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Original Article

Comparing transabdominal and transvaginal ultrasound-guided follicular aspiration: A risk assessment formula



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ABSTRACT

Objective: We sought to identify patients at risk of incomplete transvaginal oocyte retrieval, develop a risk assessment formula to identify patients who would benefit from a transabdominal approach, and compare complication and pregnancy rates between these two approaches.

Materials and Methods: In this retrospective case control study in a private *in vitro* fertilization center, 95 cases of women undergoing transabdominal follicular aspiration for oocyte retrieval (15 transabdominal only and 80 transabdominal and vaginal combined) were compared with 278 controls of women undergoing the transvaginal aspiration only. Transabdominal oocyte retrieval was performed when one or more ovaries could not be retrieved via the transvaginal approach. Main study outcomes included need for transabdominal retrieval, pregnancy rates, and complications.

Results: A risk assessment scoring system was developed as follows: difficulty seeing ovaries on ultrasound (+4), history of pelvic surgery (+3), and body mass index of 30 kg/m² or greater (+2). With a cutoff score of 4 or greater, the overall sensitivity is 75%, specificity is 80%, positive predictive value is 57%, and negative predictive value is 90%. No statistically significant differences were found for pregnancy rates or complications.

Conclusion: The transabdominal approach is an alternative option that would increase the total number of oocytes retrieved with no statistical difference in complication or pregnancy rates. We also developed a scoring system that can serve as a useful screening tool for identifying women at increased risk of transabdominal oocyte retrieval.

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Introduction

Oocyte retrieval is achieved almost exclusively by the transvaginal ultrasound-guided (TVUS) follicle aspiration method [1,2]. Before TVUS-guided aspiration, oocytes were aspirated under direct visual guidance via laparoscopy or via transabdominal approach [3].

Several studies have compared laparoscopic [4], transabdominal, and transvaginal follicular puncture and aspiration. Transvaginal follicular aspiration is usually preferred due to its shorter operation time and less invasive nature, but the transabdominal ultrasound-guided (TAUS-guided) follicular aspiration is considered a safe and efficacious procedure in women with ovaries inaccessible by TVUS [5]. The TAUS oocyte retrieval method is still used and published in case reports in women with radical hysterectomies, transposed ovaries [6,7], and Müllerian agenesis [8–10].

There may be a larger role presently for an increased utilization of transabdominal retrievals due to an increasing body mass index (BMI) in the U.S. population [11]. As the BMI increases, there is an increase in anatomic distortion, which contributes to

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decreasing ultrasound image quality and difficulties in identifying and accessing ovaries from the transvaginal approach [12]. We have developed a risk assessment scoring system to identify women undergoing *in vitro* fertilization (IVF) who are at risk of requiring TAUS as compared with TVUS oocyte retrieval. The purpose of this study is to determine factors requiring TAUS oocyte retrieval due to an inability to retrieve all oocytes transvaginally and evaluate its complications and effects on pregnancy rates. We wanted to evaluate if an increased BMI would be a risk factor, making it less likely to retrieve all oocytes by the traditional transvaginal aspiration approach. We evaluated additional risk factors (fibroids, prior surgery, infection, and endometriosis) to see whether these factors show a difference in the ability to retrieve oocytes and have an impact on pregnancy rates or complications.

Materials and methods

Participants

This is a retrospective case control study of women undergoing IVF who had underwent either TVUS or TAUS oocyte retrieval at a private infertility center. Institutional Review Board approval from North Shore-Long Island Jewish Health System was obtained. At retrieval, an attempt was made to access the ovaries transvaginally but if TVUS aspiration was not possible for one or both ovaries, transabdominal aspiration was performed to maximize the number of oocytes retrieved. Prior to proceeding with TAUS retrieval, the following steps were performed in an attempt to access the ovaries transvaginally: (1) transabdominal pressure, (2) cervical traction, and (3) reverse Trendelenburg. If these steps failed to provide transvaginal access to one or both ovaries, then a transabdominal approach was attempted. Cases (the transabdominal group) included patients with oocyte retrieval using TAUS exclusively or oocyte retrieval using a combination of TAUS and TVUS. Combined retrievals were defined as cases in which TVUS retrieval was achieved in one ovary but only TAUS in the contralateral ovary. Controls were selected as the subsequent three transvaginal oocyte retrievals. A total of 373 cases were obtained for this study. Inclusion/exclusion criteria were applied to both groups. The study period was from January 18, 2012, to October 9, 2013.

Inclusion criteria

Inclusion criteria were patients seeking fertility who had oocyte retrievals. Data were collected in a 3:1 ratio where 278 (74.5%) underwent vaginal oocyte retrieval, and 95 (25.5%) underwent transabdominal oocyte retrieval. TAUS oocyte retrieval included 15 patients who had TAUS oocyte retrieval exclusively and 80 patients who had combined transvaginal/transabdominal oocyte retrieval. Cases within each group were randomly assigned to be in the derivation sample ($n = 186$) for the validation sample. Derivation was used to identify factors that differentiated transabdominal from vaginal cases and build a scale. The validation sample was then used to examine the utility of the scale and calculate diagnostic efficiency scores. These procedures are consistent with those utilized by other researchers attempting to build detection scales [13].

Exclusion criteria

Patients who had incomplete documentation were excluded from the study.

Variables of interest

Data were collected using a standardized form to review medical records. For each case, we recorded whether the patient had required TAUS oocyte retrieval or not. Other variables included BMI and history with the following considerations: laparoscopic surgery, history of laparotomy or pelvic surgery including cesarean section and myomectomies, presence of leiomyomas, polycystic ovarian syndrome (PCOS), ovaries difficult to see with TVUS, parity, sexually transmitted disease including pelvic inflammatory disease and tubo-ovarian abscesses, ectopic pregnancy, and endometriosis. We also compared pregnancy rates and time of procedure. Difficult to see ovaries with TVUS was defined as the inability to see one or both ovaries using a TVUS after the following steps: (1) transabdominal pressure, (2) cervical traction, and (3) reverse Trendelenburg. Complications were defined as excessive bleeding requiring more than vaginal sutures for hemostasis including blood transfusion, infections, or hospital admissions. Postoperative pain in both groups was also measured as follows: patients with “mild pain” were defined as those receiving one to two tablets of acetaminophen (500 mg) in the postoperative period and patients with “moderate to severe pain” were defined as those receiving one to two doses of ketorolac (30 mg) intravenous push.

Statistical analysis

Categorical variables for patients who received TAUS procedures were compared with those of patients who underwent TVUS retrieval procedures using Pearson Chi-square tests (χ^2). Chi-square tests were used to examine whether there were differences in pregnancy rates and pain status across the TVUS and TAUS groups. We used Student *t* tests to compare dimensional variables (e.g., age). For variables that differed significantly between groups, we calculated sensitivity (Se), specificity (Sp), positive likelihood ratio (LR+), and negative likelihood ratio (LR–).

We conducted multiple logistic regression analysis, with a forward stepwise procedure, to identify an optimal model for detecting individuals requiring transabdominal procedures [14]. Only variables that differed significantly across patient groups in the univariate analyses were utilized in the multiple logistic regression analysis. This approach has been employed in similar studies [15]. Based on the findings from the multiple logistic regression analysis, we weighted the value of each variable. These weighted scores were summed to create a scale score. We then calculated Se, Sp, LR+, LR–, odds ratio (OR), positive predictive value (PPV), and negative predictive value (NPV) for multiple cutoff scores. Because prevalence rates for transabdominal procedures may vary across populations, diagnostic efficiency scores for multiple cutoff scores were calculated and reported. This allows clinicians to adjust risk thresholds based on specific needs and prevalence rates for various populations.

Results

Demographics and complications

The average age (in years) for the study sample was 37.60 (standard deviation 5.15). Regarding ethnic background, 225 (59.3%) cases were identified as white/Caucasian, 75 (19.8%) for black/African American, 50 (13.2%) Hispanic/Hispanic American, 18 (4.7) Asian/Asian American, and 11 (2.9%) “others.” Of these cases, 278 (74.5%) underwent TVUS oocyte retrieval and 95 (25.5%) underwent TAUS oocyte retrieval. The TVUS group had an

Table 1

Diagnostic performance characteristics for variables significantly differing across groups in the derivation sample.

	Derivation sample n ()	Vaginal with condition n ()	Transabdominal with condition n ()	χ^2	<i>p</i>	Se ()	SP ()	LR+	LR–
No. of patients	186 (100)	139 (74.3)	47 (25.7)						
Obese ^a	69 (37.3)	40 (29.0)	29 (61.7)	15.05	<0.001	62	71	2.13	1.85
History of laparoscopic surgery	40 (21.5)	25 (18)	15 (31.9)	4.04	0.05	32	82	1.77	1.21
History of pelvic laparotomy including cesarean section and myomectomies	70 (37.6)	42 (30.2)	28 (59.6)	12.9	<0.001	60	70	1.97	1.72
Presence of leiomyoma	54 (29)	35 (25.2)	19 (40.4)	3.96	0.05	40	75	1.61	1.26
PCOS	12 (6.5)	6 (4.3)	6 (12.8)	4.12	0.04	12	96	2.96	1.1
Difficulty seeing ovary on transvaginal ultrasound	40 (21.5)	16 (11.5)	24 (51.1)	32.55	<0.001	0.51	0.89	4.44	1.81

LR+ = positive likelihood ratio; LR– = negative likelihood ratio; PCOS = polycystic ovarian syndrome; Se = sensitivity; Sp = specificity; eta = partial regression coefficient.

^a Obese indicates patients with BMI ≥ 30 kg/m².

average procedure time of 20.2 minutes, whereas the TAUS group had an average of 28.2 minutes.

No serious intraoperative complications were observed. In the TVUS group, two patients required vaginal sutures for hemostasis, whereas in the TAUS only one patient required sutures. Hospital admission and infections requiring antibiotics were not observed in either group. With regard to pain, 39.4% of patients in the TAUS group experienced mild pain, whereas only 20.4% of those in the TVUS group experienced mild pain. This difference was highly significant ($\chi^2 = 13.41$, $df = 1$; $p < 0.001$); 42.5% of the patients in the TVUS group experienced moderate to severe pain and 51.1% of those in the TAUS group experienced moderate to severe pain, but this difference was not statistically significant.

Derivation sample results

For the derivation sample, we compared pregnancy rates between the TVUS retrieval group and the TAUS retrieval group using Chi-square test. Data on derivation sample comparing TAUS with TVUS for pregnancy rates are as follows: $\chi^2 = 0.02$, $p = 0.88$. Groups did not differ significantly on pregnancy rates. Regarding the oocyte retrieval method, 139 (74.7%) underwent TVUS retrieval and 47 (25.3%) required TAUS procedures in the derivation sample. Data from univariate analyses are reported in Table 1. Risks for requiring TAUS procedures were not associated with age, being underweight (BMI < 18.5 kg/m²), parity, a history of sexually transmitted infection or pelvic inflammatory disease, or a history of an ectopic pregnancy. Although a history of endometriosis was closely associated with requiring TAUS procedures, it did not achieve statistical significance ($\chi^2 = 2.99$, $df = 1$, $p = 0.08$).

The variables listed in Table 1 were entered into a multiple logistic regression using procedure (TVUS vs. TAUS) as the dependent variable. Results for the logistic regression are reported in Table 2. The following three variables were entered into the model as significant predictors: difficulty seeing ovaries on ultrasound, being obese (BMI ≥ 30 kg/m²), and a history of pelvic laparotomy surgery.

A scale score was calculated using the Wald ratio to weigh each variable from the logistic regression. This culminated in the following formula: score = (obese $\times 2$) + (history of pelvic surgery $\times 3$) + (ovaries difficult to see on ultrasound $\times 4$). The receiver-operating characteristic (ROC) curve for this score is presented in Figure 1. The area under the ROC curve (AUC) was 0.80, which falls into the lower portion of the “good” range [16]. A simpler way to look at the formula would be

Difficulty seeing the ovaries on ultrasound	Yes (4 points)	No (0 points)
History of Laparotomy pelvic surgery	Yes (3 points)	No (0 points)
BMI in obese range (BMI ≥ 30 kg/m ²)	Yes (2 points)	No (0 points)
Total points		

Validation sample results

For the validation sample, we compared pregnancy rates between the TVUS retrieval and TAUS retrieval groups using Pearson Chi-square test. The validation sample compares the two groups for pregnancy rates ($\chi^2 = 0.75$, $p = 0.39$). Consistent with the derivation sample, the two groups did not differ significantly on pregnancy rates in the validation sample as well. The validation sample was used to examine the diagnostic utility of various cutoff scores for the scale. In the validation sample, 139 (74.3%) cases received vaginal retrieval and 48 (25.7%) cases required TAUS retrieval. Of note, BMI data were missing for three of the TVUS retrieval cases in the validation sample. Thus, we were only able to calculate scale scores for 136 of the 139 TVUS retrieval cases. Diagnostic efficiency statistics for the validation sample are reported in Table 3. Diagnostic efficiency statistics are reported for multiple cutoff scores to allow clinicians to adjust risk tolerance as needed. A cutoff score of four or greater appears to balance sensitivity and specificity needs. The ROC curve for the validation sample is depicted in Figure 2. The AUC for the validation sample was highly similar to that of the derivation sample (ROC–AUC = 0.79).

Comments

Risk assessment score

TVUS-guided follicular aspiration has been the standard of care for IVF procedures since studies have proven its efficacy and ease of use. However, some clinical situations have made TVUS oocyte retrieval an ineffective method for patients with certain risk factors, such as increased BMI and displacement of ovaries. These patients may benefit from the use of TAUS oocyte retrieval to maximize the numbers of oocytes retrieved. Our retrospective study sought to determine the factors that would require the use of TAUS over TVUS oocyte retrieval. In the derivation sample, we found that women undergoing TAUS were more likely to be obese, have a history of laparoscopic or pelvic laparotomy surgery, and have fibroids and PCOS (Table 1). The most significant risk factor was the difficulty to see the ovaries on TVUS during follicular monitoring. After entering these variables into a multiple regression analysis, three variables came out as significant predictors: difficulty seeing ovaries on

Table 2
Multiple logistic regression values for variables entered into the final model.

	Wald	aOR	95% CI
Difficulty seeing ovary on transvaginal ultrasound	22.67	0.11	0.05–0.28
Obese ^a	9.66	0.28	0.13–0.63
History of pelvic laparotomy including cesarean section and myomectomies	14.99	0.19	0.08–0.44

95% CI = 95% confidence interval; aOR = adjusted odds ratio.

^a Obese indicates patients with BMI ≥ 30 kg/m².

ultrasound, being obese (BMI ≥ 30 kg/m²), and history of pelvic laparotomy surgery (Table 2).

To stratify the probability of patients that may need to undergo TAUS, a risk assessment scoring system was developed based on these significant variables using the following formula: difficulty seeing ovaries on ultrasound (+4), a history of pelvic surgery (+3), and BMI ≥ 30 kg/m² (obese) (+2). With a cutoff score of 4 or greater, the overall sensitivity is 75%, specificity is 80%, PPV is 57%, and NPV is 90% (Table 3). A cutoff score of four or greater appears to

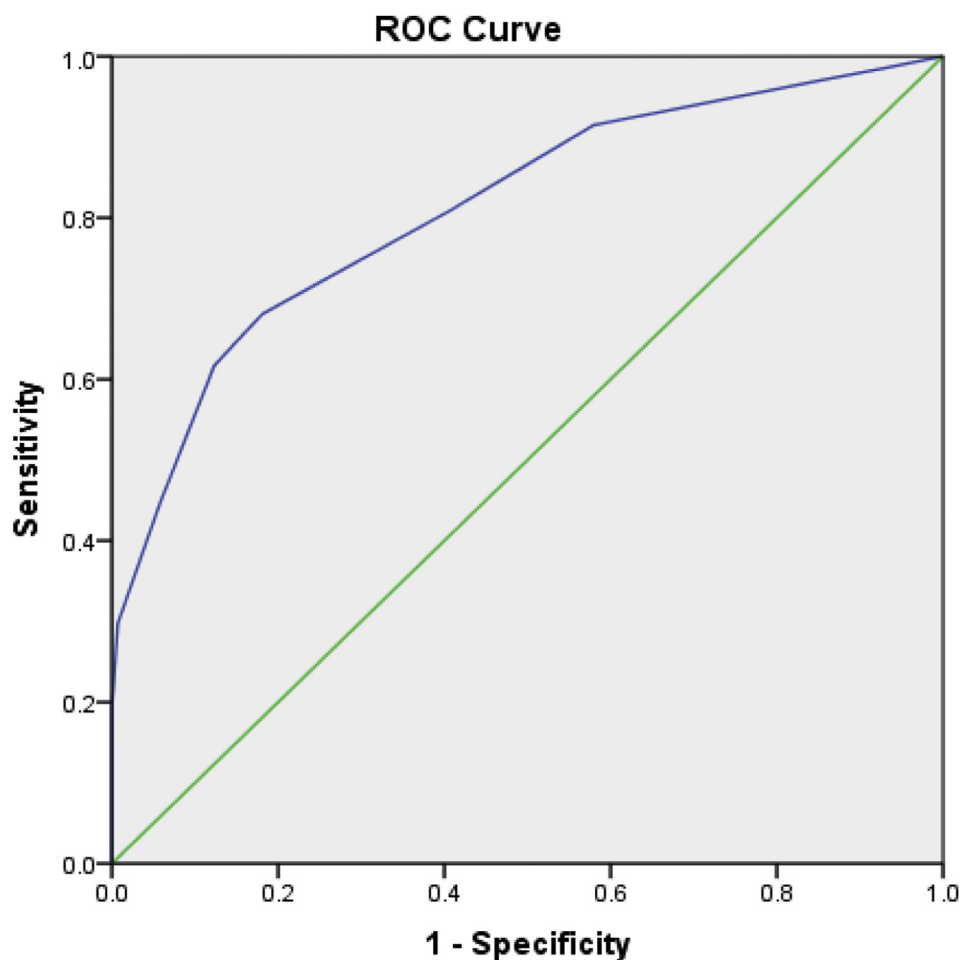


Figure 1. Receiver-operating characteristics (ROC) curve for scale score in the derivation sample.

Table 3
Diagnostic efficiency scores for various scale cutoffs in the validation sample.

Cutoff score ^a	Se (%)	Sp (%)	LR+	LR–	PPV (%)	NPV (%)	OR
2	87	46	1.63	3.63	36	91	5.90
3	81	58	1.93	3.03	40	90	5.86
4	75	80	3.75	3.14	57	90	11.78
5	64	83	3.77	2.3	57	87	8.67
6	53	90	5.17	1.92	64	85	9.90
7	28	93	4.18	1.29	59	79	5.40

LR+ = positive likelihood ratio; LR– = negative likelihood ratio; NPV = negative predictive value; OR = odds ratio; PPV = positive predictive value; Se = sensitivity; Sp = specificity.

^a Score is the sum of difficulty seeing ovaries on ultrasound (+4), a history of pelvic surgery (+3) and BMI ≥ 30 kg/m²—obese (+2).

balance sensitivity and specificity needs. The ROC curve for the validation sample (ROC–AUC = 0.79) is depicted in Figure 2 and this is highly similar to that of the derivation sample in Figure 1 (ROC–AUC = 0.80). When the population base rate is low, the predictive power of a negative test result will be more than that of a positive test result. In addition, in cases with a rare condition having a low prevalence, a positive test result is most likely to be incorrect and the PPV will be artificially deflated [17]; however, the OR will not be affected [18]. This is important for understanding the current results. The suggested cutoff produced reasonable sensitivity, specificity, NPV, and OR; PPV is, however, low. Low PPV is due in large part to the fact that the event (i.e., TAUS) occurs infrequently. Thus, while the screening test has adequate to strong test characteristics overall, PPV is necessarily limited. It is important to appreciate the meaning of this pattern of results. Low PPV is not

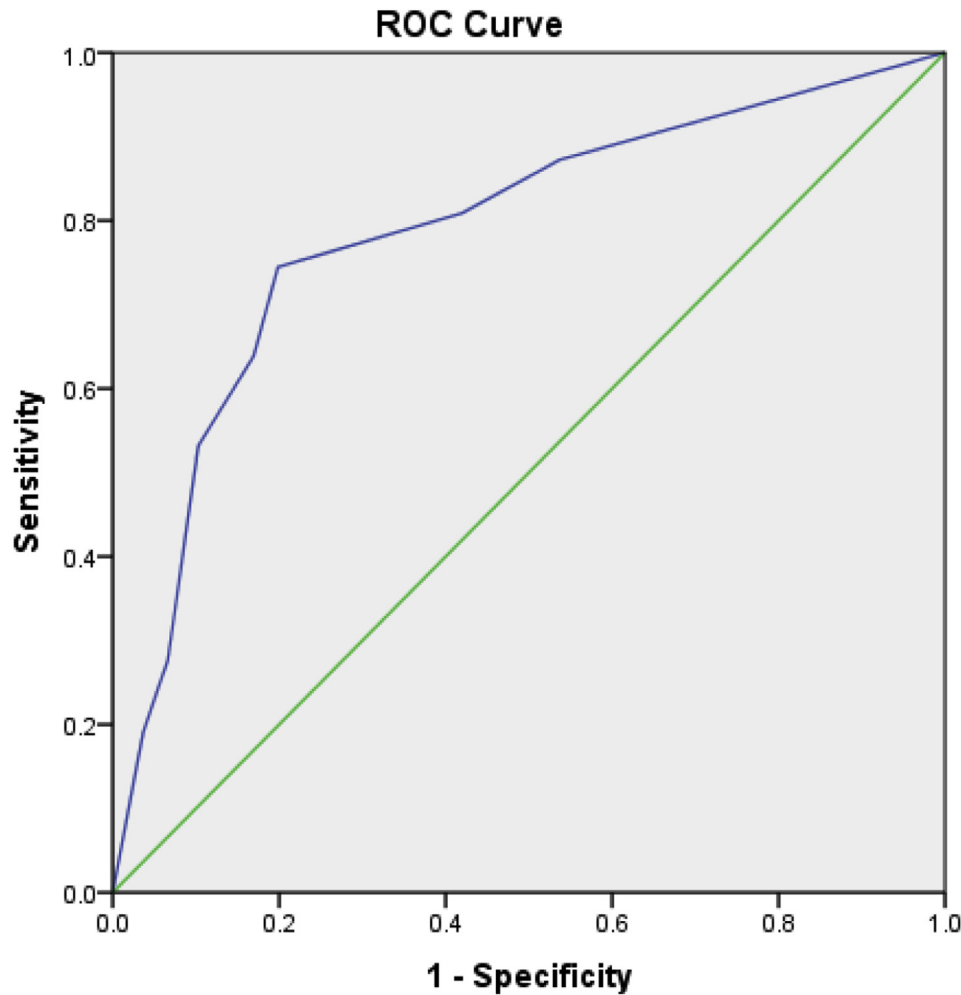


Figure 2. Receiver-operating characteristics (ROC) curve for the validation sample.

necessarily problematic, especially when OR is strong [19]. Instead, it is best to consider the PPV in relation to the other diagnostic indicators to appreciate implications for interpreting results.

The scale's strong OR, specificity, and NPV suggest that the approach will yield few false negatives. For example, NPVs suggest that a woman scoring below the suggested cutoff has a 90% chance of *not* requiring TAUS oocyte retrieval. Thus, clinicians can be fairly confident that a woman scoring below the cutoff will not require TAUS. By contrast, scores above the cutoff do not guarantee that TAUS will be required. In fact, in the present sample, only 57% of women scoring above the suggested cutoff required TAUS oocyte retrieval (following attempted TVUS oocyte retrieval). Thus, a positive score indicates an increase in risk above the observed prevalence rate of 25% but it probably does not indicate that TAUS is needed with certainty. As such, clinicians are likely, except in exceptional circumstances, to proceed with TVUS oocyte retrieval procedure even in women scoring above the cutoff. Nonetheless, information from the screening test may inform how the clinician characterizes the probability of success, counsels, and proactively informs that patient regarding other options (should TVUS oocyte retrieval fail).

We believe that this novel scoring system can serve as a useful screening tool for identifying and counseling women undergoing IVF who are at an increased risk of TAUS oocyte retrieval. The scale requires very little in terms of clinical burden and scores can be calculated using data routinely collected as part of the overall

procedure. From a clinical standpoint, with good OR, this information can be used to help physicians prepare preoperative patients accurately by informing patients with a low risk score that they will most likely require only TVUS. When counseling women with scores below the cutoff, physicians can feel confident that TAUS oocyte retrieval will not be needed. However, when counseling women with scores above the cutoff, clinicians will do well to be a bit more cautious in terms of framing risk for TAUS. However, clinicians should not misconstrue the present findings as suggesting that a score above the cutoff guarantees that a woman will definitely need TAUS nor does a score above the cutoff suggest that TVUS oocyte retrieval procedures should not be utilized. Instead, scores above the cutoff suggest that clinicians be considerate in how they describe the likelihood of needing TAUS to maximize oocyte retrieval.

We acknowledge that our cutoff score is the same as what difficulty seeing ovaries is worth. Thus, when this indicator is present, the patient automatically "screens in" emphasizing its potential importance. Patients with other factors (obesity and history of laparotomy) will have a higher score, and therefore a greater risk of undergoing TAUS to maximize the number of oocytes retrieved. The difference between using the single indicator of "difficult to see ovaries on TVUS" and the scale could be the level of confidence. As indicators accrue, there is a cumulative increase in the patient's risk and when making clinical decisions, our confidence should increase as more indicators are present.

Although TAUS is not as widely used as TVUS, previous studies have proven its efficacy and safety in follicular aspiration. In a study done to test TAUS, it was demonstrated that TAUS-guided follicular aspiration is safe and efficient in women with significant ovarian displacement compared with transvaginal aspiration in women with normally positioned ovaries [5]. Given the demonstrated safety of this procedure, a risk assessment score to guide the use of TAUS follicular aspiration is of particular importance in our society today and should be considered to maximize the numbers of oocytes retrieved. It is known that BMI is steadily increasing nationwide, which is affecting fertility and assisted reproductive technology outcomes [20]. In a study on obese pregnant women, it was shown that increased adipose tissue slows down the returning signal during ultrasound, causing loss of image quality and possibly explaining why ovaries might be difficult to see in obese patients [12]. Studies have also reported difficulty seeing ovaries in patients with PCOS secondary to central displacement of fat that occurs with androgen excess and insulin resistance [21]. In our study, PCOS was statistically significant ($p = 0.04$) in the derivation sample of the TAUS retrieval group. However, we believe that increased BMI in these patients was the main risk factor that may have contributed to the use of TAUS as the patients with PCOS also had a BMI suggesting obesity.

Pregnancy rates

Our study revealed no statistically significant difference between TAUS and TVUS procedures when comparing pregnancy rates. These results are important because TAUS oocyte retrieval will provide an alternative to retrieving and maximizing oocytes retrieval for cases in which transvaginal access is difficult without affecting pregnancy rates. Previous studies reported that cases of TAUS aspiration had slightly fewer oocytes retrieved, but no statistically significant differences were found for damaged oocytes, fertilization rates, embryo number and quality, or pregnancy rates [5]. These previous reports are consistent with our findings because no difference in pregnancy rates was seen in both groups. Knowing that pregnancy rates are not affected, the physician can counsel the patient on this modality and reassure her that the likelihood of pregnancy will probably be the same as for TVUS follicular aspirations.

Complications and safety

In terms of intraoperative complications and safety, there was no statistical difference in complications associated with TAUS when compared with TVUS. Postoperative moderate/severe pain medication had no statistical significance in both groups and there were no hospital admissions or infections requiring antibiotics. These findings are consistent with a recent study that reported that TAUS appears to be a safe alternative to TVUS with minimal complications [5]. A prior study reported abdominal complications following ultrasonically guided percutaneous transvesical collection of oocytes for IVF. Among the reported complications were a higher incidence of abdominal pain, exacerbation of previous pelvic inflammatory disease, mild hemoperitoneum, urinary tract infections, and transient macroscopic hematuria after the procedure [22]. In our study, we did not see these complications. In the TVUS group, only two patients required vaginal sutures for hemostasis, whereas in the TAUS combined group only one patient required vaginal sutures as that ovary was retrieved transvaginally. In addition, patients in the TAUS group did require more pain management for the diagnosis of mild pain, which was adequately controlled with acetaminophen. In addition, patients undergoing TAUS follicular aspiration were under anesthesia for

an average of 8 minutes longer than those undergoing the TVUS technique. This along with the fact that most TAUS techniques were combined procedures, because the first attempts were to retrieve transvaginally, may account for the slight increase in pain management requirements for the mild pain group as well as the increase in surgery time. Despite this fact, the patients undergoing TAUS in our study did not experience any of the other complications described in previous studies. No blood transfusion, antibiotics, or hospital admissions were needed in our patients. These findings are significant because many physicians turn away from TAUS due to concerns that these potential complications may outweigh the risk of not retrieving all oocytes from a patient during an IVF cycle. This study shows no significant statistical difference in complications with TAUS when compared with TVUS.

Clinically, this can reassure physicians to have this additional tool to maximize oocytes retrieval without increasing morbidity to the patient. Implementing a structured assessment tool to predict the use of TAUS can indicate a patient at risk of undergoing TAUS to maximize the total number of oocyte retrieved. By proceeding directly to TAUS in patients at high risk, we may also decrease the total operating time and avoid an unsuccessful transvaginal approach first.

Limitations

Although we attempted to minimize confounding factors, our study was not without limitations. Pregnancy rates were influenced by a variety of patient risk factors, and we were unable to control all of them. For example, both PCOS and BMI were statistically significant in the derivation sample of the TAUS retrieval group. However, we believe that the increased BMI in these patients was the main risk factor that contributed to the use of TAUS. In addition, live birth rates could not be determined due to pending deliveries.

Conclusion

In conclusion, TAUS-guided follicular aspiration can augment the total number of oocyte retrieved over the standard transvaginal method, especially in patients with obese BMIs, history of pelvic surgeries, or difficulties with visualizing the ovaries during IVF cycle stimulation. With this novel and simple scoring system, we can have a useful screening tool for identifying and counseling IVF women at increased risk of transabdominal oocyte retrieval when a score is greater than or equal to 4 points with a sensitivity of 75%, specificity of 80%, PPV of 57%, and NPV of 90%. From a clinical standpoint, this information can be used to help physicians prepare preoperative patients with a low risk score by informing them that they will most likely require only TVUS. As previous literature supports, TAUS oocyte retrieval is a safe and effective way to retrieve more oocytes when transvaginal procedure is not possible. In regards to pregnancy rates, there is no statistical difference noted between the two procedures. Our novel scoring system will permit physicians to identify patients who are likely to undergo TAUS and counsel them prior to the procedure. TAUS oocyte retrieval provides a safe and effective complement to retrieving more oocytes for cases with difficult transvaginal access and has no difference in complications and pregnancy rates.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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