



**PREVALENCE AND FACTORS ASSOCIATED WITH CERVICAL INCOMPETENCE
AMONG WOMEN WITH HISTORY OF SECOND TRIMESTER ABORTION AT
TERTIARY HOSPITAL IN SOUTH WESTERN UGANDA**

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ABSTRACT

Background: Cervical incompetence is one of the causes of second trimester abortion. It is of clinical and epidemiological interest because of its potential for significant consequences for women's health and, by extension, to the well-being of families and society. But follow up of these mothers who have aborted is not routinely done to MRRH to find out whether they could be having cervical incompetence. To improve outcomes for mothers with clinically suspected cervical incompetence, cervical assessment is mandatory to first confirm the diagnosis. Then counselling and cervical cerclage can be done for the next pregnancy to prevent subsequent pregnancy loss and improve overall maternal morbidity and perinatal outcomes. **Objective:** To determine the prevalence and identify factors associated with cervical incompetence among women with second trimester spontaneous abortions attending gynecology outpatient clinic at Mbarara Regional Referral Hospital. **Methodology:** This was a Cross-sectional study carried out from 1st November 2017 to 30th March 2018 on patients with a history of second trimester abortion in at least 6 preceding weeks prior to the study. A total of 121 none pregnant patients with history of pregnancy were consented, interviewed, cervix assessed and diagnosis of cervical incompetence was made if a cervix freely admitted Hegars dilator size 8 and above. Data was collected on socio-demographics, medical conditions, obstetrics and gynecological factors and entered in Excel and analyzed using STATA 13. Multivariate analyses were done to determine the factors associated with cervical incompetence having statically significant level (CI \leq 0.05). **Results:** The prevalence of cervical incompetence among second trimester abortion was 21.5% (26/121). Factors that had a significant relationship with cervical incompetence included number of abortions, specifically more than 2 (aOR 6.8; CI: 1.7-26.8; $p=0.006$), and cervical tear (aOR 17.1; CI:4.2-69.12; $p=0.000$). **Conclusion:** The Prevalence of cervical incompetence among second trimester abortion as diagnosed by Hegars dilator test was at a high of 21.5%. Number of abortions and previous cervical tear were independently associated with cervical incompetence.

KEYWORDS: Abortion, cervical incompetence, second trimester abortion, recurrent abortion.

INTRODUCTION

Background

Pregnancy losses have a variety of causes, one of which is cervical incompetence that tends to cause recurrent second trimester abortions.^[1] Cervical incompetence is defined by the American College of Obstetricians and Gynecologists (ACOG) as the inability of the uterine cervix to retain a pregnancy in the second trimester or early third trimester, in the absence of uterine contractions.^[2]

Cervical incompetence can be congenital or acquired; leading to spontaneous pregnancy loss from the second trimester up to preterm delivery. It may be associated with congenital uterine anomalies such as septate or

bicornuate uterus. Rarely it may be congenital following collagen weakness. Cervical trauma may occur during abortion/process following abortion, labor or delivery (spontaneous, forceps- or vacuum-assisted, cesarean section), rapid mechanical cervical dilation before a gynecological procedure, or treatment of cervical intraepithelial neoplasia. This may predispose to loss of the following pregnancy.^[3] Wong in a study in the US reported intrapartum cervical laceration as predisposing factor for cervical incompetence in subsequent pregnancy.^[4]

According to Abenheim et al, the diagnosis is often based on: a typical history of painless dilatation of the cervix in the second trimester of pregnancy, leading to

the finding of bulging membranes on presentation or sudden rupture of membranes, followed by a relatively painless miscarriage or preterm delivery (Talaviya and Suvagiya, 2011). During the non-pregnant stage, the cervical resistance, as measured by the cervical resistance index is reduced.^[5] The diagnosis can also be made by either allowing passage of Hegar dilator size 8, traction test using an inflated Foley catheter size 16, or internal os measurement >8mm on hysterosalpingogram.^[6-8]

The women identified using these tools are defined objectively as high risk for cervical incompetence and cervical cerclage has been shown to reduce both abortions and preterm deliveries.^[8] It is believed that cervical incompetence is the cause of 20 - 25% of all second trimester losses. This insufficiency generally shows up in the early part of the second trimester, but possibly as late as the early third trimester.^[2]

The prevalence of cervical incompetence is 0.05% to 2% of all deliveries. This wide variation is in part due to the rarity of the condition, but also due to the difficulty and subjectivity involved in making the diagnosis.^[9] In a study done in United Kingdom at Liverpool University Teaching Hospital, 8% of spontaneous second trimester abortion fulfilled strict criteria for cervical incompetence.^[10] In a study done in Nigeria about pregnancy complications and outcomes following cervical cerclage operation, at the University of Maiduguri teaching hospital, they found an incidence of 0.5%.^[11]

Multipara mothers, old age, and history of previous abortion are particularly at risk for spontaneous second trimester abortion.^[12] Cervical incompetence is associated with uterine malformations such as septate or bicornuate uterus.^[13] There is also a strong reproducible inverse correlation between cervical length and preterm delivery.^[14] Recurrent abortion poses a grave risk to women's health and, by extension, to the well-being of families and society.^[15]

A review of records of gynecology ward at MRRH from April – September 2016 showed a total of 169 abortions of which 81 (47%) were spontaneous abortions in second trimester. Among these, 30 (36%) were recurrent possibly because of cervical incompetence.

In the same period, only 3 cervical cerclage were done according to the theatre records from April to September. Even then, these three were not diagnosed according to standard protocol.

Follow up of these mothers who have aborted is not routinely done at MRRH to find out whether they could be having cervical incompetence.

Despite this high number of second trimester abortions at MRRH, no study has been done/documentated about the

prevalence and factors associated with cervical incompetence among these groups of women. Yet once identified there is an available treatment option of cervical cerclage with a success rate of 80 – 90%.^[2] But if the diagnosis of cervical incompetence is missed, the mother will be prone to the unbearable recurrent pregnancy losses which affect her social and family life.

Cervical incompetence is treatable in our setting but its prevalence is unknown and yet it contributes to the causes of abortion and preterm deliveries. Even those who undergo cervical cerclage the diagnosis is usually not done through standard protocols.

Knowing the prevalence and factors associated with cervical incompetence among women with history of second trimester spontaneous abortions presenting at MRRH will help guide appropriate modification of the clinicians' degree of suspicion for a possible improvement in the management of cervical incompetence locally at MRRH, others regions of Uganda and possibly other developing countries all over the world. This will improve overall maternal morbidity and perinatal outcomes and counseling for patients attending our facility and other similar settings.

MATERIALS AND METHODS

STUDY DESIGN: this was a cross sectional study in which patients who were at least 6 weeks post abortion were recruited in gynecology clinic, interviewed and assessed for cervical incompetence at the same time.

Study site: The study was conducted at Mbarara Regional Referral Hospital in gynecology clinic. MRRH is a public health facility and also doubles as a University teaching hospital for both undergraduate and postgraduate students. MRRH is situated in Mbarara town, Mbarara district, South Western Region in Republic of Uganda.

This gynecology clinic had an average of 20 to 25 patients visits daily among which an average of 30% of the daily visits, around 8 patients come for PAC. Among these, around 3 patients (35%) have a pregnancy loss from the second trimester and above. Patients in the gynecology clinic are assessed by resident doctors supervised by specialists during work days. Patients who need evacuation are sent to Gynecology ward, where an average of 3- 4 abortions are managed daily. At gynecology ward, patients are admitted, examined and managed by a team consisting of interns and residents permanent on ground supervised by specialists. After recovery, PAC patients are discharged on oral treatment then scheduled for review in gynecology clinic.

Study population: All women attending gynecology clinic at MRRH with history of second trimester spontaneous abortion during the study period who met the inclusion criteria for the study.

Sampling procedure and sample size calculation

Consecutive enrollment of all women meeting the inclusion criteria attending gynecology outpatient from 1st November to 30th March 2018.

We determined the sample size by using the Keish and Leslie (1995) formula as below; $n = \frac{Z^2 pq}{d^2}$ Where; **n** = sample size

Z = **1.96** (the Z score value corresponding to 95% level of confidence on the standardized normal distribution curve).

P = prevalence (0.08 prevalence of cervical incompetence among spontaneous abortion in United Kingdom)

q = 1 – P

d = **0.05** (CI=confidence interval) which is the acceptable tolerable error.

Substituting for **n**, $n = \frac{1.96^2 \times 0.08 \times (1-0.08)}{0.05^2}$ **n** = 114

A total sample size of **114** patients was estimated.

In consideration of the participants who may have missing or incomplete data, a 10% addition to the calculated N was included to give an overall estimated sample size of, N= **125** patients.

Eligibility criteria

Inclusion criteria

- All confirmed non pregnant women with a more than 6 weeks' history of a spontaneous second trimester abortion attending gynecology clinic at MRRH.

Exclusion criteria

- Molar pregnancy.
- Women with symptoms of infection or abortion complication.

Study instrument and data collection

An interviewer administered questionnaire was tested on 10 patients from gynecology clinic to assess the feasibility of the questionnaire.

We applied a consecutive sampling method whereby all women with history of second trimester spontaneous abortion attending gynecology outpatient clinic at MRRH and met the inclusion criteria were recruited every working day. The confirmation of a non-pregnant state using urine HCG test was done. We had an USS for diagnosis of early pregnancy wherever necessary. Before the interview, the nature of the study was explained to each woman and a written consent to participate in the study was obtained. Each participant was assured of the

confidentiality of her information and anonymity. The questionnaire was administered to the study participants in the language they best understood, by the Principal Investigator or trained research assistants. Interviews were conducted as privately as possible, as each respondent was taken in a side room.

Dependent variable was cervical incompetence.

Independent variables that were captured in the questionnaire included:

- Socio-demographic: age, education level, marital status, occupation.
- Obstetrics and gynecology: parity, previous abortions, gestational age, previous D/C, induced abortions/cervical trauma, cervical laceration/tear, previous preterm delivery, previous prolonged 2nd stage labor, precipitated labor, previous instrumental vaginal deliveries, macrosomia, instrumental delivery
- Social/environmental: smoking, alcohol.
- Medical factors: chronic diseases, drugs use, contraception, BMI/obesity.

After data collection, the questionnaire was cross checked by principal investigator to rule out any missing data before the patient had gone.

Principal Investigator and research assistants had weekly meetings to evaluate the progress of the study or whenever need arose.

Cervical incompetence assessment

After interview, the procedure was explained to the participant. This was done in a private room with an examination couch and adequate light. A female nurse or chaperon was present in the examination room whenever the woman was going to be examined by principal investigator. The participant was put in lithotomy position. The vulva was swabbed using cotton swabs. A sterile Sim's speculum was inserted. Swabbing of Vaginal wall and cervix with hibitaine were done. Cervix was stabilized by two volselum forceps put on the upper and lower lips of the external cervix to remove the ante-vertex angle of the normal position of the uterus. Gradual plastic Hegar's dilators were used, from size 12-8 in that order. We used the plastic Hegar's dilators over the metallic because of the availability, low price and easy processing of the plastics Hegar's compared to the metallic ones. Analgesia was not given.

Cervical incompetence was defined as cervix that would admit size 8 or bigger Hegar's dilator with ease.

In case of other findings (suspicion of infection, cervical lesion), the participant was referred to the corresponding subunit, CCP (Cervical Cancer Prevention clinic), for further management.

Data management and statistics analysis

All completed questionnaires were checked for completeness by the principal investigator prior to data entry. Data entry was done in a database designed in Epi-Info version 7.2. Following completion of data entry, the dataset was exported in Excel format. The collected data was entered into a password protected computer using Excel and exported into STATA 13 software. This data was presented using tables. Demographic data variables were reported by mean and standard deviation or median and interquartile range for continuous variables, and counts and percentages for categorical variables. To answer the first objective, the prevalence of cervical incompetence was found by the proportion of patients with cervical incompetence over all patients with history of second trimester abortion. To answer the second objective, a bivariate analysis was done to establish all factors which have a significant relationship with cervical incompetence, based on a significance level of 5% and using two-way tables with measures of association and logistic regression. Their crude odds ratios with 95% confidence intervals were generated. All statistically significant factors ($p < 0.05$) and those of importance with $p < 0.1$ were used in a multiple logistic regression to control for confounders. The most

significant model was chosen and tested to see if it fits the data (Hosmer-Lemeshow χ^2).

Quality control and standardization

A qualified Obstetrician/Gynecologist was regularly joining the Principal Investigator to perform the cervical assessment procedure on the tenth patient to ensure that the researchers are following the standard procedure for the assessment of study participants.

Study limitation

- Concealment of relevant information like marital status, induced abortion, use of drugs, alcohol, tobacco. But we explained that there was confidentiality.
- Inability to discover a missed abortion that could have occurred in first trimester but aborted in second trimester, derived from fetal demise occurring in first trimester.

Ethical clearance

Ethical clearance was obtained from the department of obstetrics and gynaecology, Faculty of medicine research committee, and the Mbarara University of Science and Technology Research Ethics Committee.

RESULTS**BASELINE CHARACTERISTICS****Table 1: Socio-demographic and Behavioral characteristics of patients (N=121).**

Characteristic	n [%]
Age categories in years	
<25	31 [25.62]
25-34	49 [40.50]
≥35	41 [33.88]
District	
Mbarara	75 [61.98]
Isingiro	14 [11.54]
Bushenyi	09 [07.44]
Ntungamo	08 [06.61]
Others	15 [12.40]
Residence type	
Rural	67 [55.37]
Urban	54 [44.63]
Tribe	
Banyankole	84 [69.42]
Baganda	8 [06.61]
Bakiga	23 [19.01]
Others	06 [04.96]
Religion	
Catholic	46 [38.01]
Protestant	54 [45.38]
Moslem	12 [9.91]
Others	09 [7.56]
Highest level of education	
None	11 [09.09]
Primary	58 [47.93]
Secondary	44 [36.36]
Tertiary	08 [06.61]

Marital status	
Single	22 [18.18]
Married	99 [81.82]
Occupation	
Housewife	15 [12.40]
Business	36 [29.75]
Peasant	52 [42.97]
Student	11 [09.90]
Professional	09 [07.43]
Age of spouse	
18-34	48 [39.67]
>35	73 [60.33]
Alcohol consumption	
Non consumed	83 [68.60]
consumed	38 [31.40]
Cigarettes Smoking	
Non smoker	116 [95.84]
smoker	05 [04.13]

The mean age at presentation was 31.19 ± 7.85 . Majority of the participants were married, Banyankole from Mbarara district. Majority of the participants were neither self-reported smokers nor alcohol consumer.

Participants with history of preterm labor, precipitated labor, prolonged second stage, instrumental delivery were 102 because 19 participants were nulliparous, had not yet experience labor.

HIV seropositive status was found in 18.18% of the participants. Of the 121 participants, majority reported no Diabetes mellitus 116 (95.87%), no Hypertension 111 (91.74%) and 4(3.31) were using recreational drugs.

Majority of the participants were grand multiparous followed by multiparous in their 2nd trimester. 15 participants (12.4%) had had at least 3 spontaneous abortions, 17 participants had history of preterm delivery (16.67%), majority (74.38%), had started ATN visit prior to the abortion. 28.44% had history of precipitated labor, majority of the participants 74 had a history of herbal use, which gives 61.16%. Among the participants, 16 of them had cervical tear.

THE PREVALENCE OF CERVICAL INCOMPETENCE

The overall prevalence of cervical incompetence among women with history of second trimester abortion attending outpatient clinic at MRRH was 21.49% (26/121) (Table 3).

Table 2: Prevalence of cervical incompetence.

Prevalence type	n/N	%[95% CI]	P
Overall	26/121	21.5 [15.0-29.8]	-
Age specific			0.523
< 25	6/31	19.4 [8.5-38.1]	
25-34	13/49	26.5 [15.7-41.1]	
>=35	7/41	17.1 [8.5-38.1]	

FACTORS ASSOCIATED WITH CERVICAL INCOMPETENCE

Table 3: Factors associated with cervical incompetence (Univariate and bivariate analysis).

Variable	No CI n[%]	CI n[%]	Crude OR [95% CI]	P value
Age categories in years				
<25	25 [80.7]	6 [19.4]	Ref	
25-34	36 [73.5]	13 [26.5]	1.5[0.50-4.49]	0.464
≥35	34 [82.9]	7 [17.1]	0.86[0.25-2.87]	0,803
Alcohol consumption				
Non consumed	66[79.5]	17 [20.5]	1.2 [0.48-3.02]	
Consumed	29 [76.3]	9 [23.7]	Ref	0.691
Smoker				
Non smoker	92[79.30]	24 [20.7]	2.55 [0.40-16.16]	
Smoker	39[60.00]	2 [40.0]	Ref	0.303
Diabetes				

Non diabetic	93 [80.2]	23 [19.8]	6.06[0.95-38.43]	0.032
Diabetic	2 [40.0]	3 [60.0]	Ref	
HIV status				
HIV negative	76[76.77]	23 [23.4]	0.52[0.14-1.92]	0.322
HIV positive	19[86.36]	3 [13.6]	Ref	
Abortion number				
1	67 [87.0]	10 [13.0]	Ref	
2	21 [72.4]	8 [27.6]	2.55[0.89-7.30]	0.081
>=3	7 [64.7]	8 [53.3]	7.65[2.27-25.74]	0.001
Gestational age of most recent pregnancy lost				
12-16 WOA	57 [80.3]	14 [19.7]	Ref	0.609
17-20 WOA	16 [75.0]	6 [25.0]	3.23 [1.28-8.17]	0.297
21-24 WOA	9 [66.7]	4 [33.3]	4.3 [1.3-14.6]	0.980
25-28 WOA	12 [80.0]	3 [20.0]	1.02[0.25 – 4.10]	
Preterm delivery				
Yes	65 [78.4]	17 [22.6]	0.96[0.29-3.21]	0.960
No	24 [79.0]	5 [21.1]	Ref	
ANC				
Non attended	24 [77.40]	7 [22.60]	0.91[0.34-2.45]	0.864
Attended	71 [78.90]	19 [21.11]	Ref	
Herbal use				
Used herb	40[85.1]	7 [14.9]	1.97[0.7-5.1]	0.159
Never used	55[74.3]	19 [25.7]	Ref	
Tear				
Yes	89 [84.7]	16 [15.2]	9.2[2.2-29.1]	0.000
No	6 [37.5]	10 [62.5]	Ref	

Factors which had a significant association with cervical incompetence before adjusting for confounder included number of abortion, diabetes, cervical tear. The parity, socio-economic status, smoking, alcohol, HIV status, herbal use, preterm labor, ATN attendance before abortion were not associated with cervical incompetence (Table 3).

Number of abortion and cervical tear were found to be significantly and independently associated with cervical incompetence (Table 5). The odds of having cervical incompetence is 17.1 times higher for a patient with cervical tear with a 95% confidence interval of [4.2-69.2] and at a level of significance of p value less than 0.001.

The odds of having cervical incompetence is 6.8 time higher for a patient with history of 3 abortions and above with a 95% confidence interval of [1.7-26.8] and a level of significance of p value of 0.006.

DISCUSSION

PREVALENCE OF CERVICAL INCOMPETENCE

In our study, the overall prevalence of cervical incompetence was 21.5% which was high compared to the study done in United Kingdom University Teaching Hospital where a prevalence of 8% fulfilled strict criteria for cervical incompetence without any other associated factor like infection, hemorrhage, or uterine over distension. This was done for over 5 years (from 1991-1996) with a very big sample size of 636 participants.^[16]

This low prevalence of the united kingdom university Teaching Hospital could be because they excluded all participants with signs of infection, hemorrhage or uterine over distension, these being confounders.

The Prevalence in our study is higher than the rate in of the study by Stattery and Morrison (0.5-2%) because in that study the rate was for the total deliveries while in our study it was over the patients who have had second trimester abortion.^[9]

Our prevalence was also higher than the one done in Nigeria about pregnancy complications and outcome following cervical cerclage operation, there were 20,250 deliveries at the University of Maiduguri teaching hospital from January 1983 to December 1999, it was found that 108 patients diagnosed with cervical incompetence and then had cervical cerclage during the period of review. Which gives an incidence of 0.5% [1/200].^[11]

These different findings could be explained by the fact that the Nigerian study was a cohort done during a period of 15 years and accounted for all deliveries at the university of Maiduguri teaching hospital.

The prevalence of our study is also higher than one in a cohort study done in a community hospital of Roanoke valley in Virginia, about outcome of pregnancy, it was found that: Cervical incompetence was present in 0.8 per cent of 5,984 pregnancies progressing beyond the stage of viability (Jennings 1972).

This low prevalence of Roanoke community hospital of Virginia could be because it was a cohort study where their numerator considered patients with cervical incompetence who had cervical cerclage over the total pregnancies progressing beyond the age of viability.

Our result is in line with general findings of cervical incompetence 20 - 25% of all second trimester losses.^[2]

FACTORS ASSOCIATED WITH CERVICAL INCOMPETENCE

Numbers of abortion

In our study, it was found that number of abortion /recurrent abortion was significantly associated with cervical incompetence with a p value of 0.006 for those with at least 3 abortions. The number of previous pregnancy losses ranged from 1 to 6. On average, therefore, most patients presented with 2 to 3 lost pregnancies. The gestation age at presentation varied from 12-28 weeks, with an average of 16.24 weeks.

These findings are in line with the Kenyan study which found the following obstetric factors as risk factors for cervical incompetence; recurrent pregnancy loss was the most common presentation. The number of previous pregnancy losses ranged from 1 to 11, with a mean pregnancy loss of 2.45. The number of past viable pregnancies at presentation was 0.77, with a range of 1 to 4. On average, therefore, most patients presented with 2 to 4 lost pregnancies. The gestation age at presentation varied from 7-28 weeks, with an average of 14.96 weeks.^[17]

Traditionally the diagnosis of cervical incompetence was made after a history of two or more consecutive second trimester abortions.^[18] That can explain why women with two or more abortions in our study had a higher odds of incompetence.

Cervical tear

We found that cervical tear was statistically significant with a P value less than 0.001. 16 participants (13.22 %) had cervical tear which was reported by participant or/and identified during cervical assessment.

This result is almost similar to same study done in Kenya, they found that 17.1% of the patients had a prior history of cervical or uterine surgery, compared to those with no history of surgery (p=0.001). 11.6% of the patients had uterine and cervical defects, including bicornuate uterus, uterine septa and cervical tears. 7.1% of the patients had a history of uterine fibroids. previous history of macrosomia.^[17]

Our results are in line with the findings in a clinical practice guideline where a history of prior cervical surgery, e.g. loop electrosurgical excision procedure (LEEP), Other forms of cervical trauma, for example cervical tears may also present a risk for cervical insufficiency.^[19]

Our findings are in agreement with other studies; by Romeo and by Wong. Cervical trauma may occur during labor or delivery (spontaneous, forceps- or vacuum-assisted, cesarean), rapid mechanical cervical dilation before a gynecologic procedure, or treatment of cervical intraepithelial neoplasia. This predisposes to the loss of the following pregnancy.^[3] Wong in a study in the US reported intrapartum cervical laceration as predisposing factor for cervical incompetence in subsequent pregnancy.^[4]

Normally the cervix is rigid and tightly closed. In order to perform an abortion, the cervix must be stretched open with a certain amount of force. This forced dilation almost always causes microscopic tearing of the cervix muscles and occasionally and the uterine wall.^[20]

Barbara Luke (PhD) has identified one mechanism that explains abortion causing prematurity risk: A weakened cervix pre-disposes a woman to mid-term miscarriage or premature delivery, because the cervix has been naturally or artificially dilated previous to the pregnancy.^[21]

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The prevalence of cervical incompetence as tested by Hegar's dilator was at a high rate of 21.5%. Number of abortion and cervical tear were found to be significantly associated with cervical incompetence among patients with history of second trimester spontaneous abortion attending gynecology outpatient clinic at Mbarara Regional Referral Hospital.

RECOMMENDATIONS

To Mbarara Regional Referral Hospital and the Department of Obstetrics and Gynecology:

To put in place capacity to do routine cervical incompetence assessment of all none pregnant patient with history of spontaneous abortion of 12 weeks and above because of high prevalence of cervical incompetence, especially those with more than 2 abortions or and cervical tear.

To all pregnant mothers with history of more than 2 consecutive abortions, plan for cervical cerclage at 12-16 weeks of amenorrhea.

This study recommends infancies on prevention and management of cervical tear.

We recommend a cohort study aimed to determine outcomes of these patients diagnosed to have cervical incompetence at MRRH.

ACRONYMS AND ABBREVIATIONS

ANC: antenatal care

CCP: Cervical Cancer Prevention

BMI: Body Mass Index

D/C: Dilatation and Curettage

LEEP: loop electro surgical excision procedure

LNMP: First day of the last normal menstrual period
MRRH: Mbarara Regional Referral Hospital
MIAC: Microbial invasion of the amniotic cavity
MUST: Mbarara University of Science and Technology
OPD: Out Patient Department
PAC: Post abortion care
TVS: Transvaginal sonography
USS: Ultra sound scan
VIA: visual inspection under acetic acid
WHO: World Health Organization

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Availability

The data set from which conclusions were drawn are presented in the main paper.

Authors contributions

B.M.A: conceived, designed, participated in data collection, analysis and discussion, draft the manuscript
K.H: participated in study concept and design; all authors read and approved the final manuscript.
A.L: participated in study concept and design; all authors read and approved the final manuscript.
L.J.J: participated in the collection, analysis and discussion, all authors read and approved the final manuscript.
M.A.D.K: participated in the collection, analysis and discussion, all authors read and approved the final manuscript.

Competing interests

The authors declare that there was no competing interest.

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