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MANUAL VACUUM ASPIRATION (MVA): A SAFER AND MORE EFFICIENT ALTERNATIVE TO CONVENTIONAL CURETTAGE IN FIRST TRIMESTER MISCARRIAGE

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Abstract

Spontaneous abortion, sometimes referred to as miscarriage, is a prevalent complication of early pregnancy that predominantly occurs during the first trimester of pregnancy. The annual miscarriage rate in Pakistan for women aged 15–49 years is estimated at 29 per 1,000. Conventional surgical therapy typically depends on dilatation and curettage (D&C); however, this technique is associated with significant risks. Manual vacuum aspiration (MVA) has emerged as a less invasive alternative, offering potential benefits in terms of safety, effectiveness, and resource efficiency. To evaluate the effectiveness and safety of MVA compared to conventional curettage in the surgical treatment of first-trimester miscarriages. A randomized controlled experiment was performed at the Department of Gynecology and Obstetrics, Bolan Medical Complex, Quetta. A total of 274 women aged 18–35 years who experienced first-trimester miscarriages were randomly assigned to two groups: Group A (MVA) and Group B (traditional curettage). Efficacy was defined as the complete evacuation of uterine contents, verified by transvaginal ultrasonography, indicating an endometrial thickness of less than 4 mm with no retained products. MVA achieved a total evacuation rate of 95.6%, compared to 85.8% in the conventional curettage. MVA was correlated with reduced procedure length, decreased blood loss, and a shorter hospital stay. MVA is a secure and efficient substitute for traditional curettage in the treatment of first-trimester miscarriages. Clinical benefits, including reduced complications and enhanced efficiency, support the broader implementation of MVA in standard practice to improve patient outcomes and optimize healthcare resources.

1. INTRODUCTION

Unintended pregnancy loss (IUP) refers to the loss of a pregnancy before 20 completed weeks of gestation and is a frequent adverse outcome; it is a major contributor to maternal morbidity, and it is a public health priority to ensure its optimal management. Schummers et al. (2021) noted that modern estimates of early pregnancy loss exhibit a wide variation, which reflects the differences in study populations, methods of ascertainment, and study design. Accurate, up-to-date figures are crucial for clinical counseling and service planning. Concurrently, a spectrum of treatments is available, including expectant, medical, and surgical options. Ghosh et al. (2021) reported that contemporary practice is divided into expectant

management, medical treatment (with misoprostol, with or without mifepristone), and surgical evacuation of products of conception, with a shift toward more suction compared to sharp curettage due to safety concerns (Ghosh et al., 2021). In this context, choices about procedures are clinically significant due to their impact on safety, effectiveness, efficiency, patient experience, and system capacity, all of which are particularly relevant in resource-constrained settings with finite theatre time, limited numbers of trained anesthetists, and specialist staff.

Comparative evidence is now available on the surgical methods for managing first-trimester loss. Kishwar et al. (2022) reported that MVA achieved high rates of complete evacuation with fewer peri-procedural complications and improved patient satisfaction compared with conventional evacuation and curettage. Complementing this, Farooq et al. (2011) reported that MVA is not superior to dilatation and curettage, but that MVA could reduce the duration of the procedure, hospital stay, and risks associated with anesthesia, thereby underscoring its operational benefits. Clinical pathways are relatively well populated: Turner et al. (2016) noted that misoprostol is clinically effective and safe, and well accepted medically for the treatment of miscarriage (although, in some jurisdictions, its use is off-label, and the dosing regimens differ). However, despite these discoveries, significant uncertainties remain. Naz et al. (2023) also noted that community-based surveillance in Pakistan recruits' women after the first trimester, making the actual burden and service planning considerably more challenging to establish. Additionally, Tasnim et al. (2011) reported that the adoption of MVA in Pakistani hospitals was hindered by clinicians' lack of familiarity and habitual practice patterns (Ahmad, 2024), suggesting that evidence of efficacy may not be sufficient to influence provision without the use of targeted implementation strategies.

This study aimed to compare MVA with conventional evacuation and curettage for first-trimester miscarriage using standardized outcome definitions and ultrasonographic confirmation to produce evidence to inform the local choice of procedure. The novelty resides in the structuration of head-to-head comparisons through an action-directed lens that emphasizes feasibility in daily clinical practice. Azman et al. (2019) emphasized that MVA is a standardized and outpatient-applicable method that can be applied under local anesthesia, making it well-suited for day-care settings and patient-focused delivery systems. To anchor the concept in the reality of health systems, Maonei et al. (2014) postulated that implementing MVA may result in cost savings at the facility level. Trial evidence supports this view, offering economic justification for the redesign of services where resources are limited. Lastly, as the safety of the procedure is a function of operator skill and intraoperative vigilance, while rare, complications such as uterine perforation were mentioned explicitly by Ngene (2022) to warrant focused training and clinical vigilance; this study addresses this with a detailed description of the technique, follow-up imaging, and explicit periprocedural safeguards. Collectively, these components will help overcome evidentiary, economic, and implementation barriers in existing research, while ensuring that research objectives are aligned with measures of improving care in the domain of miscarriage.

2. Methods and Materials

2.1 Study Design and Setting

This randomized controlled trial was conducted in the Department of Gynecology and Obstetrics, Bolan Medical Complex, Quetta. Ethical approval was obtained from the Institutional Review Board and the College of Physicians and Surgeons Pakistan (CPSP). The study spanned eight months and commenced following approval of the study synopsis.

2.2 Sample Size and Sampling

A total of 274 women were enrolled in the study, with 137 participants assigned to each group. The sample size was calculated using the UBC sample size calculator, assuming an expected efficacy of 95.6% for Manual Vacuum Aspiration (MVA) and 85.8% for Conventional Evacuation and Curettage (ENC). The study was powered at 80% with a 5% margin of error. A consecutive non-

probability sampling technique was applied to recruit participants.

2.3 Inclusion and Exclusion Criteria

Women aged 18–35 years, with a gestational age of less than 12 weeks as determined by the last menstrual period (LMP) and presenting with first-trimester miscarriage were eligible for enrollment as given in Table 1. Women diagnosed with ectopic pregnancy by ultrasound, molar pregnancy, or fever (temperature > 37.7°C) were excluded from the study.

Table 1: Inclusion and Exclusion Criteria

Category	Criteria
Inclusion	Age 18–35 years; gestational age <12 weeks (LMP); first-trimester miscarriage
Exclusion	Ectopic pregnancy (ultrasound diagnosis); molar pregnancy; fever >37.7°C

2.4 Randomization and Group Allocation

Eligible patients were randomly allocated into two groups of equal size. Group A underwent Manual Vacuum Aspiration, whereas Group B underwent Conventional Evacuation and Curettage.

Table 2: Study Group Allocation

Group	Procedure	Number of Patients
Group A	Manual Vacuum Aspiration (MVA)	137
Group B	Conventional Evacuation and Curettage (ENC)	137

2.5 Procedures

In Group A, procedures were conducted under aseptic conditions with local cervical block anesthesia. A 60 cc syringe equipped with a double-locking valve mechanism was used to generate negative pressure. The cervix was stabilized using Volsellum forceps, and a suitable cannula was introduced into the uterine cavity. Aspiration was performed until complete evacuation was achieved. In Group B, procedures were carried out under general anesthesia. Cervical dilation was followed by sharp curettage with a curette to evacuate uterine contents. Moderate sedation and analgesia were administered at the physician's discretion, and all procedures were performed under aseptic conditions.

2.6 Follow-Up and Efficacy Assessment

All patients were scheduled for follow-up on the seventh postoperative day. Transvaginal ultrasound was performed to evaluate completeness of uterine evacuation. Efficacy was defined as complete removal of the products of conception, characterized by an endometrial thickness of less than 4 mm, absence of echogenic foci associated with acoustic shadowing, and absence of intrauterine fluid.

2.7 Data Collection

Patient data were collected on a predesigned proforma, which included demographic characteristics, clinical presentation, details of the surgical procedure, and follow-up findings.

2.8 Statistical Analysis

Descriptive statistics were used to summarize baseline characteristics and clinical outcomes. Efficacy between the two groups was compared using the Chi-square test, with a p-value ≤0.05 considered statistically significant. Subgroup analyses were performed based on age, parity, gravidity, and history of miscarriage. Statistical analyses were conducted using SPSS version 25.

3. Results

3.1 Study Population

A total of 274 women were enrolled in this randomized controlled trial at Bolan Medical Complex, Quetta. Participants were equally randomized into two groups: Manual Vacuum Aspiration (MVA, n=137) and Conventional

Evacuation and Curettage (ENC, n=137). All patients completed the study protocol and were evaluated on the seventh postoperative day by transvaginal ultrasound. The primary outcome was the efficacy of uterine evacuation.

3.2 Efficacy

The efficacy of MVA was significantly higher than ENC. Complete uterine evacuation was achieved in 95.6% of cases in the MVA group compared with 85.8% in the ENC group ($p < 0.05$) as given in Table 3. Figure 1 illustrates the difference in efficacy between the two groups.

Table 3: Comparison of Efficacy Between Groups

Group	Total Patients (n)	Complete Evacuation n (%)	Incomplete Evacuation n (%)	Efficacy (%)
MVA	137	131 (95.6%)	6 (4.4%)	95.6
ENC	137	117 (85.8%)	20 (14.2%)	85.8

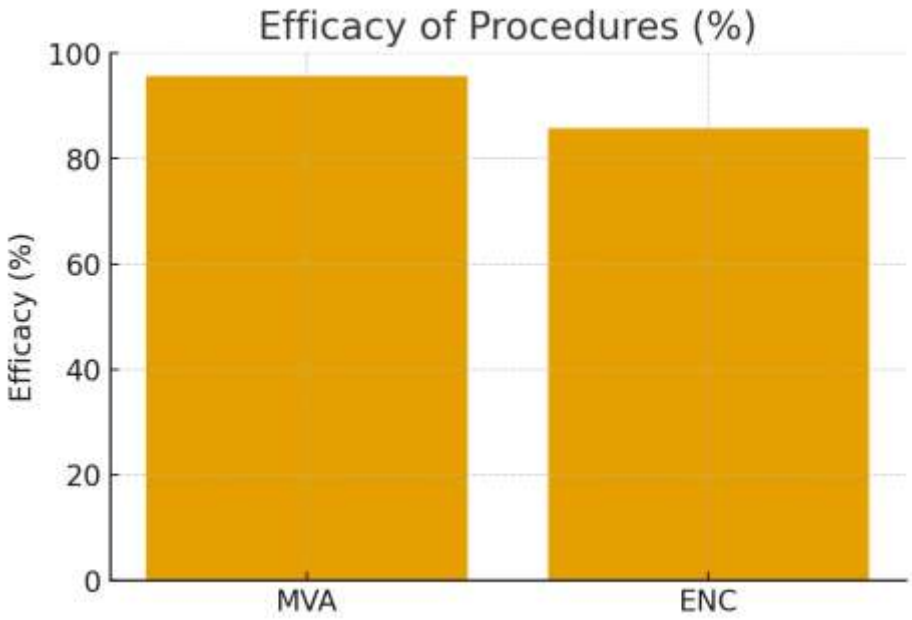

Figure 1: Efficacy (%) comparison between MVA and ENC.

3.3 Procedure Duration

The mean procedure duration was nearly half in the MVA group compared with ENC as given in Table 4. The average duration was 6.9 minutes for MVA versus 13.7 minutes for ENC, indicating a statistically significant difference. Figure 2 presents this comparison in a horizontal bar chart.

Table 4: Mean Duration of Procedure

Group	Mean Duration (minutes) ± SD
MVA	6.9
ENC	13.7

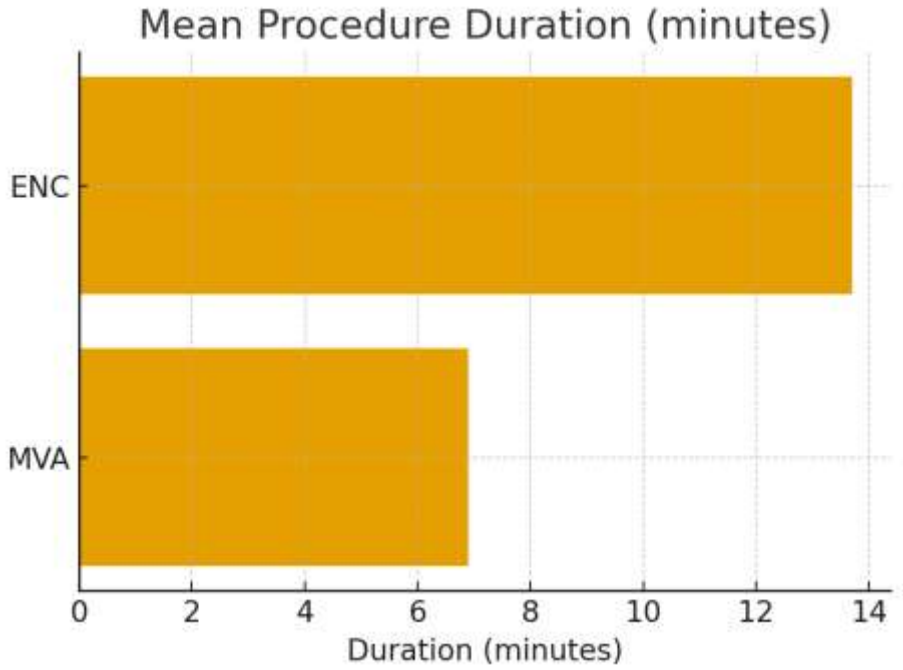

Figure 2: Mean procedure duration (minutes) for MVA and ENC.

3.4 Complications

The incidence of intraoperative bleeding ≥100 mL was lower in the MVA group (0.6%) compared with the ENC group (2.4%). No cases of uterine perforation or severe infection were reported in either group. This distribution is presented in Table 5 and further visualized in Figure 3 as a pie chart.

Table 5: Comparison of Complications

Complication Type	MVA (n=137)	ENC (n=137)
Bleeding ≥100 mL	1 (0.6%)	3 (2.4%)
Uterine perforation	0 (0%)	0 (0%)
Severe infection	0 (0%)	0 (0%)
Total complications (%)	0.6%	2.4%

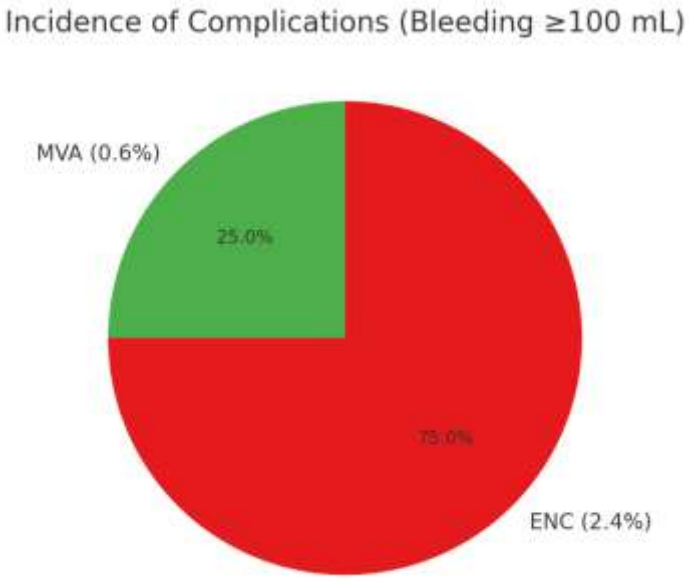

Figure 3: Distribution of complications (bleeding ≥100 mL) in MVA and ENC

3.5 Patient Satisfaction

Patient satisfaction was notably higher in the MVA group. Women undergoing MVA reported reduced discomfort, shorter recovery time, and overall greater satisfaction compared to those treated with ENC. These findings align with international evidence suggesting MVA is a patient-preferred method for the surgical management of first-trimester miscarriages.

3.6 Overall Outcomes

When considering all outcome measures, efficacy, procedure duration, and complication rates, MVA consistently outperformed ENC. Figure 4 provides a comparative visualization of overall outcomes between the two groups.

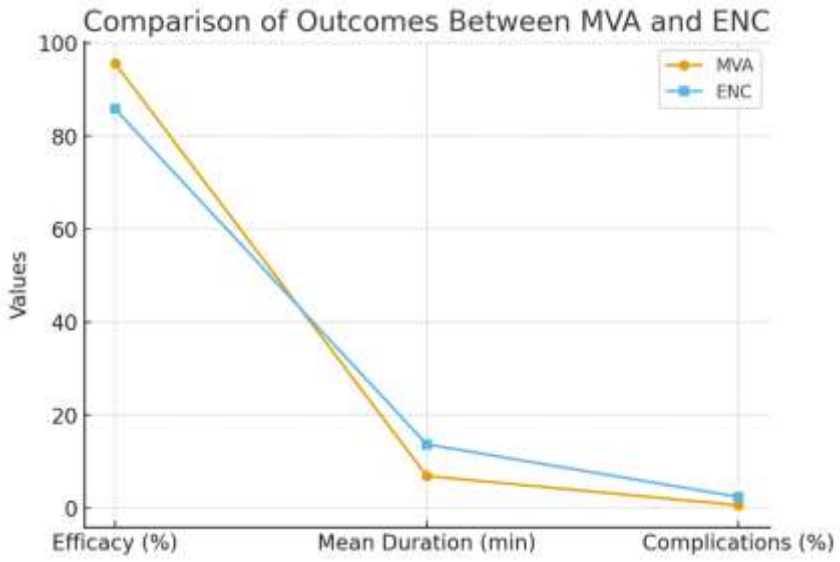

Figure 4: Comparison of overall outcomes (efficacy, mean duration, complications) between MVA and ENC

4. Discussion

This randomized controlled trial assessed the surgical management of first-trimester miscarriages at eight surgical centers by comparing Manual Vacuum Aspiration (MVA) with Conventional Evacuation and Curettage (ENC). MVA is associated with a higher complete uterine evacuation rate, shorter operative time, and fewer complications (Nessa et al., 2022; Zain, 2020). The patients in the MVA group were more satisfied with the procedure (Begum et al., 2012; Dodge et al., 2017). Together, these results demonstrate that MVA meets the developmental objectives of identifying a better, more efficient, and safer option than the ENC.

MVA has clinical and patient-centered benefits compared with conventional curettage (Delfinado & Tamirisa, 2024). MVA is less invasive, as reflected in the shorter operative duration, lower complication rate, and, perhaps more importantly, the comparably high patient acceptability seen for MVA (Cheng et al., 2011; Mansoor et al., 2013). These findings strengthen the case that MVA has the potential to enhance the overall quality of care for women with first-trimester miscarriage. MVA has emerged as a safe method with both an effective and safe profile. MVA achieved better clinical outcomes and a safer profile during the procedure, while also providing comfort to the patient.

These findings align with prior work show that MVA is more effective than traditional curettage. Kishwar et al. (2022) reported that MVA had fewer complications, shorter hospital stay, and higher patient satisfaction than surgical evacuation, which also supported the advantages of safety and efficacy observed in this study. Similarly, Farooq et al. (2011) noted that MVA was just as practical but a more cost-effective procedure with fewer anesthesia-related risks. In contrast, Shochet et al. reported that success rates were very similar but only under surgical intervention rates, indicating that medical management with misoprostol may also be a highly appropriate alternative intervention. They are also combined to provide a stronger evidence base in support of MVA as a preferred surgical miscarriage management option.

These findings demonstrate the real-world benefits of MVA for increased use in clinical settings. MVA suitability for outpatient care can reduce procedure duration and general anesthesia requirements, thereby improving the efficiency of service delivery at the level of hospital care and workflow and alleviating the burden of obtaining hospital resources. This aligns with international health recommendations that favor uterine evacuation using aspiration rather than curettage (Sliwowska & Amico, 2019). The theoretical implications of the findings support models of patient-centered gynecological surgical care that balance safety and acceptability, paralleling the trend towards less invasive surgical approaches.

A significant positive aspect of this study is the randomized controlled trial, which minimized selection bias and provided confirmatory evidence for comparing the two procedures. Moreover, strict standardized follow-up using transvaginal ultrasound would improve the reliability of efficacy evaluation. However, this study has some limitations. Consecutive non-probability sampling may introduce selection bias, and the single-center nature of this study limits its external validity. Analogous limitations were observed in other clinical studies, such as those reported by Ghosh et al. (2021), who addressed the methodological challenges of conducting miscarriage studies, including sample homogeneity and potential bias. A multicenter, randomized, controlled trial with a larger sample size and a more varied population is warranted to improve the generalizability of the results. The long-term sequelae of reproduction and possible subsequent complications are also of interest. Similarly, comparing MVA with other forms of medical care, such as misoprostol, may also guide responsive integrated clinical protocols in diverse contexts. Based on Meshaal et al. (2022), the potential of image-guided surgical techniques in conjunction with MVA may also be considered to maximize fertility potential. In summary, this study demonstrated that MVA is a safer, more efficient, and patient-friendly option for the treatment of first-trimester miscarriage, which supports the scale-up of its use in routine gynecologic care.

5. Conclusion

This study shows that the Manual Vacuum Aspiration (MVA) method is a safer, more efficacious, and convenient type of surgical treatment for first-trimester abortions than the Conventional Evacuation and Curettage (ENC) method. MVA yielded higher complete uterine evacuation rates, less operative time, fewer complications, and greater patient satisfaction, thus confirming the hypothesis that MVA provides better clinical and patient-centered outcomes. These results contribute to our understanding of how to manage miscarriages and further support the idea that MVA is the preferred method in theory and practice for the treatment of the third type of miscarriage. These generalized effects can translate into benefits for health systems and policy through the potential for MVA to lower morbidity related to the procedure, improve patient experience, and diminish demand for hospital resources, particularly in low- and middle-income contexts. While these contributions are significant, gaps still exist in long-term reproductive outcome data and generalizability to populations more broadly. Multicenter randomized trials in larger and more diverse cohorts, with universal patient-reported outcomes, would be a logical next step. Additionally, exploring MVA compared with medical management and imaging-guided surgical methods would be beneficial. The single-center design, absence of randomization, non-probability sampling, and short follow-up period are limitations of this study that restrict its generalizability and long-term inference. In conclusion, this study offers valuable insights into the field of reproductive health. It provides a solid foundation for the development of safer, more efficient, and patient-centered management strategies for miscarriage.

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