

THE PATTERN OF FINDINGS

IN DOUBLE CONTRAST

KNEE ARTHROGRAPHY AND COMPARISON

WITH RESULTS AT ARTHROTOMY

IN

NAIROBI

THE PATTERN OF FINDINGS
IN DOUBLE CONTRAST KNEE ARTHROGRAPHY
AND COMPARISON WITH RESULTS AT ARTHROTOMY
IN
NAIROBI

This dissertation is submitted in part - fulfilment for
the degree of Master of Medicine in Diagnostic Radiology
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July 1990.

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DECLARATION

Candidate.

This dissertation is my original work and has not been presented for any Degree in any other University.

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SUMMARY

A retrospective and prospective study was carried out between July 1988 and July 1990. During this period 171 consecutive double contrast knee arthrograms were done at the Nairobi Hospital and studied for purposes of this dissertation.

The various types of knee derangements seen on double contrast arthrography were analysed. 28% of these patients also had arthrotomy done. In patients where arthrotomy records were available comparison and relationship between double contrast knee arthrography and arthrotomy were made.

The commonest pathology demonstrated was meniscal tears - either medial or lateral meniscus. The commonest tear was of the medial meniscus posterior horn (45.5%). Other lesions demonstrated included Baker's cysts (18.2%), Discoid menisci (2.4%), Cruciate ligament tears (2.4%), Loose body (3.0%) and Collateral ligament tears (2.4%).

The patients age ranged from 6 to 60 years, and the commonest age group was 20 to 30 years. The male to female ratio was 1.8:1.0.

The overall arthrographic accuracy calculated compared with arthrotomy was 90.5%. Arthrography was found to be accurate in

Arthrography of

diagnosing medial meniscal lesions and had a sensitivity of 0.92, where as arthrography was inaccurate in diagnosing lateral meniscal with a low sensitivity of 0.50.

arthrography

It is recommended that arthrography is safe, easy to perform, virtually free of complications, not time consuming and an accurate procedure in diagnosing internal derangements of the knee. It is recommended as the first diagnostic tool of choice, and in those cases where arthrographic findings are equivocal and do not match with clinical findings, particularly in injuries to the lateral meniscus, other diagnostic aids e.g Arthroscopy or Exploratory arthrotomy should be undertaken.

arthro

internal

Arthro

is an

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Rickli

diagno

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I N T R O D U C T I O N

Arthrography of the knee was first performed in 1905 (Robinson and Werndorff, 1905) using air.

Arthrography

Orthopaedi

Later Boyd in 1934 recommended the use of positive contrast arthrography, which became popular in Scandinavia following the work of Lindblom (1938).

There are

Double Contrast techniques using mixtures of air and water soluble contrast media were initiated by Bircher and Oberholzer (1934).

should

Later advances in this technique were reported by Simon et al (1946), Sachs et al (1950) and Butt and McIntyre(1) 1969.

Arthro

Only in the last decade in North America and Europe has arthrography become a routine examination for accurate diagnosis of internal derangements of the knee.

nee

hand

Arthrography should not be regarded as a short cut to diagnosis but is an adjunct to clinical examination and certainly not an alternative. (Noble and Erat 1980).

Ricklin et al (1971) have produced a monograph on clinical diagnosis and therapy of meniscal injuries, based on results of more than 2,500 examinations.

The knee joint
commonly sports

Arthrography of the knee was introduced to the Royal National Orthopaedic Hospital (London) in 1972, and the first 1,000 arthrographic examinations were reviewed to provide a background for any institution setting up an arthrographic service.

the author

There are various indications for double contrast arthrography and it is used to investigate various joints including the knee, the shoulder, the hip, the temporomandibular, the metatarsophalangeal and interphalangeal joints.

Arthrography of the knee accounts for over 90% of all arthrograms performed. The use of arthrography and arthroscopy has almost eliminated the need for diagnostic arthrotomy. Double contrast knee arthrography is as accurate as arthroscopy in experienced hands and requires neither hospitalization nor general anaesthesia. The Examination lasts 15 - 30 minutes and the patient is mobile immediately. Within 24 - 48 hrs any residual pain and swelling will have subsided.

The morbidity attached to Double Contrast knee arthrography has been shown to be negligible.

The objectives of this study are to critically evaluate the pattern and accuracy of the radiological reports and to ascertain whether Double Contrast arthrography provides useful diagnostic information in the management of the knee derangements.

The knee joint is prone to a variety of complex injuries, which are commonly sports related. Double Contrast arthrography of the knee joint is a safe and informative investigation.

DEFINITION

In Nairobi, to date, this investigation is only carried out at the Nairobi Hospital. One of the aims of this study was to familiarise the author with the technique, and reporting of Double Contrast knee arthrograms.

The specific aim of this study are to;

1. Analyse the pattern of radiological findings double in contrast knee arthrography.
2. Evaluate the efficacy of Double Contrast knee arthrography as a diagnostic tool in knee derangements as compared to arthrotomy.
3. Make recommendations and/or criticisms to improve the practice of Double Contrast arthrography - in Kenya.

DEFINATION OF TERMINOLOGY REFERRED TO IN THIS STUDY:

1. Sensitivity: The sensitivity of an examination is shown by the percentage of all patients with the disease for whom a true positive is found.
2. Specificity: The specificity of an examination is shown by the percentage of patients without the disease for whom a true negative is found.

B A S I C A N A T O M Y

The knee joint is the largest and most complex derived from a primitive double condylar articulation.

Articular surfaces.

The knee joint is composed of 3 articulations;

1. Femoral Patellar
2. Medial Tibial-Femoral
3. Lateral Tibial-Femoral

The femoral articular surfaces are composed of medial and lateral condyles separated by the inter condylar notch. Anteriorly the trochlear surface is the site of articulation with the patella.

The tibial articular surfaces consist of the medial and lateral condyles separated by the intercondylar area. The condylar surfaces are gently hollowed out centrally and flattened peripherally where it is covered by the corresponding meniscus.

The patella has medial and lateral facets for articulation with the patellar surface of the femur.

The Synovial Membrane

The synovial membrane of the knee is the most complex and extensive in the body. It extends upwards from the patella to form the supra patella bursa, which lies beneath the quadriceps

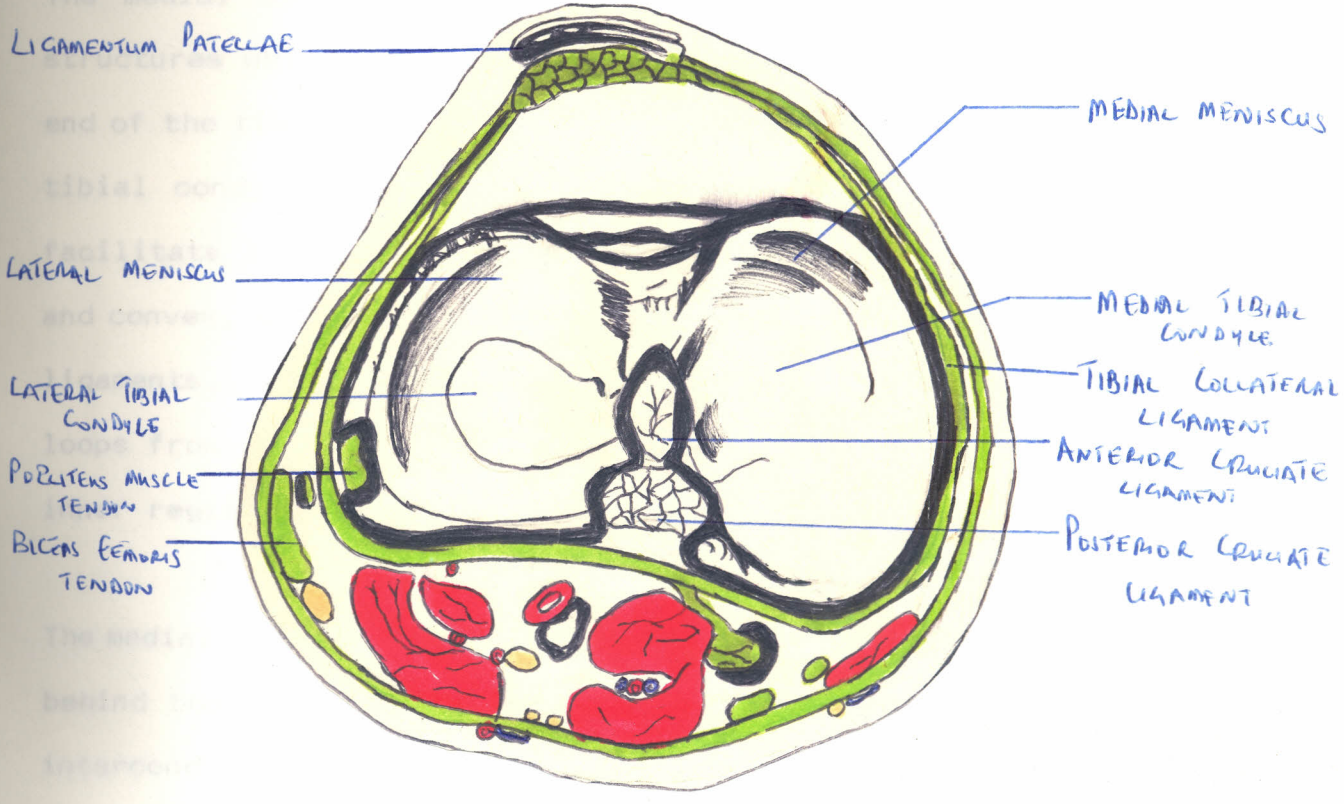
femoris. The bursa frequently contains folds of synovia thus producing communicating compartments. At the back of the lateral meniscus the synovial membrane forms a cul - de - sac, the sub - popliteal recess, between the groove on the surface of the meniscus and the tendon of the popliteus.

Intra-articular:

An inconstant posterior pouch extends into the popliteal space in about 13% of cases(35). When the stalk like communication of this pouch with the knee is obstructed, or when this bursa becomes inflamed, this popliteal bursa is called a Baker's cyst.

The menisci

The medial



THE MENISCI : SECTION THROUGH KNEE JOINT TO SHOW SHAPE AND ATTACHMENTS OF MENISCI.

The Extra - Capsular Ligaments

These ligaments are essentially for joint stability namely; ligamentum patella, the fibrous capsule, tibial and fibular collateral ligaments, oblique and arcuate popliteal ligaments.

Intra - articular Ligaments

These are the anterior and posterior cruciate ligaments, which extend obliquely from the walls of the intercondylar notch of the femur to the intercondylar area of the tibia.

The menisci

The medial and lateral menisci are crescentic shaped fibrous structures which rest on the articulating surfaces of the upper end of the tibia. Their function is to deepen the concavity of the tibial condyles, to act as cushions or shock absorbers and to facilitate lubrication. The peripheral borders of each is thick and convex, and is attached to the tibial condyles by the coronary ligaments. The thick peripheral zone is vascularized by capillary loops from the fibrous capsule and synovial membrane, whilst the inner region is avascular. (24, 35, 37).

The medial meniscus is nearly semicircular in shape, but is broader behind than in front, anteriorly it is attached to the anterior intercondylar area in front of the attachment of the anterior cruciate ligament. Posteriorly the medial meniscus is attached to the posterior intercondylar area between the

attachment of the posterior cruciate ligament and tibial spine. The lateral meniscus in contrast nearly forms a complete circle. The anterior and posterior horns are attached to the anterior and posterior intercondylar areas respectively. It lacks firm attachment posteriorly where the popliteus muscles enters and exits the joints. The posterior horn of the lateral meniscus is loosely attached to the femur by the anterior (Wrisberg) and posterior (Humphrey) menisco femoral ligaments. The lateral meniscus is not attached to the fibular (lateral) collateral ligament. (24)

MATERIALS AND METHODS

MATERIALS

The study was carried out at Nairobi Hospital, Radiology Department and was both retrospective and prospective. A total of 86 retrospective cases were analysed from 5th July, 1988 to 7th July, 1989, additionally 85 prospective Double Contrast knee arthrograms were performed from 7th July, 1989 to September 30th 1990, giving a grand total of one hundred and seventy one consecutive D.C. (Double Contrast) knee arthrograms.

The Double Contrast knee arthrograms have all been performed and reported after reaching a consensus decision by the same group of radiologists therefore excluding any bias.

Patients were referred to the department by their physicians or orthopaedic surgeons for investigation of a suspected meniscal tear, from various parts of the country. On average one examination was performed on every alternate day, excluding weekends.

A comparison was made between the findings on Double Contrast knee arthrography and those at arthrotomy. This was done by analysis of operation notes and direct communication with the respective orthopaedic surgeons.

No adverse effects were noted during the study.

Adrenalin Solution can be added to the contrast medium and may be useful if the examination is prolonged for any reason(31) (Roebuck, 1977). This was not done at our hospital.

Preparation:

Apart from explaining the procedure to the patient, no additional preparation is required.

Reactive synovitis defined as a post-arthrographic hydrops combined with inflammatory signs as hyperaemia, heat and tenderness were found in 25% of patients using urograffin 60%. No such cases were observed using Omnipaque (Non-ionic low osmolar).

Double Contrast methods are more reliable in diagnosing lesions of the central meniscal rim.

Indications:

1. The investigation and elucidation of suspected meniscal or cruciate ligament injury provides the main indication for Double Contrast knee arthrography.

2. Diagnosis of popliteal cysts.
3. Diagnosis of Osteochondritis dessicans.
4. Diagnosis of Chondromalacia patellae, Pigmented Villonodular synovitis, Synovial Chondromatosis, Synovial haemangioma.
5. Diagnosis of Discoid menisci and meniscal degeneration, persistence of symptoms following arthrotomy.
6. Contemplated meniscectomy in any child and Blount's deformity.
7. Recurrent joint effusion without significant history of trauma, where the diagnosis lies between a meniscal lesion and non traumatic synovitis.

Contraindications:

Presence of local skin sepsis is an absolute contraindication to knee arthrography because of the risk of inducing septic arthritis. Bleeding disorders and anticoagulant medication are relative contraindications.

TECHNIQUE:

The technique used in this project was a fluoroscopically controlled double contrast knee arthrography. The procedure is

carried out with strict asepsis.

Four flourosopic exposures are taken, and used as scout films to determine the precise technique and exposure factors for the procedure. Local anaesthesia for the joint puncture was found necessary.

The knee is cleaned with spirit and draped. A medial approach is preferred at our centre. The patella is pulled medially and the mid patellar dimple felt. Puncture is made at this site.

A 19 gauge 1.5 inch, short bevelled needle is used to enter the joint. The needle is directed so as to scrape the posterior surface of the patella. A 2ml syringe is used for joint aspiration, as this allows better suction, despite any inconvenience due to a large joint effusion. Complete aspiration is necessary as any retained fluid dilutes the constrast media. In addition contrast and synovial fluid are poorly miscible giving decreased film clarity.

The aspirated fluid is usually discarded unless there is a specific indication for culture or crystal identification.

When a joint effusion is not present verification of the intra-articular position of the needle tip can be accomplished by injecting a small amount of positive contrast media under flourosopic observation.

5ml of positive contrast media is injected into the joint space, this is followed by 50 - 80 ml of air. The volume of air injected is determined by the joint space size.

The volume of air is thought to be sufficient when the patient complains of fullness of the joint, or alternatively when an increase in difficulty of injection is noted by the radiologist.

After removing the needle, the joint was flexed and extended actively or passively for a minute or two, to ensure adequate distribution of contrast media throughout the joint.

The patient is prone with the knee elevated by a hard foam pad, which facilitates positioning of the joint, and increase the focus subject distance and to increase sharpness. The medial meniscus is examined first, by applying an abduction force, to "open - up" the medial anterior horn, starting from a neutral position and moving anteriorly. The posterior horn is examined in a similar way.

In cases where the prone position is impracticable adequate films may be obtained with the patient supine (ROEBUCK, 1977).(31)

To visualize the lateral meniscus an adduction force is applied to the joint and 8 exposures taken in the same manner as the medial side.

Two over couch views, true anteroposterior and lateral with the knee flexed are taken to study the synovial cavity and the state of the cruciate ligaments.

An assistant is needed to manipulate the leg while the Radiologist screens the joint.

After care

The patient is allowed to weight bear immediately and is advised to avoid strenuous exercises for 24 hours. Mild analgesics are prescribed if indicated.

RADIATION PROTECTION:

Coning is used to reduce the radiation field size. Scatter radiation is reduced by the use of lead impregnated rubber shields. Both these factors will reduce radiation exposure to the patient and radiologists. Both the radiologist and his assistant uses lead aprons and in addition the assistant wears lead gloves during the procedure.

CRITERIA USED TO DIAGNOSE TEARS

Criteria used to diagnose meniscal tears were

- (a) Passage of contrast media into the substance of the meniscus
- (b) Loss of its triangular shape.
- (c) Abnormal shortening of the meniscus.
- (d) Marked irregularity of the meniscal surface.

- (e) Peripheral and/or central detachment of a fragment.
- (f) Distortion of the popliteus bursa.

SHORTCOMINGS:

Arthrotomy has certain shortcomings:

- (a) Employing a single anterior incision, the limited field of view prevents complete visualization of menisci, particularly the posterior horns of the ipsilateral meniscus and most of the contralateral meniscus (B.M.J. 1979).
- (b) An injury may only be revealed when an attempt is made to remove the meniscus.
- (c) The operative incision into the meniscus may extend into a peripheral meniscal tear so that it is not apparent at the time of removal.
- (d) A normal meniscus may be torn inadvertently during menisectomy so that it appears that the removed structure was already torn.

These problems apply only to a minority of cases and reference to them is in no way intended to explain all discrepancies between the findings at arthrography and operation.

The radiologist must, however, be aware of the surgeon's limited field of view of the meniscus under certain circumstances and appreciate that in such conditions the arthrographer's view may be superior and his findings therefore most likely to be correct.

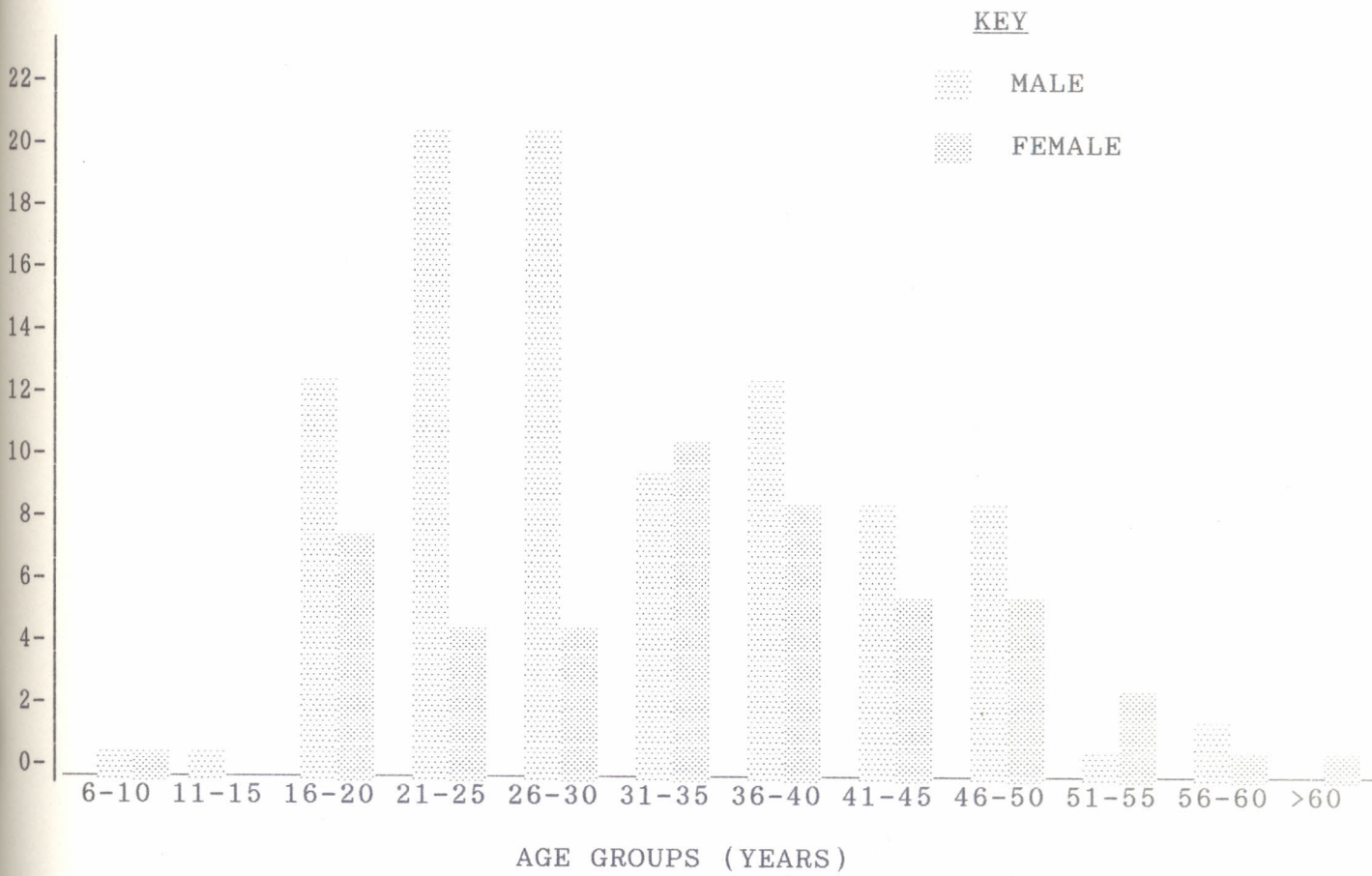
RESULTS

The results obtained in this study are presented in two sections.

SECTION A: Tables 1 - 6.

SECTION B: Figures 1 - 12.

TABLE 1: HISTOGRAM OF AGE & SEX DISTRIBUTION



NB: 12 males and
7 females did not give any age

TABLE 2: AGE SEX DISTRIBUTION

MALES: 110 FEMALES: 61

M:F RATIO = 1.8:1

AGE GROUP	MALE (%)	FEMALE (%)	TOTAL (%)
6 - 10	1 (0.6%)	1 (0.6%)	2 (1.2)
11 - 15	1 (0.6%)	-	1 (0.6)
16 - 20	13 (7.6%)	7 (4%)	20 (12)
21 - 25	20 (12%)	5 (3%)	25 (15)
26 - 30	20 (12%)	5 (3%)	25 (15)
31 - 35	10 (6%)	11 (6.4%)	21 (12.4)
36 - 40	13 (7.6%)	8 (4.8%)	21 (12.4)
41 - 45	8 (4.8%)	6 (3.5%)	14 (8.3)
46 - 50	9 (5.3%)	6 (3.5%)	15 (8.8)
51 - 55	1 (0.6%)	3 (1.8%)	4 (2.4)
56 - 60	2 (1.2%)	1 (0.6%)	3 (1.8)
OVER 60	-	1 (0.6%)	3 (1.8)
NO AGE GIVEN	12 (7%)	1 (4%)	19 (11)
TOTAL	110 (64%)	61 (36%)	171 (100)

N.B. 12 males and 7 females did not give any age.

TABLE 3: PRESENTING SYMPTOMS

SYMPTOMS	NO	%
PAIN	84	100%
SWELLING	27	32%
LOCKING	12	14%
DISTURBANCE OF GAIT	70	84%
GIVING WAY	8	10%
CLICKS	27	32%

NB

1. Patients presented with more than one of the symptoms above.
2. Only the prospective part of the study was analysed above.

TABLE 4: TYPES OF TRAUMA

TYPE OF TRAUMA	NO	%
SPORTS RELATED	23	27%
ROAD TRAFFIC ACCIDENTS	4	5%
OCCUPATIONAL	2	3%
TWIST INJURIES	22	26%
NO DEFINITE HISTORY OF INJURY	34	39%
TOTAL	85	100%

N.B. The above data was collected from the prospective group of patients.

TABLE 5: ARTHROGRAPHIC PATTERN OF KNEE PATHOLOGY

FINDING	NUMBER OF PATIENTS		
	L. KNEE (%)	R.KNEE (%)	TOTAL (%)
NORMAL	20 (11.7%)	21 (12.2%)	41 (23.9%)
TEAR OF MEDIAL MENISCUS ANTERIOR HORN	10 (5.8%)	8 (4.7%)	18 (10.5%)
TEAR OF MEDIAL MENISCUS POSTERIOR HORN	37 (21.6%)	41 (23.9%)	78 (45.5%)
TEAR OF LATERAL MENISCUS ANTERIOR HORN	9 (5.3%)	8 (4.7%)	17 (10%)
TEAR OF LATERAL MENISCUS POSTERIOR HORN	1 (0.6%)	-	1 (0.6%)
BAKERS CYST IN ASSOCIATION WITH MENISCAL INJURY	15 (8.8%)	16 (9.4%)	31 (18.2%)
DISCOID LATERAL MENISCUS	2 (1.2%)	-	2 (1.2%)
DISCOID MEDIAL MENISCUS	2 (1.2%)	-	2 (1.2%)
CRUCIATE LIGAMENT TEAR	1 (0.6%)	3 (1.8%)	4 (2.4%)
LOOSE BODY	2 (1.2%)	3 (1.8%)	5 (3.0%)
TEAR OF MEDIAL MENISCUS ANTERIOR & POSTERIOR HORNS	6 (3.6%)	11 (6.4%)	17 (10%)
TEAR OF LATERAL MENISCUS ANTERIOR & POSTERIOR HORNS	2 (1.2%)	-	2 (1.2%)
TEAR OF THE MEDIAL COLLATERAL LIGAMENT	(0.6%)	3 (1.8%)	4 (2.4%)

NB: A total of 171 knee Arthrograms were performed, out of these 85 were left knee and 86 were right knee.

The Arthrographic Examinations showed that patients often had a combination of pathologies.

TABLE 6: ACCURACY OF ARTHROGRAPHIC DIAGNOSIS OF MENISCAL TEARS

ARTHROGRAPHY	ARTHROTOMY	
	TEAR	NO TEAR
MEDIAL MENISCUS		
TEAR	34	2
NO TEAR	3	8
LATERAL MENISCUS		
TEAR	2	2
NO TEAR	2	41

Total Number of Arthrotomies = 47 (28%)

Total of Normal Arthrograms = 38 (22%)

Total cases not operated = 86 (50%)

(With proven tears by Arthrography)

Total study sample = 171 (100%)

STATISTICS DERIVED FROM TABLE 6

MEDIAL MENISCUS:

$$\text{Sensitivity} = 34/37 = 0.919$$

$$\text{Specificity} = 8/10 = 0.8$$

$$\text{Accuracy} = 100 \times 42/47 = 89.4\%$$

LATERAL MENISCUS:

$$\text{Sensitivity} = 2/4 = 0.5$$

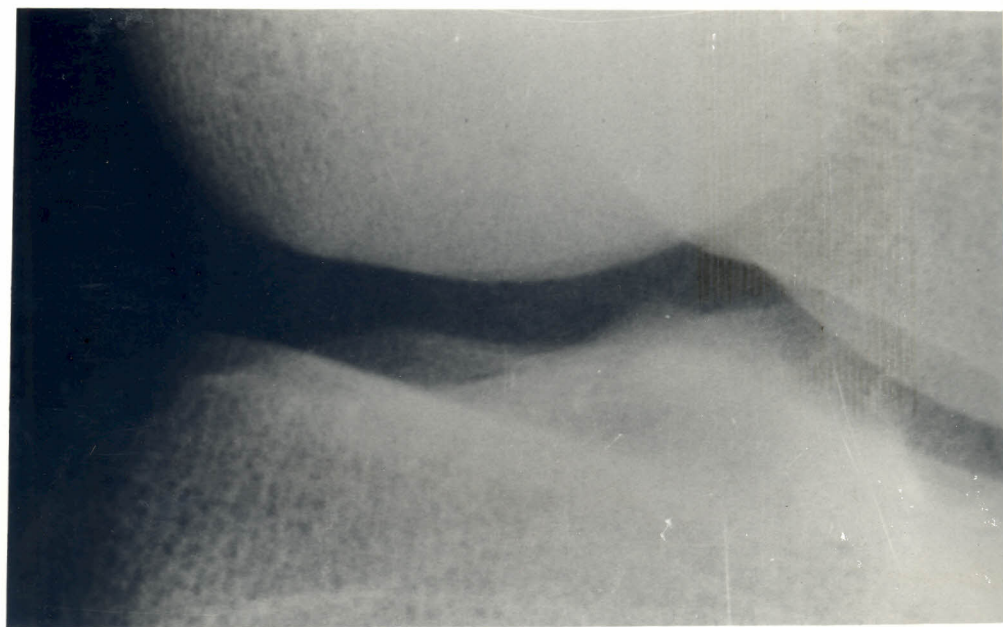
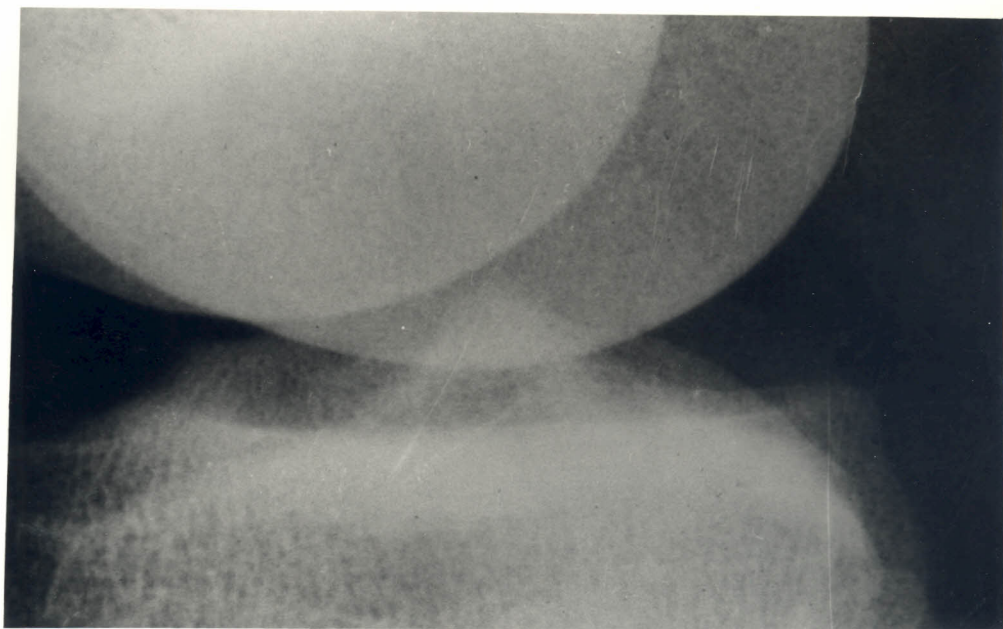
$$\text{Specificity} = 41/43 = 0.95$$

$$\text{Accuracy} = 100 \times 43/47 = 91.5\%$$

$$\text{Average overall accuracy} = \frac{91.5 + 89.4}{2} = 90.5\%$$

SECTION B:

FIGURES 1-12.



FIGURES 1 & 2 - CONTROL PICTURES WITH
MANIPULATION.

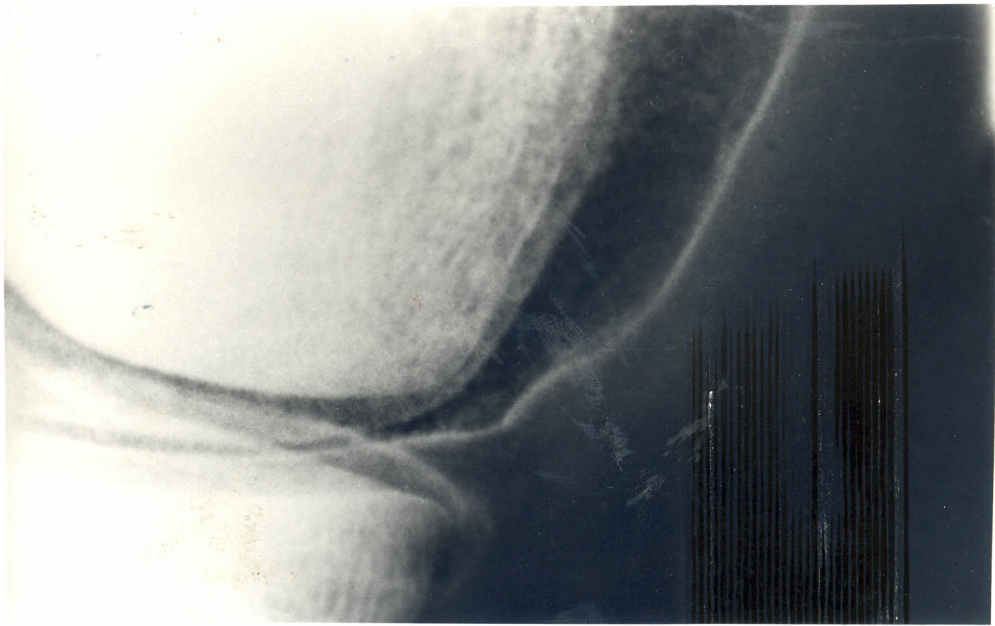


FIGURE 3

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DOUBLE CONTRAST KNEE ARTHROGRAM SHOWING A
NORMAL MEDIAL MENISCUS ANTERIOR HORN.

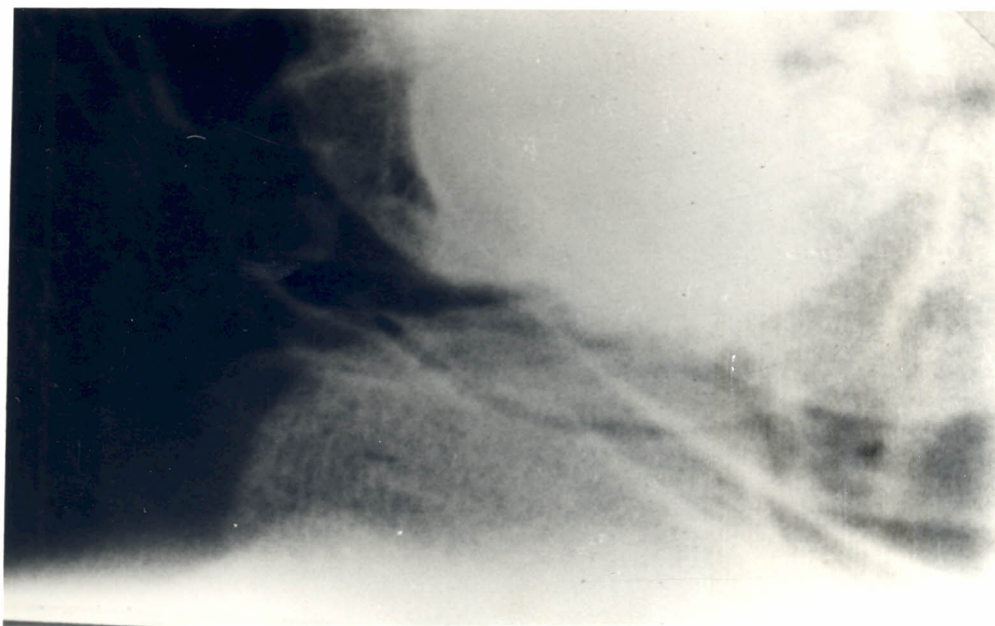


FIGURE 5

-

DOUBLE CONTRAST KNEE ARTHROGRAM SHOWING A
NORMAL LATERAL MENISCUS.



FIGURE 6

DOUBLE CONTRAST KNEE ARTHROGRAM DEMONSTRATING
NORMAL ANTEROPOSTERIOR AND LATERAL VIEWS.

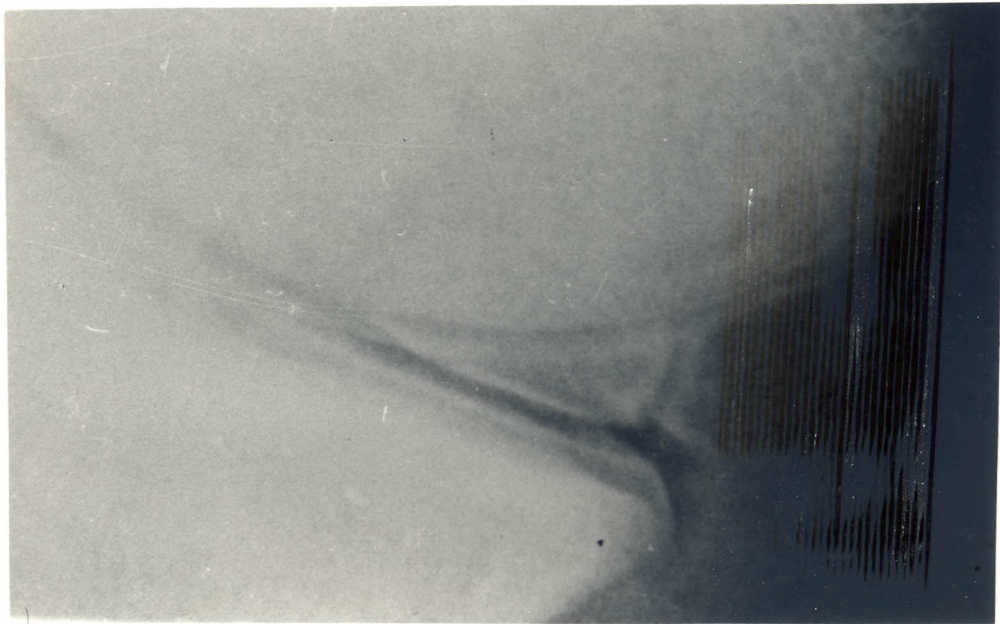
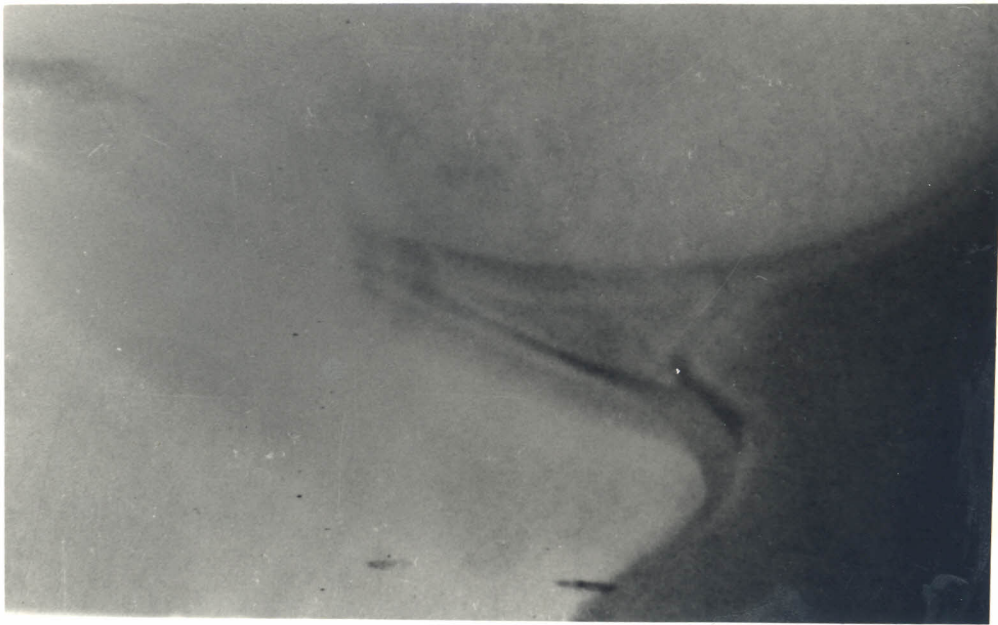


FIGURE 7

DOUBLE CONTRAST KNEE ARTHROGRAM DEMONSTRATING
A PERIPHERAL VERTICAL TEAR OF THE POSTERIOR
HORN.

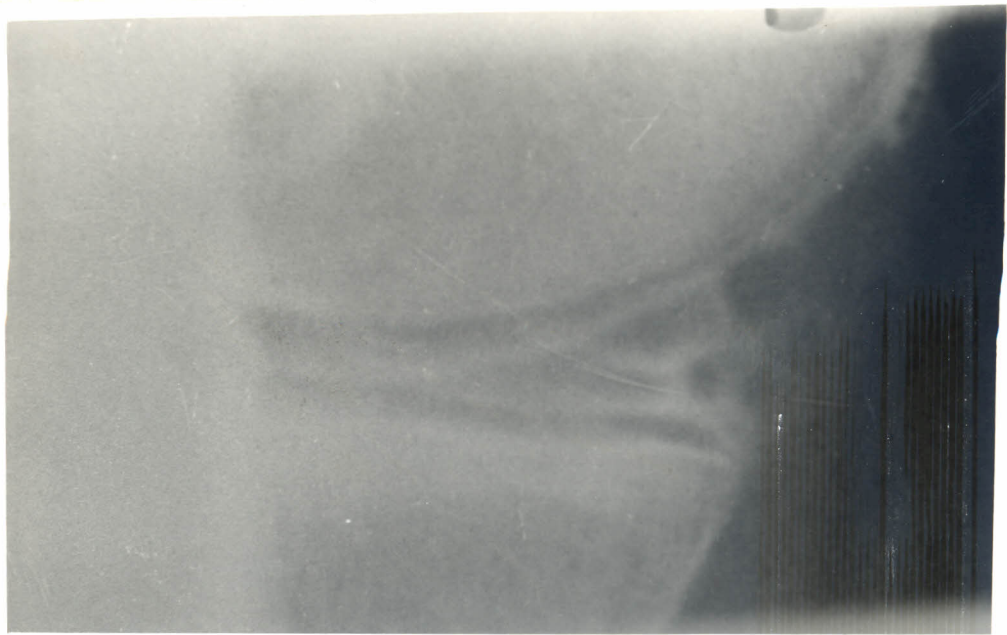


FIGURE 8 - DOUBLE CONTRAST KNEE ARTHROGRAM SHOWING
MULTIPLE TEARS OF THE MEDIAL MENISCUS
POSTERIOR HORN.

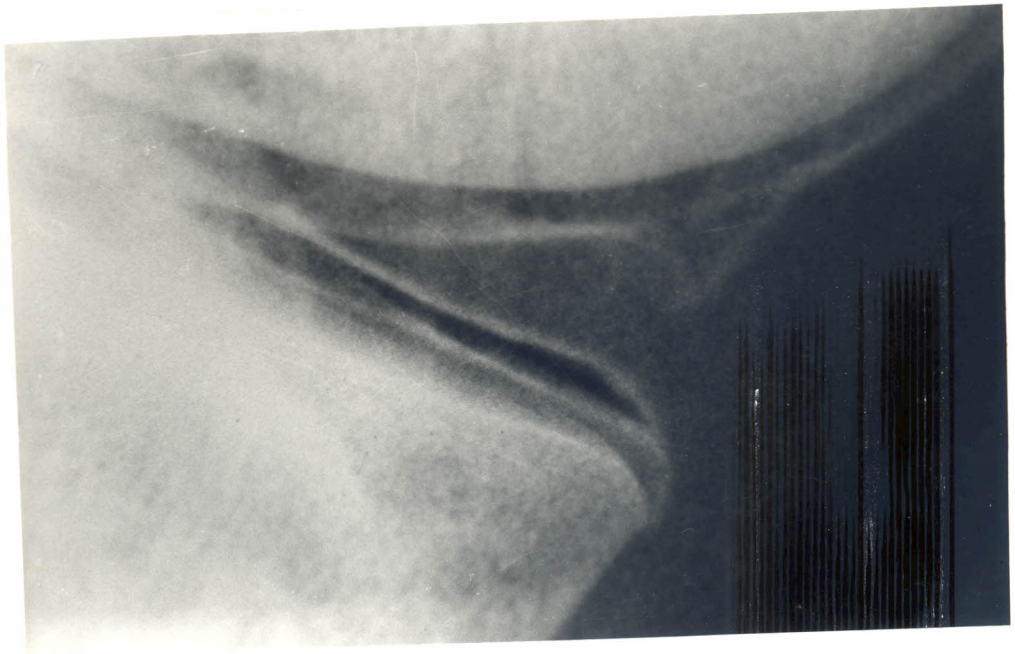


FIGURE 9

DOUBLE CONTRAST KNEE ARTHROGRAM SHOWING A
TEAR OF THE MEDIAL MENISCUS POSTERIOR HORN.

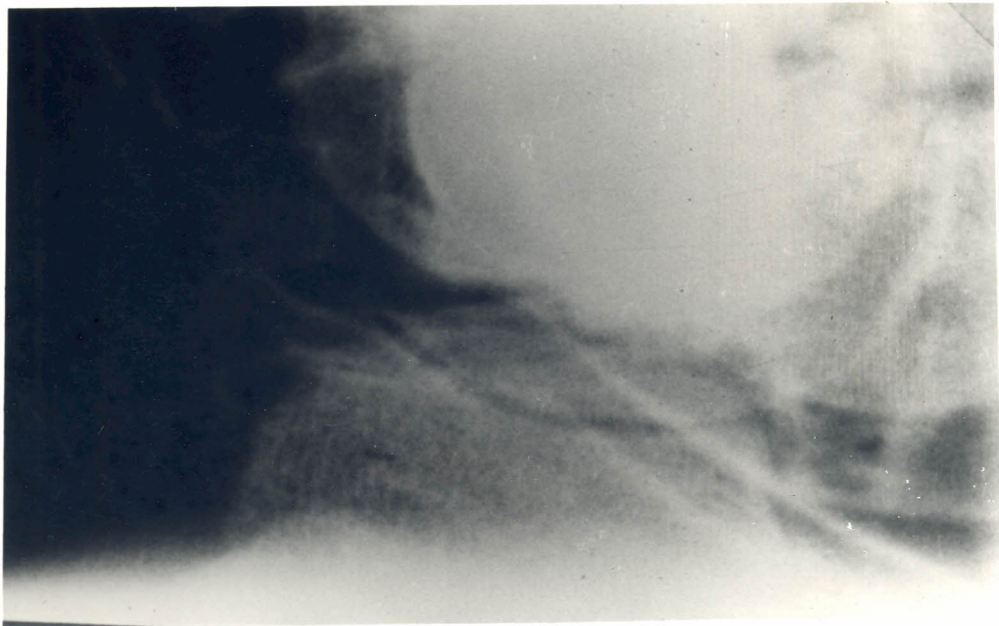
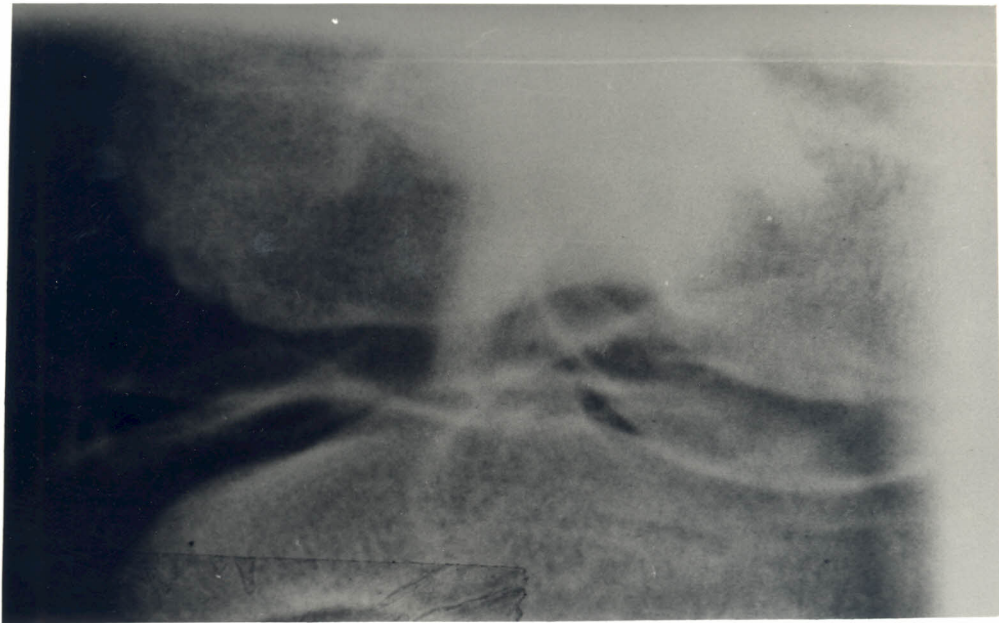


FIGURE 10 & 11

DOUBLE CONTRAST KNEE ARTHROGRAM SHOWING DISCOID MENISCUS.

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DISCUSSION

A total of one hundred and seventy one (171) consecutive Arthrograms were performed in this study and the results were analysed and elaborated upon in this section.

AGE AND SEX DISTRIBUTION

The age range was 6-60 years with a mean male age of 31 years and a mean female age of 34 years.

The overall median age agroup was 20-30 years which accounted for 30% of the patients. This was comparable with a study done at the Royal National Orthopaedic hospitals, London where 32.7% of the patient were between the age of 20-30 years.

There were three patients in the 6-15 years age group. All these patients were discovered to have discoid menisci which is a congenital disorder.

The peak male incidence was 20-30 years whilst the peak female incidence appeared between 30-40 years. This was comparable with Smillie's findings, where females had a delayed peak incidence.(32) The difference can be attributed to the different aetiologies affecting the groups, the commonest being degenerative disease. The male group is more likely to be involved in vigorous sporting activities for example football and squash, whereas this is not

the case with females.

The overall male to female ratio of patients undergoing this examination was 1.8 :1 . The male preponderance is similar to that found by previous researchers. (8, 21)

PRESENTING SYMPTOMS

The most common presenting symptom was pain which was found in 84 patients (100%) of those questioned. A study by Smillie (32) showed similar results where all his 239 patients (100%) presented with pain.

Pain was more pronounced whilst walking or weight bearing on the affected joint. Patients had varying degrees of pain, however no attempt was made to differentiate them. There were different locations of pain but all grouped under one.

Swelling of the knee joint was noted in 32% of patients. Carvalho(6) showed that not all patients having joint swellings had effusions, and no definite relationship was found between the two. Local swelling is not a prominent clinical feature of the longitudinal tears, on the other hand one of the most consistent and reliable signs of horizontal tears.(32)

Locking of the knee joint was recorded in 14% of patients. This

was smaller than the number in Smillie's study 24%(32). Another study by Butt and Mcltyre(1) reported 12% of patient locking at the original accident.

Locking has been defined as the occurrence of a sudden positive block in the course of a rotating movement of the joint.(32) It is evident that, however, the number of cases which experience locking at the original accident is smaller than generally supposed (32).

Locking has been shown to be due to the interposition of a section of a meniscus between the femur and tibia. The patient's statement that the knee is "locked" is not enough. He must explain exactly what he means by locking, demonstrating the position in which the knee was fixed.

84% of patients complained of a disturbance of gait. This varied from limping, avoidance of weight bearing on the affected knee or use of a walking aid, all of these were grouped under one heading. 10% of patients presented with a history of "giving-way" in a study by Smillie. (32). 12% of patients presented with "giving-way". This symptom was described as "something slipping about in the joint" or a collapse of the joint during weight bearing or walking. The commonest cause of "giving-way" is a longitudinal or horizontal cleavage tear of the posterior segment the meniscus.

whilst other causes are old rupture of the anterior cruciate ligament, quadriceps insufficiency or loss of full extension (Smillie).

TYPES OF TRAUMA

51 patients (61%) attributed their injuries to a definite traumatic event, 34 (39%) patients give no definite history of trauma. In other studies results showed 47% of patients attributed their injuries(32) to a definite traumatic event, whereas 53% had no injury. The sample size in our study was much smaller, 85 as compared to 2000 which could possibly explain the difference. 23 (27%) patients has a sports related injury. Commonly these involved football or squash. The below studies show 16% of patients has sports related injuries.

2% of the patients had been involved in road traffic accidents, with trauma to the knee. This was higher than other studies which had 0.7%.(32)

Two patients gave a history of occupational trauma or work related trauma. One patient related his symptoms to a fall from a ladder, whilst the other was hit by a falling metal pipe. The below table (Smillie page 114) shows comparable results. The results for coalmining injuries has decreased tremendously from 22% to 0.8%, due to the advent of mechanisation.

Changing pattern contrasting histories of 'original injury' in 6000 menisectomies.

Circumstances of mechanism	2000 cases 1955 - 1960 (%)	2000 cases 1963 - 1967 (%)	2000 cases 1969 - 1974 (%)
<hr/>			
Football or Athletic injury	23	16	16
Coalmining	22	19	0.8
Industrial	5.5	5	7
Road Traffic	1.5	2	0.7
Domestic		6	4.5
Twist (minimal strain)	23	21	18
No injury	25	41	53

Twist injuries accounts for 26%, where patients missed a step, as their foot was caught in a hole. The above study shows a range of 23% - 18% accounting for twist injuries.

The Pattern of Arthrographic findings

A total of 171 consecutive knee arthrograms were performed 85 (49.7%) left knees and 86 (50.3%) right knees were examined. The above results show that both knees were equally affected without any preferences. Studying table 5 the pathology found in the left knee is almost identical to that of the right knee. The results by BUTT and MCINTYRE (1) are comparable.

Normal Arthrograms

A total of 41 patients 23.9% of the arthrograms performed were reported as normal. A study by Carvalho and Jurik(6) showed 40% of arthrograms performed as normal. The difference between the two was possibly because of the different sample sizes. Carvalho only had 30 patients, compared to 171. A study by Butt and McIntyre(1) showed comparable results 21% normal arthrograms and had a large sample size of 239 patients.

The reason for a small number of normal arthrograms is that most patients had been referred by Orthopaedic Surgeons, who had examined the patients thoroughly and only referred the highly suspicious cases.

Patients referred for arthrography had mostly been screened by two doctors, that is a General practitioner who then referred them to an Orthopaedic Surgeon, in this way reducing the normal examinations.

The follow up of these patients reported as normal is discussed under the accuracy of arthrography.

THE MEDIAL MENISCUS

OVERVIEW

The firm peripheral attachments of the medial meniscus makes it more prone to tears by shearing forces especially in athletes(32) (Smillie). There is a spectrum of meniscal injuries that is listed below, and some already shown in the illustrations

The spectrum of meniscal injuries includes peripheral detachment, peripheral tear, cleavage tear, simple vertical tear, bucket handle tear and oblique tears.

The normal meniscus is resilient, and because of this resilience slight rotation of the lower leg will cause the meniscus to pop into the joint space. This can be appreciated fluoroscopically. The degenerated meniscus soon loses this resilience, often will not respond to leg manipulation, and is curled, bent or drooping.

Degenerated menisci are prone to horizontal tears (32) and is often difficult to tell when one becomes the other. The medial meniscus is attached throughout to the fibrous synovium with the exception of a small recess postero-superiously. An 'overturned lateral view' has been recommended by Thomas Frede(10), to view pathology of the posterior horn of the medial meniscus that would have gone unrecognised using the routine technique.

FINDINGS OF THE MEDIAL MENISCUS

Using the criteria discussed to diagnose meniscal tears 78 patients (46%) had tears of the medial meniscus posterior horn, where as 18 patients (10.5%) had tears of the anterior horn, and 17 patients (10%) had tears of the anterior and posterior horns.

This pathology was the commonest found in this study and many others (8, 12).

THE LATERAL MENISCUS

OVERVIEW

The normal lateral meniscus has a complete peripheral attachment in its anterior two thirds, but posteriorly is crossed by the sheath of the popliteus tendon. The sheath communicates with the knee joint and is therefore filled with both positive and negative contrast media. The filled sheath gives the meniscus a detached appearance. The accumulation of contrast media in the politeus sheath interferes considerably with the evaluation of the contours of the lateral meniscus and makes it practically impossible to detect contrast media that has penetrated the posterior third of the meniscus. This anatomical feature undoubtedly accounts for the decreased accuracy of diagnosis of tears of the lateral meniscus.

FINDINGS OF TEARS OF THE LATERAL MENISCUS

On arthrography 17 patients (10%) had tears of their lateral meniscus anterior horn, where as 1 (0.6%) patient had a tear of the posterior horn. Two patients (12%) had tears of both anterior and posterior horns. The pathology seen is much less than that compared to the medial meniscus. Smillie(32) showed 71.1% medial meniscal tears compared to 28.9% lateral meniscal tears. Our study showed 81% medial menisci tears compared to 19% lateral meniscal tears.

CRUCIATE LIGAMENTS

OVERVIEW

The anterior cruciate ligaments should be examined routinely because, although it might be ruptured as an isolated injury, it is commonly deranged in association with medial meniscal or medial collateral ligament tears.

A very satisfactory technique is that advocated by Freidberger (1979) and Stroker (1980) (8, 11). The patient sits on the end of the radiographic table with his thigh supported on a pad and the leg hanging vertically. Two radiographs are exposed with a horizontal beam, one at rest and one with the calf actively pressed against the edge of the table.

Liljedahl(11) recommends a lateral view for demonstrating tears. It is important that the knee is flexed through at least 60

degrees. Radiographs are taken with a vertical beam, using either a fluoroscopic spot film device or an overcouch tube. A radiograph should be routinely taken under stress with the tibia pulled anteriorly the "drawer sign" manouver.

If there is no visible cruciate ligament even with anterior traction on the lower tibia than a complete rupture can be diagnosed with certainty (1). If the anterior cruciate, instead of being a taut strut is "droopy" and this laxity persists both with anterior traction of the tibia and with the knee in full extension then attenuation or tearing of the anterior ligament can be diagnosed with certainty.

Arthrography has been correct in 69% in diagnosing ruptured and posterior cruciates (17). According to Liljedahl(11) single contrast arthrography combined with tomography is the method of choice in demonstrating cruciate ligament lesions and an accuracy of 90% recorded.

MR has an accuracy of 95% in diagnosing anterior cruciate ligament tears (19), MRI. Imaging of the knee is an extremely accurate means of non-invasive assesment of the integrity of the menisci and anterior cruciate ligaments. This accuracy exceeds that reported for arthrography. The only great disadvantage of MRI Imaging being the cost and hence unavailability.

FINDINGS

Cruciate ligaments tears were noted in 4 patients (2.4%). This is very low compared to a study by Butt and McIntyre (1969)(1) which had 11.6% anterior cruciate ligament tears.

This under diagnosis is possibly due to not doing any stress views. The complete technique to visualize the cruciate ligaments has been discussed in detail above and recommendations made to introduce this in future arthrographic examination.

COLLATERAL LIGAMENTS

OVERVIEW

Acute tears of the medial and lateral collateral ligaments are accompanied by tears of the synovium, and if arthrography is performed in the acute period the contrast media (11) extravasate through the synovial capsule, usually in the region of the coronary ligament. These synovial separations soon heal, however, and if arthrography is delayed the only evidence of collateral ligament rupture will be an increase in widening of the joint produced by the appropriate valgus or varus strains.

FINDINGS

Our study showed 4 patients (2.4%) with collateral ligament tears. A study by Butt and McIntyre(1) had 4.7% of patients with tears of the collateral ligaments. This difference possibly explained in the overview by delayed arthrographic examinations.

OVERVIEW

A popliteal cyst is an abnormal distention of the gastrocnemius - semimembranous bursa. Connection with the knee joint is reported in 50% of cadaveric knees (Wilson et al 1938) and in 65% of excised cysts (Buileson et al 1958) (19). Popliteal cysts are associated with various conditions like Rheumatoid arthritis, Gout, tears of the medial meniscus, Sjogren's syndrome, Reiter's syndrome, Ankylosing spondylitis, Gonorrhoea arthritis and knees containing calcific deposits.

Popliteal cysts may be symptomless or clinically undetectable (Palmer, 1969)(19). They may cause pain and impinge knee function, may dissect into the calf, or may rupture. Normally, cysts disappear when the knee is extended, their synovial fluid being forced back into the joint space and suprapatella pouch (Russel et al 1978)(19).

The clinical presentation with cyst rupture, a large unruptured cyst and deep vein thrombosis may all be similar (Hall and Scott 1966). Ultrasonic B mode scanning has been used to demonstrate popliteal cysts (19) and further its ability to demonstrate cysts which do not fill in arthrography.

During arthrography, contrast medium is displaced into the suprapatellar pouch is compressed by the quadriceps muscle and its contents forced into the posterior part of the joint.

Sometimes, contrast material may not move posteriorly adequately to outline a cyst, particularly when patient co-operation is compromised by pain or when communication between the knee joint is obstructed by loose bodies (Carpenter et al 1976).

Ultrasonography and arthrography are complementary techniques. Arthrography allows full visualization of the extent of synovial proliferation, and any extensions of the joint spaces important features when medical or surgical synovectomy is being considered.

FINDINGS

In our study 31 patients (18.2%) had a Baker's cyst diagnosed on arthrography. A study by Butt and McIntyre(1) showed 17% of patients had Baker's cysts. A study by Gompel(14) showed 18% of patients had Baker's cysts on arthrography.

The results in our study are comparable with other studies, and show a high accuracy rate.

LOOSE BODIES

OVERVIEW

A loose body can be due to subchondral fractures, fragmentation of the menisci with calcification, osteochondritis dessicans, (post-traumatic necrosis), degenerative joint disease with detached spur, synovial osteochondromatosis and totally torn fibrosed anterior cruciate ligament. (13).

FINDINGS

Loose bodies were found in 5 patients (3%) compared with 10% in a study by Butt and McIntyre.(1)

A study done by Part Aichrth on 200 patients at the Royal National Orthopaedic Hospital with osteochondritis dessican showed 75% of the lesions occurred in the classical site on the lateral edge of the medial femoral condyle, 10% on the inferocentral surface of the medial femoral condyle, and 13% on the inferocentral surface of the lateral condyle. More than 60% of these patients were classified as excellent or good athletes (32).

DISCOID MENISCUS

OVERVIEW

An abnormally large, elongated menscus is necessary for arthrographic diagnosis of this entity. A familiar relationship has been suggested. Kaplan(18) reported that subjects with discoid menisci are born without the normal posterior attachments by the ligaments of Humphrey and Wrisberg and this retards the normal backward movement of the posterior horn. This part of the menisci is then subject to repetitive trauma and likely to become thickened and hypertrophic and ensure a discoid form. The meniscus body is also thickened and assumes parallel surfaces rather than a wedge shape.

FINDINGS

4 patients (2.4%) in this study had discoid menisci. They were all young patients ranging from 6 - 15 years. The incidence of medial and lateral discoid menisci in this study was equal.

These results are comparable with a study by Butt and McIntyre where 3% of patients had discoid menisci. They reported a higher incidence of lateral discoid menisci.

A study by Hall(18) showed the incidence of discoid lateral meniscus 2.7% . The average patient age was 34. Two thirds of the patients were male. No cases of discoid medial meniscus were encountered.

OVERALL ACCURACY OF DOUBLE CONTRAST ARTHROGRAPHY

COMPARED WITH ARTHROTOMY

FINDINGS

The results show an accuracy of 90.5% achieved by double contrast knee arthrography as compared to results at arthrotomy. Sachs et al (1940) reported an 86.5% diagnostic accuracy using oxygen alone. Using the double contrast technique Ricklin et al achieved a 95% accuracy, but they emphasised that the examiner must have gained experience in both technique and interpretation before maximum accuracy is achieved.

In the first 100 cases examined in the Nottingham unit, the accuracy was 69% as judged on operative findings and clinical progress in the third 100 cases an accuracy of 84% was achieved.

Since arthrography became available at The Hospital for Special Surgery in 1963 (32), more than 3000 arthrographic examinations of the knee have been performed with preoperative diagnostic accuracy of approximately 90%.

A study by De Semet(7) on 475 consecutive double contrast knee arthrograms showed an accuracy of 95% for both medial and lateral menisci although the specificity for lateral tears was only 0.64.

CONCLUSIONS

1. Knee pathology was found affecting all age groups including the paediatric age group. The most common pathology in the paediatric age group being discoid meniscus. The commonest age group requiring arthrographic examination was the 20-30 years age group. The mean male age was 31 years and mean female age 34 years.
2. The left and right knees were equally affected without any preference.
3. The most common knee derangement for which patients had arthrography was a tear of the medial meniscus posterior horn.
4. An accuracy of 90.5% of double contrast knee arthrography in diagnosing derangement of the knee makes arthrography an accurate tool for orthopaedic surgeons.

RECOMMENDATIONS

In the absence of the newer non-invasive imaging modalities like MRI, use of arthrography in the radio diagnosis of knee derangements is recommended.

However, arthrography is an invasive procedure and patient selection must be thorough. The introduction of stress views for depicting cruciate ligament injuries is recommended in future arthrographic examinations.

Once Kenyatta National Hospital acquires the appropriate equipment, the introduction of Double Contrast knee arthrograms to the hospital would enable the Orthopaedic Surgeon make a firmer decision whether surgical intervention is necessary.

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APPENDIX
DATA COLLECTION FORM

Name of Patient:
Surname Other names

Hospital Number:

Date of Examination:

Name of referring Doctor:

Patients Clinical Presentation:

a) Age:

b) Sex:

c) Symptoms and their duration:

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.....
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d) Clinical signs:

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e) Clinical Diagnosis:

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f) Right or Left Knee:

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DATA COLLECTION FORM

History and Type of Trauma:

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Arthrogram Report (Double Contrast):

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.....
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Findings at Arthrotomy:

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