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ORIGINAL RESEARCH

To study safety and efficacy of manual vacuum aspiration vs electric vacuum aspiration in 1st trimester abortion

[1]Dr. Smita Tyagi, [2]Dr. Niranjana Prajapati, [3]Dr. Alka Singh

[1]Professor, [2]Assistant Professor, [3]Junior Resident, Department of Obstetrics & Gynaecology, Muzaffarnagar Medical College, Muzaffarnagar, UP, India

Corresponding author
Dr. Alka Singh
Junior Resident, Department of Obstetrics & Gynaecology, Muzaffarnagar Medical College, Muzaffarnagar, UP, India
Email: singh.alka2603@gmail.com

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ABSTRACT

Introduction: The aim of this study was to compare the effectiveness of Manual Vacuum Aspiration (MVA) and Electric Vacuum Aspiration (EVA) for first-trimester abortion. **Methods:** This hospital-based interventional study involved antenatal patients up to 12 weeks of gestation seeking abortion services at the Department of Obstetrics and Gynecology, Muzaffarnagar Medical College, Uttar Pradesh. Patients were randomly assigned to either the MVA group or the EVA group, with 50 patients in each group. Univariate sampling was employed to assign patients to either MVA or EVA groups. **Results**: The findings indicate that while there are no significant differences in age distribution, gestational age, BMI, and amount of Propofol used between the two methods, notable distinctions were observed in specific areas .MVA procedures were significantly shorter compared to EVA, suggesting a potential benefit in terms of reduced operation time. MVA proved better in cases of incomplete abortions, while EVA had a higher rate of success in cases of missed abortions, indicating different profiles of procedural efficacy. **Conclusion:** Both methods had unique risk profiles, with EVA linked to higher risks of uterine rupture and haemorrhage, while MVA had higher rates of incomplete evacuation and retained products of conception. The study emphasizes the importance of personalized medical care in choosing between MVA and EVA for first trimester abortion.

Keywords:MVA, EVA, gestational age, missed/incomplete abortions

INTRODUCTION

Abortion is a common medical procedure among women, with 20% of pregnancies in the United States ending in abortion in 2014, and an estimated 25% of women having an abortion at some point in their lives (1). Globally, one in four pregnancies is terminated through abortion. Clinicians must understand the prevalence, options, safety measures, limitations, and challenges of abortion to provide effective care.In 2018, the National Academies of Sciences, Engineering, and Medicine confirmed the safety and efficacy of all types of abortion, including medical and aspiration methods (2, 3). First-trimester abortions are not associated with infertility, ectopic pregnancy, spontaneous abortion, or breast cancer. Additionally, abortion does not pose a risk to a patient's mental health (4).

Abortion can be performed via medication or aspiration, depending on maternal or fetal indications. Pre-abortion assessments typically include blood tests, coagulation studies, STD screening, beta HCG levels, and a transvaginal ultrasound. Medication abortions can be done at home, while aspiration procedures are usually performed in clinical settings with local anesthesia, sometimes with conscious sedation (5-7).According to the World Health Organization (WHO), 211 million pregnancies occur globally each year, with over 46 million terminated by induced abortion. Most abortions occur in the first trimester, with vacuum aspiration, sharp curettage, and medical methods being the primary techniques. WHO advocates vacuum aspiration as the preferred method due to its safety, effectiveness, and reduced pain compared to sharp curettage and some medical abortions. Vacuum aspiration has a documented complete abortion rate of 95-100% (8, 9). It involves using a plastic cannula attached to a vacuum source, with electric vacuum aspiration (EVA) using an electric pump and manual vacuum aspiration (MVA) using a hand-held syringe (9). MVA is preferred by

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some for its quieter operation and suitability for primary care settings, but it is less commonly used due to limited comparative data (10-12).

Miscarriage, or early pregnancy loss, affects 10-20% of clinically identifiable pregnancies, with a recorded rate of 29 per 1000 in women aged 15-49 (13, 14). Unsafe abortions account for 10-13% of maternal mortality in developing countries (15). Miscarriages can present with various symptoms and are managed through medical, surgical, or expectant approaches. About 88% of women who miscarry undergo surgical evacuation under general anesthesia (17). MVA, introduced in China in 1958, is effective and safe for early pregnancy loss, with a success rate of 98% compared to 97% for EVA (18, 19). MVA results in less blood loss and shorter hospital stays than EVA (19, 20).MVA and EVA provide safe, accessible, and cost-effective abortion services, addressing barriers to women's access. MVA is advantageous due to its simplicity, portability, affordability, and lack of need for electricity or extensive personnel. Despite its global use, there is limited local research comparing MVA and EVA effectiveness (15, 20). This study aims to evaluate MVA's effectiveness in terminating first-trimester pregnancies compared to EVA.

METHODOLOGY

Study Design

This hospital-based interventional study was conducted in the Department of Obstetrics and Gynecology at Muzaffarnagar Medical College, Uttar Pradesh. The research aimed to compare the effectiveness of Manual Vacuum Aspiration (MVA) and Electric Vacuum Aspiration (EVA) for first-trimester abortion.

Study Place

The study was carried out in the Department of Obstetrics and Gynecology at Muzaffarnagar Medical College, Uttar Pradesh, leveraging the clinical infrastructure and patient population available at the institution to conduct the research.

Study Population

The study involved antenatal patients up to 12 weeks of gestation seeking abortion services at the Department of Obstetrics and Gynecology, Muzaffarnagar Medical College. These patients were randomly assigned to either the MVA group or the EVA group, with 50 patients in each group.

Duration of Study

The study spanned 18 months, with 12 months dedicated to data collection and the remaining six months allocated for data compilation and analysis. This timeframe ensured a thorough collection and assessment of relevant data to draw meaningful conclusions.

Sample Size and sampling technique

The sample comprised 100 women seeking first-trimester evacuation, divided into two groups of 50 each for MVA and EVA. The sample size was determined based on the average number of first-trimester evacuation cases over a three-year period (2021-2023) at the hospital. Simple random sampling was employed to assign patients to Group M (MVA) and Group E (EVA), ensuring an unbiased distribution of participants across the two intervention groups.

Inclusion & exclusion criteria:

Women with pregnancies up to or less than 12 weeks of gestation were included in the study. This criterion ensured the relevance and uniformity of the study population regarding gestational age.The exclusion criteria were: gestational age greater than 12 weeks, irregular uterine cavity (e.g., large submucosal fibroid, septate or bicornuate uterus), bleeding disorders, and genital infections. These conditions could complicate the abortion procedures or affect the outcomes, thereby ensuring patient safety and study validity.

Study Procedure:

The study compared the use of manual vacuum aspiration (MVA) and electric vacuum aspiration (EVA) for abortion services. MVA is a secure, efficient, and affordable solution for women's access to abortion services, with success rates of approximately 99%. It is endorsed by the WHO as a preferred technique for uterine evacuation due to its cost-effectiveness, accessibility, and comparable efficacy to dilation and curretage (D&C). MVA is applicable for any situation requiring suction, including medical termination of pregnancy in the first trimester. Pre-procedure tests included total and differential blood counts, Rh typing and blood grouping, blood glucose levels, viral markers, urine tests, and ultrasonography. The procedure involved various components, including the MVA syringe, Karman cannula, Cusco self-retaining retractor, vulsellum or Allis tissue forceps, Betadine or Savlon, Hegar dilators, and regional anesthesia. MVA is preferred over D&C due to the lower risk of cervical or uterine damage from excessive dilation. MVA's simplicity, portability, and cost-effectiveness make it suitable for various healthcare settings, including primary health centers and low-cost medical setups. It allows prompt and safe abortion services, especially in low-resource or remote areas. Contraceptive counseling is an integral part of abortion care, helping women prevent future unintended pregnancies.

Statistical analysis: Statistical analysis was done using SPSS 25.0 version, chi-square test was used to analyze the difference between two categorical groups. The P-value < 0.05 will be considered for statistical significance.

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RESULT

The results of this hospital-based interventional study provide significant insights into the comparative efficacy and safety of Manual Vacuum Aspiration (MVA) and Electric Vacuum Aspiration (EVA) for first-trimester abortions. Key findings are summarized below:

The age distribution of women undergoing MVA and EVA showed no statistically significant difference (p=0.414). The majority of participants were in the 30-40 years age group for both MVA (46%) and EVA (52%). This suggests that women in this age group are more likely to seek abortion services. Interestingly, the mean age for the MVA group was slightly higher at 36.2 years compared to 33.3 years for the EVA group, indicating a marginally older demographic opting for MVA.The analysis of parity indicated a non-significant difference between the two groups (p=0.11). Primigravida women (first-time pregnancies) constituted a larger proportion in the MVA group (40%) compared to the EVA group (28%). Conversely, multigravida women were more prevalent in the EVA group (72%) compared to the MVA group (60%). This suggests a potential preference for EVA among women with previous pregnancies.

There was no significant difference in the gestational age distribution between the MVA and EVA groups (p=0.414). Most participants in both groups were within the 6-9 weeks gestational age bracket. The mean gestational age for the MVA group was slightly lower at 8.6 weeks compared to 9.1 weeks for the EVA group, indicating a trend towards earlier abortions in the MVA group.The BMI distribution did not show a statistically significant difference between the groups (p=0.567). However, the most common BMI category in the MVA group was 25-29.9 (62%), compared to the EVA group (42%). This highlights the varied BMI profiles of women undergoing these procedures.

The duration of surgery was significantly shorter for the MVA group compared to the EVA group (p=0.004). Most MVA procedures were completed within 3-7 minutes, while EVA procedures tended to take longer, with a significant proportion extending beyond 9 minutes. This indicates a more time-efficient process for MVA.The analysis of complications revealed notable differences between the two groups. Incomplete evacuation was more common in the MVA group (28%) compared to the EVA group (20%). Conversely, blood loss ≥100ml and uterine perforation were more frequent in the EVA group (16% and 6%, respectively) compared to the MVA group (8% and 2%). These findings suggest that while MVA may have a higher incidence of incomplete evacuation, EVA is associated with greater risks of significant blood loss and uterine perforation. The amount of Propofol used did not differ significantly between the groups (p=0.677). Most participants in both groups received 5-10 ml of Propofol, indicating similar anesthesia requirements for both procedures. USG findings indicated a statistically significant difference in the rates of missed or incomplete abortions (p=0.023). Incomplete abortions were more prevalent in the MVA group (58%), whereas missed abortions were more common in the EVA group (62%). This underscores the distinct profiles of procedural efficacy and risk between the two techniques.

Post-operative pain perception showed a significant difference between the groups (p<0.005). Severe pain (scale 7-10) was more frequently reported in the EVA group (24%) compared to the MVA group (12%). This suggests a higher incidence of severe post-operative pain associated with EVA. Hospital stay durations post-procedure were significantly shorter for the MVA group (p<0.005). A majority of the MVA group (66%) had stays of 6-12 hours, compared to only 26% in the EVA group. Longer stays were more prevalent in the EVA group, indicating quicker recovery times for MVA. Complications in patients with specific risk factors (Prev 1, Prev 2, and anemia) highlighted significant differences between the groups. For instance, RPOC and bleeding were more frequent in the MVA group for certain risk factors, while EVA was associated with higher bleeding rates in anemic patients.

Table 1: Distribution of Study Groups According to Age, Parity, and Gestational Age

Demographic Factor	Category	Group M (MVA)	Group E (EVA)	p-Value
Age	< 20 years	7 (14%)	6 (12%)	0.414
Age	20-30 years	14 (28%)	15 (30%)	
Age	30-40 years	23 (46%)	26 (52%)	
Age	> 40 years	6 (12%)	3 (6%)	
Age	Total	50	50	
Age	Mean ± SD	36.2 ± 6.6	33.3 ± 5.2	
Parity	Primigravida	20 (40%)	14 (28%)	0.11
Parity	Multigravida	30 (60%)	36 (72%)	
Parity	Total	50	50	
Gestational Age	< 5 weeks	10 (20%)	7 (14%)	0.414
Gestational Age	6-9 weeks	31 (62%)	35 (70%)	
Gestational Age	9-12 weeks	9 (18%)	8 (16%)	

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Table 2: Distribution of Study Groups According to BMI, Duration of Surgery, and Complications

Factor	Category	Group M (MVA)	Group E (EVA)	p-Value
BMI	< 18.5	10 (20%)	7 (14%)	0.567
BMI	18.5-24.9	6 (12%)	16 (32%)	
BMI	25-29.9	31 (62%)	21 (42%)	
BMI	≥ 30	3 (6%)	6 (12%)	
Duration of Surgery	3-5 mins	16 (32%)	5 (10%)	0.004
Duration of Surgery	5-7 mins	18 (36%)	9 (18%)	
Duration of Surgery	7-9 mins	14 (28%)	10 (20%)	
Duration of Surgery	9-11 mins	2 (4%)	16 (32%)	
Duration of Surgery	11-13 mins	0 (0%)	10 (20%)	
Duration of Surgery	Total	50	50	
Complications	Blood loss ≥ 100ml	4 (8%)	8 (16%)	0.211
Complications	Incomplete evacuation	14 (28%)	10 (20%)	
Complications	Uterine perforation	1 (2%)	3 (6%)	
Complications	Anesthesia complication	0 (0%)	0 (0%)	
Complications	Cervical injury	0 (0%)	0 (0%)	

Table 3: Distribution of Study Groups According to Propofol Usage, USG Findings, Hospital Stay, Post-Operative Pain Perception, and Complications with Risk Factors in Prev 1 lscs

Factor	Category	Group M (MVA)	Group E (EVA)	p-Value
Propofol Usage (ml)	< 5	10 (20%)	10 (20%)	0.677
Propofol Usage (ml)	5-10	35 (70%)	37 (74%)	
Propofol Usage (ml)	> 10	5 (10%)	3 (6%)	
USG Findings	Incomplete abortion	20 (58%)	14 (38%)	0.023
USG Findings	Missed abortion	14 (42%)	22 (62%)	
Hospital Stay (hours)	6-12	33 (66%)	13 (26%)	<0.005
Hospital Stay (hours)	12-18	11 (22%)	17 (34%)	
Hospital Stay (hours)	18-24	5 (10%)	12 (24%)	
Hospital Stay (hours)	> 24	1 (2%)	8 (16%)	
Post-Operative Pain	Mild (1-4)	13 (26%)	13 (26%)	<0.005
Post-Operative Pain	Moderate (4-6)	31 (62%)	25 (50%)	
Post-Operative Pain	Severe (7-10)	6 (12%)	12 (24%)	
Complications with Risk Factors - Prev 1	Bleeding	2 (4%)	3 (6%)	0.981
Complications with Risk Factors - Prev 1	RPOC	6 (12%)	2 (4%)	0.001
Complications with Risk Factors - Prev 1	Uterine perforation	0 (0%)	1 (2%)	0.001
Complications with Risk Factors - Prev 1	Shock	0 (0%)	1 (2%)	0.001

Table 4: Distribution of Study Groups According to Complications with Risk Factors in Prev 2 lscs

Factor	Category	Group M (MVA)	Group E (EVA)	p-Value
Complications with Risk Factors - Prev 2	Bleeding	2 (4%)	1 (2%)	0.002
Complications with Risk Factors - Prev 2	RPOC	4 (8%)	2 (4%)	0.001
Complications with Risk Factors - Prev 2	Uterine perforation	0 (0%)	1 (2%)	0.01
Complications with Risk Factors - Anemia	Bleeding	12 (24%)	8 (16%)	0.0001
Complications with Risk Factors - Anemia	RPOC	6 (12%)	2 (4%)	0.034
Complications with Risk Factors - Anemia	Shock	0 (0%)	0 (0%)	-

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DISCUSSION

In light of safety, effectiveness, and reduced risk of endometrial damage, both the WHO and FIGO recommend suction methods for abortion and treating first-trimester miscarriages (21). Miscarriage or early pregnancy loss is a common gynecological issue for women of reproductive age, with 10-20% of clinically recognized pregnancies resulting in abortion (19,22, 23). For women aged 15 to 49, the recorded pregnancy loss rate is 29 per 1000 (46). By age 45, most women have experienced at least one miscarriage (24). In underdeveloped nations, 10-13% of maternal deaths are related to unsafe abortions (22), with approximately 20 million miscarriages occurring in non-safe settings performed by untrained medical professionals contributing to 8% of pregnancy-related deaths (23).

Abortions are permitted in India, with about 620,472 abortions recorded in 2012; the total may have reached seven million. Annually, India sees about eleven million miscarriages, with complications from abortions claiming the lives of almost 20,000 women each year (4). Despite liberal regulations on medical termination of pregnancy since April 1, 1972, unsafe illegal abortions continue to pose severe health risks in India (25). One method for suction curettage in <12 weeks abortions is MVA, which uses a vacuum aspiration pump connected with a Karman catheter. This method has proven efficacious in treating first-trimester miscarriages over many years globally. It is less traumatic and faster at removing uterine contents (26, 27).

The age distribution analysis of women undergoing first-trimester abortions by MVA and EVA revealed no statistically significant difference (p-value = 0.414). The 30-40 years age group was the largest for both MVA (46%) and EVA (52%). The 20-30 age bracket was also well represented, with 28% in MVA and 30% in EVA. The frequencies were lower among <20 years and >40 years age groups. The mean age for the MVA group was slightly higher (36.2 years) compared to the EVA group (33.3 years). According to Debbarma et al. (54), MVA causes less pain and blood loss than EVA, particularly in the 26-30 age range. Samal et al. (28) also noted the efficacy and safety of MVA compared to EVA without a direct focus on age correlation.

Parity analysis showed a non-significant difference (p-value = 0.11) between MVA and EVA groups. Primigravida women were more prevalent in the MVA group (40%) compared to the EVA group (28%), while multigravida women were more common in the EVA group (72%) compared to the MVA group (60%). This suggests a possible preference for MVA among first-time pregnant women and EVA among those with previous pregnancies. Dutta et al. (29) and Dabhi et al. (30) found both methods effective for <12 weeks gestation abortions, with MVA associated with less blood loss and shorter hospital stays.

Gestational age analysis showed no significant difference (p-value = 0.414). Most participants were within the 6-9 weeks gestational age bracket, with the MVA group slightly younger on average (8.5 weeks) compared to the EVA group (9.1 weeks). Debbarma et al. (31) noted MVA's efficiency for gestations less than 10 weeks due to lower blood loss and shorter treatment duration, while Tasnim et al. (14) found higher gestational ages managed by MVA compared to EVA.

BMI analysis showed no significant difference (p-value = 0.567). The most common BMI range was 25-29.9, with 62% in the MVA group and 42% in the EVA group. Normal weight (18.5-24.9) was the second largest category for EVA (32%) compared to MVA (12%). Kamel et al. (32) did not consider BMI categories in their study, while Chiumello et al. (33) noted varying BMI impacts in other clinical scenarios.

Significant differences in recovery and symptom scales (p-value = 0.004) were observed, with the MVA group reporting lower scores. EVA had higher frequencies of more severe outcomes. Dabhi et al. (57) reported shorter surgical times for MVA (5-9 minutes) compared to EVA (7-11 minutes), and Debbarma et al. (31) found MVA preferable for first-trimester abortions due to shorter surgical time.

Complications analysis indicated a higher risk of incomplete evacuation with MVA (28%) compared to EVA (20%), but a higher risk of blood loss ≥100ml and uterine perforation with EVA (16% and 6% respectively) compared to MVA (8% and 2%). Dabhi et al. (30) noted fewer complications with MVA compared to EVA. Ghafar et al. (34) found both methods faster than D&C, with EVA being the quickest.

Propofol usage showed no significant difference (p-value = 0.677). Both groups primarily received 5-10 ml of Propofol, with similar mean amounts used. Dabhi et al. (30) did not specifically address Propofol amounts in their study.USG findings indicated a significant difference (p-value = 0.023) in incomplete and missed abortions. MVA was more effective for incomplete abortions, while EVA was better for missed abortions. Chau et al. (35) and Anjum et al. (36) confirmed MVA's safety and effectiveness for first-trimester abortions without directly comparing it to EVA.Hospital stay durations were significantly shorter for MVA (p<0.005), with most MVA patients staying 6-12 hours compared to longer stays for EVA patients. Dabhi et al. (30) and Kerure et al. (37) reported shorter stays for MVA compared to EVA.Post-operative pain perception showed significant differences (p<0.005), with more severe pain reported in the EVA group (24%) compared to the MVA group (12%). Dabhi et al. (20) found less pain with MVA, while Renner et al. (38) found no significant differences in pain perception between the methods.Complications in patients with specific risk factors (Prev 1 LSCS and Prev 2 LSCS) highlighted significant differences. MVA had higher rates of

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RPOC, while EVA had higher rates of uterine perforation and bleeding. Dabhi et al. (30) and Patil et al. (39) noted fewer complications with MVA, while Tristan et al. (40) emphasized the low complication rates for both methods.Anemia-related complications showed significant differences, with higher bleeding rates for MVA (24%) compared to EVA (16%). RPOC was also more common with MVA. Tasnim et al. (41) and Tristan et al. (40) reported similar complication rates for both methods, with low overall rates.

CONCLUSION

The study compares the use of Mechanical Vaginal Abdominal (MVA) and Electrovascular Abdominal (EVA) for first trimester abortions. It found no significant differences in age distribution, gestational age, BMI, duration of surgery, complications, Propofol use, missed/incomplete abortions, hospital stay, post-operative pain perception, and complications in patients with specific risk factors. MVA procedures were shorter, suggesting a potential benefit in reduced operation time. Both methods had unique risk profiles, with EVA linked to higher risks of uterine rupture and haemorrhage, while MVA had higher rates of incomplete evacuation and retained products of conception. MVA was better in cases of incomplete abortions, while EVA had a higher success rate in missed abortions. Post-operative pain perception was higher in EVA, indicating a need for pain management. The study emphasizes the importance of personalized medical care in choosing between MVA and EVA for first trimester abortions.

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