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High Tibial Medial Opening Wedge Osteotomy and Ligament Reconstruction for Varus Angulated Anterior Cruciate Ligament Deficient Knee

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Abstract

Background: Chronic anterior cruciate ligament (ACL) deficiency is associated with knee instability and development of chronic varus malignment and medial compartment osteoarthritis (OA). ACL reconstruction (ACLR) is performed with high success rate in most patients. However, patients presenting with chronic anterior cruciate ligament deficient (ACLD) and varus angulated knees represent a challenge to orthopedic surgeons, as ACLR addresses anterior knee instability alone, however, it fails to correct knee malignment, and thus, fails to impact the progression of OA.

Aim of Study: The aim of this study is to prospectively assess the effectiveness of management of varus angulated-ACL deficient knees by simultaneous arthroscopic ACL reconstruction and medial opening wedge high tibial osteotomy (HTO) using locked plate and synthetic bone graft. The Lysholm knee scoring systems are used to assess the patients. Clinical outcomes are assessed preoperatively and at 20 months post-operatively.

Patients and Methods: This prospective study included 20 patients. The patients' age ranged between 18-40 years, all were males, most injuries were sports injury and all of them suffered from chronic ACL insufficiency with varus deformity. All patients underwent simultaneous arthroscopic ACL reconstruction and medial opening wedge high tibial osteotomy (HTO) using locked plate and synthetic bone graft.

Clinical outcomes were assessed with the Lysholm knee scoring system, pivot shift test, anterior drawers test and Lachman test; and KT-1000 arthrometer. Preoperatively, MRI and X-ray were used for ACL diagnosis and for measuring degree of varus, the standing hip knee ankle angle (HKA °, alignment), posterior tibial slope (PTS), lateral joint opening and degree of arthritis. Postoperative X-rays were done to evaluate deformity correction, union, fixation devices and tunnels position. All patients were followed-up at 2 weeks and at 1, 3, 6, 12 and 20 months postoperatively. Clinical outcomes were assessed preoperatively and at 20 months post-operatively.

Results: All clinical scores improved significantly after surgery. 75% of patients had excellent knee function and 25% had good knee function according to Lysholm score. The anterior laxity of the patients' knee was also improved after surgery as 90% of patients were considered normal or near normal according to KT-1000 arthrometer measurement. Varus deformity was also improved after surgery asthe mean HKA angle improved from 10.65 ° varus to 0.6° varus; with 60% of the patients showed normal alignment. Also, postoperatively all patients had mild lateral joint opening and the posterior tibial slope was slightly increased after surgery (from 6.06 ° to 6.32°). 80% of the patients returned to their preinjury level of activity at the end of the follow-up period. Postoperative complications were few and mild, and were easily managed.

Conclusion: It could be concluded that performing simultaneous arthroscopic ACL reconstruction and medial opening wedge high tibial osteotomy (HTO) using locked plate and synthetic bone graft was effective for obtaining a satisfactory correction angle, good clinical outcomes and lower complication rate.

Key Words: *Medial opening wedge – High tibial osteotomy – Arthroscopy – Anterior cruciate ligament reconstruction.*

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Introduction

ANTERIOR cruciate ligament (ACL) tear induces progressive deterioration in knee structures **[1-3]**. In the meniscus, secondary lesions are often medial and are followed by cartilage lesions that lead to osteoarthritis **[1,4-6]**. Osteoarthritis involves usually the medial tibiofemoral compartment, especially following medial meniscectomy **[7]**. ACL reconstruction achieves knee stability **[8-10]** and can limit the osteoarthritic process. Valgus medial opening wedge high tibial osteotomy (HTO) limits the evolution of medial tibiofemoral osteoarthritis in varus knees **[11,12]**. Combined ACL reconstruction and valgus HTO (ACL-HTO) stabilizes the knee and counters osteoarthritic evolution.

Congenital varus malalignment (primary varus) in the untreated ACL insufficiency cases often promotes the degenerative changes due to the mechanical unicompartmental overload. On the other hand, varus malignment can secondarily be caused or enlarged with the development of medial osteochondral destruction or meniscus deficiency (double varus). Persistent knee instability in a double varus situation with increasing unicompartmental damage leads to varus thrust with posterolateral instability (triple varus) [13].

The commonest role for HTO is to relief medial joint overload symptoms through redistributing joint force across the knee joint in the coronal plane, relief lateral joint tension symptoms and decrease intraosseous venous hypertension and increasing biomechanical and clinical interest in adjusting the angle of the posterior tibial slope to control ligament imbalances in the sagittal thus, add satiability for the knee [14].

As described by many studies, the simultaneous HTO and ACL reconstruction was preferred than the staged procedure, because performing the two procedures in one session is beneficial for the patient with one exposure to anesthesia, one hospital stay, one rehabilitation for the two procedures and they can return quickly to recreational and professional life [5,15-17].

Medial opening wedge osteotomy is a relatively simple procedure that involves a single osteotomy and a few dissections. The technique does not necessitate either a fibular osteotomy that has been associated with neurovascular complications or bone resection of the lateral tibia. Accordingly, the normal anatomical tibial bone shape is maintained after the procedure. The level of correction can be identified and adjusted intraoperatively on the coronal and sagittal planes. Disruption of proximal tibiofibular joint and invasion of the lateral compartment can be avoided and shortening of the lower limbs can be prevented or treated.

The plates used in opening-wedge HTO are either a short spacer plate (Aescula plate or Puddu plate) or a rigid long plate (Tomo Fix plate or Proximal tibial T-locked plate). The locked plate showed sufficient residual stability whereas the Puddu plate required additional lateral fixation [18].

Autologous bone graft is the “gold standard” for the augmentation, but due to donor site morbidity some concerns remains. Several authors have reported good results with allograft [19,20], despite the fact that it is associated with a higher failure rate when compared to autograft [21]. Recent study showed that HKA angle value was preserved in the patients received xenograft locking plate, with adequate maintenance of the correction [22].

Patients and Methods

Inclusion criteria:

Patients' age ranged between 18-40 years old. They must be diagnosed for chronic ACL insufficiency with varus deformity. Patients with isolated injury, combined with other ligaments or meniscal injury were also included.

Exclusion criteria:

All patients, aged below 18y and above 40y or having advanced osteoarthritis large chondral lesions who are not candidate for ligament reconstruction, or poliomyelitis were excluded from this study. Also, patients with low physical demands, obese or have muscle strain were excluded.

Participants:

From March 2012 to January 2015, this prospective study was conducted in Cairo University Hospital, Orthopedic Surgery Department. 20 patients, with instability as their main complaint, were diagnosed for chronic ACL insufficiency with varus deformity. They underwent simultaneous arthroscopic ACL reconstruction and medial opening wedge high tibial osteotomy (HTO).

Cause of injury:

Sport trauma (contact and non-contact) was the commonest cause of ACL rupture. Football was the main sport causing ACL injury.

Associated injury:

35% of the patients had medial meniscal injury (M.M.), 10% had lateral meniscal injury (L.M.) and 10% had both M.M. and L.M. all patients had mild degree of medial compartment degeneration with no posterolateral ligament deficiency.

Time from injury to surgery: The mean time from injury to surgery was 14 months.

Radiological assessment:

Prior to surgery all patients underwent MRI and X-ray. To determine degree of varus represented by the standing hip knee ankle angle (HKA °) and the lateral joint opening, one-leg weight-bearing antero-posterior radiographs of the injured knee were obtained prior to surgery and again at the last clinical follow-up appointment.

The tibial posterior slope angle, defined as the angle between the line drawn perpendicular to tibial shaft axis and the posterior inclination of the tibial plateau, was measured using the lateral radiograph prior to the simultaneous surgery and at the end of follow-up.

Clinical assessment:

Clinical outcomes were assessed with Lysholm knee scoring system, pivot shift test, anterior drawers test and Lachman test to evaluate the condition of the knee ligament prior to surgery and again at the final follow-up. Anterior laxity was measured prior to surgery and at the end of follow-up using KT-1000 arthrometer to measure side-to-side laxity difference with a force of 10 lb. The functional ability of the knee joint was tested postoperatively using the one leg hop test.

Follow-up:

All patients were followed up at 2 weeks and at 1, 3, 6, 12 and 20 months afteroperation.Clinical outcomes were assessed preoperatively and at 20 months post-operatively.

Informed consent was obtained before simultaneous combined operation.

Statistical analysis:

Data entry and master sheet were carried out using Microsoft Office Excel 2007. Statistical analysis was carried out using SPSS Statistical package for social science v.16. The analysis included descriptive analysis (frequency and percentage for categorical data - mean & standard deviation for scale data).

Preoperative planning for medial opening wedge HTO:

Preoperative standing X-ray hip knee ankle was taken to evaluate the mechanical axis in the coronal plane. Correction determined to move the mechanical axis from the medial compartment to 63% of the way across the plateau. As shown in Fig. (1), Line (t) is from the center of the ankle through a point at the knee approximately 63% across the tibial plateau from medial to lateral. Line (f) is from the center of the femoral head through the same point. Line AB is the desired site of the osteotomy. The length of line AB is measured from the intersection point of lines t & f. Line CB is the amount of opening wedge required to bring lines t and ftogether, so the mechanical axis is corrected to go through the joint at the desired 63% across the tibial plateau.

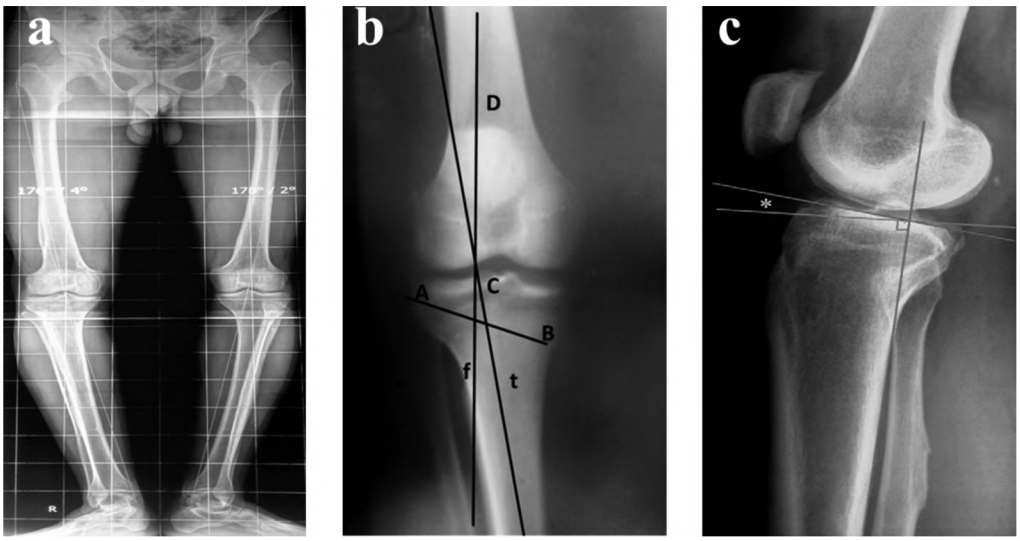

Fig. (1): (A): Long leg bilateral standing film, (B): Enlarged portion at the knee level showing the preoperative HTO planning, (C): Measurement of tibial slope.

The Posterior tibial slope was obtained by themeasurement of the inclination angle between the tangent to the medial tibial plateau and the line perpendicular to the tangent of the posterior tibial cortex **[23,24]**.

Surgical technique and postoperative management/rehabilitation:

As shown in Fig. (2), at the time of the simultaneous operation, diagnostic knee arthroscopy was first performed, and cartilaginous surface lesions and the intercondylar notch were evaluated. An approximately 8cm longitudinal skinincision was made along the medial patellar tendon and the semitendinosus and gracilis tendons were harvested for the four-bundle or six-bundle hamstring autograft and the transverse line of the osteotomy wasdrawn at a position 1 cm medial to the tuberosity and about 3cm distal to the tibial articular surface. Femoral and, subsequently, tibial tunnels were

formed, and a distal end of the reconstructed ligament was pulled through the tunnels and fixed to the femoral cortex using biodegradable screws. At this point in the operation, the graft was not yet fixed to the tibia.

The osteotomy site was gradually opened and bovine TUTOBONE® wedge graft was inserted were inserted into the osteotomy gap posteromedially. Stabilization was achieved at the osteotomy site using a proximal tibial T-locked plate and locking screws, inserted posteromedially to avoid increase of PTS. The reconstructed ACL graft was fixed to the tibial tunnel at the end of the operation via interference screws. Arthroscopic second look was performed at the end of the operation to exclude impingement or laxity of the reconstructed ACL. All patients received thromboembolism prophylaxis in the form of low molecular weight heparin.

An extensive rehabilitation program was put aiming at early restoration of range of motion and muscle power, with regard to delayed weight bearing until union of the osteotomy site is achieved. Quadriceps and range-of-motion exercises were begun on the first day after surgery. Partial weight-bearing was allowed on the operated leg at 6 weeks and full weight-bearing was permitted at 3 months after surgery. Patients were allowed to engage in sports or in work involving heavy weight-bearing 6 months after surgery.

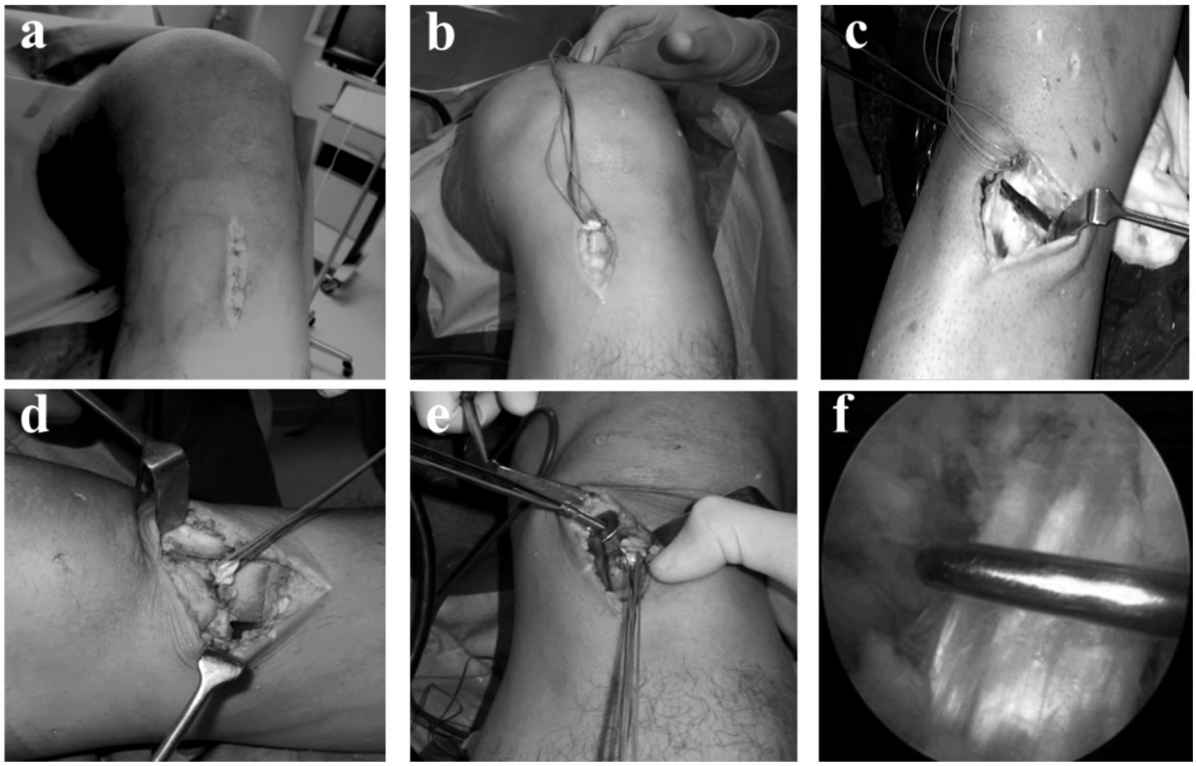

Fig. (2): Intraoperative photos of simultaneous ACL reconstruction & HTO: (A): Vertical skin incision on the anteromedial aspect of the tibia, (B): Graft passage through the tibial tunnel, (C): Opening the wedge medially and posteriorly, (D): wedge graft insertion, (E): T-locked plate fixation, (F): Arthroscopic assessment of the reconstructed ACL.

Results

1- Pain:

Preoperatively all patients suffered pain at different activity levels and postoperatively, 80% of patients were free of medial pain and only 20% suffered mild pain during vigorous activities like jumping or pivoting.

2- Knee stability and anterior laxity:

All patients showed functional instability of the knee preoperatively, 40-60% hadgrade 3 Lachman test, grade 3 anterior drawer test and grade+++ pivot shift (gross reduction) and 40-55% had grade 2 Lachman test, grade 2 anterior drawer test and grade++ pivot shift (clunk).

By the end of follow-up, 85- 90% of patients had normal or near normal grades; grade 1 & 2 Lachman test, grade 1 & 2 anterior drawer test and grade-ve & + pivot shift (glide & normal flexion) and only 10% had abnormal grades with no patient had complete giving way.

Prior to surgery, 30% of patients had mean side-to-side anterior laxity difference in the range 5-10mm and 70% had more than 10mm side-to-side anterior laxity difference on KT- 1000 examination. At the end of follow-up, the mean side-to-side anterior laxity difference was 1-2mm for 65% of patients, 3-5mm for 25% and 5-10mm for 10% of patients.

3- Lysholm score:

At the time of simultaneous operation, all patients had poor knee function with mean Lysholm score less than 65 points (range 25-54 points). At the end of follow-up, the mean Lysholm score improved to 95-100 points for 75% of the patients, having excellent knee function, and to 84-94 points for 25% of the patients, having good knee function (Table 1).

Table (1): Preoperative and follow-up Lysholm score.

Lysholm score	Preoperative		Follow-up	
	Number	%	Number	%
Excellent (95-100)	0	0	15	75
Good (84-94)	0	0	5	25
Fair (65-83)	0	0	0	0
Poor (<65)	20	100	0	0

4- Radiography:

At end of follow-up, all patients showed consolidation. There was no radiolucency between bone substitute and bone, even in the patients with residual pain.

All patients showed varus deformity preoperatively (mean: 10.65° varus, range: 6-14°). Postoperatively, the mean HKA angle improved from 10.65° varus to 0.6° varus. At the end of follow-up, 60% of the patients showed normal alignment, 10% valgus (mean: 1° valgus) and 30% still varus (mean: 2.33° varus, range: 1-4°) (Table 2).

The preoperative tibial slope (PTS) was 6.06° and increased postoperatively to 6.32° (Table 3).

Preoperatively, all patients had increased lateral joint opening; 75% had moderate lateral joint opening (5-10mm) and 25% had severe lateral joint opening (> 10mm), and no increase in external tibial rotation was detected in all cases. At the end of follow-up,no patient had more than 3mm increase in the lateral joint opening (mild lateral joint opening), and none had an increase in external tibial rotation (Table 4).

Table (2): Preoperative and follow-up lower-limb goniometry.

	Degree (°)	Preoperative		Follow-up	
		Number	%	Number	%
Varus	1-3	0	0	4	20
	>3	20	100	2	10
Normal alignment	0	0	0	12	60
Valgus	1-3	0	0	2	10
	>3	0	0	0	0

Table (3): Preoperative and follow-up PTS.

PTS	Preoperative		Follow-up	
	Number	%	Number	%
<0	0	0	0	0
≥0-5	6	30	4	20
≥5-10	14	70	16	80
>10	0	0	0	0

Table (4): Preoperative and follow-up lateral joint opening.

lateral joint opening	Preoperative		Follow-up	
	Number	%	Number	%
Mild	0	0	20	100
Moderate	15	75	0	0
Severe	5	25	0	0

5- One leg hop test:

The functional ability of the knee joint was tested using the one leg hop test. 15% of the patients achieved 76-90% of the non-injured leg, 30% achieved 50-75% and 55% achieved less than 50% of the non-injured leg, preoperatively. At the end of the follow-up 90% of patients achieved more than 90% of the non-injured leg and 10% achieved 76-90% of the non-injured leg (Table 5).

Table (5): Preoperative and follow-up one leg hop test.

%	Preoperative		Follow-up	
	Number	%	Number	%
90-100	0	0	18	90
76-90	3	15	2	10
50-75	6	30	0	0
<50%	11	55	0	0

6- Return to pre-injury level of activity:

80% of the patients returned to their preinjury level of activity at the end of the follow-up period, 10% turned to office work mainly, 5% changed the job and 5% used assistant.

7- *Complications:*

The complications are either intraoperative due to some technical errors or postoperative complications.

I- Intraoperative complication and technical errors:

Only 15% of the patients experienced fracture lateral tibial plateau which was treated by percutaneous fixation with two canulated screws.

II- Postoperative complication:

a- General complication:

Postoperative vascular injury, deep vein thrombosis (DVT), tourniquet polsy and nerve injury were not experienced,but only two patients developed superficial infection at site of plate fixation which was treated medically.

b- Specific complication:

One patient experienced stiff knee which was managed later by arthroscopic adhesiolysis. Some thin patients felt discomfort with the inserted plates and only one patient underwent second surgery for plate removal two years after the main operation.

Discussion

Simultaneous arthroscopic ACL reconstruction and medial opening wedge high tibial osteotomy (HTO) using locked plate and synthetic bone graft in incipient or mild medial femorotibial osteoarthritis with chronic anterior laxity enabled return to sport, stabilized the knee and relieved medial pain [17]. It was implemented exclusively in case of pain relating to osteoarthritis or early osteoarthritis with episodic instability of the knee in varusknee.

The simultaneous operation was chosen for this study owing to its great benefits and also the surgeons planned to shorten the operative time in the way that it does not exceed 2 hr. to avoid any major complications and also used only one incision for both ACL reconstruction and HTO. A study conducted by Willey et al. (2010) concluded that the risk of complications of simultaneous and staged ACL reconstruction and HTO is similar [25].

The genovarum deformity is not always in one plane so it should be corrected via biplanar osteotomy combines both coronal and sagittal planes [26]. Therefore, the medial opening wedge HTO was preferred as it enables predictable correction in both coronal and sagittal planes besides the ability to adjust correction intraoperatively and using one incision for both harvesting graft and osteotomy.

Proximal tibial T-locked plate was used with synthetic bovine bone graft (TUTOBONE®). T-locked plate provides superior stability in both compression and torsion compared with a short spacer plate, with lower risk of post-operative compression and correction loss [27]. The allograft was used to avoid donor site morbidity and shorten the time of the combined operation [28].

Osteotomy abolished medial pain in 80% of cases. ACL autograft restored stability in all but two cases, and controlled laxity effectively(mean side to side difference 2.77mm) as well as instability (90% of patients with no pivot shift). Subjective and objective outcomes were satisfactory. It also allowed quick return of 80% of the patients to their recreational and professional lives. Surgery did not induce stiffness, except in one case, whether in extension or flexion.

Radiologically, the knee axis was in the normal alignment in 60% of the patients and 30% still varus (mean: 2.33° varus, range: 1-4°) that might be due to errors in determination of the size of wedge or due to the lack of bone stock as the distance from joint line to the tibial tubercle is variable from person to another. The tibial slope slightly increased (moved from 6.06° preoperatively to 6.32° at follow-up) thanks to the appropriate insertion of the plate and wedge graft posteromedially. All patients hadmild lateral joint opening as HTO provided a valgus axis, distributing force onto the lateral compartment.

Conclusion:

It could be concluded that performing simultaneous arthroscopic ACL reconstruction and medial opening wedge high tibial osteotomy (HTO) using locked plate and synthetic bone graft was effective for obtaining a satisfactory correction angle, good clinical outcomes and lower complication rate.

References

1- FRIEL N.A. and CHU C.R.: The role of ACL injury in the development of posttraumatic knee osteoarthritis. Clin. Sports Med., 32 (1): 1-12, 2013.

2- PAOLO ADRAVANTI, NICOLAAS C. BUDHIPARAMA, KEITH R. BEREND and EMMANUEL THIENPONT: ACL-deficient knee and unicompartmental OA: state of the art. Journal of ISAKOS, 2 (3): 162-170, 2017.

3- ANDREW N. PIKE, JEANNE C. PATZKOWSKI and CRAIG R. BOTTONI: Meniscal and Chondral Pathology Associated With Anterior Cruciate Ligament Injuries. J. Am. Acad. Orthop. Surg., 27: 75-84, 2019.

4- MARCO KAWAMURA DEMANGE, GILBERTO LUIS CAMANHO, JOSÉ RICARDO PÉCORA, RICCARDO GOMES GOBBI, LUIS EDUARDO PASSARELLI TIRICO and ROBERTO FREIRE DA MOTA ALBU-

QUERQUE: Simultaneous anterior cruciate ligament reconstruction and computer-assisted open-wedge high tibial osteotomy: A report of eight cases. The Knee, 18 (6): 387-391, 2011.

5- MALAHIAS M.A., SHAHPARI O. and KASETA M.K.: The clinical Outcome of One-stage High Tibial Osteotomy and Anterior Cruciate Ligament Reconstruction. A Current Concept Systematic and Comprehensive Review. Arch. Bone Jt. Surg., 6 (3): 161-168, 2018.

6- TROJANI C., ELHOR H., CARLES M. and BOILEAU P.: Anterior cruciate ligament reconstruction combined with valgus high tibial osteotomy allows return to sports. Orthop. Traumatol. Surg. Res., 100: 209-212, 2014.

7- JACOB J. CAPIN, ASHUTOSH KHANDHA, THOMAS S. BUCHANAN and LYNN SNYDER-MACKLER: Partial medial meniscectomy leads to altered walking mechanics two years after anterior cruciate ligament reconstruction: Meniscal repair does not. Gait & Posture, 74: 87-93, 2019.

8- CONTEDUCA F., CAPERNA L., FERRETTI A., IORIO R., CIVITENGA C. and PONZO A.: Knee stability after anterior cruciate ligament reconstruction in patients older than forty years: Comparison between different age groups. Int. Orthop., 37 (11): 2265-9, 2013.

9- AYMAN M. EBIED and ADEL ABDEL AZIM FODA: Combined Anterior Cruciate Ligament Reconstruction and High Tibial Osteotomy in Anterior Cruciate Ligament-Deficient Varus Knees. J. Orthop. Trauma Rehabil., 23: 8-12, 2017.

10- RAHNEMAI-AZAR A.A., NAENDRUP J.H., SONI A., OLSEN A., ZLOTNICKI J. and MUSAHL V.: Knee instability scores for ACL reconstruction. Curr. Rev. Musculoskelet Med., 9 (2): 170-7, 2016.

11- PORNRATTANAMANEEWONG C., NUMKANISORN S., CHAREANCHOLVANICH K. and HARNROONGROJ T.: A retrospective analysis of medial opening wedge high tibial osteotomy for varus osteoarthritic knee. Indian J. Orthop., 46 (4): 455-61, 2012.

12- MIETTINEN S.S.A., MIETTINEN H.J.A. and JALKANEN J.: Long-term follow-up results of medial opening wedge high tibia osteotomy with a pre-countered non-locking steel plate. Arch. Orthop. Trauma Surg., 142: 3111-3121, 2022.

13- NOYES F.R., BARBER-WESTIN S.D. and HEWETT T.E.: High tibia osteotomy and ligament reconstruction for varus angulated anterior cruciate ligament-deficient knees. Am. J. Sports Med., 28: 282-296, 2000.

14- LIU X., CHEN Z., GAO Y., ZHANG J. and JIN Z.: High Tibial Osteotomy: Review of Techniques and Biomechanics. J. Healthc Eng., 2: 8363128, 2019.

15- IMHOFF A.B. and AGNESKIRCHNER J.D.: Simultaneous ACL Replacement and high tibial osteotomy: Indication, Technique, Results. Techniques in Knee Surgery, 1 (2): 146-154, 2002.

16- AGGARWAL A., PANARELLA L. and AMENDOLA A.: Considerations for Osteotomy in the ACL Deficient Knee. Sports Med. Arthrosc. Rev., 13 (2): 109-115, 2005.

17- BONASIA D.E., DETTONI F., PALAZZOLO A. and ROSSI R.: Opening Wedge High Tibial Osteotomy and Anterior Cruciate Ligament Reconstruction or Revision. Arthrosc. Tech., 6 (5): e1735-e1741, 2017.

18- JUNG W.H., CHUN C.W., LEE J.H., HA J.H., KIM J.H. and JEONG J.H.: Comparative study of medial opening-wedge high tibial osteotomy using 2 different implants. Arthroscopy, 29 (6): 1063-71, 2013.

19- DE MEO P.J., JOHNSON E.M., CHIANG P.P., FLAMM A.M. and MILLER M.C.: Midterm follow-up of opening-wedge high tibial osteotomy. Am. J. Sports Med., 38: 2077-2084, 2010.

20- YACOBUCCI G.N. and COCKING M.R.: Union of medial opening wedge high tibial osteotomy using a cortico cancellous proximal tibial wedge allograft. Am. J. Sports Med., 36: 713-719, 2008.

21- KUREMSKY M.A., SCHALLER T.M., HALL C.C., ROEHR B.A. and MASONIS J.L.: Comparison of autograft vs allograft in opening-wedge high tibial osteotomy. J. Arthroplasty, 25: 951-957, 2010.

22- MAFFULLI N., LOPPINI M., LONGO U.G., DENARO V. and OLIVA F.: Bovine xenograft locking Puddu plate versus tricalcium phosphate spacer non-locking Puddu plate in opening-wedge high tibial osteotomy: A prospective double-cohort study. Int. Orthop., 37 (5): 819-26, 2013.

23- MUTHUURI J.M.: Determination of posterior tibia slope and slope deterioration with osteoarthritis: A radiological study in an African population. EAOJ, 8: 16-20, 2014.

24- CHEN Y., DING J., DAI S., YANG J., WANG M., TIAN T., DENG X., LI B., CHENG G. and LIU J.: Radiographic measurement of the posterior tibial slope in normal Chinese adults: A retrospective cohort study. BMC Musculoskelet Disord, 26; 23 (1): 386, 2022.

25- WILLEY M., WOLF B.R., KOCAGLU B. and AMENDOLA A.: Complications associated with realignment osteotomy of the knee performed simultaneously with additional reconstructive procedures. Iowa Orthop J., 30: 55-60, 2010.

26- DONG CHUL LEE and SEONG JOON BYUN: High Tibial Osteotomy. Knee Surg. Relat. Res., 24 (2): 61-69, 2012.

27- PAPE D., KOHN D., VAN GIFFEN N., HOFFMANN A., SEIL R. and LORBACH O.: Differences in fixation stability between spacer plate and plate fixator following high tibial osteotomy. Knee Surg. Sports Traumatol. Arthrosc., 21: 82-89, 2013.

28- GIEDRAITIS A., ARNOCZKY S.P. and BEDI A.: Allografts in soft tissue reconstructive procedures: Important considerations. Sports Health, 6 (3): 256-64, 2014.

استعدال أعلى عظمة القصبة بعمل شق عظمى مخروطى داخلى مفتوح فى حالة التقوس الأنسى لمفصل الركبة المصاحب لإعادة بناء الرباط الصليبى الأمامى

الخلفية : لنجاح عملية إعادة بناء الرباط الصليبى الأمامى لابد من تقييم الركبة جيداً سواء إكلينيكياً وباستخدام الأشعة وذلك لتحديد وجود تشوة أنسى بالركبة أو ضعف بالأجزاء الخارجية الخلفية للركبة وعلاجها لتفادى فشل العملية.

الهدف من الدراسة : لذلك هذه الدراسة تبرز النتائج الأكلينيكية لعملية إعادة بناء الرباط الصليبى الأمامى للركبة المصاحب لاستعدال التقوس الانسى بعمل شق عظمى مخروطى داخلى مفتوح باستخدام شريحة ذاتية الغلق وترقيع عظمى مخروطى غير متجانس (فى نفس العملية). وقد تم استخدام وترى الضلة الشبه وتريه والجراسيليس فى كل الحالات. وقد تم التأكد من استعدال التقوس فى المستويين التاجى والسهمى أثناء عملية الاستعدال. من أهم مميزات إجراء العمليتين فى عملية واحدة هو تقليل تعرض المريض للتخدير وجعله يمكث فى المستشفى لمرة واحدة مع فترة إعادة تأهيل واحدة للعمليتين معاً. ومن المميزات الأخرى هى سرعة عودة المريض إلى حياته الطبيعية. وللاستفادة العظمى من مميزات العملية حرص الجراحون على ألا تزيد الفترة الزمنية للعملية عن ساعتين وذلك لتجنب حدوث مضاعفات.

المرضى والطرق : تم إجراء هذه الدراسة فى مستشفيات جامعة القاهرة على عدد ٢٠ من المرضى يتراوح أعمارهم بين ١٨–٤٠ سنة. قد كانت الشكوى الرئيسية للمرضى هى عدم ثبات الركبة. وقد تم التأكد من إصابة جميع الحالات بتمزق الرباط الصليبى الأمامى مع وجود تقوس أنسى فى مفصل الركبة. وقد تم تقييم الحالات وفقاً لنظام Lysholm قبل وبعد العملية المزدوجة. وقد تم فحص الرباط الصليبى باستخدام KT-1000 arthoremeter بجانب الطرق الإكلينيكية للحصول على أفضل النتائج.

النتائج : حسب نظام Lysholm كان هناك تحسن ملحوظ فى العرج وتربسة الركبة والقدرة على صعود السلم. وقد حدث تحسن ملحوظ فى درجة التقوس الانسى للركبة فقد تم استعدال التقوس لتصبح على استقامتها الطبيعية فى ٦٠٪ من المرضى.

الاستنتاج : أن الإجراء عملية إعادة بناء الرباط الصليبى الأمامى المتزامنة مع استعدال التقوس الانسى بعمل شق عظمى مخروطى داخلى مفتوح باستخدام شريحة ذاتية الغلق وترقيع عظمى مخروطى قد حسن من الحالة العامة للركبة. وقد اثبتت الدراسة أن التقييم الجيد للركبة وعلاج أى تشوه اروحى بالركبة أو ضعف بالاجزاء الخلفية للركبة يقلل من فشل الرباط الصليبى الذى تم استعاضته.