WFUMB – Students Webinar

Ultrasound Journal Club

By David Boten und Nils Daum

09.06.2021

Ultrasound Image Optimization („Knobology“): B-Mode

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How to Manually, On/Off

- Us systmem is powered on and off using partial power on/off cotrol located on the control panel
- Due to complex soft-
- ware functions, booting and shutting down the system may take
- some time.

Monitor

- LCD is supirior to cathode-ray tube (CRT) monitors
- The human eye needs 20-30minutes to archive complete dark adaptation

Right Transducer

- Process is based on the piezoelecric effect
- 99% of the time is allocated to reciving the returning soundwave

Image Quality

- Gel,Gel Gel
- Depends on: depth penetration,image width, spatial and temporal resolution


a
H


b
H

Tranducer frequency

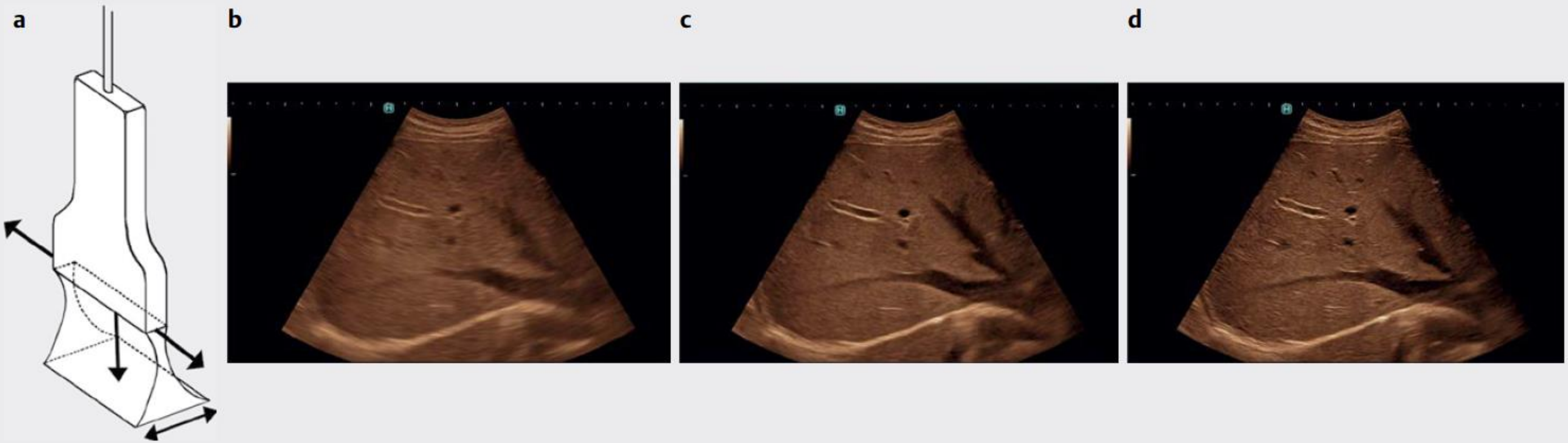
- The transducer frequency is calculated from the ratio of speed and wavelengththe highest possible frequency should always be selected (“try high”).
- This setting is limited by the decreasing depth penetration that results from an increase in frequency

Resolution

- It is influenced by beam width and the transducer’s line
- density. The latter is the number of pulses (scan lines) being later-
- ally transduced.

- Line density adjusts the number of scan lines in your ultrasound image. A higher level provides better resolution in the image (more scan lines), but reduces the frame rate. Use this to get the best possible image with the most acceptable frame rate.

- The examiner can adjust the line density to affect
- the resolution, but the maximum value is hardware-limited



▸**Fig. 2** Overview of ultrasonic axes **a** and examples for varying line density. Examination of the right liver lobe with line density at 1/8 **b**, 4/8 **c** and 8/8 **d**.

Tissue Harmonic Imaging (THI)

Disadvantages of the past are no longer relevant today due to tech-
nology improvements, which is why it is typically not practical to
switch off THI

Compounding

Compounding is a tool for image optimization that combines mul-
tiple images resulting from multiple aperture positions (spatial
compounding) or multiple transmission frequencies (frequency compounding) into a single
composite frame in **real time.**


a
12 cm
Br179


b
12 cm

Dynamic range

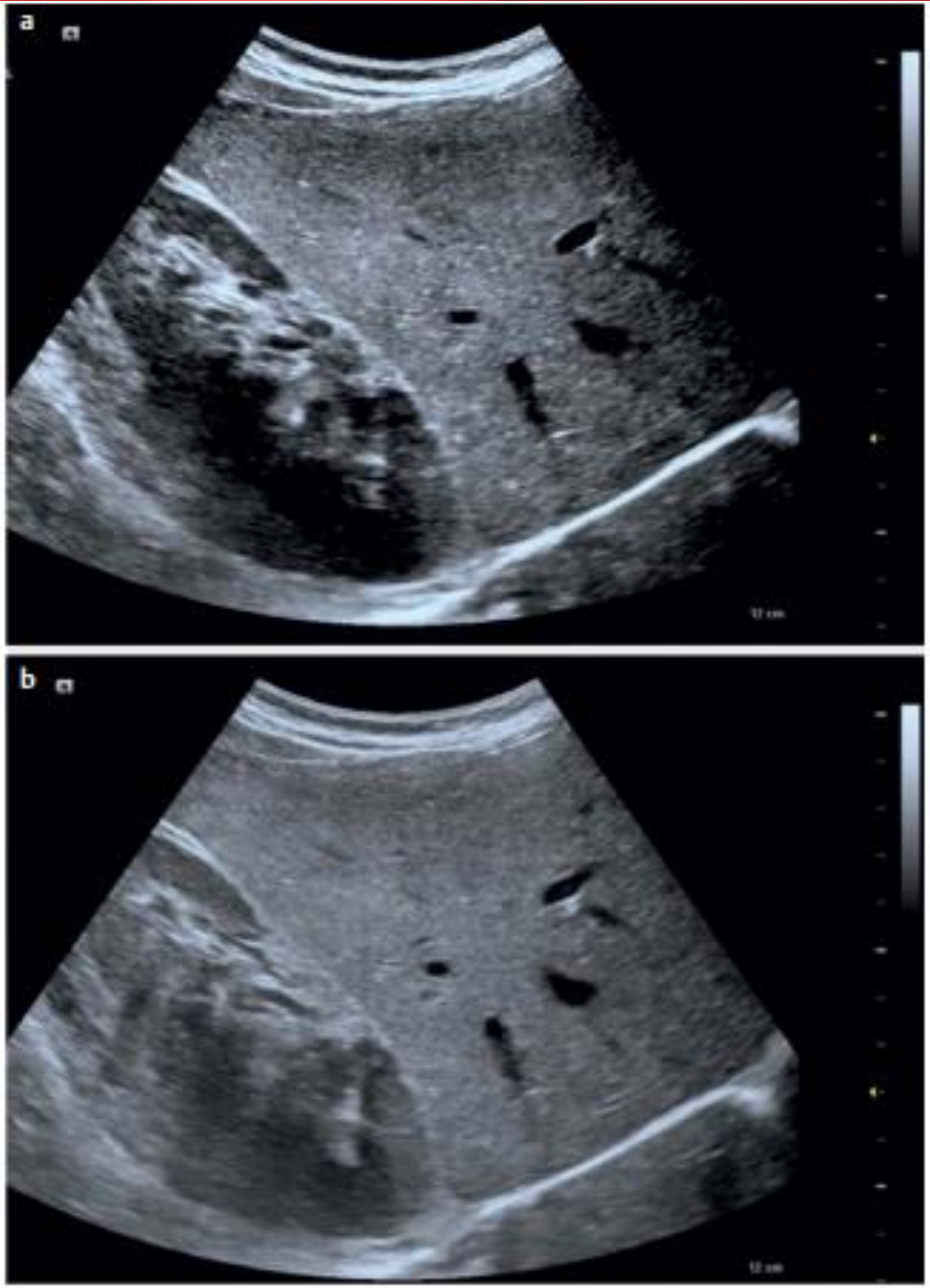
-> defines the echo strengths shown on the monitor

-> a high dynamic range offers more information about the echo patterns

-> preferable for representing organ parenchyma

-> for vessels, a low dynamic range is favored

-> e results in a more “black-and-white” like shape

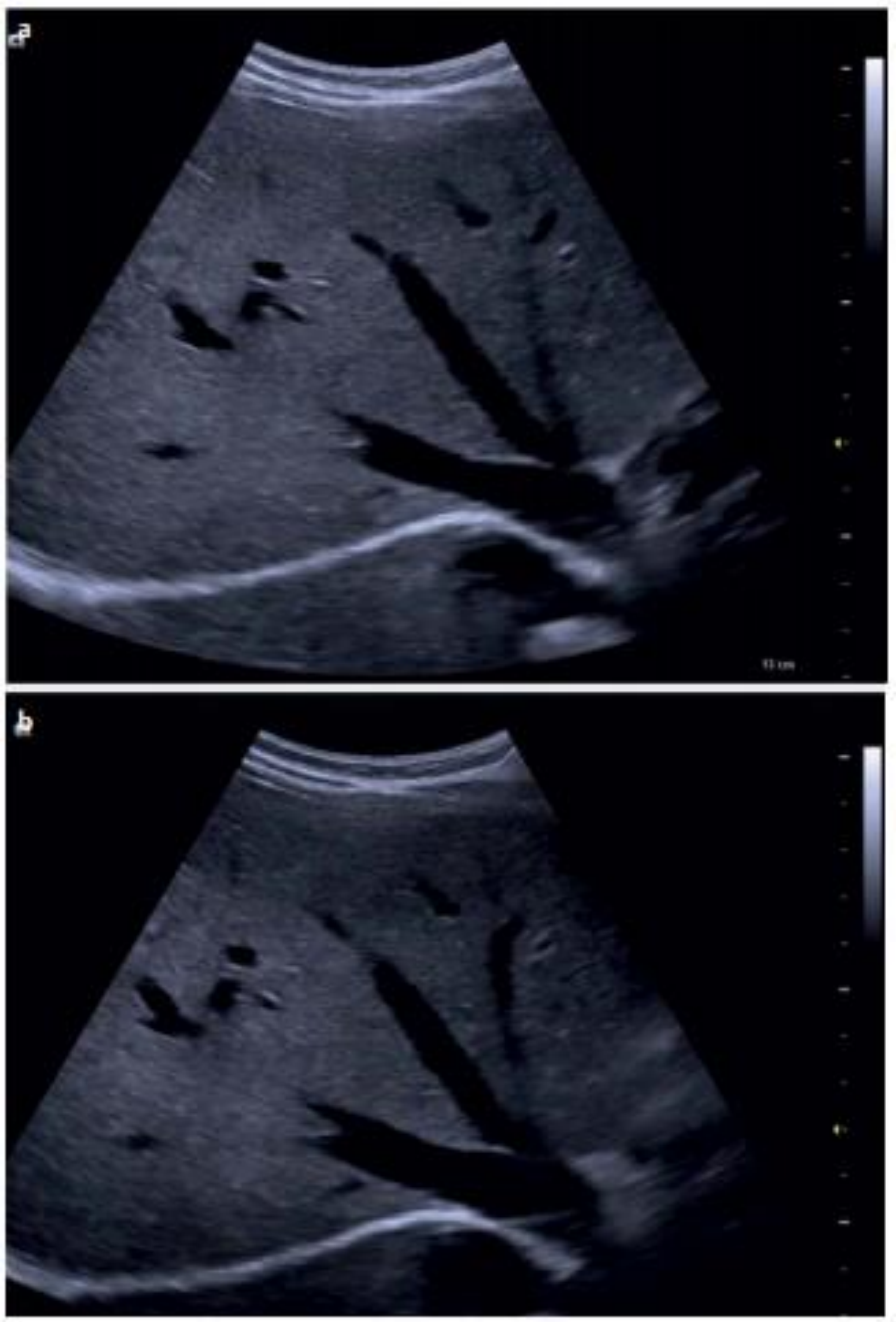

a
b

Transmission power

-> Transmission power describes the energy per unit of time (mW/ cm2) and influences image quality

-> US examination should still follow the ALARA principle ("as low as reasonably achievable")

-> important in fetal US and in ophthalmology



Six steps to achieve optimal settings for B-Mode US

Steps	B-Mode parameter
1st	Transmission power
2nd	Gain
3rd	Frequency
4th	Depth penetration
5th	Focal zone(s)
6th	Further settings

Documentation

Clips

-> the clips function makes it possible to record short films, and thus display moving structures

Measurements

-> essential part of the US examination, as many diagnostic criteria are based on quantitative findings

Pictogram, body marker

-> a simple way of making the location of the sound window comprehensible to viewers of the recorded images

Store

-> allows for permanent storage of single frames of the live image

Further Literature

-> „Knobology“ in Doppler Ultrasound

Axel Löwe, Christian Jenssen, Sebastian Hüske, David Zander, André Ignee, Adrian Lim, Xin-Wu Cui, Yi Dong, Beatrice Hoffmann, Christoph F Dietrich

-> Knöpfologie in der Dopplersonografie

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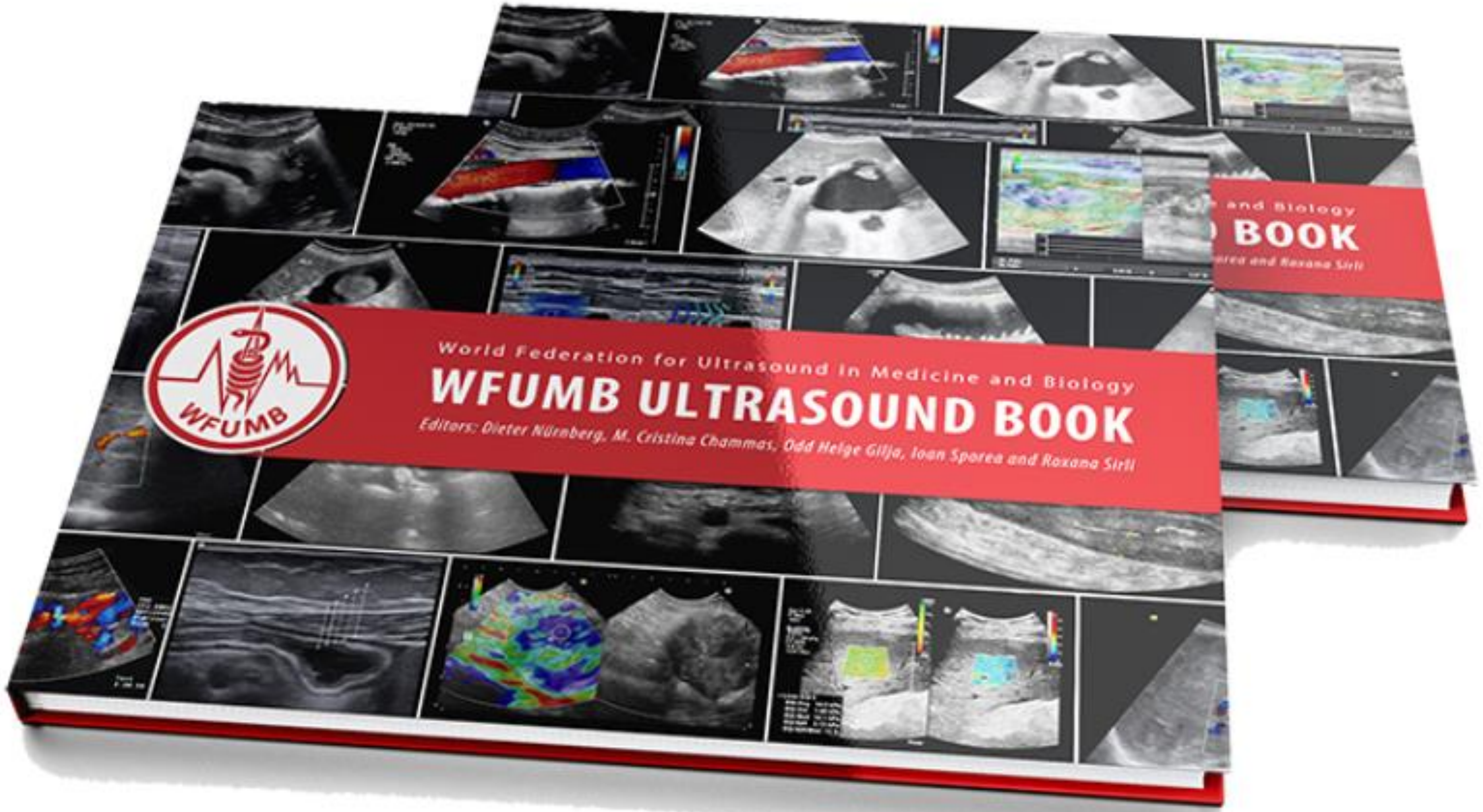
WFUMB
World Federation for Ultrasound in Medicine and Biology
WFUMB ULTRASOUND BOOK
Editors: Dieter Nürnberg, M. Cristina Chammas, Odd Helge Gilja, Ioan Sporea and Roxana Sirli