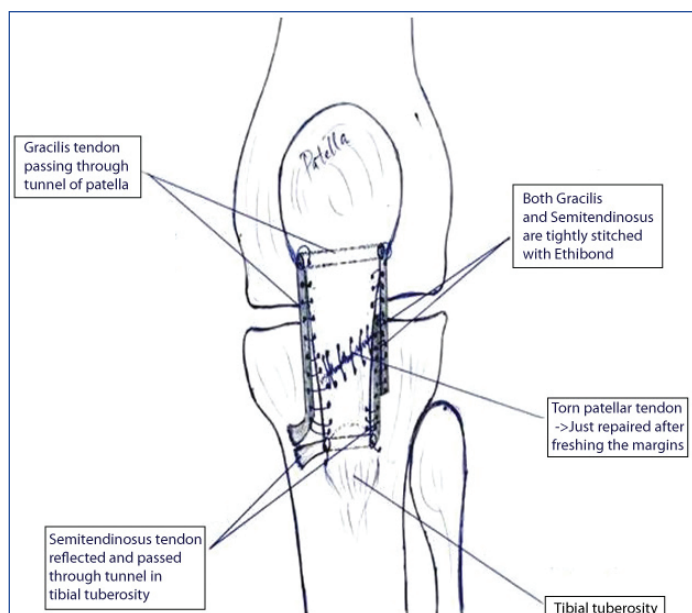
[Table/Fig-8]: Postoperative findings.

in most of the patients and at the end of 1 to 1.5 years almost all the patients have regained normal girth, except one who had a sedentary lifestyle and did not follow the proper physiotherapy settings. Overall outcomes was excellent (was based on near normal mean IKDC scores, Lysholm scores and around full range of motion of the knee) in eight patients and good in two, without any pre and postoperative significant complications. Postoperative radiographs were within the normal limit at 1-2 year follow-up without any patella femoral arthritis and they regained their normal occupational life within one year even though they were labourers by occupation.

DISCUSSION

In this series, 10 patients with chronic PT rupture were included and mostly male with mode of injury was road traffic accident. Mostly PT rupture is unilateral and seen in athletics or in road traffic accidents [1,2]. Chronic patellar rupture is due to delayed reporting to the health center, misdiagnosis, early treatment with quacks or a sedentary life style. Acute PT can be repaired with good results but in the chronic case, due to poor tissue quality reconstruction is mandatory.

Vadala A et al., reviewed several methods of repair with facial strips, but they lack the strength of intact tendons [19]. Levin PD described the use of dacron graft to repair the PT rupture gap, and he stated that fibrous tissue invasion will provide the long-term strength [20]. Ecker ML et al., reported a case series of four patients in which he described the reconstruction of the PT by using hamstring (gracilis and semitendinosus) tendons [9]. Each tendon passed through a separate horizontal tunnel made in the patella and tibial tuberosity through which tendons passed and sutured with each other, he used cerclage wire to add stability which may require removing later on. Dejour H et al., reported contralateral block of the tibial bone auto graft to treat PT rupture but in this series, limitation was producing morbidity in the contralateral knee [21]. In 2007 Van der Zwaal P and Van Arkel ERA reported two cases using hamstring graft with augmentation by bio-screws and staples for PT ruptures [22]. Similarly in 2012, Chen B et al., reported two cases using hamstrings tendon for reconstructions of PT rupture by retaining distal insertion of tendons proposing the preservation of vascularity of tendons as in our series [23]. Other similar studies have been reported using various techniques with different grafts, that include auto grafts {contralateral PT [24], semitendinosus [2,25], allograft extensor mechanism graft [26], achilles tendon [27]}. In this series, hamstring tendons (semitendinosus and gracilis) were used and passed through the patellar and tibial tunnel [Table/Fig-4], then they were sutured in a circumferential manner on the opposite side of the tendon insertion [Table/Fig-9] with the help of ethibond, simultaneously after trimming the edge of the remnant PT to repair.



[Table/Fig-9]: Handmade picture depicting how the hamstring tendon passed from patellar and tibial canal without stripping from its origin, and they sutured with each other in circumferential manner simultaneously suturing the torn Patellar Tendon (PT) with ethibond.

CONCLUSION(S)

Excellent outcome with faster recovery was observed and patients regained their normal physically active life around eight months after reconstruction. This is a unique technique of circumferential reconstruction of the hamstring which did not give any foreign body sensation while kneeling.

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