

DECLARATIONS:

CANDIDATE:

This thesis is my original work and has not been presented for a degree in any other University.

Signed: *And Chen*

DR. C.P.A. NYAKINDA, MBChB (NAIROBI)

SUPERVISOR:

This thesis has been submitted for examination with my approval as University Supervisor.

Signed: *Mulimba* *28/11/88*

MR. J.A.O. MULIMBA, MBChB (NAIROBI), MMed. (NAIROBI),
FRCS

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(iii)

SUMMARY

A study of septic arthritis at Kenyatta National Hospital was done in two stages:- First, a retrospective study was carried out by reviewing files of patients, then a prospective study of patients was done. The retrospective study was of patients seen between July 1980 and July 1984. The prospective study was of patients seen between July 1984 and July 1985.

A total of 87 patients were studied. Of these, 42 were retrospective cases and 45 prospective cases.

The data was obtained from the hospital records, wards and orthopaedic clinic.

Septic arthritis was found to be common in children below the age of 5 years who accounted for 37% of the total number of patients studied. Male to female ratio was noted to be 21:8. 45 per cent of the patients studied presented with a history of trauma with or without evidence of trauma. The knee joint was the most commonly affected joint accounting for 35 per cent of all the affected joints.

The commonest bacterial strains isolated from the synovial fluid aspirated from the affected joints were:- staphylococcus aureus accounting for 35%, gram negative organisms of which klebsiella species comprised 12%, salmonella species comprised 11% and proteus species 11% of all the bacterial strains isolated.

Most staphylococcal strains isolated were sensitive to erythromycin, septrin, aminoglycosides and minocycline and very few strains were sensitive to ampicillin and penicillin G.

Most gram negative organisms isolated were sensitive to amikacin and gentamycin and sensitivity to kanamycin was found to be inferior to that of either gentamycin or amikacin.

Good immediate results were noted in 84% of patients by arthrocentesis and specific antibiotics while in those treated by arthrotomy or surgical toilet and specific antibiotics, good immediate results occurred in 58% of the patients. A word of caution here is that most patients subjected to surgery were those with advanced disease in whom joint destruction had set in, or those with infected traumatic wounds, and these factors affected the immediate outcome of the treatment instituted.

It is recommended that attempt should be made to arrive at early diagnosis before joint destruction ensues and specific antibiotics of correct dosage and for long enough duration be given together with adequate drainage and splintage or traction.

CHAPTER I

INTRODUCTION

DEFINITION: ARTHRITIS -

The term arthritis means inflammation of a joint. It has been applied generally to all inflammatory as well as degenerative conditions (best termed arthroses) affecting joints.

SEPTIC ARTHRITIS

SYNONYM S: SUPPURATIVE ARTHRITIS

PYOGENIC ARTHRITIS: is a specific form of arthritis (joint inflammation) caused by infection of a joint by pus forming organisms. The condition which is usually of rapid onset requires early effective treatment to prevent serious joint destruction.

AIMS OF THE STUDY

Having worked in a large provincial hospital, a remote district hospital in Kenya and at the orthopaedic unit at Kenyatta National Hospital, it became apparent to me that septic arthritis, a disease that commonly afflicts the younger generation causes considerable disability in those affected. This observation stimulated me to carry out the present study.

The main purposes of the study were:-

1. To assess the age distribution and mode of presentation of the disease.
2. To assess the microbiological pattern.
3. To evaluate the immediate outcome of the various modes of management and ascertain the adequacy of aspiration with antibiotics treatment as a form of management.

CHAPTER II

REVIEW OF LITERATURE

HISTORICAL PERSPECTIVE

Records from Egyptian Museum specimens¹⁸ indicate that arthritis has afflicted man since ancient times. Tetanus infection is recorded in early Egyptian literature²⁷. Surgical infection was a puzzle to the ancient surgeon and remains a problem to the modern surgeon. Hippocrates described signs of suppuration and wound healing many years ago, and several early workers demonstrated that suppuration could be controlled and wound healing achieved by:-

- (i) employing aseptic techniques in surgery
- (ii) use of antiseptics
- (iii) use of antibiotics.

The use of antiseptics dates back to biblical times or even earlier as exemplified by the blind practice of pouring oil and wine on wounds and bounding it²⁷ (Luke 10:33, 34). This practice demonstrates that the antiseptic property of alcohol was recognized by laymen long before it was discovered by doctors to be a potent antiseptic.

In more recent times, Lister (1867) applied antiseptics on infected wounds and managed to control infection in patients with compound fractures. Lister's antiseptic methods in surgery were displaced within the next two decades by aseptic surgery practiced by Von Bergmann in Berlin and later perfected by Oliver Wendel Holms and Semmel Weis in 1940's²⁷. Robert Lawson Tait in 1970's by combining Lister's antiseptic methods and aseptic techniques managed to reduce the incidence of puerperal sepsis to 1%.

The antibiotic era emerged when Fleming in 1929 discovered the bacteriocidal effect of penicillin²³. This was later followed by the demonstration of therapeutic value of sulfanilamide by Domagk and Trefouel²³ 1935. These measures have enabled surgeons to control surgical infection considerably.

Newman³⁵ (1976) in his review of septic arthritis throughout the antibiotic era found that the incidence of the disease has not changed much despite use of antibiotics although more cases are being seen among the elderly. The microbiology pattern was also noted to have remained the same with staphylococcus aureus being the commonest causative organism. Badgley et al (1936)⁹ reported a substantial mortality arising from septic arthritis (12%) and in spite of widespread use of very potent antibiotics, more recent figures indicate continuing high mortality from septic arthritis³⁵.

AETIOLOGY^{5, 33, 35, 36}

Joint infection may arise as a result of invasion of a joint by various infective agents such as bacterial organisms including mycobacterium tuberculosis, viral organisms and fungal organisms.

The present study is concerned with joint infection caused by pus forming (pyogenic) organisms. Tuberculosis of joints and viral infections of joints have been excluded.

Bacterial organisms which commonly cause septic arthritis include the following in order of frequency:-

- staphylococcus aureus
- streptococcus pyogenes
- staphylococcus albus
- streptococcus pneumoniae

haemophilus influenzae
neisseria gonorrhoeae
pseudomonas aeruginosa
escherichia coli
proteus mirabilis
klebsiella species
salmonella species
bacteroides fragilis

Fungal organisms causing pyogenic arthritis include the following:-

candida species
cryptococcus neoformans
blastomyces dermatidis
histoplasma capsulatum
coccidioides immitis
aspergillus fumigatus
sporothrix schenckii
actinomyces israelii (anaerobic bacterium)

The above listed organisms reach the joint through three distinct routes.

- (a) Haematogenous spread from a focus remote from the affected joint.
- (b) Direct introduction through a wound.
- (c) Direct spread from juxta articular focus usually in bone.

In fungal infections, the joint is usually affected by spread from an adjacent bone which has been the seat of chronic osteomyelitis.

RISK FACTORS

The disease is more common in the younger age groups. A large number of patients suffering from septic arthritis have no demonstrable predisposing factor making them more susceptible to joint infection, but some have definite risk factors making them unable to mount adequate defence against invading bacteria. It has been noted that a critical bacterium inoculum of 10^6 organisms per gram of body tissue is required in order to develop wound infection (Irvin)²⁸ (Gilmore)²³. If this figure is exceeded in an individual with normal body defences and especially if the invading organism has a higher pathogenicity, joint infection ensues, on the other hand, joint infection may occur with a lower number of pathogenic organisms deposited in a wound if the individual has impaired immunity (Stephen)³⁸.

Some of the risk factors associated with septic arthritis are:- Trauma or surgery, chronic illnesses such as diabetes mellitus, sickle cell disease, corticosteroid therapy, cytotoxic therapy and immunosuppressive therapy. Also pre-existing joint disease such as rheumatoid arthritis, extra articular disease such as osteomyelitis may predispose a patient to septic arthritis.

PATHOLOGY^{6, 40}

The causal organism, having gained entry into a joint through one of the three routes mentioned above spreads through the joint. When synovial membrane is invaded, the joint responds by an out pouring of fluid with a high leucocyte count - especially the polymorphonuclear neutrophils. Joint destruction is the inevitable sequelae of untreated or inadequately treated infected joint. Three different mechanisms are responsible for joint destruction - normally:-

- (i) Leucocytes which are abundant in the synovial fluid when the synovium is invaded by bacteria release proteolytic enzymes which destroy articular cartilage.

- (ii) Staphylococcus which is commonly implicated as causal organism in septic arthritis produce staphylokinase - an enzyme capable of activation of plasminogen to produce a protease which destroys the protein chondroitin sulphate complex of the matrix.
- (iii) Intra articular pressure resulting from copious outpouring of synovial fluid, bacteria dead and alive plus necrotic tissue and inflammatory cells leads to ischaemic necrosis of soft tissue within the joint cavity, the surrounding soft tissues and bone.

If the joint is not drained in good time, the intra articular pressure builds up until the joint capsule burst releasing pus into the particular soft tissues. The infection also extend into the adjacent bone causing Osteomyelitis.

The eroded cartilage heals with fibrosis or if the cartilage is completely destroyed, the regeneration occurs with complete bone union causing bony ankylosis (see appendix e).

CLINICAL FEATURES

The disease commonly affects children^{6, 33, 35}. The main presenting features are acute onset of joint pain, fever, pseudoparalysis. The joint is swollen, shiny, hot and very tender. Joint movement is markedly restricted. There is also erythema and evidence of fluid in the joint. Atypical presentation may occur when antibiotics are used prior to diagnostic aspiration.³³

INVESTIGATIONS

The investigations carried out in order to arrive at a diagnosis of septic arthritis include:-

1. Aspiration:

A positive gram stain from synovial fluid or a positive joint fluid culture is truly diagnostic of septic arthritis. Accumulation of pus occurring in non-specific arthritis may be misdiagnosed as septic arthritis, but in this condition, the pus obtained yields no growth on culture. Use of non-specific antibiotics before aspiration of an infected joint may lead to a false negative culture in a case of septic arthritis.

2. Blood cultures and other fluids:

Bacterial organisms causing septic arthritis may be recovered from blood and other body fluids. Molteni³⁶ reported 25% of the blood cultures positive for the offending organism and in the same series, 50% of the synovial fluid cultures were positive.

3. In septic arthritis, erythrocyte sedimentation rate and white blood cell count are raised, but these are non-specific.

4. Radiology³⁶

The main radiological features found in specific arthritis include:-

- (a) Soft tissue swelling noted in early stages as well as in later stages of the disease.
- (b) Widening of joint space noted in early stages.
- (c) Osteomyelitis is noted in the later stages of the disease unless the joint infection is secondary to a previous bone infection.
- (d) Subluxation and joint dislocation commonly seen in the hip joint occurs when there is a delay in evacuating pus from the affected joint.

- (e) Ankylosis is a later sequelae of septic arthritis.

DIFFERENTIAL DIAGNOSIS

The list of conditions causing joint inflammation (arthritis) is formidable. A modified version of the classification of the American Rheumatism Association (1958)¹⁸ attempts to classify all the conditions causing arthritis. Of these, the conditions which closely simulate septic arthritis are⁴⁰ :-

- (i) Rheumatic fever: In this condition however the pain is less severe and relieved by large doses of salicylates. The other signs of rheumatism may be found.
- (ii) Acute non-suppurative arthritis: In this condition, the general illness is less and local signs are less severe.
- (iii) Haemarthrosis: There is history of injury and the patient is not very ill.
- (iv) Acute osteomyelitis: This is another condition which although not a joint disease may simulate septic arthritis, but in this condition, most tenderness occurs over the affected bone and joint movement is permitted to some extent.
- (v) Haemophilia: This is a sex linked recessively inherited bleeding disorder occurring commonly in males. The defect in haemophilia is an absence of antihæmophilic globulin (factor 8), and this results in defective clotting. The condition manifests in early childhood with prolonged bleeding from cut wound, mucus surfaces and sometimes bleeding into the joints after trivial trauma. Bleeding into joints leads to a painful swollen joint with restriction of movement. Differentiation of this condition from septic arthritis rests on a proper history which may reveal that immediate relatives also suffer bleeding tendencies and that the patient has

been noted to bleed excessively from minor cut wounds. Investigations reveal defective coagulation mechanism which is corrected by administration of factor 8.

MANAGEMENT

The immediate treatment of septic arthritis is evacuation of pus from the affected joint either by aspiration or formal incision and drainage. The latter is resorted to if the pus is too thick to be aspirated or if the hip joint is involved.

The instillation of antibiotics into the affected joints after aspiration has been advocated by many workers but since the penetration of most antibiotics into the inflamed joint is good (Garròd et al)¹⁹, all that is required is adequate drainage and parenteral antibiotics for several weeks.

Since the joint affected by septic arthritis is usually very tender and articular cartilage damaged by proteolytic enzymes mentioned above, the limb should be rested in a splint or by means of traction in the case of lower limbs. This relieves muscle spasms and prevents traumatic damage of articular cartilage.

After the acute illness has subsided and the joint no longer painful or warm, gentle and gradually increasing movements are encouraged. The patient is allowed out of bed non-weight bearing. Gradually weight is taken and splints eventually discarded.

If there is evidence of damage to the articular cartilage, the splint is maintained with the joint in optimum position of function while awaiting ankylosis (Appley)⁴⁰.

CHAPTER III

MATERIALS AND METHODS

This is a prospective and retrospective study of 87 patients with septic arthritis seen at Kenyatta National Hospital Nairobi between JULY 1980 - JULY 1985.

The data for this study was obtained from the following sources:-

- (i) All adult wards and children's wards at Kenyatta National Hospital.
- (ii) Case notes obtained from the Medical records department.
- (iii) Theatre registration books for patients operated on.
- (iv) Laboratory reports obtained from the microbiology department.
- (v) The orthopaedic clinic at Kenyatta National Hospital.

Kenyatta National Hospital is located in Nairobi and is the country's referral centre as well as a teaching hospital. It handles all patients referred from provincial and district hospitals as well as mission hospitals.

Most of the patients included in the study were seen and followed up by the doctors working in the orthopaedic unit. Some patients who were initially treated in the medical and paediatrics units were subsequently referred to the orthopaedic clinic for follow up.

The study was conducted by drawing up a protocol which included all the information to fulfil the aims and objectives of the study. Proforma 'A' was for retrospective cases and proforma 'B' for prospective cases. See appendix "a" and "b".

The retrospective study period extended from July 1980 to July 1984. The prospective study covered the period extending from August 1984 to July 1985.

In the retrospective study, patients' files were examined and the relevant information recorded in proforma 'A'. In the prospective study, all the patients suspected to be suffering from septic arthritis were seen. The clinical history, relevant clinical findings and investigations were recorded in proforma 'B'. See appendix "a" and "b".

Pus culture

Diagnostic aspiration was carried out in all joints noted clinically to be tender, hot and with evidence of fluid in the joint. A septic technique was strictly observed during aspiration. The aspirated fluid was divided into two parts, some was put in a sterile container which was tightly closed and the remainder delivered in a sterile syringe with all air expelled and needle bent to ensure anaerobic environment. The specimens were delivered to the laboratory within 30 minutes of collection and subjected to direct microscopic examination and gram stain.

The specimen collected anaerobically was inoculated onto blood agar and cultured anaerobically in anaerobic jar, incubated at 37°C for 24 to 48 hours.

The specimens in sterile bottles were cultured aerobically and incubated at 37°C for 24 to 48 hours. After this period, the plates were examined and in those showing positive cultures, colonial morphology was noted. The organisms were then subjected to gram stain and microscopy and various biochemical tests.

Some of the specimen was sent for fungal culture carried out in sabouraud's dextrose agar, while some was sent for mycobacterial culture carried out on Lowenstein-Jensen medium if clinical history and physical examination was suggestive of tuberculosis infection.

Antibiotic sensitivity testing

All possible pathogenic bacteria isolated by the above procedure were subjected to antibiotic sensitivity testing. This was done by disc diffusion method (Garrod and Lambert 1981)¹⁹. Gram positive organisms were tests on 1/2 sensitivity discs and gram negative organisms on 2/2 sensitivity discs.

OTHER INVESTIGATIONS

Other important investigations carried out were:-

- (a) Radiological examinations carried out at the time of initial presentation and repeated after about two weeks. Results of some of the radiological changes noted during various stages of the disease are shown in appendix "c" to "f".
- (b) Synovial biopsy was performed in some patients who underwent surgery to evacuate pus from the affected joints especially if there was suspicion of tuberculosis infection.
- (c) Some patients presenting with polyarticular septic arthritis were subjected to immunological studies.
- (d) Sickling test and haemoglobin electrophoresis was performed on patients from the lake region and the coast.
- (e) Non-specific tests such as erythrocyte sedimentation rate and white blood cell count were carried out.

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CHAPTER IV

RESULTS

Eighty seven (87) patients were included in the study. Of these 45 patients (52%) were prospective cases and 42 patients (48%) were retrospective cases. The study period covered July 1980 to July 1985.

AGE AND SEX DISTRIBUTION

The disease was found to be more common in children under five years of age who accounted for 37% of the total number of patients studied. Males were affected more commonly than females - the male to female ratio being 21:8. The results are shown on table 1.

TABLE 1

AGE AND SEX DISTRIBUTION

AGE IN YEARS	SEX MALE	FEMALE	TOTAL	PERCENTAGE OF TOTAL
0 - 5	20	12	32	37%
6 - 10	10	2	12	14%
11 - 20	15	5	20	23%
20+	18	5	23	26%
TOTAL	63	24	87	100%

MALE PATIENTS NO. 62 (72%)

FEMALE PATIENTS NO. 24 (28%)

M:F RATIO IS 21:8

MODE OF PRESENTATION

All the 87 patients presented with history of pain and tenderness or tenderness noted by mother in infants. They also complained of swelling and inability to move the affected joint. Septic wound communicating with the affected joint following trauma was noted in 10 patients.

RISK FACTORS

Risk factors predisposing to septic arthritis were looked for. The results tabulated below (see table 2) show that history of trauma without evidence of trauma was noted in (21) 24% of the patients studied. Evidence of accidental trauma noted in 13 patients and iatrogenic trauma in 5 patients. 4 patients had focus of infection in bone, 2 patients had sickle cell diseases, 1 patient suffering from diabetes mellitus and malignant renal tumour developed septic arthritis.

In 38 patients, there was no risk factor identified.

TABLE 2

RISK FACTORS

RISK FACTOR	NO. OF PATIENTS	PERCENTAGE OF TOTAL
HISTORY OF TRAUMA WITH NO EVIDENCE OF TRAUMA	21	24%
EVIDENCE OF TRAUMA	13	15%
IATROGENIC TRAUMA	5	6%
FOCUS ON INFECTION IN BONE	4	5%
SICKLE CELL DISEASE	2	2%
DIABETES) MALIGNANCY)	1	1%
CHRONIC ARTHRITIS	2	2%
MALNUTRITION	1	1%
NO RISK FACTOR IDENTIFIED	38	44%
TOTAL	87	100%

PATTERN OF JOINT INVOLVEMENT

The disease affected only one joint in each patient in 75 patients (86%) and affected more than one joint in 12 patients (14%).

The knee joint was the most commonly affected joint accounting for 35% of all the joints affected followed by the hip joint which accounted for 27%.

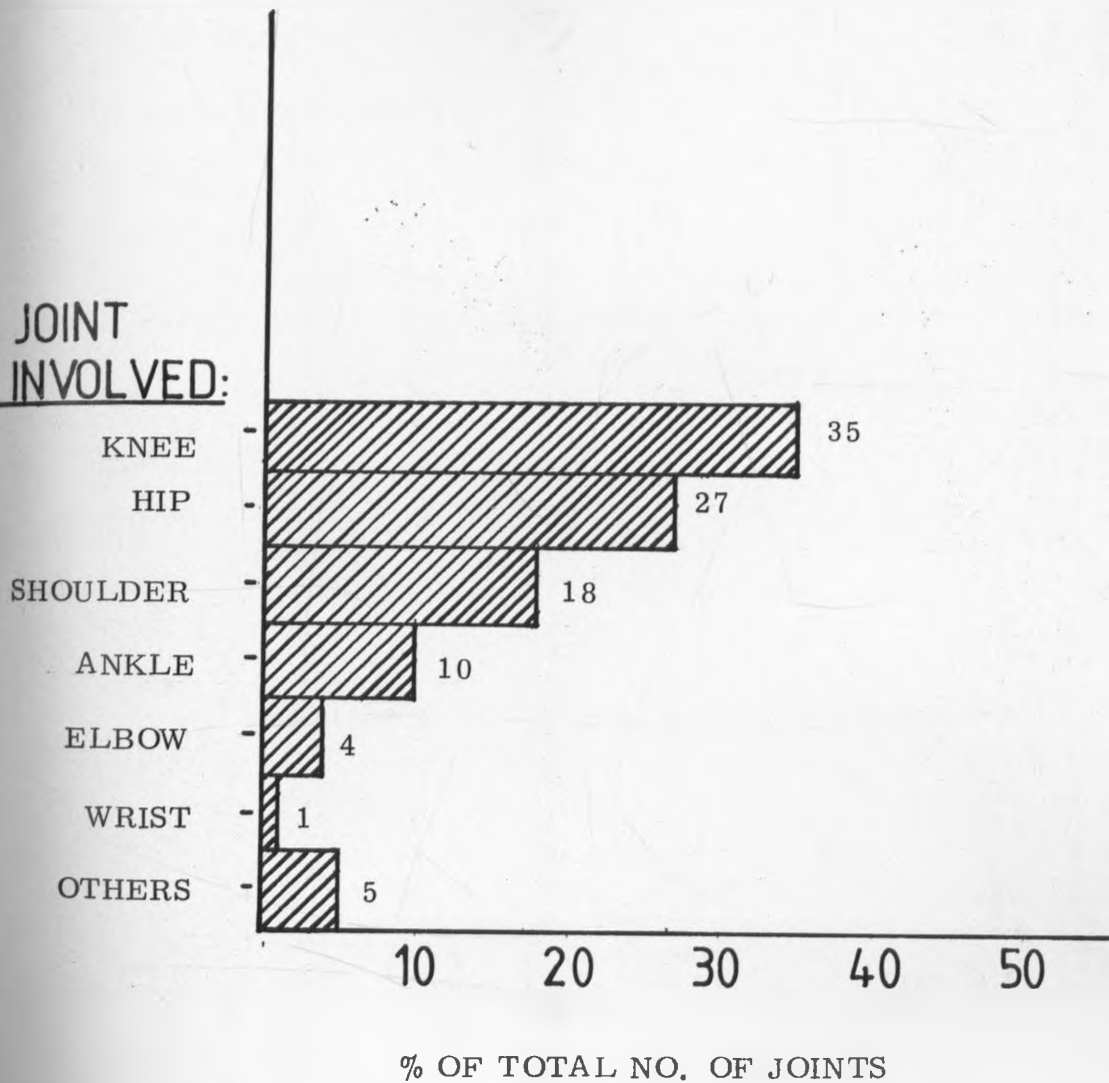
The least commonly affected joints were the wrist joint accounting for 1% and the small joints of hands and feet plus the vertebral joints accounting for only 5% of all the affected joints. The ankle joint accounted for 10% of all the joints affected, shoulder joint accounted for 18% and the elbow joint for 4% of all the joints affected. In total, 100 joints were affected by the disease in the 87 patients studied. See table 3 for table of pattern of joint involvement.

TABLE 3

PATTERN OF JOINT INVOLVEMENT

	<u>NO.</u>	<u>%</u>
MONOARTICULAR	75	86.2%
POLY ARTICULAR	12	13.8%
TOTAL	87	100 %
JOINT INVOLVED	NO.	% OF TOTAL
HIP JOINT	27	27%
KNEE JOINT	35	35%
ANKLE JOINT	10	10%
SHOULDER JOINT	18	18%
ELBOW JOINT	4	4%
WRIST JOINT	1	1%
OTHER JOINTS	5	5%
TOTAL NO. OF JOINTS	100	100%

HISTOGRAM SHOWING PATTERN OF JOINT INVOLVEMENT



DIAGNOSIS

Pathogenic bacteria were isolated from pus culture in 51 patients out of the 87 patients studied. In 23 patients, pus culture revealed no growth and in 13 patients, the diagnosis was based on clinical and radiological features. The results are shown on table 4.

Category	Number of Patients	Percentage
Pathogenic bacteria isolated	51	58.5%
No growth in pus culture	23	26.5%
Diagnosis based on clinical and radiological features	13	15%
Total	87	100%

TABLE 4

DIAGNOSIS

	NO.	% OF TOTAL
POSITIVE PUS CULTURE	51	59%
NEGATIVE PUS CULTURE	23	26%
DIAGNOSIS BASED ON CLINICAL AND RADIO- LOGICAL FEATURES	13	15%
TOTAL	87	100%

BACTERIAL AND FUNGAL STRAINS ISOLATED

In the 51 patients with positive pus culture, 71 bacterial strains were isolated and only one fungal strain was isolated. The bacterial strains isolated were all aerobic bacteria. Staphylococcus aureus was the commonest bacterial strain isolated accounting for (25) 35% strains out of the (72) isolated. The next commonest organism was klebsiella species accounting for (9) 12% of the total number of bacterial strains isolated. Other organisms were as follows: salmonella species 8 (11%), proteus species 8 (11%), citrobacter species 7 (10%), pseudomonas species 6 (8%), escherichia coli 4 (6 %), streptococcus pyogenes and acinetobacter calcoaceticus 2 organisms each 3%.

The above listed strains of micro organisms are shown in the table of bacterial strains shown :

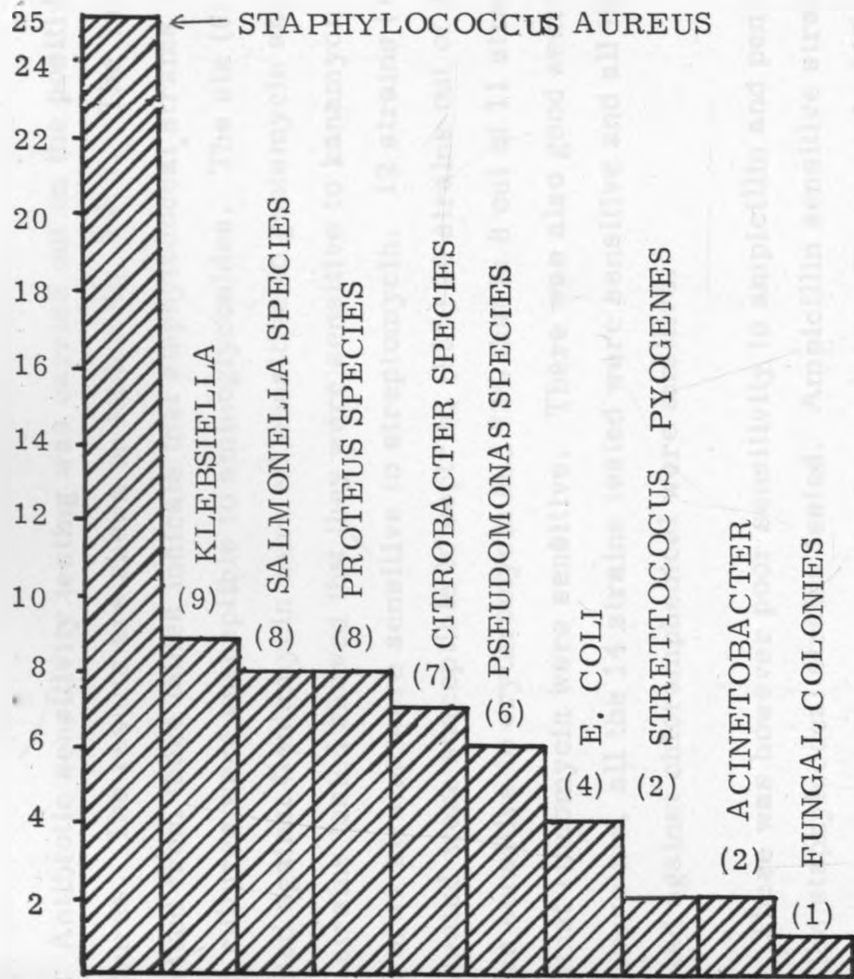
Organism	Number of Strains	Percentage
Staphylococcus aureus	25	35%
Klebsiella species	9	12%
Salmonella species	8	11%
Proteus species	8	11%
Citrobacter species	7	10%
Pseudomonas species	6	8%
Escherichia coli	4	6%
Streptococcus pyogenes	2	3%
Acinetobacter calcoaceticus	2	3%

TABLE 5

TABLE OF BACTERIAL/FUNGAL STRAINS ISOLATED

BACTERIAL STRAIN	NO. ISOLATED	% OF TOTAL
STAPHYLOCOCCUS AUREUS	25	35%
KLEBSIELLA SPECIES	9	12%
SALMONELLS SPECIES	8	11%
PROTEUS SPECIES	8	11%
CITROBACTER SPECIES	7	10%
PSEUDOMONAS SPECIES	6	8%
E. COLI	4	6%
STREPTOCOCCUS PYOGENES	2	3%
ACINETOBACTER CALCOA- LETICUS	2	3%
FUNGAL COLONIES	1	1%
TOTAL	72	100%

HISTOGRAM SHOWING (BACTERIAL) STRAINS ISOLATED FROM PUS
(BACTERIAL STRAINS ISOLATED FROM PUS CULTURE)



BACTERIAL SENSITIVITY PATTERN

Antibiotic sensitivity testing was carried out on the positive pus cultures. The results are shown on tables No. 6 & 7. The information derived from these tables indicate that staphylococcal strains isolated from pus cultures were susceptible to aminoglycosides. The six (6) strains tested against Gentamycin were all sensitive to gentamycin and all the four (4) strains tested showed that they were sensitive to kanamycin. (82%) 9 out of 11 strains were sensitive to streptomycin. 12 strains (75%) out of 16 tested were susceptible to septrin, (95%) 20 strains out of 21 tested were sensitive to erythromycin and 73% that is 8 out of 11 strains tested against lincomycin were sensitive. There was also good sensitivity to minocycline, all the 14 strains tested were sensitive and all the 15 strains tested against chloramphenical were sensitive.

There was however poor sensitivity to ampicillin and penicillin G - by the staphylococcal strains tested. Ampicillin sensitive strains accounted for only 25% and those sensitive to penicillin G were only 12%. The result of sensitivity to the various antibiotics by the staphylococcal strains is shown on table 6 .

TABLE 6

ANTIBIOTIC SENSITIVITY PATTERN

: STAPHYLOCOCCUS AUREUS STRAINS

ANTIBIOTIC	NO. OF STRAINS TESTED	NO. OF SENSITIVE STRAINS	PERCENTAGE OF TOTAL
SEPTRIN	16	12	75%
ERYTHROMYCIN	21	20	95%
LINCOMYCIN	11	8	73%
MINOCYCLINE	14	14	100%
TETRACYCLINE	11	4	36%
CHLORAMPHE- NICOL	15	15	100%
GENTAMYCIN	6	6	100%
KANAMYCIN	4	4	100%
STREPTOMYCIN	11	9	82%
AMPICILLIN	20	5	25%
PENICILLIN G.	17	2	12%

Gram negative organisms sensitivity pattern

Three common strains of gram negative organisms were selected to illustrate the antibiotic sensitivity pattern exhibited by gram negative organisms. The organisms chosen were: klebsiella species, salmonella species and proteus species. The antibiotics chosen were: amikacin, gentamycin, kanamycin, streptomycin, ampicillin, septrin, and tetracycline. The results are shown in the table below (table No. 7).

From this table, it is evident that the highest sensitivity was noted in amikacin 100% sensitive and the lowest in ampicillin 17%. The next best sensitivity was noted in gentamycin 87%. Kanamycin and streptomycin were the poorest among the aminoglycoside group of antibiotics with sensitive organisms comprising only 57% and 32% of the strains tested respectively.

Susceptible organisms to septrin and tetracycline comprised 31% and 20% respectively. The results are shown on table 7.

Table 7

GRAM NEGATIVE ORGANISMS ANTIBIOTIC SENSITIVITY PATTERN

ANTIBIOTIC	NO. OF STRAINS TESTED	NO. OF STRAINS SENSITIVE	PERCENTAGE SENSITIVE STRAINS
AMIKACIN	15	15	100%
GENTAMYCIN	23	20	87%
STREPTOMY- CIN	22	7	32%
KANAMYCIN	21	12	57%
AMPICILLIN	24	4	17%
SEPTRIN	16	5	31%
TETRACY- CLINE	20	4	20%

MODE AND OUTCOME OF MANAGEMENT
EMPLOYED

Various modes of specific therapy were instituted in the 87 patients studied. It is noted that arthrocentesis and chemotherapy combined had good results in 16 out of 19 patients, surgery combined with chemotherapy good results in 31 out of 53 patients and in chemotherapy alone, good results were noted in 7 out of 15 patients. The results are shown in table 8 .

COMPLICATIONS

Complications were noted in 33 out of 87 patients studied. The commonest complications were joint ankylosis which was noted in 11 patients, persistent infection noted in 11 patients, joint dislocation (commonly noted in the hip joint) occurred in 7 patients. Other complications encountered were: unequal limb length 4 patients, deaths occurred in 4 patients. Table 9 outlines the various complications noted above.

TABLE 8

MODE AND OUTCOME OF MANAGEMENT EMPLOYED

MODE OF MANAGEMENT	NO. OF PATIENTS	GOOD RESULTS	PERCENTAGE OF TOTAL
CHEMOTHERAPY	15	5	47%
ARTHROCENTESIS AND CHEMOTHERAPY	19	16	84%
SURGERY (surgical toilet or arthrotomy) AND CHEMOTHERAPY	53	31	58%

TABLE 9

COMPLICATIONS

COMPLICATION	NO. OF PATIENTS
ANKYLOSIS	7
ANKYLOSIS AND DISLOCATION	3
ANKYLOSIS AND UNEQUAL LIMB LENGTH	1
DISLOCATION	4
PERSISTENT INFECTION	11
UNEQUAL LIMB LENGTH	3
DEATHS	4
TOTAL	33

CHAPTER V

DISCUSSION

Eighty seven (87) patients who were diagnosed as having septic arthritis and treated for this condition at Kenyatta National Hospital from July 1980 to July 1985 are discussed.

AGE AND SEX DISTRIBUTION

The commonest age group affected by this disease is the age group below five years accounting for 37% of all the patients studied. This compares well with the findings of Melvin³³ which indicated that children below six years of age accounted for 43% of the patients. Considering all age groups, the study shows that males were more commonly affected by the disease than females. Male to female ratio being 21:8. In the study by Melvin³³ mentioned above, there were 30 male patients and 21 female patients giving male to female ratio of 10:7.

MODE OF PRESENTATION

All the 87 patients studied presented with features of joint infection. The following symptoms were noted:- general malaise, pain and inability to move the affected joint, joint swelling, fever and erythema or infected wound communicating with the joint. Clinical examination revealed a tender, warm joint with marked restriction of movement. There was also swelling of the affected joint with evidence of fluid in the joint cavity. Septic wound communicating with the joint was noted in patients in whom joint infection was secondary to contaminated wounds penetrating into the joint space. 10 out of 87 patients studied had septic arthritis arising from penetrating wounds.

The characteristic signs of pyogenic arthritis may be masked by the use of non-specific antibiotics before attempting to reach a definite diagnosis (Melvin)³³. In new-born babies, there may be minimal evidence of joint infection apart from restriction of joint movements (Paterson)¹¹. Therefore, nurses and paediatricians being among the first people to get in touch with the new-born baby should be alerted of the possibility of septic arthritis in a new-born who presents with pseudoparalysis.

RISK FACTORS

Many workers have demonstrated that certain patients are more at risk of developing septic arthritis than others. Bellamy et al⁵ gives a list of conditions that may predispose a patient to septic arthritis. Included in the list are conditions such as trauma, chronic illnesses, chronic joint disease such as rheumatoid arthritis, corticosteroid treatment, immunosuppressive therapy, extra articular focus of infection and iatrogenic causes such as surgery. Deep intramuscular injections³⁴ have been noted to predispose patients to develop septic arthritis especially of the hip joint.

In the present study, trauma was the commonest risk factor predisposing the patients studied to septic arthritis. Occurring in 21 (24%) out of 87 patients noted in history but not confirmed by evidence of physical examination. 15 patients (15%) had either evidence of trauma with open wounds communicating with the joint or foreign body recovered from the affected joint or evidence of a scar overlaying the affected joint. 5 patients (6%) had septic arthritis arising from iatrogenic causes such as surgery or injection. No case was noted to have occurred following diagnostic joint aspiration. Ainscow² in a prospective study of 1112 patients done total joint replacement showed that the risk of haematogenous infection is very small.

Only three patients developed haematogenous infection at the site of joint replacement - among those who did not have skin infection. However he noted that of the 40 patients who had recurrent skin ulceration and infection, three developed haematogenous infection of the replaced joint. Irvin²⁸ has stressed the role of foreign body and haematoma in the causation of surgical infection. In one of the patients in this study, silk stitch was removed from an infected shoulder joint which subsequently healed following the exploration. In another patient, kirschner wires inserted to treat fracture neck of humerus lead to pyogenic arthritis of the shoulder joint and destruction of the head of humerus. Removal of the kirschner wires, the necrotic head of humerus and thorough drainage of the affected joint was followed by complete elimination of the infection, but the joint was destroyed and healed with marked limitation of movement - an eventuality which would have been avoided if the fracture had been treated conservatively!

Two of the patients in this series had sickle cell disease, one died of septicaemia despite repeated aspiration and antibiotic treatment. The patients with sickle cell disease documented in this study were those seen during the prospective study period. The low number of patients with sickle cell disease noted in the study may be due to the fact that they came with a diagnosis of sickle cell disease and even though they were found to have septic arthritis, this diagnosis was not recorded in the master index and therefore, they could not be traced in the records department. Sligman³⁸ has suggested that the increased susceptibility to infection in bone and joints by those suffering from sickle cell disease may be due to their decreased ability to activate alternate complement pathway secondary to low levels of factor D (C_3 proactivator convertase). Functioning classical and alternate pathway plus type specific antibody prevent blood bone bacterial infection. He has also shown that diabetics are more susceptible to infection because of decreased chemotaxis and that this can be improved by incubating patients white blood cells in insulin.

It is noteworthy that one of our patients who had a renal tumour and was also a diabetic developed septic arthritis of the shoulder joint which improved with aspiration, antibiotics and better control of blood sugar with no residual joint impairment.

PATTERN OF JOINT INVOLVEMENT

Most of the patients presented with monoarticular septic arthritis 86%. Only 14% had polyarticular septic arthritis. This conforms with the findings in most series. The knee joint was the most commonly involved joint, it was involved in 35% of all the joints involved followed by the hip joint accounting for 27% of all the joints affected by the disease. Wrist and elbow joints were the least affected joints. Molteni³⁶ in his series of 37 patients noted that septic arthritis of the knee occurred in 40% of cases followed by the hip joint 23% of all the cases, this compares well with the findings in the present study. Paterson¹¹ found that the hip was the most commonly involved joint in his series of 96 patients with suppurative arthritis followed by the knee and elbow. The high frequency of involvement of the knee joint in this study may be due to its being more prone to trauma than other joints being more exposed.

DIAGNOSIS

The diagnosis of septic arthritis especially in the initial stages when specific treatment may yield good results can be difficult. In this study, the criteria for diagnosis which was adopted closely resemble that used by Newman (1976)³⁵. In his series of 137 patients, he isolated organisms from synovial fluid in 69% of the patients, our series had 59% positive synovial fluid cultures (see table 4). He had turbid synovial fluid with growth in 16% of the patients and in 7% of the patients, he based his diagnosis on histology or radiological evidence of infection. In the present study, 26% of the patients had purulent synovial fluid aspirate in which no organism was isolated. The high percentage of negative pus culture may be due to the frequent use of antibiotics before taking specimens for culture and sensitivity. Mulimba (1983)³⁴ noted that all the patients in his series who had septic arthritis with joint dislocation arising from injection osteomyelitis had negative pus cultures. Molteni³⁶ (1978) in his series of 32 patients found positive pus cultures in 16 (50%) of the patients studied. 9 patients in the latter series had received antibiotics prior to diagnostic aspiration in these, pathogenic organisms were isolated in pus cultures of 5 patients.

The above findings demonstrate that administration of antibiotics before taking specimen for culture and sensitivity prevents establishment of definitive diagnosis.

BACTERIAL STRAINS ISOLATED

Organisms isolated from the 51 patients with positive pus cultures consisted of

71 bacterial strains and

1 fungal strain

Total 72 organisms isolated.

The commonest organism isolated from pus cultures was staphylococcus aureus accounting for 25 strains (35%). Many studies have reported a

similar finding.^{20, 11, 33, 35} These studies also indicate that gram negative organisms only account for a small percentage of bacterial strains isolated from the synovial fluids of septic arthritis patients. The present study however indicate that of the 10 different strains of micro-organisms isolated from pus cultures, 44 were gram negative organisms, accounting for 61% out of the 72 (100%) strains isolated.

Malenga (1981)³¹ studying bacterial infections in neonates at Kenyatta National Hospital Nursery noted that gram negative organisms were the commonest cause of neonatal infection. Klebsiella and E. coli being the strains most commonly isolated. Although the study mentioned above was not devoted to septic arthritis, its findings reflect the microbiological pattern encountered in children at Kenyatta National Hospital which as a result of haematogenous spread will affect the joints with increasing frequency.

Fungal infection was diagnosed in one patient who presented with persistent joint infection despite previous surgery and chemotherapy. The fungal colonies were identified on histology - colonies seen resembled actinomyces species. Bates⁴⁰ et al reported a case of candida osteomyelitis and arthritis following hyperalimentation therapy. Other series listed here have not reported fungal colonies as being causative organisms in septic arthritis.

BACTERIAL SENSITIVITY PATTERN

Antibiotic sensitivity testing was carried out for both gram positive strains and gram negative strains. The results of antibiotic sensitivity for the common bacterial strains are discussed.

The commonest gram positive strain was staphylococcus aureus. Antibiotic sensitivity pattern for this organism is shown on the result table number 6. From the table, it is apparent that the staphylococcal strains isolated were most susceptible to aminoglycosides especially gentamycin and kanamycin 100% sensitive strains noted, less so to streptomycin - sensitive strains being 82%. The other antibiotics to

which the strains isolated were most susceptible include minocycline - 100% sensitive, chloramphenicol 100% of the organisms sensitive, erythromycin 95% of the organisms sensitive, septrin 75% of the organisms sensitive and lincomycin 73% of the organisms sensitive.

The poorest sensitivity was noted when the organisms were tested against penicillin G - 12% of the organisms tested were sensitive and only 25% of the organisms tested against ampicillin were sensitive. These findings are comparable with observations made by Malenga³¹ and Newman et al (1976)³⁶. Newman noted a rise in the number of staphylococcal strains resistant to penicillin from 29% in the period 1944 - 1953 to 59% between 1964 - 1973.

The gram negative organisms included in the discussion were klebsiella species, salmonella species and proteus species since they were the three most common gram negative organisms isolated from pus cultures. The results of their combined antibiotic sensitivity are shown on table 7. These organisms were noted to be most susceptible to amikacin - 100% of the organisms tested being sensitive, gentamycin 87% of the organisms tested were sensitive, but less susceptibility to kanamycin and streptomycin was noted.

The least susceptibility was noted against ampicillin in which only 17% of the strains tested were sensitive followed by 20% noted in tetracycline. These findings confirm the observation by Malenga³¹.

MODE AND OUTCOME OF MANAGEMENT: (TABLE 8)

Table 8 outlines the various types of specific therapy offered to the patients studied. Chemotherapy (antibiotics treatment) was provided to 15 patients (17%). 19 patients (about 22%) were managed by aspiration and chemotherapy. 53 patients (61%) were managed by arthrotomy or surgical toilet.

The results of the above modes of management as outlined in the table show that in 54 patients (62%) the immediate results were good but in 33 patients. Good results were observed in 84% (16) patients treated by arthrocentesis (aspiration) and specific antibiotics while in those managed by surgery, good results were seen in 31 patients (58%). The ~~last~~ satisfactory results were noted in patients treated by antibiotics alone without any joint drainage in which only 7 (47%) out of 15 patients had immediate good results.

From these figures, it appears that arthrocentesis and specific antibiotics is superior to surgery, but these apparent good results may have been due to the fact that those subjected to arthrocentesis were the patients who presented early, the definitive diagnosis was made early from synovial fluid culture report and specific antibiotics administered in time before irreparable joint damage occurred.

Whereas those subjected to surgery comprised a majority of patients coming later with established infection and joint damage already in progress. A number of patients with open wounds communicating with the affected joints were also subjected to surgical toilet - a factor which must have contributed to the apparent immediate poor results when the two methods of management were considered. Baynum¹³ in a ten-year review of 12 children and 24 adults with acute haematogenous pyogenic arthritis found arthrocentesis to be ineffective. Melvin et al³³ found that the incidence of complications, except for pathological dislocation of the hip, was about the same whether the patient was treated by specific antibiotics or incision and drainage following diagnostic aspiration. Raff³² found that arthrocentesis and specific antibiotics if carried out during the early stages of the disease prevented joint destruction. These observations indicate that both surgery and arthrocentesis have a place in the management of septic arthritis, the latter being useful if it is instituted early and combined with specific antibiotics.

COMPLICATIONS

Complications occurred in 33 (38%) out of a total of 87 patients. The various complications encountered included:

Persistent infection in the affected joint, joint dislocation, ankylosis of the affected joint(s), unequal limb length and death. The results represented in the table below indicate that joint ankylosis and persistent joint infection were the commonest complications encountered. These occurred in 11 patients 33% respectively. Joint dislocation occurred in 7 patients (21%) and unequal limb length in 4 patients (12%). Deaths occurred in 4 patients (12%). Some patients had multiple complications that is ankylosis and dislocation occurring in 3 patients and ankylosis and unequal limb length in 1 patient.

Two out of the four (4) deaths occurred in patients treated by aspirations, 8 out of 11 patients with ankylosis were treated by surgery and 1 by aspiration and antibiotics, the remaining 2 patients were treated with antibiotics alone.

Badgley⁹ reported 34 (30%) patients out of a total number of 113 patients who had septic dislocation of affected joints. The present study had less septic dislocations compared with those of Badgley 7 out of a total of 87 patients.

Melvin³³ reported pathological dislocation in (16%) 8 patients out of a total of 51 patients studied, a figure which is higher than that found in the present study. Other complications reported in the study by Melvin³³ are: spontaneous ankylosis occurring in 4 patients, subsequent osteomyelitis 20 patients. Death due to septicaemia was noted in 8 patients accounting for 16% of all the patients studied. Deaths in the present study were lower than those recorded above occurring in (5%) of patients out of 87 patients studied. Two of the deaths occurred in those treated by aspiration and antibiotics. However, in one patient who was a known case of sickle cell disease with thick pus and multiple joint

involvement, aspiration and antibiotics although instituted because of the poor general condition of the patient, this was not the best mode of management and perhaps arthrotomy would have yielded better results.

CHAPTER VI

CONCLUSION

Based on the findings in the present study, the following conclusions can be made:

- (1) That septic arthritis at Kenyatta National Hospital affected children more commonly than it does affect adults, and males more than females.
- (2) That staphylococcus aureus is the commonest causative organism followed by gram negative organisms, the three commonest ones being klebsiella species, salmonella species and proteus species.
- (3) That most of the staphylococcal strains isolated were susceptible to the aminoglycosides, minocycline, lincomycin, erythromycin and septrin, and very few were susceptible to penicillin G. and ampicillin. On the other hand, gram negative organisms isolated exhibited marked susceptibility to amikacin and gentamycin and least susceptibility to ampicillin.
- (4) That the results of arthrocentesis and specific antibiotics treatment, arthrotomy and antibiotics treatment are superior to chemotherapy alone.

RECOMMENDATIONS

The following recommendations are made:

- (1) An attempt at prompt establishment of the diagnosis of septic arthritis by arthrocentesis before starting antibiotics treatment.

- (2) Prophylactic use of ampicillin and penicillin G. should be discouraged,. Instead, while awaiting culture and sensitivity results, suspected cases of septic arthritis should be treated by antibiotics to which most strains of bacteria found in septic are susceptible. Examples of appropriate prophylactic antibiotics are:-

For gram positive organisms, lincomycin and minocycline are suitable.

For gram negative organisms, gentamycin and amikacin are suitable. A word of caution here is that these are not the only suitable prophylactic antibiotics as can be deduced from the table 6 and 7 above.

- (3) Arthrotomy be employed in treating septic arthritis of the hip joint because of the possibility of septic dislocation when the joint is distended with pus and also in all cases where the pus is so thick that it cannot be adequately drained by aspiration.

APPENDIX

APPENDIX "a"

PROFORMA A: (RETROSPECTIVE STUDY)

SEPTIC ARTHRITIS AT K. N. H.

NAME	IP/OP No.	AGE	SEX
		(At onset of disease)	

1. PRESENTING SYMPTOMS:

- Any predisposing factors -----

2. SIGNS AT FIRST EXAMINATION - Joint(s) affected

- Swelling
- Erythema
- Restriction of movement

3. PROGRESS OF SIGNS AND SYMPTOMS

4. INVESTIGATIONS (i) Lab. Results - Microbiology -

- Pus) anaerobic c/s
-) aerobic c/s
-) Fungal c/s
-) AFB c/s

Blood - c/s

Haemogram - ESR -----

- WBC total of differential

- Sickling test ----- if indicated.

Synovial Biopsy

(ii) Radiology (a) X-ray latest - No. -----

(b) X-ray Report -----

TREATMENT (a) Antibiotics ----- Duration -----

6. CLINICAL FOLLOW UP (a) Progress -----

(b) Complications -----

APPENDIX "b"

PROFORMA "B" (PROSPECTIVE STUDY)

A STUDY OF SEPTIC ARTHRITIS AT K.N.H.

NAME	IP/OP NO.	AGE
		SEX

I. PRESENTING SYMPTOMS:

- History of recent trauma e. g. thorn prick -

II. SIGNS OF FIRST PRESENTATION -

- Fever -----

- Restriction of movement -----

- Swelling -----

- Joint(s) involved -----

- Evidence of resent trauma -----

- Others - specify -----

III. PROGRESS OF SIGNS AND SYMPTOMS

IV. INVESTIGATIONS:

(i) Laboratory Results (a) Microbiology (- Urine examination - L-----

(- Pus for c/s

- anaerobes

- aerobes

- Fungal organisms -----

- atypical mycobacteria

(b) Haematology - Haemogram ESR -----

(c) Synovial biopsy - report (for cases operated
on only)

(ii) RADIOLOGY: Latest X-RAY NO. -----

X-RAY REPORT -----

V. TREATMENT (a) Chemotherapy ----- Duration -----

(b) Aspiration and antibiotics

(c) Arthrotomy and irrigation

VI. CLINICAL FOLLOW UP - PROGRESS -----

COMPLICATIONS: -----

APPENDIX "c"

PLATE 1 a



a - initial radiograph showing soft tissue swelling and increased joint space

APPENDIX "c"

PLATE 1b



b - Radiograph taken after (2) two weeks showing bone changes around the ankle joint.

APPENDIX "d"

PLATE 2a



Acute septic arthritis of the shoulder joint in a child showing increased joint space and disappearance of head of humerus.

APPENDIX "d"

PLATE 2 ^b



Septic arthritis of the shoulder joint in a child showing sparing of head of humerus.

APPENDIX "e"

PLATE 3



A patient presenting late to Orthopaedic Clinic Kenyatta National Hospital. Initially managed at a peripheral Hospital by antibiotics without joint drainage. Knee joint is completely ankylosed.

APPENDIX "f"

PLATE 4



Septic arthritis of the hip joint causing joint dislocation.

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