

RESEARCH ARTICLE

CLINICAL EVALUATION OF DONAR ANKLE SITE MORBIDITY AFTER HARVESTING PERONEUS LONGUS TENDON GRAFT FOR ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Dr. Hashmukh Shantilal Varma, Dr. Jeetendra Singh Lodhi and Dr. Ashok Vidyarthi

Manuscript Info

Abstract

Manuscript History Received: 29 May 2022 Final Accepted: 30 June 2022 Published: July 2022

Key words:-

ACL Reconstruction, Peroneus Longus Tendon Graft, Visual Analogue Scale Foot Ankle **Background:** . The goal of this study was to assess ankle and foot functions using clinical examination and functional scores after harvesting autogenous peroneus longus tendon graft for anterior cruciate ligament reconstruction, with a 6 month follow-up period, with a focus on donor site morbidity. Due to the synergistic action of peroneus longus and peroneus brevis, peroneus longus graft harvest is possible.

.....

Material and Method: The study included 45 patients who underwent ACL reconstructionusing peroneus longus autograft and endobutton fixation. Donor site morbidity of the foot and ankle after tendon-harvesting was assessed using VAS-FA.

Results: Total of 45 cases were operated out of which 34 patients were male and 11 patients were female. Average thickness of Peroneus longus tendon graft obtained was 8.6mm. Average length of Peroneus longus graft harvested in the study was 283mm. None of the patient had any sign of infection or wound dehiscence at donor ankle site. None of the patient had gait abnormality or ankle instability. Our study showed progressive increase in VAS- FA score 99.71 ± 0.75 at 6 months.

Conclusion: We found that there was no significant worsening of ankle function via the examination of ankle scores based on the overall findings of the current study. There was no substantial donor site morbidity, and ankle motions were comparable to those on the contralateral healthy side.

Copy Right, IJAR, 2022,. All rights reserved.

Introduction:-

ACL injuries are one of the most prevalent sports injuries, and its incidence is rising as more people participate in sports, particularly in developing nations. The gold standard treatment option available for ACL injury is arthroscopic ACL reconstruction. The most common grafts for anterior cruciate ligamnotent reconstruction are bone-patellar, tendon-bone, or double-looped semitendinosus/gracilis autografts. These mentioned autografts also carry some donor site morbidity, although having various advantages as autogenous sources. The use of allograft as an alternate graft has expanded in order to avoid the risk of donor site morbidity associated with autogenous tissue harvesting.^(1,2)Despite the theoretical benefits of the patellar tendon, 40-60% of individuals who had arthroscopic anterior cruciate reconstruction with patellar tendon autografts suffered from anterior knee problems.^(1,3) The quadrupled hamstring has been a more popular alternative autograft, with results indicating

.....

lower graft harvest morbidity and improved device fixation compared to patellar tendon autograft.^(1,4)Hamstring tendon graft is not independent of donar site morbidity with decrease in hamstrings power after harvest, which can affect performance of some athletes who require hamstring power for their sport. It is also associated with variability in harvested graft size which is unpredictable.

In the era of arthroscopic ACL reconstruction, the use of peroneus longus tendon (PLT) autograft offers great alternative to traditional autograft and it is a recent breakthrough in arthroscpic ACL reconstruction. The advantages of using this graft are that it has about the same strength and mean thickness as the native ACL.^(2,5) Peroneus longus tendon graft are used in various popular operations including Spring ligament reconstruction, deltoid ligament reconstruction, medial patellofemoral ligament (MPFL) and ACL reconstruction. Synergistic activity of the peroneus longus and peroneus brevis made this conceivable and morbidity associated with donar site is minimized.

The goal of this study was to measure ankle and foot function using clinical examination and functional scores after harvesting autogenous peroneus longus tendon for arthroscopic anterior cruciate ligament (ACL) reconstruction, with a focus on donor site morbidity by multiple predetermined follow-up periods.

Aims And Objective:-

Clinical assessment of donor site ankle morbidity after harvesting peroneus longus tendon graft for arthroscopic anterior cruciate ligament reconstruction.

Material And Methods:-

This study is prospective observational study, the study was conducted in the department of orthopaedics Netaji Subhash Chandra Bose Medical College Jabalpur, from January 2020 to October 2021. The diagnosis of Anterior Cruciate ligament rupture was established and the patients gave their informed consent to be included in the study. 45 patients of Anterior cruciate ligament injury reconstructed arthroscopically using Peroneus longus tendon graft at our centre and were regularly followed up at14 days 4 weeks, 12 weeks, 6 months.

Inclusion Criteria

1.Symptomatic ACL tear partial or complete

Exclusion Criteria

Pre-existing ankle deformity/morbidity.
Professional sports person.
Any ankle/Foot pathology

Surgical Techniques

All the patients included in this study were operated under spinal anaesthesia in supine position. Ligament laxity was checked under anaesthesia by performing following tests – anterior drawer test, Lachman test, posterior drawer test and pivot shift test. A pneumatic tourniquet is properely applied positioned at the upper thigh with adequate soft padding.

Harvesting of the graft

Peroneus longus tendon graft was harvested by placing a vertical incision of roughly 3 cm along the posterior aspect of the distal fibula, 2 cm proximal to the lateral malleolus and just above the superior peroneal retinaculum. The incision was extended distally over the lateral malleolus. Fascia was then excised gently and the peroneus longus tendon was exposed on the posterolateral aspect of the incision (figure 1).



Figure 1:- Exposure of Peroneus Longus Tendon.

The peroneus brevis tendon was identified beneath the peroneus longus tendon. Then, using ethibond 5 suture tenodesis of the distal stem of peroneus longus tendon was done with the peroneus brevis tendon. The proximal segment of the peroneus longus tendon was sutured using No. 5 non-absorbable suture and then cut with a scalpel and tendon was harvested using long closed tendon stripper. To avoid peroneal nerve injury, the released proximal tendon was retrieved with a tendon stripper to an adequate length maximum of 5cm distally from the fibular head (figure 2). Nylon 2-0 was used to suture the skin incision. The length of the harvested tendon was measured after it was freed completely from the muscle tissue.



Figure 2:- Harvesting of graft using Tendon Stripper.

Pre tensioning of the harvested tendon graft was done on a graft tensioning board. graftwas then double/triple layered to achieve minimum 8mm thickness. Exact size of the triple layered graft was then measured by cylindrical graft sizers. The graft thickness to be kept in mind while preparing tibial and femoral tunnel. The smallest sizing sleeve through which the triple layered graft passed with minimum friction decide the diameter of tunnel.

After the graft had been prepared, based on the length of the tripled graft, the loop part of the tripled graft was attached to the endobutton with loop (the length of the loop in the endobutton depends on the graft length and the

length of the unreamed femoral tunnel). The Ethibond suture already present within the joint was pulled out through tibial tunnel. Then the passing sutures for the ACL graft were passed and taken out gently from the lateral aspect of thigh. With the help of these sutures, the graft was pulled via the tibial tunnel into the joint and then into the femoral tunnel along with endobutton. The endobutton is flipped when the estimated length of the graft was within the tunnel, Then cyclical tensioning of the graft was done by repeated knee flexion and extension (around 20 - 30 times) keeping sustained pull on the graft via the tibial tunnel. Then the arthroscopic visualisation of the graft was carried out to check for alignment, any signs of graft impingement, etc. Graft fixation from tibial side was done with interference screw (titanium or bioscrew) of appropriate length.

Rehabilitation

On the 1st postoperative day itself ankle mobilization and calf pumping exercises were initiated as tolerated by the patient. Knee and hip physiotherapy were started from second post op day .1st check dresswas done on the 3rd post-operative day and the 2nd check dress was done the 5th post-operative day. Patients are advised to come for follow up regularly as told and were taught quadriceps and ankle pump exercises.

From the first day after surgery, each patient was advised to stretch the affected ankle gently and actively, and to do modest strengthening exercises with a resistance band after the patient's ankle had gained a nearly complete range of motion. Proprioceptive exercises were performed three months after surgery.

For knee- standard physiotherapy rehabilitation protocol was followed.

FollowUpAssesment

Patients were followed up regularly for a period of 6 months. 1st follow up at suture removal on 14th day, 2nd follow up at 1 month, 3rd follow up at 3 month and last follow up at 6 month. The assessment of donor site morbidity following peroneus longus tendon grafting was assessed by clinical examination and functionally by Visual Analogue ScaleFootand Ankle(VAS- FA).

Results:-

In our study among 45 patients included in the study 27 (60%) patients were in the age group of 20 to 30 years followed by 13 (28.9%) patients in the age group of 30 to 40 years. 34patients (75.67%) were male and 11 patients (24.4%) were female, Right side was more commonly injured in 23 (51%) patients than the left side in 22 (49%) patients. The most common mode of injury in our study was Road Traffic Accidents (53%) in 24 patients followed by sports in 11(25%) patients. The other modes of injury were self-fall. There was associated meniscal injury in 30(67%) patients. The most injured was medial meniscus in 28(62%) patients, followed by injury to both medial and lateral menisci in 6 (13%) patients. Isolated ACL tear was present in 15 patients (33%). Maximum thickness of graft harvested was 9.5mm whereas minimum thickness obtained was 8mm.Mean thickness of graft harvested was 8.5mm \pm 0.452. In maximum number of patients (18%) thickness of graft obtained was 290mm whereas minimum length was 270mm. Mean length obtained was 278mm \pm 6.34.

DonarSiteMorbidity

In our study only 1(2%) case had superficial infection which was healed after antibiotics, while the remaining44 (95%) cases had no sign of infection. None of the patient had wounddehiscence. On 6 month follow up only 4(8.8%) patients have experienced minimal pain at donar site. None of the patient had numbness, infection, wound dehiscence or gait abnormality on 6month follow up. All ankle movements of the donar ankle including eversion strength were comparable to that of the contralateral healthy site with minimal donar ankle site morbidity.

This study also give emphasis on progressive increase in VAS-FA scores between14days and 6th month follow up from 57.62 \pm 3.54 to 99.71 \pm 0.75 (P < 0.05). The mean score after first 2 weeks was 57.62 \pm 3.54 which was gradually increased to 85.8 \pm 1.81 at 1st month and 96.37 \pm 1.49 at 3rd month and 99.71 \pm 0.75 at 6th month follow up (table 1).

| FOLLOW UP PERIOD | MEAN VAS | SD | PAIRED | P-VALUE |
|------------------|----------|------|--------|---------|
| | SCORE | | T-TEST | |
| PRE OP | 100 | 0 | | .026 |
| 180 DAYS | 99.71 | 0.75 | 2.303 | |
| | | | | |
| 14 DAYS | 57.62 | 3.54 | 50.718 | 0.001 |
| 180 DAYS | 99.71 | 0.75 | | |
| 30 DAYS | 85.8 | 1.81 | | 0.001 |
| 180 DAYS | 99.71 | 0.75 | 83.083 | |
| 90 DAYS | 96.37 | 1.49 | | 0.001 |
| 180 DAYS | 99.71 | 0.75 | 15.793 | |
| | | | | |

Table No. 1:- Table Showing Variation In Vas –Fa During Follow Up.

Discussion:-

Amongest all the ligament injury, the most commonly injured ligaments of the knee is anterior cruciate ligament (ACL). ACL injury occurs more commonly in people who induldge in contact sports, such as football, skiing, basketball, and soccer. Arthroscopic reconstruction of the injured ACL has become the gold standard treatment in current scenario.

There has been a lot of debate and discussion over which graft to use. One of the most crucial factors to consider during ACL reconstruction surgery is autograft selection. Numerous graft choices are available such as Bone patellar tendon bone graft, quadriceps tendon graft, hamstring tendon graft, peroneus longus tendon graft, different synthetic grafts and allograft. Most commonaly used graft are the bone patellar tendon bone graft and hamstring graft. The Bone Patellar Tendon Bone Graft has a high ultimate tensile stress and a firm attachment because of its bony ends. BPTB graft are not independent of the disadvantages which are kneeling discomfort, patellar tendon ruptures, tendon shortening, patellar fractures, Patellofemoral pain syndromes, patellar chondromalacia, and chronic quadriceps weakness. To overcome these difficulties hamstring graft include reduced incidence of anterior knee discomfort, decreased occurrence of patellofemoral adhesions and patellofemoral pain, greater mechanical strength, reduced operative site morbidity, and extension loss. Drawbacks of the hamstring grafts linked with donor site morbidity are thigh hypotrophy and hypoesthesia or numbness produced by damage to the infrapatellar branch of the saphenous nerve . We employed the Peroneus Longus Tendon graft in ACL reconstruction in our patients for these reasons and to overcome associated donar site morbidity.

The peroneus longus tendon graft has many advantages over conventionally used autograft. It is easy to identify with a simpler harvesting process, diameter of the graft obtained is larger and less graft associated donar site complications. Peroneus longus tendon graft has equivalent mechanical strength to that of the hamstring and BPTB grafts. Ankle functions are also not compromised by proper harvesting procedure, which is the major breakthrough that helps to prevent complications associated with other autografts. Grafting the peroneus longus tendon has no influence on gait parameters and does not cause ankle instability.

Cosmetically also peroneus tendon has edge over other autografts. Peroneus longus tendon harvesting leaves a scar posterior to the lateral malleolus which gets hidden due to lateral malleolus and apparently not visible. It also decreases the degree of scar formed around the tibial tunnel. As a result, it gives athletes an aesthetic edge who expose their legs frequently in their career.

Peroneus longus tendon is as strong as natural ACL in terms of biomechanics. The original ACL has a maximum tensile load of 1725N, while the highest tensile load of single strand Peroneus longus tendon in Kerimoglu et $al's^{[6]}$ research was 1950N^{[6].}

In our study of 45 patients undergoing arthroscopic ACL reconstruction, 1(2%) case had superficial infection which was healed after antibiotics, while the remaining 44 (95%) cases had no sign of infection. None of the patient had wound dehiscence. On 6 month follow up only 4(8.8%) patients have experienced minimal pain at donar site. None of the patient had numbers, infection, wound dehiscence or gait abnormality on 6 month follow up. All ankle

movements of the donar ankle including eversion strength were comparable to that of the contralateral healthy site with minimal donar ankle site morbidity. Similar results were obtained by **Shafiq Hackla et al**^[7] in their prospective study in 6 patients reporting 1 case of superficial wound infection at the donor area which was treated by antibiotics^[7]. **Dhruvik lathiya et al**^[8] also found in their study of 25 patients that donor site morbidity like wound gap, infection and weakness of ankle joint was minimal^[8]. In study by **Dhruv sharma et al**^[9] in 10 patients, similar results were obtained showing minimal donor site morbidity and no significant deterioration in ankle. As per the study only disadvantage of the peroneus graft was additional scar mark over ankle^[9]. **Kerimoglu et al**^[6] studied 29 patients in which 27 (93.1%) patients reported no comlaints in the region of the graft harvest site, although 2 (6.9 %) patients experienced light to moderate pressure pain and paresthesias and dysesthesias in the region of the extracted graft. No patients experienced any impairment in their sports activities and ankle joint dysfunction^[6]. In the study by **Khajotia BL et al**^[10] in 25 patients, they have not reported any ankle dysfunction related to graft harvest, in only 2 patients pressure pain was elicited. They concluded that the ankle functions were preserved in almost all the patients which was checked by grading the power of the muscles of the foot mainly the eversion strength^[10]. Our study holds similar opinion from the study by **Duan en trang et al**^[11] which reported no case of infection and no issue regarding the ankle joint weakness after surgery. No neurovascular complications were noted^[111].

The present study advanced a different opinion from study done by **Chayanin Angthong et al**^[1] which reported possible donor site morbidity using the peroneus longus tendon, including decreased ankle function and ankle stability with reduced ankle peak torque eversion and inversion,. But we found that the functional outcome was still excellent. Their study reported several complaints which were resolved in 1-6 months after the operation such as ankle stiffness in 2 (8.3%) patients, bulging of proximal stumps in 5 (20.8%) patients, numbness (sural nerve neurapraxia) in 2 (8.3%) patients, and inversion sprain of an ankle in 1 (4.2%) patient. They used peroneus longustendon autograft in ACL reconstruction and evaluated the donor site morbidity with VAS-FA scores.Mean VAS-FA scores pre and postoperative at around 13-month follow-up were 99.7±1.1 and 95.4 ± 12.0, respectively (p= 0.09) ^[1] In the present study, we evaluated ankle function using the VAS-FA score.The Mean pre-op and postoperative VAS-FA scores were 100.0 ± 0.0 and 99.71 ± 0.75, respectively at 6-month follow-up (P value < 0.05), which were considered excellent results. The above result suggests that the donor ankle function remains excellent even after harvesting the peroneus longus tendon.

The limitations of our study were small sample size, study conducted on general population with minimal sports activity and evertor strength of ankle could also be assessed after peroneus longus harvesting using some objective measurement and its relationship with the functional ankle score could be evaluated.

Conclusion:-

The peroneus longus tendon has the advantages of being easy to identify with a simpler harvesting process, diameter of the graft obtained is larger and less graft associated donar site complications. Ankle functions are almost preserved by proper harvesting procedure, which is the major breakthrough that helps to prevent donar site complications associated with other autografts. Peroneus longus tendon autografts are a suitable graft for a single bundle ACL reconstruction with minimal donor ankle site morbidity.

Conflicts Of Interest

None.

Informed Consent

Informed consent was taken from all the patients enrolled in this study.

References:-

- 1. Angthong C, Chernchujit B, Apivatgaroon A, Chaijenkit K, Nualon P, Suchao-in K. The anterior cruciate ligament reconstruction with the peroneus longus tendon: a biomechanical and clinical evaluation of the donor ankle morbidity.J MedAssoc Thai.2015Jun1;98(6):555-60.
- 2. Siebold R, Buelow JU, Bos L, Ellermann A. Primary ACL reconstruction with fresh-frozen patellar versus Achilles tendon allografts. Arch OrthopTrauma Surg 2003;123: 180-5.
- 3. Kartus J, Movin T, Karlsson J. Donor-site morbidity and anterior knee problems after anterior cruciate ligament reconstruction using autografts. Arthroscopy2001;17: 971-80.
- 4. Brown CH Jr., Steiner ME, Carson EW. The use of hamstring tendons for anterior cruciate ligament

reconstruction. Technique and results. ClinSportsMed 1993;12: 723-56.

- 5. Miller SL, Gladstone JN. Graft selection in anterior cruciate ligament reconstruction. Orthop ClinNorthAm.2002Oct;33(4):675-83.
- 6. Kerimoğlu S, Aynaci O, Saraçoğlu M, Aydin H, Turhan AU. Peroneus longus tendonu ile ön çaprazbağ rekonstrüksiyonu [Anterior cruciate ligament reconstruction with the peroneus longus tendon]. ActaOrthopTraumatol Turc. 2008 Jan-Feb; 42(1):38-43.
- 7. Hackla S, Sohi S, Bora M, Singh S. Ipsilateral peroneus longus tendon graft in failed ACL reconstruction: Our experience. International Journal of Orthopaedics. 2021;7(1):10-2.
- 8. Sharma D, Agarwal A, Shah K, Shah R, Shah H. Peroneus longus: Most promising autograft for arthroscopic ACL reconstruction. Indian Journal of Orthopaedics.2019Jul;5(3):172-5.
- Shah H , lathiya D, Mistry J ,Shah M , Shah V . Analysis of functional outcome of 25 patients who undergo arthroscopic anterior cruciate ligament reconstruction surgery by using peroneus longus muscle autograft Volume - 9 | Issue - 11 | November - 2020 | PRINT ISSN No. 2277 – 8179
- 10. Khajotia BL, Chauhan S, Sethia R, Chopra BL. Functional outcome of arthroscopic reconstruction of anterior cruciate ligament tear using peroneus longus tendon autograft. Int J Res Orthop. 2018 Nov;4(6):898-903.
- 11. Trung DT, Le Manh S, Thanh LN, Dinh TC, Dinh TC. Preliminary result of arthroscopic anterior cruciate ligament reconstruction using anterior half of peroneus longus tendon autograft. Open access Macedonian journal of medical sciences. 2019 Dec 30;7(24):4351.