Internal Medicine Point-of-Care Ultrasound: Suprapubic

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Disclosure

- I have no financial disclosure or conflicts of interest with the presented material in this presentation.

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PEARLS

P - Parasternal

E - Epigastric

A - Anterior lung; apical (cardiac)

R - RUQ

L - LUQ

S - Suprapubic

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Lecture Outline

- Discuss beginner and advanced goals with POCUS
- Probe Orientation
- Normal Ultrasound Anatomy
- Pathology and Applications for the internist

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Suprapubic view

- Beginner
  - Bladder as acoustic window
  - US beam shoots through the midline of bladder in long axis
  - Suprapubic anatomy in males and females
  - Anechoic region around bladder identified as ascites
  - Visually assess bladder volume and foley placement
- Advanced
  - Identify ascites in sitting patient
  - Evaluate for ureteral jets
  - Evaluate gestational females
  - Evaluate for prostatomegaly

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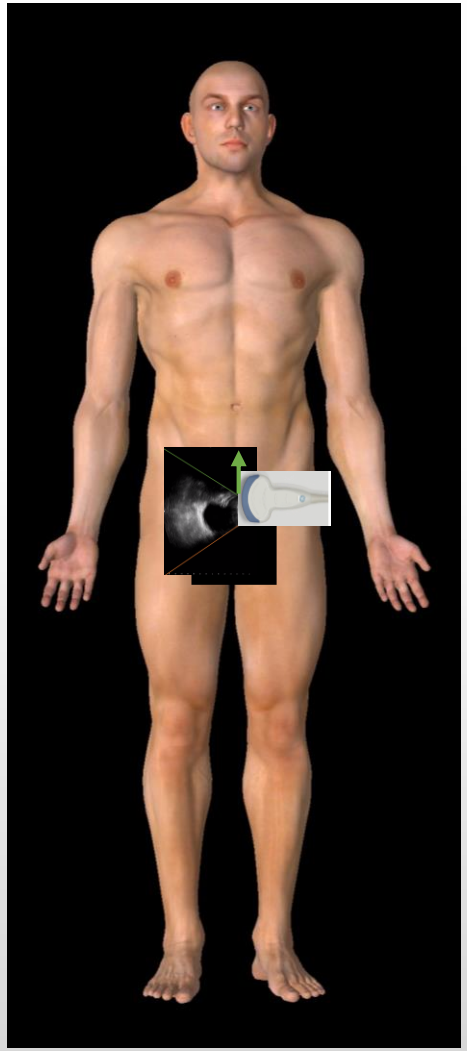
Probe Orientation in Suprapubic View

Probe: Curvilinear (Phased-Array)

Preset: Abdomen

Probe marker: Cephalad for long-axis (longitudinal plane); patient's right for short-axis (transverse plane)

Probe location: Above pubic symphysis



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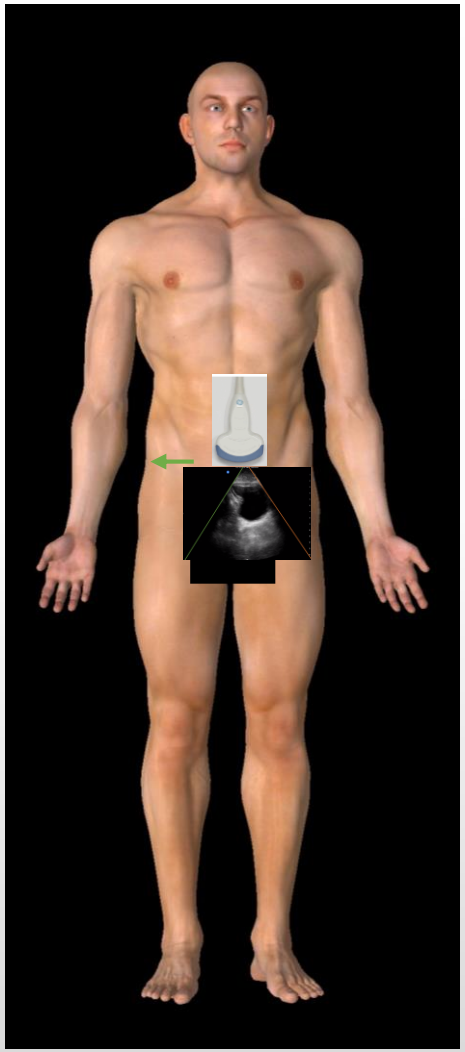
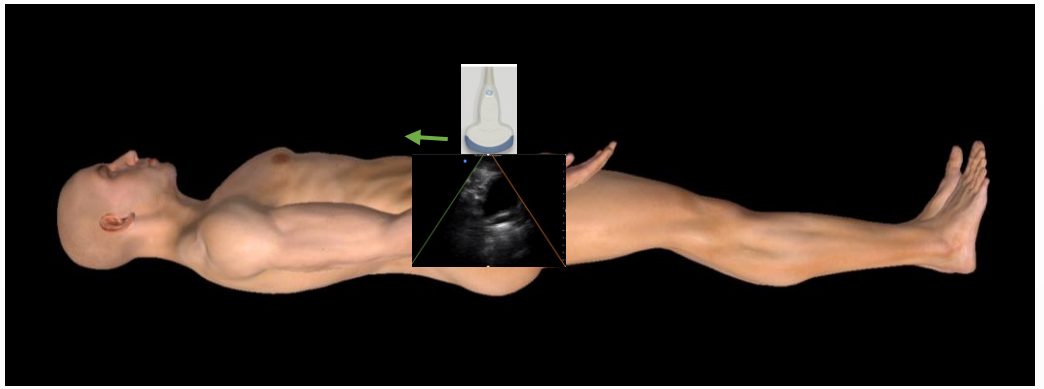
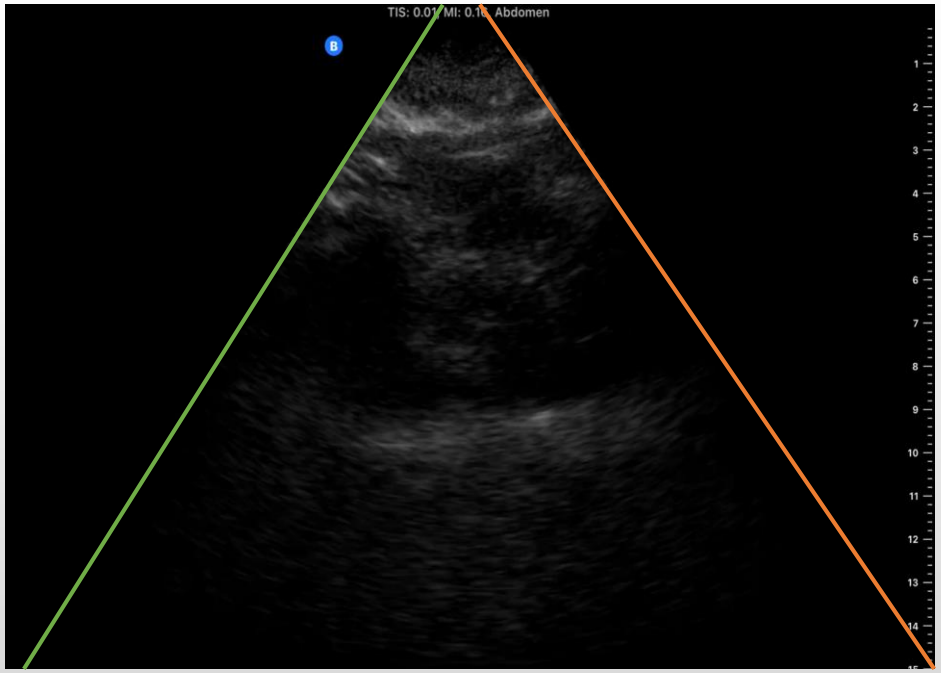
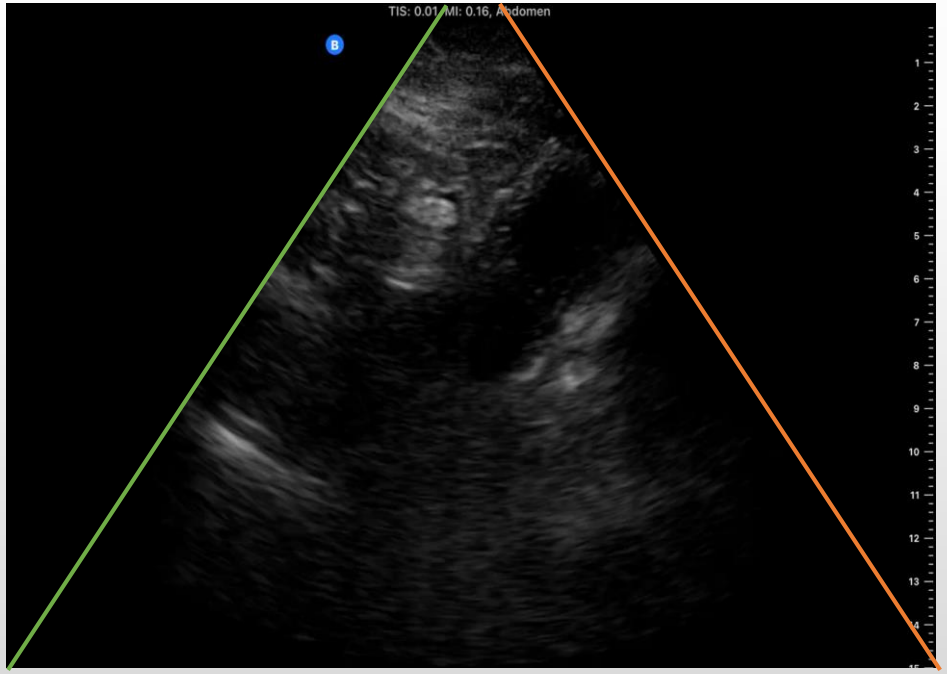
Suprapubic









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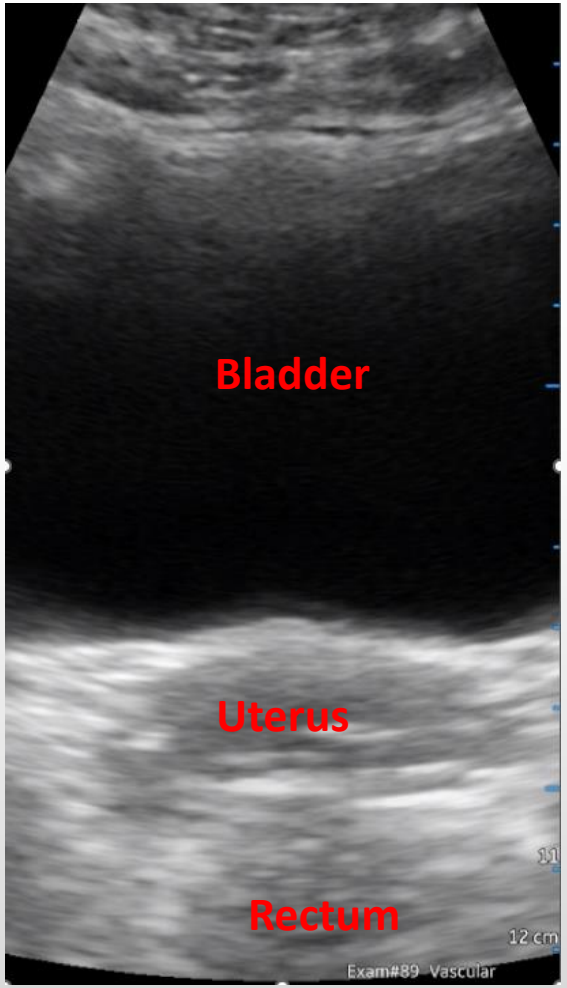
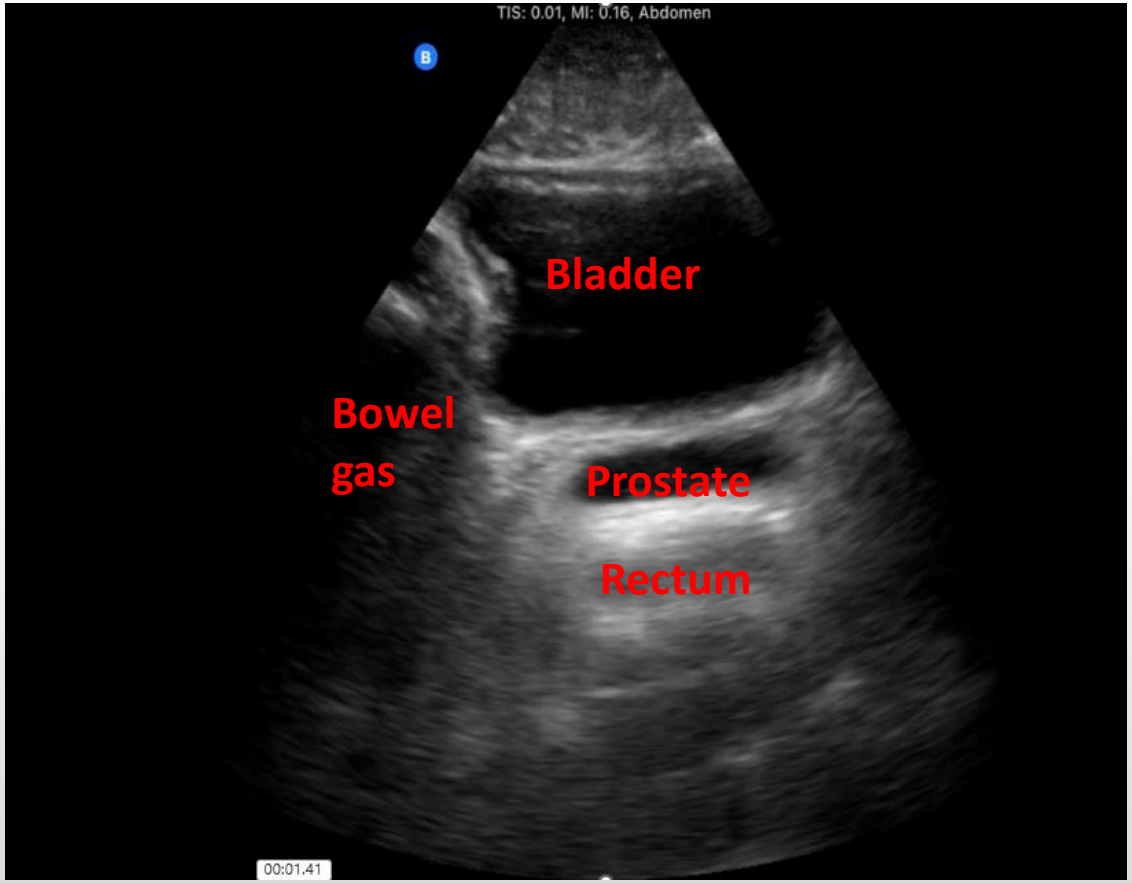
Suprapubic Anatomy in Short-Axis





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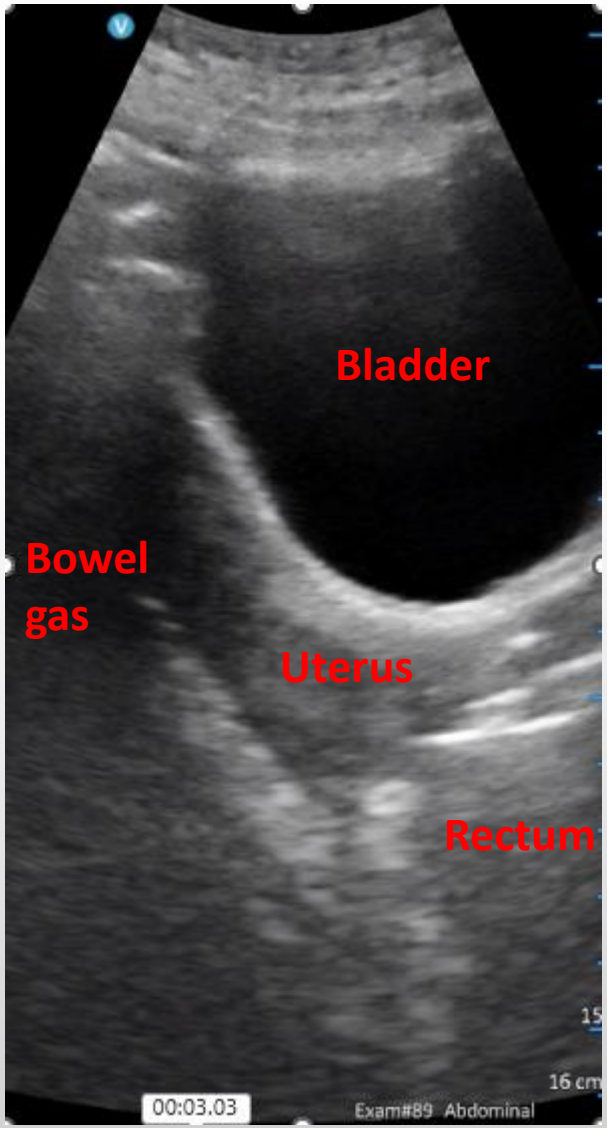
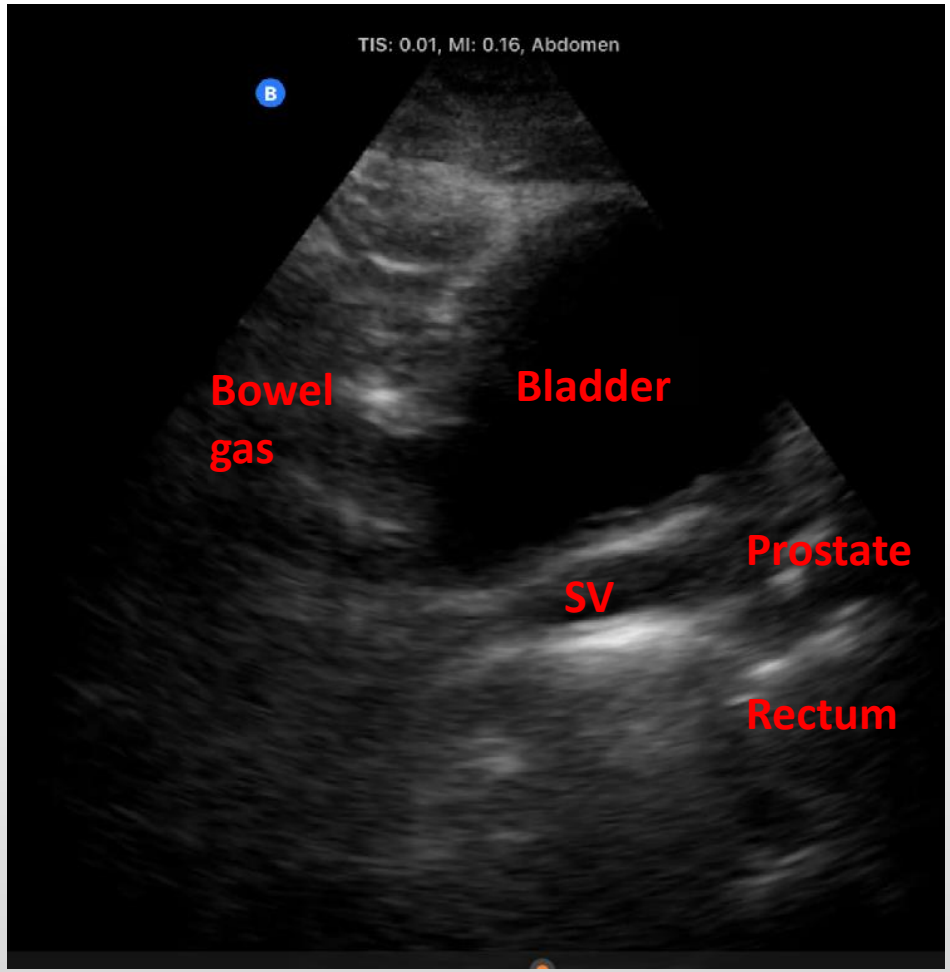
Suprapubic Anatomy in Long-Axis





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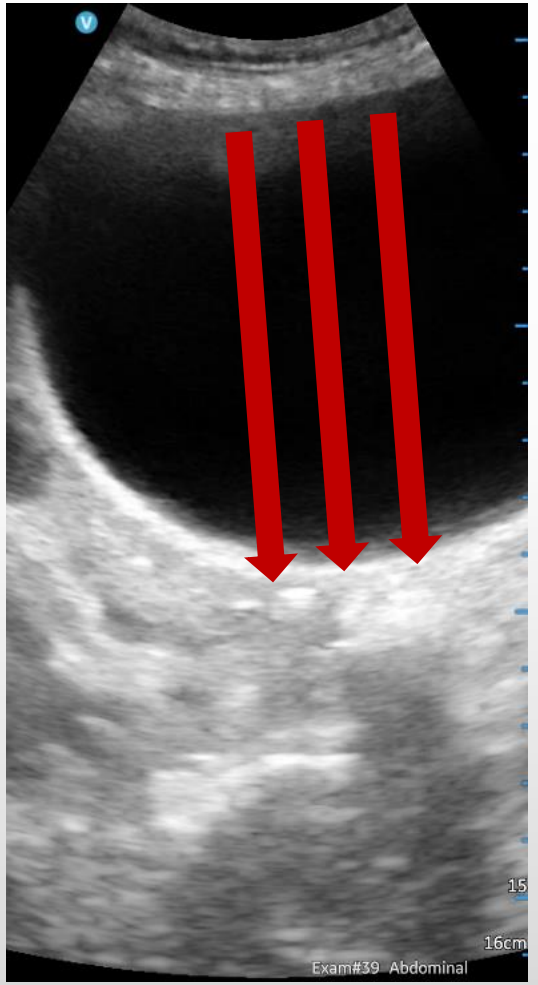
Posterior Acoustic Enhancement

- Artifact related to sound waves travel through a fluid filled bladder.
- Obscures pelvic structures and pathology posterior to the bladder
- Structures may appear significantly more hyperechoic, and free fluid can be missed due to wash-out from an overgained far field image.



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Pathology

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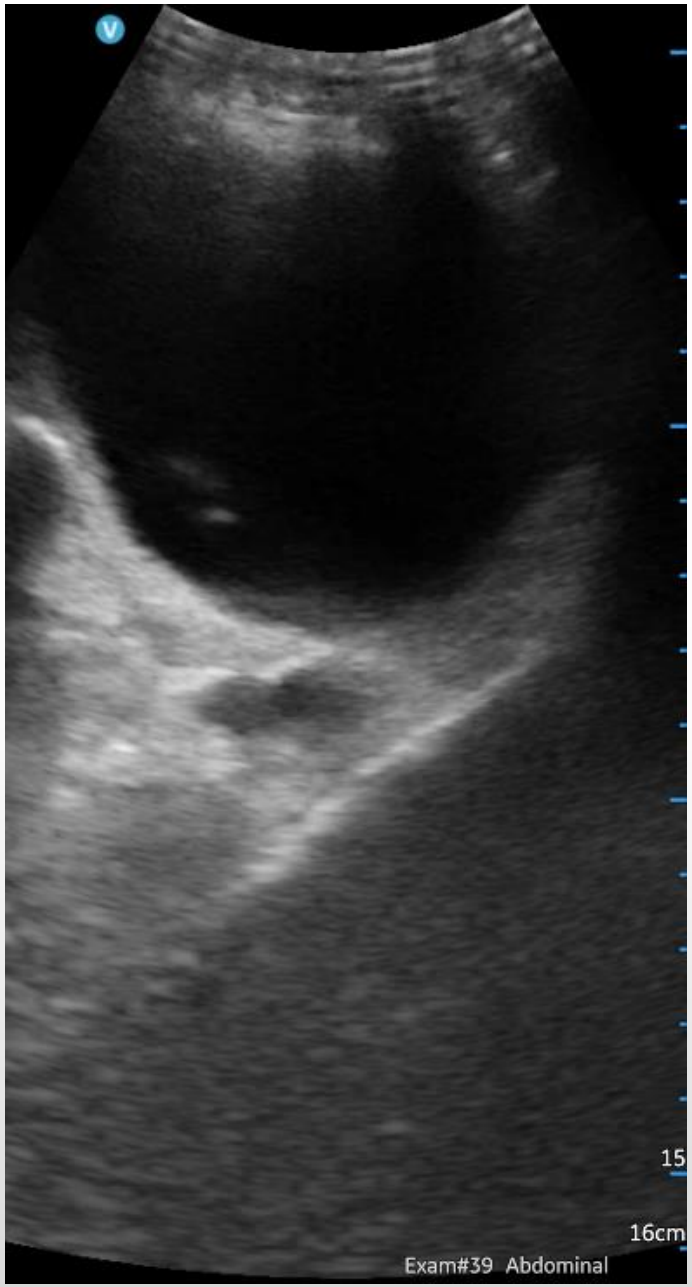
Case

76 YOM with PMHx of CVA and T2DM presents from outside hospital for confusion and abdominal swelling for 6 days. Outside hospital obtained head CT which showed no acute abnormalities. Vitals on arrival were WNL except for HR 110 and BP 168/94. On physical exam patient was ill-appearing and alert only to self. His speech was slurred. Neuro exam showed old L sided deficit of upper extremity. Abdomen was tender to palpation diffusely with positive bowel sounds and distended. Of note, during exam patient seemed to be pointing to his lower abdomen. What do you do?



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Urinary Retention

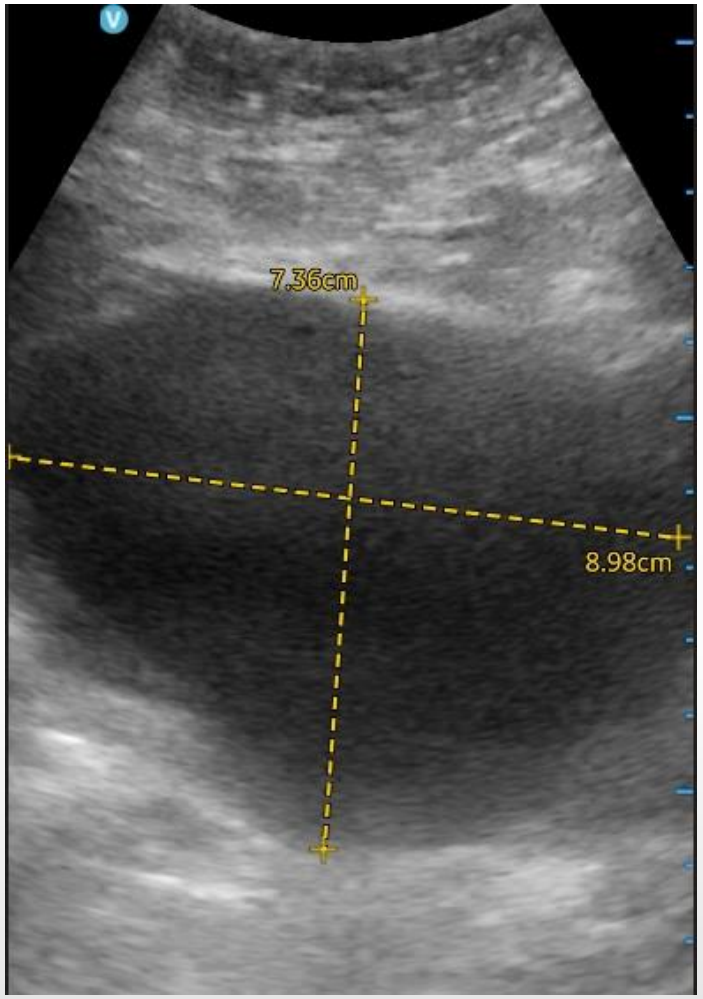
- Usually evaluated visually
- Can calculate actual volume
- Normal volume < 300-400 mL
- PVR >100mL is abnormal

Bladder Volume Assessment:

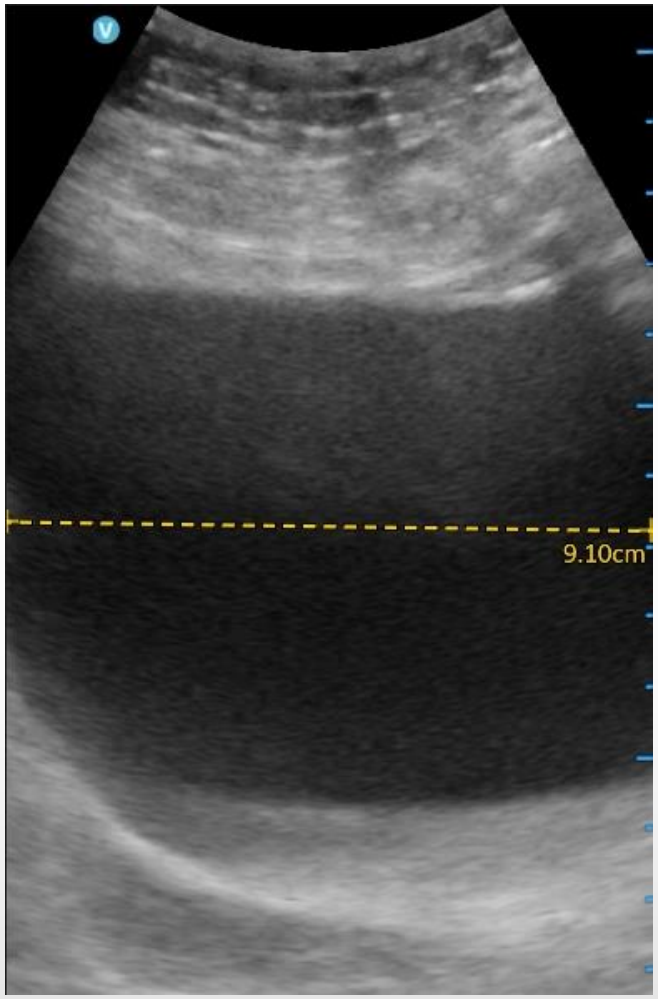
- Transverse: Measure Width , Depth
- Longitudinal: Measure Height(length)

Width x Depth x Height x 0.7* = Est bladder vol

*Sources vary from 0.52 to 0.75



Longitudinal



Transverse

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The Accuracy of Clinical Assessment of Bladder Volume

Mark Weatherall, MBChB, FRACP, Matire Harwood, MBChB

ABSTRACT. Weatherall M, Harwood M. The accuracy of clinical assessment of bladder volume. Arch Phys Med Rehabil 2002;83:1300-2.

Objective: To determine the usefulness of physical examination in detecting elevated bladder volume.

Design: A blinded study of clinical examination by physicians to detect elevated bladder volumes compared with a criterion standard (ultrasonic bladder volume measurement).

Setting: Outpatient department of a general hospital in New Zealand.

Participants: Sixteen healthy adult volunteers (age range, 21–37y; body mass index range, 22.9–37.2kg/m^2) and 8 qualified resident physicians with 2 to 6 years of clinical experience.

Intervention: Elevated bladder volumes were achieved by randomly allocating the volunteers to void or not to void before the clinical examination.

Main Outcome Measure: Clinical examination of the abdomen by abdominal palpation and suprapubic percussion, compared with portable ultrasound findings, to determine whether a healthy adult has a full bladder.

Results: For bladder volumes of 400 to 600mL, physical examination to detect a full bladder was 81% sensitive (95% confidence interval [CI], 54–96), 50% specific (95% CI, 39–68), and 55% accurate (95% CI, 45–65). The likelihood ratio for a positive finding on physical examination was 1.62 (95% CI, 1.17–2.24).

Conclusion: Physical examination of the abdomen by relatively junior physicians is unreliable in detecting bladder volumes between 400 and 600mL in healthy volunteers.

Key Words: Diagnostic equipment; Physical examination; Rehabilitation; Urination disorders.

URINARY INCONTINENCE IS A common problem in rehabilitation medicine. The prevalence of conditions that predispose rehabilitation patients to urinary retention and incontinence is high.[1-3] Examples include prostate hypertrophy, neuropathic bladder, and neurologic conditions that affect innervation of the lower urinary tract. Detrusor hyperactivity with impaired contractility is particularly common in older adults and has a documented prevalence of 33% to 61% for patients with multiple sclerosis.[3] Whatever the cause, patients may miss significant therapy because of urinary tract problems during the acute rehabilitation period.[4]

Estimating postvoid residual (PVR) bladder volume is an important component in the assessment of urinary incontinence and retention.[5] Urethral catheterization, the usual method for measuring PVR, may be uncomfortable for the patient and is associated with the risk of urethral trauma and urinary tract infection.[6] The 1998 international consultation on urinary incontinence recommended abdominal examinations of adults with a full bladder supplemented by estimation of the PVR volume.[7] One study[8] that compared bimanual examination with catheterization in women to detect postresidual volume found the sensitivity of bimanual examination was only 14% compared with catheterization; specificity was 67%. The usefulness of clinical assessment of bladder volume by abdominal palpation and percussion in adults has never been properly studied.

With portable ultrasound equipment, bladder volume measurement is performed at bedside with no adverse consequences.[1,9-12] The portable bladder scanner is as accurate in estimating PVR as catheterization.[9] Unfortunately, this equipment is expensive, but its cost would be justified if clinical assessment of bladder volume is inaccurate or unreliable. In this study, we compared the performance of physical examination with the criterion standard of portable bladder ultrasound for the detection of elevated bladder volume.

METHODS

The study design was a controlled comparison of the ability of a group of physicians to determine whether a person had a full bladder. Approval was obtained from the Regional Ethics Committee before the study.

Eight registered physicians with between 2 to 6 years of clinical experience examined 16 volunteers and performed a total of 96 clinical examinations to detect elevated bladder volume. Physicians were not instructed before the examinations. Recruited from the local hospital, they volunteered to participate in the study and to give their informed consent. The study was conducted at the hospital's general outpatient department over 2 days. A chaperone was present at every examination, including male-to-male examinations.

The other participants were young, healthy adults from a local sports club who responded to a presentation by a member of our research group calling for volunteers. Eight women and 8 men, ranging in age from 21 to 37 years, volunteered. The body mass indices for the group ranged from 22.9 to 37.2kg/m^2. Pregnant women were excluded, as were people with intra-abdominal tumors, a known history of urinary tract disorder, or previous abdominal surgery. Informed consent was obtained from all 16 volunteers before the study.

The volunteers were asked to drink 1L of water and not to void in the hour before the examinations. At the clinic, each was randomly allocated an alphabetical letter (A to H) to pin onto their sleeve so that they could be identified by the researchers and examining doctors. Volunteers were then randomly instructed either to void before the ultrasound and examination or not to void until after the examination. The research coordinator recorded the instructions for each volunteer on separate sheets of paper.

A portable bladder ultrasound[a] was used to measure the bladder volume before the abdominal examinations. The blinded assessor was experienced in the use of the equipment.

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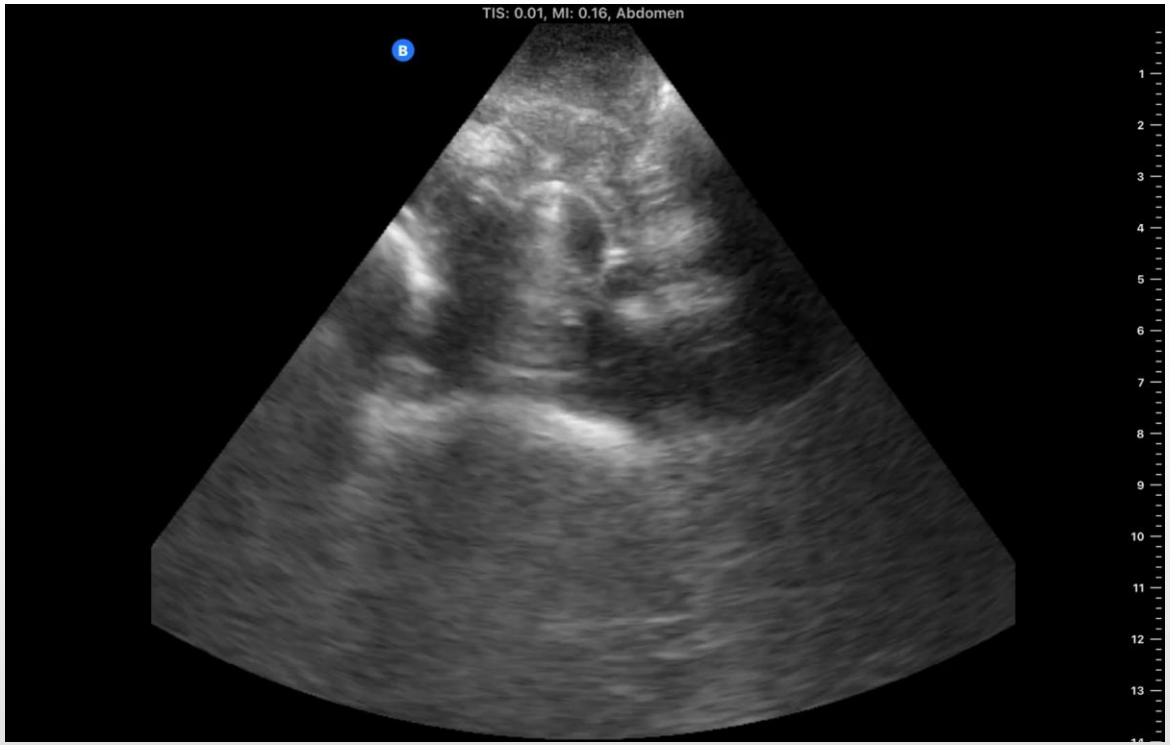
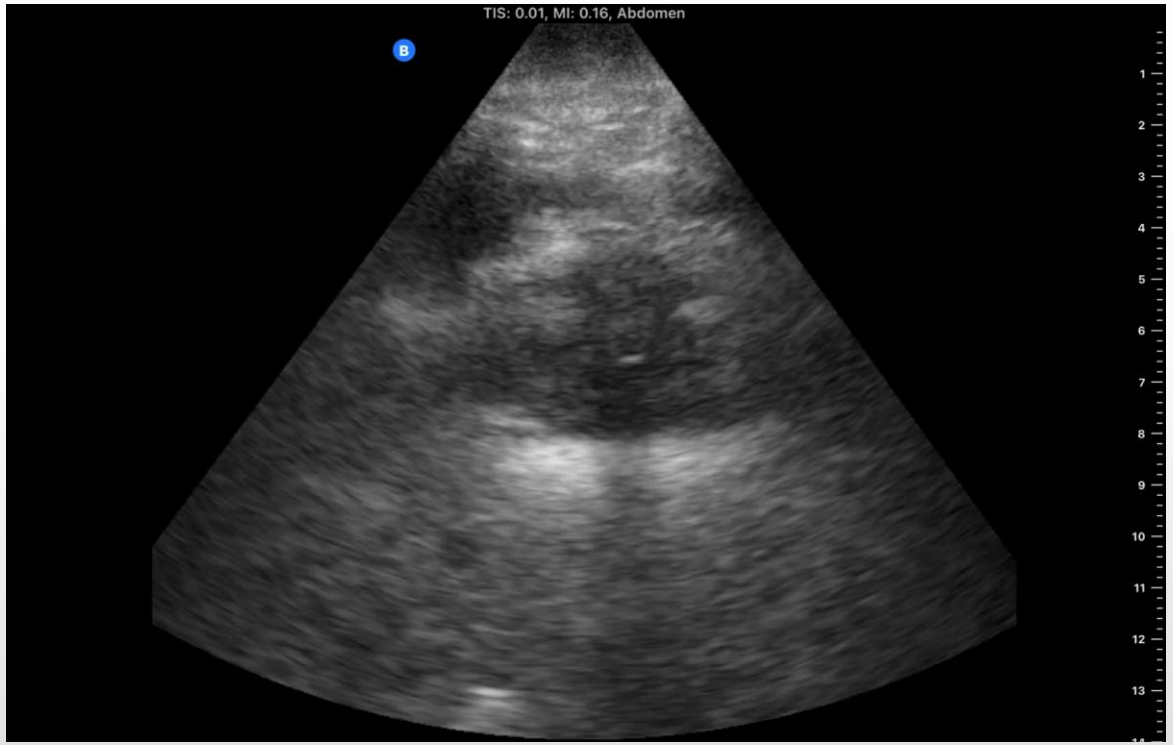
Catheter Placement (Normal)





Should see a decompressed bladder

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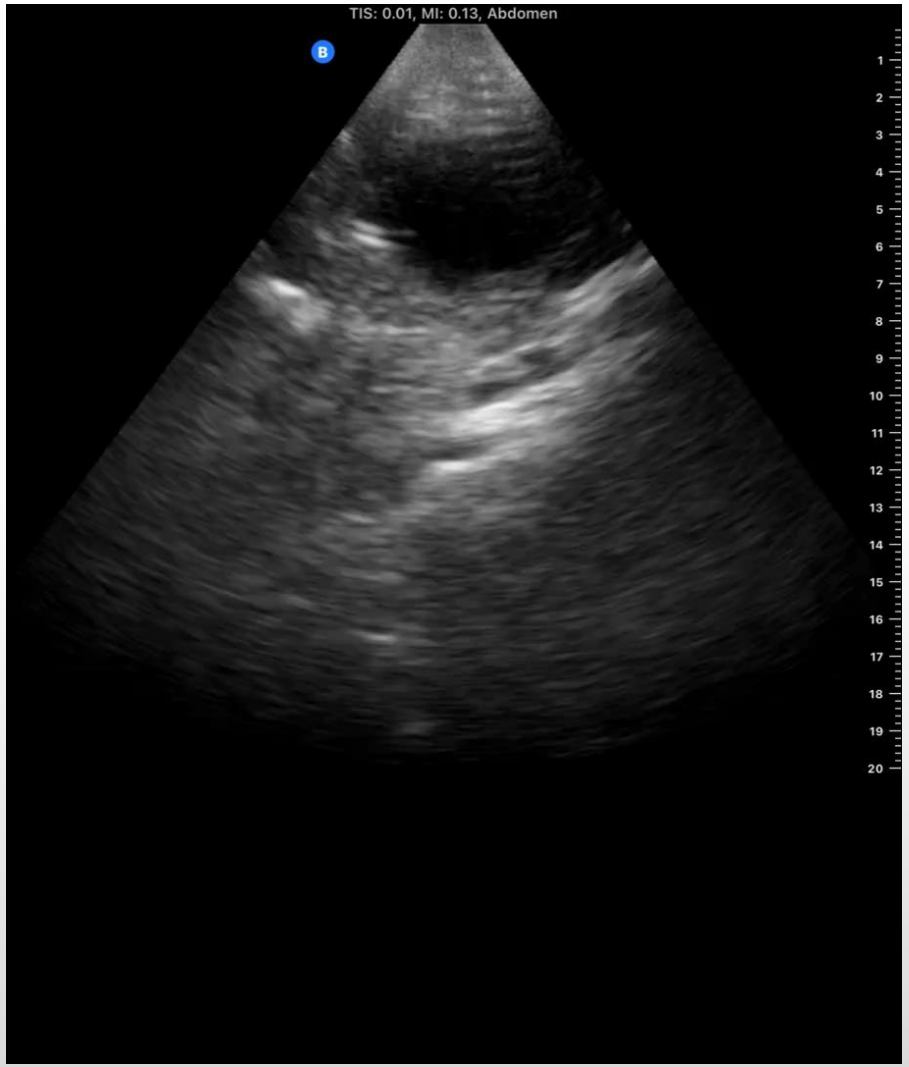
Free Fluid Accumulation

- Free pelvic fluid
  - Collects **posterior to bladder** in males; **posterior to uterus** in females (Pouch of Douglas)
  - Hemoperitoneum
  - Ascites



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Pearls and Pitfalls

- Calculating bladder volume should be done by obtaining the maximum dimensions and freezing the image.
  - Bladder volume = (0.75 x width x length x height)
- Free fluid in the pelvis can be mistaken for urine in the bladder. Always locate the bladder and surrounding structures in both transverse and longitudinal planes. Identifying the catheter or filling the bladder can help distinguish the bladder from free fluid.
- Ureteral jets may be difficult to obtain, but their presence rules out complete obstruction (high specificity). Their absence does not rule in obstructive uropathy.

Pearls and Pitfalls

- Confirmation of urinary catheter placement and detection of malfunction can easily be determined at bedside.
- Blood clots may appear as bladder masses on ultrasound. Continuous bladder irrigation usually resolves blood clots.

References

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