

## Transvaginal Echography in Assessing Cyclic Changes in Endocervix in Young Women with Hormonal Imbalance

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### Abstract

**Introduction:** Hormonal imbalance in young women is often accompanied by structural and functional disorders in the endometrium, ovaries. The nature of changes in the structure of endocervix in hormonal imbalance in previously published works is not sufficiently illustrated.

**Objective:** To study the echographic semiotics of endocervix in young women with hormonal imbalance in a transvaginal way.

**Materials and Methods:** Based on dynamic TVE and hormonal studies, polycystic ovaries (PCO) was diagnosed in 157 (66.2%) women, multifollicular ovaries (MFO) - in 53 (22.4%) women, luteinization of unovulatory follicle (LUOF) - in 21 (8.9%) women and luteal phase failure (LPhF) - in 6 (2.5%) women respectively. The total thickness of the endocervical leaflets and its echostructure were determined on the 4 - 6<sup>th</sup>, 8 - 10<sup>th</sup>, 12 - 14<sup>th</sup> and 21 - 23<sup>th</sup> days of the menstrual cycle.

**Results:** On the 4 - 6<sup>th</sup> days of the cycle, the largest total thickness of endocervix was observed in the group of women with polycystic ovary (5.7 mm), and the smallest (4.9 mm) in healthy women. Among women with polycystic and multifollicular ovary small cysts of endocervix were recorded significantly more often than in the comparative group (P1-CG < 0.001; P2-CG < 0.05).

On the 8 - 10<sup>th</sup> day of the cycle, the total thickness of endocervix among women with polycystic disease was significantly different from the other groups and was  $8.9 \pm 0.8$  mm (P < 0.05, P < 0.01). In the same group of women, the moderate echogenicity of endocervix ( $26.8 \pm 3.5\%$ ) was significantly more marked than among other groups (P < 0.05).

At 12 - 14<sup>th</sup> days of the cycle, the thickness of endocervix in women with hormonal imbalance remained enlarged, especially in women with polycystic ovary (P < 0.05). In the same period of the menstrual cycle, clear contours of endocervix ( $91.2 \pm 4.9\%$ ) and dilatation of the cervical canal ( $94.1 \pm 4.0\%$ ) in women of the comparative group were significantly (P < 0.05) more often than among women with hormonal imbalance.

In the middle secretory phase of the menstrual cycle the largest thickness of endocervix was recorded among women with luteal phase failure and luteinization of the unovulating follicle, averaged  $9.1 \pm 0.8$  mm, and then in women with polycystic ovaries ( $7.9 \pm 0.8$  mm). In the same group, clear endocervical contours were significantly more frequent than in the other groups (P < 0.05; P < 0.001 and P < 0.01 respectively). Other ultrasonographic parameters between the compared groups did not differ significantly.

**Conclusion:** In young women with hormonal imbalance often reveal small simple cysts in endocervix and develop its hyperplasia. The maximum thickness of endocervix in polycystic ovaries is achieved in the middle proliferative phase, and in the case of luteal phase insufficiency and luteinization of the unovulatory follicle - in the middle secretory phase of the menstrual cycle.

**Keywords:** Transvaginal Assessment; Cervix; Women of Early Reproductive Age; Hormonal Imbalance; Menstrual Irregularities

**Introduction**

Despite variations worldwide and within the U.S. population, median age at menarche has remained relatively stable-between 12 years and 13 years-across well-nourished populations in developed countries [1]. The absence of menstruation by age 15 is also statistically quite uncommon and merits investigation [2,3].

Abnormal uterine bleeding may be caused by ovulatory dysfunction, and bleeding patterns can range from amenorrhea to irregular heavy menstrual bleeding. Although ovulatory dysfunction is somewhat physiologic the first few years after menarche, it can be associated with endocrinopathies due to hypothalamic-pituitary-ovarian axis disturbances, such as polycystic ovary syndrome and thyroid disease, as well as mental stress and eating disorders [4,5].

Ultrasonographic imaging is an effective, easy to use, safe, and readily available noninvasive means to evaluate fertility potential. It has become one of the most useful tools available to assess the causes of infertility and to implement many of the treatments used to ameliorate infertility [6]. The study of the endometrium with hormonal imbalance is devoted to a large number of works [7,8]. However, ultrasonographic evaluation of endocervix is presented in a small number of works [9].

**Objective**

To study the echographic semiotics of endocervix in young women with menstrual irregularities in a transvaginal way.

**Materials and Methods**

237 women aged 19 - 25 years who had a disorder of the menstrual cycle of a different nature underwent dynamic transvaginal ultrasound. Based on dynamic TVE and hormonal studies, polycystic ovaries (PCO) was diagnosed in 157 (66.2%) women, multifollicular ovaries (MFO) - in 53 (22.4%) women, luteinization of unovulatory follicle (LUOF) - in 21 (8.9%) women and luteal phase failure (LPhF) - in 6 (2.5%) women respectively.

In transvaginal ultrasound, the cervix of the uterus was visualized in longitudinal and transverse projection. In the middle third of the cervix, the total thickness of the endocervical leaflets and its echostructure were determined on the 4 - 6<sup>th</sup>, 8 - 10<sup>th</sup>, 12 - 14<sup>th</sup> and 21 - 23<sup>th</sup> days of the menstrual cycle. The comparative group (CG) was 34 healthy women aged 19 - 25 years with a regular menstrual cycle.

**Results**

In transvaginal ultrasound, the cervix of the uterus was visualized in longitudinal and transverse projection. In the middle third of the cervix, the total thickness of the endocervical leaflets and its echostructure were determined on the 4 - 6<sup>th</sup>, 8 - 10<sup>th</sup>, 12 - 14<sup>th</sup> and 21 - 23<sup>th</sup> days of the cycle.

As can be seen from table 1 on the 4<sup>th</sup> - 6<sup>th</sup> days of the cycle, the largest total thickness of endocervix was observed in the group of women with polycystic ovary (5.7 mm), and the smallest (4.9 mm) in healthy women of the comparative group (CG). However, the difference between them was not statistically significant. The echostructure of the endocervix between the compared groups was also not significantly different. Only the reduced echogenicity of endocervix on the 4 - 6<sup>th</sup> days of the cycle in healthy women differed most from other groups, but it was also not statistically significant. Among women with polycystic and multifollicular ovary small cysts of endocervix were recorded significantly more often than in the comparative group (P1-CG < 0.001; P2-CG < 0.05).

Ultrasonographic parameters of endocervix	The healthy women CG (n = 34)	Those who had polycystic ovaries Group I (n = 157)	Those who had multifollicular ovaries Group II (n = 53)	Those who had LUOF and LPhF Group III (n = 27)
The total thickness of the endocervical leaflets Te, mm	4,9 ± 0,4 mm	5,7 ± 0,6 mm	5,2 ± 0,5 mm	5,4 ± 0,6 mm
Reduced echogenicity of endocervix	11 (32,3 ± 8,0%)	59 (37,6 ± 3,9%)	18 (34,0 ± 6,5%)	9 (33,3 ± 9,1%)
Moderate echogenicity of endocervix	7 (20,6 ± 6,9%)	13 (8,3 ± 2,2%)	5 (9,4 ± 4,0%)	2 (7,4 ± 5,0%)
Increased echogenicity of endocervix	-	-	-	-
Isoechoic endocervix	16 (47,1 ± 8,6%)	85 (54,1 ± 4,0%)	30 (56,6 ± 6,8%)	16 (59,3 ± 9,5%)
Clear contours of endocervix	19 (55,9 ± 8,5%)	53 (33,8 ± 3,8%)	21 (39,6 ± 6,7%)	11 (40,7 ± 9,5%)
Fuzzy contours of endocervix	15 (44,1 ± 8,5%)	104 (66,2 ± 3,8%)	34 (60,4 ± 6,7%)	16 (59,3 ± 9,5%)
Presence of cysts	3 (8,8 ± 4,8%)	49 (31,2 ± 3,7%) P 1-CG < 0.001	13 (24,5 ± 5,9%) P 2-CG < 0.05	5 (18,5 ± 7,5%)
Cervical dilatation	-	13 (8,3 ± 2,2%)	3 (5,3 ± 3,1%)	2 (8,7 ± 5,4%)

**Table 1:** Ultrasonographic parameters of endocervix in 4-6<sup>th</sup> days of the menstrual cycle.

On the 8 - 10<sup>th</sup> day of the cycle, the total thickness of endocervix among women with polycystic disease was significantly different from the other groups (see table 2) and was 8.9 ± 0.8 mm (P < 0.05, P < 0.01). In the same group of women, the moderate echogenicity of endocervix (26,8 ± 3,5%) was significantly more marked than among other groups (P < 0.05). Among women with polycystic and multifollicular ovary small cysts of endocervix were recorded significantly more often than in the comparative group (P1-CG < 0.001; P2-CG < 0.05). There were no significant differences in other sonographic parameters between the compared groups (Figure 1).

Ultrasonographic parameters of endocervix	The healthy women CG (n = 34)	Those who had polycystic ovaries Group I (n = 157)	Those who had multifollicular ovaries Group II (n = 53)	Those who had LUOF and LPhF Group III (n = 27)
The thickness of the endocervix, Te, mm	5,5 ± 0,6 mm	8,9 ± 0,8 mm P1-2 < 0,05 P1- CG < 0,01	6,8 ± 0,7 mm	6,5 ± 0,6 mm
Reduced echogenicity of endocervix	21 (61,8 ± 8,3%)	101 (64,3 ± 3,8%)	32 (60,4 ± 6,7%)	21 (77,8 ± 8,0%)
Moderate echogenicity of endocervix	5 (14,7 ± 6,1%)	42 (26,8 ± 3,5%) P < 0,05	7 (13,2 ± 4,6%)	2 (7,4 ± 5,0%)
Increased echogenicity of endocervix	-	3 (1,9 ± 1,1%)	-	-
Isoechoic endocervix	8 (23,5 ± 7,3%)	11 (7,0 ± 2,0%)	14 (26,4 ± 6,1%)	4 (14,8 ± 6,8%)
Clear contours of endocervix	27 (79,4 ± 6,9%)	141 (89,8 ± 2,4%)	39 (73,6 ± 6,1%)	22 (81,5 ± 7,5%)
Fuzzy contours of endocervix	7 (20,6 ± 6,9%)	16 (10,2 ± 2,4%)	14 (26,4 ± 6,1%)	5 (18,5 ± 7,5%)
Presence of cysts	3 (8,8 ± 4,8%)	48 (30,6 ± 3,7%) P1- CG < 0,001	13 (24,5 ± 5,9%) P1-2 < 0,05	6 (22,2 ± 8,0%)
Cervical dilatation	16 (32,8 ± 8,1%)	59 (37,5 ± 3,9%)	15 (28,3 ± 6,2%)	7 (25,9 ± 8,4%)

Table 2: Ultrasonographic parameters of endocervix in 8-10<sup>th</sup> days of the menstrual cycle.

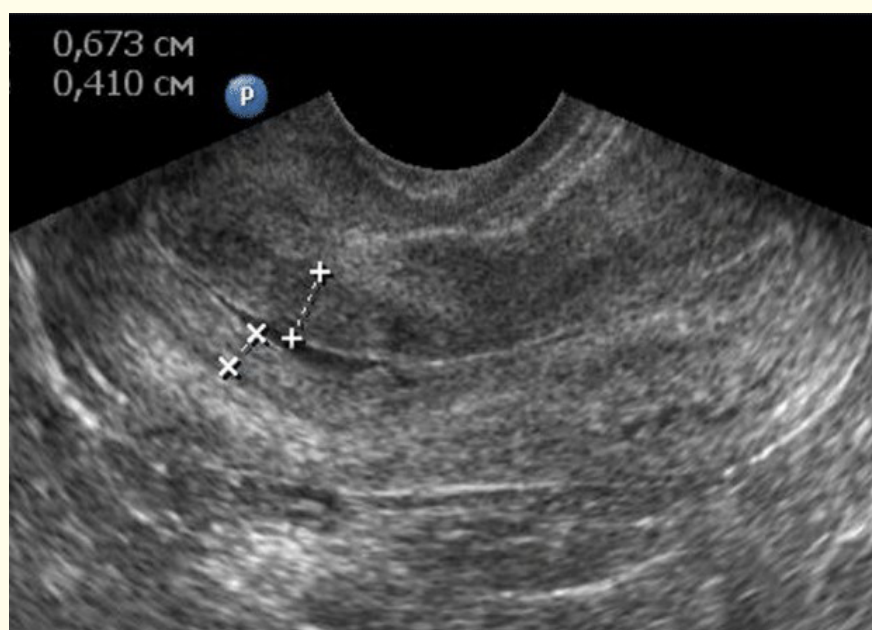
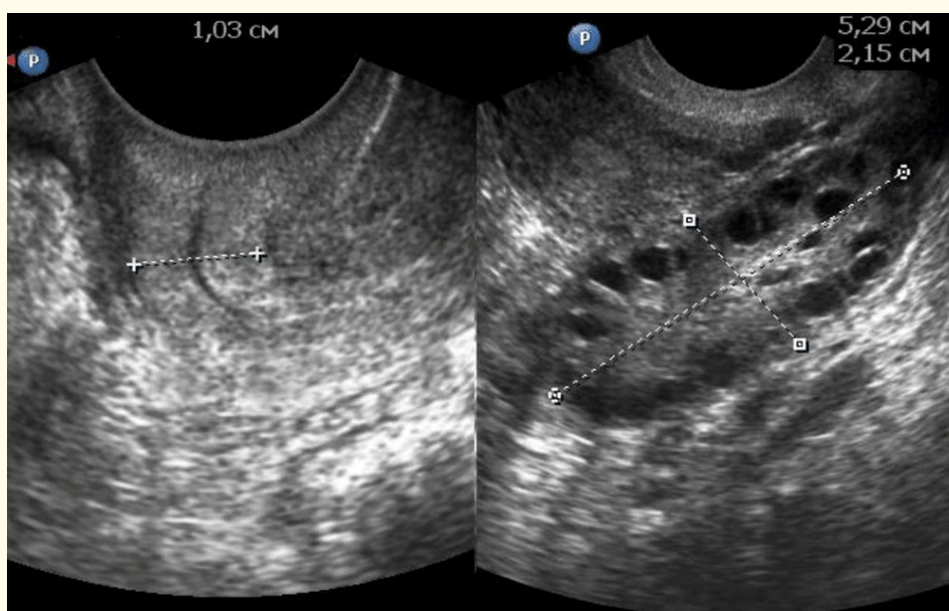


Figure 1: 8<sup>th</sup> day of the menstrual cycle. Echogram of a 23-year-old woman with polycystic ovaries. The thickened endocervix - a leaflets thickness of 0.673 cm, 0.410 cm (a total thickness of 1.083 cm). Echogenicity of endocervix is reduced.

At 12 - 14<sup>th</sup> days of the cycle, the thickness of endocervix in women of the comparative group increased to  $5.9 \pm 0.6$  mm, among women with polycystic ovaries, multifollicular ovaries, luteal phase deficiency of the menstrual cycle and luteinization of the ovulating follicle decreased to  $8.2 \pm 0.8$  mm,  $5.8 \pm 0.6$  mm and  $6.2 \pm 0.6$  mm respectively (Table 3). Moreover, in women with polycystic ovary the thickness of the endocervix remained significantly higher than in the other groups ( $P < 0.05$ ). Moderate echogenicity of endocervix in the late proliferative phase was noted more often (in  $82.3 \pm 6.5\%$  of cases), while the difference was significant ( $P < 0.05$ ) only in comparison with group I (polycystic ovary). In the same period of the menstrual cycle, clear contours of endocervix ( $91.2 \pm 4.9\%$ ) and dilatation of the cervical canal ( $94.1 \pm 4.0\%$ ) in women of the comparative group were significantly ( $P < 0.05$ ) more often than among women with hormonal imbalance (Figure 2).

Ultrasonographic parameters of endocervix	The healthy women (n = 34)	Those who had polycystic ovaries Group I (n = 157)	Those who had multifollicular ovaries Group II (n = 53)	Those who had LUOF and LPhF Group III (n = 27)
The thickness of the endocervix, Te, mm	$5,9 \pm 0,6$ mm	$8,2 \pm 0,8$ mm $P < 0,05$	$5,8 \pm 0,6$ mm	$6,2 \pm 0,6$ mm
Reduced echogenicity of endocervix	2 ( $5,9 \pm 4,0\%$ )	7 ( $4,5 \pm 1,7\%$ )	2 ( $3,8 \pm 2,6\%$ )	1 ( $3,7 \pm 3,6\%$ )
Moderate echogenicity of endocervix	28 ( $82,3 \pm 6,5\%$ ) $P < 0,05$	103 ( $65,6 \pm 3,8\%$ )	41 ( $77,3 \pm 5,7\%$ )	19 ( $70,4 \pm 8,8\%$ )
Increased echogenicity of endocervix	-	2 ( $1,3 \pm 0,9\%$ )	-	-
Isoechoic endocervix	4 ( $11,8 \pm 6,6\%$ )	45 ( $28,6 \pm 3,6\%$ )	10 ( $18,9 \pm 5,4\%$ )	7 ( $25,9 \pm 8,4\%$ )
Clear contours of endocervix	31 ( $91,2 \pm 4,9\%$ ) $P < 0,05$	108 ( $68,8 \pm 3,7\%$ )	41 ( $77,4 \pm 5,7\%$ )	19 ( $70,4 \pm 8,8\%$ )
Fuzzy contours of endocervix	3 ( $8,8 \pm 4,9\%$ )	49 ( $31,2 \pm 3,7\%$ )	12 ( $22,6 \pm 5,7\%$ )	8 ( $29,6 \pm 8,8\%$ )
Presence of cysts	3 ( $8,8 \pm 4,8\%$ )	38 ( $24,2 \pm 3,4\%$ )	12 ( $22,6 \pm 5,7\%$ )	7 ( $25,9 \pm 8,4\%$ )
Cervical dilatation	32 ( $94,1 \pm 4,0\%$ ) $P < 0,05$	41 ( $26,1 \pm 3,5\%$ )	15 ( $26,3 \pm 5,8\%$ )	8 ( $29,6 \pm 8,8\%$ )

**Table 3:** Ultrasonographic parameters of endocervix in 12-14<sup>th</sup> days of the menstrual cycle.



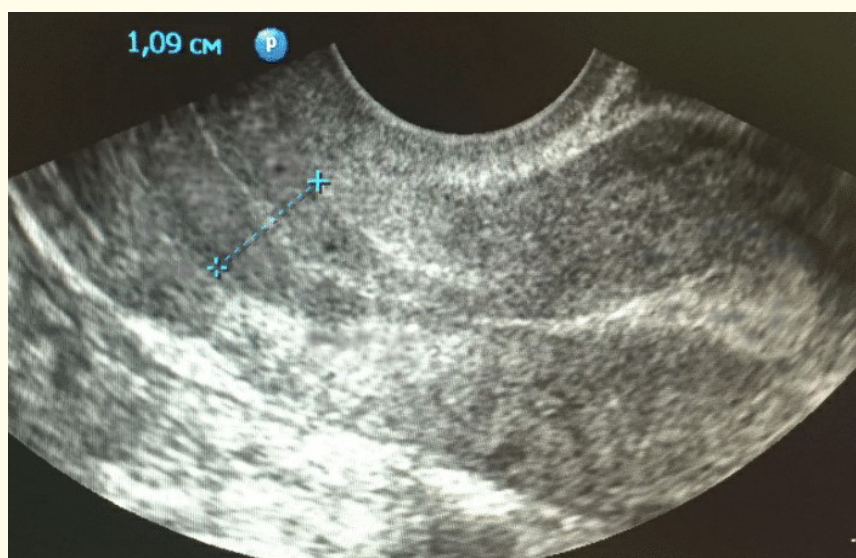
**Figure 2:** 13<sup>th</sup> day of the menstrual cycle. Echogram of a 21-year-old woman with polycystic ovaries. The thickness of the endocervix bp 1.03 cm. Moderate echogenicity of endocervix.



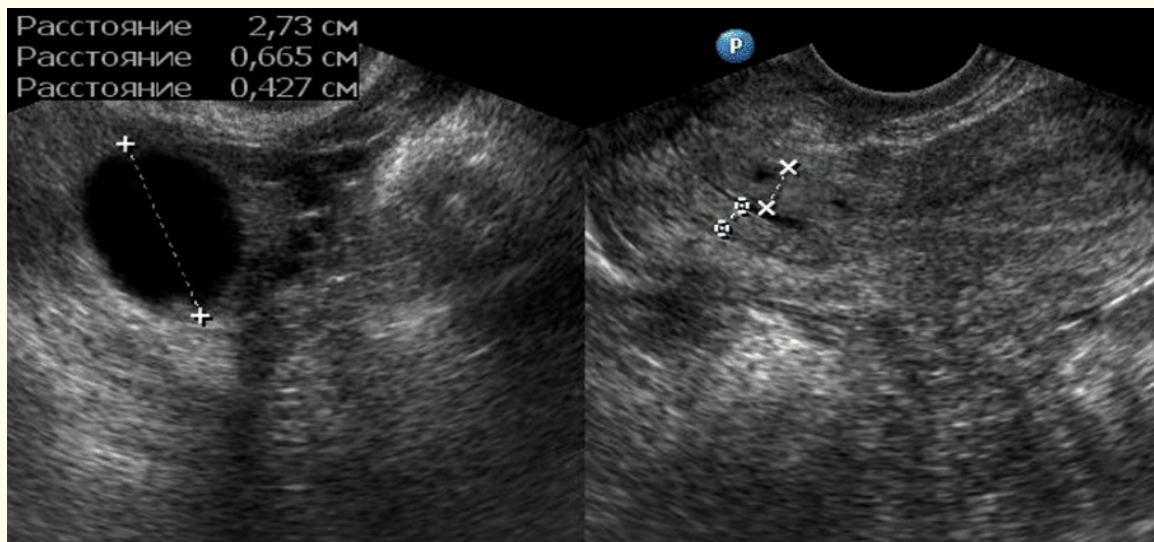
Ultrasonographic parameters of endocervix in the middle secretory phase of the menstrual cycle are presented in table 4. As can be seen from the table, the largest thickness of endocervix was recorded in the 4<sup>th</sup> group - among women with luteal phase failure and luteinization of the unovulating follicle, averaged  $9.1 \pm 0.8$  mm, and then in women with polycystic ovaries ( $7.9 \pm 0.8$  mm). In the same group, clear endocervical contours were significantly more frequent than in the other groups ( $P < 0.05$ ;  $P < 0.001$  and  $P < 0.01$  respectively). Other ultrasonographic parameters between the compared groups did not differ significantly (Figure 3, 4).

Ultrasonographic parameters of endocervix	The healthy women (n = 34)	Those who had polycystic ovaries Group I (n = 157)	Those who had multifollicular ovaries Group II (n = 53)	Those who had LUOF and LPhF Group III (n = 27)
The thickness of the endocervix, Te, mm	$4,8 \pm 0,6$ mm	$7,9 \pm 0,8$ mm	$5,9 \pm 0,6$ mm	$9,1 \pm 0,8$ mm P3- CG < 0,001 P3- 2 < 0,01
Reduced echogenicity of endocervix	6 (17,6 ± 6,5%)	3 (1,9 ± 1,1%)	2 (3,8 ± 2,6%)	1 (3,7 ± 3,6%)
Moderate echogenicity of endocervix	7 (20,6 ± 6,9%)	42 (26,8 ± 3,5%)	20 (37,7 ± 6,7%)	16 (59,3 ± 9,4%)
Increased echogenicity of endocervix	-	-	-	2 (7,4 ± 5,0%)
Isoechoic endocervix	21 (61,8 ± 8,3%)	112 (71,3 ± 3,6%)	31 (58,5 ± 6,8%)	8 (29,6 ± 8,8%)
Clear contours of endocervix	13 (38,2 ± 8,3%)	48 (30,6 ± 3,7%)	23 (43,4 ± 6,8%)	18 (66,7 ± 9,1%) P3- 2 < 0,05 P3- 1 < 0,001 P3- CG < 0,05
Fuzzy contours of endocervix	21 (61,8 ± 8,3%)	109 (69,4 ± 3,7%)	30 (56,6 ± 6,8%)	9 (33,3 ± 9,1%)
Presence of cysts	2 (5,9 ± 4,0%)	38 (24,2 ± 3,4%)	11 (20,8 ± 5,6%)	6 (22,2 ± 8,0%)
Cervical dilatation	-	21 (13,4 ± 2,7%)	3 (5,7 ± 3,2%)	5 (18,5 ± 7,5%)

**Table 4:** Ultrasonographic parameters of endocervix in 21-23<sup>th</sup> days of the menstrual cycle.



**Figure 3:** Hyperplasia of endocervix in a woman with luteal phase insufficiency. The 19<sup>th</sup> day of the menstrual cycle. The thickness of the endometrium is less than 0.8 cm. Echogenicity is reduced. The thickness of the endocervix is 1.09 cm.



**Figure 4:** Luteinization of the neovulatory follicle. Average secretarial phase. On the left side of the echogram, a neovulatory follicle is defined, on the right side a thickened endocervix - a leaflets thickness of 0.665 cm, 0.427 cm (a total thickness of 1.087 cm).

## Discussion

Cyclical changes in endocervix in healthy women have been studied in a few works [9,10]. In works devoted to chronic cervicitis development of hypertrophy of cervix is shown, without taking into account the state of endocervix [11]. It is known that among the causes of endocrine infertility the leading place is occupied by polycystic ovaries, insufficiency of the luteal phase and luteinization of the neovulatory follicle [12]. With hormonal imbalance, the status of the endometrium and ovaries is better studied. The study of the endocervical structure in different phases of the menstrual cycle in young women with hormonal imbalance will provide new information about the cervical factor of infertility.

## Conclusion

In young women with hormonal imbalance often reveal small simple cysts in endocervix and develop its hyperplasia. The maximum thickness of endocervix in polycystic ovaries is achieved in the middle proliferative phase, and in the case of luteal phase insufficiency and luteinization of the unovulatory follicle - in the middle secretory phase of the menstrual cycle.

## Conflict of Interest

The authors declare that they have no conflicts of interest.

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