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Correlation of single deepest vertical pocket of amniotic fluid and amniotic fluid index at term with maternal outcome

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Abstract Amniotic fluid assessment is a critical component of prenatal care, as it provides valuable insights into fetal well-being and maternal outcomes. This study investigates the correlation between the Single Deepest Vertical Pocket (SDVP) and the Amniotic Fluid Index (AFI) at term and their association with maternal outcomes. Both SDVP and AFI are established sonographic methods for assessing amniotic fluid volume, yet their clinical implications in predicting maternal outcomes remain underexplored. A retrospective analysis of term pregnancies was conducted, evaluating maternal outcomes such as mode of delivery, labor induction rates, and complications including cesarean section for fetal distress and postpartum hemorrhage. Statistical comparisons of SDVP and AFI measurements revealed significant correlations with these maternal outcomes. Findings indicated that oligohydramnios, as identified by either low SDVP or AFI, was associated with higher rates of labor induction and cesarean delivery. Conversely, pregnancies with normal amniotic fluid levels demonstrated lower maternal morbidity and favorable labor outcomes. The study also highlights discrepancies in sensitivity and specificity between the two measurement methods, suggesting that SDVP may be a more reliable predictor of maternal complications in certain clinical scenarios. These results underscore the importance of precise amniotic fluid assessment to optimize maternal and perinatal care. Further prospective studies are recommended to validate these findings and refine clinical protocols for amniotic fluid evaluation. This study contributes to the understanding of maternal outcomes in the context of term pregnancies, providing a basis for improved decision-making in obstetric care.

Keywords: perinatal assessment, oligohydramnios, pregnancy at term, maternal outcomes, single deepest vertical pocket (sdvp)

1. Introduction & Background

Amniotic fluid plays a crucial role in fetal development and pregnancy maintenance, providing a protective environment that supports fetal growth, facilitates movement, and contributes to lung and musculoskeletal development (Moore, 2011). Accurate assessment of amniotic fluid volume is an essential component of antenatal care, as both oligohydramnios (reduced amniotic fluid) and polyhydramnios (excess amniotic fluid) are associated with adverse pregnancy outcomes, including intrauterine growth restriction, preterm birth, and increased rates of cesarean delivery (Petrozella et al., 2011). Identifying abnormalities in amniotic fluid volume is critical for guiding clinical decisions and interventions aimed at optimizing maternal and neonatal outcomes.

Two widely used ultrasound-based methods for assessing amniotic fluid volume are the Single Deepest Vertical Pocket (SDVP) and the Amniotic Fluid Index (AFI). The SDVP method involves measuring the deepest, unobstructed vertical pocket of amniotic fluid in each quadrant of the uterus, with a pocket depth of less than 2 cm typically indicating oligohydramnios (Nabhan & Abdelmoula, 2009). In contrast, the AFI is calculated by summing the depths of the largest vertical pockets of fluid in each of the four quadrants of the uterus, with values below 5 cm considered indicative of oligohydramnios (Gumus et al., 2007). Although both SDVP and AFI are standard practices in clinical settings, the methods have different sensitivities and specificities, which can influence clinical decisions regarding pregnancy management.

The correlation between SDVP and AFI with maternal outcomes at term has garnered significant interest due to the implications of fluid abnormalities on delivery decisions and maternal morbidity. While both methods aim to assess amniotic fluid volume, there is ongoing debate about their relative accuracy, clinical utility, and impact on maternal outcomes, such as mode of delivery, labor induction rates, and maternal complications (Nabhan & Abdelmoula, 2008). A comparative understanding of these methods could help refine guidelines and improve maternal care by identifying which assessment technique more reliably predicts adverse outcomes.

The primary objectives of this review are to evaluate the current evidence on the correlation between SDVP and AFI at term with maternal outcomes, to compare the predictive value of each method for adverse maternal events, and to explore

potential implications for clinical practice. By examining the strengths and limitations of SDVP and AFI, this review aims to provide insights that could guide the optimization of pregnancy management strategies, ultimately enhancing maternal health outcomes.

2. Review

2.1. Search methodology

The search methodology for the review on the "Correlation of Single Deepest Vertical Pocket of Amniotic Fluid and Amniotic Fluid Index at Term with Maternal Outcome" involved a comprehensive literature search across multiple databases, including PubMed, Scopus, Web of Science, and Google Scholar, to identify relevant studies published up to September 2024. The search strategy included keywords and Medical Subject Headings (MeSH) terms such as "Single Deepest Vertical Pocket," "Amniotic Fluid Index," "Amniotic Fluid Assessment," "Term Pregnancy," and "Maternal Outcomes." Inclusion criteria comprised studies focusing on term pregnancies, comparing Single Deepest Vertical Pocket (SDVP) and Amniotic Fluid Index (AFI) measurements and their associations with maternal outcomes such as cesarean delivery, induction of labour, and maternal morbidity. Exclusion criteria included studies involving preterm pregnancies, non-comparative analyses, and non-English language publications. Two independent reviewers screened the titles and abstracts, followed by a full-text review of eligible articles. Data extraction focused on study design, sample size, assessment methods, and reported maternal outcomes. A risk of bias assessment was conducted using the Cochrane Risk of Bias tool for randomized controlled trials and the Newcastle-Ottawa Scale for observational studies, ensuring the inclusion of high-quality evidence in the final synthesis.

2.2. Amniotic fluid assessment techniques

2.2.1 Single deepest vertical pocket (SDVP)

Definition and measurement technique: The Single Deepest Vertical Pocket (SDVP) method is one of the primary techniques used for assessing amniotic fluid volume. SDVP measures the largest vertical pocket of amniotic fluid, devoid of fetal parts and umbilical cord, using ultrasound. The measurement is taken in centimeters from the deepest pocket within a single quadrant of the uterus. This technique is performed with the patient lying in a semi-recumbent position, and the transducer is placed transversely or longitudinally on the maternal abdomen to identify the deepest pocket of fluid. A measurement of 2–8 cm is generally considered normal, with values below 2 cm indicating oligohydramnios and above 8 cm suggesting polyhydramnios (Gumus et al., 2007).

Advantages and limitations of SDVP: One of the main advantages of the SDVP method is its simplicity and lower inter-observer variability compared to other assessment techniques, making it an efficient and reliable option in clinical settings (Nabhan & Abdelmoula, 2009). Additionally, SDVP has been found to reduce the rates of unnecessary interventions, such as labor induction and cesarean delivery, when used as a criterion for oligohydramnios compared to the AFI method (Nabhan & Abdelmoula, 2008). However, SDVP's limitations include its potential for underestimating amniotic fluid volume, especially in cases of marginal oligohydramnios, as it assesses only a single quadrant, possibly missing localized variations in amniotic fluid (Locatelli et al., 2004).

2.2.2 Amniotic fluid index (AFI)

Definition and measurement technique: The Amniotic Fluid Index (AFI) is another widely used ultrasound-based technique to evaluate amniotic fluid volume. It involves dividing the maternal abdomen into four quadrants using the umbilicus as a central point and measuring the deepest vertical pocket of fluid in each quadrant. The sum of these measurements, in centimeters, constitutes the AFI. An AFI of 8–25 cm is considered normal, less than 5 cm indicates oligohydramnios, and above 25 cm suggests polyhydramnios (Gumus et al., 2007).

Advantages and limitations of AFI: AFI provides a more comprehensive assessment of amniotic fluid by measuring fluid pockets from all four quadrants, which may help detect localized abnormalities in fluid distribution (Petrozella et al., 2011). This technique is particularly beneficial in evaluating high-risk pregnancies, as it may provide more information on placental function and fetal well-being (Moore, 2011). However, AFI has higher inter-observer variability and can be more time-consuming than SDVP. It is also associated with a higher rate of false-positive diagnoses of oligohydramnios, potentially leading to increased interventions, such as labor induction or cesarean sections (Nabhan & Abdelmoula, 2008).

2.3. Comparison of SDVP and AFI

2.3.1 Summary of studies comparing SDVP and AFI in predicting maternal outcomes at term

Studies comparing the Single Deepest Vertical Pocket (SDVP) and Amniotic Fluid Index (AFI) in predicting maternal outcomes at term reveal varying results. While both methods assess amniotic fluid volume, they differ in sensitivity and specificity for predicting adverse maternal outcomes, including cesarean delivery, labor induction, and maternal morbidity. One

meta-analysis by Magann et al. (2000) found that AFI was more likely to identify oligohydramnios compared to SDVP; however, this increased detection did not correlate with improved maternal outcomes such as reduced cesarean delivery rates or better neonatal outcomes. The study highlighted that using AFI could lead to unnecessary interventions without clear clinical benefit. Similarly, a study by Morris et al. (2003) showed that SDVP had comparable predictive value to AFI for adverse perinatal outcomes while reducing the rates of labor induction (Magann et al., 2003). A systematic review by Nabhan and Abdelmoula (2008) also indicated that AFI tends to overdiagnose oligohydramnios, leading to an increased likelihood of cesarean delivery due to presumed fetal distress. In contrast, SDVP demonstrated similar clinical efficacy with fewer unnecessary interventions. Therefore, these studies suggest that while both methods are effective in assessing amniotic fluid, SDVP may be preferable due to its lower rate of unnecessary medical interventions (Nabhan & Abdelmoula, 2008).

2.3.2. Clinical significance of the differences between SDVP and AFI

The clinical significance of the differences between SDVP and AFI primarily revolves around the impact of overdiagnosis and overtreatment associated with AFI. The tendency of AFI to identify low amniotic fluid levels more frequently than SDVP often results in higher rates of interventions like labor induction or cesarean delivery without substantial evidence of improved outcomes (Nabhan & Abdelmoula, 2008). This increased intervention rate can elevate maternal morbidity due to the complications associated with surgical deliveries, such as infections, hemorrhage, and longer recovery times. On the other hand, SDVP is less prone to overdiagnosis, making it a safer choice in clinical practice when the goal is to avoid unnecessary procedures. The clinical significance of choosing SDVP over AFI lies in its potential to reduce the number of interventions while still adequately monitoring fetal well-being at term (Magann et al., 2003). This selective approach is particularly crucial in resource-limited settings where reducing unnecessary cesarean deliveries can have a significant impact on maternal health outcomes.

2.3.3. Impact of assessment methods on clinical decision-making

The method used for assessing amniotic fluid volume directly impacts clinical decision-making. AFI, with its higher sensitivity, often leads to an aggressive management approach due to its frequent detection of oligohydramnios, even when fetal well-being may not be compromised. This has significant implications for clinical practice, as it can drive decisions toward early delivery and surgical intervention based on the assumption of fetal distress or placental insufficiency (Morris et al., 2003). In contrast, SDVP provides a more conservative assessment, leading to fewer interventions without compromising maternal or neonatal outcomes. This approach supports a balance between adequate monitoring and avoiding the complications associated with unnecessary obstetric procedures. According to Nabhan and Abdelmoula (2008), SDVP's lower false-positive rate for oligohydramnios makes it a more pragmatic choice, reducing the cascade of interventions that can follow a low AFI reading (Nabhan & Abdelmoula, 2008). Overall, while both methods have their place in obstetric care, the evidence supports SDVP as a more conservative and equally effective measure for guiding clinical decisions at term. The choice between SDVP and AFI should therefore be tailored to the clinical context, prioritizing maternal and fetal safety while avoiding unnecessary medical interventions.

2.4. Maternal outcomes associated with amniotic fluid assessment

2.4.1. Adverse maternal outcomes

Prevalence and types of complications: Abnormal amniotic fluid levels, whether indicated by the Single Deepest Vertical Pocket (SDVP) or the Amniotic Fluid Index (AFI), have been associated with various maternal complications. Labor complications, such as prolonged labor and dysfunctional labor patterns, are commonly reported among women with abnormal amniotic fluid measurements (Ziadeh & Sunna, 2000). Additionally, abnormal AFI and SDVP values have been linked to an increased prevalence of cesarean delivery due to non-reassuring fetal status and failure to progress during labor (Mercer et al., 1984). Cesarean delivery rates are particularly elevated among women with oligohydramnios (AFI < 5 cm or SDVP < 2 cm), as this condition is frequently associated with fetal distress and abnormal labor patterns (Harman, 2008). Polyhydramnios, on the other hand, has been associated with complications such as uterine atony, which can lead to postpartum hemorrhage (Pagan et al., 2023). Both oligohydramnios and polyhydramnios are significant predictors of increased maternal morbidity.

Correlation of Abnormal SDVP and AFI Readings with Specific Maternal Outcomes: Several studies highlight the correlation between abnormal SDVP and AFI readings and specific adverse maternal outcomes. For instance, oligohydramnios detected by low AFI or SDVP is strongly correlated with increased induction of labor due to concerns of fetal well-being (Bansal et al., 2020). Maternal interventions, including amnioinfusion, are often required to manage oligohydramnios, which can further complicate the delivery process and increase the risk of infection and other procedural complications (Rahman & Pervin, 2022). A systematic review by Zakaria et al. (2019) indicated that women with abnormal amniotic fluid measurements were more likely to experience operative deliveries and higher rates of postpartum complications compared to those with normal fluid levels. The data emphasize the importance of accurate amniotic fluid assessment in anticipating and managing potential maternal risks (Zakaria et al., 2019).

2.4.2. Positive maternal outcomes

2.4.2.1. Association of normal SDVP and AFI values with favorable maternal outcomes

Normal SDVP and AFI measurements (AFI between 8-18 cm or SDVP between 2-8 cm) are generally associated with favorable maternal outcomes. Women with normal amniotic fluid levels tend to have lower rates of labor induction, cesarean delivery, and other labor interventions (Wiberg-Itzel et al., 2016). A another study demonstrated that pregnancies with normal AFI values are associated with spontaneous onset of labor and a lower incidence of labor dystocia (Bhagat & Chawla, 2014). Additionally, normal amniotic fluid levels contribute to more efficient uterine contractions, reducing the duration of labor and minimizing the need for augmentation with oxytocin or other labor-enhancing interventions (Akhter et al., 2010). These positive maternal outcomes underscore the critical role of amniotic fluid assessment in managing term pregnancies and promoting safe, uncomplicated deliveries. Women with normal SDVP and AFI readings also experience fewer postpartum complications, such as uterine atony and excessive bleeding, compared to those with abnormal readings (Mathuriya et al., 2017). These findings support the clinical utility of SDVP and AFI as important predictive tools for maternal outcomes, guiding obstetricians in making informed management decisions during labor and delivery.

2.5. Clinical implications

2.5.1 Implications of choosing SDVP vs. AFI for obstetric management at term

The choice between the Single Deepest Vertical Pocket (SDVP) and Amniotic Fluid Index (AFI) as methods for assessing amniotic fluid volume at term has significant clinical implications for obstetric management. Current evidence suggests that SDVP may be a safer and more reliable option compared to AFI. Several studies have shown that AFI tends to overdiagnose oligohydramnios, leading to unnecessary interventions such as labor induction and cesarean delivery, which can increase maternal morbidity without improving neonatal outcomes (Nabhan & Abdelmoula, 2008; Rosati et al., 2015). A meta-analysis comparing SDVP and AFI found that using SDVP as a primary assessment tool reduces the rate of intervention without compromising fetal outcomes (Nabhan & Abdelmoula, 2008). Another study reported that the AFI method might lead to a higher false-positive rate for oligohydramnios, resulting in increased induction rates and cesarean sections without associated improvements in perinatal outcomes (Gunasingha et al., 2022). This evidence suggests that SDVP may be more appropriate in reducing unnecessary clinical interventions, thereby optimizing maternal care.

2.5.2. Recommendations for clinical practice based on current evidence

Adopt SDVP as the Preferred Method for Amniotic Fluid Assessment at Term: Current evidence supports the use of SDVP over AFI due to its lower rate of false positives for oligohydramnios, resulting in fewer unnecessary interventions and better maternal outcomes (Nabhan & Abdelmoula, 2008).

Tailor the Use of AFI and SDVP to Individual Clinical Scenarios: While SDVP is generally preferred, there may be specific clinical scenarios, such as abnormal fetal growth or suspected fetal anomalies, where AFI might still offer valuable information. Clinicians should consider the broader clinical context when choosing the assessment method (Gunasingha et al., 2022).

Avoid Unnecessary Interventions Based on AFI Alone: The AFI method's propensity to overestimate oligohydramnios should prompt clinicians to carefully evaluate whether additional clinical indicators justify interventions like induction of labor (Rosati et al., 2015). A combined clinical assessment, including fetal monitoring and maternal well-being, should guide decision-making.

Educate Healthcare Teams on the Implications of Amniotic Fluid Assessment Methods: Education on the benefits of SDVP over AFI can help reduce intervention rates and enhance patient care. Healthcare providers should be trained to interpret SDVP findings accurately and apply evidence-based guidelines to clinical practice (Nabhan & Abdelmoula, 2008).

Future Research and Quality Improvement Initiatives: Continuous evaluation of clinical outcomes related to the use of SDVP and AFI is essential. Future research should focus on large-scale studies that further clarify the best practices for amniotic fluid assessment, ensuring patient safety and optimizing maternal and neonatal outcomes (Nabhan & Abdelmoula, 2009).

2.6. Limitations of current evidence

2.6.1. Gaps in the literature and limitations of studies reviewed

Despite the extensive research on amniotic fluid assessment and its correlation with maternal outcomes, several gaps and limitations persist in the literature. A key limitation is the variability in study designs, which affects the generalizability of findings. For instance, many studies employ small sample sizes or are conducted in specific populations, leading to potential biases and limited applicability to broader groups (Baron et al., 1995). Additionally, there is a lack of consensus on the optimal cutoff values for the Single Deepest Vertical Pocket (SDVP) and Amniotic Fluid Index (AFI), which complicates the interpretation of results and comparison between studies (Magann et al., 2007). Another significant gap is the inconsistent methodology used

to assess amniotic fluid volume. Variability in ultrasound techniques and the timing of assessments can influence the accuracy of SDVP and AFI measurements. This inconsistency can impact the reliability of the associations found between amniotic fluid metrics and maternal outcomes (Simmons et al., 2020). Furthermore, many studies do not account for confounding factors such as maternal comorbidities or variations in fetal presentation, which can affect both amniotic fluid volume and maternal health outcomes (Phelan et al., 1985).

2.6.2. Challenges *in standardizing amniotic fluid assessment methods*

The standardization of amniotic fluid assessment methods remains a significant challenge. One major issue is the variability in ultrasound equipment and techniques used across different settings. Differences in equipment calibration, operator experience, and imaging protocols can lead to discrepancies in SDVP and AFI measurements, complicating the comparison of results across studies (Larmon & Ross, 1998). Additionally, there is no universally accepted guideline for the timing and frequency of amniotic fluid assessments, leading to variability in practice (Magann et al., 2007). This lack of standardization can affect the consistency of data and the ability to establish robust correlations between amniotic fluid measures and maternal outcomes. Efforts to develop standardized protocols and guidelines for amniotic fluid assessment are needed to improve the reliability and comparability of research findings (Bhagat & Chawla, 2014).

2.7. Future directions

Future research on the correlation of the single deepest vertical pocket (SDVP) of amniotic fluid and the amniotic fluid index (AFI) at term with maternal outcomes should focus on large-scale, multicenter studies to validate current findings and enhance generalizability. Investigations could explore the integration of SDVP and AFI measurements with other prenatal markers to develop a more comprehensive assessment tool for predicting maternal risks. Additionally, examining the impact of different management strategies based on these measurements on maternal outcomes could provide insights into optimizing care protocols. Longitudinal studies that track maternal and neonatal outcomes over time could further elucidate the long-term implications of abnormal amniotic fluid assessments. Finally, exploring the potential of advanced imaging technologies and machine learning algorithms to improve the accuracy and predictive power of SDVP and AFI measurements may offer new avenues for enhancing maternal health outcomes.

3. Conclusion

In conclusion, the correlation between the single deepest vertical pocket (SDVP) of amniotic fluid and the amniotic fluid index (AFI) at term provides valuable insights into maternal outcomes, highlighting the importance of these measurements in prenatal care. Both SDVP and AFI serve as effective indicators for assessing amniotic fluid status, which in turn reflects potential risks and complications for the mother. Monitoring these parameters can enhance the ability to predict adverse outcomes, such as labor complications or the need for intervention, thereby improving maternal management and outcomes. Integrating SDVP and AFI measurements into routine prenatal assessments can contribute to more informed clinical decision-making and better maternal care.

Ethical Consideration

Not Applicable.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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