Teaching and use of bedside ultrasound in Colombia

An internal medicine perspective

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"In the history of mankind, it will be found that no great discovery, or probably conjecture was ever promulgated, without encountering the most bitter opposition".
WILLIAM STOKES, 1825. AN INTRODUCTION TO THE USE OF THE STETHOSCOPE

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Abstract

Ever since the invaluable contributions of Auenbrugger and Laennec, we had not experienced a physical exam revolution equal to the introduction of ultrasound performed by the patient's clinician and/or attending physician. Ultrasound performed by clinical specialists in any area (hospital floors, intensive care, the emergency room, outpatient departments and even in the home) with different training backgrounds (emergency medicine specialists, internists, intensivists, anesthesiologists, pulmonologists, nephrologists, family medicine doctors, rheumatologists, general surgeons, etc.) has brought a new energy to the physical exam. The evidence of the impact of bedside ultrasound is growing and compelling in many aspects. Compared to the usual practice, it allows the clinician to not only make more accurate but also faster diagnoses and thus begin treatment sooner and, in some cases, improve clinical outcomes like emergency room visits, rehospitalizations, hospital stay, and clinical times, among others.

This article relates how point-of-care ultrasound (POCUS) emerged, how it is taught around the world, and what is being done in our country in different settings to make ultrasound performed by internists and subspecialists a reality in Colombian patient care. **(Acta Med Colomb 2024; 49. DOI: https://doi.org/10.36104/amc.2024.3039).**

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Introduction

As with all facets in medicine, today's physical exam has not always existed. It was Hippocrates who spoke of disease within the body, and from then on, physical exploration has been reinvented and mutated countless times up to its current version, with changes mostly motivated by the relentless curiosity of their proponents.

However, not since the priceless contributions of Auenbrugger y Laennec (1) had we witnessed a revolution in physical exploration like the one introduced by ultrasound performed by the patient's clinician and/or attending physician. Ultrasound performed by clinical specialists in any area (hospitalization, intensive care, the emergency room and even in the home) and with different training (emergency medicine specialist, internist, intensivist, anesthesiologist, pulmonologist, nephrologist, family medicine specialist, rheumatologist, general surgeon, etc.), has breathed new life into the physical exam. We have enough evidence today in different publications around the world showing that ultrasound has a positive impact on clinical diagnosis (2). This has resulted in changes in medical teaching focused on the techniques and interpretation of bedside imaging, all in light of the classical medical history.

This practice of bedside ultrasound is intended to be a focus tool which should be linked to and complement the work of diagnostic imaging experts like radiologists and cardiologists. Therefore, it does not seek to compete for space with radiology or cardiology; rather, clinical ultrasound is here to enrich the diagnostic process, with the main beneficiary being the patient. The most common criticism of ultrasound is its operator dependence, but we should not forget that daily use instruments like the stethoscope and ophthalmoscope, among others, also depend on the operator that interprets them.

The evidence of the impact of bedside ultrasound is growing and compelling in many aspects. It allows the clinician

to make not only more accurate but more rapid diagnoses, compared with the usual process, thus achieving earlier treatment and, in some cases, improving clinical outcomes like emergency room visits, readmissions, hospital stay, and treatment times, among others (3-5).

This article discusses how point-of-care ultrasound (POCUS) emerged and is taught around the world and what is being done in our country in different settings to make ultrasound performed by internists and subspecialists a reality in Colombian patient care.

Ultrasound as an extension of the physical exam

Medical ultrasound is thought to have been first used by Karl Theodore Dussik in 1942 (Figure 1); there were also significant contributions by Wild, Hertz, and Siemens, among others. With the implementation of ultrasound in areas like cardiology, radiology and obstetrics in the 1970s, an important area was opened up for ultrasound diagnosis in these specialties (6).

It is at least a curious coincidence that it was also in Paris, where Laennec lived and heralded the use of the stethoscope, that Daniel Lichtenstein used the obsolete ADR 4000 ultrasound machine at the famed Hôpital Ambroise-Paré towards the end of the 80s, under the tutelage of Francois Jardin, to broaden his senses using bedside ultrasound, thus starting the journey that would lead to him being recognized today as the father of pulmonary ultrasound (7).

The main problem was the size of these large ultrasound machines. It was not until the 90s that their size began to give them some portability, thus allowing their use to be transferred from highly specialized areas with staff trained solely in image interpretation, to patient care areas.

The publication of the now classic Focused Assessment with Sonography in Trauma (FAST) protocol highlighted the relevance of ultrasound focused on critical areas in which expeditious diagnosis is essential for outcomes (8). This led to its inclusion in the Advanced Trauma Life Support (ATLS) guidelines at that time, and since then it has evolved

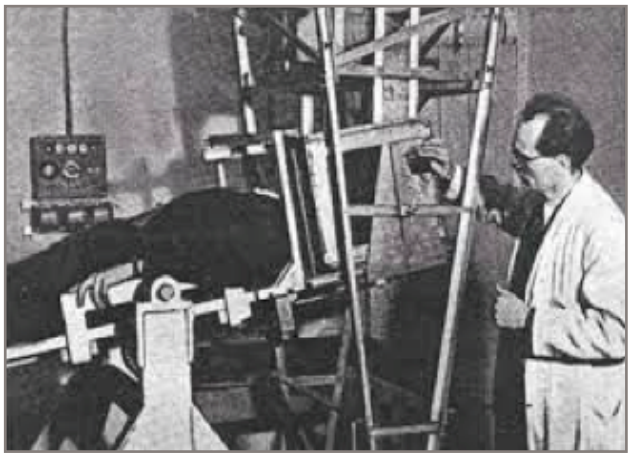

Figure 1. *The first ultrasound machine in 1942. Taken from Sudol-Szopinzka et al. History page: Leaders in MSK Radiology Karl Dussik. Seminar in musculoskeletal radiology. 25. (1) 2021. Thieme Medical Publishers..*

exponentially, with ultraportable devices available today which are so small that they can be carried in lab coats and used continuously at the bedside (9) (Figure 2).

Currently, bedside ultrasound is consolidated as the fifth pillar of physical examination, joining the irreplaceable inspection, percussion, palpation and auscultation; supported by figures like Eugene Braunwald and changing a paradigm inherited from centuries ago (10). Point-of-care ultrasound has arrived to be a tool that adds to and complements the clinician›s ability to make decisions based on better information, correct interpretation and aimed at a better approach. It once again appeals to our curiosity to «see under the skin» and complements the initial examination pillars, providing the ability to visualize the ascites suspected during inspection, see the valvular regurgitation which was suggested during auscultation and even confirm the suspected hydronephrosis in patients with anuria.

POCUS training around the world

Many experiences have been published since the beginning of the 21st century, showing how adequate and super-

Figure 2. *Various ultraportable ultrasound devices. *Authors' compilation.*

vised training allows clinicians to have a good diagnostic performance which can be complemented by diagnostic imaging specialists. For example, pericardial effusion could be diagnosed by emergency medicine physicians with one hour of theoretical training and four hours of practical training, with 96% sensitivity (11). There is evidence to suggest similar outcomes in detecting systolic dysfunction (12) and valvular disease (13). Even the detection of ascites by first-year medical students shows the plausibility of teaching POCUS at different training levels (14).

At the same time, it should also be emphatically stated that the transmission and appropriation of the tool must be responsible, supervised by trained professionals with experience, and even verified by formal imaging. All of this to avoid lapsing into diagnostic oversimplification which can be a latent danger in patient care.

Based on this premise, different academic figures like Nilam Soni, the director of the Center for Clinical Ultrasound at the University of Texas (USA), have taken the lead and not only advocated for the inclusion of this diagnostic modality in graduate internal medicine curriculums but also for the endorsement of scientific societies and their commitment to proper training and certification (15).

There are several entities today that allow certification through a series of training steps that provide ultrasound training for clinicians, ranging from basic to advanced skills. Among these, we could highlight the Point of Care Ultrasound (POCUS) Pathway for Internal Medicine offered by the American College of Physicians, which includes three modules in an expert-guided process, thus offering the general skills that a general internist should have, such as minor procedures (thoracentesis, paracentesis) and diagnosis focusing on prevalent diseases in that specialty (16). Also, the Society of Hospital Medicine provides a series of training steps with tests that certify the pupil's skills. These training strategies involve strict theoretical teaching with previously established concepts, expert supervised practice and the presentation of image portfolios that must be evaluated to determine if they have been properly acquired and interpreted.

The appropriation of this tool has been extending mainly from the intensive care units toward general clinical practice. Various leaders like Andre Denault and Phillipe Rola in Canada, Antoine Viellard Baron and Daniel Lichtenstein in France, and Giovanni Volpicelli in Italy, have managed to consolidate ultrasound as a vitally important tool around the world (17). Recently, the academic nephrologist and proponent Abilash Koratala has promoted the progress of nephrology-focused ultrasound with his project *NephroPOCUS, allowing many to access the theoretical principles of POCUS free of charge (18).*

We emphasize that, in some countries, clinical ultrasound is already a formal subspecialty for internists, emergency medicine specialists, intensivists and other related specialists. In the United States and Canada, you can apply to a specialty like clinical ultrasound, which lasts anywhere from two to three years, in which residents support clinical teams in hospitalization, the emergency room and intensive care, performing imaging for immediate decision making. Training in basic and advanced ultrasound is the characteristic of these programs, achieving expert skill in the different clinical ultrasound modalities.

POCUS training in Colombia

In our experience, we can highlight the path POCUS has traveled in the institutions where we have trained and in internal medicine throughout the country. Initiatives began to appear around 2012, mainly in specialties like emergency medicine and critical care, with the goal of training in bedside ultrasound. These initiatives had the academic support of universities and, at times, personal efforts. The impact of professionals like Yuri Bustos in the Simulation Center at Universidad del Rosario and the INSIMED simulation center were particularly important, along with the subsequent presence of Carlos Santacruz in critical care at Fundación Santa Fe in Bogotá. Likewise, Hans García provided an invaluable contribution to ultrasound training in the anesthesiology and critical care program at Universidad Militar and the PERIOCRIT initiative.

This shows that the initial POCUS impetus began in the areas of critical care and resuscitation, just as in other countries. It was in the emergency room and ICU where POCUS found its first natural niche. In this regard, we highlight current efforts like those of the Department of Emergency and Critical Care Medicine at Universidad de Antioquia, Pontificia Universidad Javeriana, Universidad de Caldas and ICESI, which have advanced in university extension proposals aimed at this task.

The work of Gabriel Ortiz at Universidad Nacional de Colombia drove the publication of the first thesis on POCUS in the country, written by internists in 2013. This study was performed with the support of José Luis Díaz Gómez, an anesthesiologist and intensivist at Baylor College of Medicine in the United States and Chair-elect of the Critical Care Echocardiography Council of the American Society of Echocardiography (19) today. Subsequently, the efforts of Gladys Alfonso and the cardiologist Arnold Méndez to have internists train internal medicine residents has allowed the process to continue. In 2022, the first graduate course on bedside ultrasound in our specialty was created, providing future internists with skills in obtaining and interpreting images. This process is supervised by experts, thus supplying the country with internists trained in ultrasound in different settings. We participated in the formation of the Focused Ultrasound Interest Group at Universidad Nacional, whose goal is to provide academic dissemination within the specialty, and which generates free access audiovisual materials. This experience has been complemented with training for some subspecialties, such as the inclusion in 2023 of the first POCUS course for pulmonologists at the same institution.

In another part of the country, with the same purpose and goal, bedside ultrasound training began for internal medicine residents at Universidad del Norte. Residents in 2017 saw the dawning of clinical ultrasound when POCUS evaluation was slowly introduced for patients with dyspnea, chest pain and shock in the emergency room at Hospital Universidad del Norte. In 2021, the POCUS Course for Internal Medicine Residents began, included within the first-year training for students in that specialty. Training is based on theory classes and guided practice with healthy models over two successive months. After this initial part, training is focused on the ongoing use of ultrasound for decision making in the emergency room, hospitalization and intensive care during the three years of residency. The images taken by residents are taped and then supervised with feedback and ongoing training (20). The POCUS-medical history integration is the real success of the tool and what specialists in training should learn: to interpret the images in the clinical context to make better decisions, as Dr. José Luis Díaz Gómez defines POCUS (21).

Both at Universidad Nacional as well as Universidad del Norte, ultrasound training has been strengthened with clinical research. Case reports, cohorts, and cross-sectional diagnostic validity studies, among others, have been published in national and international journals (5, 19, 20, 22–24). This adds to the repertory of global evidence that allows clinical ultrasound to be recognized today as a revolutionary tool for both physicians and patients, and even for healthcare systems.

The Asociación Colombiana de Medicina Interna (ACMI) [Colombian Association of Internal Medicine] has heeded the call to lead POCUS teaching for the country›s internists. Thus, the Ultrasound Course for Internists. POCUS: point-of-care ultrasound has been offered since 2021. Under the initial initiative of the former national president, Dr. Tatiana Espinosa, and with the decided support of Dr. Javier Arango, the current national president, more than 250 internists have been trained throughout the country. ACMI members and nonmembers, along with physicians from all over Colombia and even several Latin American countries, have gathered. This training is conceived as an initial basic training, which motivates internists to continue on the path toward the ongoing use of ultrasound as an extension of the physical exam.

Having trained specialists throughout the country has placed the importance of this tool as a complement for clinicians who need to make quick decisions, at the center of national discussion. We firmly believe in what POCUS can provide in terms of better diagnostic and treatment outcomes and patient safety.

Where we are heading with POCUS

Education

Compared to the rest of the world, Colombia is just beginning the journey: POCUS has been used by internists and subspecialists in other countries for over 20 years. Countries like the United States, Spain, the United Kingdom, France and Italy teach us that the path to incorporating ultrasound in daily practice begins with methodical, structured training for residents and professors (25). Standardized ultrasound training needs to be included in Colombian curriculums for future internal medicine specialists, and there should be a training plan for the professors in each specialty program throughout the country. With ACMI's leadership, some specialist professors have been able to be trained, who will multiply this knowledge in their programs.

Much remains to be done. Acquiring ultrasound equipment for every hospitalization, ICU or emergency room service requires determination on the part of university and hospital leadership to provide an environment in which our country's future specialists will be trained. Articles show that one of the great barriers to adopting POCUS as the standard of care is the lack of ultrasound-trained professionals to teach others how to use this tool (26).

We, along with our radiologist colleagues, believe in quality ultrasound training. We ensure this essential quality through demanding and comprehensive training for residents and internists in each of the specialty's programs throughout the country.

In this regard, we highlight the experience in other countries (27), in which imaging experts (cardiologists and radiologists) team up with non-expert clinicians for training and training validation. This collaboration is essential for proper training of healthcare staff.

Ultrasound training in undergraduate medicine is already beginning in several countries around the world. We still do not know at what point during medical school POCUS training should be started; however, there are already recommendations showing the benefit of teaching anatomy and physiology with ultrasound (28, 29). In our country, some medical schools are slowly increasing their use of ultrasound as a valuable tool for teaching our future physicians at the basic science and clinical level.

Medical practice

The evidence for ultrasound is compelling and indisputable. Its superiority to the physical exam and chest x-ray makes POCUS an ideal tool to be adopted in settings with diagnostic uncertainty, in critically ill patients, and for follow-up of ambulatory patients, among others (2).

The internists in our country are called to rapidly adopt bedside ultrasound as the ideal complement to classic semiology. Clinical presentations like dyspnea, chest pain, acute kidney injury, sepsis, and shock; and clinical conditions like heart failure, acute coronary syndrome, syncope, and thromboembolic disease, among others, are situations in which ultrasound contributes a lot of information, allowing better and faster decisions for patients. However, training should be responsible, supervised and high-quality. The usefulness of ultrasound is directly proportional to the appropriate interpretation and integration of the findings; otherwise, it could be dangerous.

In addition, ultrasound in the hands of general practitioners in remote areas of our country has the immense potential of providing greater resolution capacity for the less complex levels of care. It could provide more security for our physicians in diagnosing and greater safety for our patients in the measures taken, making the referral and counter-referral processes efficient. This discussion will be very important for our healthcare system in the near future. It will be essential to clearly and responsibly determine the methodology for training and certifying general practitioners, for this to be implemented properly and safely.

Conclusions

Ultrasound performed by clinicians is not a fad or a luxury tool. It is one more pillar in today's semiology which is not a part of the future but rather the present in our specialty, and which provides us with greater diagnostic certainty. Thus, it is vital to adopt POCUS in daily practice. Internists, as adult physicians and quintessential clinicians, are especially called to lead the training of healthcare staff, as well as implement and adopt this tool in hospital and outpatient services throughout the country. Providing rapid, reliable and safe care for our patients includes bedside ultrasound to make better and faster decisions. As a medical community in Colombia, we should begin to discuss how to train future physicians and specialists in our country, providing a framework of uniform and quality training to achieve the best possible ultrasound results. We have a hopeful future ahead if we begin now to plan the strategies for each physician in our country to be able to perform bedside ultrasound for any patient who requires it.

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