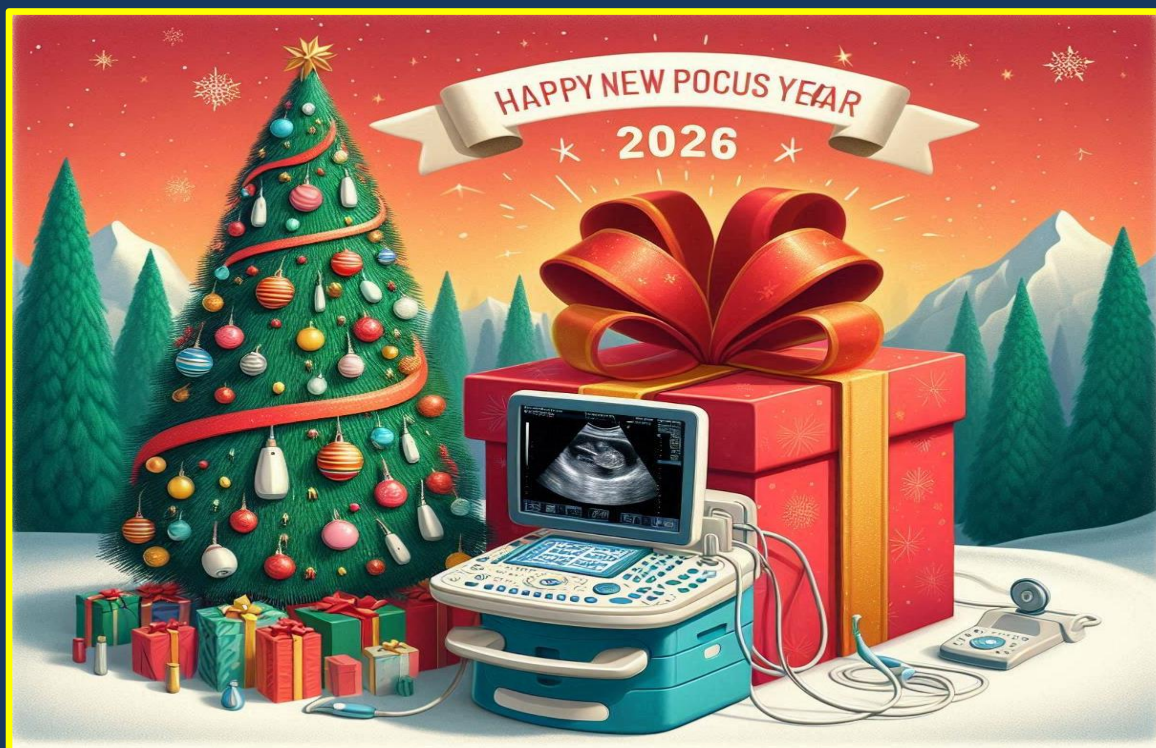
POCUS JOURNAL

International POCUS Academy JANUARY 2026

Non-profit association of national Point-Of-Care-UltraSound schools



Dear Colleagues and Friends,

Here is another issue of our Journal and yet another opportunity to review the past six months, draw a line under our activities, and assess our achievements. It has become clear that our plans for the International POCUS Academy to grow into a large organization of strong national schools are still far from realization. The reasons are numerous, including international crises, wars, difficult conditions for travel and visiting, as well as other challenges, such as the extremely rapid advancement of artificial intelligence. This technology enables colleagues to master POCUS diagnostics or use ultrasound without deep personal knowledge, which somewhat diminishes the purpose of our work.

As a result of these circumstances, the International POCUS Academy continues to function as an informal network (association) of individuals, groups, schools, and academies operating in several countries - primarily in Serbia, Bosnia and Herzegovina, Russia, and the Caspian region, including Kazakhstan, Kyrgyzstan, etc.

Of course, we also still have members and friends in countries such as the United States, United Arab Emirates, Haiti, Gerrmany, etc. We hope that in the future they will contribute more, both in creating this journal and in the exchange of knowledge, skills, and everything else that makes up the POCUS community.

I hope that even with reduced international activity, we will remain connected in the future, while all of us who are highly active locally continue to be guided by enthusiasm and the idea "Think globally, act locally." I wish you a happy New Year, with my sincerest wishes for health, personal, family, and professional happiness, as well as every other form of prosperity in 2026.

Dr. Ivica Zdravković
General Secretary of IPA
Editor-in-Chief

POCUS Academy of Serbia

POCUS WORKSHOP, Požarevac, December 2025

Contributed by Ivica Zdravkovic, MD, Director of POCUS Academy of Serbia

On December 7, 2025, a mini-symposium of the POCUS Academy of Serbia, titled **"POCUS as the Fifth Pillar of Propaedeutics – 30 Essential Skills in Ultrasound Diagnostics,"** was held at the "Dr.Pavle Savić" Medical High School in Požarevac. The event was attended by approximately 30 physicians from Požarevac, Belgrade, Pančevo, Smederevo, Kruševac, Vršac, Kostolac, Kovačica, Čačak, Čajetina, Svilajnac, Doboj, Banja Luka, and other cities.

At the beginning of the gathering, participants were welcomed by **Prim.Dr.Ivica Zdravković**, Director of the Academy and Associate Professor at the International POCUS Academy, who also delivered the introductory lecture.

Following him, the audience was addressed by **Luka Ćirić,B.Eng.**, a representative of the company **Medisal d.o.o.**,which supported the workshop by providing **Mindray** ultrasound devices.

The wide range of diagnostic possibilities offered by ultrasound was demonstrated at five hands-on stations by former students of our POCUS school and current Academy instructors: **Dr.Sava Vojnović, Dr.Kristina Stević, Dr.Gordana Bojović, Dr.Marko Stevanić, Dr.Dijana Đurić Manojlović, Prim.Dr.Danijel Atijas, Dr.Branka Popović, Dr.Nikola Milojević, and Dr.Tijana Raduka.**

After the working session, participants were awarded certificates of attendance. Certain colleagues were granted the title of echosonographer on behalf of the Academy, while others were promoted to POCUS instructors based on their long-term work and contributions to the field of echosonography.

Following the event, most of the colleagues gathered for a formal lunch and celebration.

We would like to thank the staff and students of the **"Dr.Pavle Savić" Medical High School** for their hospitality, especially the principal, **Marija Urošević**. We also express our gratitude to the **Health Center Veliko Gradište** and its director, **Dr.Ljiljana Stevanović**, for their help and support.

The next major event, a weekend workshop and symposium titled **"2nd DAYS OF POCUS DIAGNOSTICS,"** is planned for the spring of 2026 in Kragujevac.

See you there!

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STRUKOVNO NEPROFITNO UDRUŽENJE LEKARA
ZA OBUKU U ULTRAZVUČNOJ DIJAGNOSTICI
POCUS AKADEMIJA
SRBIJE
ČLANICA MREŽE NACIONALNIH ŠKOLA ULTRAZVUKA UDRUŽENIH U
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BLUE, LUS, POCUS, FoCUS,
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POCUS in the Diagnostics of Malignant Salivary Gland Tumors

Dr. Vekoslav Zajić, Specialist in Emergency Medicine,
POCUS Academy of Serbia Instructor & Scientific Assistant

Malignant salivary gland tumors represent a rare but extremely heterogeneous group of neoplasms in the general population, encompassing more than twenty different histopathological subtypes [1]. The etiopathogenesis of these tumors is still not fully understood. According to literature data, their occurrence is associated with exposure to ultraviolet and ionizing radiation, tobacco and alcohol consumption, as well as certain viral infections [2].

Anatomically, salivary glands are divided into major glands—including the parotid, submandibular, and sublingual glands—and minor salivary glands, which are distributed throughout the mucosa of the lips, gingiva, cheeks, palate, and tongue, as well as in the oropharynx, paranasal sinuses, and parapharyngeal space.

Salivary gland tumors account for approximately 3–10% of all head and neck neoplasms. The majority of these tumors are benign, while about one-fifth are malignant. The parotid gland is the most common site for salivary gland tumors, with an incidence of 80–85%, of which approximately 75% are benign. In contrast to the parotid gland, a significantly higher percentage of malignant tumors is recorded in other salivary glands: 40–45% in the submandibular, 70–90% in the sublingual, and 50–75% in the minor salivary glands [3]. Malignant neoplasms of the salivary glands can present as primary tumors or as secondary lesions in the form of metastases from malignancies of other organ systems. The average age of patients with salivary gland tumors is about 45 years, with an increased incidence in the sixth and seventh decades of life.

Ultrasound examination of the salivary glands reveals a solid lesion of inhomogeneous echogenicity, most commonly hypoechoic, with an irregular shape and poorly defined margins, lacking a clearly formed capsule. The lesion shows signs of infiltrative growth, disrupting the normal architecture of the surrounding glandular parenchyma (Figure 1).

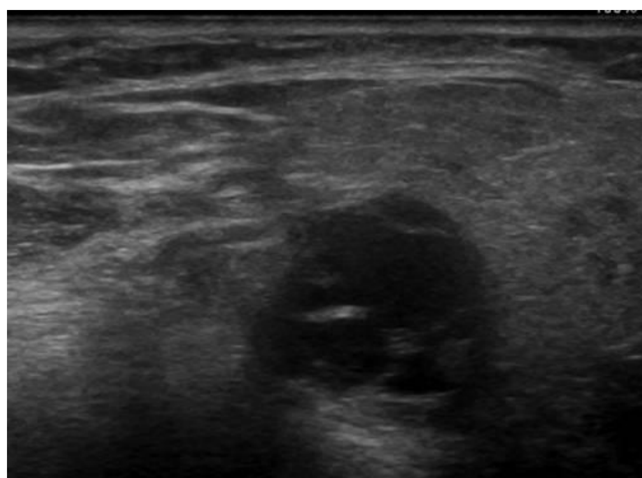

Figure 1

Color Doppler ultrasound shows increased, non-uniform, and disorganized intralesional vascularization, further indicating the malignant potential of the lesion. Posterior acoustic shadowing is often recorded, unlike in benign tumors where this phenomenon is less common.

In the regional lymphatic drainage, enlarged lymph nodes with pathological ultrasound characteristics may be observed, including the loss of the fatty hilum, rounded shape, cortical thickening, and a pathological vascular pattern, consistent with possible metastatic involvement (Figure 2).

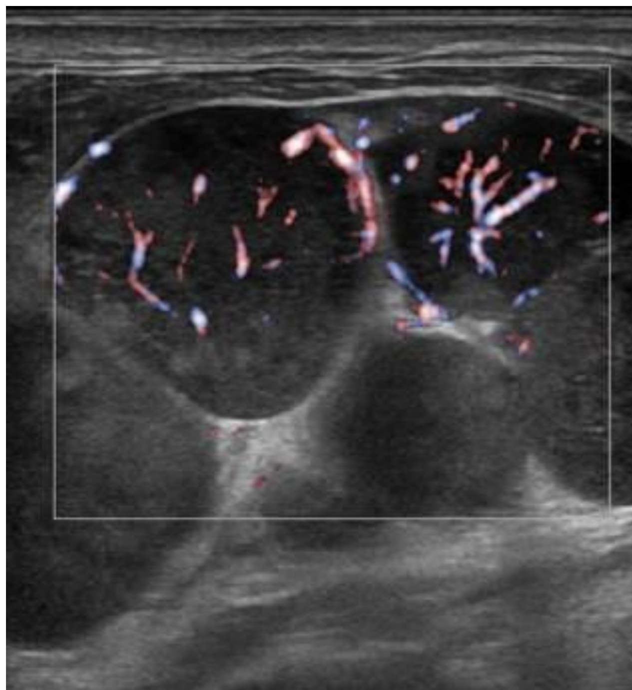

Figure 2

The described ultrasound characteristics indicate a high degree of suspicion for a malignant salivary gland neoplasm, establishing ultrasound as a significant initial diagnostic method. A definitive diagnosis requires histopathological verification, most commonly through fine-needle aspiration biopsy (FNA) or surgical excision.

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POCUS Activities In Haiti

Contributed by Gédéon GELIN MD-MSc-RDMS
IPA Haiti Program Director

This report details the activities of the IPA (International Point-of-Care-UltraSound Academy) in collaboration with the Geriatric Cardiology and Polyvalent Hospital Medicine University Center in Haiti, as of December 28, 2025.

The IPA program has been actively engaged in training medical professionals in Haiti since 2017. A significant achievement by the end of June 2025 is the intensive general clinical ultrasound training of 160 hours over four weeks for 12 new professionals in the City of Cap-Haïtien. This marks a crucial step in strengthening the ultrasound healthcare workforce throughout Haiti, particularly in the context of the country's challenges.

Here is the list of the physicians and nurses that participated in this intensive training:

Dr Elie Michel, Dr Johanne Trévant, Dr Josnel Pierre,Dr Judely Roseau,Br Enioth Bright,
Dr Prophete Bélizaire, Dr Rose Cassandre Joazard, Ronald Pierre. Nurses: Angela Jean, Madame Leindz Tchercy Soraya Phanord, Carmise Jean, Lovely Eugène

IPA Haiti Team : Dr Jean Levelt, Dr Sendia Gustave and Dr Gédéon Gélin

Under the leadership of Dr- Gedeon Gelin, a physician trained in general medicine at the State University of Haiti and in geriatric cardiology and polyvalent medicine at Sorbonne and Paris Sorbonne Universities, the Haiti Ultrasound Program is the only formal and academic ultrasound training program in Haiti. The Haitian medical community has confidence in this training and does not seek ultrasound training abroad since this program was established, as it adheres to the highest standards. Almost no physician in Haiti goes abroad for training in ultrasonography.

IPA Haiti established a new curriculum for 2026 integrating Artificial Intelligence. This forward-thinking approach aims to equip future healthcare professionals with the skills and knowledge necessary to utilize AI tools effectively in their practice. This integration will likely cover areas such as AI-assisted diagnostics, image analysis, and data interpretation, enhancing the quality of care provided

The IPA program has established practical training sites in four areas of Haiti to provide hands-on experience to its trainees. Currently, practical training sites are available in Gonaïves, Plateau Central, Duchity (Grande Anse), and Limbe. A new site is also being developed.

The IPA Haiti program is set to launch a rigorous 9-month echocardiography training program in April 2026 for physicians already certified in general ultrasonography. The program's director, Dr. Gedeon GELIN, continues to demonstrate strong resilience and leadership, which is crucial for the program's continued success and the advancement of healthcare in Haiti, especially given the increasing isolation of Haiti on the international stage. His dedication is vital for navigating challenges and ensuring the program's sustainability.

IVC ULTRASOUND

By Ivica Zdravkovic, MD

IVC ultrasound is used to estimate right atrial pressure (RAP), not true circulating volume. The IVC should be measured in supine position, subcostal long axis, during quiet breathing. The correct measurement point is just BELOW the hepatic veins, before the IVC enters the right atrium. Assess two things: IVC diameter at end expiration degree of inspiratory collapse

A) Normal RAP:

- **IVC diameter roughly 1.2–2.2 cm**
- **Inspiratory collapse about 30–50%**

This corresponds to normal RAP, approximately 5–8 mmHg.

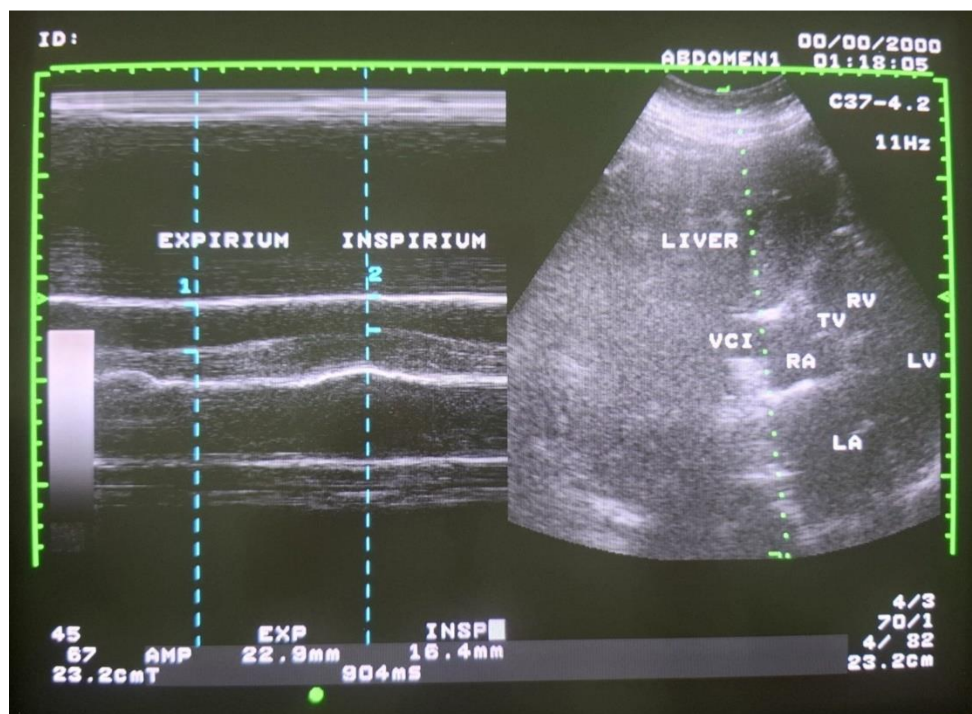
B) Low RAP:

Small IVC with marked collapse (>50%) suggests low RAP, around 0–5 mmHg, often hypovolemia.

C) High RAP:

Dilated IVC with poor collapse (<30%) suggests elevated RAP, roughly 10–15 mmHg or higher. A very large, fixed IVC suggests markedly elevated RAP and venous congestion.

Key rules: IVC size alone does not define RAP. A mildly large IVC that collapses well can still mean normal RAP. A normal-sized IVC that does not collapse indicates elevated RAP. Always interpret IVC together with symptoms and other ultrasound findings. IVC reflects RAP, not volume.



Point-of-Care Ultrasound in Primary Care Revealing a Large Ovarian Tumor in a Patient With Nonspecific Abdominal and Urinary Symptoms: A Case Report

Author: **Željka Popović, MD, Prim., Associate professor of IPA**
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Email: zeljkapopovic982@gmail.com

Abstract

Nonspecific abdominal and lower back pain accompanied by urinary symptoms are common complaints in primary care and are often attributed to benign conditions. We present a case of a 43-year-old woman with chronic lower back and lower abdominal pain and frequent urination, initially managed as recurrent urinary tract infection. Laboratory findings revealed mild anemia, attributed to heavy menstrual bleeding. Due to persistent symptoms, point-of-care ultrasound (POCUS) was performed in a primary care setting, revealing a large pelvic mass suspicious for an ovarian tumor. The patient was referred for further evaluation and underwent surgical treatment, after which symptoms completely resolved. This case highlights the importance of POCUS in primary care for early detection of significant pathology in patients with long-standing nonspecific symptoms.

Introduction

Patients presenting with nonspecific abdominal pain, lower back discomfort, and urinary symptoms are frequently encountered in primary care. These symptoms are often attributed to urinary tract infections, musculoskeletal conditions, or gynecological disorders, especially in women of reproductive age. However, persistent or recurrent symptoms warrant further evaluation.

Point-of-care ultrasound (POCUS) has become an increasingly valuable diagnostic tool in primary care, enabling timely identification of underlying pathology and facilitating appropriate referral. This case demonstrates the role of POCUS in detecting a large ovarian tumor in a patient whose symptoms persisted for over a year despite conservative management.

Case Presentation

A 43-year-old woman presented to a family medicine clinic with complaints of nonspecific lower back pain and lower abdominal discomfort, accompanied by frequent urination. Symptoms had been present intermittently for approximately one year. She had been repeatedly treated for presumed urinary tract infections, although her symptoms did not significantly improve.

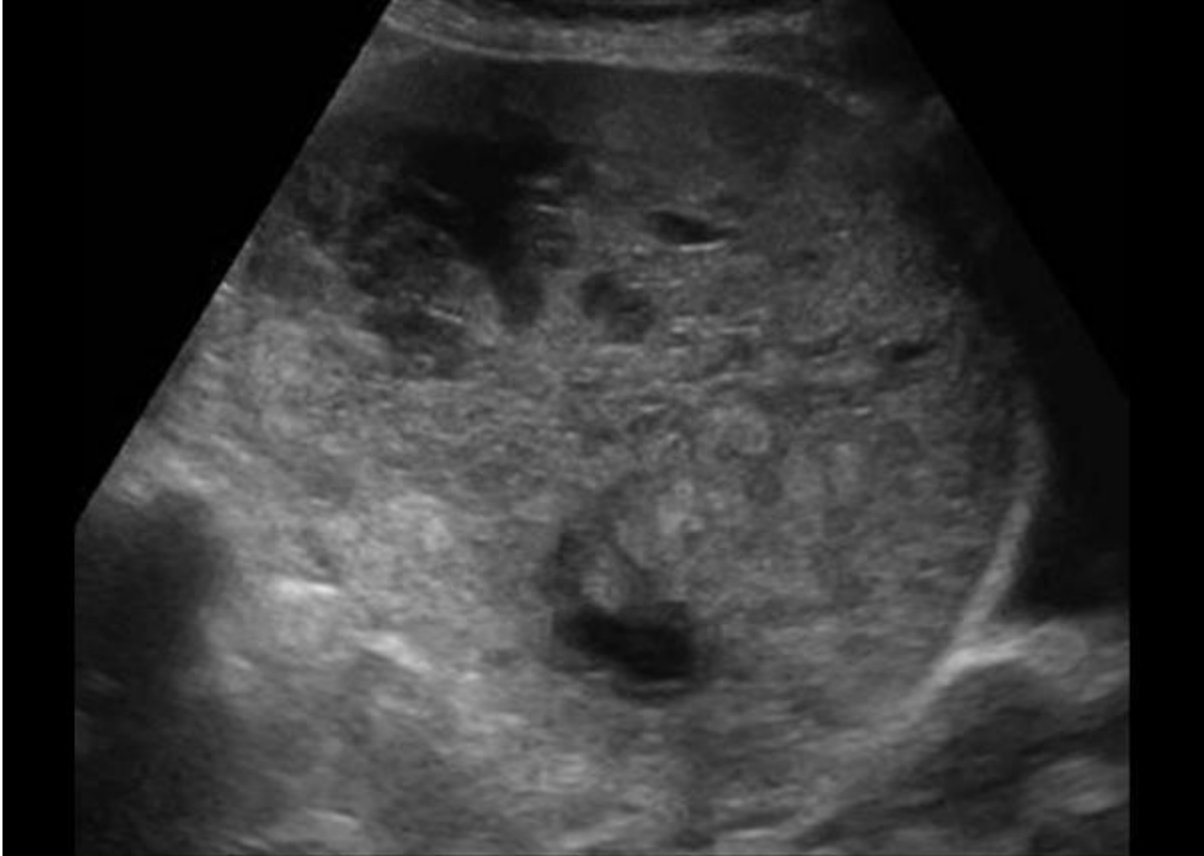
Laboratory investigations revealed mild anemia, which was attributed to heavy menstrual bleeding. No other significant abnormalities were noted. Despite ongoing symptoms, no definitive diagnosis had been established.

Given the persistence of symptoms and their unclear etiology, abdominal point-of-care ultrasound was performed in the primary care setting.

POCUS Findings

Abdominal POCUS revealed a large, well-defined pelvic mass occupying a significant portion of the lower abdomen. The mass was suspicious for an ovarian origin due to its location and size. No free intraperitoneal fluid was observed.

Based on the ultrasound findings, the patient was urgently referred to gynecology for further diagnostic evaluation.



Outcome and Follow-Up

Subsequent imaging and specialist evaluation confirmed a large ovarian tumor. The patient underwent surgical removal of the mass. Postoperatively, her symptoms completely resolved, including abdominal pain, lower back discomfort, and urinary frequency. At follow-up, the patient reported significant improvement in quality of life and no recurrence of symptoms.

Discussion

This case illustrates how nonspecific symptoms such as abdominal pain, back pain, urinary frequency, and anemia may mask significant underlying pathology. In this patient, symptoms were initially attributed to common conditions encountered in primary care, including urinary tract infection and menorrhagia.

The use of POCUS in the family medicine setting enabled early identification of a pelvic mass that had likely contributed to urinary compression and chronic discomfort. Early detection facilitated appropriate referral and definitive surgical management.

POCUS represents a valuable extension of the physical examination in primary care and can significantly reduce diagnostic delay, particularly in patients with persistent or unexplained symptoms.

Conclusion / Learning Points

- **Persistent nonspecific abdominal, back, and urinary symptoms warrant further evaluation.**
- **Mild anemia in women should not always be attributed solely to heavy menstrual bleeding without additional assessment.**
- **POCUS in primary care can detect significant pathology and guide timely referral.**
- **Incorporating POCUS into family medicine practice may improve diagnostic accuracy and patient outcomes.**

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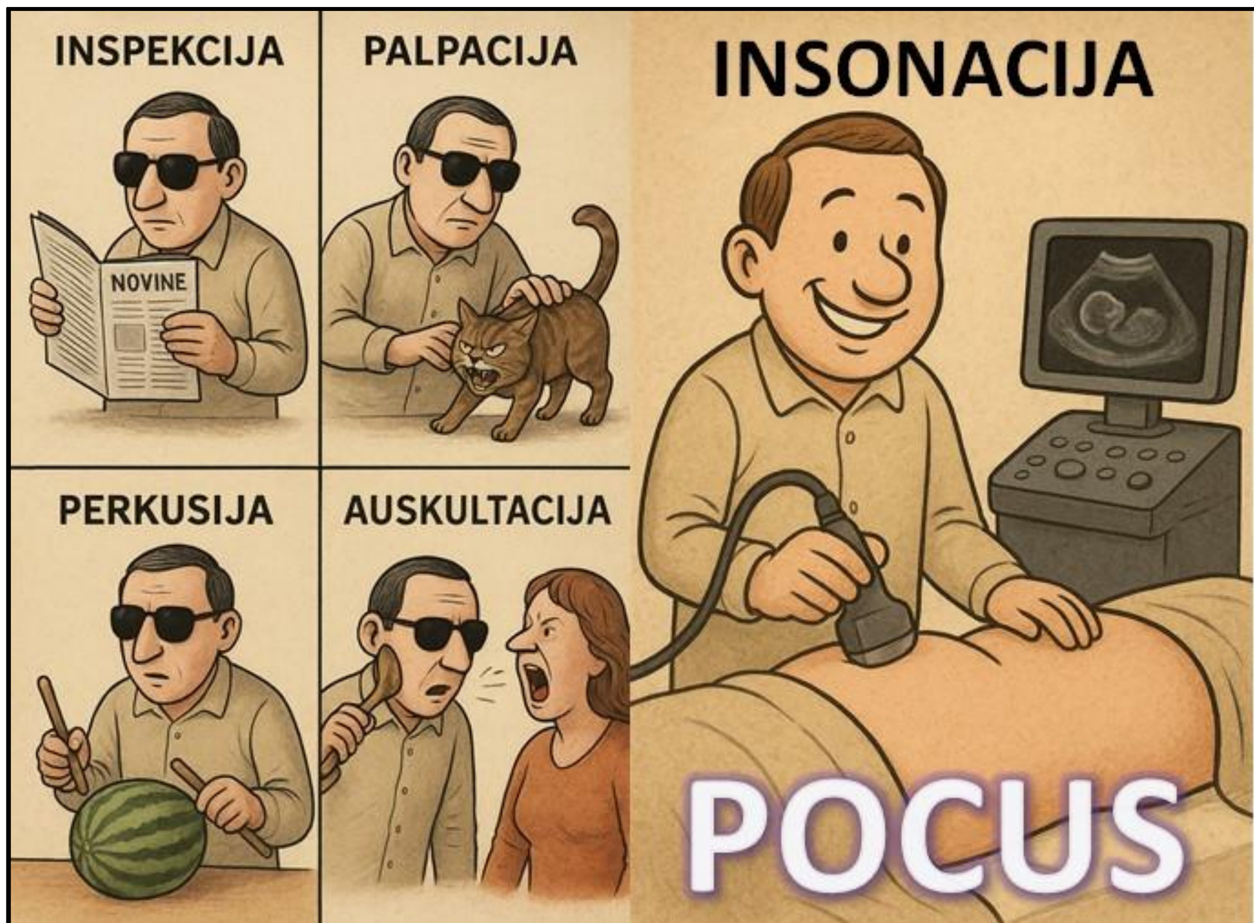
WBU – The Importance of Comprehensive Insonation as the Fifth Pillar of Propaedeutics

By Ivica Zdravkovic, MD



Some time ago, I heard about a case of a patient who lost his life due to an abdominal aortic dissection. A few days prior, he had sought medical attention and was examined by both a cardiologist and a urologist. The cardiologist examined his heart; the urologist examined his bladder and prostate. One scanned "above," the other scanned "below"... but no one looked at the middle. Unfortunately, the patient never made it to the surgeon.

At the POCUS Academy Serbia, we advocate for a holistic approach to ultrasound use within primary healthcare settings, as well as in healthcare in general. This "fifth pillar" of physical examination (insonation) must become part of routine practice: fast, non-burdening, and MANDATORY!

Traditionally, Point-of-Care Ultrasound is used partially: doctors mostly focus on a single organ system or region, while the rest of the body remains "invisible." The reasons for this include a focus on narrow specialization, sometimes - unfortunately - a lack of interest in delving deeper into the patient's history, and often a fear of "venturing into territories" that are insufficiently familiar.

At our Academy, we like to say: we will teach you how to drive the car (how to hold the probe and scan), and it is up to you to decide which terrains you will drive that car across (what you will scan).

It is necessary to move away from a fragmented approach in ultrasonography in favor of a systematic, comprehensive examination. A standard Whole-Body Ultrasound (WBU) includes an examination of the lungs, heart, abdomen, and pelvis, a quick evaluation of the thyroid gland and carotid arteries, as well as a rapid exclusion of deep vein thrombosis (DVT) and peripheral ischemia. When necessary, other regions are added, such as insonation of focal breast lesions, bedside musculoskeletal (MSK) ultrasound, rapid scrotal sonography, ocular ultrasound, and similar.

A Whole-Body Ultrasound conceived this way - known at our Academy as the "PROBE Protocol" - incorporates most other well-known protocols, such as eFAST, RUSH, BLUE, PEARLS, FATE, and others.

Most importantly, the common misconception that ultrasound "wastes time" does not hold up: for a well-trained physician, performing a comprehensive "head-to-toe" examination takes no more than ten minutes.

Furthermore, we must repeat over and over again: ultrasound is not a "bogeyman"! You have learned so much already; you will learn this too.

Finally: using ultrasound as part of a physical examination is not and cannot be anyone's "privilege" - it is the RIGHT of every physician, and we hope that one day it will also become an OBLIGATION!

Learn WBU. Use POCUS. Provide answers, stop posing questions.

International POCUS Academy

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Free Add:

As a token of gratitude to the company **Medisal d.o.o.** from Belgrade, which has assisted us on several occasions this year in organizing our POCUS gatherings by providing ultrasound machines, today we would like to draw our colleagues' and friends' attention to the phenomenal **TE Air wireless multipurpose probe**.

Medisal is a distributor of **Mindray** equipment. We have had the opportunity to compare the performance of this probe with similar devices (such as Clarius, GE V-scan, Butterfly, Philips Lumify, etc.), and the TE Air probe is truly impressive. It enables rapid scanning of practically all anatomical regions, and we highly recommend it - especially for use in ambulances, by emergency department physicians, as well as by doctors working in rural and remote areas. Ideally, every General Practitioner (GP) will one day have a probe like this in their pocket.

For details regarding the price of the TE Air probe, please consult the relevant internet links.

B-lines and B-profile in Lung Ultrasound: "Wet" vs. "Dry" Interstitial Syndrome

By Ivica Zdravkovic, MD

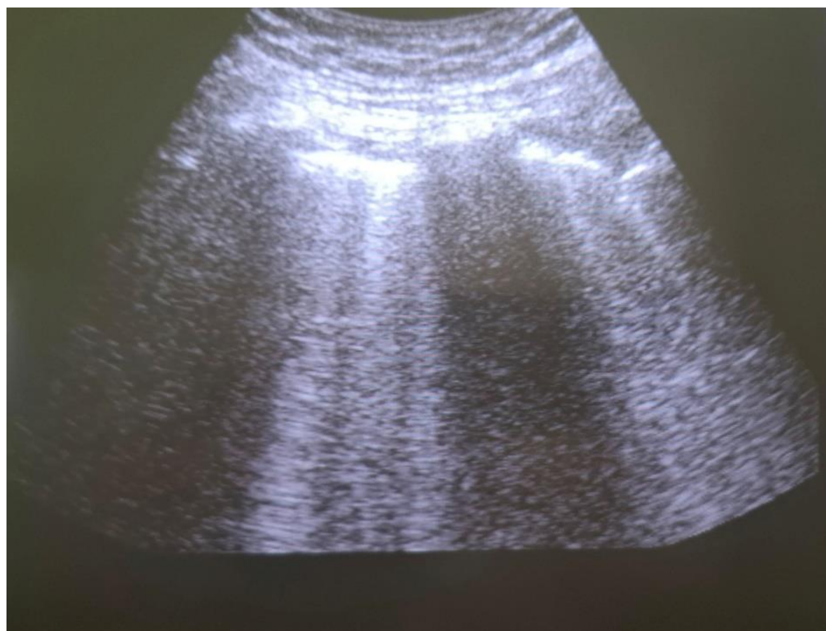
In lung ultrasound, we sometimes observe vertical, bright lines that originate from the pleural line and extend all the way to the bottom of the screen. These are known as B-lines. Their key characteristics are that they move with lung sliding, reach the bottom of the screen, and crossw-cut the horizontal A-lines. In earlier literature, they were also referred to as "lung rockets," to distinguish them from "lung comets" - which also originate from the pleura but are shorter, usually reaching only to the first A-line, and are typically a result of pleural adhesions or subpleural microbullae.

When we observe at least three B-lines in a single intercostal space, or one confluent, thick B-line, we refer to this as a B-profile. This is the ultrasound equivalent of interstitial syndrome.The B-profile can be:

1. "Wet" → representing transudate (cardiogenic pulmonary edema) or exudate (pneumonia, ARDS, inflammation).
2. "Dry" → representing pulmonary fibrosis, where there is no fluid component, but rather permanent structural changes in the lung tissue.

Failing to recognize this third, fibrotic etiology of interstitial syndrome (B-profile) can lead into a clinical trap. A patient with chronic pulmonary fibrosis can develop acute inflammation. After treatment, symptoms subside and laboratory results normalize (CRP, ESR, white blood cell count), but the B-profile remains on the ultrasound. If we do not understand that this is a consequence of fibrosis, there is a risk of unnecessarily "over-treating" the patient.

Therefore, it is crucial to remember: a B-profile does not always indicate an active, "wet" process - it can also represent permanent, "dry," fibrotic changes.



B-Lines on Lung ultrasound

POCUS MOSCOW: JULY–DECEMBER 2025

MD/PhD Vsevolod Lykhin, CEO of POCUS MOSCOW

The second half of 2025 marked one of the most dynamic and productive periods for the POCUS MOSCOW team. Building upon the momentum of the first half of the year, we continued to expand our educational and clinical presence both locally and internationally, delivering a broad spectrum of POCUS-focused initiatives that reflect our growing role in the global POCUS community.

Continuous Education at Botkin Simulation Center

Throughout the entire second half of the year, we consistently ran our core curriculum of POCUS MOSCOW training courses at the Simulation Center of the Botkin Hospital in Moscow. These high-fidelity, simulation-based workshops provided physicians of all levels—from residents to practicing anesthesiologists—with hands-on experience in protocols ranging from eFAST and RUSH to regional anesthesia and vascular access.

The “School of the Young Specialist” Grows

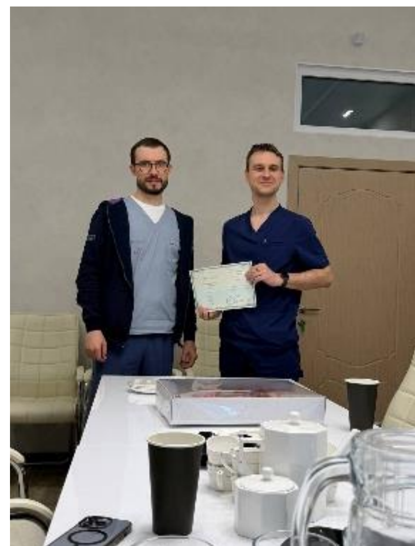
We continued to develop our flagship academic initiative - the School of the Young Specialist in Anesthesiology and Critical Care - with over 10 thematic sessions held on topics critical to junior clinicians. These interactive forums not only reinforce foundational skills but also promote a culture of collaboration, mentoring, and innovation.

POCUS & PAIN Congress – A New Multidisciplinary Milestone

In July 2025, we launched a groundbreaking new event: the POCUS & PAIN Congress - a multidisciplinary conference focused on the synergy between ultrasound-guided diagnosis and pain management. Held at a state-of-the-art venue in Astana, Kazakhstan, this congress featured a unique format combining lectures, hands-on workshops, and international dialogue. We extend our deep gratitude to POCUS KAZAKHSTAN and Andrey Proshunin for their leadership, as well as to Dr. Ivica Zdravković for his powerful keynote contribution on behalf of the International POCUS Academy.

Reaching Remote Regions: Magadan, Ulan-Ude, Blagoveshchensk

From Magadan to Blagoveshchensk, our team traveled across thousands of kilometers and time zones to deliver in-person POCUS training in some of Russia's most remote areas. The enthusiastic response in each region highlights the growing demand for practical, bedside ultrasound education across the country



Kazakhstan Outreach: 4 Cities, 1 Mission

Our collaborative efforts with POCUS KAZAKHSTAN intensified during this period, with successful training events held in Atyrau, Shymkent, Almaty, and Ust-Kamenogorsk. Thanks to the support of ultrasound equipment manufacturers, we were able to offer free, high-quality training sessions to local physicians, greatly enhancing accessibility to point-of-care ultrasound in Central Asia.

PHILIPS

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PHILIPS

Continued Excellence in Moscow with AILB

Back in Moscow, our partnership with the interpain.ru Educational Center remained strong. Together, we conducted multiple advanced workshops on ultrasound-guided regional anesthesia and interventional pain procedures, continuing to position Moscow as a hub of excellence in POCUS-based pain education.

Expanding into Veterinary Medicine

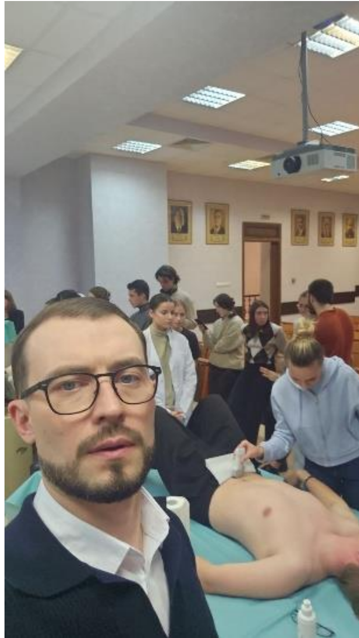
In an exciting interdisciplinary leap, we launched POCUS VETERINARY, a new initiative exploring the use of ultrasound in small animal anesthesia and diagnostics. Our anatomical expertise now spans both human and veterinary domains. Ultrasound for all!

International Faculty: POCUS India Congress

Our colleague Dr. Elena Adieva represented POCUS MOSCOW as faculty at the 10th SARPS Pain Congress in New Delhi, marking another successful chapter in our growing collaboration with the Indian pain and ultrasound community. Congratulations to Elena on a well-received presentation and continued engagement with international peers.

POCUS for Students: eFAST Course for Future Doctors

We remain committed to supporting medical students and young learners. Together with Andrey Efanov, we conducted a dedicated eFAST protocol course for students, emphasizing the importance of ultrasound fundamentals across all medical specialties. POCUS is not a luxury - it is an essential skill for the next generation of clinicians.

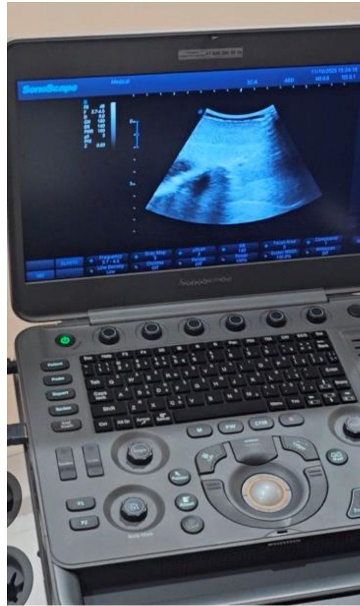


Innovation: Custom Phantom for Pelvic Pain Interventions

In 2025, the POCUS MOSCOW team took part in the development of a custom-designed ultrasound phantom specifically tailored for ultrasound-guided interventions in chronic pelvic pain. This innovative model was engineered through a collaboration between POCUS educators and a specialized team of phantom designers with experience in creating high-fidelity anatomical simulators.

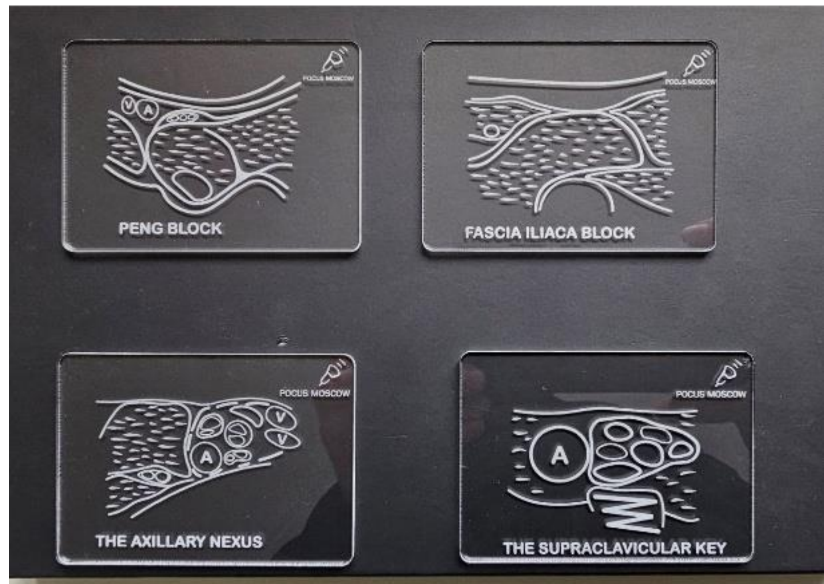
The phantom was successfully tested during a national hands-on course held as part of the conference *One Problem for Two*, dedicated to the multidisciplinary management of pelvic pain. Notably, this course had a strong international presence, with active participation from leading pain specialists Tolga Ergönenç (Turkey) and Felice Occhigrossi (Italy). Their contributions enriched the program, enabling the demonstration and validation of new interventional techniques in a diverse educational setting.

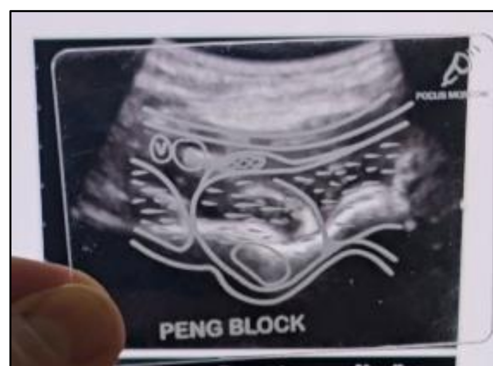
This milestone project not only showcased the potential of ultrasound phantoms as tools for procedural standardization, but also emphasized the value of cross-border educational collaboration in pain medicine and ultrasound-guided therapy.



Educational Materials: Anchor Anatomy Acrylic Cards

One of our most ambitious educational projects was the creation of acrylic cards for ultrasound-guided regional anesthesia, based on the concept of "Anchor Anatomy." These visually striking, tactile tools guide learners through key sonoanatomical landmarks and will soon be expanded to cover all major POCUS protocols.





Strategic Collaboration: NYSORA & POCUS MOSCOW in Dubai

A defining moment of the year was our meeting with NYSORA at their anniversary conference in Dubai. During the event, we presented our Anchor Anatomy cards to Prof. Admir Hadzic and held productive discussions about future collaborations. This encounter marks the beginning of a new era of synergy between POCUS MOSCOW and NYSORA—two teams with a shared vision for excellence in education.

Looking Ahead

The second half of 2025 showcased our unwavering commitment to innovation, collaboration, and global integration. From remote cities in Russia to prestigious conferences abroad, the POCUS MOSCOW team remains dedicated to advancing point-of-care ultrasound as a universal medical language.

In POCUS We Trust.

ULTRASOUND DIAGNOSTICS OF PORTAL HYPERTENSION

By Ivica Zdravkovic, MD

Portal hypertension is a condition characterized by increased blood pressure within the portal venous system, which is responsible for collecting and draining blood from the gastrointestinal tract, spleen, pancreas, and gallbladder. The portal circulation begins in the capillary network of the intestines and spleen, collecting nutrient-rich and toxin-laden blood, which is then directed through the portal vein toward the liver. Within the liver, blood flows through the sinusoids and exits via the hepatic veins into the inferior vena cava and onward to the heart.

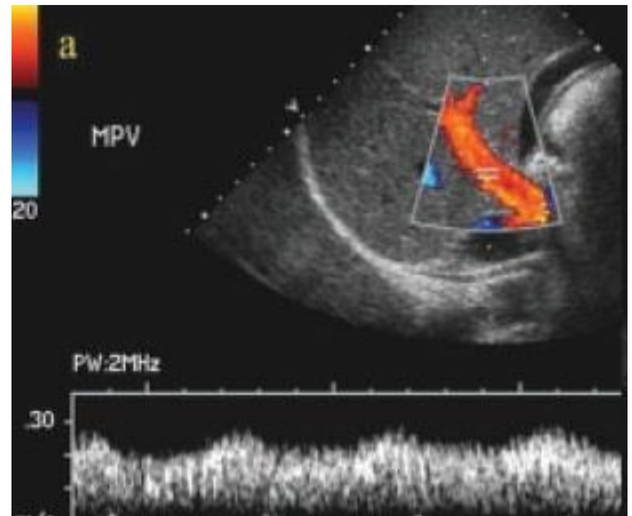
The etiology of portal hypertension is multifactorial and can result from prehepatic, intrahepatic, or posthepatic causes. Prehepatic causes include portal vein thrombosis or luminal narrowing. Intrahepatic causes are most commonly a consequence of liver cirrhosis, which leads to fibrosis and impaired sinusoidal flow. Posthepatic causes are typically associated with obstruction in the hepatic veins or the inferior vena cava (e.g., Budd-Chiari syndrome). Additionally, portal hypertension can be caused by extraluminal compression from tumor masses.

The pathophysiological processes accompanying portal hypertension include increased resistance to blood flow through the liver, leading to elevated pressure in the portal vein. Consequently, collaterals (bypass vessels) and shunts develop between the portal and systemic circulations to alleviate the pressure. However, these collateral vessels often lead to complications such as esophageal and gastric varices, ascites, and splenomegaly.

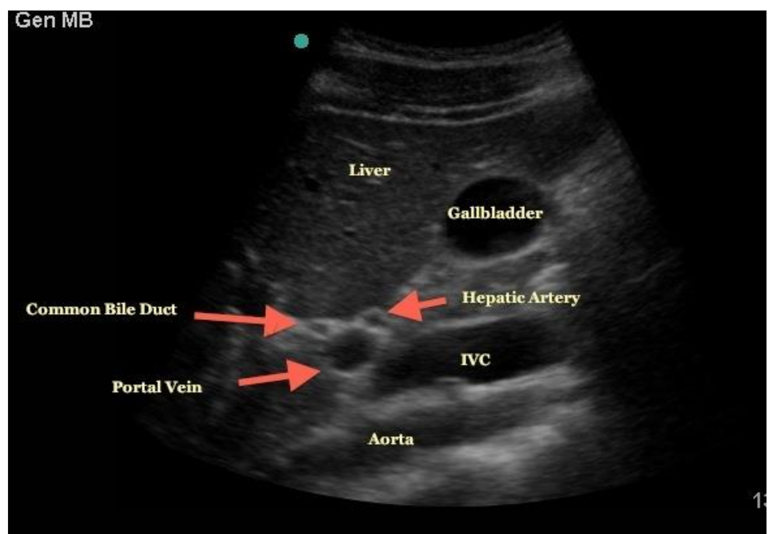
Ultrasound examination of the portal vein is one of the primary non-invasive diagnostic methods for evaluating portal hypertension. This examination allows for the assessment of size, flow dynamics, and potential complications within the portal venous system. During the ultrasound examination, the following parameters are observed:

1. **Portal vein diameter** – normally up to 13 mm; a diameter exceeding 13–15 mm may indicate portal hypertension.
2. **Flow velocity and direction** – Doppler ultrasound measures flow velocity; reduced velocity (<16 cm/s) or the presence of retrograde flow indicates portal hypertension.
3. **Presence of thrombosis or luminal obstruction** of the portal vein.
4. **Presence of collateral vessels** – identification of dilated portosystemic collaterals.
5. **Ascites and splenomegaly** as indirect signs.

Analysis of Doppler flow characteristics is of particular importance in the ultrasound diagnosis of portal hypertension. In the standard subcostal probe position, the portal vein is displayed in red, which according to the BART rule (BLUE AWAY, RED TOWARDS), indicates blood flow toward the probe, and thus toward the liver. This type of flow is called HEPATOPETAL. Reversed or retrograde flow, which carries blood away from the liver, is called HEPATOFUGAL. In such cases, Doppler displays blue, as the blood flows ("flees") away from both the probe and the liver.



The well-known ultrasound "Mickey Mouse" sign in the liver consists of the portal vein as the "head," while the hepatic artery and the common bile duct represent the "ears." In healthy individuals, Doppler flow in both the portal vein and hepatic artery is red, indicating hepatopetal flow. The diameter of the portal vein (the "Mickey Mouse head") typically measures between 8 and 10 mm. In portal hypertension, the diameter exceeds 13 mm, and the Doppler colors change—the hepatic artery remains red (hepatopetal flow), while the portal vein displays blue, indicating hepatofugal, retrograde flow. This formation and the change in Doppler characteristics represent a vital ultrasound sign of portal hypertension.



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ASSESSMENT OF VOLUME STATUS WITH POCUS

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Introduction

POCUS (Point-of-Care Ultrasound) is defined as a bedside ultrasound performed by the treating clinician to answer specific, focused clinic questions in real time.

Advantages of Point-of-Care Ultrasound (POCUS)

1. **Rapid, repeatable, non-invasive, bedside decision-making**

   Enables immediate clinical decisions directly at the patient's bedside, providing instant information without waiting for radiology. Saves crucial time in emergency, ICU, nephrology, and internal medicine settings.

2. **Enhances diagnostic accuracy**

   More accurate than physical examination alone.

3. **Improves patient safety**

   Guides procedures such as central venous catheter placement, thoracentesis, paracentesis, and biopsies, significantly reducing complication rates.

4. **Highly accessible and cost-effective**

   Portable machines and handheld devices allow ultrasound use anytime and anywhere, decreasing reliance on expensive imaging modalities.

5. **Supports repeated monitoring**

   Can be performed multiple times per day to track disease progression. Ideal for dynamic conditions such as shock, acute kidney injury, heart failure, and fluid overload.

Role of POCUS in Fluid Assessment

- **Accurate fluid assessment and determination of a patient's true volume status directly influence decisions regarding resuscitation, diuresis, vasopressor therapy, and overall hemodynamic management.**
- **Traditional clinical examination alone is often insufficient; findings such as edema, blood pressure changes, and jugular venous pressure may be subjective and appear late in the disease process.**
- **Point-of-care ultrasound has emerged as a powerful bedside, real-time tool that enhances the accuracy of fluid status assessment.**
- **By evaluating the heart, lungs, inferior vena cava (IVC), internal jugular vein (IJV), and venous congestion (VExUS), POCUS provides dynamic and objective information.**
- **Integrating clinical findings with ultrasound improves diagnostic confidence, guides fluid administration or removal, and reduces the risks of both fluid overload and hypovolemia.**

- **Ultimately, combining clinical examination with POCUS enables faster, safer, and more individualized fluid management, making POCUS an essential component of contemporary patient assessment.**

Internal Jugular Vein Assessment

- **Jugular venous pressure is traditionally measured vertically from the sternal angle to the highest point of venous pulsation, with the addition of an assumed right atrial depth of 5 cm.**
- **Recently, there has been growing interest in using point-of-care ultrasound for internal jugular vein assessment.**
- **POCUS allows easier identification of the vein and significantly improves the sensitivity of estimating right atrial pressure compared with traditional visual inspection.**

Sonographic Methods of IJV Assessment

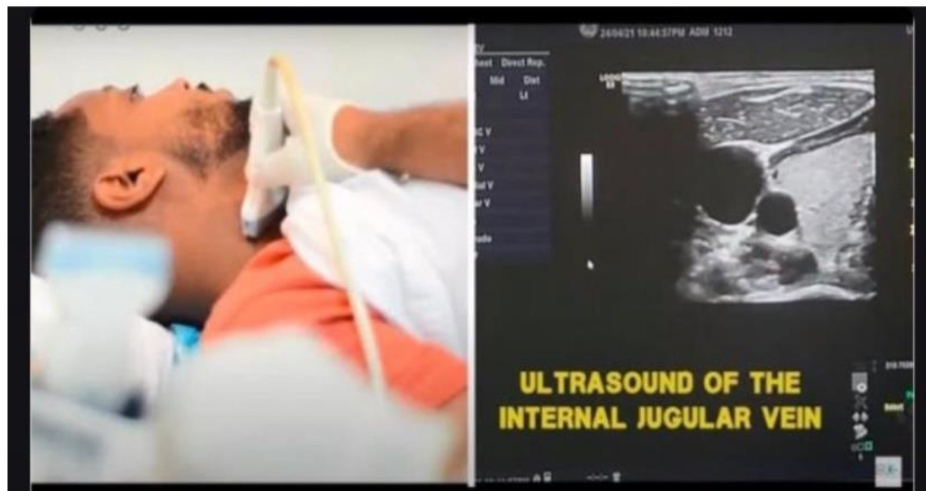
Multiple ultrasound techniques have been described for estimating central venous pressure via the internal jugular vein, including:

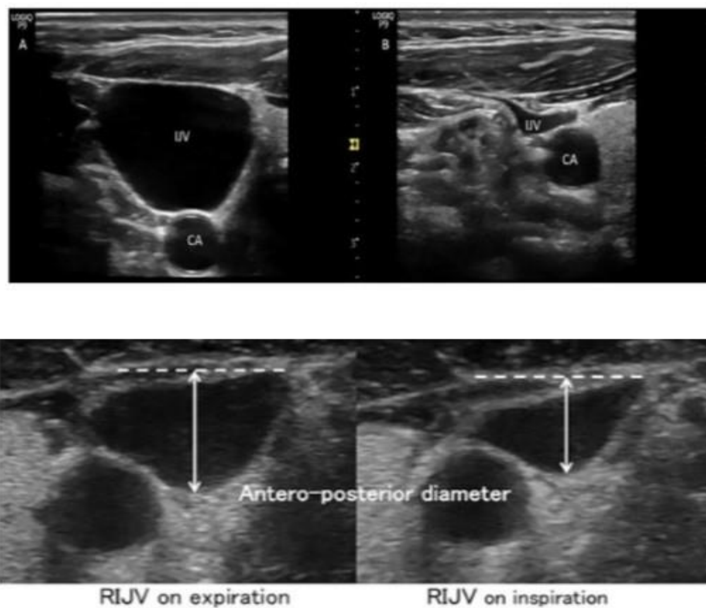
- **Measurement of the vertical height of the blood column in the IJV**
- **IJV height-to-width (aspect) ratio**
- **IJV collapsibility index (IJV-CI)**
- **IJV distensibility index**
- **Maximal anteroposterior diameter of the IJV (AP-IJV Dmax)**
- **Percentage change in IJV cross-sectional area or diameter before and after the Valsalva maneuver**
- **Combination of IJV vertical height with right atrial depth measured by echocardiography**

Internal jugular vein POCUS is a rapid, non-invasive method for assessing fluid status by visualizing the vein and measuring its diameter and collapsibility. Analysis of IJV parameters, such as diameter and collapsibility index, helps clinicians better estimate a patient's volume status and fluid responsiveness. This approach is particularly useful for estimating right atrial pressure and central venous pressure. Analyzing IJV parameters like the collapsibility index and diameter, clinicians can better understand a patient's volume status and fluid responsiveness. It is particularly useful for estimating right atrial pressure (RAP) and central venous pressure (CVP

IJV Collapsibility Index (IJV-CI):

- **This measures the degree to which the vein collapses.**
- **A low collapsibility index (e.g., < 30%) suggests high right atrial pressure (RAP).**
- **A high collapsibility index can indicate low volume.• IJV diameter:**
- **The size of the vein is an indicator of its filling status.**
- **A larger, rounder, and more engorged IJV is associated with increased central venous pressure**





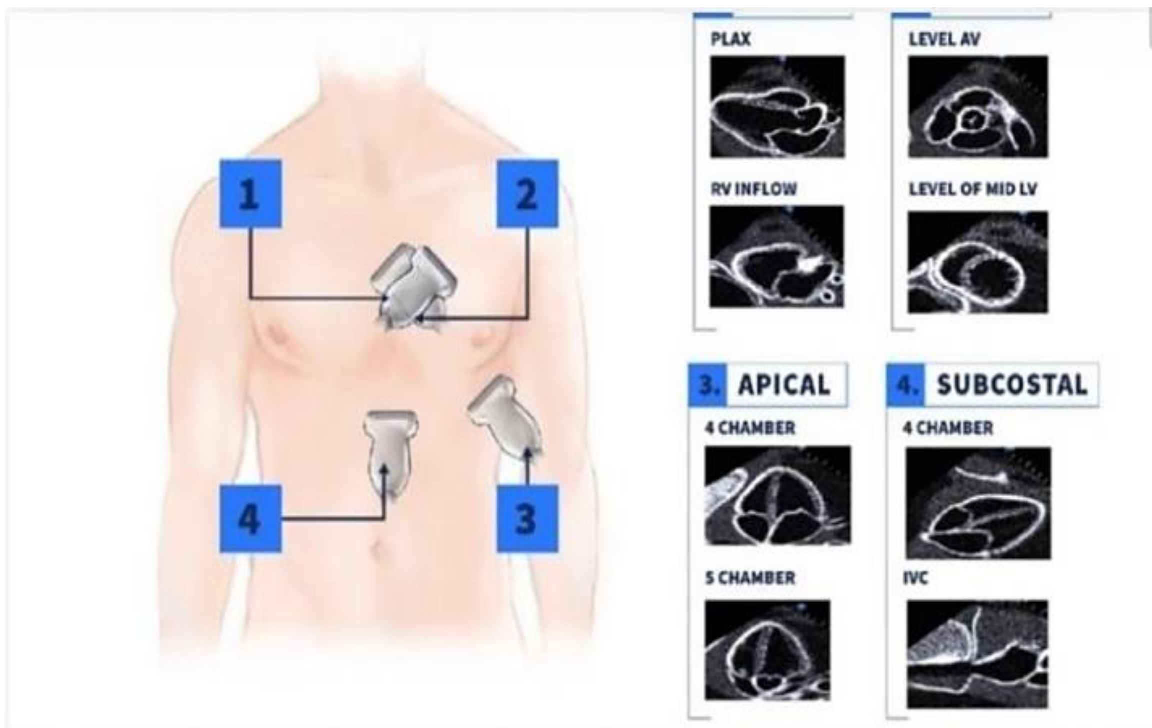
Advantages of using IJV POCUS

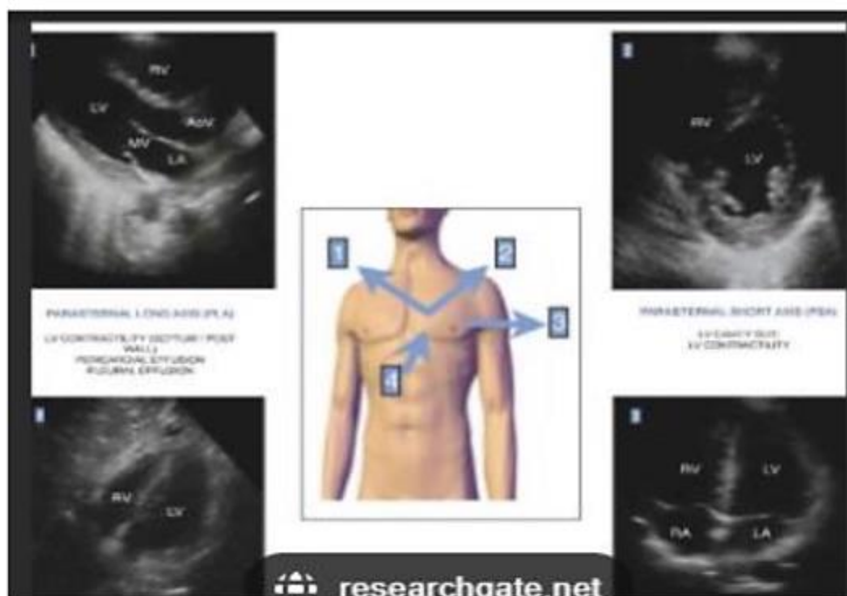
- **Non-invasive: Unlike central venous pressure monitoring, it does not require invasive catheters.**
- **Real-time: It provides immediate results at the bedside.**
- **Objective data: It provides objective measurements to supplement clinical exams, which can be subjective.**

Limitations

- **Patient anatomy: Some patients have anatomies that make visualization difficult. stenosis, thrombosis**
- **Technical factors: The technique requires expertise and proper patient positioning to avoid misinterpretation.**
- **Excessive pressure, can falsely compress the vein, making it appear collapsed when it is not Incorrect angle**
- **Thrombosed, stenosis of IJ**
- **Multiparametric approach: It is best to use IJV POCUS in conjunction with other clinical data rather than as a standalone diagnostic too**

POCUS Assessment of Volume Status (Cardiac-Focused)





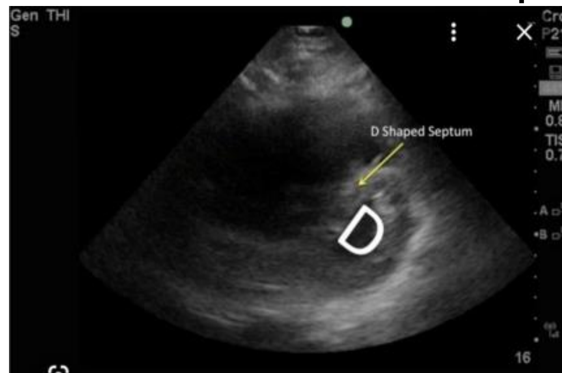
1. Parasternal Long-Axis (PLAX) – LV Contractility & Filling

What to look for:

- **LV size – small LV cavity suggests low volume / underfilling.**
- **LV contractility – hyperdynamic LV suggests hypovolemia.**
- **Small, vigorously contracting LV → likely hypovolemic.**
- **Normal or dilated LV with poor contractility → fluid overloaded or cardiogenic.**
- **D-shaped LV → RV pressure/volume overload (not hypovolemia).**
- **Pericardial effusion → rule out tamponade.**

2. Parasternal Short-Axis (PSAX) View for Fluid Assessment – LV Contractility & Filling

- **Small LV cavity with vigorous squeeze → suggests hypovolemia**
- **Large LV with poor squeeze → suggests overload**
- **RV Size**
- **In PSAX you compare RV (crescent-shaped) to LV:**
  - **Normal: RV < 2/3 LV diameter**
  - **If RV dilation → think RV strain**
- **D-shape**
- **In a normal heart, LV cross-section in PSAX is perfectly round.**
- **When RV pressure or volume increases, the interventricular septum pushes toward the LV, making the LV look like the letter "D". This is called septal flattening or "D-sign"**



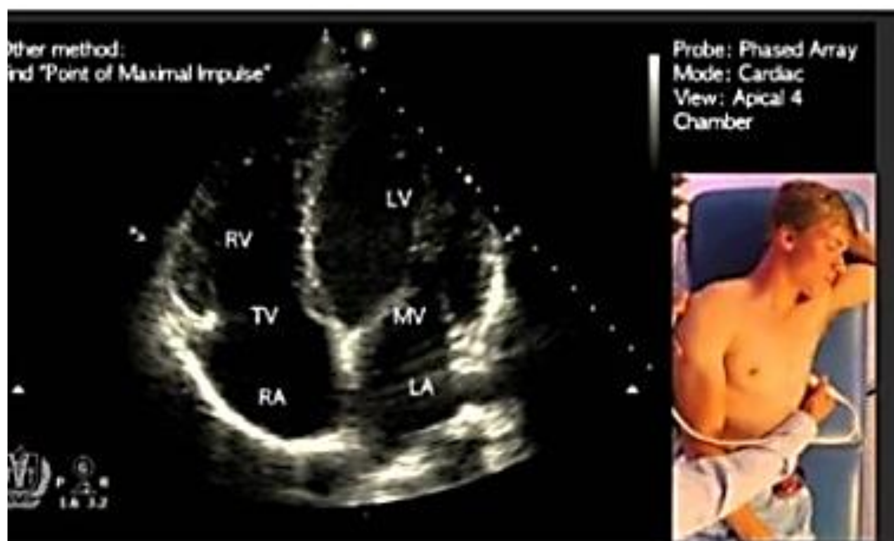
3. Apical 4-Chamber View – LV & RV Filling

Assess:

- **RV size to LV**

Tips:

- **RV bigger than LV → RV overload, not hypovolemia.**
- **Very small LV cavity → volume depletion**



4. Subcostal View – IVC Size & Collapsibility (Most Used)

How to measure:

- **2 cm from the IVC–RA junction**
- **Measure maximal diameter (IVCmax)**
- **Measure minimum diameter with sniff (IVCmin)**
- **Calculate Collapsibility Index**

5. LVOT Velocity–Time Integral (LVOT-VTI)
(For more advanced assessment)

- **LVOT VTI measures how much blood leaves the heart with each beat.**
- **Low VTI → low stroke volume → may respond to fluids**
- **Rising VTI after fluids → patient is fluid responsive**
- **No change → patient not fluid responsive**
- **Very high VTI with signs of congestion → consider decongestion, not fluids**

When we assess a patient's volume status, we want to know:

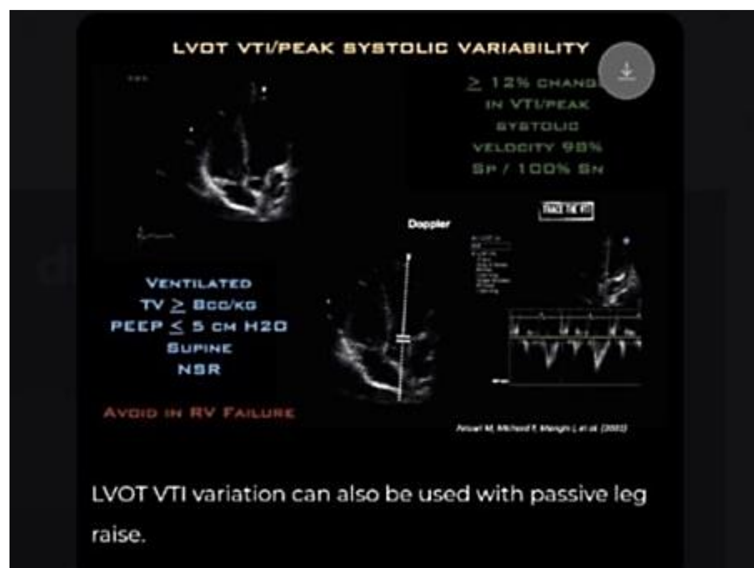
- **Is the patient fluid-responsive**
- **Is the cardiac output improving with fluids**
- **Is the patient in shock or overloaded**

How LVOT VTI is used:

- **1. Put the probe in apical 5-chamber view**
- **2. Use PW Doppler in LVOT**
- **3. Measure VTI (normal ~ 18–22 cm)**
- **4. Give a small fluid challenge or passive leg raise**
- **5. Re-measure VTI**

- **If VTI ↑ by > 10–15% → Fluid responsive**
- **If VTI stays the same → Not fluid responsive**

LVOT VTI is one of the most reliable POCUS methods to assess fluid status because it directly measures forward cardiac output, not just volume in vein



(*... Editor's note: Article firted discusses Lung ultrasound - for full version please contact author:*
Dr. Emad Khater mailto:e_swalha@yahoo.com)

Venous Excess Ultrasound (VExUS) Score

To help us with this, doctors William Beaubien-Souligny, Philippe Rola, KorbinHaycock, Rory Spiegel, et al developed a 4- step ultrasound protocol: the Venous Excess Ultrasound (VExUS) Score evaluate the severity of venous congestion of not just the IVC but also the liver, gut, and kidneys. VExUS Score validated in a recent study and showed a correlated increased risk of AKI with an increased grade of venous congestion syndrom

When to use POCUS for Venous Congestion

Evaluation for venous congestion using Point of Care Ultrasound (VExUS POCUS) can be performed when trying to assess the fluid status of the patient. This can be especially important in our septic shock, congestive heart failure, and acute renal failure patients to help give us more data points towards starting fluids, stoping fluids, diureses, or vasopressor choice. This exam should be done in conjunction with the clinical picture, lab values, and hemodynamic status of the patient. It should also be combined and interpreted along with cardiac ultrasound findings when possible. The VExUS Score can give you evidence of venous congestion in the liver, gut, and kidneys to help predict early signs of end-organ damage. It will allow you to change/optimize your fluid management approach for your patient. It can also prompt you to look for the etiologies of your venous congestion such as causes of right heart failure

The organs you will be evaluating using the VExUS Ultrasound Protocol (ProtocoloVexus). several points prior to blood entering the right heart.

- **Inferior Vena Cava**
- **Liver (hepatic veins)**
- **Gut (portal veins)**
- **Kidneys (intrarenal veins**

1) VExUS Score Step 1: IVC Assessment

- **Acquiring the IVC view with Ultrasound:**
- **Evaluate the size and collapsibility of the IVC.**
- **If the maximum IVC diameter is <2cm, then there is no significant venous congestion (at least cardiac related). You can stop the exam here and the VExUS score is 0.**
- **If IVC is >2cm then proceed to the next steps**

2) VExUS Score Step 2: HEPATIC Vein Doppler Assessment

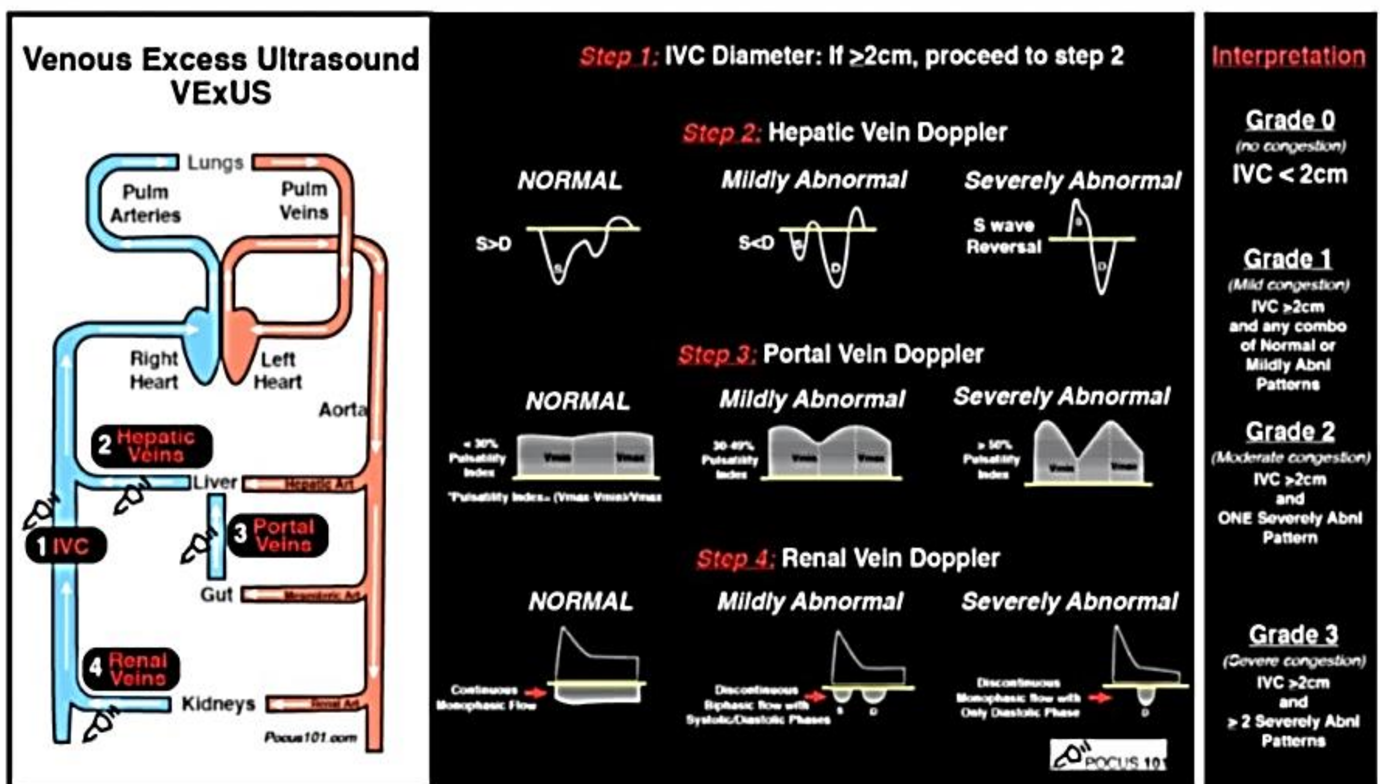
- **Acquiring the Hepatic Vein View with Ultrasound:**
- **There are three hepatic veins: the right, middle, and left hepatic veins.**
- **You can use any of these veins to evaluate for hepatic vein Doppler patterns but the middle and right hepatic are usually the most accessible since the L hepatic vein view can be obscured by bowel/stomach gas.**
- **figure showing approximately where you should**

3) VExUS Score Step 3: PORTAL Vein Doppler Assessment

- **Acquiring the Portal Vein View with Ultrasound:**
- **portal vein is probably the easiest vein to find (compared to the hepatic and intrarenal veins).**
- **This can be done by placing your probe in the right midaxillary line.**

4) VExUS Score Step 4: Intrarenal Venous Doppler Assessment

The intrarenal vein assessment is probably the most difficult assessment to do out of all of the vessels. This is because the intrarenal veins are fairly small and the patient's breathing patterns may limit your views. But don't be discouraged and keep trying your best to get these views. With practice, you will get better at acquiring them. To View the kidneys on either side at the posterior axillary line. Turn on the color Doppler and then look for the Interlobar vessels.Place the pulse wave Doppler gate where you see the best color Doppler signal and activate pulse wave Doppler.



VExUS Ultrasound Score Protocol PDF

VExUS Ultrasound Score:

- **Grade 0: IVC <2cm = NO Congestion**
- **Grade 1: IVC >2cm with any combo of Normal or Mildly Abnormal Patterns = MILD Congestion**
- **Grade 2: IVC >2cm and ONE severely Abnormal Pattern = MODERATE Congestion**
- **Grade 3: IVC >2cm and >2 Severely Abnormal Patterns = SEVERE Congestio**

CONCLUSION

- **Fluid assessment some time challenging and clinical examination is not always sufficient.**
- **The diagnostic performance of POCUS is superior compared to traditional clinical examination and can be utilized as complement to PE**
- **Physician should be encouraged to use POCUS in clinical practice**
- **POCUS provides a rapid, accurate, and bedside tool to assess intravascular volume and hemodynamic status, outperforming isolated clinical examination.**
- **Integrated assessment is essential: No single parameter defines volume status.**
- **A combined evaluation of IVC, IJV, lung ultrasound, focused cardiac views, and VEXUS grading offers the most reliable picture of congestion or hypovolemia.**
- **Clinical decision-making should always integrate POCUS with patient history, vital signs, and labs to avoid misinterpretation.**
- **POCUS-guided volume assessment enhances accuracy, safety, and individualized**

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