Point of Care Ultrasound (POCUS) using echoscopy

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Introduction

The introduction of a new type of small handheld ultrasound device brings greater portability and affordability. The basic ultrasound approach with these handheld devices has been defined by European Federation of Societies of Ultrasound in Medicine and Biology (EFSUMB) as “EchoScopy” [(1)]. Currently the smallest device used in daily routine is the Vscan™ (GE Healthcare). The EchoScope provides conventional B-mode and colour Doppler imaging (CDI). The compact size of the EchoScope makes it possible to carry the ultrasound device almost like a stethoscope under most clinical circumstances including visiting patients. Owing to this convenience, the EchoScope could be used as adjunctive tool for the physical examination [(2)]. An atlas in German has been recently published [(3)]. The presented paper is an updated atlas version demonstrating the use and limitation of the Vscan device.

Anatomical structures that can be assessed using echoscopy

Abdomen

Echoscopy is particularly suitable for imaging the heart, vessels, and structures between the blood vessels (organ limits). For example, the size of the gall bladder, extensions of the extra-and intra-hepatic bile ducts and changes in the hepatic portal can be reliably visualised using echoscopy. It is possible to make statements on the blood flow in the portal vein and the hepatic veins. Perihepatic lymph nodes are imaged in the triangle between the portal vein and the lower caval vein at the height of the ductus cysticus. Practical experience on the pancreas is extraordinarily good, in particular in imaging the ductus wirsungianus and peripancreatic liquid behaviour. The sharpness of detail at deep levels is extraordinary. It is therefore often possible to detect the right adrenal gland with its 5 layers. Extensions of the abdominal aorta can be reliably detected. Backing up of urine can be diagnosed unambiguously. A bladder scan is one of the main indications. The examination of the prostate, uterus and vagina as well as the rectum is only for orientation.

Thorax

Another domain in echoscopy is formed by the assessment of the heart, the pericardium and the evaluation of contractility in the framework of required cardiological examinations. Pleural effusion and ascites can be reliably imaged. Excellent imaging is possible on the mediastinum (aortic arch, paratracheal region, aorto-pulmonary window but also the subcarinal region).

Emergency examinations and FAST

Imaging the Douglas's cul de sac in order to assess free liquid is sufficiently possible in almost all cases. Echoscopy has particular practical significance for assessing the urinary bladder and here in particular for the exclusion of overflow incontinence (bladder scan).

Anatomical structures that cannot be assessed using echoscopy

All near-surface anatomical structures cannot be sufficiently assessed using VScan echoscopy, for example the (not pathologically changed) ilioacaecal region, colon sigmoideum, near-surface intestinal structures, the pleural cavity and the lateral and posterior recessus.
The liver parenchyma also cannot be sufficiently assessed; in particular, it is neither possible to exclude nor sufficiently characterise liver tumours. The thyroid and cervical vessels cannot be sufficiently imaged and assessed because of their shallow position. Echoscopy is also not helpful in the assessment of surface lymph node stations. Echoscopy is not suitable for excluding hepatic, renal and pancreatic tumours. It is not possible to precisely define the size of the spleen and kidneys because of the relatively small field of view.

**Abdomen**

**Liver**

In terms of echoscopy, no statement can be made on blood flow in the portal vein and in the hepatic veins. Perihepatic lymph nodes are imaged in the triangle between the portal vein and the lower caval vein at the height of the ductus cysticus. Echoscopy is not suitable for excluding hepatic, renal and pancreatic tumours. It is not possible to measure the liver size precisely because of the relatively small field of view.

**Confluence of the hepatic veins**

**Figure 1 Confluence of the hepatic veins. SV: Segment V of the liver. SVI: Segment VI. SVII: Segment VII. Segment VI. SVIII: Segment VIII. RHV: Right hepatic vein. CHV: Central hepatic vein.**
**Confluence of the portal veins**

Intrahepatic portal vein

Figure 3 Intrahepatic portal vein. The ductus hepatocholedochus (DHC), portal vein (PV) and vena cava inferior (VCI) are shown. SS: Sonic shadow. RHV: Right hepatic vein. ART: Artefact.

a

Hepatic veins

Figure 4 Display of the right hepatic vein, from intercostal in slightly left lateral position. RHV: Right hepatic vein. PV: Portal vein. K: Kidney. ART: Artefact.

a
Gall bladder and bile ducts

The size of the gall bladder, extensions of the extra- and intra-hepatic bile ducts and changes in the hepatic portal can be reliably visualised using echoscopy.

Gall bladder

Figure 5 Gall bladder. VCI: Vena cava inferior. PV: Portal vein. DUO: Duodenum. L: Liver. Note the echoscopically smaller field of view.
**Extrahepatic bile ducts**

**Hepatic portal, lymph nodes dorsal in the ligamentum hepatoduodenale**

Figure 7 Ligamentum hepatoduodenale. Lymph node stations (LN) in the ligamentum hepatoduodenale dorsale in the aperture area of the ductus cysticus (DC) in the ductus hepatochondochus (DHC). L: Liver. A: Arteria hepatica. VCI: Vena cava inferior. PH: Pancreatic head. ARD: Arteria renalis dextra. PV: Portal vein. MA: Stomach.
**Hepatic portal, lymph nodes ventral in the ligamentum hepatoduodenale**

Figure 8 Ligamentum hepatoduodenale. Lymph node stations (LN) in the ligamentum hepatoduodenale ventrale. PUPA: Pars umbilicalis of the portal vein. LLL: Left lobe of the liver. LVA: Ligamentum venosum Arantii. AH: Arteria hepatica. VCI: Vena cava inferior. P: Pancreatic head. ARD: Arteria renalis dextra.
Pancreas.

Practical experience on the pancreas is extraordinarily good, in particular in imaging the ductus wirsungianus and peripancreatic liquid behaviour. Echoscopy is not suitable for excluding pancreatic tumours.

The pancreas in longitudinal section of the organ

Pancreatic head

Figure 10 Cranio-caudal diameter of the pancreatic head (between the markers). The caput pancreatis and the vena cava inferior (VCI) are marked. CO: Confluence of the vena portae. AH: Arteria hepatica.
**Cauda pancreatis**


a

b

c

Figure 12 Cauda pancreatis, colour Doppler sonogram imaging of the splenic vein as a landmark of the cauda pancreatis. CP: Cauda pancreatis. VL: Vena lienalis. "Art vessels": Arterial vessels.

a
Pancreas, Ductus Wirsungianus

Retroperitoneum, large vessels

Aorta longitudinal, cranial

Figure 14 Aorta. Longitudinal section over the Aorta (AO) with imaging of the truncus coeliacus (TC) and the arteria mesenterica superior (AMS). AHC: Arteria hepatica communis. PUPA: Pars umbilicalis of the portal vein. On this image, it is easily recognisable that the field of view diverges significantly in the two procedures.
**Aorta longitudinal, cranial over the truncus coeliacus and arteria mesenterica superior**

Figure 15 Aorta. Aorta (AO) longitudinal over the truncus coeliacus (TC) and arteria mesenterica superior (AMS). VMS: Vena mesenterica superior. D: Diaphragm.
**Aorta lateral over the truncus coeliacus**

Figure 16 Section over the Truncus coeliacus (TC). AHC: Arteria hepatis communis. AL: Arteria lienalis. LTH: Ligamentum teres hepati.
Figure 17 Alternative. Section over the truncus coeliacus (TC). AHC: Arteria hepatis communis. AL: Arteria lienalis. AGS: Arteria gastrica sinistra.

Arteria renalis dextra, longitudinal

Arteria renalis sinistra, longitudinal

Gastrointestinal tract

Oesophagus

Spleen

Figure 21 Spleen. It is only possible to measure the spleen to a limited extent using echoscopy.
Figure 22 Area around the spleen. RCL: Recessus costodiaphragmaticus lateralis. D: Diaphragm. 1: Interior muscle layer. 2: Exterior muscle layer. LPC: Ligamentum phrenicocolicum. Art: Artefacts.

Urogenital tract
**Kidneys**

**Figure 23** Kidney, longitudinal. It is a challenge to precisely measure the kidney using the VScan due to the small angle of insonication which is depth dependent.

![Image](image1.png)

**Figure 24** Kidney, lateral.

![Image](image2.png)
Figure 25 Renal cortical vessels. a

Adrenal gland, right side

Figure 26 Adrenal gland, right side (between the markers). RHV: Right hepatic vein. PV: Portal vein. VCI: Vena cava inferior. D: Diaphragm. SA: Sonic shadow. a
**Adrenal gland, left side**

Figure 27 Left adrenal gland. NN: Adrenal gland. RF: Mass. D: Diaphragm. WS: Spine.
Pelvis, female

Urinary bladder, uterus, Douglas’s cul de sac

Figure 28 Urinary bladder (UB), uterus (U) and a small amount of free liquid in Douglas's cul de sac (FF). V: Vagina. R: Rectum.
Ovary

Figure 29 Ovary. Ovary, left, in the recess between the pelvic vessels. Between the markers, small physiological ovarian cyst of a young woman. AIE: Arteria iliaca externa. VIE: Vena iliaca externa. VII: Vasa iliaca interna.
Urinary bladder, ureteral jet

Figure 30 Ureter. Ureter outlet, shown using colour Doppler sonogram with the ureteral jet (echoscopically left-sided, high-end device right side)
**Thorax**

** Mediastinum 


Figure 32 Paratracheal region, right side. With digits indicates the tracheal cartilage rings. PVR: Prevascular region. VA: Vena anonyma. AA: Aorta ascendens. AOB: Aortic arch. TPC: Truncus brachiocephalicus. BIF: Bifurcation. SCR: Subcarinal region.
References

Reference List

