MEDICAL UNIVERSITY 'PROF. PARASKEV STOYANOV' OF VARNA
FACULTY OF MEDICINE
DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

Vilislava Robert Ivanova, MD

PROPHYLACTIC ULTRASOUND EXAMINATION AS A METHOD FOR DETECTION OF ASYMPTOMATIC PATHOLOGIES IN GYNAECOLOGY

AUTHOR'S DISSERTATION SUMMARY

for the acquisition of the educational and scientific degree of '**doctor of philosophy**' in the field of higher education No 7. Public health and sports, professional trend No 7.1. Medicine and scientific speciality of obstetrics and gynaecology

Adviser:

Prof. Emil Georgiev Kovachev, MD, PhD, DSc

Official peer reviewers:

Varna
2024

The present dissertation has been elaborated in the Department of Obstetrics and Gynaecology at the Faculty of Medicine of the Medical University 'Prof. Paraskev Stoyanov' of Varna. The dissertation contains 116 type-written pages and is illustrated with 27 tables and five figures. The reference list includes 228 primary sources, of which there are nine in Cyrillic and 219 in Latin.

The dissertation has been discussed and forwarded to a public defence by the Departmental council of the Department of Obstetrics and Gynaecology of the Medical University 'Prof. Paraskev Stoyanov' of Varna according to article No 24, paragraph 6 and article 30, paragraph 3 of the Statute-book for the Application of the Law for development of the academic staff in the Republic of Bulgaria and article 68, paragraph 1 of the Statute-book for development of the academic staff in the Medical University of Varna based on report ref. No 102-2060/23.07.2024 by Prof. Emil Georgiev Kovachev, MD, PhD, DSc, Head of the Department of Obstetrics and Gynaecology of the Medical University of Varna, according to Decision of the Faculty Council of the Faculty of Medicine, protocol No 25/29.07.2024, report ref. No 103-3752/30.07.2024 by Prof. Yoto Trifionov Yotov, MD, PhD, Dean of the Faculty of Medicine of the medica lUniversity of Varna.

The public defence of the dissertation will be held on October 8, 2024 starting at 10:00 a.m. based on Order No R-109-269/05.08.2024 of Prof. Dimitar Ivanov Raykov, MD, PhD, DSc, Rector of the Medical University "Prof. Paraskev Stoyanov" of Varna in front of a scientific jury consisting of:

President:
Assoc. Prof. Kremen Tsvetanov Tsvetkov, MD, PhD
External members:
Prof. Petar Histov Petrov, MD, PhD, DSc
Assoc. Prof. Mariya Angelova Angelova, MD, PhD
Assoc. Prof. Nadya Minkova Magunska, MD, PhD
Internal members:
Assoc. Prof. Kremen Tsvetanov Tsvetkov, MD, PhD
Assoc. Prof. Nikolay Dimitrov Kolev, MD, PhD
Reserve external member:
Assoc. Prof. Vesela Ivanova Karamisheva, MD, PhD
Reserve internal member:
Assoc. Prof. Stefan Vasilev Kisyov, MD, PhD

Dissertation-related materials have been published on the Internet site of the Medical University 'Prof. Paraskev Stoyanov' of Varna and are at the disposal in the Research Department of the Medical University 'Prof. Paraskev Stoyanov' of Varna.

CONTENTS

ABBREVIATIONS USED

CA	cancer antigen
cm	centimetre
et	et alierte
al.	figure
fig.	International Ovarian Tumor Analysis
IO	kilogram
TA	meter
kg	millimeter
m	pulsatility index
m	resistive index
m	transabdominal sonography
PI	transvaginal sonography
RI	transvaginal ultrasonography
TA	Units per millilitre
S	
TV	
S	
TV	
U	
U/	
mL	

1. INTRODUCTION

Gynaecological diseases affect millions of women worldwide and exert a considerable influence on their reproductive health. Early and precise diagnosis is of crucial importance for the effective treatment and improved outcomes. Ultrasound technology performed a revolution in the field of gynaecology by enabling the physicians to visualize and diagnose different conditions with a remarkable accuracy. During this non-invasive and painless procedure, sound waves are used for the creation of images of the pelvic organs.

One of the main advantages of the ultrasound is its capacity to provide real-time images that enables the gynaecologists to observe the pelvic organs during movement. This opportunity for a dynamic imaging is particularly beneficial to the evaluation of the function and localization of the uterus and ovaries. Besides it deals with a widely accessible, safe and profitable method for imaging diagnosis. It does not make use of ionizing radiation and that is why it is suitable for reiterated examinations and follow-up.

The absence of complex investigations in our country stimulated us to carry out the present study in order to make an attempt to outline the concrete significance of the contemporary ultrasound diagnosis for the detection of the asymptomatic pathologies in gynaecology and to contribute for the further optimization of the ultrasound evaluation and prevention of the gynaecological diseases.

2. PURPOSE AND TASKS

The purpose of the present dissertation work is to study the diagnostic value of the pathological ultrasound findings of the female genital tract among asymptomatic and symptomatic women.

For accomplishment of this purpose, we defined the following **tasks**:

1. To analyze the prevalence of the gynaecological diseases with or without clinical symptoms diagnosed by means of transvaginal ultrasonography (TVU).
2. To follow-up the frequency of the concrete complaints of the female patients.
3. To study the age distribution of the female patients with gynaecological diseases.
4. To study the frequency of the past diseases and operative interventions of the female patients with gynaecological diseases.
5. To analyze the frequency of the accompanying diseases of the female patients with gynaecological diseases.
6. To establish the relationship between the identified gynaecological diseases of the female patients and the manner of delivery.

3. MATERIAL AND METHODS

3.1. Material

We retrospectively analyzed the results from the clinical investigation of 564 female patients in the Specialized Hospital of Obstetrics and Gynaecology 'Prof. Dimitar Stamatov' of Varna Ltd during the period between September 1, 2020 and September 30, 2022 inclusive. It was realized in the shape of free-of-charge examinations of the women within the joint programme with the Municipality of Varna, 'Prevention of female health - transvaginal echography'.

In 2020, a total of 397 female patients aged between 22 and 86 years while in 2022, a total of 167 female patients aged between 22 and 76 years are examined. Following the case history study, routine clinical and imaging diagnostic methods are applied.

The criterion for inclusion into the present investigation is the obtained female patient's informed concent. The criteria for exclusion from the study are the following: female patient's refusal to participate in the study; pregnancy; considerably expressed vaginal atrophy at which presence, the female patient could not tolerate TVU; female patients who had not started sexual life yet (*virgo intacta*), and vaginal obstruction as a consequence of congenital anatomical anomalies. The examined and followed-up female patients were divided into two groups: women at child-bearing age and in menopause. In all the female patients, a registration file-card and a form for the ultrasound pelvic examination were filled-in.

3.2. Methods

The diagnostic methods include a detailed case history and TVU by means of the MyLabTM X6 ultrasound system. The most common case-history data are the following: genital bleeding; low abdominal and waist pains similar to menstrual ones; abdominal swelling; anxiety and sweating among the patients in menopause; irregular menstrual cycle and vaginal dyscomfort including dysparereunia, vulvar dysuria, vaginal fluor of different nature, and *pruritus vulvae*. During the performance of the examinations by means of TVU, the indications and recommendations of the Bulgarian Society of Obstetrics and Gynaecology are observed.

During the statistical data processing, not only the independent Pearson χ^2 test, but also the descriptive, variation (Student-Fisher's test), and graphic analyses are made use of. The statistical reliability according to the Student-Fisher's *t*-criterion is read at a significance level of $p<0,05$.

4. OWN RESULTS

4.1. Gynaecological diseases and complaints

The distibution of the female patients presenting with three most commonly diagnosed gynaecological diseases with and without clinical symptoms towards the women with a negative pathological ultrasound finding can be seen in Table 1.

Table 1. Distibution of the symptomatic and asymptomatic female patients according to the diagnosis of the disease

Diagnosis	with symptoms		without symptoms		total	
	n	%	n	%	n	%
uterine myoma	13	14,94	74	85,06	87	15,43
endometrial polypus	15	34,09	29	65,91	44	7,80
adnexial formations	12	34,29	23	65,71	35	6,21
no pathological finding	36	9,05	362	90,95	398	70,56

Uterine myoma is detected in 15,16%, endometrial polypus - in 5,94%, and adnexial formations - in 4,71% of the asymptomatic female patients. The endometrial polypus is present in 19,74%, the uterine myoma in 17,11%, and adnexial formations in 15,79% of the patients with clinical symptoms. Pathological findings during TVU are absent in 47,37% of the symptomatic and in 74,18% of the asymptomatic women. The relative share of the female patients without symptoms prevails over that of the other women presenting with the three diseases. This difference is most outlined in terms of the uterine myoma and it is statistically significant (t=6,541; p<0,001).

The distibution of the number of the female patients with or without clinical symptoms of the three diseases is juxtaposed in Fig. 1.

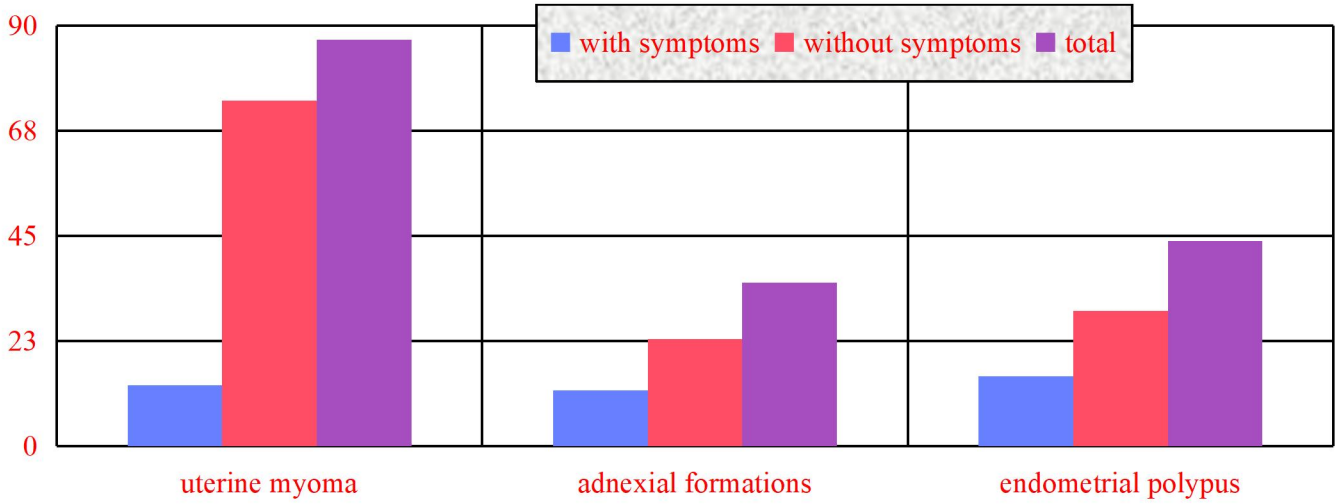

Fig. 1. Distibution of the number of the female patients with or without symptoms of the diseases

The distribution of the patients with nine common gynaecological diseases according to their number and relative share is demonstrated in Table 2.

Table 2. Distribution of the patients with common gynaecological diseases

No	Disease	2020		2022		total	
		n	%	n	%	n	%
1.	uterine myoma	68	17,13	19	11,38	87	15,25
2.	endometrial polypus	23	5,79	21	12,57	44	7,80
3.	right ovarian cyst	9	2,27	6	3,60	15	2,66
4.	left ovarian cyst	8	2,02	6	3,60	14	2,48
5.	polycystic ovary syndrome	2	0,50	4	2,40	6	1,06
6.	endometrial hyperplasia	2	0,50	0	0	2	0,35
7.	cystocele	0	0	2	1,20	2	0,35
8.	primary sterility	0	0	2	1,20	2	0,35
9.	urinary stress incontinence	0	0	2	1,20	2	0,35
total		112	28,21	62	37,13	174	30,85

In 2020, the following two other gynaecological diseases in one female patient each are diagnosed by means of TVU: adhesion in the uterine cavity and pyometra, while in 2022, the following six other gynaecological diseases are found out: uterine prolapse, secondary sterility, bilateral ovarian cyst, retained larger-sized follicle, bleeding during the menopause, and urinary incontinence. Besides uterus duplex, calcification in a uterine tumour formation and status post hysterectomy are established. In one female patient, there is suspicion of ovarian cancer.

During the clinical examination, colpitis, status post abortion, and enlarging follicle are revealed.

As a whole, it deals with a total of 18 gynaecological diseases among a total of 156 female patients (in 27,66% of all the cases). The number of the gynaecological diseases is nine among a total of 103 patients (in 25,94%) in 2020 and 14 among a total of 53 patients (in 31,74% of the cases) in 2022, respectively.

Common complaints of the female respondents in 2020 and in 2022 are presented in Table 3 (page 9).

In 2020, only one female patient shares burning in the genital area and vaginal prolapse each, while in 2022, labial herpes, dyscomfort in the left abdominal region, low abdominal swelling, breast pains, breast secretions, and hampered micturition are reported.

As a whole, it deals with a total of 19 concrete complaints among a total of 74 women (in 13,12% of all the cases). The number of the complaints is nine among a total of 40 patients (in 10,08%) in 2020 and 13 among a total of 34 patients (in 20,36% of the cases) in 2022, respectively.

Table 3. Distribution of the women with common complaints

No	Complaint	2020		2022		total	
		n	%	n	%	n	%
1.	low abdominal pains	16	4,03	10	5,99	26	4,61
2.	vaginal fluor	5	1,26	4	2,40	9	1,60
3.	profuse menstrual cycles	2	0,50	5	2,99	7	1,24
4.	urinary incontinence	5	1,26	0	0	5	0,89
5.	hot waves	5	1,26	0	0	5	0,89
6.	vaginal dyscomfort	0	0	4	2,40	4	0,71
7.	bleeding	3	0,76	0	0	3	0,53
8.	scarce menstrual cycles	0	0	2	1,20	2	0,35
9.	dysmenorrhea	2	0,50	0	0	2	0,35
10.	vaginal dryness	0	0	2	1,20	2	0,35
11.	common miction urges	0	0	2	1,20	2	0,35
total		38	9,57	29	17,37	67	11,88

The results from the statistical analysis of the correlation between the symptomatic and asymptomatic female patients according to the diagnosis of the disease are presented in Table 4 while the symmetric measures of the strength of the association or of the size of the difference between these two variables - in Table 5.

Table 4. Statistical evaluation of the correlation between the female patients with and without symptoms according to the diagnosis of the disease

Parameter	value	bilateral asymptotic significance

χ^2 of Pearson	25,928	0,0001
likelihood ratio	21,446	0,0001
linear-by-linear association	4,857	0,028
valid cases	564	

Table 5. Symmetric measures of the association and of the difference between the variables

Variables	parameters	value	asymptotic standard error	approximate value T	approximate significance
nominal by nominal	Phi	0,214			0,0001
	V of Cramer	0,214			0,0001
	contingency coefficient	0,210			0,0001
interval by interval	R of Pearson	0,093	0,043	2,211	0,027
ordinal by ordinal	Spearman correlation	0,142	0,044	3,401	0,001
valid cases		564			

The value of χ^2 of Pearson is with a freedom degree of 5 and it is statistically significant ($p<0,0001$). The control of the zero hypothesis by using of the independent χ^2 test according to which there is no association between these two variables rejects this hypothesis. The association between these two variables is statistically significant: $\chi^2=25,928$; $p<0,0001$ at Phi =0,214 and at V of Cramer =0,214.

4.2. Age distribution of the female patients with gynaecological diseases

The age distibution of the real, expected and residual number of the female patients without and with pathological ultrasound findings can be seen in Table 6.

Table 6. Age distibution of the number of the female patients according to the presence of the pathological ultrasound findings

Findings	n	age groups (in years)	total

		20-29	30-39	40-49	50-59	60-69	>70	
absent	real	36	94	120	79	49	23	401
	expected	34,1	86,7	136,5	78,9	43,4	21,3	401,0
	% in the group	75,0	77,0	62,5	71,2	80,3	76,7	71,10
	residual	1,9	7,3	-16,5	0,1	5,6	1,7	
present	real	12	28	72	32	12	7	163
	expected	13,9	35,3	55,5	32,1	17,6	8,7	163,0
	% in the group	25,0	23,0	37,5	28,8	19,7	23,3	28,90
	residual	-1,9	-7,3	16,5	-0,1	-5,6	-1,7	
total	real	48	122	192	111	61	30	564
	expected	48,0	122,0	192,0	111,0	61,0	30,0	564,0
	% in the group	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Pathological findings from the ultrasound examination are observed in 28,90% of all the female patients.

The highest relative share of the patients with these findings is established in the age group between 40 years and 49 years (37,50%), but the lowest one - in the age group between 60 years and 69 years (19,67% of the cases). The difference between the two age groups is not statistically significant (t=1,391; p>0,05).

The age distibution of the number of the female patients with such findings is illustrated in Fig. 2.

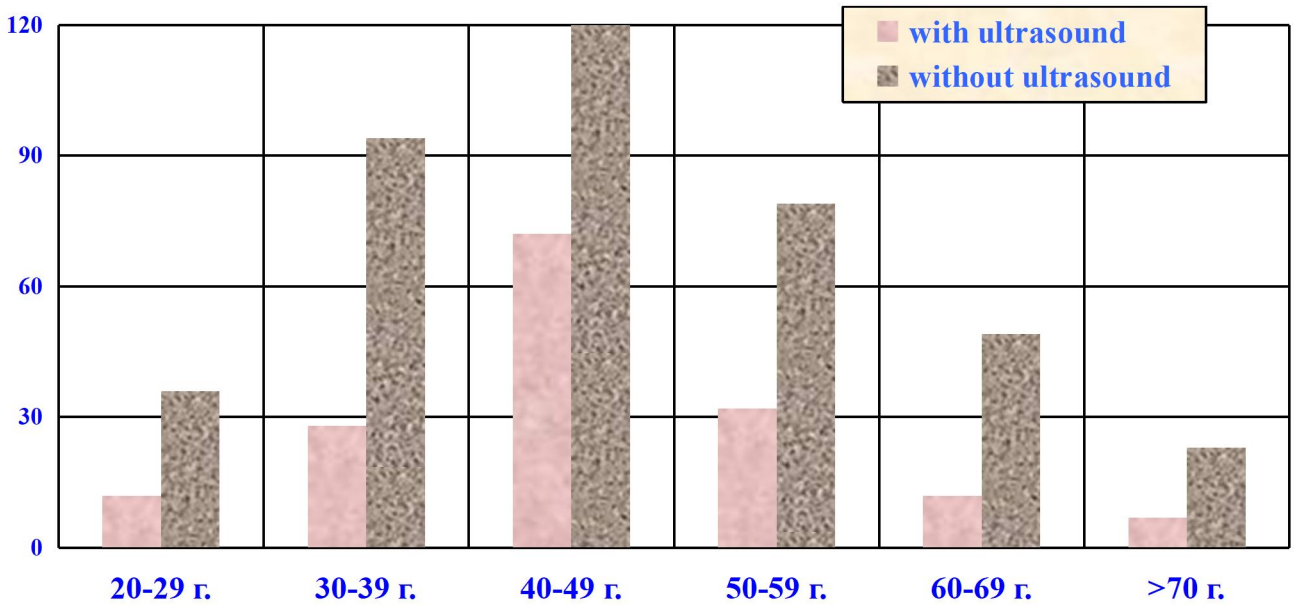

Fig. 2. Age distribution of the number of the female patients with TVU findings

The results from the statistical analysis of the correlation between the findings from the ultrasound examination and female patients' age are presented in Table 7 while the symmetric measures of the strength of the association or of the size of the difference between these two variables - in Table 8.

The value of χ^2 of Pearson is with a freedom degree of 5 and it is statistically significant (p=0,03).

Table 7. Statistical evaluation of the correlation between the findings from the ultrasound examination and the age groups

Parameter	value	bilateral asymptotic significance
χ^2 of Pearson	12,348	0,030
likelihood ratio	12,336	0,030
linear-by-linear association	0,151	0,698
valid cases	564	

The control of the zero hypothesis by using of the independent χ^2 test according to which there is no association between these two variables rejects this hypothesis.

The association between these two variables is statistically significant: χ^2=12,348; p=0,03 at Phi =0,148 and at V of Cramer =0,148.

Table 8. Symmetric measures of the association and of the difference between the variables

Variables	parameters	value	asymptotic standard error	approximate value T	approximate significance
nominal by nominal	Phi	0,148			0,030
	V of Cramer	0,148			0,030
	contingency coefficient	0,146			0,030

interval by interval	R of Pearson	-0,016	0,040	-0,388	0,698
ordinal by ordinal	Spearman correlation	-0,006	0,040	-0,134	0,893
valid cases		564			

4.3. Past diseases and operative interventions

The distribution of the women with the common past diseases and operative interventions performed in them according to their number and relative share is indicated in Table 9 (page 13).

In 2020, one female patient shares having undergone cholecystectomy, while in 2022, only one female patient each reports the following nine other past diseases and operative interventions: endometriosis, tumour formation in the uterine cavity, mammary gland cyst, stroke, hydronephrosis, leukoplakia, cryodestruction of the uterine cervix, operation of the Bartholin glands, and habitual abortion.

As a whole, it deals with a total of 23 past diseases and operative interventions during this period among a total of 127 female patients (in 22,52% of all the cases).

The number of the past diseases and operative interventions is 12 among a total of 72 patients (in 18,14%) in 2020 and 21 among a total of 55 patients (in 32,93% of the cases) in 2022, respectively.

The difference in terms of the total relative share of the patients with the past diseases and operative interventions between these two years is not statistically significant (t=1,897; p>0,05).

Table 9. Distribution of the women with the common past diseases and operative interventions

No	Disease/operation	2020		2022		total	
		n	%	n	%	n	%
1.	ovarian cyst	11	2,77	8	4,79	19	3,37
2.	polypectomy	7	1,76	11	6,59	18	3,19
3.	hysterectomy	15	3,78	3	1,80	18	3,19
4.	appendectomy	16	4,03	1	0,60	17	3.01
5.	uterine myoma	1	0,25	8	4,79	9	1,60
6.	myomectomy	6	1,51	3	1,80	9	1,60
7.	extrauterine pregnancy	6	1,51	2	1,20	8	1,42
8.	breast cancer	6	1,51	2	1,20	8	1,42
9.	erosion of the uterine cervix	3	0,76	2	1,20	5	0,89
10.	conization	3	0,76	2	1,20	5	0,89
11.	endometrial polypus	3	0,76	0	0	3	0,53
12.	test abrasio	0	0	2	1,20	2	0,35
13.	operatuion of the thyroid gland	0	0	2	1,20	2	0,35
total		71	17,88	46	27,54	117	20,74

4.4. Accompanying diseases

The distribution of the patients with the common accompanying diseases according to their number and relative share is shown in Table 10.

Table 10. Distribution of the patients with the common accompanying diseases

№	Disease	2020		2022		total	
		n	%	n	%	n	%
1.	arterial hypertension	19	4,79	5	2,99	24	4,26

2.	diabetes mellitus	4	1,01	1	0,60	5	0,89
3.	breast cancer	1	0,25	2	1,20	3	0,53
4.	Hashimoto's thyroiditis	1	0,25	2	1,20	3	0,53
5.	thyroid gland disease	1	0,25	1	0,60	2	0,35
6.	disc herniation	2	0,50	0	0	2	0,35
total		28	7,05	11	6,59	39	6,91

In five female patients each, two, while in one female patient, ever three serious accompanying diseases are established.

As a whole, it deals with a total of 26 accompanying diseases during this period among a total of 60 female patients (in 10,64% of all the cases). The number of the accompanying diseases is 14 among a total of 36 patients (in 9,07%) in 2020 and 17 among a total of 23 women (in 13,77% of the cases) in 2022, respectively.

In 2020, in one patient only each, the following eight accompanying diseases are found out: uterine myoma, heart failure, bronchial asthma, arthritis, varicose veins, cholelithiasis, gout, and adenoma of the hypophysis, while in 2022, there are the following 12 accompanying diseases: endometriosis, cystocele, mammary gland cyst, vaginal infection, polycystic ovary syndrome, exhausted ovarian reserve, large bowel polypus, kidney disease, vitiligo, insulin resistance, migraine, and epilepsy.

The relative share of the patients with accompanying diseases who have been examined by means of TVU is 12,88%, that one of the rest patients without this imaging examination is 7,98%, while the total relative share of the patients with accompanying diseases is 9,40%.

In Fig 3, the distribution of the number of the female patients who have or have not undergone TVU and in whom there are or there are no accompanying diseases is compared.

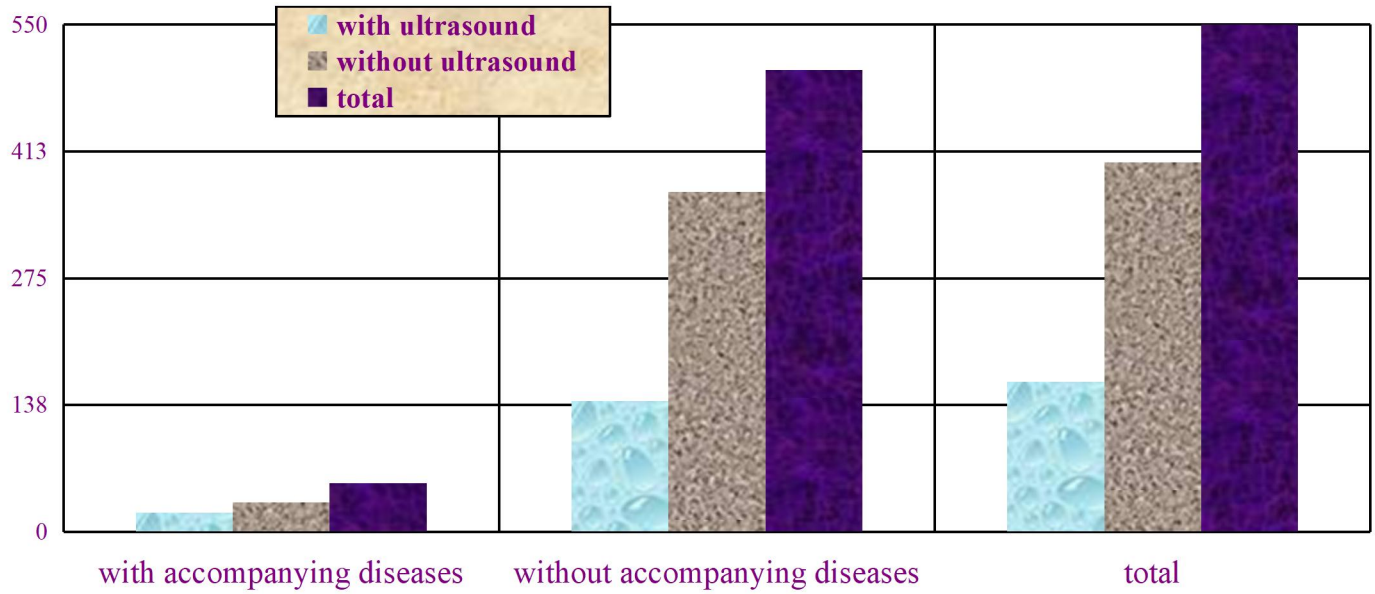

Fig. 3. Distribution of the number of the female patients with or without accompanying diseases

In Table 11, the distribution of the number of the female patients with or without TVU according to the presence or absence of accompanying diseases is demonstrated.

In Table 12, the results from the statistical analysis of the correlation between the findings from the TVU and the accompanying diseases are presented.

The symmetric measures of the strength of the association or of the size of the difference between these two variables can be seen in Table 13.

Table 11. Distribution of the number of the female patients in dependence on the performance of TVU and the accompanying diseases

Examination	number of female patients	accompanying diseases		total
		without diseases	with diseases	
without ultrasound	real	369	32	401
	expected	363,3	37,7	401,0
	residual	5,7	-5,7	
with ultrasound	real	142	21	163
	expected	147,7	15,3	163,0
	residual	-5,7	5,7	
total	real	511	53	564
	expected	511,0	53,0	564,0

Table 12. Statistical evaluation of the correlation between the findings from the ultrasound examination and the accompanying diseases

Parameter	value	bilateral asymptotic significance	bilateral exact significance	unilateral exact significance
χ^2 of Pearson	3,273	0,070		
Yate's continuity correction	2,722	0,099		
likelihood ratio	3,101	0,078		
Fisher's exact test			0,080	0,052
linear-by-linear association	3,267	0,071		
valid cases	564			

Table 13. Symmetric measures of the association and of the difference between the variables

Variables	parameters	value	asymptotic standard error	approximate value T	approximate significance
nominal by nominal	Phi	0,076			0,070
	V of Cramer	0,076			0,070
interval by interval	R of Pearson	0,076	0,045	1,811	0,071
ordinal by ordinal	Spearman correlation	0,076	0,045	1,811	0,071
valid cases		564			

The value of χ^2 of Pearson is with a freedom degree of 1 and it is not statistically significant (p=0,07).

The control of the zero hypothesis by using of the independent χ^2 test according to which there is no association between these two variables confirms this hypothesis. The association between these two variables is not statistically significant: χ^2=3,273; p=0,07 at Phi =0,076 and at V of Cramer =0,076.

4.5. Relationship between the gynaecological diseases and the manner of delivery

During the study of the correlation between the manner of delivery and the results from the examination by means of TVU, we excluded the women who have delivered by both methods, with Caesarean section and with vaginal delivery.

The presence and absence of pathological ultrasound findings in the female patients in dependence on the manner of delivery are juxtaposed in Table 14 and illustrated in Fig. 4.

Table 14. Distribution of the number of the female patients in dependence on the pathological ultrasound findings and the manner of delivery

Ultrasound finding	number of female patients	manner of deliovery		total
		with Caesarean section	normal delivery	
without finding	real	227	93	320
	expected	224,9	95,1	320,0
	% in the group	73,23	70,99	72,56

	residual	2,1	-2,1	
with finding	real	83	38	121
	expected	85,1	35,9	121,0
	% in the group	26,77	29,01	27,44
	residual	-2,1	2,1	
total	real	310	131	441
	expected	310,0	131,0	441,0
	% in the group	70,29	29,71	100,00

The results from the statistical analysis of the correlation between the presence of pathological ultrasound findings among the female patients and the method of delivery are indicated in Table 15.

The value of χ^2 of Pearson is with a freedom degree of 1 and it is not statistically significant (p=0,623).

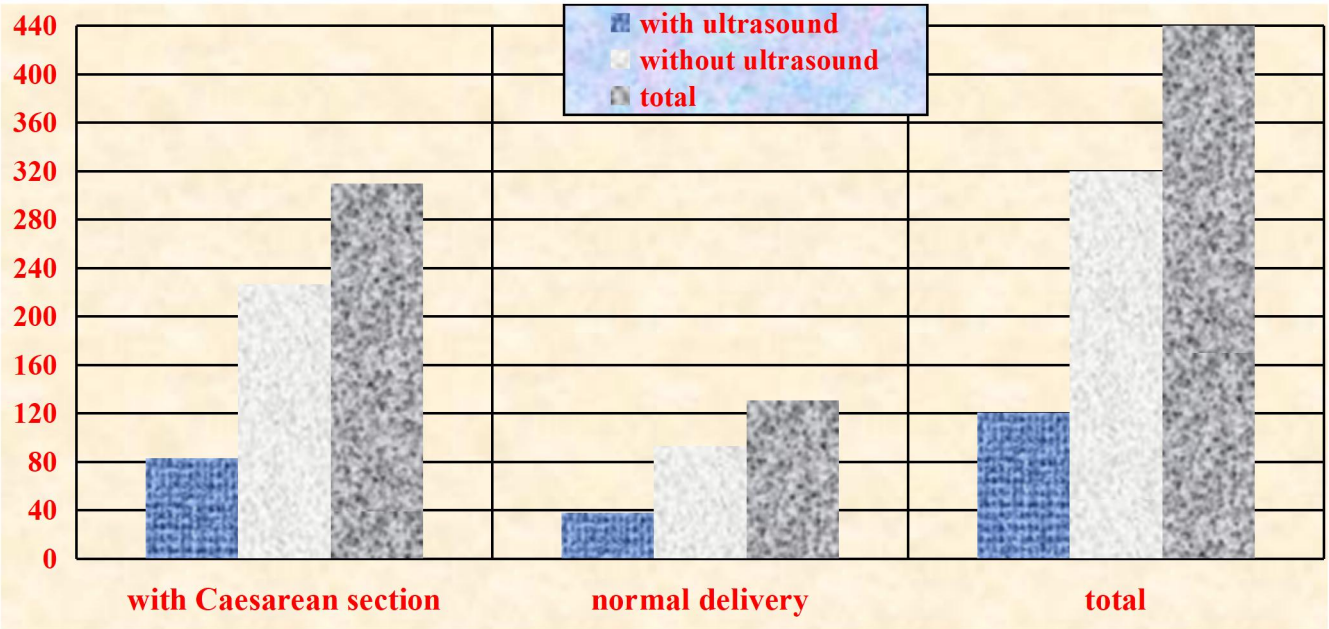

Fig. 4. Distrtibution of the number of the female patients with or without pathological findings according to the method of delivery

Table 15. Statistical evaluation of the correlation between the presence of the pathological findings and the method of delivery

Parameter	value	bilateral asymptotic significance	bilateral exact significance	unilateral exact significance

χ^2 of Pearson	0,231	0,631		
Yate's continuity correction	0,132	0,716		
likelihood ratio	0,229	0,632		
Fisher's exact test			0,642	0,356
linear-by-linear association	0,230	0,631		
valid cases	441			

On Table 16, the symmetric measures of the strength of the association or of the size of the difference between these two variables can be seen.

The control of the zero hypothesis by using of the independent χ^2 test according to which there is no association between the pathological findings from TVU and the method of delivery necessitates the acceptance of this hypothesis.

The association between the method of delivery and the gynaecological pathology is not statistically significant: χ^2=0,231; p=0,631 at Phi =0,023 and at V of Cramer =0,023.

Table 16. Symmetric measures of the association and of the difference between the variables

Variables	parameters	value	asymptotic standard error	approximate value T	approximate significance
nominal by nominal	Phi	0,023			0,631
	V of Cramer	0,023			0,631
	contingency coefficient	0,023			0,631
interval by interval	R of Pearson	0,023	0,048	0,479	0,632
ordinal by ordinal	Spearman correlation	0,023	0,048	0,479	0,632
valid cases		441			

5. DISCUSSION

5.1. Ultrasound diagnosis of the common gynaecological diseases

In our contingent of asymptomatic female patients, most often, uterine myoma (in 15,16%), endometrial polypus (in 5,94%), and adnexial formations (in 4,71%), while among the patients with clinical symptoms, endometrial polypus (19,74%), uterine myoma (in 17,11%), and adnexial formations (in 15,79% of the cases) are detected, respectively. Pathological findings during TVU are absent in 47,37% of the symptomatic and in 74,18% of the asymptomatic women. The relative share of the female patients without symptoms prevails over that of the other women with the three diseases. This difference is most oulined in terms of the uterine myoma and it is statistically significant (t=6,541; p<0,001).

The uterine myoma, the endometrial polypus, the right and left ovarian cyst, and the polycystic ovary syndrome are the most common gynaecological diseases during the whole period.

As a whole, it deals with a total of 18 gynaecological diseases among a total of 156 female patients (in 27,66% of all the cases). The number of the gynaecological diseases is nine among a total of 103 patients (in 25,94%) in 2020 and 14 among a total of 53 patients (in 31,74% of the cases) in 2022, respectively.

According to E. Dreisler *et al*. (2024), TVU is the ideal first step in the evaluation of the common pathological uterine bleeding during the perimenopause. The number of the benign diseases such as endometrial polyps and uterine myomas increases with advancing age which leads to a higher incidence of this bleeding. Based on data from the ultrasound examination, invasive diagnostic procedures such as endometrial biopsy or hysteroscopy can be planned, too.

The results from the retrospective investigation of 1745 women at a mean age of 51 years (range, 20 years to 85 years) without pathological uterine bleeding by using of TVU during the period between January 2011 and December 2018 demonstrate endometrial polyps or uterine myomas in 1094 female patients (in 62,69% of the cases) (R. Heremans *et al*., 2024).

According to the results from the comprehensive literature survey of original and review articles and of meta-analyses, the pathological uterine bleeding, advanced age and body mass index represent valid risk factors for cancer development in the endometrial polypus (M. Koblížková *et al*., 2024). The women with Lynch syndrome are with a high risk for this malignant disease, too. On the other hand, there is no convincing evidence that the number and size of the endometrial polyps, diabetes mellitus, arterial hypertension, and family history are risk factors for this cancer.

The differential and diagnostic value of the colour Doppler sonography is analyzed in a total of 60 female patients at a mean age of 43,75 years with ovarian tumours in the course of a prospective longitudinal observational study during the period between 2017 and 2019 in the city of Manipal, India (N. Mahale *et al*., 2024). Initially, it deals with 35 benign and 23 malignant tumours and with two borderline lesions. According to the classification of the group for the International Ovarian Tumor Analysis (IOTA), 27 cases (77,14%) are correctly identified as benign, six cases (17,14%) are incorrectly identified as malignant while two cases (5,71%) are not determined in this respect. The colour Doppler sonography demonstrates a pulsatility index (PI)<0,8 in three benign and in 21 malignant tumours as well as a resistive index (RI)<0,6 in four benign and in all the malignant tumours.

The additional advantages of the integration of the contrast-enhanced ultrasound and the ultrasonography for the preoperative characterization of the adnexial formations with solid components are studied in a total of 180 lesions of 175 women within a prospective multicentre study during the period between September 2021 and December 2022 in China (M. Wu *et al*., 2024). It deals with 100 benign and 80 malignant tumours. The results from the multivariate analysis indicate that the presence of acoustic shadowing and peak intensity ratio of these solid components during the examination with contrast-enhanced ultrasound are independently associated with the malignant nature of the adnexial formations. The modified model for risk stratification through the contrast-enhanced ultrasound possesses superior diagnostic value for the evaluation of the adnexial formations with solid components when compared with the Assessment of Different NEoplasias in the adnexa reporting and data system of the American College of Radiology (at area under the curve of 0,91 versus 0,78; p<0,001) and comparable performance towards the Assessment of Different NEoplasias in the adnexa model (at area under the curve of 0,91 versus 0,86; p=0,07) (M. Wu *et al*., 2024).

The diagnostic value of the Assessment of Different NEoplasias in the adnexa reporting and data system of the American College of Radiology for predicting the risk of malignant degeneration of the adnexial formations is analyzed in a total of 158 lesions, 126 benign and 32 malignant, of 130 female patients in the city of Shandong, China (Y. Li *et al*., 2024). The area under the curve of this system is 0,950. Its sensitivity is 100% (between 0,867 and 1,0 at 95% confidence interval), its specificity is 83,3% (between 0,754 and 0,892 at 95% confidence interval), its negative predictive value is 60,4% (between 0,460 and 0,732 at 95% confidence interval), while its positive predictive value is 100% (between 0,956 and 1,0 at 95% confidence interval).

Acording to M. Shetty (2023), the most common non-uterine formation in the pelvis originates from the ovary, and the ultrasound examination is the initial method

of choice for the imaging diagnosis while computed tomography and/or magnetic resonance imaging are applied in strictly selected cases. Adnexial tumours are seldom findings in these three examinations. The majority of them are benign and they are removed through operation. The non-ovarian and non-uterine formations in the pelvis include Falopian tube anomalies, paraovarian cysts, cysts in the peritoneum and rare tumours originating from the gastrointestinal tract or from the sacrum. The distinction between the non-ovarian and the ovarian tumour in women with atrophic ovary during postmenopause is a serious challenge.

Within a prospective monocentre study in the town of Bydgoszcz, Poland, M. Szymanski *et al*. (2023) assess the relationship between the parameters of the preoperative contrast-enhanced colour Doppler sonography and the levels of the immunohistochemical expression of CD34, CD105, and bcl-2 proteins in the adnexial formations of 51 female patients. The authors do not establish any statistically significant association between the examined parameters independently of whether the operated tumour mass is benign or malignant. The contrast-enhanced TVU can detect the pathological vascularization of the neoplasm independently of the postoperative density of the microcapillaries.

The results from the systematic review of 148 articles in obstetrics and of 41 articles in gynaecology published during the period between 1994 and 2023 and abstracted in *PubMed* and *The Cochrane Library* databases demonstrate a rising application of the artificial intelligence during the ultrasound examination, the so-called 5D ultrasound (E. Jost *et al*., 2023). Most commonly, it deals with the identification of the adnexial formations and mammary gland tumours and with the assessment of the endometrium and the pelvic floor. The applications of the 5D ultrasound include the examinations of the foetus in the shape of biometry, echocardiography, and neurosonography, too.

The clinical value of the quantitative analysis of the contrast-enhanced ultrasonography in the differential diagnosis between the benign and malignant pelvic tumours is analyzed in 151 female patients in the city of Guangzhou, China (Q. Fan *et al*., 2023). The multiparametric analysis of the ultrasonographic images includes the following parameters: arrival time, time to peak, peak intensity, and ascent slope. Among the female patients with benign tumours, who are statistically significantly younger (p=0,001), statistically significantly smaller values of ther peak intensity in the lesion (p<0,01) are found out. The sensitivity and specificity of the peak intensity difference and of the ascent slope difference are higher when compared with the other parameters of the same female patient (of 90,9% and 91,7% and of 86,4% and 72,5%, respectively).

TVU is carried out in a total of 570 postmenopausal women hospitalized on the occasion of abnormal uterine bleeding or other symptoms and/or with endometrial

thickness >5 mm in the city of Beijing, China (X. Yang *et al*., 2023). TVU sensitivity in the diagnosis of the atypical endometrial hyperplasia is 86,8%, its specificity is 20,4%, accuracy is 33,7%, positive predictive value is 21,1%, and negative predictive value is 86,1%. TVU is considered an effective first-line method for endometrial pathology identification in postmenopausal women aiming at endometrial cancer screening.

In the course of a descriptive observational study performed by means of TVU during the periood between January 1, 2019 and December 31, in the city of Katmandu, Nepal, among 70 perimenopausal women with pathological uterine bleeding the majority of whom (30 or 42,86%) are aged between 40 years and 43 years, endometrial thickness of 10-12 mm (in 25 women or in 35,71% of the cases) is most commonly established (S. Sah *et al*., 2023). Next follow the women with endometrial thickness of 7-9 mm (19 or 27,14% of the cases). The proliferative endometrium is the most frequent pathohistologiocal finding (in 26 women or in 37,14%) followed by the secretory endometrium (in 21 women or in 30,00% of the cases). TVU represents a standard diagnostic procedure for the early detection of the endometrial hyperplasia and cancer as well.

The results from TVU performed between the 8^{th} and 12^{th} day of the menstrual cycle in a total of 245 women with sterility in the town of Rasht, Iran, demonstrate prevalence rate of endometrial polyps of 60% and a strong association between them and tubal opbstruction (S. H. Sharami *et al*., 2023).

The results from the cross-sectional study of a total of 778 consecutive female patients with abnormal uterine bleeding in the city of Beijing, China, demonstrate the following pathological ultrasound findings: endometrial polypus (in 337 or in 43,32%), endometrial hyperplasia without atypia (in 139 or in 17,87%), and atypical endometrial hyperplasia and endometrial carcinoma (in 28 patients or in 3,60% of the cases) (M. Shang and W. Zhang, 2023). A total of 274 women (35,22% of the cases) present with normal endometrium. Woman's age (odds ratio of 1,122; between 1,002 and 1,257 at 95% confidence interval; $p<0,001$), endometrial thickness (odds ratio of 2,702; between 1,629 and 4,404 at 95% confidence interval; $p<0,001$), and cancer antigen (CA) 125 marker (U/mL) (odds ratio of 1,007; between 1,003 and 1,021 at 95% confidence interval; $p<0,001$) are independent risk factors for the occurrence of endometrial lesions among the women with pathological uterine bleeding.

Accoring to V. Wheeler *et al*. (2023), the adnexial formations in the Falopian tubes, ovaries and surrounding regions are, most commonly, benign. TVU is the method of choice in the imaging diagnosis for the determination of the size and complex structure of these tumours. The adnexial cysts sized over 10 cm and with solid components or with strong blood flow during the examination by means of colour Doppler ultrasonography are characterized by a high malignancy risk. The

application of the computed tomography or magnetic resonance imaging is recommended in case of apprehension of the dissemination of the disease outside the ovary.

The diagnostic value of TVU and magnetic resonance imaging of the pelvis is investigated in 227 female patients with proved adnexial formations during the period between March 5, 2013 and December 31, 2021, in a specialized centre in the city of Paris, France (A. Campos *et al*., 2023). The malignant prevalence rate amounts to 11,1%. The sensitivity and specificity of the Assessment of Different NEoplasias in the adnexa reporting and data system of the American College of Radiology and of the Assessment of Different NEoplasias in the adnexa reporting magnetic resonace imaging data system of the American College of Radiology are 83,3% versus 83,3% and 73,2% versus 92,9%, respectively ($p<0,001$). The application of the magnetic resonace imaging following the ultrasonography leads to a correct reclassification of 51 lesions and to an incorrect one of four lesions only. The prevailing benign lesions are cystadenomas or cystadenofibromas. Four lesions only are incorrectly classified by magnetic resonace imaging, however, they are correctly defined by ultrasonography.

In the course of the cross-section ultrasonographic investigation carried out during the period between January 1, 2019 and December 31, 2021 in four hospitals in the town of Butembo, Eastern Democratic Republic of Congo, of 749 out of a total of 1024 sterile female patients (in 73,14%) at a mean age of 30,85±5,05 years, a predominance of the uterine myomas (in 71 patients or in 9,48% of the cases) is established (D. Kaseso *et al*., 2023). Next follow the polycystic ovary syndrome (in 56 patients or in 7,48%), the endometrial dysplasia (in 54 or in 7,21%), and the ovarian cysts (in 34 or in 4,54% of the cases).

Within a sonographic follow-up of uterine myomas among a total of 189 premenopausal female patients during the period between January 2015 and March 2022 in a specialized polyclinic in the city of Berlin, Germany, a myoma size enlargement in 82% of the cases is established (V. Seidel *et al*., 2023). The mean annual enlargement of these myomas amounts to 68,42 cm^3. The initial size of the uterine myoma is the most important prognostic factor for its growth. The absolute annual enlargement of the myomas by a size >50 cm^3 during the initial sonographic examination is statistically significantly greater in comparison with that of the smaller myomas ($p<0,001$). The relative enlargement of the myomas with initial dimensions between 20 cm^3 and 50 cm^3 is statistically significantly the greatest ($p=0,003$). The relative enlargement of the myomas is statistically significantly greater among the women aged below 40 years than among those at a higher age ($p=0,003$).

During the intrauterine ultrasound examination of two groups of 33 hospitalized patients each in China, an incidence rate of the endometrial polyps of 90,9% and of the submucous uterine myomas of 80,8% is established (Z. Xia and H. Jin, 2022). The sensitivity, specificity, and accuracy of the ultrasonography in the diagnosis of the endometrial polyps are 90,0%, 66,7% and 87,9%, respectively, while in that of the submucous uterine myomas are 88,9%, 50,0% and 81,8%, respectively.

The results from the prospective investigation of 60 women with different complaints such as premenopausal and postmenopausal abnormal uterine bleeding, sterility and chronic pelvic pain carried out during the period between September 2020 and June 2021 in the University Hospital in the city of Baghdad, Iraq, prove the higher accuracy of the ultrasound diagnosis of the endometrial myoma (of 90%) in comparison with the hysteroscopy (F. A. H. S. Al-Asadi and S. K. Jasim, 2022). On the other hand, the hysteroscopy surpasses TVU in the diagnosis of the endometrial polyps (with accuracy of 100%), the fibroids (of 83%), and the endometrial hyperplasia (of 84,2%). The sensitivity of these two methods in terms of the diagnosis of the uterine cancer is comparatively low (of 34% and 50% only, respectively).

R. Heremans *et al*. (2022) perform a prospective observational investigation of a total of 1745 women without pathological uterine bleeding during the period between 2011 and 2018 in seven centres in Belgium, Sweden, the Netherlands, Spain, Italy and Great Britain specialized in the field of the gynaecological ultrasonography. The standard TVU is followed either by a histological examination of an endometrial specimen from 1537, or by a clinical and ultrasound follow-up for at least one year of 208 female patients. A total of 887 women are at postmenopause and the rest 858 ones are at premenopause. Endometrial polyps are diagnosed in 1028 (in 58,91%), myomas in the uterine cavity - in 66 (in 3,78%), proliferative or secretory alterations or endometrial hyperplasia without atypia - in 144 (in 8,25%), and endometrial atrophy - in 265 female patients (in 15,19% of the cases). The most common vascular finding among the women with endometrial polyps is the single dominating blood vessel (in 666 patients or in 64,79% of the cases). The asymptomatic endometrial polyps are associated with a thinner endometrium. They are, more frequently, characterized by a bright edge, a regular endometrial-myometrial junction, less intensive vascularization and a single dominant vessel than the polyps in symptomatic women (R. Heremans *et al*., 2022).

During the investigation of 70 women at a mean age of 46,5± 11,4 years with strongly vascularized uterine myomas diagnosed by using of colour or power Doppler in Italy, it is established that in 65 female patients (in 92,86% of the cases), it deals histologically with benign lesions (C. Russo *et al*., 2022). They include 32 typical leiomyomas, 29 leiomyoma variants, and four adenomyomas. In the rest five

patients, malignant neoplasms are established such as two uterine sarcomas, one leiomyosarcoma, one neuroendocrine tumour, and one uterine smooth muscle tumour of uncertain malignant potential. The mean age of the female patients with benign lesions is statistically significantly younger than that of the other patients (42,4±5,1 years verus 64,8±16,0 years; p<0,001). The ultrasonography identifies cystic areas within the lesion in ten typical leiomyomas (in 31,25%), in 16 leiomyoma variants (in 55,17%), in all the adenomyomas as well as in the leiomyosarcoma and in the uterine smooth muscle tumour of uncertain malignant potential. Lesion borders are statistically significantly more commonly regular in the benign than in the malignant lesions (in 64 or in 98,46% versus in two only or in 40% of the cases; p<0,05). The endometrium is statistically significantly more often visible in benign than in malignant neoplasms (in 55 or in 84,62% versus in two or in 40% of the cases; p=0,03) (C. Russo *et al*., 2022).

5.2. Ultrasound diagnosis of more seldom gynaecological diseases

During the period of our study, in two women each, it deals with endometrial hyperplasia, cystocele, primary sterility, and urinary stress incontinence. The following disturbances are diagnosed by using of TVU in one female patient only: adhesion in the uterine cavity, pyometra, uterine prolapse, secondary sterility, bilateral ovarian cyst, retained follicle of larger dimensions, menopausal bleeding and urinary incontinence, uterus duplex, calcification in a uterine tumour formation, status post hysterectomy, and suspicion of ovarian cancer while during the clinical examination, it deals with colpitis, status post abortion, and enlarging follicle.

The diagnostic value of power Doppler ultrasonography is assessed in 100 women at a mean age of 41,34±7,67 years (range, 35 to 52 years) with pathological uterine bleeding within a prospective cohort study during the period between July 2012 and July 2014 in the town of Utar Pradesh, India (S. Batra *et al*., 2022). The following diseases and pathological findings are diagnosed: fibroids - in 15, endometrial polyps and endometrial hyperplasia - in nine each, adenomyosis - in six, but endometrial cancer and atrophy - in three female patients each. The mean thickness of the endometrium of the endometrial polyps amounts to 11,77±5,02 mm, that one of the fibroids - to 13,33±4,22 mm, that one of the endometrial hyperplasia - to 14,97±4,56 mm, and that one of the endometrial cancer - to 18,9±8,74 mm. The sensitivity of the power Doppler ultrasonography for the endometrial polyps, endometrial hyperplasia and endometrial cancer is 81,81%, 72,72%, and 75%, respectively; the specificity is 100%, 98,9%, and 100%; the positive predictive value is 100%, 88,9%, and 100%, and the negative predictive value is 97,8%, 97,8%, and 98,7%.

In the parasitic uterine fibroids, it deals with a specific myoma type without any direct attachment to the uterus (M. Bruno *et al*., 2023). The diagnostic importance of TVU application in these benign tumours is emphasized. In the town of L'Acvila, Italy, a rare case of the histological diagnosis under ultrasound control and of a successful conservative management of a parasitic uterine myoma that arises 20 years after a total hysterectomy and bilateral adnexectomy in a female patient with multiple comorbidities is described.

The ultrasound examination of 175 women at a mean age of 28,9 years with sterility in the city of New Delhi, India, in whom within a prospective cross-secion investigation during the period between August 2015 and August 2019, tuberculosis of the genital organs is diagnosed demonstrates pathological findings in 63 female patients (in 36% of the cases) (J. B. Sharma *et al*., 2021). The following relative share of the concrete diseases and pathological alterations is established: ovarian cyst (23,42%), tubar and ovarian formations (15,42%), unilateral or bilateral hydrosalpinx (13,71%), ascites (6,85%), adnexial immobility (6,28%), synechiae in the endometrium (4,57%) and in the uterine corns (2,28%), pyosalpinx (0,57%), thinned endometrium (24,57%), disturbed endometrial vascularization (21,71%), presence of fluid in the endometrium (12,57%), thickening of the peritoneum or omentum (1,75%), and calcification in the endometrium (1,7%).

A rare case of leiomyoma of the Falopian tube associated with cystic degeneration and manifested as a large pelvic-abdominal cyst is reported (J. Wu *et al*., 2024). Based on the computer tomography examination, an ovarian cystadenoma is suspected. The ultrasonographic examination convincingly excludes the possibility for the origin of the tumour from the ovaries.

A 27-year old woman with long-lasting primary sterility in the city of Constanta, Romania, in whom endometrial osseous metaplasia is diagnosed by means of TVU is described (V. I. Tica *et al*., 2023). It deals with a hyperechoic endometrial mass sized 18/13/7 mm with posterior acoustic shadowing and without any data about blood flow on colour Doppler examination. The pathohistological evaluation reveals the microscopic elements of the endometrial calcification.

5.3. Complaints because of gynaecological disturbances

The most common complaints of the women in our contingent because of gynaecologocal disturbances are low abdominal pains, vaginal fluor, profuse menstrual cycles, urinary incontinence, hot waves, vaginal dyscomfort, and bleeding.

As a whole, it deals with a total of 19 concrete complaints among a total of 74 women (in 13,12% of all the cases). The number of the complaints is nine among a

total of 40 patients (in 10,08%) in 2020 and 13 among a total of 34 patients (in 20,36% of the cases) in 2022, respectively.

Two women each share scarce menstrual cycles, dysmenorrhea, vaginal dryness, and common miction urges. Only one female patient each shares burning in the genital area, vaginal prolapse, labial herpes, dyscomfort in the left abdominal region, low abdominal swelling, breast pains, breast secretions, and hampered micturition.

The statistical evaluation of the corerelation between the female patients with and without symptoms according to the diagnosis of the disease demonstrates a value of χ^2 of Pearson of 25,928, of the likelihood ratio of 21,446 and of the linear-by-linear association of 4,857. The value of χ^2 of Pearson is with a freedom degree of 5 and it is statistically significant ($p<0,0001$). The control of the zero hypothesis by using of the independent χ^2 test according to which there is no association between these two variables rejects this hypothesis. The association between these two variables is statistically significant: $\chi^2=25,928$; $p<0,0001$ at Phi =0,214 and at V of Cramer =0,214.

The results from the ultrasound examination carried out within a multicentre observational investigation in 18 specialized clinics of uterine bleeding in nine European countries in a total of 2471 consecutive female patients at a mean age of 50 years (in the interquartile range between 43 years and 57 years) with abnormal uterine bleeding show the presence of an endometrial polypus or uterine myoma in 996 (in 40,31%), an endometrial atrophy - in 414 (in 16,75%), proliferative or secretory alterations, endometritis or hyperplasia without atypia - in 852 (in 34,48%), but of a malignant disease of the endometrium or atypical hyperplasia - 155 patients (in 6,27% of the cases) (L. Wynants *et al*., 2022).

The abnormal uterine bleeding affecting approximately one third of the women during their life includes two categories - a predictable considerable bleeding during the menstrual cycle and an irregular bleeding during the time between the menstrual cycles (S. Hill and M. K. Shetty, 2023). The fibroids and the adenomyosis are the most frequent reasons for the considerable menstrual bleeding. The irregular bleeding between the menstrual cycles is due to ovarian dysfunction in the polycystic ovary syndrome, endometrial polypus, or intrauterine device. The pelvic ultrasound is the initial and often only imaging diagnostic modality of the abnormal uterine bleeding. It can identify the common causes of this disorder among the women at reproductive age.

The postmenopausal bleeding is the reason for 5% of females' visits in the consulting room of gynaecology (S. Hurtado and M. K. Shetty, 2023). Most often, it is due to the endometrial polypus as well as to the atrophy of the vagina or of the endometrium. The endometrial thickness ≤4 mm measured by means of TVU

possesses a negative predictive value for the endometrial carcinoma of 99%. A further evaluation of the endometrial polypus can be achieved by means of saline infusion sonography, magnetic resonance imaging, and hysteroscopy.

5.4. Accompanying and past diseases and operative interventions among the women with gynaecological disturbances

Arterial hypertension is the most common accompanying disease during the whole period of our investigation. Next follow diabetes mellitus, breast cancer, and Hashimoto's thyroiditis. In five female patients each, two, while in one female patient, ever three serious accompanying diseases are established. As a whole, it deals with a total of 26 accompanying diseases during this period among a total of 60 female patients (in 10,64% of all the cases). The number of the accompanying diseases is 14 among a total of 36 patients (in 9,07%) in 2020 and 17 among a total of 23 women (in 13,77% of the cases) in 2022, respectively.

In two women each, it deals with thyroid gland disease and disc herniaion. In one patient only each, the following 20 accompanying diseases are revealed: uterine myoma, heart failure, bronchial asthma, arthritis, varicose veins, cholelithiasis, gout, adenoma of the hypophysis, endometriosis, cystocele, mammary gland cyst, vaginal infection, polycystic ovary syndrome, exhausted ovarian reserve, large bowel polypus, kidney disease, vitiligo, insulin resistance, migraine, and epilepsy.

The statistical evaluation of the correlation between TVU findings and the accompanying diseases demonstrates a value of χ^2 of Pearson of 3,273, of Yate's continuity correction of 2,722, of the likelihood ratio of 3,101, and of the linear-by-linear association of 3,267. The value of χ^2 of Pearson is with a freedom degree of 1 and it is not statistically significant (p=0,07). The control of the zero hypothesis by using of the independent χ^2 test according to which there is no association between these two variables confirms this hypothesis. The association between these two variables is not statistically significant: χ^2=3,273; p=0,07 at Phi =0,076 and at V of Cramer =0,076.

The most common past diseases and operative interventions accomplished among the women in our contingent are the following: ovarian cyst, polypectomy, hysterectomy, appendectomy, uterine myoma, myomectomy, extrauterine pregnancy, and breast cancer.

As a whole, it deals with a total of 23 past diseases and operative interventions during this period among a total of 127 female patients (in 22,52% of all the cases).

The number of the past diseases and operative interventions is 12 among a total of 72 patients (in 18,14%) in 2020 and 21 among a total of 55 patients (in 32,93% of the cases) in 2022, respectively. The difference in terms of the total relative share of

the patients with the past diseases and operative interventions between these two years is not statistically significant (t=1,897; p>0,05).

In five patients each, it deals with uterine cervix erosion and conization, in three patients, with endometrial polypus, but in two patients, with test abrasion and with operation of the thyroid gland. Only in one female patient each, the following ten other past diseases and operative interventions are revealed: endometriosis, tumour formation in the uterine cavity, mammary gland cyst, stroke, hydronephrosis, leukoplakia, cholecystectomy, cryodestruction of the uterine cervix, operation of the Bartholin glands, and habitual abortion.

The results from the retrospective study of a total of 4236 premenopausal women at a mean age of 42±7,5 years who have undergone hysteroscopic polypectomies during the period between January 2015 and December 2021 at a tertiary hospital in the city of Chengdu, South-Western China, demonstrate a prevalence of premalignant and malignant endometrial polyps of 2,15% (91 polyps) (L. Lu *et al*., 2023). It deals with endometrial hyperplasia with atypia in 48 (in 1,13%) and with endometrial carcinoma in 43 female patients (in 1,02% of the cases). The rest 4145 endometrial polyps are benign. The following accompanying diseases are detected: diabetes mellitus (in 749 women or in 17,68%), arterial hypertension (in 516 women or in 12,18%), and polycystic ovary syndrome (in 337 women or in 7,96% of the cases). By using of the univariate analysis, the following statistically significant risk factors for the premalignant and malignant endometrial polyps are identified (p<0,05): age ≥40 years (odds ratio of 1,74; between 1,12 and 2,71 at 95% confidence interval), obesity (odds ratio of 1,64; between 1,07 and 2,53 at 95% confidence interval), absent delivery (odds ratio of 2,8; between 1,81 and 4,35 at 95% confidence interval), diabetes mellitus (odds ratio of 3,3; between 2,16 and 5,06 at 95% confidence interval), polycystic ovary syndrome (odds ratio of 2,96; between 1,74 and 5,02 at 95% confidence interval), and the number of the endometrial polyps (odds ratio of 1,71; between 1,12 and 2,61 at 95% confidence interval). Following the adjustment in terms of the potential confounding factors by means of the multivariate analysis, it is established that the polycystic ovary syndrome only is related to a statistically significantly higher risk for these polyps among the premenopausal women (odds ratio of 2,75; between 1,02 and 3,45 at 95% confidence interval; p<0,001). This imposes a timely evaluation of the endometrium by means of TVU or hysteroscopy in the patients with this syndrome (L. Lu *et al*., 2023).

The relationship between the case history of accompanying diseases and the parameters of the ovarian reserve is analyzed in 645 substerile women at a mean age of 35,0 years (range, 18 years to 45 years) within an observational investigation during the period between 2005 and 2019 in the city of Boston, the USA (L. Mínguez-Alarcón *et al*., 2022). The number of the antral follicles is assessed by

means of TVU while the serum concentrations of the follicle-stimulating hormone and the anti-Műlerian hormome on the third day - with immunological tests. The number of the accompanying diseases shared by 244 of the female respondents is considerable. It deals with depression (in a total of 134 women or in 20,78%), arterial hypertension and diabetes mellitus (in 16 women each or in 2,48% each of all the women), hypo- and hyperthyroidism (in a total of 73 women or in 11,32%), gastrointestinal diseases (in a total of 40 women or in 6,20%), bulimia and anorexia (in a total of 27 women or in 4,19%), neurological diseases (in a total of 23 women or in 3,57%), malignant diseases (in a total of 22 women or in 3,41%), and scoliosis (in a total of 38 women or in 5,89% of the cases). There is a negative association between the number of the antral follicles, on the one hand, and the arterial hypertension, malignant and neurological diseases, on the other hand. The standardized number of these follicles is statistically significantly smaller among the women with arterial hypertension than among those without this disease (11,5 versus 15,6; $p<0,0001$) (L. Mínguez-Alarcón *et al*., 2022).

TVU prognostic value in combination with bleeding features for the identification of the factors associated with the abnormal uterine bleeding is analyzed in a total of 205 women aged between 30 years and 65 years during the period between February 2020 and February 2022 in the city of Hunan, China (Y. Xu and D. Xie, 2022). Eighty-four women are with endometrial polypus, 56 are with endometrial hyperplasia and malignization, and 65 are with normal endometrium. Various bleeding disorders are detected in 59 female patients with endometrial polypus, in 32 - with endometrial hyperplasia and malignization, and in 61 - with normal endometrium. The endometrial thickness is 11,23±3,38 mm, 14,82±6,99 mm, and 9,71±3,26 mm, respectively. A polycystic ovary syndrome is present in 23 (in 11,22%), arterial hypertension - in 22 (in 10,73%) but diabetes mellitus - in eight female patients (in 3,90% of the cases). The increased body mass index, the dysmenorrhea, and the endometrial thickness are the other risk factors for the abnormal uterine bleeding.

According to C. Berceanu *et al*. (2022), the main risk factors for the endometrial polyps include advanced age, arterial hypertension, hyperestrogenemia, and tamoxifen usage. The importance of the diabetes mellitus and some hormonal factors for the etiopathogenesis of these polyps is rendered an account. TVU is the most important method for their imaging diagnosis in the women at reproductive age, especially, in the presence of abnormal uterine bleeding or sterility. TVU accuracy is enhanced through the introduction of the colour Doppler examination, three-dimensional image reconstruction, and contrast enhancement.

The results from the descriptive cross-section study performed during the period between September 2019 and September 2020 in the city of Colombo, Sri

Lanka, of 60 women at a mean age of 26,7±6,7 years (range, 18 years to 44 years) with polycystic ovary syndrome diagnosed according to Rotterdam criteria and with a mean body mass index of 27,1±4,8 kg/m^2 demonstrate clinical or biochemical findings of hyperandrogenism in 54 (in 90%) and irregular menstrual cycle in 50 female patients (in 83,33% of the cases) (I. Ranathunga *et al*., 2022). TAS identifies polycystic ovaries in 24 women (in 40% of the cases). It deals with the following accompanying diseases: hypothyroidism (in ten or in 16,67%), diabetes mellitus and dyslipidemia (in four each or in 6,67% each), as well as arterial hypertension and hyperthyroidism (in three female patients each or in 5,00% of the cases each).

L. Patrizi *et al*. (2022) carry out a retrospective study during the period between January 1, 2014 and September 30, in the city of Rome, Italy, of a total of 1020 consecutive female patients with endometrial anomalies diagnosed by means of TVU and/or hysteroscopy. It deals with 403 premenopausal women at a mean age of 43±6,85 years and with 617 postmenopausal women at a mean age of 63,6±9,42 years. The women with symptoms are statistically significantly more in the first than in the second group (293 or 59,31% versus 173 or 29,4%; odds ratio of 3,740; between 2,868 and 4,876 at 95% confidence interval; p<0,0001). The abnormal uterine bleeding is statistically significantly more seldom among the premenopausal female patients (in 183 or in 29,66% versus in 233 or in 57,82%; p<0,0001), while the following two accompanying diseases such as arterial hypertension and diabetes mellitus are statistically significantly more common (p<0,0001) among the postmenopausal patients - in 310 or in 50,24% versus in 38 or in 9,43% and in 73 or in 11,83% versus in 12 or in 2,98% of the cases, respectively. The endometrial polypus is detected statistically significantly in more postmenopausal female patients (p<0,0001) than in premenopausal ones, too - in 540 or in 87,52% versus in 312 or in 77,42% of the cases. The risk for its occurrence is smaller among the premenopausal patients (odds ratio of 2,04; between 1,46 and 2,85 at 95% confidence interval; p<0,0001) (L. Patrizi *et al*., 2022).

During the period between January 2015 and September 2022, L. Pace *et al*. (2022) perform a retrospective investigation in the University Hospital in the city of Torino, Italy, in 80 female patients at a mean age of 64,9±1,1 years with preoperatively diagnosed atypical endometrial hyperplasia who have undergone hysterectomy on the occasion of endometrial carcinoma. Forty patients are with arterial hypertension and 16 ones are with diabetes mellitus. The diagnosis of the atypical endometrial hyperplasia is ultrasonographically confirmed in 27 female patients at a mean age of 62,3±1,8 years but the endometrial carcinoma is proved in the rest 53 female patients at a mean age of 66,2±1,4 years. TVU results indicate a mean endometrial thickness of 16,3±1,7 mm. It is statistically significantly greater among the patients with occult endometrial carcinoma than among those with

atypical endometrial hyperplasia (20,3 mm versus 10,3 mm; p=0,001). The size of the endocavitary lesion (of a maximal diameter of 25,2±3,0 mm versus 10,6±2,5 mm; p=0,001) and the prevalence not only of the irregular endometrial-myometrial junction (in a total of 18 women) (40,5% versus 6,7%; p=0,022), but also of the endouterine vascularization at colour Doppler examination (in a total of 43 women) (64,2% versus 34,6%; p=0,017) are statistically significantly greater in the first group, too. Uterine fibroids are detected in a total of 29, focal endometrial lesions in a total of 24, non-uniform endometrial echogenicity in a total of ten, and intracavitary fluid in a total of six female patients (L. Pace *et al*., 2022).

In the course of a retrospective single-centre investigation of 244 postmenopausal women carried out during the period between February 2016 and December 2019 in the city of Changwon, South Korea, it is established that the endometrial thickness ≥5 mm identified by TVU and the endometrial fluid collection are risk factors for the development of the endometrial cancer (H. C. Jo *et al*., 2021). The following accompanying diseases are found out: arterial hypertension (in 62 women or in 25,41%), diabetes mellitus (in 26 women or in 10,66%), and thyroid gland disease (in eight women or in 3,28% of the cases). A total of 17 female patients share that they have been operated on on the occasion of breast cancer, eight ones on the occasion of thyroid cancer, and seven ones because of gastric cancer.

A 65-year old woman with a giant asymptomatic endometrial polypus sized 8,5x1,5 cm is described in the city of New Delhi, India (J. Meena *et al*., 2017). The accompanying diseases are arterial hypertension, diabetes mellitus, and obesity. Ultrasonographically, endometrial thickness of 12,3 mm is established. The histopathological examination indicates a cystic hyperplasia without atypia.

The results from the comprehensive literature survey show a total incidence rate of ovarian tumours during pregnancy between 0,05% and 5,7% (A. V. Smith *et al*., 2022). The frequencyof the malignant diseases among them is less than 5%. The diagnosis of these tumours is predominantly based on the application of the traditional TVU.

The prevalence rate of the malignant diseases and the risks for their occurrence are retrospectively analyzed in a total of 1665 asymptomatic postmenopausal women at two reference centres in Brazil, in the city of São Paulo and in the town of Campinas (M. B. Bracco Suarez *et al*., 2021). These female patients are diagnosed by means of hysteroscopy or ultrasound examination. The incidence rate of the malignant diseases amounts to 2,39%. The arterial hypertension and the diabetes mellitus are the main accompanying diseases. The value of the endometrial thickness ≥8 mm is the basic risk factor for the malignant endometrial diseases. The chance for these diseases at endometrial thickness ≥12,55 mm increases statistically significantly by 4,68 times (between 1,99 and 11,03 times at 95% confidence interval; p<0,001).

5.5. Dependence between the gynaecological diseases and the manner of delivery

Within our investigation, we establish by means of TVU pathological findings in 83 out of a total of 310 women delivered by Caesarean section (in 26,77%), in 38 out of a total of 131 women with normal delivery (in 29,01%), and in 121 out of a total of 441 women (in 27,44% of the cases).

The statistical evaluation of the correlation between the pathological ultrasound findings and the method of delivery demonstrates a value of χ^2 of Pearson of 0,231, of Yate's continuity correction of 0,132, of the likelihood ratio of 0,229, and of the linear-by-linear association of 0,230. The value of χ^2 of Pearson is with a freedom degree of 1 and it is not statistically significant (p=0,623). The control by using of the independent χ^2 test accepts the zero hypothesis according to which there is no association between the pathological findings from TVU and the method of delivery of the female patients. The association between the method of delivery and the gynaecological pathology is not statistically significant: χ^2=0,231; p=0,631 at Phi =0,023 and at V of Cramer =0,023.

In their review article, Y. J. Choi *et al*. (2023) outline the advances of the application of the Doppler ultrasonography for the management of females sterility and for the prediction of the outcomes from the usage of the assisted reproductive technologies during the last years. The colour or power three-dimensional Doppler are used for blood flow measurement in the vessels near to the ovaries and the uterus and in the endometrium.

The results from the systematic review of 33 investigations published during the period between 1970 and 2020 and abstracted in *PubMed* database demonstrate that TVS possesses a higher sensitivity and specificity than TAS when achieving the high-quality imaging of the uterus and adnexa (J. Mathis *et al*., 2022). There are different opinions concerning the reference value of the endometrial thickness of the asymptomatic postmenopausal women, however, the dimensions >5 mm and bleeding at this age raise doubts and impose a further examination of the women. Their ovaries are of small volumes.

N. H. M. Khalid *et al*. (2022) carry out a descriptive cross-section investigation of 100 women at a mean age of 34,8 years with sterility during the period between May 2020 and May 2021 at the University Hospital in the city of Najran, Saudi Arabia. The results from the ultrasonographic examination demonstrate a statistically significant association (p<0,05) between woman's age and sterility type (primary in 65% and secondary in the rest 35% of the cases), on the one hand, and polycystic ovary syndrome, the most common accompanying disease (in 56% of the women), on

the other hand. The fibroids (in 22%), the endometrial polyps (in 9%), the adenomyosis (in 5%), the hydrosalpinx (in 4%), and the congenital anomalies (in 2% of the cases) are the rest risk factors for the sterility.

The diagnostic value of the two methods for the ultrasound examination such as TAS and transvaginal colour three-dimensional Doppler ultrasonography is juxtaposed in 150 female patients at a mean age of 43,2±2,9 years (range, 23 years to 65 years) with adenomyosis during the period between January 2020 and December 2021 in China (J. Zhu *et al*., 2022). The diagnosis of the disease is proved by TAS in 94, but by transvaginal colour three-dimensional Doppler ultrasonography in 131 female patients. The sensitivity of both methods is 68,42% and 81,06%; the specificity is 51,07% and 90,11%; the accuracy is 64,39% and 82,47%; the positive predictive value is 31,57% and 90,27%, and the negative predictive value is 60,00% and 80,00%, respectively. These differences are statistically significant ($p<0,05$). The majority of the lesions of the uterine cervix (91 or 60,67% of the cases) are benign. Hypoechogenic and hyperechogenic images are established in 57 (in 62,64%) and in 20 benign lesions (in 21,98% of the cases), respectively.

The diagnostic effectiveness of the colour TVS and of the colour TAS is juxtaposed in a total of 140 female patients with endometrial diseases during the period between April 2018 and October 2019 in China (X. L. Lin *et al*., 2021). Endometrial polypus is diagnosed in 63, submucous uterine myoma - in 42, endometrial hyperplasia - in 25, and endometrial cancer - in ten patients. TVS is characterized by a statistically significantly higher diagnostic accuracy when compared with TAS in the four pathological conditions - in 59 or in 93,65% versus in 40 or in 63,49% ($\chi^2=27,012$; $p=0,001$); in 39 or in 92,86% versus in 29 or in 69,05% ($\chi^2=18,385$; $p=0,001$); in 22 or in 88,00% versus in 18 or in 72,00% ($\chi^2=8,000$; $p=0,005$), and in eight or in 80,00% versus in ten female patients or in 100,00% of the cases ($\chi^2=8,000$; $p=0,001$), respectively. Endometrial thickness <5 mm is found out by using of TVS in 12 patients with endometrial polypus only (in 19,05%) and in ten patients with submucous uterine myoma (in 23,81% of the cases) as the difference towards the other two pathological conditions is statistically significant ($\chi^2=36,214$; $p=0,001$). The endometrial thickness of 5-10 mm is revealed in 20 female patients with endometrial polypus only, too (in 31,75%) and in 24 female patients with submucous uterine myoma (in 57,14% of the cases). The endometrial thickness of >10 mm is observed in all the patients with endometrial hyperplasia and with endometrial cancer as well as in 31 with endometrial polypus (in 49,21%) and in 15 female patients with submucous uterine myoma (in 35,71% of the cases) (X. L. Lin *et al*., 2021).

Our own immediate observations convincingly show the advantages of the ultrasound diagnosis for the purposes of the prevention of the gynaecological

diseases. The low cost of the ultrasound makes it a valuable diagnostic tool in the field of gynaecology by enabling the providers of health services to ensure qualitative care to a larger population without a considerable financial burden. The ultrasound is considered a safe and non-invasive method during which usage, there are neither risks, nor side effects. It does not deal with ionizing radiation by x-rays or computed tomography.

6. CONCLUDING REMARKS

We analyzed the diagnostic value of TVU for the revealing of the pathological findings of the female genital system among asymptomatic and symptomatic women at a different age.

Our retrospective clinical investigation was carried out in a total of 564 female patients aged between 22 years and 86 years in the Specialized Hospital of Obstetrics and Gynaecology 'Prof. Dimitar Stamatov' of Varna Ltd. during the period between September 1, 2020 and September 30, 2022 inclusive.

We identified three considerably more common gynaecological diseases necessitating timely therapeutic behaviour: uterine myoma, endometrial polypus, and several adnexial formations. The number and the relative share of the cases without symptoms considerably prevailed which proved the role of the prophylactic examinations. The difference between these women and the women with clinical symptoms in the uterine myoma was statistically significant (t=6,541; p<0,001). The age group between 40 years and 49 years considerably prevailed in our contingent. A statistically significant correlation between the findings from the ultrasound examination and female patient's age was present (χ^2 of Pearson =12,348; p=0,03).

By means of TVU, we diagnosed a total of 15 other gynaecological diseases as the right and the left ovarian cyst and the polycystic ovary syndrome were the most common of them.

A total of 74 women (13,12% of the cases) shared a total of 19 concrete complaints, predominantly low abdominal pains, vaginal bleeding, and profuse menstrual cycles.

A statistically significant correlation between the symptomatic and asymptomatic female patients and the diagnosis of the three most often diagnosed diseases was established (χ^2 of Pearson =25,928; p<0,0001).

A total of 26 accompanying diseases in a total of 60 female patients (in 10,64% of the cases) were observed. The arterial hypertension was most commonly detected - in 26 women. The accompanying diseases were present in 21 female patients who have undergone TVU (in 12,88%), in 32 female patients (in 7,98%) without this imaging examination and in a total of 53 female patients (in 9,40% of the cases). The

correlation between the accompanying diseases and the pathological findings from TVU was not statistically significant (χ^2 of Pearson =3,273; p=0,07).

We detected a total of 127 female patients (22,52% of the cases) with a total of 15 past diseases and 11 operative interventions accomplished in them. The total relative share of these two patients' groups did not statistically significantly differ between 2020 and 2022 (18,14% versus 32,93%; *t*=1,897; p>0,05).

The number and the relative share of the women with Caesarean section were greater than those of the women with normal delivery, both with and without pathological ultrasound findings. The correlation between the presence of the pathological ultrasound findings among the female patients and the method of delivery was not statistically significant (χ^2 of Pearson =0,231; p=0,623).

We convincingly proved the advantages of the ultrasound diagnosis for the purposes of the prevention of the gynaecological diseases. TVU is a cheap, safe, and non-invasive method during which usage, there are neither risks, nor side effects.

The present investigation could stimulate the broader application of the contemporary ultrasound diagnosis for the purposes of the effective prevention of the socially significant gynaecological diseases in our country.

7. CONCLUSIONS

Based on the investigation performed by us, the following main **conclusions** can be drawn:

1. The contemporary ultrasound diagnosis contributes to the identification of a large number of gynaecological diseases nor only among the symptomatic but also among the asymptomatic female patients.

2. The uterine myoma, the endometrial polypus and the adnexial formations are the three most common gynaecological diseases diagnosed by means of TVU.

3. The clinical examination of the women reveals a considerable number of complaints, accompanying and past diseases and of operative interventions accomplished in them.

4. We establish a considerable predominance of the disturbances of the female genital system during the active and creative age between 40 years and 49 years.

5. We do not establish any statistically significant correlation between the identified pathological ultrasound findings and the method of delivery.

8. LIST OF PUBLICATIONS RELATED TO THE DISSERTATION WORK

Articles in periodical jounals

1. Tabakova GN, Kovachev E, **Ivanova RV**, Kachovski TE, Ivanov DD. Ovarian abscess rupture after oocyte retrieval in a patient with endometriosis: case report. Arch Balk Med Union. 2021;56(1):110-113.
2. Kachovski Ts, **Ivanova V**, Kovachev E. Change in the blood flow of the uterine arteries in spontaneous abortions with high values of dNK cells. Reprod Health. 2023(38):3-8 (in Bulgarian).
3. **Ivanova V**, Kovachev E, Kachovski Ts. Prophylactic ultrasound diagnosis as a method for detection of asymptomatic pathologies in genealogy. Med.journal Medical - in print

Participation in a scientific forum

1. Ilieva Y, **Ivanova V**, Kachovski Ts, Kovachev E. Ultrasound diagnosis of congenital cytomegalovirus infection. In: 8th Black Sea Symposium for Young Scientists in Biomedicine. Varna, 9-12.XI.2023. Scr Sci Vox Studentium. 2023;7(Suppl. 1):48.

9. CONTRIBUTIONS OF THE DISSERTATION WORK

The contributions of the present dissertation work are scientific and applicable, of original and confirmatory nature.

Contribution of original nature

1. For the first time in Bulgaria, a regional prophylactical ultrasound investigation of the women with gynaecological diseases is performed.

Contributions of confirmatory nature

1. By analyzing the literature data and own results, we confirmed TVU effectiveness in the women without and with symptoms of the gynaecological diseases.
2. We proved the important diagnostic role of the imaging method during the examination of the female patients without and with symptoms of the gynaecological diseases.
3. We confirmed the considerable incidence of the concrete present and past gynaecological diseases and complaints of the women.
4. We visualized a considerable incidence of a great number of the accompanying diseases among the female patients with gynaecological pathology.