ENDOCERVICAL MICROBIAL PATTERN, ANTIBIOTIC SENSITIVITY AND COMPLICATIONS SEEN WITH SEPTIC ABORTION AT KENYATTA NATIONAL HOSPITAL IN 2018.

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A dissertation submitted as a part of fulfilment for the award of degree of master's of medicine in Obstetrics and Gynaecology, at the University of Nairobi.

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DECLARATION

I hereby declare that this research proposal is my own work and has not been accepted for the award of any other degree or diploma at the University of Nairobi or any other educational institution.

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DEDICATION

Dedicated to my family for their continued support and encouragement.

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ABBREVIATIONS AND ACRONYMS

SDG - Sustainable Development Goals

M/C/S - Microscopy Culture Sensitivity

ECS - Endocervical

KDHS - Kenya Demographic Health Survey

KNH – Kenyatta National Hospital

SPSS - Statistical Package of Social Science

RCTs – Randomized Control Trials

WHO – World Health Organization

Spp - Species

E. coli -*Escherichia Coli*

MMR – Maternal Mortality Ratio

LB - Live Births

DIC - Disseminated Intravascular Coagulation

CFR - Case Fatality Rate

IV - Intravenous

USA - United States of America

POC - Products of Conception

GCLP - Good Clinical and Laboratory Practice

APHRC - African Population and Health Research Centre

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ABSTRACT.

Background: Globally an estimated 56 million induced abortion occur every year(1). WHO estimates that 68,000 women die annually due to complications of unsafe abortion with sepsis as the primary cause of death(2). Microbial culture and sensitivity testing in a low resource setting, is not only expensive but takes an average of 3days to get the results. Many patients present with septic complicationsarising from the abortion when it's too late to put them on appropriateantibiotics based on the culture and sensitivity results.

Objective:

To determine the bacteriology,antibiotic sensitivityand complications among patients presenting withseptic abortion at KNH.

Methodology: Descriptive cross sectional study, comprised a total of 81 women, with evidence of abortion related sepsis. Samples of endocervical swabs from women with signs and symptoms of septic abortion were collected at recruitment and taken for m/c/s. The participants were followed up till discharge for complications. Statistical analysis was done using SPSS 21. Proportions were compared using Chi2 test, 95% CI with p-value significant at $p<0.05$.

Results: The commonest bacteria isolated on culture were, Escherichia coli (25%), Klebsiella Pneumonia (20%) and Staphylococcus aureus (15%). A high resistance was noted with amoxicillin-clavulanic acid, cephalosporin and cotrimoxazole. In 90% of the cases, organisms were sensitive to Gentamicin, amikacin and meropenem. 8 participants had complications, among them peritonitis, pelvic abscess, septic shock and renal failure. Laparotomy was done in one case. There were two mortalities in our study giving a case fatality rate of 2.47%.

Conclusion: New guidelines for the management of septic abortion should be considered in this population due to the high resistance pattern to the commonly used antibiotics.Septic abortion has serious health complication and needs to be urgently addressed to reduce maternal morbidity and mortality.

1. INTRODUCTION

Unsafe abortion remains a major cause of maternal death in developing countries. Out of 46 million induced abortion occurring annually,20 million are considered unsafe and virtually all occur in developing countries(3).Across various settings, complications from septicabortion are cited as a leading cause of abortion related deaths(4). WHO estimates that 80,000 deaths from unsafe abortion occur in the world every year,about 13% of all maternal death(mostly in developing countries)(5). Adolescent girls and young women accounted for more than 48% of post-abortion care patients in Kenya in 2012. Adolescent girls and young women who seek post abortion care in Kenya are diverse in their characteristics.

Around 15% of more than 500,000 pregnant deaths in developing countries may result from complications of unsafely induced abortions(6). A 2005 study found that close to 30% of Kenyan women hospitalized annually with abortion related complications, have complications of high severity including uterine perforation, haemorrhage, sepsis, pelvic abscess and shock(7). In a WHO systematic analysis on the global causes of maternal deaths,unsafe abortion and its complication accounted for 8-18% of maternal death and the number of death ranged from 22,500 to 44,000 in 2014(8).

Under SDG 3,target 3.1,high burdened countries havecommitted to reducingthe global maternal mortality ratio to less than 70 by 2030(9).According to KDHS 2014estimated maternal mortality ratio in Kenyawas362, with an annual reduction rate of 2.6%,putting it in theleague of developingcountrieswith a high burden. Unsafe abortion and its complicationsare urgent priority areas that needs to be addressed to accelerate efforts of reducing the maternal mortality ratio(10)

Septic abortion remains one of the most serious threats to the health of women throughout the world due to its high morbidity and mortality in women of childbearing age (17). The WHO estimates that 68,000 women die annually due to complications of unsafe abortion with sepsis as the primary cause of death (16).A study on the magnitude and complications of unsafe abortion in Kenya by APHRC foundthat anestimated464,690induced abortions occurredin Kenyain2012,correspondingtoaninducedabortionrateof48abortions per1000 women ofreproductiveage (15-49 years), and an induced abortion ratioof30 abortions per100birthsin2012. Anestimated157,762womenreceived care forcomplicationsofinduced andspontaneousabortions inhealth facilities in thesame year.Of these,119,912 wereexperiencing complicationsofinduced abortions.

A recent systematic review of hospital based studies reporting on morbidity from unsafe abortion reported severe abortion related infections in up to 52% of the cases (18). Closer home in two different studies done at KNH, the mortality rate documented for abortion related complication were high 2-3deaths/1000 abortion admissions (19; 20). A study on magnitude of abortion complication in Kenya, reported a case fatality rate of abortion in Kenya 0.87% (95% CI 0.71–1.02%), so an estimated 182 (95%CI 148–213) of these women die annually (7). Sepsis and haemorrhage are often cited as important major complications in Sub Saharan Africa of unsafe abortion and are the two main causes of abortion related death (21).

Unsafe abortion and its complication remains one of the most neglected sexual and reproductive health problems in the world today (3). Every year an estimated 210 million women become pregnant with 40% (80 millions) of all pregnancies being unintended (25). Worldwide more than 46million of these pregnancies will end in abortion with 20 million being unsafe (3). More than 97% of unsafe abortion occurs in developing world (26). An additional 5 million women

worldwide are admitted each year due to complications of unsafe abortion, of these many suffer long term effect including an estimated 1.6 million women who suffer annually secondary infertility and further 3-5 million who suffer chronic reproductive tract infection (24). The socio-economic and political implications of deaths and other complications related to unsafe abortions are far reaching. Unsafe abortions and its complications like sepsis are more common in countries with high incidence of unwanted pregnancies, lack of access to contraceptives, high rates of contraceptive failure, and restrictive laws on abortion. Further, social stigma associated with abortion makes it difficult for girls and women to receive post abortion care. The treatment of complications from unsafe abortions also saps scarce health system resources (24,7).

2. LITERATURE REVIEW

Abortion is the expulsion or extraction of all or part of the placenta or membranes with or without an identifiable foetus weighing <500grams (11). UnsafeabortionisdefinedbytheWorldHealthOrganization(WHO)asaprocedurefor terminatingpregnancy,carriedouteitherbypersonslackingthenecessaryskillsorin anenvironmentthatdoesnotconformtominimalmedicalstandards,orboth.A septic abortion refers to any abortion (spontaneous or induced) complicated by upper genital tract infection including endometritis or parametritis (12). The signs and symptoms of abortion related infection are mainly fever, chills, severe abdominal/pelvic pain, prolonged and heavy vaginal bleeding, uterine tenderness foul smelling uterine discharge and elevated inflammatory marker(13,14). As the condition becomes more serious, signs of septic shock may appear including hypotension,

hypothermia, oliguria, and dyspnoea. Septic shock may lead to renal failure, bleeding diathesis DIC, intestinal organ infection leading to scar tissue with chronic pain, intestinal obstruction and infertility (15). Lastly if not treated quickly and effectively, the woman may die (15).

A 1973 report from a medical journal described an adolescent admitted to a major Boston teaching hospital with what proved to be incomplete septic abortion (12). Uterine evacuation was not performed until several days after admission because this diagnosis was not initially entertained (12). The patient died despite massive antibiotic therapy and intensive medical management.

In septic abortion, although properly timed surgery for evacuation of septic products is very important, effective antibiotic based on culture and sensitivity report is the mainstay treatment (22).In the absence of antibiotic treatment, infection spreads upwards through the genital tract, causing damage to the fallopian tubes, ovaries and pelvic inflammatory disease. This condition causes pain, discomfort, and if left untreated can result in chronic pelvic pain, bilateral tubal occlusion and infertility (23). Infertility remains the most significant long term complication due to tubal occlusion estimated to affect 450,000 women each year (23). Direct cost of treatment of abortion related complications burden impoverished healthcare system and indirect cost also drain struggling economies (24).

In a study by Adisa et al in KNH, the prevalence of induced abortion was 38% and 16% had complications with haemorrhage and sepsis being the commonest at 58.8% and 41.2% respectively (20). A Nigerian study reported 35% of hospital maternal mortality from abortion with sepsis as the most common cause of death (21). A study on magnitude of abortion

complications in Kenya in 2002, reported an annual rate of abortion complication at 39/1000 live births, CFR 0.87% and complications from sepsis were 27.7% (7).

More recently, a report of a 10 year study in rural India published in 2002 found 41.9% of all maternal deaths were from septic abortion (12). Worldwide 68000 women die due to complications of unsafe abortion equivalent to 8women/hour (3) . This prevalence translates into an estimated case fatality rate of 367deaths/100,000 unsafe abortion (3). This ratio is higher in developing world with Africa at 709deaths/100,000 unsafe abortion (3). The disparity between the health of women in developed and developing countries is stark with regard to complications of unsafe abortion. The estimated global abortion rate in 2010-2014 was 36 per 1000 of married women and 25 per 1000 unmarried women (1) .This is in contrast to numerous studies that found predominance of young unmarried women procuring an abortion (27;28;29).

A study in Zambia found 53% of women seeking abortion were of low and middle SES (30). Another study, also from Zambia reported that half of all the women who died from induced abortion were of low and middle SES (29). A study on illegal induced abortion in Nigeria reported low contraceptive use among patient seeking illegal abortion (31). In a study in Zimbabwe Harare, contraceptive failure occurred in 18% of patient treated for abortion related complication and 44% were on oral contraceptives (21). Inappropriate pregnancy timing, fear of school expulsion, financial difficulties and uncertainty about partner, are among the reasons cited for procuring an abortion (31;32;33).

Typical infections in septic abortion are polymicrobial. The microbial flora commonly implicated are microorganism that colonized the cervix and vagina prior to or during the abortive process with important addition of sexually transmitted organisms (12). The microorganisms also

introduced into the uterus from use of poorly sterilized instrument during the process of uterine evacuation for incomplete or induced abortion are also implicated (34). Microbiological studies of blood, urine, endocervical, and evacuated specimens enable the identification of involved bacteria (4).

The presence of sexually transmitted pathogens at the time of abortion, particularly chlamydia species pluralis (spp.) or gonorrhoea, is an established risk factor for abortion related infection (4). Infections complicated by Clostridium spp. are less common, more serious and rapidly fatal (4). In developing countries, tetanus contributes to septic abortion deaths (12) .Common organisms implicated are E.Coli, Streptococcus, Staphylococcus, rarely Clostridia spp (Welchi, tetani, Perfringen) (34).

Escherichia coli is the predominant bacteria in human intestine, the close proximity of the female genital tract and anal region aids easy transfer of the bacteria to the vagina and urethra. These organisms have also been generally reported to be the common organisms implicated in septic abortion. These organisms are very virulent. They release endotoxins and easily predispose to septic shock and maternal death. Specific E. coli virulence factors, such as the P-fimbriae and S fimbriae adhesions enable them to colonize, invade and attach to the vaginal epithelium, allowing for multiplication.

In a cross sectional study in Nigeria Port Harcourt, E.Coli was the commonest pathogen cultured 49.2%, Staph. Aureus 37.1%, Candida albican 21.2%, Klebsiella 11.4%, GBS 6.1%, Neisseria Gonnorhea 5.3%, Peptostreptococcus and Bacteroides 3.8% (34). In a study in West Bengal India by Hazra SK et al, bacteriologic examination revealed E.Coli 62%, Klebsiella Pneumonia 32%, Staphylococcus aureus 26% (35). Dalia Rafat et al in a case report isolated MR

staphylococcus aureus (22). Singh Richa et al culture of HVS and endocervical swab showed E.Coli 21cases, GBS 9 cases, bacteroides 3cases, Gonococcus 1case, Chlamydia spp (tetani and perfringen) 1case each (36). Incomplete and missed abortions are particularly prone to sepsis due to retention of non-viable products of conception which are good culture media for microorganisms. Fomulo et al conducted a cross sectional study on bacteriology and sensitivity pattern in patient with septic abortion, post abortal sepsis and associated pelvic abscess in KNH in 1979 (19). E coli was the commonest microbe cultured and etiology was polymicrobial with both aerobes and anaerobes cultured (19).

Parenteral antibiotic therapy and removal of retained products of conception is the mainstay treatment of septic abortion (14). Porter et al in 2008 reported that although broad spectrum antibiotic are routinely recommended for treatment of septic abortion, there is no consensus on the most effective antibiotic alone or in combination (4). A RCT in California USA compared response to treatment with clindamycin alone or penicillin plus chloramphenicol in 77 patients with septic abortion in a random double blinded study. It was found that aggressive management that included early uterine evacuation and broad spectrum antibiotics effective against both aerobic, anaerobic bacteria was key to reduced morbidity and mortality rates in the treatment of septic abortion (37).

In a systematic review, on antibiotic for treating septic abortion, 3 RCT of 233 women with septic abortion were analysed; one study compared Clindamycin alone or penicillin plus chloramphenicol, the second study compared Penicillin plus chloramphenicol or cephalothin plus kanamycin and the third study compared tetracycline enzyme based antibiotic with IV penicillin G. The conclusion was the quality of evidence from 3small trials conducted over 30years ago using antibiotics some of which are no longer in use in clinical practice is insufficient to

advocate for change in existing treatment regimen for septic abortion. Furthermore, the emergence of new and antibiotic resistant strains of organisms suggests practice needs to be based on these realities (4) .

The recommended regimens of the Centres for Disease Control and Prevention for outpatient management of pelvic inflammatory disease are appropriate for patients with early postabortal infection limited to the uterine cavity in addition to uterine evacuation. One such regimen is ceftriaxone 250 mg by intramuscular injection (or other third generation cephalosporin such as cefoxitin, ceftizoxime, or cefotaxime) plus doxycycline 100 mg orally twice a day for 14 days, with or without metronidazole 500 mg orally twice a day for 14 days (38).

Abudu et al reported microorganisms that were resistant to ampicillin and fluoroquinolones thus culture should be the gold standard for appropriate antibiotic treatment (4). While antibiotics therapy may offer benefit, women may also experience adverse effects dependent on the class and combination of antibiotics. These range from relatively mild GIT disturbance such as nausea, vomiting, diarrhoea and bloating to life threatening allergic reaction.

Complications from unsafe abortion accounts for an additional amount of abortion related morbidity and mortality. More frequent short term complications are incomplete evacuation, sepsis, haemorrhage, bladder or bowel injury, uterine perforation, cervical laceration, DIC, septic shock (17). Instrumental injury and infection with mixed pathogen derived from normal vaginal flora causing septic shock (17). A Nigerian study on bowel injury in septic abortion, noted a high mortality rate at 64% in 11patients with septic abortion with bowel perforation (21).

A retrospective review of 647 septic abortion patients in South Africa, noted that 5.4% had hysterectomy, 6.5% laparotomy and 1.8% died (39). Rees et al in South Africa classified

abortion related complications into low (temp less than 37.2C, no signs of infection, no system or organ failure, no suspicious finding on evacuation), moderate(temp 37.3-37.9C ,offensive POC, and localized peritonitis) , and high(temp equal to or more than 38C, pulse greater than 120bpm, generalized peritonitis, organ or system failure, foreign body or mechanical injury on evacuation, shock and death) (40). Gebresellasie et al in a study in Kenya in 2002 reported an annual rate of abortion complication at 39/1000LB, CFR 0.87%, and complication of high severity occurred in 27.7%.He also noted that abortion related complication and mortality increases as the pregnancy progresses and 6/7 deaths occurred for pregnancies in the second trimester (7).

According to WHO, information on long term health complications of unsafe abortion is scarce and approx. 20-30% of unsafe abortions result in reproductive tract infection, 1/3 of them being upper genital tract infection and infertility (41). 2% of women in the reproductive age group are infertile due to abortion and 5% have chronic infections (41) .

A cross sectional study on unsafe abortion complication severity reported that women who reported inducing the abortion had 2.4times the odds of having a moderate/severe complication compared to those who reported it was spontaneous (42). Delay of more than 6hours to get to the health facility had at least 2times the odds of having moderate/severe complications compared to those who sought care within 6hours from onset of complications (42). Moderate to severe post abortal complications are common in Kenya and a sizeable proportion of these are not properly managed. Factors like delay in seeking care, interference with the pregnancy, unwanted pregnancy are important determinants of complication severity (42).

3. RATIONALE

Complications of unsafe abortion are the second leading cause of maternal death in Kenya, accounting for 7.9% of maternal death worldwide. Despite numerous policy implementation, maternal mortality in Kenya is not showing the decline needed to meet the target for achieving SDG 3(target 3.1) by 2030.There is therefore need to reassess closely the leading cause of maternal mortality and identify the gaps. Septic abortion is one of the areas due to scarcity of data on the same.

Microbiological culture and sensitivity testing in a low resource setting, is not only expensive but takes an average of 3days to get the results. Majority of patients present with late advanced infection morbidity and may not be alive in the next 3days to benefit from culture and sensitivity results. Therefore, knowledge of microbial flora involved in septic abortion will guide the choice of antibiotic treatment.

In a systematic review on antibiotic for the treatment of septic abortion done in 2016 that compared three 3small RCT, the results were inconclusive on the most appropriate antibiotics to treat septic abortion to replace the current guidelines thus there is no consensus on the most effective antibiotic alone or in combination for the treatment of septic abortion justifying the need for this study.Emergence of new and antibiotic resistant strains of organisms suggests that practice needs to be based on these emerging realities.

In the absence of antibiotic treatment septic abortion may be complicated by chronic pelvic pain, pelvic inflammatory disease, bilateral tubal occlusion and infertility. Infertility remains the most significant long-term complication due to tubal occlusion estimated to affect 450,000 women each year.

4. RESEARCH QUESTION

What is the microbial pattern, antibiotic sensitivity and complications among patients presenting with septic abortion at KNH?

5. CONCEPTUAL FRAMEWORK.

5.1. Narrative

Womenwithunwantedpregnancy consideroptionsofhowtodealwiththeircondition. Shouldthey findthemselvesinasocialnetworkthatsupportsunsafeabortion,theirdecisions could possiblybe influencedandthey go forunsafe abortion. Sepsis and haemorrhage are the commonest complications of unsafe abortion.

Theriskfactors associatedwithdevelopmentof septic abortion includeunwanted pregnancy,lowsocio-economicstatus, laws and policies, health seeking behaviour, cultural and social norms service delivery.

The clinical signs and symptoms of septic abortion include fever, tachycardia, foul smelling POC, abdominal and pelvic pain. The gold standard for confirmation of septic abortion is culture of POC for M/C/S for identification of the offending microorganism.

Timely diagnosis and treatment is crucial to avert the complications of septic abortion. Delay in seeking appropriate care may result in complications like septicaemia, end organ damage, DIC, recurrent genital tract infection, infertility and death.

5.2. Diagrammatic.

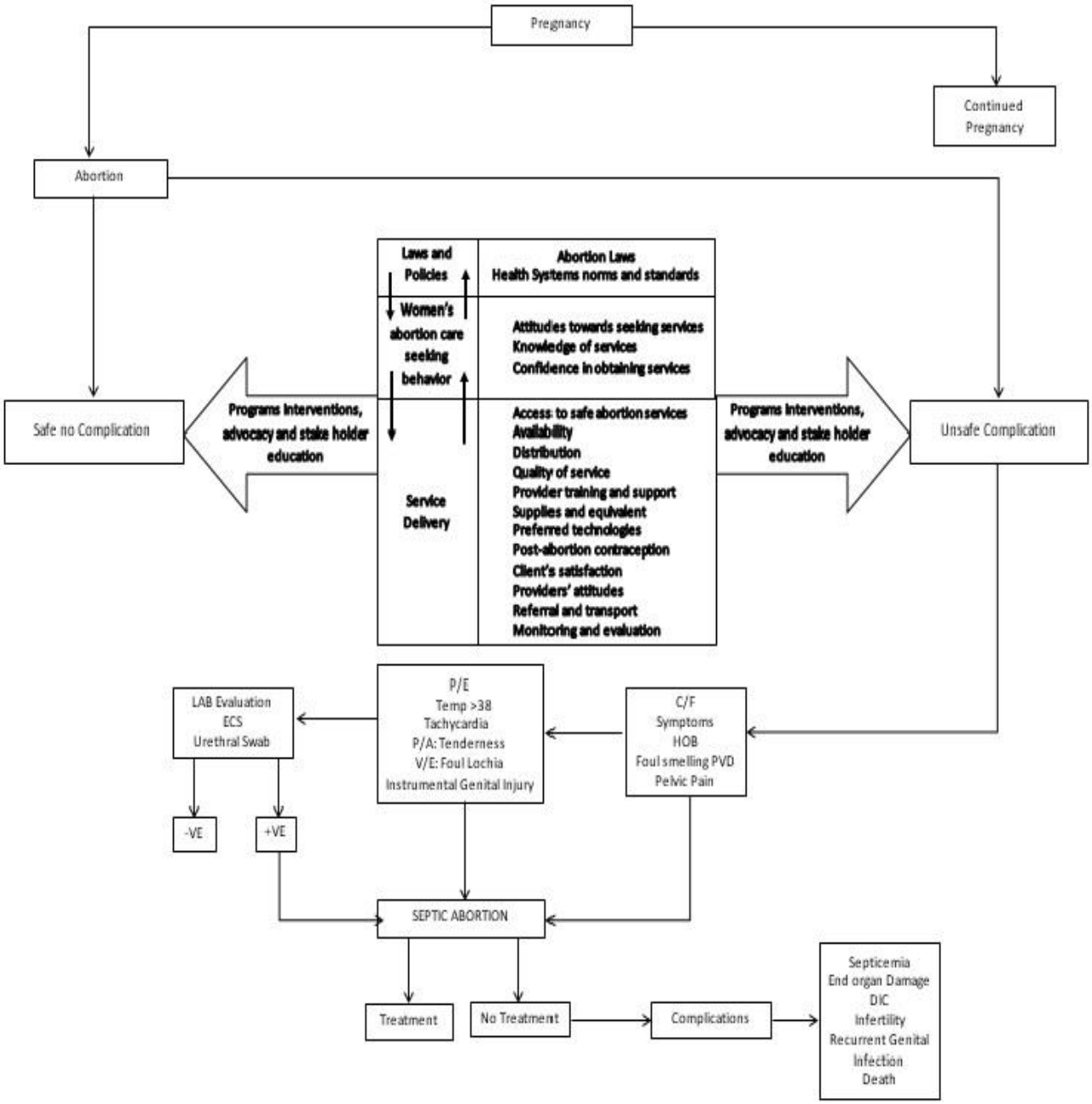

Figure 5-1: Diagrammatic Presentation Of The Conceptual Framework

6. OBJECTIVES

6.1. Broad Objectives

To determine the microbial pattern, antibiotic sensitivity and complications among patients presenting with septic abortion at KNH.

6.2. Specific Objectives

Among patients presenting with septic abortion at KNH during the study period of April to October 2018:

1) Determine the endocervical bacteriology through culture.
2) Determine the antibiotic sensitivity
3) Describe the social demographic characteristics
4) Describe the complications.

7. STUDY METHODOLOGY.

7.1. Study Site

This studywas carriedoutintheacute gynaecological ward 1D and emergency gynaecological room in casualtyatKNH,Kenya's nationalreferralhospital, locatedinNairobi,thecapitalcityofKenya, withinNairobi County.KNHisKenya'slargest referralandteachinghospital, andforms theapexofKenya's publichealthcaresystem.KNH has 50wards,24theatres and22out-patientclinicsanAccidentandEmergencyUnitanda bedcapacityof1800. . The obstetrics and gynaecological wards in KNH are GFA, GFB, 1A, 1B and 1C and 1D. Ward 1D admits patients with acute gynaecological conditions.

Accident and emergency unit in KNH has a reproductive health room number 8 where patient are first reviewed. In patient presenting with septic abortion, a thorough history is taken by the resident on duty plus physicalexamination. The patient is then sent for laboratory and radiological investigation after which they are to ward 1D.

7.2. Sampling Procedure

Consecutive sampling technique was used to select women with symptoms of septic abortion among those attending emergency gynaecological clinic and acute gynaecological ward in KNH. Consecutive sampling was used to recruit eligible women into the study with application of the set inclusion and exclusion criteria. This was done consecutively until the required sample size was achieved.

7.2.1. Sample Size

The sample size was calculated using Cochran (1977) formula with finite population correction as illustrated in equation 3-1.

$$n = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)} \qquad 7\text{-}1$$

$Where$

$n = minimum\ sample\ size$

N = population size of women seeking care for post abortion sepsis in KNH during study period (N = 90)

Z = Z statistic representing standard normal deviate for 95% level of confidence (1.96)

P = the expected sensitivity to specific antibiotics among post abortion women. The antibiotic sensitivity reported in recent studies was 68% (45, 46). A sensitivity of 68% was used in the calculation of the sample size.

D = level of precision (margin of error) set at 5% (d = 0.05)

$$n = \frac{90 \times\ 1.96^2 \times 0.68(1-0.68)}{0.05^2(90-1) + 1.96^2 \times 0.68(1-0.68)}$$

Where
n = 72
Increase by 10% = 81
n = 81

7.3. Study Design

This was a descriptive, cross sectional study.Data collection was undertaken from April to October 2018.The patient were evaluated on admission for signs and symptoms of septic abortion on admission the files were then reviewed at the time of discharge for complications that arose. The study was designed to relate the m/c/s of endocervical swab in patient presenting with septic abortion. Culture was used as the gold standard to confirm the diagnosis of septic abortion. The study participants were also followed up until discharge for complications associated with their septic abortion.

7.3.1. Study Flow Chart

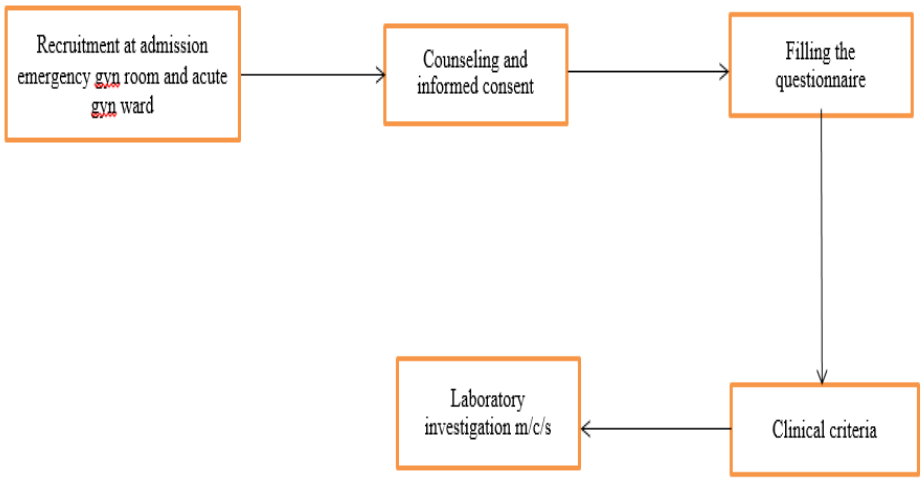

Figure 7-1: Study Flowchart

7.3.2. Study Population

The study participants includedwomen selected among those attending emergency gynaecological clinic in casualty and those admitted in ward 1D at KNH.Women who presented with abortion whether spontaneous or induced with signs and symptoms of sepsis were recruited after giving consent

7.3.2.1. Inclusion Criteria

1) All patients with septic abortion who were willing to give consent

7.3.2.2. Exclusion criteria

1) Critically morbid patients with septic abortion
2) Ectopic pregnancy
3) Other causes of febrile illness and STI

7.3.3. Study Procedure

The women were recruited as they came in for review in the clinic and those admitted in the ward. Women who met the inclusion criteria were informed about the study and informed consents obtained. A structured questionnaire on socio-demographic and obstetric characteristics of the participant was administered by the principle researcher or research assistants. The women were examined for signs and symptoms of sepsis based on clinical diagnosis and recruited into the study. Specimen were taken for laboratory analysis during speculum examination from the endocervix before the evacuation process. Endocervical *swab* for m/c/s was taken; high vaginal swab was excluded due to the highly variable normal flora within the vagina. Samples were

checked for correct labelling and requisition and then transferred to the laboratory for microbiological analysis.

7.3.4. Quality Assurance Procedure

Validation of the laboratory procedure was done by internal quality control and standard operating procedure. Labelled sterile containers with tight fitting lids were used to collect the endocervical swab. The research assistant were given clear instructions on how to collect the endocervical swab after washing their hands, putting on sterile gloves and swabbing the genital area five times with cotton balls soaked in clean water or normal saline. Antiseptic solution was avoided during the cleaning of the genital area. The specimen collecting container were kept at room temperature and expiry dates also checked. The swabs were immediately placed in Bijou bottles containing Stuarts transport media freshly built to expel air.

The samples for culture were put in a cool box at 4 degrees Celsius and delivered to the laboratory within one hour of collection. Bacteriologic culture was done under the set laboratory standards for best results.

7.3.5. Standard Operating Procedure

The endocervical M/C/S was done at the University of Nairobi microbiology laboratory by the laboratory technologist who was trained for 2weeks on GCLP protocol. The Specimen is collected from endocervical swabs using sterile swabs and placed into Amies transport medium (+/- charcoal).Specimens should ideally be stored and transported in sealed plastic bags. Laboratory processing should occur as soon as possible after specimen collection. Specimens should be refrigerated if delays in processing over two hours are unavoidable.

Specimen processing and reception by logging the specimen in the appropriate specimen book and assign a specimen number.Microscopic examination by inoculating the appropriate agar plates and prepare the following:A thin smear on a clean microscope slide for Gram stain and a wet prep for Trichomonas vaginalis (TV): mix the swab with a drop of sterile saline on a clean microscope slide. Place a coverslip over the wet inoculum and examine with the low power objective.

The culture is obtained by Inoculation and incubation of the culture media as indicated in Table (7-1) After inoculating the appropriate agar plates, prepare the following:A thin smear on a clean microscope slide for Gram stain and a wet prep for Trichomonas vaginalis (TV): mix the swab with a drop of sterile saline on a clean microscope slide. Place a coverslip over the wet inoculum and examine with the low power objective.

Table 7-1: Inoculate and Incubate Culture Media

Medium	Incubation			Cultures read	Target organisms
	Temp (°C)	Atmosphere	Time		
Blood agar	35 – 37	5 - 10% CO_2	16 - 24h	16 - 24h	S. aureus Group A, C and G beta-haem streptococci Other organisms may be significant (see section 4)
Chocolate agar	35 – 37	5 - 10% CO_2	40 - 48h	Daily	H. influenza
Sabouraud agar	35 – 37	Air	40 - 48h	Daily	Yeasts
GC agar	35 – 37	5 - 10% CO_2	40 - 48h	Daily	N. gonorrhoea

Interpretation involves recording the semi-quantitative growth of each colony type (i.e. +/- to ++++).In general, the minimum level of identification in the laboratory and significant isolates should be identified as fully as possible: potentially significant organisms are summarized as: Group A, C, and G beta-haemolytic streptococci; Haemophilus ducreyi; Neisseria gonorrhoea and Yeasts: report to the "yeasts" level (not necessary to identify further). Other organisms may be significant in certain settings:Group B beta-haemolytic streptococcus: do antimicrobial susceptibilities and report only if clinical details state that the patient is pregnant; Coliforms: identify, do antimicrobial susceptibilities and report only if heavy pure growth. If heavy and mixed, report as "heavy growth of coliforms" and do not perform antimicrobial susceptibilities; S. aureus: do antimicrobial susceptibilities and report only if heavy or pure growth and Upper respiratory tract flora (Haemophilus influenza and Streptococcus pneumonia): do antimicrobial susceptibilities and report only if heavy or pure growth.

In antimicrobial susceptibility testing all significant isolates should have antimicrobial susceptibilities determined according to SOP MIC. Reporting of gram stain results, WBC and organisms detected. The presence of intra-cellular Gram negative diplococci should be communicated to the clinician urgently. Wet prep results: presence or absence of Trichomonas vaginalis (note presence of parasite ova if seen incidentally). Culture results are interpreted by presence of significant isolates (e.g. N. gonorrhoea); no significant growth / mixed growth of doubtful significance may be used; absence of growth.

To achieve Quality assurance, media and identification tests should be quality controlled according to the relevant SOP. Thesamplesforculturewerekeptinacoolboxat4degrees Celsius anddeliveredtothe laboratorywithinanhourofcollection.Qualityoftheculturemediawas testedforsterilityby incubatingoneoftheplates overnightat35-37ºCwithoutspecimeninoculation. StandardreferencestrainsofStaphylococcusaureus (grampositive)and Escherichiacoli (Gramnegative)wereusedforqualitycontrol.Temperatureofincubatorwas monitoreddaily.

7.4. Data Collection

Data on socio-demographic characteristics, culture results and complications of septic abortion was collected by use of the questionnaire, clinical examination and laboratory investigations. Permission to collect data was obtained from emergency gynaecological clinic and nursing officer in charge and a separate room was identified for interviews and specimen collection. Recruitment of study participants, clinical examination and specimen collection was done in casualty and the wards. KNH/UON microbiology laboratory was be used to run the culture tests.

7.4.1. Specimen Collection

Specimen collection was done before a patient underwent uterine evacuation for retained POC. Using aseptic techniques, a sterile Cusco's speculum was passed into the vagina to expose the cervix and samples were collected from the cervical canal. Sterile cotton tipped swabs on wooden applicator sticks encased in plastic tubes were used for sample collection.The swab were gently rotated for 10-30sec in the endocervical canal for adequate sampling. The swabs were immediately placed in Bijou bottles containing Stuarts transport media freshly built to expel air. Each swab stick was broken at the middle and the bottles screwed with the cover. After collection, transport and storage of the swab was in the swab specimen bottle and was maintained at 2^{o}C-30^{o}C until tested. The specimens were returned to the microbiology laboratory for analysis within an hour of collection. Each specimen was inoculated on to sterile plates of blood agar, chocolate agar and MacConkey (Bile salt) agar and sabouraud dextrose agar. The plates were incubated aerobically, anaerobically and microaerophilically in a gas-pack jar at 37^{o}C for 48hours. The anaerobic plates with no growth after the initial 48hours incubation were re-incubated for another 24hours. At the end of incubation, the cultures were read and appropriate colonies sub cultured for purity. The routine laboratory methods involving microscopy, biochemical and physiological tests were used to identify the different organisms. The antibiotics used for sensitivity testing included amoxicillin,ampicillin, amoxyclav, gentamicin, cefuroxime, ceftriaxone, Nitrofurantoin and Meropenem.

7.4.2. Study Instrument

The study instrument constituted a pre-structured and pre- coded questionnaire with open ended questions.

7.4.3. Data Variables

Table 7-2: Clinical and Laboratory Criteria For Septic Abortion

VARIABLE	INDICATOR	MEASUREMENT	DATA SOURCE	DATA INSTRUMENT
DEPENDENT a) Presence of septic abortion	• Fever • Tachycardia • Foul POC • Pelvic/ abdominal pain	• Temperature in Celsius • Pulse rate	Patient	• Questionnaire • Thermometer • Speculum
b) Presence of septic abortion	• Culture • M/C/S	Positive/ Negative		Questionnaire Laboratory Speculum ECS/Urethral swabs

Table 7-3: Complications of Septic Abortion

VARIABLE	INDICATOR	MEASUREMENT	DATA SOURCE	DATA INSTRUMENT
INDEPENDENT a) septic abortion	LOW • Fever < 37.2 MODERATE • Fever 37.3 – 37.9 • Foul POC • Localised Peritonitis SEVERE • Fever ≥ 38 • Generalised Peritonitis • Organ/System Failure • Shock • Death • Foreign Body/Mechanical injury on evacuation	Temperature	Patient	Questionnaire Thermometer Patient records Speculum

7.4.4. Training Procedure

Research assistants were trained on the study details, how to fill the questionnaire in a standardized manner, how to recruit cases, clinical examination and specimen collection. Laboratory technologists were also be trained according to the GCLP Protocol; Good Clinical

and Laboratory Practice for two weeks on specimen processing, microscopic examinationand inoculation and incubation in the culture media.

7.4.5. Data Retrieval and Storage

Data collected was sorted, coded and entered into a computer and analysed using SPSS version 21 software. Data entry and editing for any errors was done throughout the study period.

Acodednumber,uniqueforeachstudyparticipantwas usedonthequestionnaire,sample bottles andonbothtestresults.Thecodednumbersmatchedwiththepatient's realname. Confidentialitywasmaintained.Qualityofdatawas assessedbyconductingconsistency checks toensurecompletenessinfillingthequestionnaireandthetestresults foreach participant.

7.4.6. Data Analysis

Data analysis was conducted using IBM SPSS version 21. Counts and frequency distributions or percentage were used for descriptive analysis of the socio-demographic characteristics measured using categorical variables in women presenting with septic abortion in KNH. The variables measure on a continuous scale for example age and duration of illness were analysed using means (SD) or median (range).

Bacteriology findings were presented by calculating percentages representing the frequency of specific organisms cultured in the laboratory based on a denominator of all the septic post abortion mothers. Antibiotic sensitivity were calculated for a range of antibiotics (in KNH testing is conducted for broad spectrum antibiotics covering both aerobic and anaerobic microorganisms). Based on the analysis of sensitivity to individual antibiotic an overall

proportion was calculated to represent antibiotic resistance with a numerator including samples that show resistance to all the specific antibiotics tested.

The frequency of complications associated with septic abortion were calculated and presented using percentage and counts. An overall percentage for septic abortion complications were also calculated. Cross tabulations of complications and patient characteristics were conducted and associations were examined using chi square or fishers exact tests for small cell counts (less than 5). Statistical significance was determined based on a p-value cut off of 0.05.

The results were presented using summary descriptive statistics (means and medians), counts and percentages, tables, figures and text.

7.5. Ethical Considerations

Permission to carry out the study was sought from the Kenyatta National Hospital / University of Nairobi ethics and research committee and also from the department of obstetrics and gynaecology after presentation of the research proposal. Each of the eligible participants was given information on the purpose of the study and allowed to voluntarily give a written informed consent. Confidentiality of the participants' identity and that of all the data acquired was taken care of by use of unique coded numbers.No extra costs or risks to the participants. They will benefit by having free bacteriologic culture and antibiotic sensitivity testing. Failure to participate in the study did not compromise the care received by the patient from the hospital.

7.6. Study Limitation

Specimen contamination during collection of the endocervical swabs, this was minimised by adhering to strictly sterile condition during the process of sample collection and delivery of the

sample for analysis within an hour of collection. The research assistant was also trained on sample collection procedure.

Laboratory limitation unable to carry out anaerobic culture and could not provide culture media for fastidious organism thus reducing yield of some potential organisms. Lack of novel molecular genotyping for detection of chlamydia.

Few number of isolates for some species thus caution needed when interpreting antibiotic susceptibility pattern.

8. STUDY RESULTS

8.1. Socio– DemographicCharacteristicsofStudy Participants.

The presentstudywas conductedat KNH,NairobifromAprilto October2018.Total numberofadmissions during thestudy period due to abortions were 432.Among 432cases of abortions81had signs and symptoms of septic abortion. Incidenceofsepticabortionin ourstudywas18%.

As indicated in table 8-1 below a total of 81 respondents with signs and symptoms of septic abortion, were subjected to endocervical bacteriologic culture testing for confirmation of septic abortion. The mean age for the respondents was 29.7years (± standard deviation of 6.0 years). From the results 42(51.9%) of the respondents were between age group 26 and 35 years. Majority of the respondents 69% were married. Half of the respondents were self-employed 41(50.6%) and had attained secondary level of education 42(51.9%).

Table 8-1: Socio Demographic Characteristics in Patients Presenting with Septic Abortion at KNHfrom April to October 2018 (N=81)

Age in years	
18 – 25	21 (25.9)
26 – 35	42 (51.9)
>35	18 (22.2)
Occupation	
Unemployed	29 (35.8)
Self employed	42 (51.9)
Formal employment	10 (12.3)
Marital status	
Single	20 (24.7)
Married	57 (70.4)
Divorced	4 (4.9)
Highest education level	
Primary	25 (30.9)
Secondary	42 (51.9)
Tertiary	14 (17.3)

8.2. ReproductiveHealthCharacteristics of the Study Participant

As demonstrated in table 8-2 below majorityof the respondents were multipara 63(77.8%) and53(65.4%) wereata gestationalage ofless than13weeks. It is important to note that 37(45.7%) of the respondents were not on any contraceptive method. Slightly more than three quarter 71(87.7%) reported the mode of abortion as spontaneous where by 10(12.3%) of the respondents abortion was induced. In 6 cases termination was done by a nurse, 3 by a paramedic and 1 by a traditional birth attendant.Of the cases that were induced use of over the counter medication was in 90 % of the respondents. Reasons given for termination of pregnancy was unplanned pregnancy in 80 % of the respondents, while the others indicated financial constraints as there motivator for the termination. It is important to note that slightly more than three quarter 76.5% of the respondents had

taken antibiotics prior to admission, this has important implications on endocervical culture results and antibiotic resistance patterns.

Table 8-2: Reproductive Health Characteristics in Patients Presenting with Septic Abortion at KNHfrom April to October 2018 (N=81)

Parity	
0	17 (21.0)
1	29 (35.8)
2	20 (24.7)
≥ 3	15 (18.5)
Gestation age	
< 13	53 (65.4)
13-28	28 (34.6)
Previous contraceptive use	
Implant	5 (6.2)
Injectable	24 (29.6)
IUD	1 (1.2)
None	37 (45.7)
Pills	14 (17.3)
Mode of abortion	
Spontaneous	71 (87.7)
Induced	10 (12.3)
Termination done by	
Nurse	6 (60.0)
Paramedic	3 (30.0)
TBA	1 (10.0)
Method of termination	
Medical	9 (90.0)
Herbs	1 (10.0)
Reason for termination	
Unwanted	8 (80.0)
Financial	2 (20.0)
Antibiotic Rx prior to admission	
Yes	32 (39.5)
No	49 (60.0)
Duration	
Less than 2 weeks	62 (100.0)

Septic abortionwasfound tobehighestin women aged 26-35years, whoconstitutedmore thanhalfof theparticipants42(51.9%).Inadditionseptic abortionwasmore prevalentamong themarried 56(69.1%)respondents.

Endocervical swabwastakenprospectively inall casesfor microscopy,cultureandsensitivity.No bacterialgrowth was obtained in61cases (75.3%) of the respondents.Inculture-positive cases Escherichiacoli 5(25%) wasisolated inmajorityof thecasesfollowed by Klebsiella pneumonia 4(20%), Staphylococcus aureus and streptococcus agalactiae 3(15%) each. Other organisms were streptococcus epidermidis, Enterobacter, Acinetobacter Cloacae and Citrobacter baumanii. In 75%ofcases,organisms weresensitiveto Amikacin, Gentamicin and Meropenem. Blood test and urine test for culturewas notdone, due to lack of infrastructure.

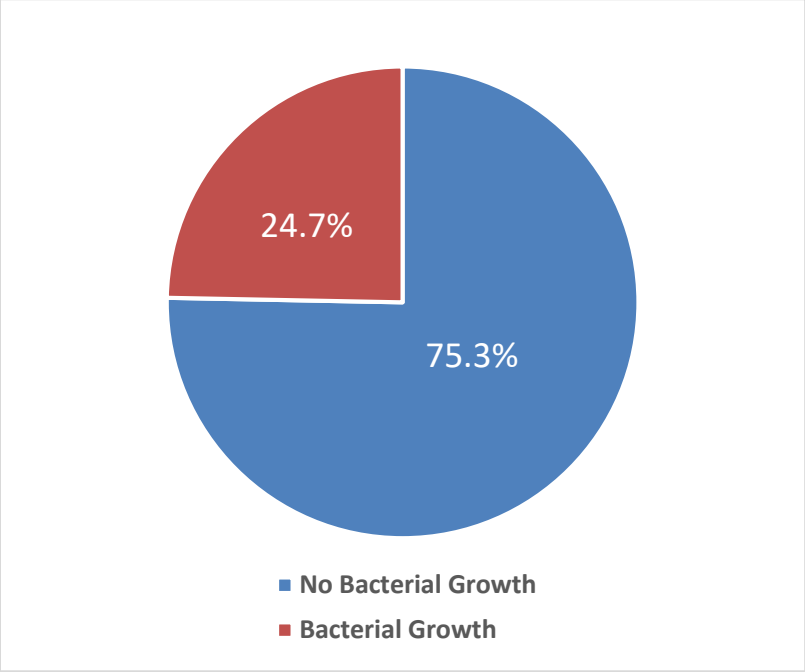

Figure 8-1: Endocervical culture results in patients presenting with septic abortions at KNH from April to October 2018 (N=81).

Table 8-3: Bacterial species isolated from endocervical swab in patients presenting with septic abortion at KNH from April to October 2018 (N=81).

Bacterial Species	Frequency	Percentage
E. Coli	5	25
Klebsiella Pneumonia	4	20
Staphylococcus aureus	3	15
Streptococcus agalactiae	3	15
Enterobacter cloacae spp dissolvens	2	10
Acinetobacter baumanii	1	5
Staphylococcus epidermis	1	5
Citrobacter freundii	1	5
Total	**20**	**100.0**

Table 8-4 below shows the antibiotic sensitivity pattern of the bacterial isolates. E. coli, Klebsiella Pneumonia, Acinetobacter baumanii and Citrobacter freundii showed 100%sensitivitytoMeropenem and amikacin.Escherichiacoli and Klebsiella Pneumoniashowed 100%sensitivitytonitrofurantoin. E. coli was 75% sensitive to levofloxacin.The rateofresistancetoampicillin,co-trimoxazole, amoxicillin-clavulanicacid, cephalosporin and tetracycline among E.colistrains was100%.It was noted that Citrobacter freundii was the only organism that was 100% resistant to meropenem and gentamicin. 100% resistance was also noted with amoxyclav, cephalosporin, ciprofloxacin, aztreonam and Piperacillin-Tazobactam. It was 100% sensitive to amikacin

Table 8-4: Antibiotic sensitivity pattern of the bacterial isolates from the endocervical swab of patients presenting with septic abortion at KNH from April to October 2018 (N=81).

	E. Coli		Enterobater cloacae spp dissolvens		Klebsiella Pneumonia		Staphylococcus aureus		Streptococcus agalactiae		Acinetobacter baumanii		Citrobacter freundii		Staphylococcus epidermidis	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
Ampicillin	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Amoxicillin/ Clavulanic Acid	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Ampicillin/S ulbactam	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (66.7)	1 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Piperacillin/ Tazobactam	2 (66.7)	1 (33.3)	1 (100.0)	1 (100.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cefazolin	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	2 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cefuroxime	5 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	4 (50.0)	4 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cefotaxime	3 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Ceftazidime	3 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Ceftriaxone	3 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)

	E. Coli		Enterobater cloacae spp dissolvens		Klebsiella Pneumonia		Staphylococcus aureus		Streptococcus agalactiae		Acinetobacter baumanii		Citrobacter freundii		Staphylococcus epidermidis	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
Cefepime	3 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Aztreonam	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0%)	1 (100.0 %)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Meropenem	0 (0.0)	1 (100.0)	1 (50.0)	1 (50.0)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)
Amikacin	0 (0.0)	1 (100.0)	1 (50.0)	1 (50.0)	0 (0.0)	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)
Gentamicin	2 (66.7)	1 (33.3)	1 (50.0)	1 (50.0)	1 (25.0)	3 (75.0)	0 (0.0)	3 (100.0)	0 (0.0)	2 (100.0)	1 (100.0 %)	0 (0.0%)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Ciprofloxacin	3 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	1 (25.0)	3 (75.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0 %)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Nitrofurantoin	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)
Trimethoprim/Sulfamethoxazole	1 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)
Benzyl penicillin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (66.7)	1 (33.3)	0 (0.0)	2 (100.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)
Levofloxacin	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)	0 (0.0)	3 (100.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)
Moxifloxacin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)	0 (0.0)	3 (100.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)
Erythromycin	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (33.3)	2 (66.7)	0 (0.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0

	E. Coli		Enterobater cloacae spp dissolvens		Klebsiella Pneumonia		Staphylococcus aureus		Streptococcus agalactiae		Acinetobacter baumanii		Citrobacter freundii		Staphylococcus epidermidis	
	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S
																%)
Clindamycin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (33.3)	2 (66.7)	3 (100.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)
Tetracycline	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (100.0)	2 (100.0)	0 (0.0)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0 %)	0 (0.0%)
Cefoxitin	0 (0.0)	0 (0.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)						

Key:

100% Sensitivity

100% Resistant

Complicationsfollowing septicabortionwereseenin8cases as shown in table 8-5 below.Among themperitonitis2(25%), pelvicabscess 1(12.5%),renal failure8(100 %),septicshock1(12.5%).Pelvicabscess was drainedby laparotomy. During laparotomy, pus was seen in the peritoneal cavity, necrotic ovary and fallopian tube. There were two mortality in our study giving a case fatality rate of 2.47%.

Table 8-5: Complications associated with septic abortion at KNH from April to October 2018 (N=81).

Complication	n=8	Percentage
Renal failure	8	100
Generalized peritonitis	2	25
Mortality	2	25
Pelvic abscess	1	12.5
Septic shock	1	12.5

8.3. DISCUSSION

The prevalence of septic abortion in our study was 18% comparable to a study by Egeigbe PN et al in Nigeria but much higher than that of other countries in Africa or elsewhere in the world. Previous study done on bacteriology of retained POC by Kibwana et al in KNH, prevalence of septic abortion was 6%, the high prevalence in our study could be due to the restructuring in KNH as a referral hospital attending to emergency and referral cases only. Prevalence of septic abortion varies widely between developing and developed countries. It depends upon literacy, awareness about the facilities available, legislation and socio-economic status of the population

In our study, the mean age of the respondents was 27.9 years with 51.9% in the age group of 26-35 years which is comparable to previous studies done (43;44;36). Majority 69% of women

who presented with septic abortion were married and multiparous similar to the findings of Hazra SK et al in West Bengal India (45). Early marriages, high parity, poor socioeconomic condition, lack of availability of family planning services and awareness may all increase the risk for septic abortion.

The main reasons for termination of pregnancy were family size and economic limitations similar to findings of Sreelakshmi et al (44). Thus, our results are likely to be due to suboptimal use of contraceptives and indicate lack of contraceptive use by the Kenyan population. This study highlights that in Kenya, married, multiparous women in the second and third decade of their lives are principal sufferers of complications of unsafe abortions. Abortion is being used as an alternative to contraception to space the birth of children, or to limit family size. Thus, there is a serious unmet need for easy availability of safe and effective ways to limit or space births. This finding is also supported by similar studies in Kenya by Ziraba et al and Gebresellasie et al.

Typical infections in septic abortion are polymicrobial with evidence from previous studies by Oriji et al in Nigeria and Hazra SK et al in India. From our study gram positive, gram negative and facultative anaerobes were isolated. Chlamydia Trachomatis which is the most common organism involved in sexually transmissible infections in women was not detected in this study because tissue culture and the serological tests for its detection were not available. The commonest bacterial isolate was Escherichia coli (25%), followed by Klebsiella pneumonia (20%) and Staphylococcus aureus at (15%). Comparable findings of Escherichia Coli as the most prevalent organism have been reported in KNH by Fomulo et al, in Port Harcourt Nigeria, 49.2% (34),West Bengal, 62%(45) and in India, 60%(36;47;48).

Isolates from this study were highly sensitive (100%) to meropenem, amikacin and gentamicin. Sreelakshmi et al in Tirupathi, India reported 75% sensitivity to similar antibiotics. The high sensitivity may be attributed to the drugs' potent activity against both gram positive and negative organisms and that they are less frequently abused locally due to their intravenous or intramuscular routes of administration. Highest resistance was noted with ampicillin and trimethoprim. This concurs with the study by Abudu et al where resistance was noted to ampicillin and fluoroquinolones. Isolates in our study exhibited variable susceptibility to antibiotics like cephalosporin and amoxicillin-clavulanic acid commonly used for empirical treatment of septic abortion. E. coli and Klebsiella were 100% sensitive to nitrofurantoin. E.Coli was 100% sensitive to levofloxacin. Considerable resistance of E.Coli (100%), Enterobacter (100%) and Klebsiella pneumonia (50%) to cephalosporin was reported. This is in contrary to CDC recommended regimen for outpatient management of PID which is also recommended for patient with early postabortal infection limited to the uterine cavity (38) which recommends ceftriaxone or other 3rd generation cephalosporin.

The antibiotic resistance could be due to the specific drugs widespread prescription for empirical treatment or self-medication in our localities. Choice of antibiotics should be based on efficacy and high sensitivity rates in a given population. With antibiotic abuse in giving empirical regimens, more resistant bacterial strains can emerge hence increasing antibiotic resistance in a locality. The high resistance with ampicillin, septrin and amoxyclav could be attributable to antibiotic abuse in our population for empirical treatment. While antibiotics therapy may offer benefit, women may also experience adverse effects dependent on the class and combination of antibiotics. These range from relatively mild GIT disturbance such as nausea, vomiting, diarrhoea and bloating to life threatening allergic reaction. This also has cost implications.

In our study, complications were seen in 8 cases among them peritonitis 2(25%), pelvic abscess 1 (12.5 %), renal failure an important sequela of septic abortion was seen in all the 8 cases with complication (100 %), septic shock 1(12.5%).This is similar to findings by Sreelakshmi et al(3), and Singh et al(4) in India. Hazra et al in West Bengal reported Peritonitis occurred in 35.51% of cases. Shock was present in 38.31%, Injury to the genital tract was found in 40.18% subjects. Other complications were septic shock (33.33%), acute renal failure (14.58%), and coagulation failure (2.08%).

There were 2 maternal death in our study giving a case fatality rate of 2.47%. The high rate was due to the fact that women admitted as a result of septic abortion had been referred with complications that required tertiary level of care. Gebresellasie et al reported a CFR of 0.87%. Rees et al in South Africa reported a case fatality rate of 1.8%. Hazra SK in west Bengal India reported a case fatality rate of 13.1%.

9. CONCLUSION AND RECOMMENDATIONS.

9.1. Conclusion

In conclusion this study addressed the current knowledge gap regarding antibiotic susceptibility pattern and revealed overwhelming resistance to commonly used antibiotics

Majority of the patients with septic abortion have polymicrobial infection with over 50% of them having E.Coli or Klebsiella or both of these organisms, initial treatment should include more than one broad spectrum antibiotics, while a culture and sensitivity of the patient's intracervical swab is being carried out to determine the offending micro-organism.

Antibioticsensitivitypatterns showedmeropenem, amikacin and gentamicin were highly sensitive to the bacterial isolates and thus gentamicin which is readily available can be used for empirical treatment as we await the culture results.

Sexual and Reproductive health services should take special focus on married women as a group at risk for unwanted pregnancies. Abortion is being used as an alternative to contraception to space the birth of children, or to limit family size.

9.2. Recommendations

New guidelines for the management of septic abortion at KNH should be considered in this population due to the high resistance pattern to the commonly used antibiotics.

Further studies on microbial flora and antibiotic susceptibility in patient with septic abortion with large sample size which can be generalizable due to increased yield of pathogenic bacteria.

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APPENDICES

Appendix 1: Study Participation Consent Form.

Study title: Pattern of microbial flora and antibiotic sensitivity in patient presenting with septic abortion atKNH

Participant's study number;

Introduction:

Principle Investigator:	Dr. Nuru Abbas
Institution:	University of Nairobi
Department:	Obstetrics and Gynaecology
Registration no.:	H58/75053/2014
Contacts:	0720201210

This research project is done as a part of the requirements for the award of the master's degree in Obstetrics and Gynaecology.

Investigator's Statement

I am inviting you to participate in this research study. This consent form is intended to give you information about the study that will help you make a decision on whether to participate in the study or not.

Introduction

Complications from unsafe abortion continue to be a major cause of maternal morbidity and mortality. Sepsis and haemorrhage are the major complication associated with death. Sepsis

occurswhen the products of conception are partially removed or evacuation process is done in unsterile area and poorly sterilized equipment. Removal of retained POC and initiating antibiotics remain the main treatment of septic abortion.

Purpose of Study

This is a cross sectional study that will help us know themicro-organisms causing septic abortion and the appropriate antibiotic treatment.

Objectives: Among patients presenting with septic abortion in KNH

- Determine the endocervical bacteriology through culture.
- To determine the antibiotic sensitivity
- To describe the social demographic characteristics
- To describe the complications.

Methodology

Descriptive cross-sectional study. The study participants will include women with abortion whether spontaneous or induced with signs and symptoms of sepsis. This study will be carried out in ward 1D and casualty. Study participant with septic abortion willing to give consent will be recruited.

Voluntary Participation

Your participation in this research study is voluntary. Any participant willing to withdraw from the study will be free to do so at any stage without being penalized or victimized. Your participation will involve answering questions related to you and the pregnancy and also providing an endocervical sample for m/c/s.

Risks:

There are no short or long-term risks associated with participation in this study.

Potential Benefits:

Participants will benefit by having culture tests and antibiotic sensitivity profiles done at no extra cost.

Protection of Confidentiality

Only those involved in the study will be allowed access to any data collected. True participant's identity will not be revealed in data analysis or in any publication resulting from this study. Only their unique coded numbers will be used. The sample availed will be used only for the investigations described in the study.

Contact Information

If you have any question, you may ask them now, during the study period or even after the study is over. If you wish to ask questions later, please use the contacts below:

Dr. Nuru, principal investigator on 0720201210 abbasnuru.na@gmail.com

Dr Onesmus Gachuno, Supervisor on 0722851914

KNH-UON Ethics& Research Committee on 02726300 ext.44102

Appendix 2: Consent Declaration

I have read this consent form, understood it fully, was given the opportunity to ask questions and assured of confidentiality. I voluntary give my informed consent to participate in this study.

Participants'Name_____

Participants' signature_____

Date : _____

Statement by the Researcher

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of Researcher: _____

Signature_____ Date: _____

Appendix 3: Questionnaire (Study Tool)

Study title: Pattern of microbial flora and antibiotic sensitivity in patient presenting with septic abortion

This questionnaire is to be filled by the investigator or research assistant by circling only one of the various options given for each question as per the participant's response. This is after the participant confirms full understanding of the question.

Consent Filled: Yes - No

Study Number:

Date:

Age in Years:

Contact:

Occupation: Housewife - Unemployed - Self-Employed - Formal Employment

Marital Status: Single- Married- Divorced- Widowed - Cohabiting

Highest Education Level Attained: None - Primary - Secondary - Tertiary – Don't Know

Area of Residence: Rural - Urban

Socio Economic Status: Low - Middle - High

PART 2-Obstetric History;

Parity Gravida

LNMP:

Gestation by Dates – In Weeks

Previous Contraceptive Use

Mode of Abortion: Spontaneous - Induced

If Induced, Termination Done By: Dr - Nurse - Paramedic - TBA - Others

Method of Termination; Mva - Medical - Herbs - Others

Reason for Termination; Unwanted - Dfs - Financial - Others

Antibiotic Treatment Prior To Admission; Yes - No

Duration Prior To Admission: Less Than 2weeks - More than 2weeks

Medical History:

Have You Received Any Antibiotics In The Last Two Weeks? Yes - No

Have You Been Treated For Any Infection In This Pregnancy? Yes – No – I Don't Know

Part 3

Hob/Fever Yes - No

Abdominal Pain Yes - No

Pelvic Pain Yes - No

Foul Smelling Poc Yes - No

Urinary Symptoms Yes - No

On Examination:

Vital Signs:

Temperature

Pulse Rate

Abdominal Tenderness Yes - No

Foul Poc Yes - No

Tender Adnexa/Cervical Motion Tenderness Yes - No

Laboratory Results

Microscopy - Organisms

Endocervical Culture - VE/+VE

Sensitivity pattern

THANK YOU

VIAMBATISHO

Kiambatisho 1: Fomu ya Ushirikiano wa Ushiriki wa Utafiti.

Kitabu cha Utafiti: Kipimo cha flora ndogo na virusi vya ukimwi katika mgonjwa akiwasilisha na utoaji mimba wa septic katika knh

Nambari ya kujifunza ya Mshiriki;

Utangulizi:

Mtafiti Mkuu: Dk Nuru Abbas

Taasisi: Chuo Kikuu cha Nairobi

Idara: Ugonjwa wa uzazi na uzazi

Usajili hakuna: H58 / 75053/2014

Mawasiliano: 0720201210

Mradi huu wa utafiti unafanywa kama sehemu ya mahitaji ya tuzo ya shahada ya bwana.

Wasimamizi; Dr Onesmus Gachuno - Mhadhiri Mwandamizi katika Idara ya Obstetrics na Gynecology / UON

Taarifa ya Mpelelezi

Ninawaalika kushiriki katika utafiti huu wa utafiti. Fomu hii ya idhini inalenga kukupa maelezo kuhusu utafiti ambao utakusaidia kufanya uamuzi kuhusu kushiriki katika utafiti au la.

Utangulizi

Matatizo kutoka mimba isiyo salama yanaendelea kuwa sababu kubwa ya ugonjwa wa uzazi wa uzazi na vifo. Sepsis na upungufu wa damu ni matatizo makubwa yanayohusiana na kifo. Sepsis hutokea wakati bidhaa za mimba zimeondolewa sehemu au mchakato wa uokoaji unafanywa katika eneo lisilo na sehemu na vifaa vilivyotengenezwa vibaya. Uondoaji wa POC iliyohifadhiwa na kuanzisha antibiotics hubakia matibabu kuu ya utoaji mimba septic.

Kusudi la Utafiti

Utafiti huu utatusaidia kujua viumbe vidogo vilivyosababisha utoaji mimba wa septic na matibabu sahihi ya dawa.

Kushiriki kwa hiari

Ushiriki wako katika utafiti huu wa utafiti ni hiari. Mshiriki yeyote anayetaka kujiondoa kwenye utafiti atakuwa huru kufanya hivyo kwa hatua yoyote bila kuadhibiwa au kudhulumiwa. Ushiriki wako utahusisha kujibu maswali kuhusiana na wewe na ujauzito na pia kutoa sampuli ya mkojo.

Hatari:

Hakuna hatari mfupi au ya muda mrefu inayohusishwa na ushiriki katika utafiti huu.

Faida za Uwezekano:

Washiriki watafaidika kwa kuwa na vipimo vya utamaduni na maelezo ya unyeti wa antibiotiki kufanyika kwa gharama yoyote.

Ulinzi wa Usiri

Ni wale tu waliohusika katika utafiti wataruhusiwa kufikia data yoyote iliyokusanywa. Utambulisho wa mshiriki wa kweli hautafunuliwa katika uchambuzi wa data au katika gazeti

lolote linalozotolewa na utafiti huu. Nambari zao za pekee za coded zitatumika. Sampuli iliyotumiwa itatumika tu kwa uchunguzi ulioelezwa katika utafiti.

Maelezo ya Mawasiliano

Tafadhali wasiliana na Dk Nuru juu ya 0720201210 ikiwa una maswali au wasiwasi kuhusu utafiti.

Wasimamizi; Dr Onesmus Gachuno ya0722851914- Mhadhiri Mwandamizi katika Idara ya Obstetrics na Gynecology / UON

Prof. James Karanja, ya 0722513881 Mhadhiri Mwandamizi katika Idara ya Obstetrics na Gynecology / UON

Ikiwa kuna maswali yoyote kuhusu haki zako kama somo la utafiti unaweza kuwasiliana na KNH-UON Kamati ya Maadili na Utafiti juu ya 02726300 ext.4410

RUHUSA KWA MSHIRIKI:

Nimesoma fomu hii ya idhini, kuelewa kikamilifu, alipewa nafasi ya kuuliza maswali na uhakika wa siri. Mimi kwa hiari kutoa ridhaa yangu ya kushiriki kushiriki katika utafiti huu.

Sawa ya mshiriki _____ Tarehe: _____

Mtu anafanya mchakato wa idhini:

Nimetoa habari zinazohitajika na kuhakikisha kuwa mshiriki ameelewa utafiti kama ilivyoelezwa katika fomu hii ya idhini.

Saini _____ Tarehe: _____

Nitapewa nakala ya fomu hii ya idhini

Kiambatisho 2: Maswali (Kitabu cha Utafiti)

Kitabu cha Utafiti: Kipimo cha mimea michache na uelewa wa antibiotic katika mgonjwa akiwasilisha na utoaji mimba wa septic

Jarida hili ni kujazwa na mpelelezi au msaidizi wa utafiti kwa kuzunguka moja tu ya chaguo mbalimbali zinazopatikana kwa kila swali kulingana na majibu ya mshiriki. Hili ni baada ya mshiriki huyo kuthibitisha uelewa kamili wa swali.

Nia ya kujazwa: Ndiyo - Hapana

Nambari ya Utafiti:

IP Hapana:

Tarehe:

Umri Katika Miaka:

Wasiliana:

Kazi: Mke wa nyumbani - asiye ajira - Mwenyewe-Ajira rasmi

Hali ya ndoa: Ndoa- Ndoa- Ndoa- Ndoa - Makazi

Ngazi ya Elimu ya Juu Inayofikia: Hakuna - Msingi - Sekondari - Msituni - Sijui

Eneo la Makazi: Vijijini - Mjini

Hali ya Uchumi wa Kiuchumi: Chini - Kati - Juu

SEHEMU YA 2-Historia isiyo ya kawaida;

Shahidi Gravida

LNMP:

Gestation By Dates - Katika Wiki

Matumizi ya awali ya uzazi wa mpango

Mfumo wa Utoaji mimba: Kwa kawaida - Inapendekezwa

Ikiwa Inapotwa, Kuondolewa Kufanywa na: Dr - Muuguzi - Paramedic - Tba - Wengine

Njia ya Kukamilisha; Mva - Matibabu - Herbs - Wengine

Sababu ya Kuondolewa; Wasiyotakiwa - Dfs - Fedha - Wengine

Matibabu ya Matibabu kabla ya Kuingia; Ndio la

Muda Kabla ya Kuingizwa: Chini ya 2eeks - Zaidi ya 2weeks

Historia ya Matibabu:

Je, umepokea antibiotics yoyote katika wiki mbili zilizopita? Ndio la

Je, umefanyiwa ugonjwa kwa ugonjwa wowote katika ujauzito huu? Ndio - Hapana - Sijui

Sehemu ya 3

Hob / Fever Ndio - Hapana

Maumivu ya tumbo Ndio - Hapana

Maumivu ya Pelvic Ndiyo - Hapana

Uovu Smelling Poc Ndio - Hapana

Dalili za Mkojo Ndio - Hapana

Juu ya Uchunguzi:

Vital Ishara:

Joto

Kiwango cha Pulse

Upole wa tumbo Ndio - Hapana

Poc mbaya Ndio - Hapana

Tne Adnexa / Cervical Motion Tenderness Ndio - Hapana

Matokeo ya Maabara

Microscopy - Viumbe

Utamaduni wa Kizamani - VE / + VE

Sensitivity pattern

ASANTE

Appendix 4: Dummy Tables

Table 1: Socio-Demographic Characteristics

Characteristic	Number	Percentage
Age in years		
15_19		
20_29		
>30		
Educational level		
None		
Primary		
Secondary		
Tertiary		
Don't know		
Marital status		
Single		
Married		
Divorced/Separated.		
Widowed.		
Cohabiting		
Occupation		
House wife		
Self-employed		
Unemployed.		
Formal employment		

Table 2: Obstetric History

Characteristic		Number	Percentage
Parity	0		
	1		
	2		
	3		
	>4		
Gestational age (weeks)	<12		
	13 – 20		

Table 3: Bacterial Species Identified After Culture

Bacteria species	Number positive	Percentage
Escherichia Coli		
Klebsiella		
Streptococcus		
Staphylococcus		
Bacteroides		
Clostridia		
Chlamydia		
Gonococci		
Peptostrep		
GBS		

Table 4: Culture Test Results

Culture growth	Number	Percentage
Positive		
Negative		

Table 5: Antibiotic Sensitivity

Antibiotic / Bacterial species	E. Coli	Klebsiella	Streptococcus	Staphylococcus	Bacteroides	Clostridia	Chlamydia	Gonococci	Peptostrep	GBS
Amoxicillin										
Ampicillin										
Gentamicin										
Augmentin										
Nitrofurantoin										
Ceftriaxone										
Meropenem										
Cefuroxime										

APPENDEX 5: KNH – UON ERC APPROVAL FORM