Outcomes of Different Treatments for Hydrosalpinx Undergoing in Vitro Fertilization and Embryo Transfer: A Retrospective Study with a Follow-Up of 5 Years

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Research

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Abstract

Background: Except for laparoscopic surgery (salpingectomy or proximal tubal occlusion/ligation), there are also some other common treatments used for hydrosalpinx before IVF such as ultrasonic-guided hydrosalpinx aspiration, hysteroscopic tubal occlusion etc. More evidence is needed to give advice for clinicians on the most effective treatment for hydrosalpinx undergoing IVF-ET.

Methods: We reviewed 936 women with hydrosalpinx and 6715 tubal infertile women without hydrosalpinx who underwent IVF/ICSI between January 2014 and August 2019 in our center. Hydrosalpinx patients received different treatments including laparoscopic surgery (only salpingectomy and proximal tubal occlusion/ligation were included), ultrasonic-guided aspiration and hysteroscopic tubal occlusion. Patients received laparoscopic surgery (salpingectomy or proximal tubal occlusion/ligation) before fresh cycles or freeze-thaw embryo transfer cycles. Ultrasonic-guided aspiration was conducted during oocyte retrieval procedure in fresh cycles. Hysteroscopic tubal occlusion was conducted before freeze-thaw embryo transfer cycles. Outcomes were analyzed by One-way ANOVA, Chi-Square test and logistic regression.

Results: The live birth rate (LBR) of laparoscopic surgery (salpingectomy or proximal tubal occlusion/ligation) was significantly higher compared with hydrosalpinx aspiration (48.3% vs 39.6%, P=0.024). The cumulative live birth rate (CLBR) of subsequent laparoscopic surgery was significantly higher compared with subsequent hysteroscopic occlusion (65.1% vs 34.1%, P=0.001) and no subsequent treatment (65.1% vs 44.9%, P<0.005). Subsequent laparoscopic surgery (salpingectomy or proximal tubal occlusion/ligation) significantly improved the CLBR of hydrosalpinx patients who received ultrasonic-guided aspiration and didn't get clinical pregnancy in fresh cycles (Oddis Ratio (OR) =1.875; 95%CI=1.041-3.378, P=0.036).

Conclusions: Laparoscopic surgery (salpingectomy or proximal tubal occlusion/ligation) leads to significantly higher LBR than ultrasonic-guided aspiration and significantly higher CLBR than hysteroscopic occlusion and no treatment.

Background

Tubal infertility accounts for 25–35% of female infertility. [1, 2] Hydrosalpinx is a serious type of tubal disease, [3, 4] and tubal infertile patients with hydrosalpinx were proved to have negative consequences on pregnancy outcomes. [5–8] The prevalence rate of hydrosalpinx diagnosed by trans-vaginal ultrasound was 10%, and the prevalence rate of hydrosalpinx diagnosed by hysterosalpingography (HSG) or laparoscopy was 30%. [3, 7] Initially, the diagnosis of hydrosalpinx was usually based on hysterosalpingography (HSG) and confirmed by laparoscopy. Later on, the diagnosis was made almost entirely by image diagnosis including HSG and ultrasound. [8]

In young women without other obvious factors of infertility, the American Society for Reproductive Medicine ASRM recommended laparoscopic fimbrioplasty or neosalpingostomy to treat mild

hydrosalpinx. [9] In older women or women with more severe hydrosalpinges, it may be more advisable to proceed directly to salpingectomy and IVF treatment. [9, 10] Although salpingectomy was the most recommended treatment for hydrosalpinx in clinical practice, [11–13] there are also some other common treatments used for hydrosalpinx before IVF such as ultrasonic-guided hydrosalpinx aspiration, tubal sclerotherapy, hysteroscopic tubal occlusion and antibiotic treatment, etc.[9, 12–14]

Ultrasonic-guided hydrosalpinx aspiration was considered less invasive, safer, easier to perform under dense adhesion, and had a shorter hospital stay. [15] Hydrosalpinx aspiration was also proved to improve pregnancy outcome of hydrosalpinx patients [16, 17] and it was also widely applied in clinical practice. Hysteroscopic occlusion was also proved to be an effective option for management of hydrosalpinx in women before IVF.[18] A cross-sectional survey of Society for Reproduction Endocrinology and Infertility(SREI)/Society of Reproductive Surgeons (SRS) members showed that although laparoscopic salpingectomy was the preferred method of surgical management, nearly one-half members responded that hysteroscopic tubal occlusion should have a role as a primary method of intervention. [19] However, a meta-analysis founded ultrasonic-guided hydrosalpinx aspiration and hysteroscopic had lower LBR compared with salpingectomy. [12, 20] So far, more evidence are needed to give advice for clinicians on the most effective treatment for hydrosalpinx before IVF-ET(in vitro fertilization and embryo transfer).

Our retrospective study compared the baseline data and pregnancy outcomes of patients with hydrosalpinx from 2014 to 2019 in order to explore the effectiveness of laparoscopic surgery, ultrasonic-guided hydrosalpinx aspiration and hysteroscopic occlusion on pregnancy outcomes on patients with hydrosalpinx.

Methods

Study design

In our retrospective study, 12451 tubal infertile patients who underwent IVF/ICSI-ET at the Reproductive Center of The First Affiliated Hospital of Zhengzhou University between January 2014 and August 2019 were included and 8462 of them meet our acceptance criteria. There were 1747 patients with hydrosalpinx detected by ultrasound or hysterosalpingography (HSG) and 6715 patients without hydrosalpinx. Of all 1747 hydrosalpinx patients, 811 patients with undetectable fluid under ultrasound were excluded. Laparoscopic surgery group was defined as Group A including 209 hydrosalpinx patients with history of laparoscopic surgery such as salpingectomy and proximal tubal occlusion/ligation. Aspiration group was defined as Group B including 727 hydrosalpinx patients with fluid can be detected under ultrasound yet without history of laparoscopic surgery. Control group was defined as Group C including 6715 tubal infertile patients without hydrosalpinx.

Hydrosalpinx patients who didn't get clinical pregnant after ultrasonic-guided aspiration and had subsequent freeze-thaw embryo transfer cycles till December 2020 were included in the follow-up research. Subsequent laparoscopic surgery group was defined as Group B1 including 86 hydrosalpinx patients who received subsequent laparoscopic surgery treatment. Hysteroscopic occlusion group was

defined as Group B2 including 41 hydrosalpinx patients who received subsequent hysteroscopic occlusion treatment. No treatment group was defined as Group B3 including 138 hydrosalpinx patients who received neither subsequent laparoscopic surgery treatment nor hysteroscopic occlusion treatment.

Inclusion criteria and exclusion criteria

The inclusion criteria were as follows: (1) tubal infertility women with age ≤40 years, BMI30 kg/m2, (2) at least one high-quality embryos transferred, (3) no history of intrauterine manipulation in the past 3 months, (4) not in the oocyte donation program, (5) not with preimplantation genetic diagnosis (PGD).

The exclusion criteria were as follows: (1) chromosomal anomaly and monogenic disease, (2) uterine malformations, (3) uterine anomaly or pathologies such as intrauterine adhesion, endometrial polyps or endometrial hyperplasia, (4) severe endometriosis (grade III and IV), (5) diabetes, hypertension, endocrinopathy, and autoimmune diseases, (6) no history of laparoscopic surgery, (7) undetectable fluid under ultrasound, (8) no subsequent cycle after aspiration due to pregnancy or personal reason.

Outcome measurements

The primary outcome measures of this study were LBR and CLBR while the secondary outcome measures were clinical pregnancy rate (CPR), cumulative clinical pregnancy rate (CCPR), implantation rate, multiple pregnancy rate, miscarriage rate, and ectopic pregnancy rate. LBR was calculated as the ratio of the number of live-born events divided by the number of transferred cycles. CLBR was calculated as the ratio of the number of patients whose freeze-thaw embryo transfer cycles following these studied fresh cycles had live-born events till December 2020 divided by the number of included patients. Clinical pregnancy was defined as at least one intrauterine gestational sac detected by ultrasound 5 or 6 weeks after embryo transfer. The cumulative clinical pregnancy was defined as at least one intrauterine gestational sac detected by ultrasound 5 or 6 weeks after all freeze-thaw embryo transfer following this studied fresh cycle till December 2020.

ART Procedures

Controlled ovarian hyperstimulation protocols were determined according to each patient's characteristics (age, body mass index [BMI], antral follicle count [AFC], and AMH. [21] We regularly monitored follicle growth by trans-vaginal ultrasound and the serum estradiol, progesterone and LH levels during the cycle. When at least one follicle had a mean diameter of more than 18 mm, Aizer 250 μg (Merck Serono, Italy) or hCG (Zhuhai Lizhu Medicine) 2,000 IU was given. Oocytes retrievals were done 36 h later, and subsequent fresh embryo transfers were performed on day 3 or 5. Progesterone (60 mg) was injected intramuscularly on the day of oocyte retrieval. Progesterone gel (Xenotong, Merck Sherano, Switzerland) and oral dydrogesterone [10 mg [Duphaston], Solvay Pharmaceuticals B.V., Veenendaal, The Netherlands] were given vaginally from the day of embryo transfer for luteal phase support.

Treatments

Patients received laparoscopic surgery before fresh cycles or freeze-thaw embryo transfer cycles. Laparoscopic surgery mentioned here only included salpingectomy or proximal tubal occlusion/ligation. Salpingostomy or other surgery was excluded. Salpingectomy directly removes the fluid, while proximal tubal occlusion uses electrocoagulation or ligature suture to cut off the interstitial part and the isthmus of the fallopian tube to block the reflux of fluid into the uterine cavity.

Ultrasonic-guided aspiration was conducted during oocyte retrieval procedure in fresh cycles. Ultrasound puncture needle was used to remove the fluid in the fallopian tube away.

Hysteroscopic tubal occlusion was conducted before freeze-thaw embryo transfer cycles. Before the freeze-thaw embryo transfer cycles, the Esure intrauterine device was placed under the hysteroscope to block the fallopian tubes and block reflux.

Statistical analysis

Continuous data were presented as mean±SD(Standard Deviation). Difference comparison would be tested by One-way ANOVA, and LSD test or TamhaneT2 test were used to put up multiple comparisons. Qualitative variables were given in frequency. Differences among groups would be tested by Chi-Square test. To adjust the influence of potential confounders, logistic regression analyses were performed. All statistical analyses were performed using SPSS (version 22.0, IBM Corp., Armonk, NY, USA) software. Statistically significant difference was defined as $P < 0.05$. In logistic regression analyses, odds ratio (OR) and their 95% confidence intervals (95% CI) were calculated from the model's coefficients and their standard deviations.

Results

Patient and cycle characteristics

There were 12451 tubal infertile women who meet our inclusion criteria undergoing IVF/ICSI cycle in our center between January 2014 and August 2019. 3989 patients were excluded from the study according to the exclusion criteria. The grouping is presented in Figure 1.

Patient and IVF/ICSI cycle characteristics of groups are presented in Table 1. The duration of infertility of the aspiration group (Group B) was significantly longer compared with the control group (Group C) (4.7(3.5) vs 4.0(3.0), P□0.001), and the primary infertility rate of Group B was significantly increased compared with both Group C (43.6% vs 36.5%,P□0.001) and Group A (43.6% vs 35.9%,P=0.046). The endometrial thickness, Gn dosage(IU), the rate of IVF and the rate of two embryos transferred of Group B was significantly higher than control group. Both Group A and Group B had significant higher FSH compared with Group C, and Group A had significant lower AMH and higher Gn dosage (IU) compared with Group C. What's more, the fertilization rate of Group A was significantly lower than other two groups. The age, BMI, number of oocytes retrieved and the stage of embryos transferred did not differ in these three groups (P□0.05).

IVF outcomes

Pregnancy outcomes of the groups are listed in Table 2. The pregnancy outcomes of Group A were similar compared with Group C. Compared with Group C, Group B had significantly lower biochemical pregnancy rate(53.5.1% vs 63.7%, P□0.001), implantation rate (46.5% vs 58.3%, P□0.001), CPR (49.8% vs 59.5%, P□ 0.001),and LBR (39.6% vs 51.1%, P□0.001), and significantly higher ectopic pregnancy rate□7.7% vs 2.3%,P□0.001). It is worth noting that the LBR was significantly higher (48.3% vs 39.6%, P=0.024) in Group A compared with Group B. There were no differences in multiple pregnancy rate and miscarriage rate in three groups(P□0.05). Table 3 show the main results of the logistic regression analysis. The following variables were found to be independently associated with the LBR of tubal infertile patients: age(OR = 0.947, 95% CI: [0.931-0.964],P□0.001), duration of infertility(OR = 0.958, 95% CI: [0.936-0.982],P= 0.001), type of infertility(OR = 1.199, 95% CI: [1.037-1.386],P= 0.014), endometrial thickness(OR = 1.096, 95% CI: [1.067-1.126],P□0.001), number of embryos transferred(OR = 1.705, 95% CI: [1.430-2.033],P□0.001) and hydrosalpinx aspiration compared to control group(OR = 0.672, 95% CI: [0.563-0.802],P□0.001).

Baseline characteristics and outcomes of follow-up patients

As for all patients who had received ultrasonic-guided aspiration (Group B) but did not get clinical pregnant, we conducted a follow-up research on their freeze-thaw embryo transfer cycles followed these studied fresh cycles until 2020.12. Table 4 show baseline characteristics and cumulative freeze-thaw embryo transfer cycle pregnancy outcomes of the patients.

No differences were observed in age, BMI, IVF rate and primary infertility rate in these three groups (P□ 0.05). The duration of infertility was different in three groups (P=0.038), but no differences were found in pairwise comparison afterwards. The CCPR (70.9% vs 34.1%/51.4%, P□0.005) and CLBR (65.1% vs 34.1%/44.9%, P□0.005) were significantly higher in laparoscopic surgery group (groupB1) compared with both hysteroscopy occlusion group (groupB2) and control group (Group B3). However no difference was observed in the CCPR and CLBR in groupB2 and Group B3 (P□0.05). We also performed a logistic regression analysis to identify potential confounding variables that could be independently associated with CLBR of patients who didn’t get pregnant after aspiration in fresh cycles. Table 5 describes the variables that were independently associated with the CLBR of hydrosalpinx patients who didn’t get pregnant after aspiration: age (OR =0.911, 95% CI: [0.860-0.964], P=0.001) and having subsequent laparoscopic surgery compared with no treatment (OR =1.875, 95%CI=1.041-3.378, P=0.036).

Discussion

Patients with hydrosalpinx either with history of laparoscopic surgery or received aspiration had lower outcomes campared with control group. What’s more, aspiration is less effective for hydrosalpinx and has lower LBR compared with surgery. For hydrosalpinx patients who didn’t get pregnancy in fresh cycles in aspiration group, subsequent laparoscopic surgery before freeze-thaw embryo transfer cycles highly increased cumulative outcomes of them than hysteroscopic occlusion and no treatment. Our results suggest that laparoscopic surgery significantly improve outcomes of hydrosalpinx patients undergoing

IVF-ET. For hydrosalpinx patients, having laparoscopic surgery before fresh cycles improves live birth outcomes. What's more, for hydrosalpinx patients who didn't get pregnancy in fresh cycles, having subsequent laparoscopic surgery before freeze-thaw embryo transfer cycles highly increase cumulative outcomes in long-term consideration.

Hydrosalpinx is one of the most serious tubal disorders that adversely affects the outcomes of assisted reproductive technologies (ART). [3–8] The occlusion of the distal end of the fallopian tube leads to fluid accumulation, which directly enters and contaminates the uterine cavity, adversely resulting in decreased endometrial receptivity, [22–24] contributing to the unsynchronized status of the embryo and the endometrium, [25] preventing the successful implantation of embryos produced by IVF[4, 26]or it can indirectly by causing toxic effects on implanted embryos to cause embryonic developmental disorders. [27–29] Andersen, A.N, et al Strandell, A., et al and Vandromme, J., et al had found that patients with hydrosalpinx had significantly lower implantation and pregnancy rates and higher incidence of spontaneous abortion and ectopic pregnancy compared to other types of tubal disease. [3, 24, 26] Laparoscopic surgery such as laparoscopic salpingectomy, proximal tubal occlusion or ligation can remove the hydrosalpinge and prevent hydrosalpinge from the fallopian tube from reaching the uterine cavity.[4] In clinical practice, laparoscopic salpingectomy surgery was proved to be effective for hydrosalpinx patients and can increase the chance of clinical pregnancy.[6, 14, 30, 31] Proximal tubal occlusion was also proved to result in similar improvement in IVF outcome in patients with hydrosalpinx. [12, 32] In decades laparoscopic salpingectomy or proximal tubal occlusion was the preferred method of surgical management for hydrosalpinx in multiple countries.[6, 9, 13, 14] Our study showed significant higher LBR and CLBR of laparoscopic surgery group and confirmed previous theory and provide support for laparoscopic surgery to be the preferred treatment of hydrosalpinx before IVF. However, salpingectomy may affect ovarian blood supply and thus reduce ovarian response in subsequent ART cycles, [33, 34] which can be reconfirmed by the lower AMH and higher FSH of laparoscopic group in our study. More research should be conducted to study the long-term effects of laparoscopic surgery on ovarian response.

Multiple previous randomized controlled trials (RCTs) and retrospective studies have found that trans-vaginal ultrasonic aspiration also improved pregnancy rates after embryo transfer compared with non-aspiration patients. [12, 16, 17] However, 20–30% recurrence rate of hydrosalpinx was also found within 2 weeks after aspiration which adversely affected the outcomes of aspiration. [12, 35] The LBR and CPR in the salpingectomy group were significantly higher than aspiration group was proved by several meta-analyses. [12, 15]

Hysteroscopic occlusion was used for hydrosalpinx patients. [18, 20] The CPR, IR and LBR of hysteroscopic occlusion were significantly lower than those of the laparoscopic surgery which had been proved by a review and a meta-analysis. [20, 36] An RCT research conducted by K. Dreyer and colleagues advised salpingectomy remaining the procedure of choice for hydrosalpinx patients after comparing hysteroscopic proximal tubal occlusion and laparoscopic salpingectom.[37]

Conclusions

Laparoscopic surgery (salpingectomy or proximal tubal occlusion/ligation) is more effective for hydrosalpinx patients and leads to significantly higher LBR than ultrasonic-guided aspiration and significantly higher CLBR than hysteroscopic occlusion and no treatment. We highly recommend laparoscopic surgery as preferred treatment for hydrosalpinx patients.

Abbreviations

IVF: in vitro fertilization, ICSI: intracytoplasmic sperm injection, IVF-ET: in vitro fertilization and embryo transfer, OR: odds ratio, LBR: live birth rate, CLBR: cumulative live birth rate, CPR: clinical pregnancy rate, CCPR: cumulative clinical pregnancy rate.

Declarations

Ethical approval and consent to participate :

The study has received approval and was carried out in accordance with the approved

guidelines from the Zhengzhou University Research Ethics Board.

Consent for publication

Not applicable.

Availability of data and material

All data supporting the conclusion of this article are included.

Competing interest

There is no financial or commercial conflict in this study.

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Authors' contributions

All authors contributed to the conception of this manuscript. Beibei Bi and Xiao Han were responsible for collecting data and analysing the data and they were the major contributors in manuscript writing. LinLi Hu was the supervisor. All other authors participated in invention of the study design and critically reviewing the concept of the study.

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Tables

Table 1. Characteristics of tubal infertile patients with or without hydrosalpinx.

	Hydrosalpinx after surgery Group A	Hydrosalpinx aspiration Group B	No hydrosalpinx Group C	P value
No.of patients, n	209	727	6715	
Age (years)	31.3±4.7	31.5±4.6	31.1±4.4	0.054
Duration of infertility (years)	4.4±3.3	4.7±3.5	4.0±3.0[b]	0.000
BMI (kg/m2)	22.4±2.6	22.5±2.7	22.5±2.8	0.767
Primary infertility	35.9% (75/209)	43.6% (317/727)[g]	36.5% (2454/6715)[b]	0.001
FSH (U/L)	7.4±2.2	7.5±3.9	6.9±2.1[d]	0.000
AMH	2.6±1.6	2.9±1.8	3.1±2.1[e]	0.011
Method of fertilization				0.001
IVF	81.3%(170/209)	85.3%(620/727)	79.7% (5351/6715)[b]	
ICSI	18.7%(39/209)	14.7%(107/727)	20.3% (1364/6715)	
Endometrial thickness	11.9±2.6	12.3±2.5	11.9±2.5[b]	0.001
Gn dosage (IU)	2712±1003	2684±1070	2499±984[f,b]	0.000
No.of oocytes retrieved, n	12.1±6.1	11.8±5.7	12.0±5.8	0.696
Stage of embryos transferred, n (%)				0.435
Cleavage stage	85.6% (179/209)	87.3% (635/727)	85.6% (5747/6715)	
Blastula stage	14.4% (30/209)	12.7%(92/727)	14.4% (968/6715)	
No.of embryos transferred, n (%)				0.010
1	21.5% (45/209)	18.6% (135/727)	23.5% (1578/6715)[c]	
2	78.5% (164/209)	81.4% (592/727)	76.5%	

			(5137/6715)	

Values are given in mean±SD or number (%). BMI, body mass index, FSH, follicle stimulating hormone, AMH, anti-Müllerian hormone, Gn, Gonadotropin.

a:P0.000 versus Group A, b:P0.000 versus Group B, c:P=0.003 versus Group B, d:P=0.002 versus Group A, e:P=0.003 versus Group A, f:P=0.009 versus Group A g:P=0.046 versus Group A

Table 2. Pregnancy outcomes of tubal infertile patients with or without hydrosalpinx.

Pregnancy outcomes	Hydrosalpinx after surgery Group A	Hydrosalpinx aspiration Group B	No hydrosalpinx Group C	P value
No.of patients, n	209	727	6715	
Biochemical pregnancy rate (%)	60.80% (127/209)	53.50% (389/727)	63.70% (4279/6715)[b]	0.000
Implantation rate (%)	53.60% (112/209)	46.50% (338/727)	58.30% (3918/6715)[b]	0.000
Clinical pregnancy rate(%)	55.50%(116/209)	49.80% (362/727)	59.50% (3995/6715)[b]	0.000
Miscarriage rate (%)	9.50% (11/116)	13.00% (47/362)	11.90% (476/3995)	0.593
Ectopic pregnancy rate (%)	3.40% (4/116)	7.70% (28/362)	2.30% (91/3995)[b]	0.000
Live birth rate (%)	48.30% (101/209)	39.60% (288/727)[a]	51.10% (3433/6715)[b]	0.000
Multiple pregnancy rate (%)	20.80% (21/101)	24.00% (69/288)	26.90% (924/3433)	0.229

a: P=0.024versus Group A, b: P0.000 versus Group B,

Table 3. Logistic regression analysis of the risk factors effecting the live birth rate of tubal infertile patients of IVF/ICSI-ET.

Parameters	Odd ratio	95%CI	P
Age (years)	0.947	0.931-0.964	0.000
Groups			0.000
No hydrosalpinx (C)	1		
Hydrosalpinx after surgery (A)	1.134	0.697-1.846	0.613
Hydrosalpinx aspiration (B)	0.672	0.563-0.802	0.000
Duration of infertility (years)	0.958	0.936-0.982	0.001
Type of infertility	1.199	1.037-1.386	0.014
Endometrial thickness	1.096	1.067-1.126	0.000
No.of embryos transferred	1.705	1.430-2.033	0.000

After univariate regression analysis selection (P 0.1) forward regression, patient age, groups, duration of infertility, type of infertility, endometrial thickness and number of embryos transferred were included in the final multiple logistic regression model.

Table 4. Cumulative pregnancy outcomes of the freeze-thaw embryo transfer cycles of hydrosalpinx patients who didn't get clinical pregnancy after aspiration in fresh cycles.

Parameters	Laparoscopic surgery Group B1	Hysteroscopic occlusion Group B2	No laparoscopic or hysteroscopic treatment Group B3	P value
No.of patients, n	86	41	138	
Age (years)	31.1±4.4	30.1±5.5[d]	31.9±4.9	0.094
BMI (kg/m2)	22.1±2.7	22.9±3.2	22.5±2.8	0.315
Duration of infertility (years)	3.9±3.2	4.3±3.1	5.3±3.8	0.038
IVF rate (%)	90.7% (78/86)	92.7% (38/41)	85.50% (118/138)	0.319
Primary infertility rate (%)	46.5% (40/86)	63.4% (26/41)	45.70% (63/138)	0.121
Cumulative clinical pregnancy (%)	70.9% (61/86)	34.1% (14/41)[b]	51.4% (71/138)[a]	0.000
Cumulative live birth rate (%)	65.1% (56/86)	34.1% (14/41)[c]	44.9% (62/138)[a]	0.001

a: P0.005 versus Group B1, b: P0.000 versus Group B1, c: P=0.001 versus Group B1 d: P=0.037 versus Group B3

Table 5. Logistic regression analysis of the risk factors effecting the cumulative live birth rate of the freeze-thaw embryo transfer cycles of hydrosalpinx patients who didn't get clinical pregnancy after aspiration.

Parameters	Odd ratio	95%CI	P
Age (years)	0.911	0.860-0.964	0.001
Subsequent treatment			0.003
No laparoscopic or hysteroscopic treatment	1		
Laparoscopic surgery	1.875	1.041-3.378	0.036
Hysteroscopic occlusion	0.471	0.218-1.019	0.056

After univariate regression analysis selection (P0.1) and forward regression, patient age and subsequent treatment were included in the final multiple logistic regression model.

Figures

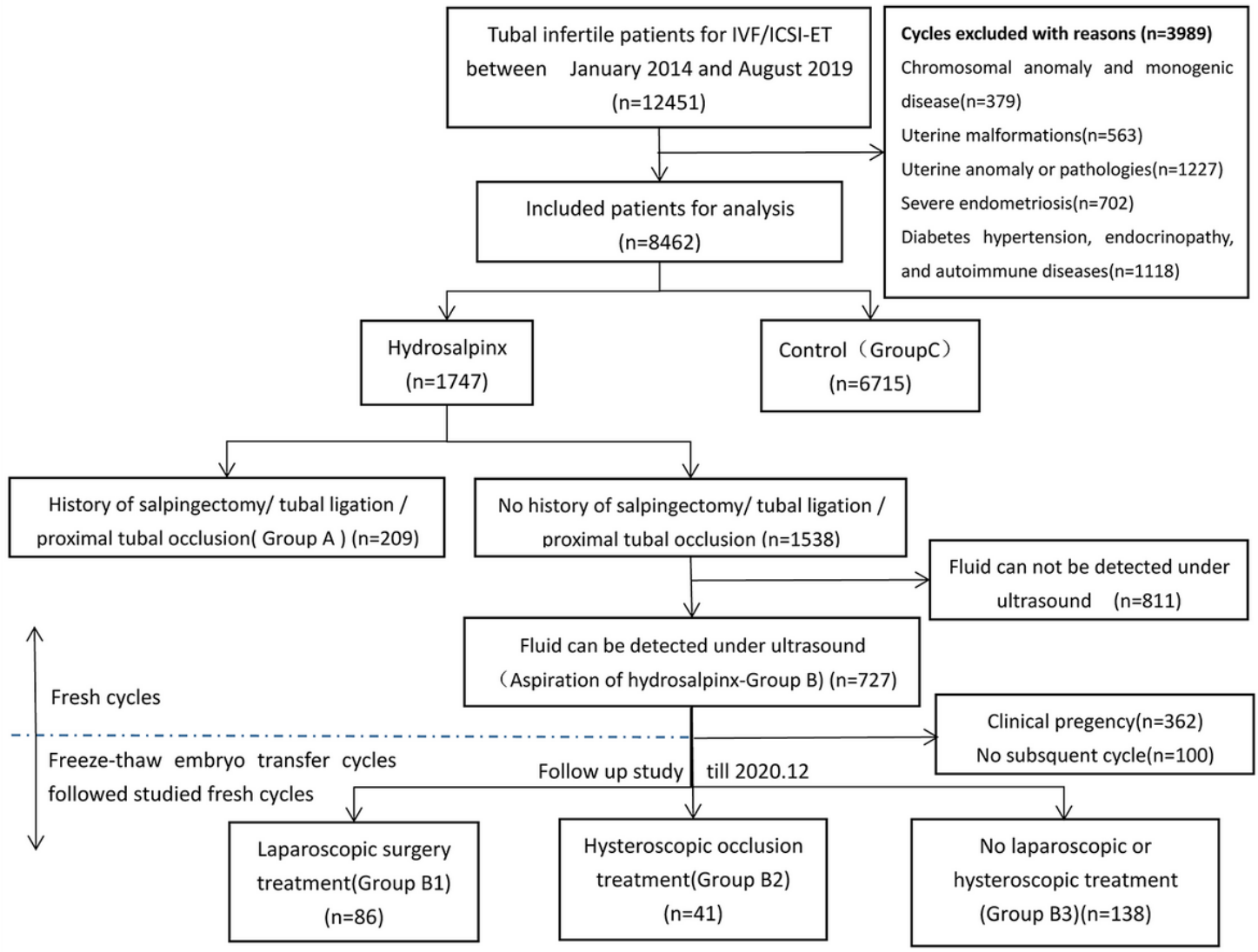

Figure 1

Flowchart of the study.