Basic Gynecologic Ultrasound Examination (Level I): DEGUM, ÖGUM, and SGUM Recommendations

Qualitätsanforderungen an gynäkologische Ultraschall-Untersuchungen der DEGUM-Stufe I: Empfehlungen der DEGUM, ÖGUM und SGUM

Authors

Dieter Grab[1], Eberhard Merz[2], Karl-Heinz Eichhorn[3], Boris Tutschek[4], Karl Oliver Kagan[5], Kai-Sven Heling[6], Renaldo Faber[7], Philipp Klaritsch[8], Andreas Rempen[9], Christiane Kähler[10], Wolfgang Henrich[11], Gwendolin Manegold-Brauer[12], Samir Helmy[13], Markus Hoopmann[14]

Affiliations

1 Obstetrics and Gynecology, University of Ulm, Germany
2 Frankfurt, Center for Ultrasound and Prenatal Medicine, Frankfurt/Main, Germany
3 Gynecology and Obstetrics, Practice of prenatal medicine, Weimar, Germany
4 Prof. Tutschek, Prenatal Zurich, Zürich, Switzerland
5 Department of Obstetrics and Gynaecology, University of Tuebingen, Germany
6 Berlin, Prenatal Diagnosis and Human Genetics, Berlin, Germany
7 Leipzig, Center of Prenatal Medicine, Leipzig, Germany
8 Department of Obstetrics and Gynecology, Medical University Graz, Austria
9 Department of Gynecology and Obstetrics, Diakonieklinik, Schwäbisch Hall, Germany
10 Obst Gyn, Practice of prenatal medicine Erfurt, Germany
11 Obstetrics, Charité University Hospital Berlin – Virchow Hospital Campus, Berlin, Germany
12 Department of prenatal medicine and gynecologic ultrasound, University Hospital Basel, Switzerland
13 Department of Obstetrics and Gynecology, Medical University of Vienna, Austria
14 Department of Obstetrics and Gynaecology, University of Tübingen, Tübingen, Germany

Key words

gynecology, education, training, quality Assurance, basic ultrasound

received 22.09.2021
accepted 28.04.2022
published online 15.06.2022

Bibliography

Ultraschall in Med 2023; 44: 151–161
DOI 10.1055/a-1851-5157
ISSN 0172-4614

Georg Thieme Verlag KG, Rüdigerstraße 14, 70469 Stuttgart, Germany

Correspondence

Prof. Dieter Grab
Klinik für Frauenheilkunde und Geburtshilfe, Universitätsklinikum Ulm, Prittwitzstr. 43, 89075 Ulm, Germany
Tel.: +49/73 15/0 05 87 70
dieter.grab@uniklinik-ulm.de

ABSTRACT

Ultrasound has become an essential diagnostic tool in gynecology, and every practicing gynecologist must be able to differentiate normal from pathologic findings, such as benign or malignant pelvic masses, adnexal torsion, pelvic inflammation disease, endometriosis, ectopic pregnancies, and congenital uterine malformations at least on a basic level. A standardized approach to the correct settings of the ultrasound system, the indications for gynecologic ultrasound investigations, and the sonographic appearance of normal anatomy and common pathologic findings in the standard planes are important prerequisites for safe and confident clinical management of gynecologic patients. Based on current publications and different national and international guidelines, updated DEGUM, ÖGUM, and SGUM recommendations for the performance of basic gynecologic ultrasound examinations were established.

ZUSAMMENFASSUNG

Die sonografische Basisuntersuchung in der Gynäkologie umfasst Diagnostik und Differenzialdiagnostik in der täglichen Praxis: Gesundheitsvorsorge, Abgrenzung der Normalbefunde von pathologischen Befunden wie kongenitale Fehlbildungen, benigne und maligne Tumoren, Adnextorsionen, entzündliche Erkrankungen des inneren Genitals, Endo-

metriose, gestörte Frühgraviditäten und Tubargraviditäten sowie Fragestellungen zu Kontrazeption und Fertilität. Die Standardisierung der Untersuchungstechnik sowie die genaue Definition der Leistungsinhalte für die Basisdiagnostik und für die weiterführende Diagnostik (DEGUM-Stufe II) analog des schon seit Jahren in der pränatalen Diagnostik bewährten Mehrstufenkonzepts der DEGUM sind inzwischen auch in die gynäkologische Sonografie implementiert worden. Als Grundlage für eine strukturierte Aus- und Weiterbildung im Rahmen dieses Stufenkonzepts haben DEGUM, ÖGUM und SGUM die Qualitätsanforderungen und die Leistungsinhalte für gynäkologische sonografische Basisuntersuchungen (DEGUM-Stufe I) entsprechend dem gegenwärtigen Kenntnisstand sowie anhand nationaler und internationaler Standards und Empfehlungen aktualisiert.

Introduction

Similar to the DEGUM's well-established multi-level concept for prenatal diagnosis [1, 2], quality requirements have also been defined for ultrasound imaging in gynecology [3, 4]. Standardization of examination techniques and precise definition of services to be performed for a basic examination and for a detailed examination by a specialized examiner help to ensure high-quality and need-based patient care and are required for quality improvement and control as well as for standardized training [5–8]. Significant advances in the further development and standardization of examination techniques and evaluation criteria in ultrasound imaging in gynecology have been achieved in recent years [9–15].

As the foundation for structured training and specialist training within the framework of the DEGUM level concept, the quality requirements for gynecological ultrasound examinations for DEGUM level I are being updated according to current knowledge and national and international standards and recommendations.

Basic ultrasound examination

The basic ultrasound examination in gynecology includes diagnosis and differential diagnosis within the daily routine: preventative care, differentiation between normal findings and pathological findings (see ▶ **Table 1**), and questions regarding contraception and fertility. For information regarding ultrasound methods for evaluating the pelvic floor and for performing a workup regarding female urinary incontinence (introitus and perineal ultrasound), refer to the AWMF guidelines 015/091 "urinary incontinence in women" [16].

Equipment standards

When performing a workup of gynecological findings, the transvaginal ultrasound examination is the most valuable imaging method. High-frequency (at least 5 MHz) transducers (mechanical or electronic sector transducers) with a sector angle of at least 100° should be used for this purpose. Electronic curved array or sector transducers or mechanical sector transducers with a frequency between 3.5 and 7.5 MHz should be used for transabdominal imaging. For differential diagnosis, particularly for differentiating between benign and malignant findings, color-coded Doppler ultrasound has become established as the standard method and can be helpful for basic ultrasound examination [15, 17]. The pulse repetition frequency and the zero line must be able to be set to show the Doppler frequency shift.

Examination technique

Transvaginal examinations are performed with an empty or almost empty bladder with the patient either lying in a supine position on an examination table or in a lithotomy position on the gynecological chair. The transducer is to be covered with a gel-filled cover (condom without a reservoir) and to be cleaned and disinfected according to manufacturer specifications after every examination. After the transducer is used, the protective cover is removed and disposed of, and the gel is cleaned from the transducer. Since handling of the probe, ultrasound gel, and protective cover can result in smear infections and cross-contamination with various pathogens, the transducer must be cleaned after removal of the protective cover and disinfected with a bactericidal, fungicidal, and virucidal disinfectant. This is especially true if the protective cover ruptures during a vaginal ultrasound examination and the transducer comes in direct contact with vaginal secretions or blood [18, 19].

A full bladder can facilitate transabdominal examinations.

The examination conditions (good, sufficient, limited, e. g. due to obesity, intestinal overlay, etc.) should be evaluated for every examination.

▶ **Table 1** Pathological findings and diseases detected during basic ultrasound examination.

Myomas
Uterine adenomyosis
Endometrial polyps
Endometrial hyperplasia
Hemorrhagic cysts
Dermoid cysts
Endometrial cysts
Cystadenoma
Inflammatory diseases of the lesser pelvis
Masses suspicious for malignancy
Adnexal torsion
Miscarriage (missed abortion, molar pregnancy, incomplete abortion)
Ectopic pregnancies

For image optimization, the following parameters must be individually adjusted.

- Image section
- Focal zone
- Grayscale enhancement
- Image resolution (frame rate, persistence, Tissue Harmonic Imaging, if applicable)
- Pulse repetition frequency (speed range)
- Color Doppler enhancement

What the examination includes

The basic ultrasound examination includes imaging of the internal reproductive organs (dynamic examination, possibly with the help of the examiner's hand externally to control the mobility of the organs in the lesser pelvis). Under consideration of the patient's medical history, cycle phase, age, and medication, position and structural changes should be identified and the most important pathological findings and diseases of the uterus, adnexa, the pouch of Douglas should be correctly diagnosed, classified, documented, and reliably differentiated from functional findings (follicles, corpus luteum).

The basic ultrasound examination also includes a check of the position of an IUD.

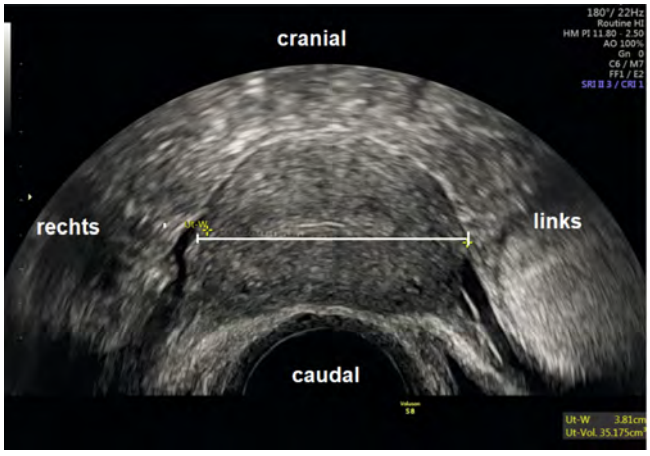
Normal findings

The basic ultrasound examination in gynecology requires correct visualization of the size, structure, and position of the uterus and adnexa as well as knowledge of physiological changes to the endometrium and ovaries in the normal cycle, early pregnancy, and menopause.

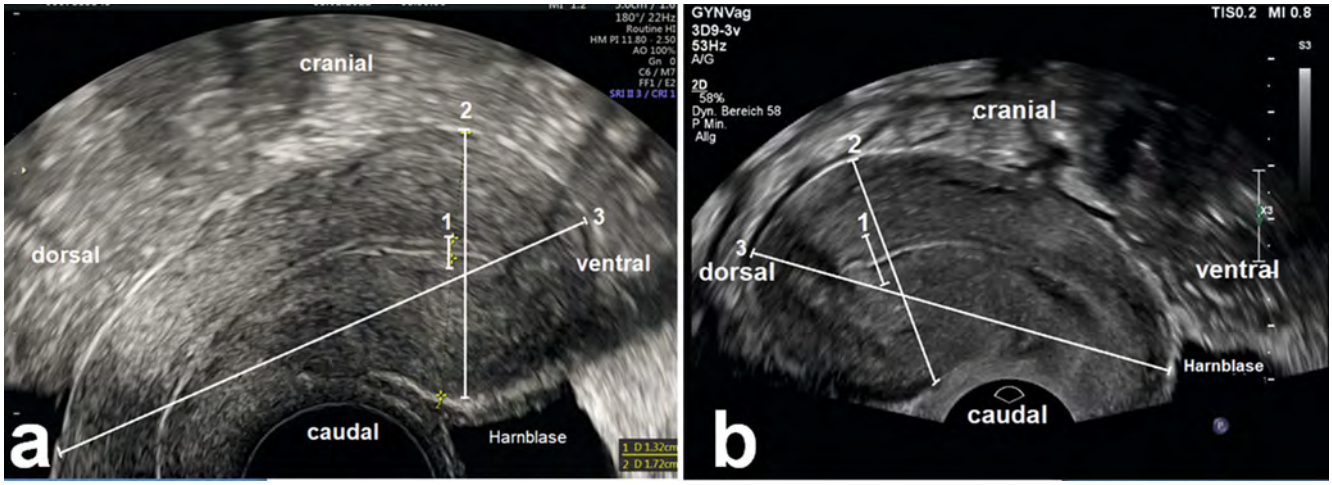
Uterus

Transvaginal imaging of the uterus is performed either from the anterior (with the uterus in anteflexion) or the posterior vaginal fornix (with the uterus in retroflexion). The entire uterus is visualized in a series of sagittal views and transverse views. The image section and sector angle are selected so that the median sagittal view of the uterus fills the screen (▶ **Fig. 1**). A standardized representation is recommended for image orientation with the transvaginal probe positioned on the lower edge of the image and the bladder on the right in the sagittal view [9]. In the transverse view, the left side of the patient is on the right edge of the image (▶ **Fig. 2**). If the spatial relationships are unclear, a pictogram can be helpful.

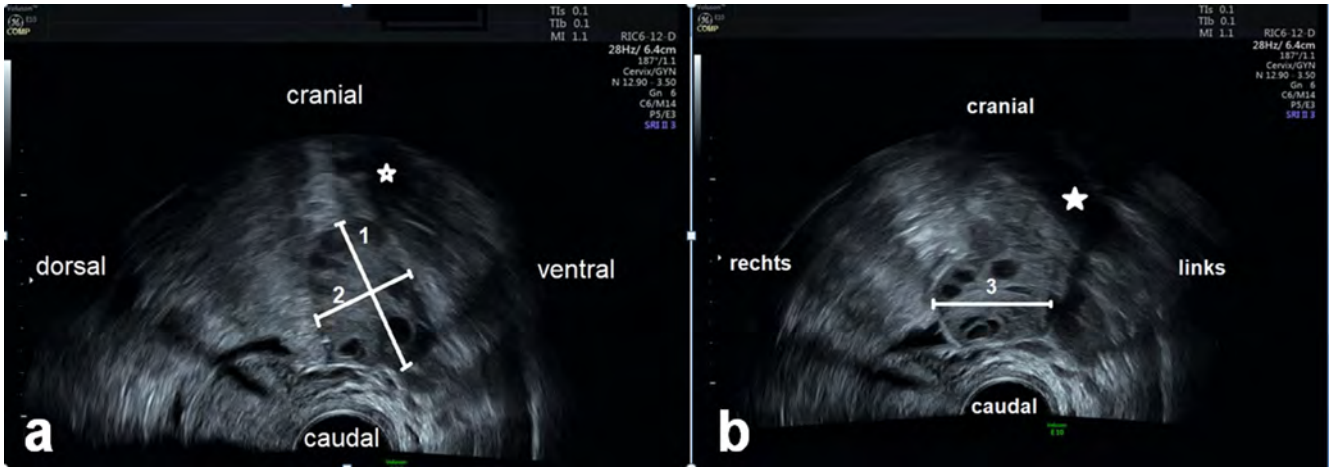
If a transvaginal view of the uterus is not possible or not fully possible, a transabdominal approach is used: Depending on the size and position of the uterus as well as on the anatomical situation (abdominal wall), a full bladder is often but not necessarily required. The selection of the image section, the sector angle, and the image orientation is performed as in transvaginal ultrasound.



▶ **Fig. 2** Transvaginal image of uterus in the upper third of the corpus with measurement of the width of the uterus.



▶ **Fig. 1** Sagittal view of uterus in anteflexion **a** and retroflexion **b** acquired using a transvaginal approach. 1: Endometrial thickness, 2: ap diameter of the corpus uteri (= uterus height), 3: uterus length.



▶ **Fig. 3** Transvaginal ultrasound of a normal ovary with numerous immature follicles. Longitudinal scan **a** and transverse scan **b** of the organ. 1: Ovary length, 2: Ovary height, 3: Ovary width.

Biometry (▶ **Fig. 1, 2**).

- Obligatory
  - ap diameter of the corpus uteri
  - Measurement of double the endometrium height
- Optional
  - Length of the uterus (length of the cervix/corpus)
  - Transverse diameter of the corpus uteri

Adnexa

Ovaries

To visualize the ovaries, the vaginal transducer is guided from the sagittal view laterally to the right or left until the external iliac vessels and the ovaries are visible. The maximum visualizable longitudinal diameter of the ovary is then displayed (▶ **Fig. 3a**). By turning the transducer 90°, cross sections of the ovary can be additionally displayed (▶ **Fig. 3b**). For spatial orientation, the image section should be selected so that segments of the external iliac vessels are also imaged. If the ovary cannot be visualized, the location on the corresponding side is documented so that at least 3 cm of the external iliac artery/vein is shown.

Biometry (▶ **Fig. 3**):

- Obligatory
  - Measurement on one plane (ovary length, width, or height)
- Optional
  - Measurement on two planes (length, width, and height of the ovary)

Fallopian tubes

Fallopian tubes cannot be differentiated in B-mode unless there is contrast enhancement with respect to surrounding or internal fluid. Tubal patency can be checked via transcervical perturbation with physiological saline solution or suitable ultrasound contrast agents. Under physiological conditions, flow via the interstitial portion of the tube can be viewed directly on the B-mode image or using color Doppler or the duplex method.

Pouch of Douglas

When acquiring a sagittal view (▶ **Fig. 1**) of the uterus, the pouch of Douglas must also be evaluated. This makes it possible to detect or rule out fluid collections or masses. During the dynamic examination, the movability between the cervix/posterior wall of the uterus and the rectum is also checked. It can be difficult to examine the pouch of Douglas with the uterus in retroflexion.

Pathological findings

The following sonomorphological indications of pathological changes or diseases of the internal reproductive organs should be detected:

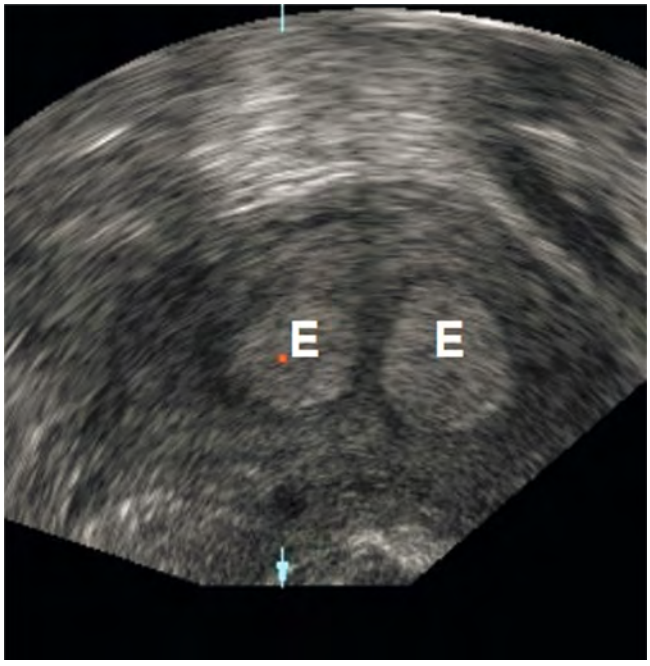
Uterus

Deviations from the typical shape and position

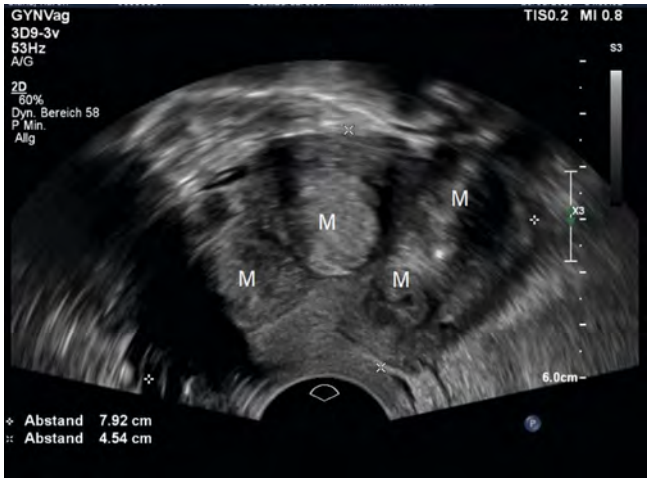
The uterus is typically pear-shaped, and the endometrium has a strictly central position. Deviations with respect to shape and position can be caused by inflammatory or malignant processes in the lesser pelvis or can be attributed to benign processes like myomas, endometriosis, adenomyosis, or congenital uterine anomalies. For the latter, the high transverse view through the fundus is considered critical. Separate endometrial reflections ("owl eyes phenomenon", ▶ **Fig. 4**) result in suspicion of a double uterus. A detailed ultrasound examination to confirm the finding and to classify the congenital uterine malformation is mandatory in this case.

Disproportions between the cervix and the corpus uteri

Physiological changes in the proportions between the cervix and corpus uteri during the life cycle must be taken into consideration: In children and often also in seniors, the cervical length compared to the length of the corpus uteri is greater than in the reproductive phase. Otherwise, an abnormally enlarged cervix can indicate a cervical myoma, cervical polyps, or cervical cancer.



▶ **Fig. 4** Transverse scan of the uterus (upper third of the corpus) with "owl eye phenomenon". The two separate ultrasound reflections of the endometrium are an indication of a longitudinal fusion defect of the uterus with medial septum formation.

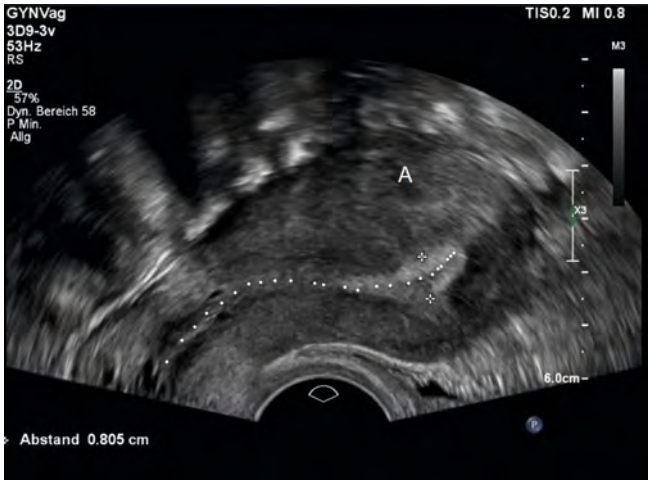


▶ **Fig. 5** Sagittal image of uterus myomatosus in anteflexion. Multiple intramural myomas of varying echogenicity, some with calcification, are seen. The linear endometrium is difficult to delimit.

Changes in the uterine wall

The most common structural abnormalities in the myometrium are caused by myomas. Myomas typically manifest as circumscribed hypoechogenic masses but can also be hyperechogenic or isoechogenic in comparison to the uterine wall and sometimes have calcifications or central necrosis.

The differential diagnosis between myomas (▶ **Fig. 5**) and adenomyosis is typically possible already during the basic examination: asymmetrical uterine wall thickness and a typical change in the shape of the uterine cavity are characteristic for adenomyosis (shape of a question mark, ▶ **Fig. 6**). If there is suspicion of adenomyosis, a detailed ultrasound examination should be performed to verify the diagnosis [13]. Particularly in the case of corresponding clinical symptoms, simultaneous ovarian endometriosis, endometriosis of the Douglas peritoneum, or deep endometriosis with infiltration into the rectum, bladder, or ureters must be ruled out [20].



▶ **Fig. 6** Sagittal view of a uterus in anteflexion with focal adenomyosis in the posterior wall **A**. Asymmetry of the wall thickness and deformation of the cavum uteri in the basic shape of a question mark (dotted line).

Uterine sarcomas typically appear as masses with inhomogeneous echogenicity, sometimes with cystic inclusions. Calcifications and fan-shaped dorsal acoustic shadowing as can be observed in myomas are less common in sarcomas. Sarcomas cannot be reliably differentiated from myomas or focal adenomyosis lesions [21].

In general, lesions in the uterine wall are described based on international classifications and are documented and measured on two planes (length, height, and width) [12, 22].

Intracavitary abnormalities

Pathological changes in the endometrium or focal masses should be documented and described according to internationally published standards [11]. The basis for the differential diagnosis of intracavitary abnormalities (▶ **Table 2**) is measurement of the endometrial thickness, as well as the description of the texture and contour of the endometrium or the mass (▶ **Fig. 7, 8**) and detection or exclusion of an intrauterine fluid collection. Color Doppler ultrasound examination of the degree of perfusion and the vascular pattern can be helpful to differentiate between malignant and benign findings [15].

In premenopausal women, an early pregnancy must be considered when evaluating intracavitary findings. If there is suspicion of a miscarriage, proceed according to the DEGUM recommendations regarding basic ultrasound examination in early pregnancy [23].

Adnexa

Ovary

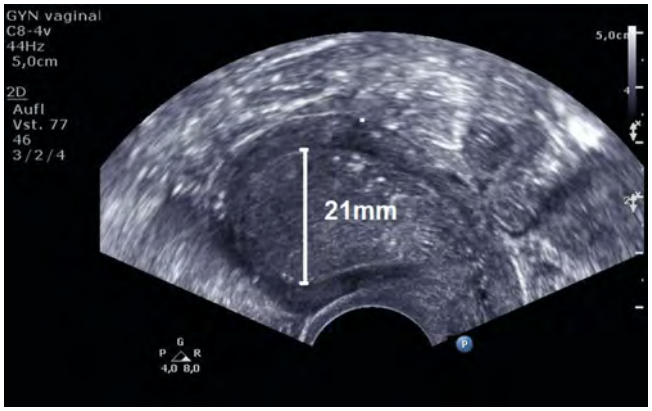
Abnormal findings in the ovaries are presented, classified, and documented based on international standards [9]. In the basic ultrasound examination, pathological findings regarding the ovary should be correctly described based on size, wall structure, internal structure, and perfusion and differentiated from physiological findings (▶ **Fig. 9, 10**).

Hemorrhagic cysts (▶ **Fig. 11**), cystadenomas (▶ **Fig. 12**), dermoid cysts (▶ **Fig. 13**), and endometriotic cysts (▶ **Fig. 14**) can be diagnosed with high validity sonomorphologically in the majority of cases already in the basic ultrasound examination per visual diagnosis [14, 24].

In the case of findings with malignancy criteria (▶ **Fig. 15**) or findings that cannot be classified as benign with high probability (▶ **Table 3**) [17], a detailed gynecological ultrasound examination for differential diagnosis, risk assessment, and surgical planning, if applicable, is needed [14, 24–26].

▶ **Table 2** Pathological intracavitary findings: Differential diagnoses.

Endometrial hyperplasia
Endometrial polyp
Submucosal myoma
Endometrial cancer
Endometrial stromal sarcoma
Miscarriage

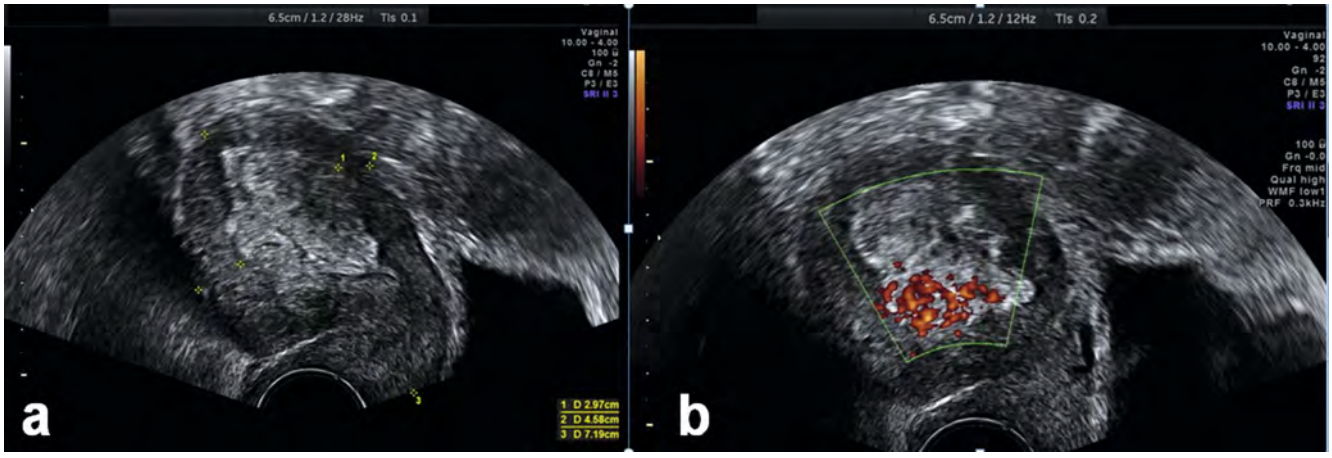


▶ **Fig. 7** Sagittal view of the uterus in retroflexion. Thick endometrium with a smooth border to the uterine wall and absence of a central echo. Depending on menopause status and symptoms, detailed ultrasound examination and histological workup are indicated.

Fallopian tube

The most common finding regarding the fallopian tube that can be diagnosed on ultrasound is sactosalpinx (▶ **Fig. 16**). The main symptoms on ultrasound are tubular, incompletely septated periovarian anechoic masses (hydrosalpinx) or dispersed masses (pyosalpinx, hematosalpinx) [27]. Nodular or thickened wall structures and free fluid or dispersed structures in the pouch of Douglas indicate an inflammatory process [28]. However, tubal obstruction is often associated with endometriosis. It is not always easy to differentiate from septated ovarian cysts or an obstructed bowel.

In the case of unilateral findings together with free fluid and/or blood clots in the pouch of Douglas, a tubal pregnancy must always be considered. Ectopic pregnancies are most common by far in the ampullary region of the fallopian tube but can also be located in the isthmus region or the interstitial region, or more rarely can be located in the cervix, the ovary, or in the pouch of Douglas. In the majority of cases, targeted sonographic imaging of an ectopic pregnancy can be achieved with the criteria shown in ▶ **Table 4** [29–31]. A high endometrium and a fluid collection located centrally between the two sides of the endometrium ("pseudogestational sac") are often additional factors. However, they do not have sufficient predictive value. The same is true for color Doppler ultrasound imaging of circumscribed vascularization around the ectopic gestational sac. Although this is regularly

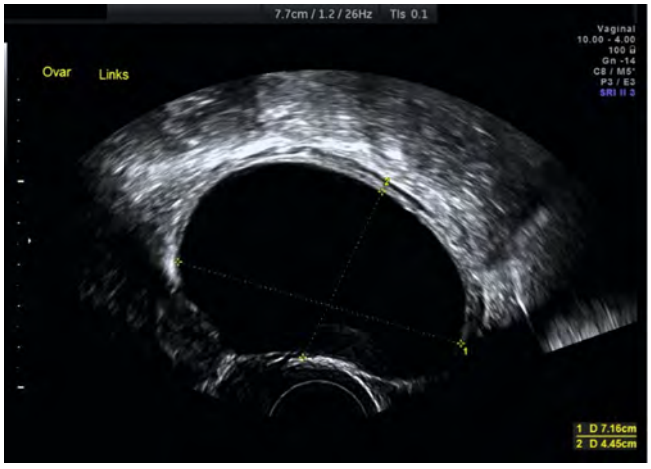


▶ **Fig. 8** Sagittal view **a** of the uterus in retroflexion, endometrium with poorly defined border to the myometrium, focal perfusion pattern suspicious for malignancy **b**. Histological workup after detailed ultrasound examination is indicated.

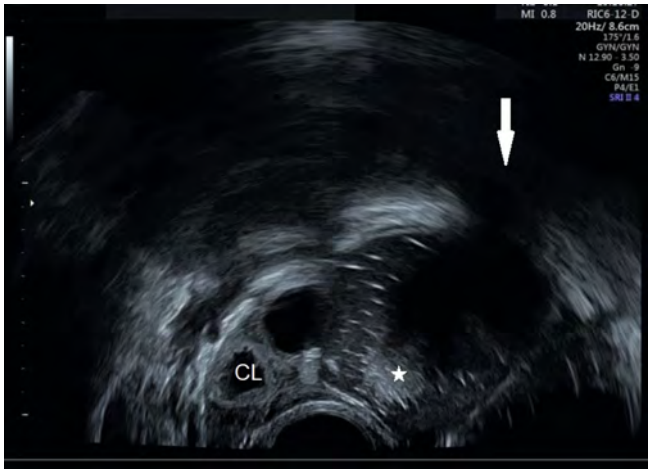
▶ **Fig. 9** Ovary with mature follicle (normal finding).

▶ **Fig. 10** Corpus luteum (normal finding).

▶ **Fig. 11** Hemorrhagic ovarian cyst with fresh bleeding. Masses with a smooth border with intracystic free-floating, web-like structures are pathognomonic here. In follow-up examinations after approximately 6–8 weeks, such findings have usually regressed.



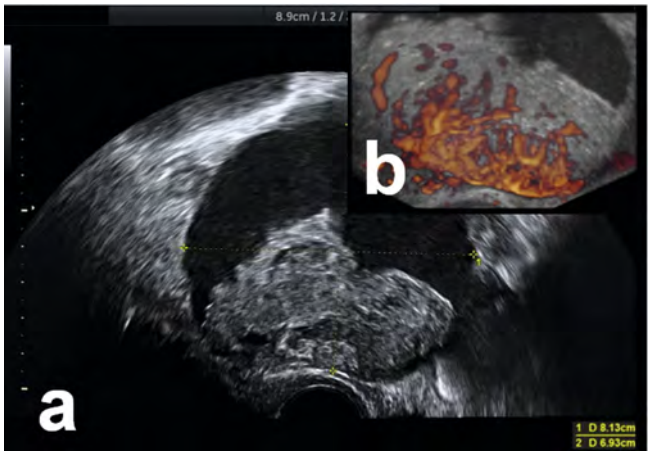
▶ **Fig. 12** Simple anechoic ovarian cyst with a smooth border. The finding is typical for a serous cystadenoma.



▶ **Fig. 13** Simple ovarian cyst with smooth border and mixed internal echo with hyperechogenic streak-like reflections, round hyperechogenic portion (*) and dorsal acoustic shadowing (arrow) at the upper edge of an otherwise normal ovary with corpus luteum (CL). The finding is typical for a dermoid cyst.

present in tubal pregnancies, the corpus luteum has a comparable perfusion pattern. Basic ultrasound examination can lead to a corpus luteum being confused with a tubal pregnancy resulting in a false-positive diagnosis. In the case of sonomorphological criteria of a tubal pregnancy (▶ **Table 4** and ▶ **Fig. 17**), the urgency of a surgical intervention depends on the clinical status of the patient and the estimated amount of intraabdominal blood. If the patient does not have any symptoms, the further approach is based on the combination of the evaluation of transvaginal ultrasound and the serum beta HCG concentration over time [30]. In unclear cases, particularly in the case of suspected heterotopic pregnancy or in ectopic pregnancies outside the fallopian tube (cervix, c-section scar, ovary, abdominal cavity), a detailed sonographic examination is recommended as long as the patient is in stable clinical condition.

▶ **Fig. 14** Simple ovarian cyst with a smooth border with homogeneous internal echo with ground glass appearance. The finding is typical for an endometriotic cyst.



▶ **Fig. 15** Cystic-solid adnexal tumor with papillary solid internal structure **a** and very strong vascularization (color score 4 based on IOTA criteria [17]) **b**. Due to suspicion of malignancy, detailed ultrasound examination is indicated as the next imaging method.

Adnexal torsion

The diagnosis of adnexal torsion is based on a combination of clinical picture and sonographic criteria (edema and enlargement of the ovary and/or fallopian tube and Doppler ultrasound imaging of the twisted vascular pedicle = whirlpool sign), which are discussed in greater detail in the quality requirements for gynecological examinations for DEGUM level II [32]. Since suspicion of adnexal torsion represents an emergency, the diagnosis should be able to be made in the basic ultrasound examination.

Pouch of Douglas

Fluid collections in the pouch of Douglas should be quantified (measurement on 2 planes perpendicular to one another: length, width, height). The echogenicity of the fluid is also evaluated:

▶ **Table 3** Basic ultrasound examination of adnexal tumors (IOTA simple rules [17]).

Malignancy criteria	
Irregular solid tumor	
Ascites	
Tumor includes at least 4 papillary structures	
Irregular multicystic solid tumor with a maximum diameter > 10 cm	
Very strong vascularization (color score 4)	
Benignity criteria	
Unilocular cyst	
Largest solid portion < 7 mm	
Dorsal acoustic shadow	
Multilocular tumor with smooth border < 100 mm	
No vascularization visible (color score 1)	
Evaluation criteria	
One or more malignancy criteria, no benignity criteria:	Malignant
One or more benignity criteria, no malignancy criteria:	Benign
Both benignity and malignancy criteria	
or	
Neither benignity criteria nor malignancy criteria	Unclear*

* Detailed ultrasound examination is necessary.

▶ **Fig. 16** Sactosalpinx. A tubular shape, incomplete septation, and nodular wall structures are characteristic.

- anechoic = serous fluid,
- dispersed = pus
- inhomogeneous with blood clots = blood.

In the reproductive phase small quantities of serous fluid in the pouch of Douglas are physiological. Sometimes, small blood clots are visible in connection with ovulation.

In the case of larger fluid collections in the pouch of Douglas, papillary peritoneal deposits, masses, or suspicion of obliteration of the pouch of Douglas, detailed gynecological ultrasound examination is indicated as the next diagnostic measure.

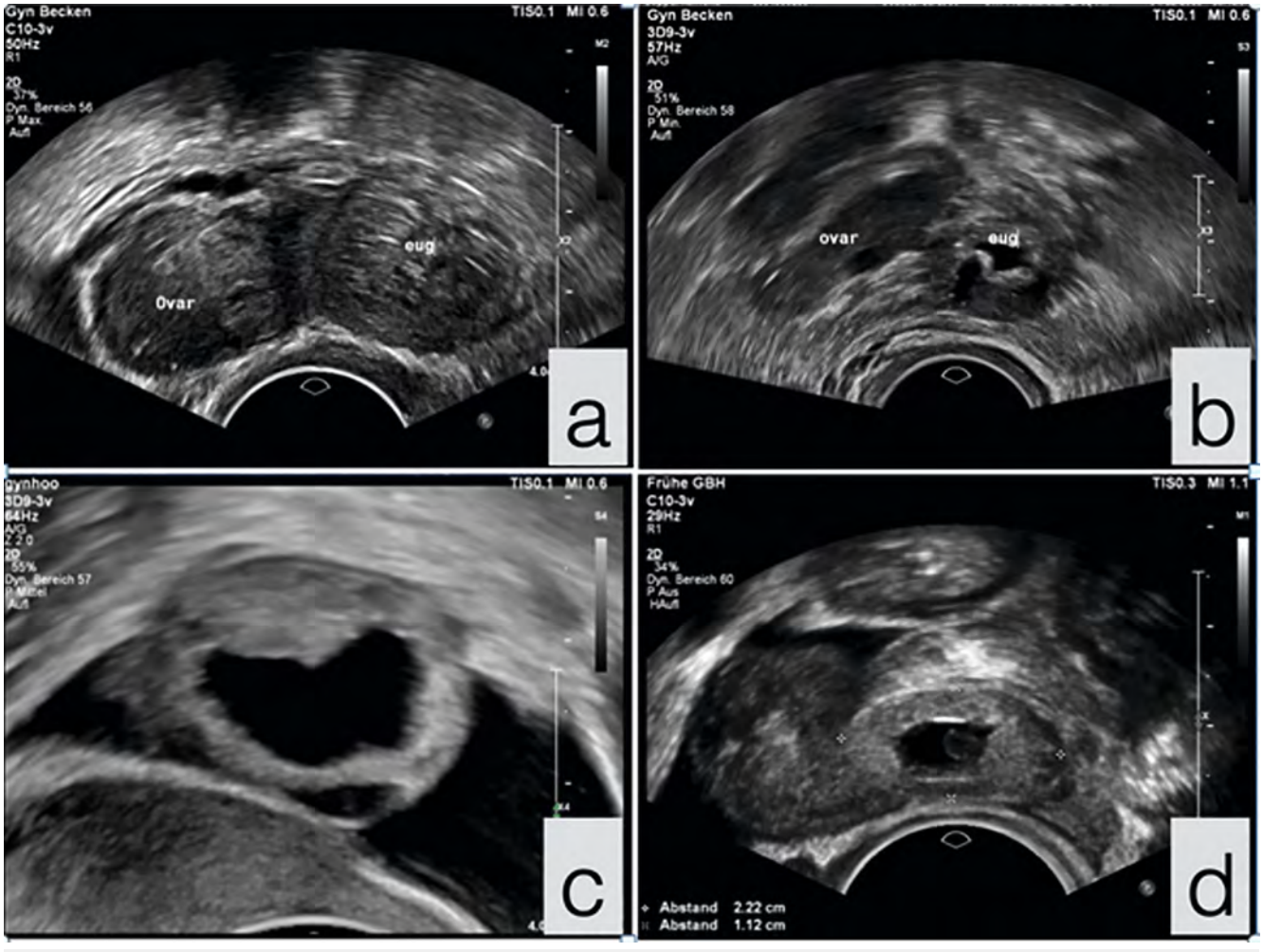
▶ **Table 4** Sonographic criteria for the presence of a tubal pregnancy.

Intrauterine pregnancy not detected
Inhomogeneous, non-cystic mass next to the ovary (blob sign)
Hyperechogenic ring next to the ovary (bagel sign)
Positive sliding sign – ability to move the tubal pregnancy toward the ovary
Ectopic gestational sac with detection of embryonic components and/or yolk sac
Ectopic gestational sac with embryo with or without detection of cardiac activity

Written report and documentation

The written report includes:

- Date of examination
- Patient data
- Medical issue or indication for the examination
- Image documentation of the following parameters
  - Longitudinal section of the uterus with visualization of the cavum/endometrium (measurement of the ap diameter and double the endometrium height)
  - Both ovaries (measurement of length and width or height), if one or both ovaries cannot be imaged, documentation of the relevant adnexal region (with visualization of the external iliac vessels)
- Abnormal findings (imaging and measurement on 2 perpendicular planes: length, width, and height)
- Description and evaluation of the finding
- Diagnosis
- Further approach
- Examiner



▶ **Fig. 17** Various types of tubal pregnancy: **a** inhomogeneous, non-cystic mass next to the ovary. **b** hyperechogenic, ring-shaped mass next to the ovary. **c** hyperechogenic, ring-shaped mass next to the ovary with free fluid. **d** hematosalpinx with detection of a gestational sac and a yolk sac contained therein, free fluid.

In the case of unclear findings in the lesser pelvis, suspicion of a malignancy, or prior to surgical interventions, detailed ultrasound examination is indicated [32].

Conflict of Interest

The authors declare that they have no conflict of interest.

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