OUTCOMES OF ASSISTED VAGINAL DELIVERY (VENTOUSE AND FORCEPS) IN SAUDI ARABIA: A SYSTEMIC REVIEW

Maha Fouad Messawa[1*], Salma Yousef Omar[2], Reem Ahmed Babagi[3], Basim Mohammad Alradadi[2], Dalia Abdullah Qalai[3]

Abstract:

Background: Operative or assisted vaginal delivery (OVD) is a vaginal birth in which an instrument is needed to facilitate the delivery and is accomplished using a vacuum device or forceps. Over 700 different types of obstetrical forceps have been known so far in history. Both vacuum and forceps deliveries require a skilled and experienced obstetrician. **Objective:** the aim of the study is to assess the outcomes of assessted vaginal delivery (ventouse and forceps) in Saudi Arabia. **Methodology:** Following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, this systematic review was carried out. **Results:** the overall outcomes of both ventouse and forceps on both mother and neonate are similar with some special differences for each instrument, vacuum-assisted vaginal deliveries were associated with significant fetal morbidity, including scalp lacerations, cephalohematomas, subgaleal hematomas, intracranial hemorrhage, facial nerve palsies, hyperbilirubinemia, and retinal hemorrhage. While forceps delivery were associated with perineal lacerations, vaginal lacerations, and hematomas, anal sphincter injury, long term complication of pelvic organ prolapse and also affect the fetus by facial lacerations, facial nerve injury, ocular trauma, skull fracture, intracranial hemorrhage, subgaleal hematoma, hyperbilirubinemia, fetal death. **Conclusion:** There were high rates of trauma following forceps and vacuum deliveries, documented across regions, levels of obstetric care and hospitals. Operative vaginal delivery (OVD) is considered safe if carried out by trained personnel so that appropriate use of both the forceps and vacuum extractor is an essential skill that should be maintained to keep Caesarean section rates in check.

Keywords: operative vaginal delivery, ventouse, forceps, neonatal complication, maternal complication

[1*]Heraa General Hospital (HGH), Makkah, KSA.
[2]Maternity and Children Hospital (MCH), Makkah, KSA.
[3]King Abdullah Medical Complex (KAMC), Jeddah, KSA

[*]**Corresponding Author:** Maha Fouad Messawa
[*]Heraa General Hospital (HGH), Makkah, KSA.

DOI: 10.53555/ecb/2022.11.11.169

Introduction:

Natural birth is a spontaneous process that may or may not run smoothly. In many cases, operative delivery is required for fetal or maternal indications. Operative vaginal delivery OVD is any method in which an instrument, whether forceps or a vacuum, is used to extract an infant from the birth canal [1]. If it is technically feasible, it can be safely accomplished. Termination of second stage of labor by operative vaginal delivery is indicated in any condition threatening the mother or fetus. According to the birth certificate data from the National Vital Statistics Report, forceps or vacuum-assisted vaginal delivery was used for 3.6% of births in the United States in 2010. There are many indications for operative virginal delivery, such as prolonged second stage of labor or concern about neonatal or maternal compromise [2]. Nowadays, institutions greatly rely on the use of a vacuum rather than forceps as an instrument of assisted delivery. This method is referred to as vacuum extraction (VE) where a soft or rigid suction cup adheres to the baby's head and aids in the delivery process. VE is highly dependent on the traction resulting from a difference between the atmospheric and suction cup pressure as well as the pressure arising from maternal contractions and bearing down. This cumulative pressure facilitates the baby's movement through the birth canal [3]. Although rare, VE can lead to minor or major neonatal and maternal complications. In fact, 25.7% of vacuum-assisted deliveries in Belgium during the years 2001-2004 resulted in complications that required admission to the neonatal intensive care unit (NICU). Therefore, it is detrimental to measure neonatal health by the Apgar score and assess it through examination [4]. Although operative vaginal delivery may be performed, as infrequently as in 1.5% of deliveries in some countries, it may be as high as 15% in other countries. In the United Kingdom, the rates of instrumental vaginal delivery range between 10% and 15%; these rates have remained fairly constant, although there has been a change in preference of instrument [5]. But currently studies show that there is a decreasing trend of instrumental deliveries and is a major concern in health care system all over the world. Assessing the trends of instrumental deliveries and its major indications would be useful in adopting suitable measures to reduce the caesarean section rate and the problems associated with it. A five-year retrospective study conducted on trends of instrumental deliveries at a tertiary teaching hospital in Puducherry, India, showed among a total of 5445 deliveries that occurred during study period, 7.7% were instrumental vaginal deliveries. The year-wise rate of instrumental deliveries ranges from 6.1% to 9.8%. During the study period (except during year 2011), a declining trend for instrumental deliveries was observed [7]. Studies revealed that the most common indication for OVD is to shorten second stage of labor considering maternal condition and the commonest unfavorable outcomes of OVD varies. Study done in Shankar Nagar and Raipur, India, reported that the most common indication was to cut short second stage of labor (52.5%) (preeclampsia, heart disease) followed by prolonged second stage of labor (22.5%), fetal distress, and maternal exhaustion. The risk of neonatal morbidity was similar between infants delivered by vacuum or forceps [8]. The commonest maternal complication was postpartum hemorrhage and genital tract laceration. Evidence evaluating neonatal morbidity after instrumental vaginal delivery is inconsistent. A systematic review of 10 trials comparing vacuum extraction with forceps delivery found no significant differences in APGAR scores at one and five minutes and few serious injuries in neonates, although the vacuum extractor was associated with an increase in cephalhematoma and retinal hemorrhage. [9]

Methodology

Following PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, this systematic review was carried out.

Study Design and Duration

This systematic review began in February 2024.

Search strategy

A comprehensive search was carried out using four major databases, PubMed, SCOPUS, Web of Science, and Science Direct, in order to find the relevant literature. We searched just in English and took into account the unique requirements of each database. The relevant studies were found by converting the following keywords into PubMed Mesh terms; “noise-induced hearing loss, attitude to noise, young adults, and "Saudi Arabia." The Boolean operators "OR," "AND," and "NOT" matched the required keywords. Among the search outcomes were human trials, publications with full text in English, and freely downloadable materials.

Selection criteria

We considered the following criteria for inclusion in this review:

- Studies that summarized the outcomes of assessted vaginal delivery (ventouse and forceps) in Saudi Arabia..
- Studies conducted between 2018-2024.

- Only human subjects.
- English language.
- Free accessible articles.

Data extraction

Rayyan (QCRI) was used twice to verify the search method's output. The researchers added inclusion/exclusion criteria to the combined search results in order to evaluate the relevance of the titles and abstracts. The reviewers gave each paper that met the inclusion criteria a thorough inspection. The authors talked about ways to resolve conflicts. The approved study was uploaded using an already-created data extraction form. The authors extracted data about the study titles, authors, study year, city, participants, gender, type of participants, and main outcomes. A separate sheet was created for the risk of bias assessment.

Strategy for data synthesis

By assembling summary tables using information from relevant studies, a qualitative assessment of the research's findings and components was given. After gathering the data for the systematic review, the most efficient way to use the information from the included study articles was chosen.

Risk of bias assessment

The ROBINS-I risk of bias assessment technique for non-randomized treatment trials was used to evaluate the quality of the included studies. Confounding, research participant selection, intervention classification, divergence from intended interventions, missing data, outcome assessment, and choice of the reported result were the seven assessed themes.

Results

Search results: After 122 duplicates were removed, the systematic search produced 332 study papers in total. 186 of the 210 studies that underwent title and abstract screening were eliminated. Out of 24 studies that were sought of retrieval, six studies could not be retrieved. Ultimately, 18 papers were screened for full-text assessment; twelve were excluded for incorrect research outcomes and one study was excluded for wrong population. This systematic review had six study papers that met the eligibility criteria. An overview of the procedure used to choose studies is provided in **Figure 1.**

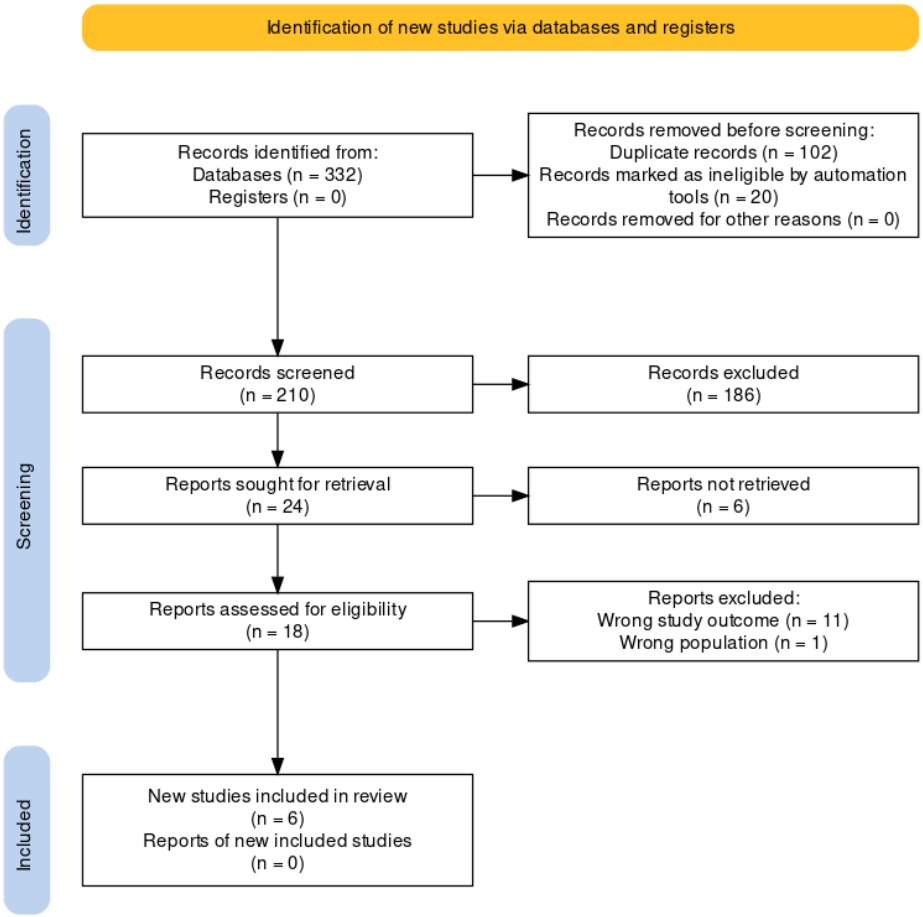

Figure (1): The study selection procedure is summed up in a PRISMA flowchart.

Table (1) ***Sociodemographic characteristics of the included participants.***

Author	Country	Study design	Participants (n)	Mean age (years)
Renad A Abbas et.al, 2021 (10)	Jeddah, Saudi arabia	a retrospective cohort study	157	30
Ratib A Mesleh et.al, 2002 (11)	Riyadh, Saudi Arabia	A retrospective case note review	304	NM
Hanan Al-Kadri et.al,2003 (12)	Riyadh, Saudi Arabia.	A retrospective case-control study.	2628	NM
Yasser Sab et.al,2019 (13)	Saudi Arabia.	population-based, retrospective cohort study	61106	NM
Zenebe Hubena et.al,2018 (14)	Southwest Ethiopia	A facility-based cross-sectional study	242	NM
Jennifer H Johnson et.al, 2004 (15)	USA	medical record review	508	NM

Study name	Complications (maternal, neonatal, both)	Key findings	Conclusion
Maternal and Neonatal Complications Resulting from Vacuum-Assisted and Normal Vaginal Deliveries	both	Of all deliveries, vacuum was used in 21.1%. Perineal tear was the most frequent maternal complication (20.9%), while caput succedaneum was the commonest neonatal complication (11.8%). Post-partum hemorrhage was significantly higher among vacuum deliveries (RR=18.8; 95% CI: 5.5-64.15), as well as cephalohematoma (RR=28.9; 95% CI: 8.79-95.04) and caput succedaneum (RR=18.6; 95% CI: 10.99-31.49). The first-minute Apgar score was lower with VE ($p < 0.001$).	The rates of maternal and neonatal complications were significantly higher among vacuum-assisted deliveries. The most serious neonatal complication was subgaleal hematoma, which is considered life-threatening.
Comparison of maternal and infant outcomes between vacuum extraction and forceps deliveries	both	Attempted ventouse delivery was successful in 91.4% as compared to 95.7% in forceps. Extension of an episiotomy was more likely to occur with ventouse than forceps deliveries while 3rd degree perineal tear occurred more with forceps deliveries. Babies who had attempted ventouse deliveries have lower apgar score at one minute than attempted forceps.	Forceps is more likely to be used in the primigravida and prolonged 2nd stage of labor and less likely to fail. Ventouse is more likely to be used by registrars.
Failed individual and sequential instrumental vaginal delivery: contributing risk factors and maternal–neonatal complications	both	The failure rate for vacuum extractions 7.5% was significantly higher than that for forceps 1.4%. There were no significant differences in all maternal complications (25.5% vs. 26.6%) between vacuum and forceps assisted deliveries. There were more maternal complications in group III (failed both) 46.2% than in groups I (failed ventouse) 35.7%. There was a significantly higher rate of all fetal complications in group III than either of them alone	Sequential use of instrumental delivery carries a significantly higher neonatal morbidity than when a single instrument is used.
Morbidity and Mortality Associated With Forceps and Vacuum Delivery at Outlet, Low, and Midpelvic Station	maternal	Among women with dystocia, forceps and vacuum deliveries were associated with higher rates of perinatal morbidity and mortality compared with Caesarean delivery (forceps: aOR 1.56; 95% CI 1.13-2.17; vacuum: aOR 1.44; 95% CI 1.06-1.97). Vacuum delivery was associated with lower rates of maternal morbidity and	Forceps and vacuum delivery is associated with increased rates of severe perinatal morbidity and mortality compared with Caesarean delivery among women with

		mortality compared with Caesarean delivery (dystocia: aOR 0.64; 95% CI 0.51-0.81; fetal distress: aOR 0.43; 95% CI 0.32-0.57).	dystocia, whereas vacuum delivery is associated with decreased rates of severe maternal morbidity and mortality.
Prevalence and Outcome of Operative Vaginal Delivery among Mothers Who Gave Birth at Jimma University Medical Center, Southwest Ethiopia	both	Out of all neonates delivered by operative vaginal delivery 210 (86.8%) had favorable outcome. Of all mothers who gave birth by operative vaginal delivery 232 (95.9%) had favorable outcome.	Nearly all of mothers and neonates had favorable outcome. Type of instrument applied for operative vaginal delivery is the strongest predictor of neonatal outcome
Immediate maternal and neonatal effects of forceps and vacuum-assisted deliveries	both	There was a higher rate of maternal third- and fourth-degree perineal (P <.001) and vaginal lacerations (P =.004) with the use of forceps, whereas periurethral lacerations were more common in vacuum-assisted (P =.026) deliveries. More instrument marks and bruising (P <.001) were found in the neonates delivered by forceps, whereas there was a greater incidence of cephalohematomas (P =.03) and caput and molding (P <.001) in the neonates delivered with vacuum	Maternal injuries are more common with the use of forceps. Neonates delivered with forceps have more facial injuries, whereas neonates delivered with vacuum have more cephalohematomas.

Discussion:

Operative vaginal delivery is the use of the obstetric forceps and vacuum extractor to deliver the fetus in the second stage of labor. Proficiency in the use of these instruments has long been regarded as a training goal for obstetricians. There has been a decline in operative vaginal deliveries worldwide [16], with a more significant decline in forceps deliveries compared with vacuum deliveries. The decrease in operative vaginal deliveries may be attributed to medicolegal implications [17], thus in this study we aimed to assess the possible outcomes of assessted vaginal delivery (ventouse and forceps). In a study conducted by Renad A Abbas et.al, 2021, revealed that the rates of maternal and neonatal complications were significantly higher among vacuum-assisted deliveries and the rates of cephalohematoma and shoulder dystocia were higher in vacuum-assisted deliveries, which corresponds to the current literature [18]. On the other hand, another study conducted by Ratib A Mesleh et.al, 2002, revealed that attempted ventouse delivery was successful in 91.4% as compared to 95.7% in forceps. Babies who had attempted ventouse deliveries have lower apgar score at one minute than attempted forceps. Consistently, Hanan Al-Kadri et.al revealed that the failure rate for vacuum extractions 7.5% was significantly higher than that for forceps 1.4%. Moreover, a study in 2013 noted that vacuum extraction was popular in Africa and Asia, while forceps delivery was popular in Eastern Europe and South America [19,20]. However, the rate of vacuum has increased against forceps application in most centers worldwide [21]. This agreement can be explained by the recent evidence of decreased maternal trauma with vacuum deliveries compared to forceps deliveries in randomized trials and by the improvement in the technique of vacuum deliveries, especially in the material used for vacuum cups [22]. on the other hand, in the review of over 50 000 vaginal deliveries at the University of Miami, the rate of third and fourth perineal lacerations was significantly higher in forceps (20.0%) than vacuum deliveries (10.0%) [23]. Moreover, multiple other studies showed that forceps are associated with a higher rate of maternal complications, while vacuum-assisted delivery is associated with higher fetal morbidities [24]. Consistently, vacuum deliveries are associated with significant fetal morbidity and among vacuum deliveries fetal morbidity is 32% and 20% were complicated with subgaleal hemorrhage. [25].

Conclusion:

Operative vaginal delivery (OVD) is considered safe if carried out by trained personnel. However, opportunities for training in OVD have declined and, given these shifts in practice, the safety of OVD is unknown. According to the previously

mentioned forceps and vacuum delivery is associated with increased rates of severe perinatal morbidity and mortality compared with Caesarean delivery; vacuum-assisted vaginal deliveries were associated with significant fetal morbidity, including scalp lacerations, cephalohematomas, subgaleal hematomas, intracranial hemorrhage, facial nerve palsies, hyperbilirubinemia, and retinal hemorrhage. While forceps delivery were associated with perineal lacerations, vaginal lacerations, and hematomas, anal sphincter injury, long term complication of pelvic organ prolapse and also affect the fetus by facial lacerations, facial nerve injury, ocular trauma, skull fracture, intracranial hemorrhage. Communication between medical professionals as well as simulation training is a key component of a successful OVD. Each operative delivery whether vacuum or forceps must consider the risks, benefits, as well as alternatives for both mother and fetus for a successful outcome.

References:

1. Operative vaginal delivery. [Mar;2021];https://www.uptodate.com/contents/operative-vaginal-delivery 2021
2. Operative Vaginal Delivery. [Mar;2021];Moldenhauer J. https://www.msdmanuals.com/professional/gynecology-and-obstetrics/abnormalities-and-complications-of-labor-and-delivery/operative-vaginal-delivery 2020
3. An engineering perspective of vacuum assisted delivery devices in obstetrics: a review. Goordyal D, Anderson J, Alazmani A, Culmer P. *Proc Inst Mech Eng Part H J Eng Med.* 2021;235:3–16. [PMC free article] [PubMed] [Google Scholar]
4. Neonatal complications of vacuum-assisted delivery. Simonson C, Barlow P, Dehennin N, Sphel M, Toppet V, Murillo D, Rozenberg S. *Obstet Gynecol.* 2007;109:626–633. [PubMed] [Google Scholar]
5. Vacuum assisted birth and risk for cerebral complications in term newborn infants: a population-based cohort study. Ekéus C, Högberg U, Norman M. *BMC Pregnancy Childbirth.* 2014;14:36. [PMC free article] [PubMed] [Google Scholar]
6. Kabiru W. N., Jamieson D., Graves W., Lindsay M. Trends of instrumental deliveries at a tertiary care teaching hospital. *The American College of Obstetrics and Gynecology Press.* 2015;5(7):20–32. [Google Scholar]
7. Abha S., Pratibha R. A comparative study of feto-maternal outcome in instrumental vaginal delivery. *The Journal of Obstetrics and Gynecology of India.* 2011;61(6):663–666. doi: 10.1007/s13224-011-0119-3. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
8. Yakasai I. A., Abubakar I. S., Yunus E. M. Vacuum Delivery in a Tertiary Institution, in Northern Nigeria: A 5-Year Review. *Open Journal of Obstetrics and Gynecology.* 2015;05(04):213–218. doi: 10.4236/ojog.2015.54031. [CrossRef] [Google Scholar]
9. Patel R. R., Murphy D. J. Forceps delivery in modern obstetric practice. *BMJ.* 2004;328(7451):1302–1305. doi: 10.1136/bmj.328.7451.1302. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
10. Abbas, R. A., Qadi, Y. H., Bukhari, R., & Shams, T. (2021). Maternal and Neonatal Complications Resulting From Vacuum-Assisted and Normal Vaginal Deliveries. *Cureus*, *13*(5), e14962. https://doi.org/10.7759/cureus.14962
11. Mesleh, Ratib A et al. "Comparison of maternal and infant outcomes between vacuum extraction and forceps deliveries." *Saudi medical journal* vol. 23,7 (2002): 811-3.
12. Al-Kadri, Hanan et al. "Failed individual and sequential instrumental vaginal delivery: contributing risk factors and maternal-neonatal complications." *Acta obstetricia et gynecologica Scandinavica* vol. 82,7 (2003): 642-8. doi:10.1034/j.1600-0412.2003.00162.x
13. Muraca, Giulia M et al. "Morbidity and Mortality Associated With Forceps and Vacuum Delivery at Outlet, Low, and Midpelvic Station." *Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC* vol. 41,3 (2019): 327-337. doi:10.1016/j.jogc.2018.06.018
14. Hubena, Z., Workneh, A., & Siraneh, Y. (2018). Prevalence and Outcome of Operative Vaginal Delivery among Mothers Who Gave Birth at Jimma University Medical Center, Southwest Ethiopia. *Journal of pregnancy*, *2018*, 7423475. https://doi.org/10.1155/2018/7423475
15. Johnson, Jennifer H et al. "Immediate maternal and neonatal effects of forceps and vacuum-assisted deliveries." *Obstetrics and gynecology* vol. 103,3 (2004): 513-8. doi:10.1097/01.AOG.0000114985.22844.6d
16. Bahl R, Strachan BK, Murphy DJ. Royal College of Obstetricians and Gynaecologists. Operative vaginal delivery. Green-top Guideline No 26. [Last accessed on 2020 Feb 17]. Available from: https://www.rcog.org.uk/globalassets/documents/guidelines/gtg_26.pdf .

17. Zwecker P, Azoulay L, Abenhaim HA. Effect of fear of litigation on obstetric care:A nationwide analysis on obstetric practice. *Am J Perinatol.* 2011;28:277–84. [PubMed] [Google Scholar]
18. Caughey AB, Sandberg PL, Zlatnik MG, Thiet MP, Parer JT, Laros RK., Jr Forceps compared with vacuum:Rates of neonatal and maternal morbidity. *Obstet Gynecol.* 2005;106:908–12. [PubMed] [Google Scholar]
19. Okeke T, Ekwuazi K. Is there still a place for vacuum extraction (ventouse) in modern obstetric practice in Nigeria. Ann Med Health Sci Res 2013. Oct;3(4):471-474. 10.4103/2141-9248.122043 [PMC free article] [PubMed] [CrossRef] [Google Scholar]
20. Adaji SE, Shittu SO, Sule ST. Operative vaginal deliveries in Zaria, Nigeria. Ann Afr Med 2009. Apr-Jun;8(2):95-99. 10.4103/1596-3519.56236 [PubMed] [CrossRef] [Google Scholar]
21. Prapas N, Kalogiannidis I, Masoura S, Diamanti E, Makedos A, Drossou D, et al.. Operative vaginal delivery in singleton term pregnancies: short-term maternal and neonatal outcomes. *Hippokratia* 2009. Jan;13(1):41-45. [PMC free article] [PubMed] [Google Scholar]
22. Chaudhari P, Bansal N, Gupta V, Tandon A, Chaudhry A. A comparative study of feto-maternal outcome in instrumental vaginal delivery at tertiary health level hospital in Uttarakhand state. *Int J Reprod Contracept Obstet Gynecol* 2016;5(10):3294-3299 . 10.18203/2320-1770.ijrcog20163169 [CrossRef] [Google Scholar]
23. Angioli R, Gómez-Marín O, Cantuaria G, O'sullivan MJ. Severe perineal lacerations during vaginal delivery: the University of Miami experience. *Am J Obstet Gynecol* 2000. May;182(5):1083-1085. 10.1067/mob.2000.105403 [PubMed] [CrossRef] [Google Scholar]
24. Neville H, Joseph G, Calvin H. *Hacker & Moore's Essentials of Obstetrics and Gynecology - 6th Edition* . Vol. 231. Philadelphia, PA: Elsevier; 2015. Hacker & Moore's Essentials of Obstetrics and Gynecology. 6th Edition; pp. 978–971. [Google Scholar]
25. Yakasai I. A., Abubakar I. S., Yunus E. M. Vacuum Delivery in a Tertiary Institution, in Northern Nigeria: A 5-Year Review. *Open Journal of Obstetrics and Gynecology.* 2015;05(04):213–218. doi: 10.4236/ojog.2015.54031. [CrossRef] [Google Scholar]