

RESEARCH ARTICLE

SELECTIVE BUNDLE RECONSTRUCTION IN PARTIAL ANTERIOR CRUCIATE LIGAMENT TEARS.

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Keywords:-

Partial Anterior Cruciate Ligament,Anteromedial bundle,Posterolateral bundle

Abstract

Study Design: prospective non-randomized clinical study.

Background Context:Diagnosis and treatment of partial ACL tear in young patients present a difficult challenge. It is based on clinical examination, radiological and MRI data, but the sure diagnosis is by arthroscopic probing that usually determine the type of partial tear. Saving ACL remnants during ACL reconstruction may have some biomechanical, vascular and proprioceptive advantages for the patient. First, ACL remnants may add biomechanical strength in the immediate post-operative period to the reconstruction, while the graft strength depends primarily on the fixation device. In this period, the augmentation may be protected by the intact remnantsand bundle and may allow accelerated rehabilitation and an earlier return to sports.

Objective: This study will evaluate the effectiveness of diagnosis and treatment of partial ACL tear and identifies which bundle was torn AM or PL and selective reconstruction of torn bundle.

Patients and Methods: Thirty patients with partial ACL tears were included in this prospective study. They wewe operated in Zagazig Univeristy Hospitals and followed up for two years. 22 of these patients underwnt isolated selective PL bundle reconstruction while preserving AM bundle remnant and 8 patients underwent an isolated AM budle reconstructio with preservin PL bundle remnant. All reconstructions were done using doupled or trippled semitendnosis graft. In all cases the femoral side was fixed using endobutton (Smith and Nephew), while the tibial side was fixed using bioabsorbable interference screw We used Lysholm score and International Knee Documentation Committee (IKDC) to evaluate our results.

Results: A significant improvement was detected in post-operative knee stability and Post-operative knee pain.

Conclusion: Our study confirms that selective bundle reconstruction with preservation of the totn bundle restores knee stability and function. The clinical outcomes were statistically improved .

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Introduction:-

The Anterior Cruciate Ligament (ACL) have two distinct anatomic and functional bundles posterolateral (PL) and anteromedial (AM). Each bundle named on the basis of its insertion on the tibial surface⁽¹⁾.

Definition of partial tear was based on the percentage of ACL fibers torn, usually involve less than 50% of ligment fibers torn. AM bundle is more commonly injured than PL and can be easily diagnosed than PL bundle⁽²⁾.

Patients diagnosed with partial tears of ACL ligament continue to experience instability and early osteoarthritis.

The diagnosis of a partial ACL tear remains a difficult challenge. It is based on clinical examination and radiological data, but the sure diagnosis is by arthroscopic probing that usually determine the type of partial tear⁽³⁾.

Saving ACL remnants during ACL reconstruction may have some biomechanical, vascular and proprioceptive advantages for the patient. First, ACL remnants may add biomechanical strength in the immediate post-operative period to the reconstruction, while the graft strength depends primarily on the fixation device. In this period, the augmentation may be protected by the intact remnants" bundle" and may allow accelerated rehabilitation and an earlier return to sports⁽⁴⁾.

The procedure commonly involves three portals: anteriolateral portal, anteromedial and acessory anteromedial portal⁽³⁾.

Contraindications to knee arthroscopy include open wounds; systemic disease; conditions that makes joint entry difficult, such as marked capsular restriction, arthrofibrosis, or ankylosis⁽⁵⁾.

Patients and methods:

Thirty patients with partial ACL tears were included in this prospective study. They were operated in Zagazig Univeristy Hospitals between 2013 to 2015 and followed up for two years. 22 of these patients underwnt isolated selective PL bundle reconstruction while preserving AM bundle remnant and 8 patients underwent an isolated AM bundle reconstructio with preservin PL bundle remnant. All reconstructions were done using doupled or trippled semitendnosis graft. In all cases the femoral side was fixed using endobutton (Smith and Nephew), while the tibial side was fixed using bioabsorbable interference screw

Inclusion criteria:

- 1. Patients having a symptomaitc partial ACL tear.
- 2. Age 18-45 years old.
- 3. Patients with or without concomitant meniscal tear.

Exclusion criteria:

- 1. Sever knee osteoarthritis.
- 2. Knee sepsis.
- 3. Other ligamentous injury.
- 4. Sever lower limb malaignment.

The age limit in this study was between 18 and 36 years with a mean of (24.8 ± 5.1) years. There were 28 males and 2 females. Of these patients 14 were students, one housewife, 6 manual workers, one butcher, one driver, 4 farmers and 3 employees. The time interval from injury to reconstruction ranges between (3-36) months with a mean of (7.93±6.39) months. Nineteen patients had their injury in the right knee (63.33%) while 11 patients had their injury in the left knee (36.7%).

Preoperative evaluation: Clinical evaluation: History

History.

The patients were asked regarding pre-injury sport and level of activity and previous knee problems and surgeries and the cause of injury, history of giving way, locking, hemoarthrosis and any associated medical problems

Examination.

All patients underwent careful examination before the operative procedure. A partial ACL injury was suspected in patients having a positive Lachman test grade I or II with hard endpoint, With negative Pivot shift test or only slight glide and was confirmed intraoperatively by examination under anethesia. Confirmation of partial ACL tear was done arthroscopicly.

Imaging:

Plain X-ray.

Weight bearing AP and lateral views were done to all patients and showed to be normal. Radiographic evaluation was done according to the IKDC recommendations.

MRI.

All patients were evaluated by doing MRI that showed partial tear of ACL in some cases. In other cases, the ACL appear normal with no evidence of interuption. Confirmation of other ligaments integraity were intact. Meniscal injuries were diagnosed also.

Rating scales:

- 1. Lysholm knee score.
- 2. International Knee Documentation committee (IKDC).

Operative technique:

All operations were performed under spinal anesthesia, under a well padded thigh tourniquet. Examination under anesthesia was done for all patients to ensure partial ACL tear by positive Lachman with hard endpoint and negative pivot shift tests. All patients were given one gram ceftriaxone intravenously 30 minutes before the operation.

Routine diagnostic arthroscopy was initially performed to ensure diagnosis of partial ACL tear and detect which bundle was torn AM or PL and evaluate other pathological conditions. Any meniscal problems were treated before proceeding of reconstruction of torn bundle. Debridement of torn bundle was done leaving intact bundle.

Harvesting the tendons:



Fig (1): Graft harvest

Preparation of the graft:

The tendon was taken to the graft station. The muscle fibers were removed using scalpel or scissor taking care not to cut the tendon itself. The tendon was folded in a double loop. Each one of the free ends of the tendon was stitched

separately by Ethibond suture no. 2 that was woven in an ascending to descending fashion to secure the loop ends firmly for a distance of 2 cm (Fig 39)



Fig 2:-Graft praeparation

Portals:

The procedure is done using three arthroscopic portals. The anterolateral for viewing during diagnostic arthroscopy, the anteromedial portal used as viewing portal and the accessory medial portal for drilling of femoral tunnel (fig 3).



Figure 3:-Arthroscopic portals

Notch preparation: Reconstruction of PL bundle (5) Femoral tunnel drilling:

- 1. The femoral tunnel was drilled first before the tibial tunnel.
- 2. The arthroscope was switched to the (AM) portal for viewing the medial wall of the lateral femoral condyle.

- 3. A micro fracture awl was inserted through the (AAM) portal and used to mark the location of the PL bundle footprint which is located an average of 5 mm posterior to the shallow articular cartilage of the lateral femoral condyle.
- 4. A 2.7 mm guide pin was inserted through the (AAM) portal to the mark of femoral tunnel location and drilled through the bone exiting the lateral cortex while the knee was in 110° of flexion (fig.4).



Fig 4:-Guide pin insertion

- 5. The femoral tunnel was drilled through the femoral cortex using a 4.5 mm endobutton drill bit, during reaming a curette was inserted through antero lateral portal to protect AM bundle
- 6. The femoral tunnel length was calculated using a special depth gauge to calculate the length of endobutton loop (fig.5).



Fig. 5:-Measuring femoral tunnel with depth guage

- 7. The femoral tunnel was drilled using an endoscopic drill bit according to diameter of the graft and length of the femoral tunnel leaving at least 6-7 mm of the lateral femoral cortex intact.
- 8. A #2 vicryl suture was loaded into the slotted end of the 2.7 mm guide pin and the free ends of the suture were passed out through the lateral soft tissue, leaving the looped end of the suture in the ACL femoral tunnel.

Tibial tunnel:

- 1. The arthroscope was switched to the (AL) portal with the knee flexed to 70-90 degree.
- 2. An AcuFex director ACL tip aimer was set at a 55° angle through (AM) or (AAM) portal into knee joint.
- 3. The tip of the aimer was positioned in the PL part of the tibial ACL insertion an average of 4-5 mm medial to the lateral intercondylar eminence and 4-5 mm anterior to the posterior root of the lateral meniscus (fig.6).



Fig. 6:-Position of the tibial aimer

A 2.4 mm drill tip guide pin was drilled into position.

The guide wire was carefully overdrilled by a conventional reamer without damaging the root of the posterior horn of the lateral meniscus, the articular cartilage of the medial tibial plateau, the lateral bony intercondylar wall, or the intact tibial AM bundle insertion. (fig.7).



Fig. 7:-Drilling of the tibial tunnel

Reconstruction of AM bundle

- A –Femoral tunnel reaming
- 1. The femoral tunnel was drilled first before the tibial tunnel.
- 2. The arthroscope was switched to the (AM) portal for viewing the medial wall of the lateral femoral condyle.
- 3. A micro fracture awl was inserted through the (AAM) portal and used to mark the location of the AM bundle footprint which should follow the presence of the remnants in the femur in the anatomical position. (fig. 8)



Fig 8:-AM bundle footprint

- 4. A 2.7 mm guide pin was inserted through the (AAM) portal to the mark of femoral tunnel location and drilled through the bone exiting the lateral cortex while the knee was in 110° of flexion.
- 5. The femoral tunnel was drilled through the femoral cortex using a 4.5 mm endobutton drill bit, during reaming a curette was inserted through anterolateral portal to protect PL bundle.
- 6. The femoral tunnel length was calculated using a special depth gauge to calculate the length of endobutton loop.
- 7. The femoral tunnel was drilled using an endoscopic drill bit according to diameter of the graft and length of the femoral tunnel leaving at least 6-7 mm of the lateral femoral cortex intact (fig.9)



Fig 9:-Femoral tunnel drilling

8. A #2 vicryl suture was loaded into the slotted end of the 2.7 mm guide pin and the free ends of the suture were passed out through the lateral soft tissue, leaving the looped end of the suture in the ACL femoral tunnel.

Tibial tunnel:

- 1. The arthroscope was switched to the (AL) portal with the knee flexed to 70-90 degree.
- 2. An AcuFex director ACL tip aimer was set at a 55° angle through (AM) or (AAM) portal into knee joint.
- 3. The tip of the aimer was positioned in the AM part of the tibial ACL insertion 4-5 mm lateral to the medial tibial spine of the medial tibial plateau and 4-5 mm posterior to the anterior rim of the ACL footprint.
- 4. A 2.4 mm drill tip guide pin was drilled into position (fig.10).



Fig 10:-Guide pin in AM footprint

5. The anterior border of the ACL insertion is carefully preserved to avoid anterior intercondylar roof impingement, damage to the transverse intermeniscal ligament and damage to the articular cortical bone or the articular cartilage. A guide wire is overdrilled by a conventional reamer according to the size of the AM graft preserving the intact insertion of the PL bundle.

Graft passage:

- 1. An arthroscopic probe or grasper was used to retrieve the suture loop that was left in the ACL femoral tunnel and the suture loop was pulled out through the tibial tunnel.
- 2. The suture of the endobutton loop was passed through the suture loop and pulled through the lateral thigh until the graft reach the end of the femoral tunnel and flipping of the endobutton was done (fig.11).



Graft tensioning and tibial fixation:

- 1. The graft was cycled for 30 cycles with an 8 kg preload was applied to the graft.
- 2. The tibial side was fixed using interference bioabsorbable screw while the knee flexed to 10° in PL bundle reconstruction and 20 -30° in AM bundle reconstruction (fig.12).



Fig. 12:-Fixation of the tibial side

The arthroscope was inserted into the (AL) portal to check for graft tensioning and roof impingement (fig.13).



Fig (16): Finally the reconstructed bundle.

Rehabilitation:

Postoperatively, all patients followed the accelerated rehabilitation program of Shelbourne and Nitz using a CPM machine.

Follow up:

Visits were conducted 2 weeks, one and half month, 3 months, 6 months and one year and every one year after. At each visit, patients were assessed both clinically using lysholm and IKDC.

Statistical analysis:-

The collected data were computerized and statistically analyzed using SPSS program (Statistical Package for Social Science) version 18.0.Qualitative data were represented as frequencies and relative percentages.Quantitative data were expressed as mean \pm SD (Standard deviation).

Paired sample T test was used to calculate difference between quantitative variables in the same group pre and post therapy in normally distributed data. Paired Willicoxon test was used to calculate difference between quantitative variables in the same group pre and post therapy in normally distributed data.

The significance Level for all above mentioned statistical tests done. The threshold of significance is fixed at 5% level (P-value)

1. *P value of >0.05 indicates non-significant results.

- 2. *P value of <0.05 indicates significant results.
- 3. *P value of <0.01 indicates highly significant results.

Results:-

Assessment by lysholm score

Regarding overall outcome of all patients in the study, the preoperative score was of a mean value of 64.9 and standard deviation of 9.07. The postoperative score at 6 months was of a mean value of 95.3 and standard deviation of 3.4

The improvement of the lysholms core at 6 months postoperatively was statistically highly significant with $\rm P$ value < 0.001.

Table 1:-Paired t test for comparison between pre and post scores as regard total lysholm score

	Mean ±SD	T. value	p. value	Sig
Pre	64.9±9.07	-19.049	< 0.001	HS
Post	95.3±3.4			

	Table 2:-Paired t test for	comparison between	pre and post	lysholm scores
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	Mean	Std. Deviation	Paired t	Р
Limp pre	4.2667	.98027	-3.247	0.003*
Limp post	4.8000	.61026		
Support pre	5.0000 ^a	.00000		
Support post	5.0000 ^a	.00000		
Locking pre	9.8333	4.08600	-6.926	0.00**
Locking post	14.80	.90		
Instability pre	14.1667	2.96047	-21.734	0.00**
Instability post	24.5000	1.52564		
Pain pre	13.0000	3.10728	-14.262	0.00**
Pain post	23.6667	2.24888		
Swelling pre	5.7333	2.55874	-9.000	0.00**
Swelling post	9.3333	1.51620		
Stair climbing pre	9.2000	1.62735	-1.361	0.184
Stair climbing post	9.6000	1.22051		
Squatting pre	3.7000	1.11880	-6.056	0.00**
Squatting post	4.8000	.40684		
Total pre score	64.9000	9.07573	-19.049	0.00**
Total post score	95.3664	3.45746		

Significant increase except in support and stair climbing

Assessment by IKDC:

Before surgery,3 patients had nearly normal IKDC grade(B), 22 patients had abnormal IKDC grade (C) and 5 patients had severely abnormal grade (D). After surgery, 26 patients had normal IKDC grade (A) and 4 patients had nearly normal grade (B) (table 3).

Grade	A		В		С		D	
	No	%	No	%	No	%	No	%
Preoperative	0	0	3	10	22	73.3	5	16.7
Postoperative	26	86.7	4	13.3	0	0	0	0

Table 3:-Pre and post-operative final IKDC grade

Table 4:-comparison between two bundle

	Bundle	Ν	Mean	Std. Deviation	Т	Р
Limp pre	PL	22	4.2727	.98473	0.055	0.956
	AM	8	4.2500	1.03510		
Support pre	PL	22	5.0000	$.00000^{a}$		
	AM	8	5.0000	$.00000^{a}$		

Locking pre	PL	22	9.6818	3.36857	-0.332	0.743
	AM	8	10.2500	3.41216	-	
Instability pre	PL	22	14.7727	2.87736	1.947	0.062
	AM	8	12.5000	2.67261	-	
Pain pre	PL	22	12.9545	3.33063	-0.131	0.897
	AM	8	13.1250	2.58775	-	
Swelling pre	PL	22	5.4545	2.55841	-0.989	0.331
	AM	8	6.5000	2.56348	-	
Stair climbing pre	PL	22	9.2727	1.57908	0.400	0.692
	AM	8	9.0000	1.85164	-	
Squatting pre	PL	22	3.5909	1.18157	-0.882	0.385
	AM	8	4.0000	.92582	-	
Total pre score	PL	22	65.0000	9.81253	0.098	0.922
	AM	8	64.6250	7.22965		
Limp post	PL	22	4.7273	.70250	-1.086	0.287
	AM	8	5.0000	.00000		
Support post	PL	22	5.0000	$.00000^{a}$		
	AM	8	5.0000	$.00000^{a}$		
Locking post	PL	22	15.0000	$.00000^{a}$		
	AM	8	14.8000	$.00000^{a}$		
Instability post	PL	22	24.5455	1.47122	0.266	0.792
	AM	8	24.3750	1.76777		
Pain post	PL	22	23.6364	2.27921	-0.120	0.905
	AM	8	23.7500	2.31455		
Swelling post	PL	22	9.2727	1.57908	-0.358	0.723
	AM	8	9.5000	1.41421		
Stair climbing post	PL	22	9.6364	1.17698	0.266	0.792
	AM	8	9.5000	1.41421		
Squatting post	PL	22	4.7727	.42893	-0.602	0.552
	AM	8	4.8750	.35355		
Total post score	PL	22	95.2727	3.80551	-0.313	0.756
1	AM	8	95.4500	4.07080		

No sig difference

Complications:

Among 30 cases in our study, two patients had superficial wound infection at graft site, one patient has touniqet neuropaxia, three patient had neuropraxia of saphenous nerve and its infrapatellar branch and one patient has hemoarthrosis The complication rate in our study is 23.33%. All cases showed complete recovery on postoperative rehabilitation programs and conservative therapy.

Discussion:-

In this study, we had a 30 cases were subjected to diagnostic knee arthroscopy. The arthroscopic findings were as the following: 22 patients had posterolateral bundle tear and 8 patient had anteromedial bundle tear.

Partial anterior cruciate ligament (ACL) tears make up10–28% of all ACL tears .There is no consensus on the definition of a partial ACL tear. However, most authors agree that partial ACL tear is one that combines a positive Lachman's test with a firm endpoint along with small differential laxity, hyperintense signal within the ACL fibers on MRI, and arthroscopic findingsof a partial tear. **Noyes**⁽⁶⁾ defined it according to the percentage of ACL remaining, **Crain**⁽⁷⁾ using an arthroscopic assessment, and **DeFranco and Bach**⁽⁸⁾ based on a combination of clinical, knee laxity and arthroscopic criteria⁽⁹⁾.

Partial ACL lesions represent a challenging pathology. The current international literature agrees on the need to spare the intact bundle of the partially torn ACL to increase the biomechanical strength of the reconstruction in the early postoperative period and to maintain ACL blood supply and proprioception. Many authors have described augmentation techniques to restore knee kinematics, thus maintaining the ACL remnant. Most techniques are

intended to obtain an anatomic reconstruction of the torn bundle. This surgery is technically challenging, requiring adapted portals, perfect control of the instruments during tunnel reaming, and intercondylar space management, which is crucial, especially when dealing with small knees⁽¹⁰⁾.

In our study, thirty patients had partial ACL injury 22 PL bundle tear(73.3%) and 8 AM bundle tear(16.7%). That's close to **Buda**⁽¹¹⁾, who had 47 patient with partial ACL 35 PL bundle tear (74.5%) and 12 AM bundle tear (15.5%). Incontrary, **Abat**⁽¹²⁾ had 28 patients with partial ACL tears 18 AM bundle tears (64.2%) and 10 PL bundle tear (35.8%). **Sabat**⁽¹³⁾ had 38 patients with partial ACL tear , 26 patients AM bundle tear (68.4%) , 12 patients PL bundle tear (42.8%)

The age of patients in our study ranged between 18-36 years with a mean (24.8 ± 5.1) . That's close to **Buda**⁽¹¹⁾, whose patients ranged between 16 -27 with a mean (23.3) and to **Sabat**⁽¹³⁾, with a mean age 28 years, similar to **sonnery cottet**⁽¹⁴⁾ with a mean age 28 years and not near to **Pyjol**⁽¹⁵⁾ with a mean 31 years.

In our study sex distribution was 28 males (93.3%) and 2 females (6.7%) ,close to Abat⁽¹²⁾, 21 male (75%) and 7 female (25%), not similar to Buda $\mathbf{R}^{(11)}$, 32 male (68%) and 15 female (32%), not similar to Sonnery Cottet⁽¹⁴⁾, 22 male (56.4%) and 17 female (43.6%), not similar to **Pyjol N**⁽¹⁵⁾, 16 male (55.1%) and 13 female (44.9%),not similar to Sonnery Cottet ⁽¹⁶⁾, 15 males (41.7%) and 21 females (58.3%).

In our study ,there were 17 patients (56.6%) having meniscal injury, 15 patients had medial meniscus tear (50%), while 2 patients had lateral meniscus tear (6.6%). That is not similar to **Sonnery Cottet**⁽¹⁴⁾ study in which 12 patients having meniscal injury (30.8%), 8 patients had medial meniscus tear (20.5%), while 4 patients had lateral meniscus tear (10.3%), not close to **Pyjol N**⁽¹⁵⁾, there were 8 patients having meniscal injury (27.5%), 3 patients had MM (10.3%) while 5 patients had LM tear (17.2%).

In our study main cause of inury was sport injuries (56.7%), similar to **Sonnery cottet**⁽¹⁴⁾, in which main cause of injury was sports (52%).

In our study, instability of the knee is the main complaint 27 patients had frequent giving way (90%).Pain in the knee related to activity was a cardinal complaint almostly in all patient in our study. Eleven patient had locking sensation (36.6%), 7 patients had swelling of knee in ordinay exertion (23%) and 18 patients had swelling in sever exertion (60%).Postoperative instability show significant improvement with no giving way in 26 patients (86.6%) and 4 patients rarely giving way in sever exertion (13.4%).Postoperative pain show significant improvement in 22 patient (73.3%).Postoperative locking sensation showed significant improvement in 29 patients(96.7%). Postoperative swelling were significant improvement in 25 patients (83.3%).Those results of our study are close to **Pyjol**¹⁵, who had 29 patients in his studty 16 male and 13 female . The averge age was 31years .All 29 patient AM bundle tear. Follow up continues 12 months . Preoperatively 25 patients had instability (86.3%). 17 patients (48.%) had pain in the knee related to activity. 6 patients (20.6%) had locking sensation in the knee. Five patients had swelling of knee in ordinay exertion (17.2%) and 14 patients had swelling in sever exertion (48.2%). Postoperatively instability show significant improvement in all patients. Also, locking sensation and swelling showed significant improvement in all patients.

The results for objective score have shown improvement of Lachman test and pivot shift test. The pivot shift test preoperatively was grade 0 in 12 patients (40%),grade I in 16 patients (53.3%) and grade I I in two patients (6.7%), while postoperatively, 29 patients (96.7%) were grade 0 and 1 patients (3.3%) were grade I. Lachman test preoperatively was 8 patients (26.7%) being grade I and 22 patients(73.3%) being grade II, while postoperatively, 26 patients (86.7%) were grade 0 and 4 patients (13.3%) were grade I. Close to **Sonnery Cottet** ⁽¹⁴⁾, preoperatively all 39 patients had Lahman test grade II with hard endpoint , pivot shift test in 34 patients grade I, 3 patients grade II and two patient grade III . Postoperatively 32 patients Lachman test grade 0 and 7 patients grade I, povit shift test 35 patients were grade 0 and 4 patients were grade I.

Lysholm knee scoring system was utilized to assess the results of this study, it was used for subjective evaluation .The total score showed significant improvement from 64.9 points(SD±9.07) preoperatively to 95.3 points (SD±3.4) postoperayively.

IKDC was utilized to assess the results of this study it was used for objective evaluation; before surgery, 3 patients had abnormal IKDC grade (B), 22 patients had abnormal IKDC grade (C) and 5 patients had severely abnormal grade (D). After surgery, 26 patients had normal IKDC grade (A) and 4 patients had nearly normal grade (B). Close to **Sonnery Cottet**⁽¹⁴⁾, who had 39 patients and followed up for 2 years preoperative 17 grade B ,21 grade C and one patient grade D, postoperative 34 grade A and 5 grde B.Superior to results of **Sabat**⁽¹³⁾, who had 38 patients and followed up for three years before surgery 8 grade B ,26 grade C and 4 patients grade D, postoperative 12 grade A ,25 grde B and one grade C.

The result of our study were comparable with the results of **Sonnery Cottet**⁽¹⁴⁾, in his study Lysholm score improved from 60.8 points preoperatively to 94.2 points postoperatively. The two studies had a similar number of patients, mean age, similar technique and same tibial and femoral fixation.

The results in our study is close to the result of $Abat^{(12)}$, who had 28 patient, mean age (30.4 years), 21 male and 7 female, 18 patient AM bundle tear, 10 patient PL bundle tear. Follow up continued for 37 months. In his study Lysholm score improved from preoperative 65.4 points preoperative to 95.8 points postoperative. This may be due to two studies had similar number of patients, mean age and small number of female patient.

The result in our study are superior to the results of **Pyjol**⁽¹⁵⁾, who had 29 patients, 16 male and 13 female, mean age 32 years with all 29 patients having AM bundle tear. In their study, mean Lysholm score improved from 69.9 points preoperative to 90.8 points postoperative at one year follow up. That may be due to the large number of female patients in his study 13 female (44.8%) but in our study only two female patients (6.6%). All patients in **Pyjol**⁽¹⁵⁾ had AM bundle tear but in our study 22 patients had PL bundle tear and 8 patients had AM bundle tear. In our study all femoral tunnel were done through accessory medial portal, femoal fixation were done by endbutton and tibial fixation by interferance screw but in **Pyjol**⁽¹⁵⁾, femoral tunnel were done by outside in, accessory medial portal and transtibial, femoral fixation by interferance screw and endbutton, tibial fixaton by interferance screw and douple fixation. The variety of fixation and technique may worse the results.

Gohil et al⁽¹⁷⁾ compared graft revascularization during a standard ACL reconstruction with removal of the torn ACL remnant to selective bundle ACL reconstruction with retention of the preserved bundle L.Using this MRI protocol, they showed that preservation of ACL remnant leads to earlier revascularization at 2months and a significant reduction of ACL graft signal at 6 months within the midsubstance of the ACL graft.

In my study there are several limitations. The sample size is small 30 patients and the study group is heterogenous regarding age and chronicity of injury. Due to a lack of a comparative group, the superiority of this procedure over standard ACL reconstruction can't be judged. We do not know if the preserved ACL remnant was actually damaged at initial trauma. The decision of surgery is based on probing ACL remnants which is a subjective technique which may affect the results. The intact fibers of ACL on probing may not correlate to their functionality; thus a dysfunctional bundle may be preserved and affect the result. We did not evaluate proprioception with this augmentation procedure to document improvement with selective reconstruction.

Among 30 cases in our study, two patients had superficial wound infection at graft site, one patient has touniqet neuropaxia, three patient had neuropraxia of saphenous nerve and its infrapatellar branch and one patient has hemoarthrosis The complication rate in our study is 26.67%. All cases showed complete recovery on postoperative rehabilitation programs and conservative therapy.

Several authors have described complications $Abat^{(12)}$, observe complication in three patients (10.7%). Two out of 18 of the AMB reconstructions (11.1%) had a persistent extension deficit. The postoperative radiographs confirmed that the tibial as well as the femoral tunnels were properly placed. The extension loss was attributed to Cyclops-like lesions in both patients .They were successfully treated with arthroscopic resection. The remaining patient, with a PLB reconstruction , developed septic arthritis. The patient was treated with arthroscopic debridement and specific antibiotic therapy for 6 weeks.

Sabat D⁽¹³⁾, observe complication in five patient two patients had persisant extension deficit, one patient infection at graft site and two patient had neuropraxia of sapenous and its infrapatellar branch

Conclusion:-

Our study confirms that selective bundle ACL reconstruction with preservation of the remnant bundle restores knee stability and function. The clinical outcomes were statistically improved and similar to those already published for the selective bundle augmentation. Success after ACL reconstruction may depend not only on the tightness or strength of the reconstruction but also on the preservation of the intact fibers. Anatomic selective bundle augmentation is technically demanding , but reproducible. The results are encouraging with excellent side to side laxity. We therefore recommend saving the intact bundle of ACL while augmenting the torn bundle in selective cases.

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