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Research Article

Outcome of Anatomical Arthroscopic Trans-Portal Anterior Cruciate Ligament Reconstruction Among Sudanese Patients

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Received Date: 23 June 2023 | Accepted Date: 02 July 2023 | Published Date: 10 July 2023

Citation: Gaafar S. Awad Alseed, Mohamed H. Awadelseid, Fahad F. Abdelrahman, (2023), Outcome of Anatomical Arthroscopic Trans-Portal Anterior Cruciate Ligament Reconstruction Among Sudanese Patients, *Journal of Clinical Surgery and Research*, 4(5); **DOI:10.31579/2768-2757/086**

Abstract:

Introduction: Worldwide incidence of ACL tear increased with increasing of contact-sport activity and increasing of RTA injuries and its management depend on arthroscopic with variety of methods, in this study our aim to determine the clinical and functional outcome of anatomical trans-portal arthroscopic ACL reconstruction with quadruple hamstring tendon auto-graft.

Material &Methods: Cross sectional observational study hospitally based, it took Two years since 2019.Data taken from the patients directly.

A total 51 male and female patients their age ranges from 18 years to 46years the mean age 27 years having ACL injury confirmed by clinical examination and MRI scan were included in this study. Patients' check list detailed demography including age, sex, causes of injury and duration of symptoms pre-operative were recorded after written consent from every patient. Lachman, anterior drawer and Pivot-shift tests were performed before surgery. All patients filled subjective Lysholm Knee form before surgery and at final follow up post-operative. In all patient arthroscopic trans-portal technique was used for ACL reconstruction with Hamstring auto-graft.

Results: There were 48 (94.1%) males and 3 (5.9%) females. Right knee was injured in 34(66.6%) cases and left knee 17(33.4%) cases. At final follow-up, 68.6% patients achieved full ROM flexion, all of them have no giving way symptoms after 2 to 3monthes post-operative. There was significant improvement in Lysholm score. Out of 51 patients, 8 (16%) patients developed post-operative infection complication.

Conclusion: Arthroscopic ACL reconstruction with quadrupled Hamstrings graft will give very good result if used as management procedure for knee instability after ACL injury. Because it uses anatomical placing the graft and tensioning it, so it has less morbidity, highly stability in coronal & sagittal plan and excellent range of motion and functional outcome.

keywords: anterior cruciate ligament arthroscopic. reconstruction. trans-portal

Introduction

Anterior cruciate ligament (ACL) is the major internal stabilizing ligament of the knee and its injury generates major instability. Anterior cruciate ligament is the most commonly injured ligament in the body, making ACL reconstruction is one of the commonly performed procedures in orthopedic surgery. In Sudan no exact data or registry available for knee ligament injuries but in America about 250,000 ACL torn patients presented to hospital each year and about 100,000 ACL reconstruction performed per year [1]. ACL tear seriously affects the life of the patient by incapacitating in his daily life activities and affecting directly his quality of life. Patients with a rupture of ACL may report pain, difficulty with athletic performance and/or giving-way symptoms in daily activities [2].

The knee joint is totally unstable joint from bony side to do its function for supporting, balancing and thrusting so it depends totally on soft tissue structures which are strong capsule, intra-articular ligament, extra-

articular ligament and controlling muscles for knee movement flexion, extension, slight medial and lateral rotation. The cruciate ligaments provide both antero-posterior and rotator stability. The anterior cruciate ligament is our center of discussion, it has double bundle antero-medial and postero-lateral named according to their tibial origin , their work is to resist anterior displacement of tibia during 90 degree flexion of the knee and full extension of the knee respectively, so far their injuries occur during twisting with valgus forces during sport activity or other type of trauma, it can occur in isolation giving instability in sagittal plane or in combination with other ligaments and capsule giving instability in oblique plane and rotation control. Their injury diagnosed clinically by history of giving way and confirm by clinical examination anterior drawer test, Lachman test, pivot-shift tests and radiographic Magnetic Resonant Image (MRI). Its injury treated by surgical reconstruction using arthroscopic techniques for autograft from hamstrings tendon positioning and tensioning which is our topic center of discussions and debates.

Arthroscopic anterior cruciate ligament reconstruction has been one of the most commonly performed procedures now a days and positioning of graft in anatomic placement through trans-portal approach or other methods trans-tibial approach and their outcome is a debatable area of discussion [3].

Worldwide incidence of ACL tear increased with increasing of contact-spot activity and increasing of RTA injuries. In Sudan we did not find any records about incidence of injures among athletes and nonathletic. We selected this topic to study the outcome of this problem among Sudanese people who had ACL tear and underwent ACL reconstruction by the last method of reconstruction which is arthroscopic trans-portal done nearly for 51 patients depending on choosing and exclusion criteria. Lysholm Scoring System used to evaluate the functional outcome pre- and post-operative. This score measures function of one or both knee by asking about 8 points in the knee function ; limping during walk, using support during walk , locking of the knee , instability and giving way during walk , pain sensation in the knee ,swelling of the knee , climbing of the stairs and lastly squatting position , all that points summation out of 100 , then according to score of the patients the results category by excellent function if result (100 to 95) , good function (94 to 84) , fair function (83 to 65) , poor function if less than 65 score. Also, VAS score used for validated subjective measure of chronic pain. Scores are recorded by making a handwritten mark on 10-cm line that represents a continuum between no pain to worst pain.

Trans-portal technique in which the ACL femoral tunnel is drilled through an antero-medial portal allows consistent with anatomical ACL tunnel placement, which control both anterior tibial translation and rotatory movement of tibia occur during the pivot-shift phenomenon [4]. The purpose of this study was to evaluate the clinical and functional outcome of trans-portal technique for anatomic ACL reconstruction with Hamstring tendon auto-graft at a minimum of 24 months follow up, and to contribute in improving our knowledge and skills in Sudan by using that method of operation.

Problem Statement

Anterior circulate ligament is crucial in stability of the knee, their tear by soccer injury or trauma is disabling condition leading to many complications at time of injure meniscal tear leading to instability which leading to early secondary osteoarthritis and there is debate regarding to use effective modality of treatment by using anatomic positioning and tensioning of the graft through arthroscopic trans-portal approach to give sufficient outcome or using other methods which are many ways either trans-tibial non-anatomical positioning of the graft or open as in past decade.

General Objectives: To assess clinical and functional outcome of all patients underwent anterior cruciate ligament reconstruction using trans-portal arthroscopic method.

Specific Objectives:

1. To determine clinical outcome post-operative.
2. To estimate active range of motion post-operative.
3. To compare stability pre- and post-operative.

Methodology

Observational descriptive and analytical prospective study which had spread through-out a period of two years, from 2019 to 2020.All patients with anterior cruciate ligament tear who underwent arthroscopic reconstruction through trans-portal approach, in Sudan.

Criteria of Choosing: Inclusion: All patients with anterior cruciate tear for the first time by soccer injury or trauma, of any gender and any age, who underwent arthroscopic reconstruction through trans-portal approach.

Exclusion

1. Patients with multi-ligaments knee injury.
2. Patients with around knee fracture.
3. Patients with revision of anterior cruciate ligament reconstruction.

Total patient's coverage is selected as a sampling technique, due to the rareness of this type of injury and its management during the period of the study. Therefore, a total of 51 patients have proved to satisfy the inclusion criteria. All of them underwent the same operation by our senior surgeon, using the same techniques, same approach, same pre- and post-operative hospital care and same post hospital follow up.

The data was collected using a quantitative method by a pre-structured checklist questionnaire including:

1. Demographic information: age and sex
2. Lysholm knee score system, which is a score to measure the knee function in a scale of maximum value of 100 point, summed up from 8 partial questions about the knee functions pre- and post-operative, from 3 to 12 months duration.
3. VAS score for pain which is score measure the degree of pain in digital standard starting from 1 to 10, used pre- and post-operative.
4. Duration symptom before operation and the cause of ACL tear
5. Post-operative data: complication, returning back activity, flexion range, using support or brace, satisfaction.

All data is collected by an interviewing technique, directly speaking to the patients pre-operative and post-operative in clinical follow up, and the data is registered using

Independent Variables

1. Patient age
2. Gender
3. Any anterior cruciate ligament complete torn
4. Surgical technique

Dependent Variables

1. Clinical outcome(pain)
2. Functional outcome (Lysholm score points, ROM flexion)

The collected data is going to be analyzed using Statistical Package for Social Science (SPSS) analysis program version 23.0.

Results

This study covered 51 patients all of them have same pre- and post-operative process all of them full filled both check list questionnaire and Lysholm score about their problems by directs contact with patients, the majority of them, 47 (94, 1%) are males, while only 3 (5.9%) are females. The Age results show a range of maximum46 years and the minimum18 years, mean age 27.5 years, standard deviation 6.7 years.Giving way is major presenting symptoms49 (96.1%), pain is second presenting symptoms usually associated with exertion 46 (90.2%) , locking is third symptoms 26 (51%) of total number of patients shown in Table 1.

Pain data was collected by the VAS scale from 0 (No pain al all) to 10 (Severe Pain), and the analysis below showed pre-operative severity of the pain, 90% score for severe pain, 8% show moderate pain, 2% show mild pain, as shown in Table 2.

Then we analyzed all those symptoms post operatively to observed their response to the operation we found all most of them 50 (98%) patients they have total disappearance of giving way unless 1 (2%) patient still has giving way, we found all of the patients have no locking symptoms post-operative 51 (100%), and we compared between pre and post-operative values as seen below in Table 3 and Table 4.

Pain scores were measured by the VAS scale of pain from 0 to 10 post-operative we found 50% they have no pain , 46 % they have mild pain with exertion, 2% have moderate pain with exertion, 2% have severe pain with exertion .

A comparison is done between the results of the pain scores pre- and post-operative, with a one missing value. Pre-operative mean was 9.5 of the scale, while the post-operative mean value was 1.2, as shown in Table 5. Gives a visual presentation of the VAS core pre- and post-operative for the whole sample as a spline curve for each, to give a visual description to the variation in pain pre- and post-operation.

The scores of the VAS pain scale pre- and post-operative were analyzed statistically to evaluate the statistical significance of the effect of operation, i.e., to judge whether this variation in the pre- and post-scores is significant or due to chance, using the WILCOXON Singed Ranks test, which is a non-Parametric test used to examine paired or related sets of data. As shown in Table 6. The Wilcoxon test variables are listed, and resulting a p-value of < 0.0005 is found.

Duration of the symptoms till the operation is ranging from less than one year to maximum of 11years, mean value 2.5 years and the standard deviation 3.17. As shown in Table 7.

Finally, in clinical data all patients, 51(100%), have positive anterior drawer test and Lachman test pre-operative, as shown in Table 8.

Mode of trauma:

In the mode of trauma, it is found that the majority of them get teared by soccer activity 37 (72.5%) and the remaining involved in route traffic accident 14(27.5%) as shown in Figure 1.

Data about the post-operative complications was collected, and classified as Deep Vein Thrombosis (DVT), Infection, Re-rupture and Knee Stiffness. All of them51 (100%) were found to have no DVT, 51 (100%) have no knee stiffness. 8 patients (15.7%) had post-operative wound infection, while only one (2%) had infection but not totally eradicated after 3 sessions of arthroscopic washout, so the graft was removed at last session, as shown in Figure 2.

In addition, most the sample, 47 (92%), were found to not using post-operative brace or cast for the knee support, only 3 (8%) used brace, as shown in Figure 6.

Time to return back to normal life activity was also presented, it revealed values of time of minimum value of 2 months, and maximum of 8 months, with the mean being 3.45 months, and the standard deviation 1.6, as shown in Table 9.

Data collected about ROM of the knee from full extension to flexion after 12 sessions of physiotherapy in Best Care center showed 35 (68.6%) have full flexion of 120 degrees, 15(29.4%) have moderate flexion of 90 degrees, and only one (2%) has mild flexion less than 90 degree as shown in Figure 3.

Self-satisfaction of the patients after the operation measured 46 (90.1%) fully satisfied, 3 (5.9%) partially satisfied, and only one (2%) with no satisfaction, as in Figure 4.

Lysholm Scoring System to evaluate the function of the knee by points maximum (100). The total score attained is classified to 4sections, which are Excellent (100 to 95), Good (94 to 84), Fair (83 to 65), and Poor (less than 65). The scoring points of the patient's pre-operative and post-operative were found. The mean score pre-operative was (62.6%), with a standard deviation of 9.1, which falls in the Poor class. Post-operative Lysholm score was in the excellent class, with mean value of 96.5% and standard deviation of 5.6. Figure 5. Show these values with a few other statistics. There is a very obvious improving in the knee function.

The Lysholm scores for both pre- and post-operation were tested for Normality, and both failed to be from a normal distribution. Therefore, The Wilcoxon's Signed Rank Test (Non-Parametric test) was applied to examine the significance pre- and post-operation scores of the Lysholm, where the result proved a very high significant difference between the pre- and post-scores, with p-value< 0.0005.

	Yes		No	
	Count	%	Count	%
Asymptomatic Giving Away	49	96.1%	2	3.9%
Locking	26	51.0%	25	49.0%
Knee Pain	46	90.2%	5	9.8%

Table 1: Presenting Symptoms

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5	4	7.8	8.0	8.0
	7	1	2.0	2.0	10.0
	10	45	88.2	90.0	100.0
	Total	50	98.0	100.0	
Missing	System	1	2.0		
Total		51	100.0		
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5	4	7.8	8.0	8.0
	7	1	2.0	2.0	10.0
	10	45	88.2	90.0	100.0
	Total	50	98.0	100.0	
Missing	System	1	2.0		
Total		51	100.0		

Table 2: Pre-operative VAS Scale of the Pain

Giving Way	Positive		Negative	
	Count	%	Count	%
Pre-op	50	98.0%	1	2.0%
Post-op	1	2.0%	50	98.0%

Table 3: Giving Way Comparison Per- & Post-operative

Locking	Positive		Negative	
	Count	%	Count	%
Pre-op	27	52.9%	24	47.1%
Post-op	0	0.0%	51	100.0%

Table 4: Locking Knee Comparison Pre- & Post-operative

		Pre-op	Post-op
N	Valid	50	50
	Missing	1	1
	Mean	9.54	1.28
	Median	10.00	.50
	Mode	10	0
	Std. Deviation	1.417	1.785
	Range	5	10

Table 5: Compare Pre- & Post-operative Pain VAS Scale.

	N	Mean	Std. Deviation	Minimum	Maximum
Pre-op	50	9.54	1.417	5	10
Post-op	50	1.28	1.785	0	10

Table 6: Compare the Pain Pre- & Post-operative

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Duration of Symptoms (Years)	50	11.0	.0	11.0	2.570	3.1752
Valid N (listwise)	50					

Table 7: Duration of the Symptoms

	Positive		Negative	
	Count	%	Count	%
Anterior Drawer Test	51	100.0%	0	0.0%
Lachman Test	51	100.0%	0	0.0%

Table 8: P re-operative Examination

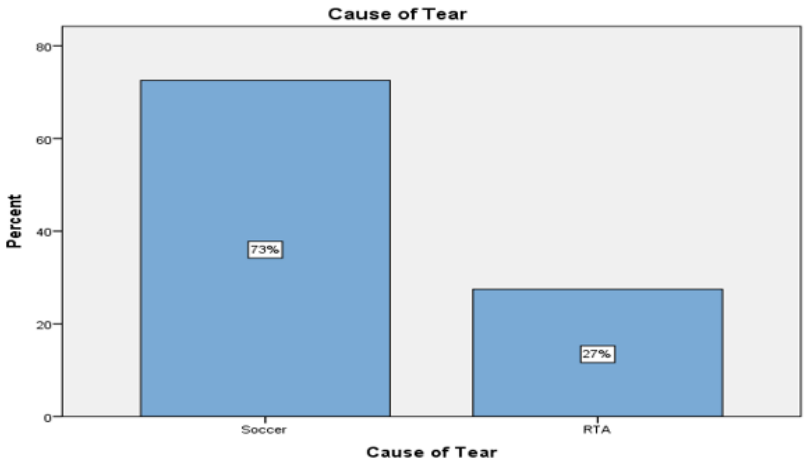

Figure 1: The Mode of Trauma

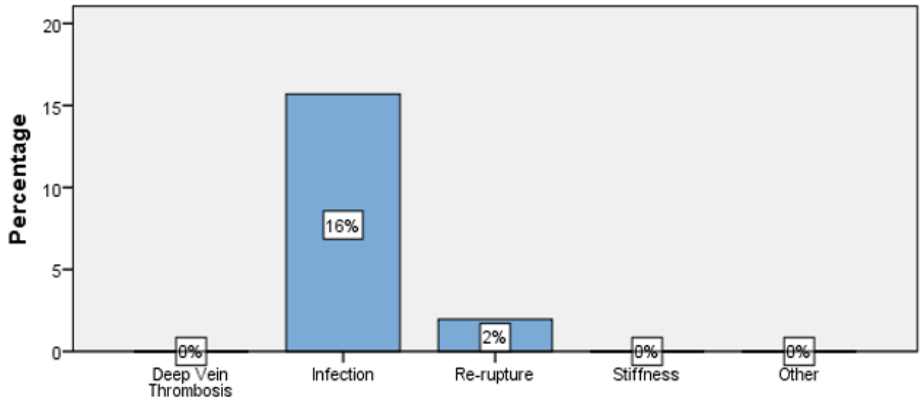

Figure 2: The Post-operative Complication

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Time Returning to Normal Activities (Months)	51	6	2	8	3.45	1.641
Valid N (listwise)	51					

Table 9: Returning Back to Normal Activity

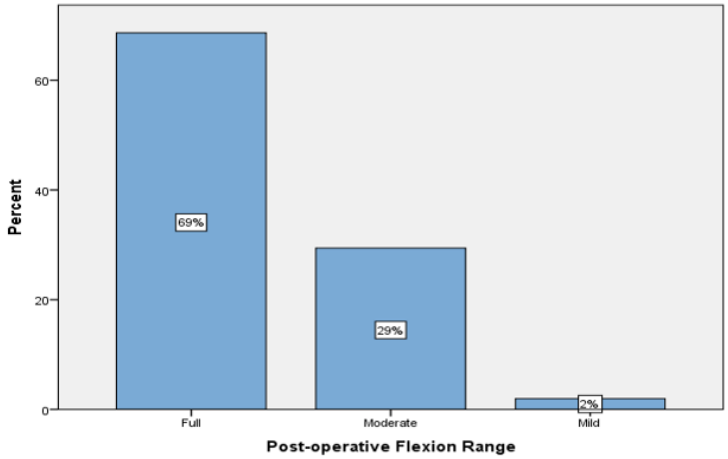

Figure 3: ROM Flexion of the Knee

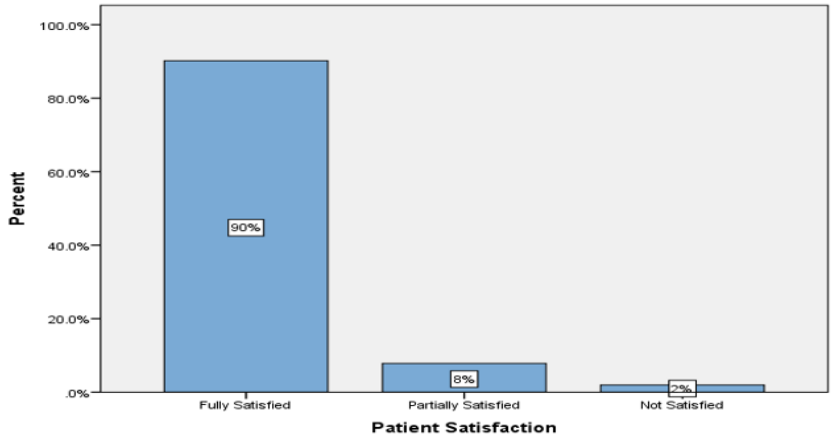

Figure 4: The Patient Satisfaction

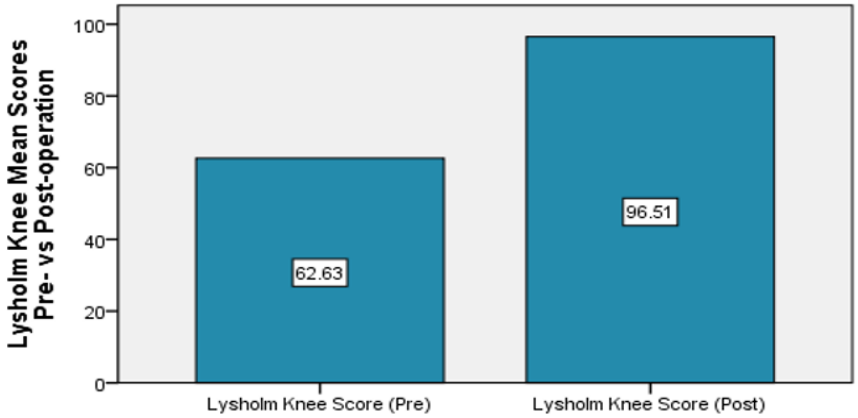

Figure 5: Lysholm scoring Compare Pre- & Post-operative

Discussion

The study aims generally to assess the clinical and function outcome of all patients underwent ACL reconstruction using trans-portal arthroscopic method, specifically to assess that outcome by determined the function of the knee post-operative using Lysholm Knee scoring scale and the ROM flexion level of the knee, and also to compare stability pre-& post-operative.

Concerning Demographic part of our study we notice that the majority sex of our patients was male (94.1%) and female (5.9%), also associate with mode of trauma in our study we found (72.5%) injured by soccer activity, and (27.5%) injured the ACL by RTA. In literature as general population the ACL tear is more in the female than the male, and the cause of tear soccer activity as found in many studies done; P Renstrom et al, reported female athletes have high incidence in ACL injury [7]. Carrie Macmillan in Yale Medicine reported the same concepts, but I found the study concerning the clinical outcome and functional outcome they have same demographic results as; Omid Shahpari et al [5], in their study reported that the male (93.9%) and female (6.1%), also Irfan Muhammad Rajput et al [6], reported 17 males and 3 females. Study done by Luke O'Brien shows males were more likely to suffer contact injuries (56%) while non-contact injuries were dominant among female players.And about the age I found in this study the maximum range 46years and minimum 18 years, in this point I found many studies reported ACL reconstruction above 40 years as in study of Christopher Brown et al [8]; their conclusion that patients aged 40 years and older with ACL injury can have satisfactory outcomes after reconstruction. and also, Omid Shahpari et al, reported the mean age 33 years ± 8.06 years, these points on demographic part participate in clinical outcome.

In the part of clinical data in this study we found the majority of patients presented symptoms with giving way (96.1%) and pain (90.2%): this agree with Mayo Clinic [9] and Jeff Houck et al [10]; their conclusions that the main presenting symptoms of patients with ACL tear are instability and pain. Actually, that are the main presenting symptoms, and the clinical and functional outcome will mainly be depending on their results post-operative.

Locking knee in ACL usually is due to meniscal injury and it is seen in this study about (51%) of patients presented with ACL tear, which is the same as the study done at Shelbourne Knee Center Research reported in Oct 2018 that 50% patients with ACL tear also have meniscus tear. Douglas J Lowery et al [11], Adel A Al-Ahidib et al [12]. they reported about same link between ACL tear and meniscal injury. In the literature by Frank R Noyes et al. they found that patients with ACL tear and meniscal injury underwent reconstruction; 65% of them have meniscectomy, and this will affect functional and clinical outcome of ACL reconstruction as reported by Shirish Pathak M.S, et al, which is mainly affected by duration of symptoms before surgery.

Duration of symptoms in the data ranged from less than 1 year to 11 years our mean 2.5 years ± 3.17 years, and this against literature all authors performed at least 3 weeks after injury to avoid arthrofibrosis as ; Stephanie Evans et al, their conclusion that there are significant potential complications associated with both early and delayed surgical reconstruction of the ACL, which can negatively affected clinical outcomes, this is not defect in our data collection or our study , but that means too late presentation to arthroscopic clinic this point need more work in our country by teaching the athletes and nonathletic the important of this issue.

Post-operative complication in our data is completely negative from early DVT and late stiffness referred that to the early movement of patients after recovery of anesthesia also they started the physiotherapy at second day, early exercise prevent knee from stiffness. Among all patients 8 (15.7%) have deep infections they entered from 1 to 2 sessions of washout and after that they are doing well in their rehab, but one of them entered third session and they removed the graft as sources of infection. Actually, infection is major disadvantage, and it will affect the outcome, and this need suitable environments in operative rooms and ward and increase awareness for all staff participating in the process of operation study in same topic showed Like any surgical procedure, a number of potential complications have been recognized that may affect functional outcome. Specifically, infection after ACL reconstruction can be a devastating complication. Overall, infection rates are low (0.14%-1.7%) after ACL reconstruction [13] Despite the theoretical risk of disease transmission and higher graft failure in irradiated grafts.

Regarding the post-operative returning back to normal live and activity in the study, it is found to range from 2 months of time as minimum to 8 months as maximum, with a mean of 3. 5months.In literature by Adam Husney et al, how soon you can return to work depends on your job. If you sit at work, you may be able to go back in 1 to 2 weeks. But if you are on your feet at work, it may take 4 to 6 weeks. If you are very physically active in your job, it may take 4 to 6 months [14]. This ranging agrees with our study, with deference of late presentation in our study.

The ROM after starting of physiotherapy post-operative is the major determinant for evaluating the efficiency of the operation. 69% of the sample got full flexion (about 120-115 degrees), as they finished their last session of physiotherapy (after 1month post-operative), 29% have moderate flexion (about 90 – 100 degrees) when they finished part of their sessions of physiotherapy. It should be noted that some of them had stopped the sessions due to the Corona shutdown, and some were far away from physiotherapy centers. 2% have mild flexion (less than 90 degrees). They did not start physiotherapy due to different complications. The patients were asked about their general evaluation of the physiotherapy as a part to complete the treatment of ACL reconstruction, and it came out that some of them had negative impressions about it. In another study, physiotherapy is strongly advised to increase the knee flexion, as in [15].

The descriptive of pain post-operatively show that 50% have no pain, 46% have mild pain with exertion, only 2% have moderate pain with exertion, and 2% also have severe pain with exertion. That suggests there is an obvious relieving of pain post-operative as compared with pre-operative results, which showed almost 90.2% presented with severe pain and 9.8% presented with moderate pain. The Wilcoxon's Signed Rank Test has proved a very high significant result difference in the pain scores pro- and post-operative, (p-value < 0.0005).

The point of view of the patients who suffered from pain and giving way for a long period of time was asked for, to get their degree of satisfaction. 90% of them are fully satisfied from their outcome after surgery, 8% are partially satisfied, specially whom got the infection post-operative, 2% are not satisfied.

Lysholm scoring system resulted to show a very high significant improvement between the pre- and post-operative knee functions, with p.value < 0.0005, in a period ranging between 12 to 18 months, with a mean pre-operative score of 62.6%, which indicates Poor functions, and post-operative score of 96.5%, which is classified as Excellent functions. In another study done by T Philippous et al, a result of the average Tegner-

Lysholm scores was 54 (41-62) pre-operatively (Poor), and 86.1 (74-96) at 24 months post-operatively (mostly Good) [16].

Conclusions

According to all the found results, which has proved an obvious improving of the patients post-operatively. The researcher believes that this type of remedy of ACL tear, which is arthroscopic trans-portal technique, gives much more flexibility intraoperative for placing the graft anatomic position, which results in a greater effect on functional outcome, and gives a very good improvement in ROM and flexion, as the results of the analyses found in the study, in both the pain relief levels and the Lysholm score. This drives the researcher to conclude that the arthroscopic trans-portal ACL reconstruction is the treatment of choice.

Recommendation

- As the researcher realized that the delay of presentation of the ACL injured patients to the clinic and the fact that they spend very long time with local bonesetters, lead to a large number of negative impacts on the outcomes, he points to the great need for more community-oriented education.
- The researcher believes that almost all the highlighted complications in this study are avoidable by simply teaching the junior staff and paramedics and nurse how to deal with this type of operations, pre- and post.
- The effect of the operation as a treatment is only about 50% of the total outcome, the remainder depends mainly on post-operative follow-up and physiotherapy, which is very crucial and compulsory to all patients underwent these operations.

Compliance with ethical standards

Acknowledgments: Department of orthopedic Khartoum State Hospital who contributed by any mean to the success of this study.

Conflict of interest: None to declare

Statement of informed consent Approval of this study was obtained from our institutional review board

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DOI: 10.31579/2768-2757/086