

Evaluation of the Clinical Examinations in Diagnosis of Anterior Cruciate Ligament(ACL)Tear in Comparison With A Definite Arthroscopic Diagnosis

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ABSTRACT:

BACK GROUND:

The cruciate ligaments consists of a pair of very strong ligaments, connecting tibia to femur crossing like the limbs of letter X and that is why they are called crucial, mostly injured in noncontact sport actions leading to knee instability.

AIM OF THE STUDY:

To determine the accuracy of the clinical approach in the diagnosis of ACL tear. We used diagnostic arthroscopy as a reference standard for evaluating our results by applying it to all the patients.

METHODS:

During the period from Dec-2000 to Oct-2002, we led a prospective study of 72 patients with suspected ACL tear, depending on careful history & physical examination, then confirmed by direct arthroscopy.

RESULTS:

We found that only 52 patients have got ACL tear, 49 of them (94%) were males & 3 (6%) were females. The age range was from 17-49 years, with a mean of 27.5 years, 42% of the patients had associated meniscal injuries. The commonest symptom was a heard pop, & the main sign detected was knee joint effusion due to haemarthrosis.

The accuracies of Lachman test, Anterior Drawer Test & Pivot Shift T. were 94%, 82% & 58% respectively, all were improved under G.A., particularly the PST.

CONCLUSION:

Most of ACL tears can be diagnosed by thorough history& repeated clinical examination only, considering arthroscopy as a last but a definite choice.

KEY WORDS: Anterior cruciate ligament (ACL), Pivot shift test (PST), Anterior drawer test (ADT), Medial collateral ligament (MCL).

INTRODUCTION:

Historical review

Written evidence of soft tissue & ligament injuries dates back to the smith papyrus (3000 – 1700 BC) & also is found in records from ancient Egypt, Babylon, China, Greece and India. ⁽¹⁾

In 1918, In Japan professor Kengi Takagi first examined the inside of the knee with a cystoscope. In 1920, by Bircher with a laparoscope & in 1920 also by Takagi with an arthroscope. ^(2,3)

Functional Anatomy

The cruciate ligaments consist of a pair of very strong ligaments connecting tibia to femur. They are inside the capsule of the knee joint but not within the synovial membrane. They are named from their tibial origin. The ACL is attached to the anterior part of the tibial plateau in front of the tibial spine & extends upwards & backwards to a smooth impression on the lateral condyle of the femur. The two cruciate ligaments cross like the limbs of the letter X. ⁽⁴⁾

The predominant source of blood supply of the ACL is the middle genicular artery. ⁽⁵⁾ The ACL has been shown to contain nerve fibers of the size that are transmitting pain as well as mechanoreceptors that are postulated to function in proprioception. ^(6,7)

TESTS FOR ACL EXAMINATION & KNEE INSTABILITY

Valgus & Varus test . when there is a marked medial or lateral opening during stressing the knee in valgus or varus in extension there will be a possibility of ACL tear.

Anterior drawer test. (ADT). With the patient supine & relaxed, the hip is flexed to 45 degree & the knee to 90 degree, the examiner sits on the patients foot to secure it in the desired position, anterior translation is elicited in 90 degree flexion of the knee with the tibia & foot in neutral position. The Lachman test. ^(8,9)

After Georges C.Noulis, In 1960 Ritchey also described anterior drawer testing with the knee slightly flexed (30°) using his both hands above & below the knee. The Lachman test is positive in

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most of acute tears of ACL when applied without anesthesia.

Advantages of LACHMAN test:

- 1- Highly specific for ACL rupture.
- 2- Not hampered by haemarthrosis.
- 3- Not hampered by posterior meniscus horn.
- 4- Less painful because the muscles are relaxed.
- 5- Not hampered by sprained or injured MCL.
- 6- Elicits greater anterior displacement, not just with isolated ACL rupture.
- 7- Performed in functional position of 30 degree of flexion.
- 8- Can be performed when there is fracture close to the knee.

PIVOT SHIFT TESTS:

The clinical test that reproduces the phenomenon of “giving way” is called the pivot shift, because of the feeling of the patient that some thing shifts in the knee when pivoting.

There are a variety of ways to elicit the pivot shift phenomenon with a basic difference between the tests is whether or not the tibia held internally rotated.^(9,10)

1-MacIntosh pivot shift test. 2-Jerk test of Hughston. 3- Slocum test .4- Losee test.

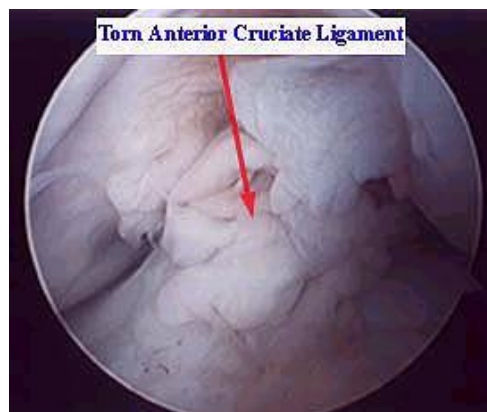
5- Noyes test (flexion rotation drawer test).6- Flexion extension valgus test.7- Nakajima test (N-test). 8- Matan's test. 9- Graded pivot shift test of Jakob. 10- Modified pivot shift test. 11- Soft pivot shift test.

Arthroscopic examination of the ACL:

With a cruciate ligament injury, it is critical to observe the architecture & width of the femoral intercondylar notch & are best viewed with the knee flexed 45-90 degree. With a complete rupture of the ACL, considerable hemorrhage within the synovial tissues is evident. Probing the ACL, opening its synovial sheath, & checking its tension with the probe are just as important as probing the menisci. A torn ACL feels mushy, without tension & some times the probe can penetrate through it. ACL present it self as a silver striated bundle, covered with synovium. Blood vessels are arranged longitudinally along the length of the ligament. Disruption of those blood vessels indicate ACL tear.^(11,12)



Normal ACL by arthroscope



Torn ACL by arthroscope

PATIENTS & METHODS:

During the period from December 2000 to October 2002, Seventy-two patients were selected after a detailed history & thorough clinical examination, all were suspected to have ACL tear depending on a previously prepared questionnaire. They were admitted at Surgical specialization Hospital for diagnostic arthroscopy.

These patients met the following criteria:

- ◆ Male to female ratio is (11:1) i.e. 66 male (92%) & 6 female (8%).
- ◆ The age of the patients range from 17—49 Y, with a mean of 32 years.
- ◆ A great number of the patients were civilian, 2 of them were military. 36 patients were athletes mostly playing football, professional or recreational.

- ◆ All the 72 patients were suspected to have ACL tear, isolated or combined with other knee joint lesions.

History & physical examinations

After the patients have been admitted to the hospital, the clinical diagnosis was based on a careful history & physical examination, using special clinical tests of the knee. The sound knee was always examined & considered for comparison.

The clinical tests applied to the patients are:

- 1- Lachman test.2- Anterior drawer tests.3- Pivot shift test of MacIntosh.4- Jerk test.
- 5- Slocum test.6- Valgus-Varus stress test.

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Arthroscopic examination

All the 72 patients are put on operation lists, & considered for diagnostic arthroscopy. We found that only 52 patients have got ACL tear, and the other suspected 20 have got different other knee lesions.

Examination under G.A.

The patients were examined under general anesthesia routinely preceding arthroscopy & before application of the tourniquet, especially the following tests:

1-Lachman test. 2- Anterior drawer test. 3- Pivot shift test. 4- Valgus-Varus test.

RESULTS:

The result of arthroscopic diagnosis confirmed that only 52 patients have ACL tear, & the remaining 20 patients were discovered to have intact ACLs, but other different knee joint pathologies. The age range of this group i.e. (52 patients with torn ACL) at time of injury is from 17-49 Y With a prevalence of 20-30 years & a mean age of 27.5 years. Among the 52 patients with ruptured ACL, there are 3 females (6%) & 49 males (94%). ACL tear was found in the Right knee of 30 patients i.e.(57%), & 21 patients got the tear in their Left

knees (41%).In one patient the tear was Bilateral (2%).The most common cause of ACL tear in our study is athletic activities especially football recreational or professional. We have 33 patients got the ACL tear during sport i.e. (63%) of the total number 52.

By arthroscopic diagnosis we found that only 28 patients had isolated tear of ACL i.e. (54%), the remaining 24 patients had ACL tear that associated with different knee lesions.Mainly, medial meniscal injury 12/52(23%), lateral meniscal tear 8/52(15%) and two of them (4%)got bilateral meniscal tear.

♦ **Symptoms & Signs of presentation:** We found that the most important complaint was a sensed POP in 46 patients i.e. 88%, then Giving way, which was found in 44 patient (85%).While regarding the most common sign we found knee effusion in 45 patient i.e. 86% as the first.

The results of clinical examination, using the ACL tear diagnostic tests as compared with the definitive arthroscopic diagnosis of the ruptured ACL, also the sensitivity, the specificity & the accuracy are identified in the table.

A Table: Showing the sensitivity, the specificity& the accuracy of the clinical tests in diagnosis of ACL tear.

Clinical tests	ACLtear Present	ACLtear Absent	Total	Results
Lachman test				SE: 96% SP: 90% ACC: <u>94%</u>
+ve	50	2	52	
--ve	2	18	20	
total	52	20	72	
Anterior drawer test				SE: 85% SP: 75% ACC: <u>82%</u>
+ve	44	5	49	
--ve	8	15	23	
total	52	20	72	
Pivot shift Test (MacIntosh).				SE: 50% SP: 80% ACC: <u>58%</u>
+ve	26	4	30	
--ve	26	16	42	
total	52	20	72	
Jerk Test (Hughston).				SE: 39% SP: 70% ACC: <u>47%</u>
+ve	20	6	26	
--ve	32	14	46	
total	52	20	72	
Slocum Test				SE: 42% SP: 75% ACC: <u>51%</u>
+ve	22	5	27	
--ve	30	15	45	
total	52	20	72	

DISCUSSION:

Rupture of the ACL compromises the stability of the knee, in individuals who are active, resulting in instability, recurrent injuries & associated intraarticular disease⁽³⁾.A thorough history &

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physical examination can diagnose approximately 90% of ligament injuries.

Even in acute injuries or haemarthrosis of the knee we can avoid arthroscopy by repeating the clinical examination after the acute symptoms had subsided.

MRI is 97% sensitive in detecting ACL pathology, but sensitivity falls to 82% with respect to complete rupture, so it is better in partial in tear.⁽¹²⁾ & to 90% for acute tear, so it is better in chronic tear.⁽⁹⁾ We believe like most of the reports in this subject, in the prevalence of the young age group 20–30 years 28/52 (54%), with a mean age of 27.5 years, similar to the observation of Daniel DM⁽¹³⁾, with mean age of 26 years, & of Hawkins RJ,⁽¹⁴⁾ with average age of 22 years. Also we noticed that the right leg is more commonly injured than the left. 30/52 patients, (58%) have right sided injury. & 21/52 (40%) with left sided ACL tear, & one patient (2%) bilaterally affected, like Ciccotti who reported 30/52 (57%) for the right side⁽¹⁵⁾, D.J. Deehan 55/90 (61%) for right sided injury, & 35/90 (39%) of patients got left sided ACL injury, & O'Brien (52%) for the right, & (48%) for the left⁽¹²⁾. This is most probably because the dominant leg is more involved in the injury.

The incidence of meniscal tears occurring in association with ACL insufficiency has been reported as 19% by Feagan et al., 42% by Giove et al., 46% by Kennedy et al., & 70% by McDaniel & Dameron⁽¹⁴⁾. While Noyes (53%), & O'Brien (68%), both reported that the Medial M. is more commonly affected than the Lateral M.⁽¹²⁾

Regarding our study we found isolated ACL tears in 28/52 (54%) of the patients & the associated meniscal injury in 22/52 (42%) of them, 12/52 (23%) had Medial Meniscal injury, 8/52 (15%) got Lateral Meniscal injury, & two of them (4%) developed bilateral meniscal tear.

Utilizing our questionnaire, we found that the commonest complaint among patients in our study was a heard or a sensed pop, 46 patients (88%). Coincides with that of Hawkins 30/40

(75%). Giving way in our study was 85% in 44 patients, similar to the result of Hawkins who noticed 86% of patients to have it. (14)

The Lachman test has been reported to be the most useful clinical examination for acute & chronic ACL tears, with a sensitivity & specificity range between 85% & 98% (Torg et al. 1976, Jonsson et al. 1982, Donaldson et al. 1985, Zarins & Rowe 1986).⁽¹²⁾

Under G.A., the accuracy of all the tests were improved, as follows:

Lachman test 94% → 97%, ADT 82% → 87%, PST 58% → 70%.

CONCLUSIONS & RECOMMENDATIONS:

- ◆ A good number of ACL tears can be diagnosed by thorough history & repeated clinical examinations only, especially when applying the Lachman test, considering arthroscopy as a last but a definite choice.
- ◆ Chronic ACL tear even if it was isolated since the acute event, it usually becomes associated with other knee lesions because the ACL injured knee joint is no more in a balance.
- ◆ Lachman test is the most accurate & reliable test in identifying ACL tear. It must be performed with experience, in different ways according to the size of the patient.

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