



# Curriculum

## ABDOMEN MODULE

In Switzerland, Austria and Germany the training in the abdomen module consists of **courses** and **practical examinations**, including both **controlled** and **independent** examinations. DEGUM, OEGUM and SGUM have common content and mutual recognition of the **basic** and **advanced courses** agreed. In Switzerland exists also final courses, in Germany and Austria exists modular courses, mostly one-day courses with specific themes.

### Introduction

This Curriculum has been discussed in SGUM, OEGUM and DEGUM and was assessed as a good common ground (skeleton) of abdominal ultrasound courses. In SGUM/ÖGUM/DEGUM societies, it will be updated every 3 years. Hereby, we would like to present it as a basis for joint courses in Europe. We invite all EFSUMB-societies to discuss this curriculum with us. This curriculum was conceived for all colleagues teaching ultrasound courses and will serve as a common resource and inspiration for other European courses.

In the autumn of 2007, the SGUM decided to reorganize the 3-part course, in accordance with the OEGUM and DEGUM. The basic and advanced courses are the foundation of abdominal ultrasound. The final course may vary, depending on interest and specialization. The course described below is oriented to the needs of general practitioners and internists. In addition, SGUM has prepared a final course for nephrologists, which takes into account their specific needs. Also, courses designed for other specialists interested in the abdomen module are possible. **Each of our course leaders can deepen or modify the proposed content at his/her discretion.**

This Curriculum is only a summary, a common framework, which is designed to assist and inspire tutors and course leaders. This summary includes following parts:

1. **Content of teaching / learning objectives** for each course is presented.
2. **Theoretical knowledge** is listed.
3. **Schedule example** of one of our actual training programs is precisely defined.
4. **Practical exercises** from our basic course will be presented as an appendix.

As mentioned above, this template should not be construed as a rigid schedule but as a tool and help to all colleagues who teach and guide ultrasound courses. The Curriculum provides a common platform that will be updated, further developed or extended to meet future course needs every 3 years.

In evaluating a candidate from the "abdomen" module, the emphasis lies with the mastery of B-mode examination techniques. In addition, the candidate should have a basic understanding of the application of Doppler technology in the abdomen (including twinkling and jet phenomenon).

## **1.Content of Teaching / Learning Objectives:**

### **Common basic abdominal course:**

- ★ The graduate should understand the physical principles of ultrasound including Doppler techniques.
- ★ He/she should master the ultrasound anatomy of the abdominal organs and the thyroid.
- ★ He/she will gain practical experience in the operation of the ultrasound device and should know how to use the various features of the device.
- ★ He/she should be able to understand the basics of examination techniques and systematically examine patients under the supervision of a tutor.
- ★ He/she should understand the principles of e-fast and focused ultrasound.
- ★ He/she should gain practical experience with cases of e-fast and focused ultrasound.

### **Common advanced abdominal course:**

- ★ The graduate becomes familiar with and practiced at identifying the most common and relevant diseases of the liver, gallbladder and bile ducts, spleen, pancreas, retroperitoneum, kidneys and adrenal glands, urinary tract and the internal genitalia.
- ★ He/she should be able to apply the examination techniques (including CDUS) to the major abdominal disorders
- ★ Under the supervision of a tutor and independently, he/she is able to gather further practical experience.

### **Switzerland: final abdominal course for general internal medicine:**

- ★ The graduate should learn the most common and relevant diseases of the gastrointestinal tract, the abdominal wall, lungs and pleura, the deep veins of the legs, scrotum, thyroid gland, the superficial lymph nodes and other soft tissues (hematoma, muscle tears etc.).
- ★ He/she should be able to practically apply the examination techniques (including CDUS) for the major diseases of the gastrointestinal tract, the abdominal wall, pleura and lung, the deep veins

of the legs, scrotum, thyroid, lymph nodes and other soft tissue.

- ★ He/she is to independently integrate all practical experiences.

### **Switzerland: final abdominal course for nephrology:**

- ★ The graduate should deepen his knowledge of the diseases of the kidneys and adrenal glands, the urinary tract, including evaluation of the renal arteries, the transplanted kidney and the hemodialysis shunts.
- ★ He/she should be able to practically apply the examination techniques (including renal biopsy, CDUS and spectral curves) to the major diseases of the kidneys, adrenals, urinary tract, transplants and A / V fistula.
- ★ He/she is to independently integrate all practical experiences.

### **Germany, Austria: Modules:**

Different modular courses with specific themes (neck, thyroid, emergency...) will be existing instead of final courses.

## **2. Theoretical knowledge:**

### **BASIC ABDOMINAL COURSE**

#### **Setting:**

Total number of hours (1 teaching hour= 45 min): 28-30 hours, of which more than 50% are practical lessons. The optimum number of participants per ultrasound device is 3-4, the maximum is 5. Participants can examine each other. It is optimal when there is one tutor per US-device. In practice, there are often two US-devices per one tutor but there must be only 3 participants per US-device, which increases the active time of the participants. The participants benefit by gaining a much higher degree of valuable practical experience in their examination technique.

#### **Learning Content:**

##### **Technical basics and examinations technique 1:**

- Sound frequencies of nature, laws of wave mechanics and optics (reflection, scattering, bending, refraction, absorption, attenuation)
- Generation of ultrasound waves (quartz crystals, special ceramics)
- Piezoelectric effect
- Relationship between frequency and wavelength
- Axial and lateral resolution as well as influence of the wavelength
- Types of ultrasound equipment: A-mode, B-mode, M-mode
- Pulse mode and calculation of depth
- Various probes and its application: linear, convex, sector.
- Attenuation and depth of penetration, influence of wavelength

- Attenuation compensation: Compensation Depth, Time Gain Curve
- Artifacts: posterior shadow, posterior echo enhancement, tangential shadow, reverberations, bow artifact, space-time error, mirroring, blooming, twinkling
- Indication of ultrasonography
- Ultrasonography as a test
  - Pretest probability
  - Sensitivity and Specificity
  - Baye`s Theorem
- Ultrasound as a clinical investigation
  - Study document
  - Supplement the medical history
  - Palpation under ultrasound view
  - Systematic abdominal ultrasound investigation
  - Patient Information
- Patient Preparation
  - sober, non-carbonated drinks, no milk, no coffee
  - No urination before the examination
- Patient Position
  - Supine position
  - Oblique lateral position
  - Prone position
  - Elbow-knee position
  - Standing position
- Report visually and in writing
- Sonomorphological assessment criteria
  - Location
  - Size
  - Shape
  - Contour
    - smooth / nodular
  - Echogenicity
    - anechoic / hypoechoic / hyperechoic / complex
    - homogeneous / inhomogeneous / coarsened
  - Architecture

### **Technical basics - Doppler technique 2:**

- Explanation of the mathematical formula and Importance of the acoustic angle
- Principle of CW-Doppler
- Frequency-time spectrum (spectral analysis)
- Principle of the pulsed wave Doppler (PW-Doppler)
  - Sample volume, Gate
  - Pulse repetition frequency (PRF)
  - Nyquist theorem (registrable relationship between PRF and maximum frequency shift)
  - Principle of aliasing
- Principle of CDUS (color duplex ultrasound)
- Principle of PWDS (power duplex sonography)

### **Abdominal Vessels:**

- Anatomy and ultrasound anatomy:
  - Aorta, CA and its main branches, renal vessels, SMA, IMA, pelvic vessels and their main branches.
  - Pelvic veins, vena cava, renal veins, hepatic veins, portal system
  - Lymphatic System
- Normal values: aorta, the definition of the aneurysm and spectral analysis above and below the renal arteries (Vmax, Vmin)
- Normal range (width) in cm, Vmax and Vmin celiac artery (CA), superior mesenteric artery (SMA), inferior mesenteric artery (IMA) and the influence of food intake (SMA)
- Normal values vena cava, venous flow profile
- Normal values portal vein (time average velocity=TAV, portal diameter, flow-volume)

### **Gallbladder / Bile Ducts:**

- Anatomy and US-anatomy
  - Location of the gallbladder
  - Relationship bile ducts / portal vein / a. hepatica
- Normal values gallbladder
- Normal values bile ducts

### **Liver:**

- Anatomy and US-anatomy
- Shape variations
- Vascular supply
- Segmental anatomy

### **Spleen, Lymph Nodes and Pleura:**

- Spleen anatomy and US-anatomy
- Normal variants
- Vascular supply
- Normal values spleen size
- Ultrasound anatomy and normal size of lymph nodes
- Examination technique chest / pleura (sitting position)
- Calculation of pleural effusion

### **Pancreas:**

- Anatomy and ultrasound anatomy
- Normal variants
- Locations and access, surrounding structures
- SMA, gastroduodenal artery and bile duct
- Relationship to splenic vein
- Representation of the tail of the pancreas through spleen

### **Kidneys / Adrenals:**

- Locations of the kidneys and normal variants
- Normal values: thickness of parenchyma, kidney length and kidney volume
- Vascular supply, renal segments and segmental arteries
- Normal values renal vessels (diameter, Vmax, Vmin, RI)
- Locations of the adrenal glands, examination technique

### **Bladder / Ureter / Prostate / Seminal Vesicles/ Uterus / Adnexa:**

- Anatomy and ultrasound anatomy of the renal sinus, ureters and bladder
- Urinary obstruction
- Search of stones: twinkling artifact
- Urine jet
- Residual urine, depending on the baseline
- Volume of the bladder: length and depth in the longitudinal, width in the transversal cuts
- Perineal sonography
- Anatomy and US-anatomy of the prostate and seminal vesicles
- Normal values for volumes of the prostate
- Measurement in longitudinal section along the urethra and 90 degrees to > width in cross section.
- Anatomy and US-anatomy of the uterus and adnexa
- Measurement: uterine length and volume of the ovaries

### **Neck/ Thyroid / Scrotum / Intestine:**

- Anatomy and US-anatomy the SD and the surrounding neck structures, ie vessels, muscles, lymph nodes, salivary glands and tongue / floor of mouth
- Values SD standard volume
- Measurement of intima-media thickness of the common carotis artery (CCA)
- Anatomy of the scrotum and US-anatomy
- Anatomy and US-anatomy of the intestinal tract

### **Principles of focused ultrasound:**

- Clinical Context
- Definition and scope
- Concept

### **Extended Fast:**

- Free fluid in the abdomen
- Pleural effusion
- Pneumothorax

### **Emergency ultrasound- core applications:**

- Gallstones
- Urinary obstruction
- Abdominal aortic aneurysm
- Deep venous thrombosis

### **Punctures:**

- Ascites
- Pleura
- Abscess
- Vessels

### **Quiz, Course Evaluation**

## **ADVANCED ABDOMINAL COURSE**

### **Setting:**

Total number of hours: 16-23, of which more than 50% are practical lessons. The maximum number of participants per ultrasound device is 4. There is also one tutor per each US-device. The practical exercises with patients should be performed in one-hour sequences. To allow for a more varied practical experience, the groups should be rotated every 30 minutes. An examination period less than 30 minutes brings with it unnecessary rush and the feeling of having insufficient time for the investigation. A clear division of participants into their respective groups helps them focus more intensely and precisely on the work.

### **Learning Content:**

#### **Repetition of Systematic Abdominal Examination: Demonstration**

- Longitudinal cuts of the liver: US-device customization
- Scanning and palpation of left liver segments under ultrasound view, clinical “elastography”
- Representation of the aorta, celiac trunk, AMS, both renal arteries (CDUS)
- Cross cuts with pancreas, representation of bile duct in head of the pancreas
- Portal vein and extrahepatic bile ducts.
- Subcostal cuts of the liver, with systematic scanning technic, hepatic veins with CDUS
- Gallbladder and intrahepatic bile ducts
- Right intercostal cuts: liver / gallbladder, kidney with measurement, pleural
- Intercostal view: left kidney and spleen, pancreas tail, pleura
- Infrarenal aorta with branches (CDUS), pelvic vessels, inferior vena cava
- Lower abdominal longitudinal and transverse bladder and uterus / vagina / urethra, respectively.
- Seminal vesicles, prostate volume measurements
- Intestinal representation specifically (cecum / appendix / terminal ileum, sigma / descending colon)

#### **Gallbladder and Bile Ducts:**

- Cholecystolithiasis
- Sludge
- Acute cholecystitis
- Cholesterosis
- Gallbladder polyps
- Gallbladder carcinoma
- Intra-and extrahepatic cholestasis
- Choledocholithiasis

- Caroli's disease and other biliary cystoid changes
- Pneumobilia
- Cholangiocarcinoma (Klatskin tumor)

### **Liver Disease Part 1: Diffuse Disease:**

- Fatty liver disease, including severity levels 1-3.
- Inhomogeneous focal steatosis or non-steatosis
- Acute lesions (hepatitis, intoxication, congestion)
- Chronic hepatitis
- Fibrosis, including hereditary forms
- Budd-Chiari Syndrome
- Forms of cirrhosis (alcohol, primary biliary, virus hepatitis B and C, Wilson`s disease, hereditary hemochromatosis)
- Portal venous flow measurement for various diseases

### **Liver Disease Part 2: Focal Changes:**

- Anechoic changes
  - Liver cysts
  - Cystic hydatid
  - Cyst Liver
  - Vascular anomalies
  - Bile duct anomalies
- Hypoechoic changes
  - Hematoma
  - Abscesses
  - Focal non-steatosis
  - Metastases
  - Adenomas
  - Focal nodular hyperplasia (FNH)
  - Hepatocellular carcinoma (HCC)
- Hyperechoic changes
  - Hemangiomas
  - Focal steatosis
  - Metastases
  - Calcifications

### **Pancreas:**

- Acute pancreatitis
- Chronic pancreatitis
- Cystic pancreatic changes
- Pancreatic cancer

### **Aorta, Inferior Vena Cava, Retroperitoneum, Spleen:**

- Aorta and its main branches, iliac arteries
- Vena Cava and other abdominal veins (excl. portal vein)
- Other changes in the retroperitoneum



- Retroperitoneal spaces, acute (inflammatory) changes
- Retroperitoneal Fibrosis
- Changes of lymphnodes
- Spleen:
  - Splenomegaly
  - Spleen injuries
  - Splenic infarction
  - Focal changes

### **Kidneys Part 1: Diffuse Disease**

- Disease associated with large kidneys
  - Acute Glomerulonephritis
  - Acute interstitial Nephritis
  - Acute Pyelonephritis
  - Amyloidosis
- Disease associated with small kidneys
  - Chronic Glomerulonephritis
  - Chronic Pyelonephritis
  - Analgetic Nephropathy
- Renal vascular disease
  - Renal artery stenosis
  - Renal vein thrombosis

### **Kidneys Part 2: Focal Changes and Adrenals:**

- Anechoic Changes
  - Renal cysts
  - Polycystic kidney disease
  - Cystic renal cell carcinoma (RCC)
- Hypoechoic changes
  - Renal adenoma / Oncocytoma
  - RCC
  - Focal pyelonephritis / Abscess
- Hyperechoic changes
  - Angiomyolipoma
  - Focal pyelonephritis
- Changes in the adrenals
  - Anechoic changes
    - Adrenal cysts and cystadenomas
    - Adrenal bleeding
  - Hypoechoic changes
    - Adrenal adenoma / Incidentaloma
    - Pheochromocytoma
    - Metastasis / Lymphoma

- Hyperechoic changes
  - Myelolipoma
- Perirenal changes
  - Hematoma
  - Abscesses
  - Infiltrates of Lymphoma
  - Liposarcoma

### **Urinary tract, Bladder:**

- Renal sinus changes
  - Anechoic
    - Hydronephrosis
    - Reflux
    - Renal Vein Width
    - Ampullary pelvis
    - Megapolykalikose
    - Parapelvic cysts
  - Hypoechoic
    - Renal Pelvic Tumors
    - Bleeding / Hematoma
  - Hyperechoic
    - Stones
    - Tbc
    - Calcium Milk
    - Vascular Calcification
- Ureter and Bladder Changes
  - Residual urine
  - Urine Jet
  - Stones
  - Bladder Outlet Obstruction and Diverticulum
  - Bladder cancer

### **Uterus and Adnexa; Prostate:**

- Uterus disease
  - Myoma and Leiomyosarcoma
  - Endometrial thickening, including Endometrial Carcinoma
- Adnexal disease
  - Salpingitis
  - Cystic Changes
  - Ovarian Cyst
  - Polycystic Ovaries
  - Ovarian Kystoma
  - Ovarian Cancer
  - EUG

- Prostate
  - Benign Prostatic Hyperplasia (BPH)
  - Prostatic Cysts
  - Prostatitis
  - Prostate Cancer

**Acute intestinal disease:**

- Appendicitis
- Diverticulitis

**Quiz, Course Evaluation.**

## **FINAL ABDOMINAL COURSE**

**Setting:**

Total number of hours: 16, of which more than 50% are practical lessons. The maximum number of participants per ultrasound device is 4. There is one tutor per each US-device. The practical exercises with patients should be performed in one-hour sequences. To allow for a more varied practical experience, the groups should be rotated every 30 minutes. An examination period less than 30 minutes brings with it unnecessary rush and the feeling of having insufficient time for the investigation. A clear division of participants into their respective groups helps them focus more intensely and precisely on the work.

**Learning Content:**

**Repetition of ultrasound examination: intestine, neck, abdominal wall, thorax: demonstration**

- Systematic investigation intestine (linear probe)
  - Stomach
  - Small Intestine
  - Terminal ileum
  - Appendix
  - Ascending, transverse, descending colon
- Systematic neck examination (linear probe)
  - Thyroid transversal cuts
  - Thyroid longitudinal cuts
  - Thyroid volume measurement (convex probe)
  - Thyroid CCDS examination
  - Salivary glands: eq. submandibular / sublingual and parotid gland
  - Search lymphnodes: along carotid artery to jaw angle, and sternocleidomastoideus muscle
  - Representation of the tonsils in the angle of the jaw
  - Measurements of intima media thickness (IMT) in the common carotid artery, formation of plaques

- Systematic examination of the chest (convex and linear probe)
  - Sitting position, dorsal, lateral ventral cuts
  - Lying position, oblique cuts (diaphragm)
- Systematic abdominal wall examination (linear probe)
  - Lying position, checking abdominal wall layer for hernia and other abnormalities
  - Inguinal region lying + standing, check with palpation, valsalva maneuver and cough under ultrasound control view
  - Location of the inferior epigastric artery (delineation of direct and indirect inguinal hernia) and the femoral vessels (medial to it femoral hernia search)

### **Gastrointestinal System:**

- Stomach changes
  - Pyloric stenosis
  - Gastric retention
  - Gastric ulcer
  - Gastric lymphoma
  - Stomach cancer
  - Rare tumors (leiomyoma, sarcoma)
- Small bowel changes
  - Acute gastroenteritis
  - Sprue
  - Small bowel obstruction
- Changes in the right lower abdomen
  - Appendicitis
  - Right side diverticulitis
  - Ileocolitis
  - Crohn's disease
- Changes in the left abdomen
  - Diverticulitis
  - Ulcerative colitis
- Further changes
  - Intestinal cancer
  - Intestinal lymphoma
  - Intestinal bleeding
  - Ileus
  - Iliopsoas muscle syndrome
  - Peritonitis
  - Peritoneal carcinosis

### **Changes in the abdominal wall:**

- Hernias
  - Inguinal hernias
  - Femoral hernia
  - Spiegel `s hernia
  - Incisional hernia
- Other abdominal wall lesions
  - Cicatricial changes
  - Hematoma
  - Inflammatory lesions (abscesses)
  - Tumors (lipomas)

- Metastases
- Bypass circulation in liver cirrhosis

### **Changes in lymph nodes and scrotum:**

- Lymph node changes
  - Reactive
  - Lymphoma
  - Metastases
- Scrotal changes
  - Anechoic changes
    - Hydrocele
    - Seroma
    - Spermatocele
    - Testicular cyst
    - Varicocele
  - Hypoechoic changes
    - Scrotal hematoma
    - Scrotal edema
    - Testicular torsion
    - Testicular rupture
    - Epididymitis
    - Orchitis
    - Testicular abscess
    - Testicular tumours
    - Seminoma
  - Echorich and complex changes
    - Testicular calcifications
    - Microlithiasis
    - Dystrophic calcification
    - Corpus librum
    - Calcified testicular atrophy
    - Epidermoid cyst

### **Thyroid and other neck organs:**

- Diffuse thyroid changes
  - Pyramidal lobe
  - Aplasia, hypoplasia
  - Diffuse goiter
  - Basedow's Goiter
  - Thyroiditis
    - Acute thyroiditis
    - Subacute thyroiditis de Quervain
    - Hashimoto's thyroiditis
- Focal thyroid changes
  - Multinodal Goiter (MNG)
  - Hyperechoic node
  - Hypoechoic nodes
    - Microfollicular adenoma
    - Papillary carcinoma

- Rare changes
- Changes in the salivary glands
  - Inflammatory changes
  - Warthin tumour
  - Pleomorphic adenoma
  - Rare changes
- Carotid artery: intima media thickness
  - Correct measurement
  - Importance of the intima media thickness
  - Plaques

## **Chest**

- Rib changes
  - Rib fracture
  - Rib metastases
- Chest wall lesions
  - Lipoma
  - Metastases
- Pleural changes
  - Pleural effusion
    - Transudate
    - Exudate
  - Pleurisy
    - Tbc
    - Pleural carcinosis
  - Pleural Mesothelioma
- Peripheral pulmonary consolidation
  - Pneumonia
  - Carcinoma
  - Pulmonary
  - Pulmonary infarction
  - Atelectasis
- Mediastinum
- Aortic aneurysms (ascending aorta, aortic arch)

## **Diagnosis of deep vein thrombosis (DVT):**

- Anatomy of leg veins
- Examination technique of leg veins under inclusion of CDUS
- Physical examination and laboratory testing in DVT
- Ultrasound findings in DVT
- Ultrasound findings in deep venous insufficiency

## Diagnosis of other soft tissue changes:

- Hematoma
- Edema
- Muscle tear
- Abscess
- Perianal fistula
- Sacral dermoid
- Baker's cyst and other ganglions
- Subcutaneous and musculoskeletal tumors

## Ultrasound examination: Report, photographic documentation, billing

- Country specific lectures

• **Contrast enhanced Ultrasound (CEUS):** This is an optional lecture, which can be replaced by the deepening of the above topics or another topic. One might also demonstrate complex cases with the inclusion of CEUS. Subsequent practical examinations can be conducted, such as viewing and evaluating especially rare or interesting cases.

## 3. Schedule examples:

### Common basic abdominal ultrasound course

#### Thursday

13.00-13.10: Welcome, introduction  
13.10-13.40: Technical Basics and Examinations Technique: Theory  
13.40-14.40: Technical Basics and Examinations Technique: Practical examination in groups  
14.40-15.10: Doppler ultrasound: Theory  
15.10-16.20: Doppler ultrasound: Practical examination in groups  
16.20-16.40: Break  
16.40-17.00: Abdominal vessels: Theory  
17.00-18.00: Abdominal vessels: Practical examination in groups

#### Friday

08.00-08.20: Gallbladder / bile ducts: Theory  
08.20-09.20: Gallbladder / bile ducts: Practical examination in groups  
09.20-09.40: Liver: Theory  
09.40-10.00: Break  
10.00-11.00: Liver: Practical examination in groups  
11.00-11.20: Spleen, lymph nodes and pleura: Theory  
11.20-12.20: Spleen, lymph nodes and pleura: Practical examination in groups  
12.20-13.30: Lunch  
13.30-13.50: Pancreas: Theory  
13.50-14.50: Pancreas: Practical examination in groups  
14.50-15.10: Kidneys / Adrenals: Theory

15.10-16.10: Kidneys / Adrenals: Practical examination in groups  
16.10-16.30: Break  
16.30-16.50: Bladder / Ureter/ Prostate / Uterus: Theory  
16.50-18.00: Bladder / Ureter/ Prostate / Uterus: Practical examination in groups

### **Saturday**

08.00-08.20: Neck / Intestine: Theory  
08.20-09.20: Neck / Intestine: Practical examination in groups  
09.20-09.40: Break  
09.40-10.00: Principles of focused Ultrasound: Theory  
10.00-10.15: Gallbladder Stones: Theory  
10.15-10.30: Urinary Obstruction: Theory  
10.30-10.45: Abdominal Aneurysm: Theory  
10.45-11.00: Deep venous Thrombosis: Theory  
11.00-12.30: Practical examination in groups Lunch  
12.30-13.30: Lunch  
13.30-13.50: E-FAST: Theory  
13.50-14.30: E-FAST: Practical examination in groups  
14.30-14.50: Punctures: ascites, pleura, abscess: Theory  
14.50-15.05: Punctures: vessels: Theory  
15.05-16.00: Punctures: vessels: Practical examination in groups (model)  
16.00-17.00: Quiz, Course evaluation

## **Common advanced abdominal ultrasound course**

### **Day 1 (Friday):**

08.00-08.15 Introduction  
08.15-08.45 Systematic abdominal ultrasound examination: Demonstration  
08.45-09.45 Practical examination in groups  
09.45-10.00 Break  
10.00-10.30 Gallbladder and Bile Ducts  
10.30-11.30 Practical examination in groups  
11.30-12.00 Liver Disease Part 1: Diffuse Disease  
12.00-13.30 Lunch  
13.30-14.30 Practical examination in groups  
14.30-15.00 Liver Disease Part 2: Focal Changes  
15.00-16.00 Practical examination in groups  
16.00-16.30 Break  
16.30-17.00 Pancreatic Disease  
17.00-18.00 Practical examination in groups

### **Day 2 (Saturday):**

08.00-08.15 "wake-up" Quiz (repetition of the previous day)  
08.15-08.45 Aorta, vena cava, retroperitoneum, spleen  
08.45-09.45 Practical examination in groups  
09.45-10.00 Break  
10.00-10.30 Kidneys, adrenals  
10.30-11.30 Practical examination in groups



11.30-12.00 Urinary system, bladder, prostate  
12.00-13.30 Lunch  
13.30-14.30 Practical examination in groups  
14.30-15.00 Uterus, Ovaries  
15.00-16.00 Practical examination in groups  
16.00-16.30 Break  
16.30-17.00 Acute intestinal disease  
17.00-18.00 Practical examination in groups  
18.00-18.30 Quiz, Course Evaluation

## **Swiss final abdominal ultrasound course:**

### **Day 1 (Friday):**

08.00-08.15 Introduction  
08.15-08.45 Examination technique: intestine, neck, thorax, abdominal wall: demonstration  
08.45-09.45 Practical investigations  
09.45-10.00 Break  
10.00-10.30 Bowel disease  
10.30-11.30 Practical investigations  
11.30-12.00 abdominal wall, hernia  
12.00-13.30 Lunch  
13.30-14.30 Practical investigations  
14.30-15.00 Lymph node changes, scrotum  
15.00-16.00 Practical investigations  
16.00-16.30 Break  
16.30-17.00 Thyroid, neck  
17.00-18.00 Practical investigations

### **Day 2 (Saturday):**

08.00-08.15 Wake-up Quiz (repetition of the previous day)  
08.15-08.45 Chest  
08.45-09.45 Practical investigations  
09.45-10.00 Break  
10.00-10.30 Diagnosis of deep vein thrombosis  
10.30-11.30 Practical investigations  
11.30-12.00 Soft tissue changes  
12.00-13.30 Lunch  
13.30-14.30 Practical investigations  
14.30-15.00 CEUS options  
15.00-16.00 Practical investigations  
16.00-16.30 Break  
16.30-17.00 Report, photographic documentation, billing  
17.00-18.00 Quiz, course evaluation

## **4. Practical exercises: Basic Course:**

### **Technical Basics 1: practical exercises "Knobology" 1**

- Probe selection and frequency selection
- Holding the probe, subcostal cut

- Total gain
- Penetration (field of study: full frame!)
- TGC (sliders series) (CAVE: different behind the bladder!)
- Focus (foci)
- Dynamic Range (DR) variation of the gray values (picture hardness)
- Photopic Imaging (coloring, optimized contrast)
- Distance and volume measurements

## Technical Basics 2: practical exercises " Knobology " 2

- Probe selection, frequency selection for B-mode and Doppler
- Order: first B-mode, then CDUS or PWDS, then spectral curve, if not possible, again the same sequence: B-mode ...
- CDUS, aorta cuts:
  - Color box: size and location set (as small as possible to keep)
  - Steering of the color field (linear probe)
  - Gain of the doppler signal
  - PRF setting (field scale), setting the max. frequency shift (as a max. calculates speed)
- PW Doppler, setting internal carotid artery:
  - Gate: setting the size and position (2 / 3 of lumen)
  - Steering doppler beam, (linear probe)
  - Gain of the Doppler signal
  - Angle correction (calculation of flow velocity)
  - PRF (or velocity, scale): setting of the maximum frequency shift (as a max. calculates speed)
  - Zero lines shift
- Measurements:
  - Vmax and Vmin (stenosis)
  - RI (nephrology, cancer diagnosis)
  - TAV and volume flow (portal venous flow)

## Examination technique: practical exercises

- Patient
  - Positioning
  - Cover with cloth
  - Gel application
- Dealing with the device and ultrasonic probe
  - Setting monitor / screen
  - Subcostal liver: Total gain and TGC
  - Probe: freeze protection
  - Probe position (between the thumb and fingers 2-3, the little finger as a support on the abdomen)
- Exercises
  - Setting an organ in the middle of the screen (wrist tilting)
  - Rotate the probe in place (transverse to longitudinal view and vice versa)
  - Tilting of the probe in place (liver subcostal and intercostal cuts)

## **Abdominal vessels and lymph nodes: practical exercises**

Representation of the proximal aorta with exits in B-mode and CCDS  
Representation of the distal aortic bifurcation with branches in B-mode and CCDS  
Representation of the iliac artery from bifurcation to inguina in B-mode and CCDS

## **Gallbladder / biliary tract: practical exercises**

Representation and Intercostalschnitt subcostal gall to represent and experiment with the infundibulum, the cystic duct, palpation under visual control  
Representation of the portal vein, bile duct, possibly with additional CCDS  
Representation of the pancreatic head, bile duct, possibly with additional CCDS  
Positioning of patient for better representation of the gallbladder

## **Liver: practical exercises**

Systematically liver representation in longitudinal cuts  
Systematically liver representation in subcostal cuts with a fan-shaped technique (including presentation of liver segments)  
Presentation of hepatic veins, with CCDS  
Representation of portal vein in B-mode systematically, with respect to the segments  
Representation of the portal vein with CCDS and PWDS, with portal flow measurement

## **Spleen / chest / pleura: practical exercises**

- Representation of the spleen with measurement of the volume
- Presentation pleura / diaphragm lying with a abdominal curved probe
- Presentation pleura / diaphragm seated, with a abdominal curved probe
- Sitting position: representation of pleura / diaphragm and ribs, including bone-cartilage boundary, with linear probe

## **Pancreas: practical exercises**

- Representation of the pancreas in longitudinal cuts
- Representation of the pancreas in transversal cuts showing the parts: head, uncinate process, body and tail
- Pancreatic duct representation with curved and linear probe, measurement of the pancreatic duct width
- Representation of the pancreatic tail through the spleen
- Representation of pancreas in standing position

## **Kidneys / adrenals: practical exercises**

- Representation in longitudinal section and measuring the length and thickness of kidney parenchyma
- Representation in the short axis measurement of width and depth, kidney volume
- Representation of the adrenal glands in cross cuts (right), and in longitudinal cuts (left)
- Representation of the parenchyma arteries, determination of RI (in the prone position)
- Representation of the renal vessels between aorta and the renal hilus in oblique position, with CDUS

- Representation of the renal vessels at the origin with CDUS and PWDS

### **Bladder / ureter: practical exercises**

- Measurements of bladder volume
- Ureter representation through the bladder wall, "Twinkling"
- Representation of the ureter "Jets"
- Representation of the kidneys in the supine position, with the search of the pyelo-ureteral transition.
- Representation of the crossing point of the ureter with the iliac vessels, with CDUS
- Representation of the kidney in the prone position, with representation of ureter and CDUS and PW Doppler derivation from the subsegmental and arcuate arteries

### **Prostate / seminal vesicles and uterus / adnexa: practical exercises**

- Presentation of prostate, seminal vesicles in the longitudinal and transversal cuts
- Volume measurement of the prostate
- Representation of the uterus, vagina, urethra, in longitudinal and transversal cuts, measurement of uterine length
- Representation of the tubes and ovaries in transversal and longitudinal cuts
- Measuring of the ovarian volume

### **Thyroid / scrotum / intestine: practical exercises**

- Longitudinal and cross-sectional representation of the thyroid, with CDUS.
- Thyroid gland volume measurement.
- Representation of the salivary glands
- Representation of the carotid artery, lymph nodes, tonsils
- Representation of the terminal ileum, Bauhini`s valve, cecum, appendix
- Representation of the descending colon, sigma

### **Systematic abdominal ultrasound examination: practical exercises**

- Longitudinal cuts: liver with palpation under ultrasound view (liver elasticity)
- Representation of the aorta with branches (also CDUS)
- Transversal cuts: pancreas, choledochus duct in pancreas head
- Intercostal cuts: with portal vein (flow velocity), extrahepatic bile ducts.
- Subcostal cuts: liver, hepatic and portal veins, segments (also CDUS)
- Gallbladder and intrahepatic bile ducts
- Intercostal cuts right: liver, gallbladder, kidney, pleura, diaphragm
- Intercostal cuts left: kidney, spleen, pancreas, pleura, diaphragm
- Infrarenal aorta with branches (CDUS), retroperitoneum, inferior cava vein
- Lower abdomen with longitudinal and transverse cuts: bladder and uterus / vagina / urethra, respectively seminal vesicles, prostate, with volume measurements
- Intestinal representation specifically (cecum, appendix, terminal ileum, sigma, descending colon)

These practical exercises are suggestions, resulting from years of applied experience. They serve as an orientation and can be specifically tailored to the needs within a group. In the time available all the exercises can either be shown or displayed, selecting a few for in depth investigation and evaluation.

### **Emergency ultrasound- core applications:**

#### **•Gallstones:**

- representation gallbladder with gallstones in sagittal/ subcostal and intercostal cuts
- Rolling-Stones by changing patients position and representation in standing position
- Stones in Knee-Elbow position

#### **•Urinary obstruction:**

- representation of obstructed kidney in supine position, ureter
- representation of obstructed kidney in prone position, ureter
- uterer and bladder, urinary jets

#### **•Abdominal aortic aneurysm**

- representation of aneurysm in longitudinal and cross cuts
- measurement of aneurysm diameter
- CDUS of aneurysm

#### **•Deep venous thrombosis**

- 2 points compression examination (femoral/ popliteal)
- CDUS in this points

#### **Punctures:**

- Vessels -model, puncture training

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