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The Diagnostic Accuracy of Clinical Evaluation and Arthroscopy for Specific Types of Knee Lesions

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Abstract:
Background & Objectives: *The purpose of this study was to compare the findings on clinical evaluation with those on arthroscopy to determine the accuracy of clinical methods for specific types of knee lesion.*
Methodology: *25 Patients presenting to Yenepoya Medical College Hospital, Dept. of Orthopaedics with complaints of knee pain, in whom a clinical evaluation was followed by a diagnostic arthroscopy by a Consulting surgeon will be evaluated pre-operatively and the results assessed post operatively.*
Results: *Correlating well with previous studies, our study showed a peak age distribution in the 21-30 years age group, females were affected more commonly and it was the right knee that was found to be affected more often than the left knee.*
Conclusion: *Clinical examination should be the initial investigation of choice in the evaluation of all cases of internal derangement of knee and Arthroscopy should be done as an adjunct, to confirm the diagnosis and in certain cases, as a therapeutic procedure.*
KeyWords: *Arthroscopy,Anterior cruciate ligament,Posterior cruciate ligament,Medial Collateral ligament,Lateral collateral ligament,Menisci,Osteoarthritis,Lachman's test,Drawer test,McMurray's test.*

I. Introduction

Many of the injuries of the knee joint produces complex intra and peri-articular pathology that does not lend itself to accurate diagnosis despite meticulous clinical examination, (Dandy 1987)[1]. Most such knees are grouped conveniently with a diagnosis of 'IDK', implying internal derangement of knee', but which could as well mean 'I Don't Know'. Routine investigations including radiology are often valueless. Arthrography is a difficult and invasive procedure useful only in meniscal lesions (Ireland and Trickey 1980)[2]. Often one has to depend on arthrotomy for a precise diagnosis. Modalities like MRI scan, unless reported by an experienced and trained radiologist can often be wrong. The various clinical tests are again observer dependent. Arthroscopy is essential to confirm the findings of clinical assessment.

Various clinical tests such as the anterior drawer test, posterior drawer test, McMurray's[3] test, Apley's[4]test are used to diagnose internal derangements of the knee(IDK). Some of the important IDK are meniscal injuries, anterior cruciate ligament injuries, posterior cruciate ligament injuries etc. However these findings need to be confirmed by arthroscopy. The purpose of this study is to compare the accuracy of clinical examination with that of diagnostic arthroscopy. Arthroendoscopic examination is introduced to make the diagnosis of knee disorders more precise. However it is neither a short cut to diagnosis nor a substitute to clinical judgement. It only supplements the established diagnostic techniques. Diagnostic arthroscopy is an established addition to the diagnostic armamentarium of the orthopaedic surgeon in many parts of the world. In advanced centres surgery through the arthroscope has made obsolete, almost all open knee surgery except, total knee replacement and patellectomy.

II. Materials And Methods:

Source of Data: Patients admitted in Yenepoya Medical College Hospital with complaint of knee disorders between May 2012 - Aug 2014.

Method of Collection Of Data: 25 Patients presenting to Yenepoya Medical College Hospital, Department of Orthopaedics with complaints of knee pain, in whom a clinical evaluation was followed by a diagnostic arthroscopy by a Consulting surgeon will be evaluated pre-operatively and the results assessed post operatively.

The patients will be evaluated as per history, mode of injury. Necessary radiological and haematology profile will be done on admission. The patients for the study were referred to the consulting surgeon with clinical suspicion of a knee lesion from out patient department, GPs and Orthopedic surgeons. Patients were evaluated by the senior surgeon. Examination involved detailed clinical examination of the involved joint apart from an entire general examination. Specific tests were performed to diagnose the cause of pain.

These included:

- Mc Murrays' test for Meniscal tears.
- Apley's Grinding test
- Squat test
- Anterior and Posterior Drawer test for cruciate ligament integrity.
- Jerk Test
- Valgus and Varus tests for collateral ligament stability.

Method Of Data Analysis

- The data was analyzed to calculate the sensitivity and specificity and the predictive value of the clinical examination with arthroscopy as the gold standard for comparison. Kappa statistics were used to analyse the data collected.

Inclusion Criteria

- Patients aged 16 years and above.
- All patients with h/o locking, giving way, buckling, clicking or other sounds.

Exclusion Criteria

- Psychiatric patients.
- Patients unwilling for clinical evaluation.
- Patients with financial constraints.

III. Results

Correlating well with previous studies, our study showed a peak age distribution in the 21-30 years age group. Females were affected more commonly and it was the right knee that was found to be affected more often than the left knee. The parameters that were assessed were the medial and lateral menisci, the anterior and posterior cruciate ligaments, the articular cartilage, osteoarthritis of the knee, the patellofemoral joint, loose bodies, patellar cartilage and joint effusion. Uniformly, throughout the study, arthroscopy was more successful in diagnosing true positives as compared to clinical evaluation. Clinical evaluation was found to have an excellent accuracy with regard to certain parameters like lateral meniscus, posterior cruciate ligament, articular surface

IV. Discussion

This is a prospective study involving 25 patients with history of knee problems who were examined clinically in the Department of Orthopaedics, Yenepoya Medical College Hospital. They then underwent a diagnostic and or a therapeutic arthroscopy at the hands of a consulting surgeon.

The various parameters that were compared clinically andarthroscopically were, the medial and lateral menisci, the anteriorandposterior cruciate ligaments, the articular cartilage, osteoarthritis, thepatellofemoral joint, loose bodies, patellar cartilage and joint effusion. In the present study group, there were 15 females and 10 males, ages ranging from 15 to 73, with a mean age of 42.40. The right knee was involved in 15 cases and the left knee in 10 cases. The most number of cases were in the medial meniscus and joint effusion category, with quite a large number of cases in the anterior cruciate ligament and osteoarthritis category.

However it was found that several cases had more than one positive parameter.

Throughout the study arthroscopy picked up more true positive cases than clinical evaluation. However clinical evaluation fared excellently incomparison to arthroscopy with regard to several parameters and moderately well to good in other parameters. With regard to the medial meniscus, the sensitivity of clinical evaluation was 90%, specificity 91.6%, positive predictive value 90%,negative predictive value 73.3%.This correlates well and is infact an improvement over previous studies done by Johnson41,Curran and Woodward[5].

With regard to the lateral meniscus clinical evaluation fared very well, with a sensitivity and specificity of 100% and a negative predictive value of 86.95%. With regard to the anterior cruciate ligament, the sensitivity was 88.9%, specificity was 92.9%, positive predictive value was 88.9% and negative predictive value 81.25%.

Clinical evaluation was fairly good in diagnosing ACL tears. This is in keeping with previous studies done by Noyes[6] and Gillquist and Hagberg[7]. With regard to the posterior cruciate ligament, sensitivity and specificity were both 100 % with a negative predictive value of over 90%.This correlates well with studies done by Harren and Hoher[8]. For osteoarthritis again, clinical evaluation was excellent with a sensitivity and specificity of 100%, but a rather low negative predictive value of 81.25%. With regard to articular cartilage abnormalities, clinical fared very well in comparison to arthroscopy with a sensitivity and specificity of 100% and a negative predictive value close to 90%. With regard to intrarticular loose bodies clinical evaluation fared moderately with a sensitivity of 83.3%,specificity of 93.3% and a negative predictive value of 73.7%.A significant number of cases had loose bodies detected only on arthroscopy, leading to the conclusion of a moderate agreement between the two diagnostic modalities. With regard to the patellofemoral joint sensitivity and specificity were both 100% and the negative predictive value was over 90%.This showed an excellent agreement between the two modalities. With regard to patellar cartilage, once again clinical evaluation fared very well with a sensitivity and specificity of 100% and a negative predictive value of over 90%.

The final parameter assessed was joint effusion. Here clinical evaluation fared well in terms of sensitivity and specificity which were 100%, but had a negative predictive value of only 71.58%, with a significant number of cases detected to have no effusion clinically, but mild to moderate effusion arthroscopically.

V. Conclusions

Internal Derangements of the Knee are fairly common. The need to properly evaluate them is very crucial for proper management and outcome, otherwise it will lead to chronic debility to the patient.

Both clinical evaluation and arthroscopy have their limitations. These shortcomings can be overcome by combining both modalities when clinically indicated.

Clinical examination should be the initial investigation of choice in the evaluation of all cases of "IDK". It is inexpensive, non-invasive and as our study has shown, fairly accurate. Arthroscopy should then be done as an adjunct, to confirm the diagnosis and in certain cases, as a therapeutic procedure.

Acknowledgement

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TABLE NO.1: Interpretation of Sensitivity

Percentage	Correlation
90-100%	Excellent
80-90%	Very Good
70-80%	Good
60-70%	Average
<60%	Poor

TABLE NO.2: Interpretation of Kappa Statistics

Kappa Value	Correlation
<0.20	Poor Agreement
0.21-0.4	Fair Agreement
0.4-0.6	Moderate
0.61-0.8	Good
0.81-1.0	Very Good

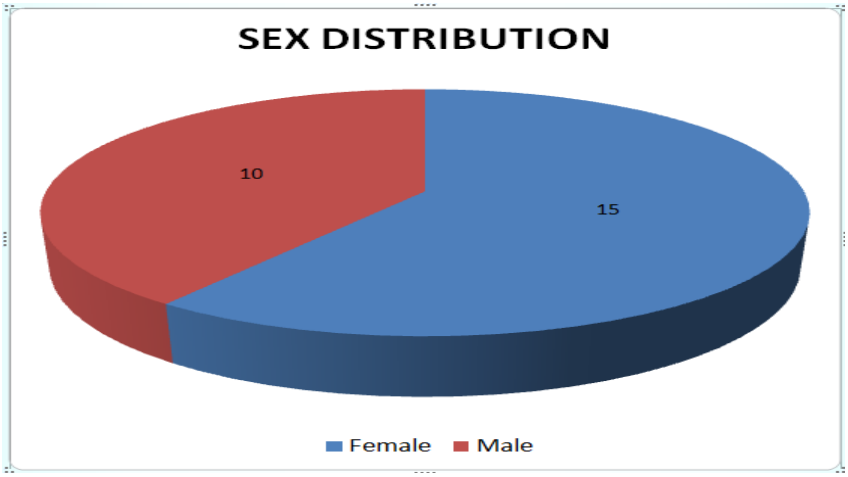
TABLE NO. 3: Age Pattern

	N	Minimum	Maximum	Mean	Std. Deviation
Age	25	15	73	42.40	18.846

TABLE NO. 4: Gender Distribution

	No. of patients	Percent
F	15	60.0
M	10	40.0
Total	25	100.0

FIG.1: Gender distribution

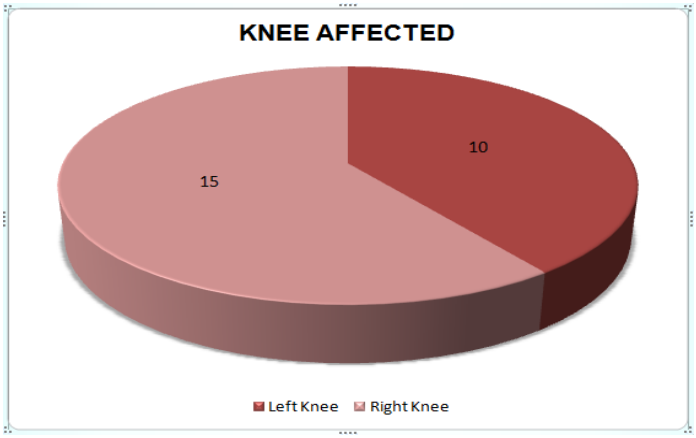


Females were affected more commonly in our study

TABLE NO. 5: Knee side affected

	No. of patients	Percent
L	10	40.0
R	15	60.0
Total	25	100.0

FIG. NO. 2: Knee side affected

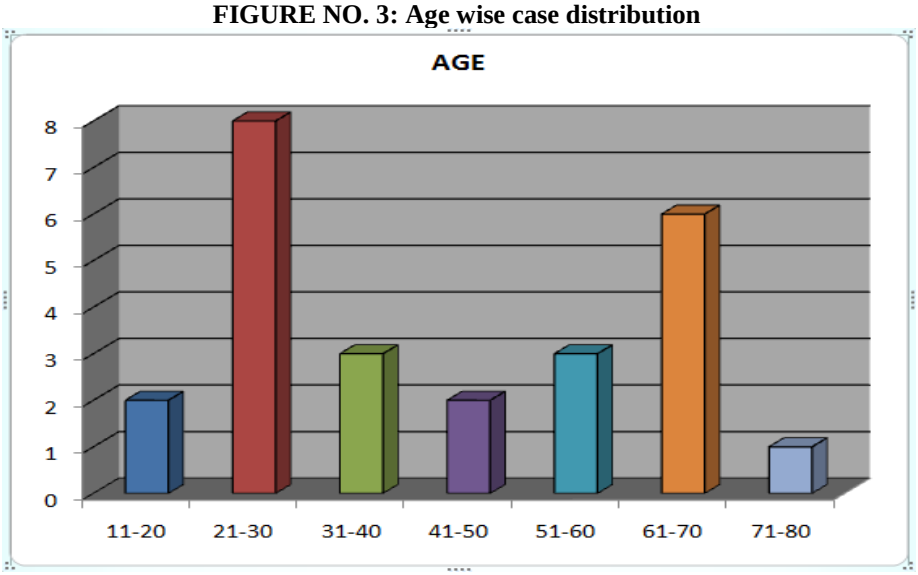


The right knee is more commonly affected in our study

TABLE NO. 6: Age wise case distribution

Age	No. of Cases
11-20	2
21-30	8
31-40	**3**
41-50	2
51-60	3
61-70	6
71-80	1

FIGURE NO. 3: Age wise case distribution

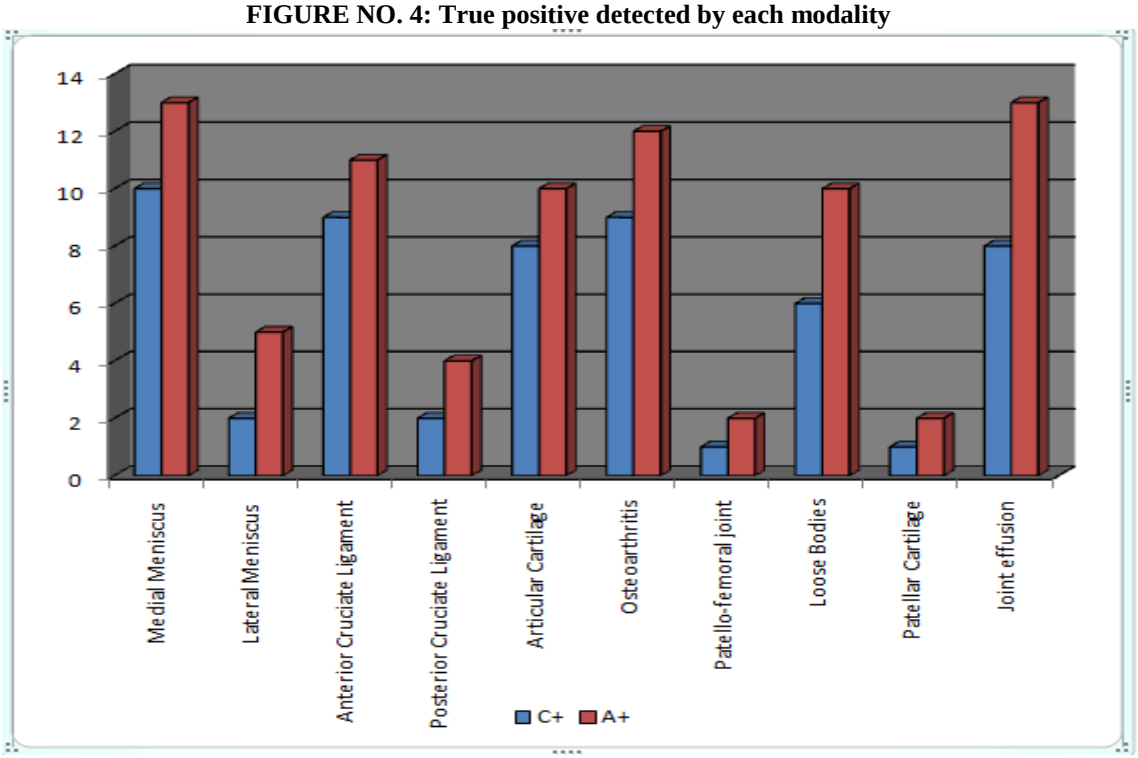


Most number of cases were in the age group of 21-30 years followed by 61-70 years.

TABLE NO. 7: True positive detected by each modality

Parameter	Clinical evaluation (C+)	Arthroscopy Evaluation (A+)
Medial Meniscus	10	13
Lateral Meniscus	2	5
Anterior Cruciate Ligament	9	11
Posterior Cruciate Ligament	2	4
Articular Cartilage	8	10
Osteoarthritis	9	12
Patello-femoral joint	1	2
Loose Bodies	6	10
Patellar Cartilage	1	2
Joint effusion	8	13

FIGURE NO. 4: True positive detected by each modality



Uniformly throughout the study, arthroscopy picked up more truepositives than clinical evaluation.

Analysis Of The Diagnostic Accuracy Of Eachparameter
Parameter = ACL

		A		
		+		Total
C	+	8 88.9% 72.7%	1 11.1% 7.1%	9 100.0% 36.0%
	-	3 18.8% 27.3%	13 81.3% 92.9%	16 100.0% 64.0%
Total		11 44.0% 100.0%	14 56.0% 100.0%	25 100.0% 100.0%

	Value	p value
Kappa	.669	.001

Sensitivity = 88.9%
Specificity = 92.9%
Positive predictive value = 88.9%
Negative predictive value = 81.25%
Kappa = 0.669
p.value = 0.001
Sensitivity & Specificity of clinical evaluation with respect to all tears is 88.9% and 92.9%; Good in diagnosing All tears

Parameter = PCL

		A		Total
		+	-	
C	+	2 100.0% 50.0%	0 .0% .0%	2 100.0% 8.0%
	-	**3** 8.7% 50.0%	21 91.3% 100.0%	23 100.0% 92.0%
Total		4 16.0% 100.0%	21 84.0% 100.0%	25 100.0% 100.0%

	Value	p value
Kappa	.627	.001

Sensitivity = 100%
Specificity = 100%
Positive predictive value = 100%
Negative predictive value = 91.3%
Kappa = 0.627
p.value = 0.001
Excellent sensitivity and specificity, good agreement

Parameter = Medial Meniscus

		A		Total
		+	-	
C	+	9 90.0% 69.2%	1 10.0% 8.3%	10 100.0% 40.0%
	-	4 26.7% 30.8%	11 73.3% 91.7%	15 100.0% 60.0%
Total		13 52.0% 100.0%	12 48.0% 100.0%	25 100.0% 100.0%

	Value	p value
Kappa	.603	.002

Sensitivity	=	90%
Specificity	=	91.6%
Positive predictive value	=	90%
Negative predictive value	=	73.3%
Kappa	=	0.603
p.value	=	0.002

Moderate sensitivity and specificity, poor negative predictive value

Parameter = Lateral Meniscus

		A		Total
		+	-	
C	+	2 100.0% 40.0%	0 .0% .0%	2 100.0% 8.0%
	-	3 13.0% 60.0%	20 87.0% 100.0%	23 100.0% 92.0%
Total		5 20.0% 100.0%	20 80.0% 100.0%	25 100.0% 100.0%

	Value	p value
Kappa	.516	.003

Sensitivity	=	100%
Specificity	=	100%
Positive predictive value	=	100%
Negative predictive value	=	86.95%
Kappa	=	0.516
p.value	=	0.003

Good sensitivity and specificity

Parameter = Articular Cartilage

		A		Total
		+	-	
C	+	8 100.0% 80.0%	0 .0% .0%	8 100.0% 32.0%
	-	2 11.8% 20.0%	15 88.2% 100.0%	17 100.0% 68.0%
Total		10 40.0% 100.0%	15 60.0% 100.0%	25 100.0% 100.0%

	Value	p value
Kappa	.828	p < 0.001

Sensitivity	=	100%
Specificity	=	100%
Positive predictive value	=	100%
Negative predictive value	=	88.23%
Kappa	=	0.828
p.value	<	0.001

Sensitivity and specificity of clinical evaluation in diagnosing articular cartilage abnormalities is 100% which is an excellent correlation

Parameter = Joint effusion

		A		Total
		+	-	
C	+	8 100.0% 61.5%	0 .0% .0%	8 100.0% 32.0%
	-	5 29.4%	12 70.6%	17 100.0%

		38.5%	100.0%	68.0%
Total		13	12	25
		52.0%	48.0%	100.0%
		100.0%	100.0%	100.0%

	Value	p value
Kappa	.0606	.001

Sensitivity = 100%
Specificity = 100%
Positive predictive value = 100%
Negative predictive value = 70.58%
Kappa = 0.606
p.value = 0.001
Poor negative predictive value,excellent sensitivity and specificity

Parameter = Loose bodies

		A		Total
		+	-	
C	+	5	1	6
		83.3%	16.7%	100.0%
		50.0%	6.7%	24.0%
	-	5	14	19
		26.3%	73.7%	100.0%
		50.0%	93.3%	76.0%
Total		10	15	25
		40.0%	60.0%	100.0%
		100.0%	100.0%	100.0%

	Value	p value
Kappa	.464	.013

Sensitivity = 83.3%
Specificity = 93.3%
Positive predictive value = 83.3%
Negative predictive value = 73.68%
Kappa = 0.464
p.value = 0.013
Poor sensitivity, moderate agreement

Parameter = OA

		A		Total
		+	-	
C	+	9	0	9
		100.0%	.0%	100.0%
		75.0%	.0%	36.0%
	-	3	13	16
		18.8%	81.3%	100.0%
		25.0%	100.0%	64.0%
Total		12	13	25
		48.0%	52.0%	100.0%
		100.0%	100.0%	100.0%

	Value	p value
Kappa	.757	p < 0.001

Sensitivity = 100%
Specificity = 100%
Positive predictive value = 100%
Negative predictive value = 81.25%
Kappa = 0.757
p.value < 0.001

Good agreement, excellent sensitivity and specificity but moderate negative predictive value

Parameter = Patellar Cartilage

		A		Total
		+	-	
C	+	1	0	1
		100.0%	.0%	100.0%
		33.3%	.0%	4.0%
	-	2	22	24
		8.3%	91.7%	100.0%
		66.7%	100.0%	96.0%
Total		3	22	25
		12.0%	88.0%	100.0%
		100.0%	100.0%	100.0%

	Value	p value
Kappa	.468	.006

Sensitivity = 100%
Specificity = 100%
Positive predictive value = 100%
Negative predictive value = 81.25%
Kappa = 0.468
p.value = 0.006
Excellent sensitivity and specificity, moderate agreement

Parameter = Patellofemoral Joint

		A		Total
		+	-	
C	+	1	0	1
		100.0%	.0%	100.0%
		33.3%	.0%	4.0%
	-	2	22	24
		8.3%	91.7%	100.0%
		66.7%	100.0%	96.0%
Total		3	22	25
		12.0%	88.0%	100.0%
		100.0%	100.0%	100.0%

	Value	p value
Kappa	.468	.006

Sensitivity = 100%
Specificity = 100%
Positive predictive value = 100%
Negative predictive value = 91.7%
Kappa = 0.468
p.value = 0.006
Excellent sensitivity and specificity

TABLE NO. 8: Comparison of the Sensitivity and Specificity of the two modalities with regard to each parameter

Parameter	Sensitivity	Specificity
Medial Meniscus	90%	91.6%
Lateral Meniscus	100%	100%
Anterior Cruciate Ligament	88.9%	92.9%
Posterior Cruciate Ligament	100%	100%
Articular Cartilage	100%	100%
Osteoarthritis	100%	100%
Patello femoral joint	100%	100%
Loose bodies	83.3%	93.3%
Patellar Cartilage	100%	100%
Joint Effusion	100%	100%