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Original Research Article

Comparison of Urinary LH Surge Kits and Transvaginal Sonography for Ovulation Detection

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Conflict of interest: Nil

Abstract:

Aim: The present study is to assess the effectiveness of urine luteinizing hormone (LH) surge kits in comparison to transvaginal ultrasonography (TVS) for the detection of ovulation in ovulatory infertile women.

Methods: This observational research, conducted at Department of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna ,Bihar, India involved 84 ovulatory infertile women aged 18 to 35 with normal semen analysis. Patent tube Participants were randomized into two groups: Group 1 utilized urine LH surge kits, whereas Group 2 received transvaginal sonography monitoring. All participants were administered letrozole for the purpose of ovulation induction. The primary objectives were the rates of ovulation confirmation; the secondary outcomes encompassed letrozole dose, conception rates, and follicular size at the time of ovulation. Statistical analyses were conducted with SPSS.

Results: Ovulation was verified in 83.3% (35/42) of Group 1 and 90.5% (38/42) of Group 2 (p=0.35). The mean time to ovulation detection was consistent at 20 hours (p=0.92). Conception rates were comparable: 51.4 percent in Group 1 and 52.6 percent in Group 2 (p=0.92). The mean follicular diameters at ovulation were 20.5 mm for Group 1 and 20.3 mm for Group 2, demonstrating no significant differences.

Conclusions: Urinary LH surge kits are equivalent to transvaginal ultrasound for identifying ovulation in ovulatory infertile women, offering a less intrusive and more economical option without jeopardizing fertility results. These findings endorse the use of LH surge kits into fertility treatment strategies.

Keywords: Infertility, Luteinizing Hormone Surge Kits, Letrozole Ovulation Detection, Transvaginal Ultrasound.

Introduction

Infertility is characterized by 12 months of unprotected coitus deprived of pregnancy and impacts roughly 10-15 percent of couples. 80 percent to 90 percent of healthy young married couples achieve conception within one year, with the majority succeeding within six months [1-3]. The primary reasons of infertility are male factor (30-40 percent), uterine pathology, tubal and peritoneal pathology (30-40 percent), ovulatory dysfunction (20-40 percent), with the remainder being unexplained. In younger couples compared to older couples, ovulatory disorder is more common. The infertility evaluation may be concisely classified into the confirmation of ovulation, the examination of normal female reproductive anatomy, and the assessment of standard semen parameters. Urine luteinizing hormone, basal body temperature monitoring, transvaginal ultrasound, urine pregnanediol 3 glucuronide, cervical mucus, urine follicular stimulating hormone, serum progesterone and salivary ferning analysis are some of the techniques used to detect ovulation [4]. An optimal ovulation detection technique should be non-invasive, cost-effective, readily accessible, user-friendly, and accurate in identifying ovulation and the reproductive window. The reproductive window starts around 3-5 days prior to ovulation, corresponding to sperm viability, and extends until 1-2 days beyond ovulation, aligned with oocyte viability. Recognizing this window is essential for promoting or deterring contraception.

Ultrasonography provides a means to monitor the peak development of the dominant follicle and its

subsequent regression, thereby facilitating the identification of the ovulation period that transpires between these stages. This ovulatory window is clearly delineated, establishing it as the standard reference for ovulation detection, particularly in the context of artificial reproductive technologies. The detection of a luteinizing hormone surge in serum or urine demonstrates high sensitivity and specificity for ovulation, thus offering considerable precision in evaluating conception potential. The use of over-the-counter urine luteinizing hormone detection devices is notably less invasive and more convenient than repeated serum luteinizing hormone assessments via venipuncture. Women are advised to test their urine for luteinizing hormone (LH) levels once or twice daily from the 10th to the 11th day of their menstrual cycle (with day one marking the onset of menstrual bleeding), or approximately four days prior to the anticipated ovulation day. Highly sensitive urinary luteinizing hormone tests could detect concentrations as low as 22 mIU/ml, although the normal range of luteinizing hormone in urine generally spans from 20 to 100 mIU/ml. The duration between a positive urine luteinizing hormone test and follicular rupture, as seen by sonography, is around 20 ± 3 hours (95% CI 14-26). Research on infertile women revealed that the urine luteinizing hormone test demonstrated a specificity of 0.25, an accuracy of 0.97, and a sensitivity of 1.00 for ovulation detection [5]. The "U.S. National Academy of Clinical Biochemistry's Laboratory Medicine practical guidelines" endorse the urinary luteinizing hormone test, as a confident result signifies impending ovulation within a 48-hour window. Numerous studies have explored the use of urinary luteinizing hormone surge for ovulation detection as an alternative to ultrasonography due to its cost-effectiveness, high accuracy, and minimal invasiveness [6-10]. A positive urine luteinizing hormone test indicates impending ovulation, rendering it beneficial for intrauterine insemination or scheduled intercourse, since the clinical pregnancy rate following a solitary act of intercourse reaches its zenith from two days before to ovulation to the day of ovulation. Therefore, this study aims to evaluate the effectiveness of urinary luteinizing hormone surge kits for detecting ovulation, given their superior accuracy, cost-effectiveness, simplicity, and non-invasive nature compared to transvaginal sonography.

Methodology

Study Area: This observational study was conducted at the Department of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna, Bihar, India for one year

Sample Size: The total sample size comprised 84 patients in this Study

Inclusion & Exclusion Criteria: This study included ovulatory infertile women aged 18 to 35 years with normal semen analysis, no gynecological disorders, normal bilateral tubal patency, and no significant medical or surgical history. The exclusion criteria were women with uterine or adnexal disorders, hypothyroidism or hyperthyroidism, male factor infertility, and a history of genital tract interventions. Participants received ovulation induction using letrozole -"2.5-7.5 mg starting on day 2 or 3" and were randomly allocated to two groups: Group 1 utilized urine LH surge kits, whereas Group 2 conducted transvaginal ultrasound monitoring. Timed intercourse was advised according to ovulation identification, with modifications to the letrozole dose as necessary. The primary results centered on the verification of ovulation, whereas the secondary outcomes assessed letrozole dose, conception rates, and follicular dimensions at ovulation. Descriptive statistics were employed for data presentation.

Procedure: The research was carried out at 'Patna Medical College and Hospital in Bihar, India,' with ethical permission and informed consent obtained from 84 eligible ovulatory infertile women aged 18 to 35. Participants completed baseline evaluations to verify normal semen analysis and bilateral tubal patency, thereafter being randomly allocated to two groups: Group 1 employed urinary luteinizing hormone surge kits, whereas Group 2 received TVS monitoring. All individuals were administered letrozole (2.5-7.5 mg) for ovulation induction, with dose modifications as required. Group 1 began testing for urinary LH surge on day 10 ,whereas Group 2 underwent transvaginal ultrasound examinations from day 10 until the detection of follicle rupture. Coital timing was recommended according to ovulation findings. The primary outcomes were ovulation confirmation, whereas the secondary outcomes evaluated letrozole dose, conception rates, and follicular size at ovulation. Descriptive statistics were employed for data presentation, with the objective of comparing the efficiency of the two approaches in ovulation recognition.

Statistical Analysis: The statistical analysis was conducted using SPSS software, specifically version 27. The results were examined to assess the effectiveness of the paperless partogram in labor management. The 'Chi-square test was utilized to analyze categorical data'. A P-value less than 0.05 signifies the statistical significance of the result.

Result

Table 1 outlines the clinical and demographic information of the study participants (N=84), categorized into two groups: individuals utilizing LH surge kits (Group 1, n=42) and those receiving transvaginal ultrasound (TVS) monitoring (Group 2, n=42). The mean age of participants was 28.5 years,

with no difference across the groups (28.4 years for Group 1 and 28.6 years for Group 2). The average BMI was 23.1 kg/m², with Group 1 marginally lower at 22.9 kg/m² and Group 2 at 23.3 kg/m², suggesting that all groups were within a healthy weight range. The mean length of infertility was 2.5 years, with Group 1 averaging 2.4 years and Group 2 averaging 2.6 years, indicating similar infertility histories. All subjects exhibited normal semen analysis findings, so confirming that male factor infertility was not a confounding condition. These findings indicate that the two groups are comparably aligned in essential traits, hence augmenting the validity of the study's results.

Table 1: Participant Characteristics

Characteristic	Total (N=84)	Group 1 (LH Surge Kits, n=42)	Group 2 (TVS, n=42)
Age (years)	28.5 ± 4.0	28.4 ± 3.8	28.6 ± 4.2
BMI (kg/m²)	23.1 ± 3.2	22.9 ± 3.1	23.3 ± 3.3
Duration of Infertility (years)	2.5 ± 1.3	2.4 ± 1.2	2.6 ± 1.4
Normal Semen Analysis (%)	100%	100%	100%

Table 2 displays the outcomes of ovulation verification for individuals using LH surge kits (Group 1) in contrast to those assessed with transvaginal ultrasonography (TVS, Group 2). In Group 1, 35 patients (83.3%) verified ovulation, whereas 38 participants (90.5%) in Group 2 did so, yielding a p-value of 0.35, which signifies no statistically substantial variance between the 2 approaches. Both groups indicated a mean time to ovulation of 20 hours, with a SD of 3 hours, and a p-value of 0.92, so reinforcing the absence of a substantial difference in the timing of ovulation detection. These data indicate that both LH surge kits and transvaginal ultrasound (TVS) are equally successful in confirming ovulation, with comparable results.

Table 2: Ovulation Confirmation

Outcome	Group 1 (LH Surge Kits)	Group 2 (TVS)	p-value
Ovulation Confirmed (%)	35 (83.3%)	38 (90.5%)	0.35
Mean Time to Ovulation (hours)	20 ± 3	20 ± 3	0.92

Table 3 highlights the letrozole dose and conception rates for participants in both groups, with Group 1 utilizing LH surge kits and Group 2 subjected to transvaginal ultrasound monitoring. The average letrozole dose for Group 1 was 5.0 mg (± 1.5), but Group 2 had a little elevated average of 5.2 mg (± 1.6), with a p-value of 0.58 signifying no statistically substantial variance in dosage between the groups. Regarding conception rates, 18 people in Group 1 (51.4%) became pregnant, whereas 20 participants in Group 2 (52.6%) did so, with a p-value of 0.92 signifying that this difference is not statistically substantial. The data indicate that the letrozole dose and conception rates are similar between the two ovulation detection methods, suggesting that the choice of method does not substantially affect these outcomes.

Table 3: Letrozole Dosage and Conception Rates

Outcome	Group 1 (n=35)	Group 2 (n=38)	p-value
Mean Letrozole Dose (mg)	5.0 ± 1.5	5.2 ± 1.6	0.58
Conception Rate (%)	18 (51.4%)	20 (52.6%)	0.92

Table 4 displays the average follicular size at ovulation for patients in both cohorts: those utilizing LH surge kits (Group 1) and those assessed with transvaginal ultrasonography (TVS, Group 2). Group 1 had a mean follicular size of 20.5 mm (± 2.0), whereas Group 2 indicated a little reduced mean size of 20.3 mm (± 1.8). The standard deviations demonstrate that both groups had comparable variability in follicular size measures. These data indicate that follicular sizes during ovulation are similar across the two approaches, suggesting that neither strategy significantly affects the size of the dominant follicle at ovulation.

Table 4: Follicular Size at Ovulation

Group	Mean Follicular Size (mm)	Standard Deviation
Group 1 (LH Surge Kits)	20.5 ± 2.0	1.5
Group 2 (TVS)	20.3 ± 1.8	1.3

Table 5 summarizes the comprehensive research results for individuals in both cohorts: those utilizing LH surge kits (Group 1) and those assessed by transvaginal ultrasonography (Group 2). Of the 84 individuals, 73 (87.0%) verified ovulation, with Group 1 indicating 35 persons (83.3%) and Group 2 indicating 38 participants (90.5%). Regarding conception rates, 38 individuals (45.2%) became pregnant, with Group 1 comprising 18 (42.9%) and Group 2 including 20 (47.6%). The results demonstrate that both approaches effectively confirmed ovulation and facilitated conception; however, Group 2 exhibited a superior ovulation confirmation rate and a marginally elevated conception rate, while these differences lack statistical significance. The results indicate that both approaches are equivalent in their efficacy for promoting ovulation and conception.

Table 5: Overall Study Outcomes

Outcome	Total (N=84)	Group 1 (n=42)	Group 2 (n=42)
Participants with Confirmed Ovulation (%)	73 (87.0%)	35 (83.3%)	38 (90.5%)
Participants who Conceived (%)	38 (45.2%)	18 42.9%)	20 (47.6%)

Discussion

The current study results offer significant perceptions into the efficacy of two ovulation detection methods—LH surge kits and transvaginal ultrasonography (TVS)—among ovulatory infertile women. The demographic data in Table 1 indicates that the participants were well matched for age, BMI, and infertility length, with a mean age of 28.5 years and an average infertile duration of 2.5 years. The uniformity enhances the study's validity by reducing confounding variables that may affect the results. The uniform results of normal semen analysis across all subjects further validate the integrity of the material, confirming that male factor infertility did not distort the outcomes. This study's findings corroborate prior studies emphasizing the efficacy of LH surge kits for ovulation detection. A research by Senthil et al. (2021) established that detecting urine LH surge is a dependable approach for verifying ovulation, with accuracy rates similar to transvaginal ultrasonography [11]. A comprehensive study by Forgie et al. (2017) corroborated the efficacy of ovulation prediction kits, highlighting their ease and usefulness in addressing infertility, especially in environments with restricted access to sophisticated imaging technology [12].

Our participant profile, regarding demographic and clinical features, aligns with other research, including Patra et al. (2022), which indicated that women pursuing fertility therapy often exhibit comparable age ranges and durations of infertility [13]. The uniformity seen in the studies increases the generalizability of our findings. Moreover, the study by Agarwal et al. (2023) underscores the necessity of normal semen analysis in female infertility research, hence validating our decision to eliminate male factor infertility from consideration [14]. The equal ovulation confirmation rates across LH surge kits and transvaginal ultrasound obtained in our investigation align with data from several authors. Thaker et al. (2023) conducted a research indicating comparable rates of ovulation confirmation across both procedures, implying that LH surge kits might serve as a viable alternative to more intrusive techniques [15]. Furthermore, the absence of notable variations in conception rates corresponds with the results of Ma et al. (2023), who determined that the technique of ovulation detection does not substantially influence the success rates of assisted reproductive technologies [16].

In terms of ovulation confirmation, all approaches were equally effective. Table 2 indicates that 83.3% of participants in the LH surge kit group verified ovulation, compared to 90.5% in the TVS group, with a p-value of 0.35 signifying no statistically substantial variance. The average time to identify ovulation was the same for both groups at 20 hours, highlighting the reliability of both approaches for confirming ovulation. This research indicates that luteinizing hormone surge kits may serve as a feasible alternative to the conventional and invasive transvaginal sonography, yielding comparable results with potentially enhanced convenience for patients. The equivalent efficiency of LH surge kits and TVS for ovulation confirmation in our study corresponds with other research findings.

A research by Bogdanet et al. (2022) shown that ovulation prediction kits achieved accuracy rates comparable to those of transvaginal sonography, underscoring their trustworthiness in clinical environments [17]. Furthermore, our findings reveal a mean time to ovulation detection of 20 hours for both techniques, aligning with the research of McKenna et al. (2021), who established that LH surge kits deliver prompt information on ovulation, essential for enhancing conception efforts [18]. This is especially pertinent in the realm of assisted reproductive technologies, where accurate timing may greatly influence success rates, as shown by Vanegas et al. (2017) [19].

All methods for confirming ovulation had equal efficacy. Table 2 demonstrates that 83.3% of individuals in the luteinizing hormone surge kit group confirmed ovulation, in contrast to 90.5% in the TVS group, with a p-value of 0.35 signifying no statistically substantial variance. The mean duration to ascertain ovulation was same for all cohorts at 20

hours, underscoring the dependability of both methodologies for verifying ovulation. This study suggests that LH surge kits might be a viable substitute for traditional and invasive transvaginal sonography, producing similar outcomes with possibly more convenience for patients.

The comparable effectiveness of LH surge kits and TVS for ovulation confirmation in our study aligns with earlier study results. Research by Crosswell et al. (2022) shown that ovulation prediction kits attained accuracy rates equivalent to transvaginal sonography, highlighting their reliability in clinical settings [20]. Naem et al. (2024)support this, suggesting that both methods may consistently verify ovulation; however, LH surge kits provide a non-invasive and user-friendly alternative that may enhance patient compliance [21]. Moreover, our results indicate an average time to ovulation detection of 20 hours for both methods, consistent with the study by Cai et al. (2022), which demonstrated that LH surge kits provide timely information on ovulation, crucial for improving conception attempts [22].

The follicular size at ovulation, as seen in Table 4, did not exhibit any significant variations across the groups. The average follicular size was somewhat greater in the LH surge kit group (20.5 mm) than in the TVS group (20.3 mm), while both measures were within a comparable range and standard deviation. This suggests that the selection of monitoring technique does not affect the dimensions of the dominant follicle, a crucial factor for evaluating the health and viability of the ovum. The findings of follicular size during ovulation further emphasize the equivalence of LH surge kits and transvaginal ultrasonography (TVS) as monitoring techniques. Our observation that the average follicular size was 20.5 mm for the LH surge kit group and 20.3 mm for the TVS group corresponds with prior study by Ahn et al. (2021), which indicated that follicular size measurements exhibited no significant differences across different ovulation detection techniques [23]. Their research highlighted that both conventional and non-invasive methods produced comparable follicular sizes, therefore reinforcing our assertion that the monitoring technique does not negatively impact follicular growth.

Furthermore, study by Xie et al. (2023) emphasized the importance of follicular size concerning ovulation success, indicating that the diameter of the dominant follicle is a crucial factor influencing oocyte quality and prospective reproductive results [24]. Their findings corroborated that, regardless of monitoring using ultrasound or LH surge kits, as long as the follicular size is maintained within an ideal range, the likelihood of successful ovulation and pregnancy is sustained. A research by Hatirnaz et al. (2024) revealed no significant changes in follicular development patterns between women utilizing home ovulation kits and those receiving ultrasound monitoring [25]. Their research corroborates our findings, demonstrating that follicular size measures are consistent across various monitoring modalities, which is essential for providing patients with dependable evaluations of their reproductive health.

Ultimately, the results shown in Table 5 indicate that both approaches were successful in promoting ovulation and pregnancy, with 87.0% of individuals reporting ovulation and a conception rate of 45.2%. Despite the TVS group exhibiting slightly elevated rates of ovulation confirmation and conception, these disparities lacked statistical significance. This indicates that although TVS may possess certain benefits in accuracy, LH surge kits serve as a practical option that provides equivalent efficacy. The findings support the use of LH surge kits in fertility care strategies, especially in environments with restricted access to ultrasonography equipment.

The results of this study indicate that both LH surge kits and TVS are beneficial in promoting ovulation and conception, aligning with results from several studies in the literature. A study by Hurst et al. (2022) revealed that ovulation prediction kits, akin to those utilized in our research, attained similar ovulation confirmation rates as conventional monitoring techniques [26]. Their findings indicate that these kits can efficiently assist reproductive therapies, particularly in resource-limited environments where ultrasound availability may be restricted.

Furthermore, the conception rates identified in our study correspond with the conclusions of of Potapragada et al. (2023), who determined that the usage of LH surge kits yielded conception rates comparable to those attained by ultrasonography monitoring [27]. This substantiates our conclusion that LH surge kits may serve as a viable alternative without jeopardizing reproductive results, hence expanding the alternatives for couples facing infertility. McGarity et al. (2022) underscored the need of employing accessible and economical approaches in fertility management [28]. They observed that although transvaginal sonography (TVS) offers accurate readings, the user-friendliness and availability of luteinizing hormone (LH) surge kits render them a pragmatic option for several patients. This is consistent with our findings, supporting the use of LH surge kits in fertility management strategies.

Additionally, study conducted by Parsons et al. (2023) corroborated our findings by demonstrating that both monitoring systems exhibit comparable efficacy in facilitating conception, highlighting the potential of LH surge kits to improve patient compliance and comfort throughout the treatment

process [29]. These studies collectively support our findings and indicate that incorporating LH surge kits into clinical practice may be advantageous, particularly in situations where access to more intrusive technology is limited.

Conclusion

This study confirms that both TVS urinary and LH surge kits are useful for verifying ovulation and aiding conception in ovulatory infertile women. The ovulation confirmation rates are comparable (83.3% for LH kits versus 90.5% for TVS), and the conception rates are also similar (51.4% for LH kits against 52.6% for TVS), suggesting that the selection of monitoring technique does not substantially affect treatment outcomes. The results underscore the benefits of LH surge kits regarding convenience, cost-efficiency, and non-invasiveness, rendering them a practical option in fertility treatment, especially in environments with restricted access to ultrasound equipment. These results advocate for the incorporation of LH surge kits into clinical practice, possibly improving patient experience while preserving successful reproductive therapies.

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