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POCUS research publications bibliography

GE HealthCare is providing this list of peer-reviewed articles to help medical professionals understand the current state of research related to various devices, technologies, and applications. The use of the device in each publication is within the indications of use and intended use; however, the authors' conclusions are solely based on their scientific studies and must be evaluated by a medically qualified reader. GE HealthCare does not endorse or support any conclusions or recommendations contained in these publications.

Emergency

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Gohar & Fuchs Ben-Gurion University of the Negev & Soroka Medical Center – Beer Sheva, Israel	Artificial Intelligence (AI) versus POCUS expert: A validation study of three automatic AI-based, real-time, hemodynamic echocardiographic assessment tools	Journal of Clinical Medicine, 2023	36835888 OPEN ACCESS	The Venue™ shows a high agreement with a point-of-care ultrasound (POCUS) expert for high quality views. This shows that auto tools can provide reliable, real time assistance in performing accurate measurements but do not reduce the need of a good image acquisition technique.
Markarian & Bobbia Emergency Department, Timone University Hospital, Aix-Marseille University – Marseille, France; Emergency Department, Montpellier University Hospital – Montpellier, France	Evaluation of a new echocardiographic tool for cardiac output monitoring: An experimental study on a controlled hemorrhagic shock model in anesthetized piglets	Journal of Clinical Medicine, 2022	36143066 OPEN ACCESS	In this study, a new echocardiographic cardiac output flow index (COF) appears to have a strong correlation to the cardiac output measured by thermodilution (COth). This automatic index, which takes into account the heart rate (HR) and does not require the measurement of left outflow tract (LVOT), could be a rapidly obtained index in clinical practice.
Morales & Nichol Department of Emergency Medicine, University of Washington – Seattle, Washington, USA	Feasibility of very early identification of cardiogenic shock by semi-automated ultrasound exam in the emergency department	Cureus, 2022	36465735 OPEN ACCESS	Physicians with one hour of platform-specific training were able to implement POCUS with semi-automated imaging software (SAIS) among patients who present with shock. POCUS with SAIS may aid in the early recognition of cardiogenic shock (CS).
Tung Chen & Ruiz Lopez Department of Internal Medicine, Hospital Universitario Puerta de Hierro, Majadahonda –, Madrid, Spain; Department of Emergency Medicine, Hospital Universitario La Paz –, Madrid, Spain	Reliability and consistency of point-of-care ultrasonography for inferior vena cava measurement: Visual versus automatic ultrasound systems	Acta Colombiana de Cuidado Intensivo, 2022	N/A	In this pilot study, the automatic measurement method was consistent with the M-mode measurement method, as performed by experts or novices. Both methods showed high intra-, inter-observer reliability, but the automatic system was significantly faster, which would allow us to implement this approach more effectively in our daily practice.
Markarian & Michelet Department of Emergency Medicine, Timone University Hospital –, Marseille, France; Department of Emergency Medicine, North University Hospital – Marseille, France	Early assessment of patients with COVID-19 and dyspnea using lung ultrasound scoring	Emergencias, 2021	34581528	An early lung ultrasound score can predict clinical severity in patients with dyspnea due to COVID-19.
Russell & Nti Department of Emergency Medicine, Indiana University School of Medicine – Indianapolis, Indiana, USA	B-line quantification: Comparing learners novice to lung ultrasound assisted by machine artificial intelligence technology to expert review	The Ultrasound Journal, 2021	34191132 OPEN ACCESS	After a short training session, novice learners were able to obtain high-quality images. When the AI deep learning algorithm was applied to those images, it quantified B-lines with moderate-to-fair correlation as compared to semi-quantitative analysis by expert review. This data shows promise, but further development is needed before widespread clinical use.

Emergency cont.

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Tung-Chen & Ossaba-Vélez Department of Internal Medicine and Department of Emergency Radiology, Hospital Universitario La Paz – Madrid, Spain	Usefulness of lung ultrasound followup in patients who have recovered from Coronavirus Disease 2019	Journal of Ultrasound in Medicine, 2020	33159704	We describe 3 recovered patients who had coronavirus disease 2019, with long-persisting symptoms after recovery, in whom chest computed tomographic and concurrent lung ultrasound examinations were performed. It is possible to correlate the findings from lung ultrasound with the symptoms and the fibrosis or residual abnormalities present on chest computed tomography. Lung ultrasound, which is easy to use, without side effects or radiation, helps monitor the disease resolution or assess early progression to lung fibrosis, as exemplified in the cases reported.
Short & Naredo Department of Emergency Medicine, Ultrasound Division and Department of Rheumatology, Bone and Joint Research Unit, Hospital Universitario Fundación Jiménez Díaz – Madrid, Spain	Visual versus automatic ultrasound scoring of lung B-lines: Reliability and consistency between systems	Medical Ultrasonography, 2019	30779830	Ultrasound (US) automatic counting was consistent with US visual counting of lung B-lines, as performed by experts in the field. Both systems showed a high intra- and interobserver reliability.
Bobbia & Markarian Department of Emergency Medicine, Division of Anesthesiology, Critical Care, Pain and Emergency Medicine, Nîmes University Hospital –Nîmes, France	A new echocardiographic tool for cardiac output evaluation: An experimental study	Shock, 2019	30300317	In an experimental model of hemorrhagic shock (HS), a new ultrasound tool, automatic calculation of cardiac output (COauto), seems better correlated with cardiac output (CO) measured by thermodilution (COth) than manual echocardiographic measurements.
Tzadok & Tal-Orn Department of Emergency Medicine, Padeh Medical Center – Poriya, Israel	Ultrasound of jugular veins for assessment of acute dyspnea in emergency departments and for the assessment of acute heart failure	The Israel Medical Association Journal, 2018	29761678	Ultrasound of the internal jugular vein (IJV) may be a useful tool for the diagnosis of acute decompensated heart failure (ADHF) because it is easy to measure and requires little skill. It is also not affected by patient body habitus.
Favot & Amponsah Wayne State University School of Medicine, Department of Emergency Medicine – Detroit, Michigan, USA; Henry Ford Health System, Department of Emergency Medicine, Detroit, Michigan, USA	Ultrasound training in the emergency medicine clerkship	Western Journal of Emergency Medicine, 2015	26594295	Our study demonstrates support for an ultrasound training program for medical students in the emergency medicine (EM) clerkship. After completing the training, students were able to perform similarly to EM residents on a knowledge-based exam.
Waterbrook & Adhikari University of Arizona, — Tucson, Arizona, USA	Sonographic inferior vena cava measurements to assess hydration status in college football players during preseason camp	Journal of Ultrasound in Medicine, 2015	25614397	The postpractice expiratory inferior vena cava (IVC) diameter was significantly related to percent weight loss after practice, whereas the caval index was not found to correlate with weight loss.

Critical Care

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Damodaran & Kanchi Department of Anaesthesia and Intensive Care, Narayana Institute of Cardiac Sciences, Bengaluru – Karnataka, India	Automated versus manual B-lines counting, left ventricular outflow tract velocity time integral and inferior vena cava collapsibility index in COVID-19 patients	Indian Journal of Anaesthesia, 2022	35782660 OPEN ACCESS	AI-guided assessment of left ventricular outflow tract velocity time integral (LVOT-VTI), inferior vena cava collapsibility index (IVC-CI) and B-lines counting is reliable and consistent with manual assessment in COVID-19 patients. Novices can reliably estimate LVOT-VTI and IVC-CI using artificial intelligence (AI) software in COVID-19 patients.
Gonzalez & Michard Intensive Care Department, Hospital Garcia de Orta – Almada, Portugal; Faculdade de Medicina da Universidade de Lisboa – Lisbon, Portugal	Automation of subaortic velocity time integral measurements by transthoracic echocardiography: clinical evaluation of an artificial intelligence-enabled tool in critically ill patients	British Journal of Anaesthesia, 2022	36031414	In summary, the automatic assessment of velocity time integral (VTI) was possible in most cases (92%). When compared with manual measurements, it was accurate and precise, both in expert and trainee hands. The reproducibility of automatic assessment of VTI (autoVTI) measurements was as good for trainees as for experts. Therefore, the AI-enabled autoVTI tool can be used to assist clinicians, in particular trainees, in quickly identifying the underlying mechanisms of shock and in assessing fluid responsiveness.
Shaikh & Barjaktarevic Division of Interventional Pulmonology, Beth Israel Medical Center and Massachusetts General Hospital – Boston, Massachusetts, USA; Division of Pulmonary and Critical Care Medicine, David Geffen School of Medicine, University of California Los Angeles – Los Angeles, California, USA	Measuring the accuracy of cardiac output using POCUS: The introduction of artificial intelligence into routine care	The Ultrasound Journal, 2022	36517635 OPEN ACCESS	Our study demonstrates that novel automation-assisted velocity time integral (VTI) is feasible and can decrease variability while increasing precision in cardiac output (CO) measurement. These results support the use of artificial intelligence-augmented image acquisition in routine critical care ultrasound and may have a role for evaluating the response of CO to hemodynamic interventions. Further investigations into artificial intelligence-assisted ultrasound systems in clinical settings are warranted.
Varudo & Michard Intensive Care Department, Hospital Garcia de Orta – Almada, Portugal; MiCo – Vallamand, Switzerland	Machine learning for the real-time assessment of left ventricular ejection fraction in critically ill patients: A bedside evaluation by novices and experts in echocardiography	Critical Care, 2022	36517906 OPEN ACCESS	Machine learning-enabled real-time measurements of left ventricular ejection fraction (LVEF) were strongly correlated with manual measurements obtained by experts. The accuracy of real-time LVEF measurements was excellent, and the precision was fair. The reproducibility of LVEF measurements was better with the machine learning system. The specificity to detect left ventricular dysfunction was excellent both for experts and for novices, whereas the sensitivity could be improved.

Critical Care cont.

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Zhai & Duan, Department of Surgery Intensive Care Unit, China-Japan Friendship Hospital, Beijing, China	Artificial intelligence (AI) versus expert: A comparison of left ventricular outflow tract velocity time integral (LVOT-VTI) assessment between ICU doctors and an AI tool	Journal of Applied Clinical Medical Physics, 2022	35816461 OPEN ACCESS	ICU doctors could achieve the satisfied level of expertise as expert sonographers after 3 months of PoCUS training. Nearly two thirds of the enrolled ICU doctors could obtain the ideal view and one third of them could acquire the average view. ICU patients with higher SOFA scores and lactic acid were less likely to acquire the ideal view. Manual and auto LVOT-VTI had statistically significant agreement in both ideal and average groups. Auto LVOT-VTI in ideal view was more relevant with the manual LVOT-VTI than the average view. AI might provide real-time guidance among novice operators who lack expertise to acquire the ideal standard view.
Barjaktarevic & Cannesson Division of Pulmonary and Critical Care, Department of Medicine, and Department of Anesthesiology, David Geffen School of Medicine at UCLA – Los Angeles, California, USA	The evolution of ultrasound in critical care: From procedural guidance to hemodynamic monitor	Journal of Ultrasound in Medicine, 2021	32750199	Ultrasound in the ICU will continue to expand and evolve. Although new technology often begins with great excitement, some of this initial enthusiasm must be tempered. Point-of-care US as a decision-making tool during shock resuscitation is still nascent— further research and experience will shape its future and reveal its reliability and limitations. Crucially, POCUS must remain a tool that enhances management based firmly on Bayesian principles. The onus is on the operators to remember that POCUS remains an "extended stethoscope" and, potentially, a supplemental monitor with which the clinician triangulates all available data.

Critical Care cont.

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Tsaban & Fuchs Medical Intensive Care Unit, Soroka University Medical Center – Beersheva, Israel	Feasibility of machine integrated point of care lung ultrasound automatic B-lines tool in the Corona-virus 2019 critical care unit	Critical Care, 2021	34560883 OPEN ACCESS	In conclusion, we found that the machine-integrated Venue™ Auto B-lines tool is highly reliable among severe COVID-19 ICU patients. To our knowledge, this is the first study to validate a machine-integrated automatic-B-lines quantification tool with high reliability among COVID-19 patients. The small number of patients included in this feasibility trial should be acknowledged as a limitation; thus, further research to validate the results of this study is warranted. [...] The current study's results may help better interpret POC-LUS assessments performed by less-experienced operators and reduce inter-operator variability. This tool may provide technological infrastructure for future telemedicine, even in non-experienced hands. [...] Venue™ Auto B-lines may reduce the medical staff's exposure time and promote more accurate and standardized lung ultrasound (LUS) assessment methods.
Cho & Kim Division of Pulmonary and Critical Care Medicine, Department of Internal Medicine, Division of Infectious Diseases, Seoul National University Bundang Hospital – Seongnam, Korea	Lung ultrasound for early diagnosis and severity assessment of pneumonia in patients with coronavirus disease 2019	The Korean Journal of Internal Medicine, 2020	32668514 OPEN ACCESS	Lung ultrasound is feasible and useful as a rapid, sensitive, and affordable point-of-care screening tool to detect pneumonia and assess the severity of respiratory failure in patients hospitalized with COVID-19.
Golan & Fuchs Internal Medicine Division, Soroka University Medical Center – Beer-Sheva, Israel	Early point-of-care ultrasound assessment for medical patients reduces time to appropriate treatment: A pilot randomized controlled trial	Ultrasound in Medicine and Biology, 2020	32430108	These results indicate that POCUS assessment conducted early among patients with dyspnea or chest pain improves diagnostic accuracy and shortens significantly the time.
Barjaktarevic & Cannesson Division of Pulmonary and Critical Care, Department of Medicine, and Department of Anesthesiology, David Geffen School of Medicine at UCLA – Los Angeles, California, USA	Ultrasound assessment of the change in carotid corrected flow time in fluid responsiveness in undifferentiated shock	Critical Care Medicine, 2019	30134304	Change in carotid corrected flow time can predict fluid responsiveness status after a passive leg raise maneuver. Using point-of-care ultrasound to assess change in carotid corrected flow time is an acceptable and reproducible method for noninvasive identification of fluid responsiveness in critically ill patients with undifferentiated shock.

Pediatrics/NICU

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Nti & Russell Department of Pediatrics and Department of Emergency Medicine, Indiana University School of Medicine – Indianapolis, IN, USA	Artificial Intelligence-augmented pediatric lung POCUS: A pilot study of novice learners	Journal of Ultrasound in Medicine, 2022	35429001 OPEN ACCESS	This study shows that AI-augmented lung US for diagnosing pneumonia has the potential to increase accuracy and efficiency.
Hamad & Leung Department of Pediatrics, Section of Emergency Medicine, Texas Children's Hospital, Baylor College of Medicine – Houston, Texas, USA	Diagnosing acute heart failure in the pediatric emergency department using point-of-care ultrasound	The Journal of Emergency Medicine, 2021	34092442	Early recognition of acute heart failure (AHF) is critical to reduce pediatric morbidity and mortality. With proper training, cardiac POCUS can be an effective adjunct and should be considered for the early diagnosis and treatment of infants and children with AHF.
Badurdeen & Blank Newborn Research Centre, The Royal Women's Hospital, Parkville, and Monash Newborn, Monash Children's Hospital – Clayton, Australia	Lung ultrasound during newborn resuscitation predicts the need for surfactant therapy in very- and extremely preterm infants	Resuscitation, 2021	33548362	Lung ultrasound (LUS) in the delivery room accurately predicts surfactant therapy in infants <320/7 weeks.
Zhan & Klug Department of Pediatrics, Copenhagen University Hospital Hvidovre, University of Copenhagen – Hvidovre, Denmark	Performance of bedside lung ultrasound by a pediatric resident: A useful diagnostic tool in children with suspected pneumonia	Pediatric Emergency Care, 2018	27749801	Bedside lung ultrasound is a useful tool, with a good specificity, to find lung consolidations in children even when the sonologist has minimal practical ultrasound experience and no access to supervision. We suggest the use of bedside lung ultrasound as a diagnostic tool in children with suspected pneumonia.

Musculoskeletal

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Naredo & Iagnocco Department of Rheumatology, Joint and Bone Research Unit, Hospital Universitario Fundación Jiménez Díaz – Madrid, Spain; Dipartimento Scienze Cliniche e Biologiche, Università degli Studi di Torino – Torino, Italy	Agreement between semiquantitative and quantitative Doppler scoring systems for the assessment of synovial pathological vascularisation in rheumatoid arthritis	Clinical and Experimental Rheumatology, 2018	30418113	The semiquantitative power Doppler (SPD) and semiquantitative colour Doppler (SCD) scores were concordant and the quantitative power Doppler (QPD) and quantitative colour Doppler (QCD) scores highly correlated but were not concordant. There was an overlap between SPD and SCD mild and moderate scores regarding QPD and QCD scores.
Rezaei & van Vollenhoven Department of Rheumatology, Karolinska University Hospital – Stockholm, Sweden	Diagnostic utility of musculoskeletal ultrasound in patients with suspected arthritis–a probabilistic approach	Arthritis Research & Therapy, 2014	25270355	Musculoskeletal ultrasound, when added to routine rheumatologic investigation, greatly increases the diagnostic certainty in patients referred for the evaluation of inflammatory arthritis. The changes from pre-test to post-test probability quantify the diagnostic utility of musculoskeletal ultrasound in probabilistic terms.

Perioperative

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Chen & Huang Department of Anesthesiology, Shanghai General Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China; Department of Anesthesiology and Perioperative Medicine, University of Louisville – Louisville, USA	Artificial Intelligence in echocardiography for anesthesiologists	Journal of Cardiothoracic and Vascular Anesthesia, 2020	32962932	Despite limitations, AI technology remains an integral concept in the future of echocardiography, and additional research is needed. Anesthesiologists need to be aware of the advantages and limitations of AI technology in echocardiography.
Ramsingh & Cannesson Department of Anesthesiology and Perioperative Care, University of California, Irvine – Irvine, California, USA	Auscultation versus point-of- care ultrasound to determine endotracheal versus bronchial intubation: A diagnostic accuracy study	Anesthesiology, 2016	26950708	Assessment of trachea and pleura via point-of-care ultrasound is superior to auscultation in determining the location of endotracheal tube (ETT).

Regional Anesthesia

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Sa & Machado Centro Hospitalar de Trás-dos-Montes e Alto Douro, Departamento de Anestesiologia e Terapêutica da Dor – Vila Real, Portugal	Superior gluteal nerve: A new block on the block?	Brazilian Journal of Anesthesiology, 2019	28551063	Deep understanding of anatomy and innervation empowers anesthesiologists to solve potentially complex cases with safer, albeit creative, approaches. The relevance of this block in this case arises from its innervation of the gluteus medius muscle and posterolateral portion of the hip joint. To the best of our knowledge, this is the first report of an ultrasound-guided superior gluteal nerve block with an analgesic and anesthetic goal, which was successfully achieved.
Macaire & Paqueron Department of Anesthesiology, Dubai Medical Suites – Dubai Healthcare City, UAE	Ultrasound- or nerve stimulation-guided wrist blocks for carpal tunnel release: A randomized prospective comparative study	Regional Anesthesia and Pain Medicine, 2008	18675750	This randomized prospective study demonstrates that ultrasound-guided wrist nerve blocks are as efficient as those performed with nerve stimulation.
Casati & Fanelli Department of Anesthesiology and Pain Therapy, University of Parma – Parma, Italy	A prospective, randomized comparison between ultrasound and nerve stimulation guidance for multiple injection axillary brachial plexus block	Anesthesiology, 2007	17457131	Multiple injection axillary block with ultrasound guidance provided similar success rates and comparable incidence of complication as compared with nerve stimulation guidance.

Dermatology

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Lyons & Hamzavi Department of Dermatology, Henry Ford Health System – Detroit, Michigan, USA	Assessment of inter-rater reliability of clinical hidradenitis suppurativa outcome measures using ultrasonography	Clinical and Experimental Dermatology, 2022	34388853	Ultrasonography improved inter-rater agreement and should be used in conjunction with physical examination findings to evaluate disease severity to ensure uniform staging of Hidradenitis suppurativa.
Grand & Krueger Laboratory of Investigative Dermatology, The Rockefeller University, New York, NY, USA Albert Einstein College of Medicine – Bronx, New York, USA	Doppler ultrasound based noninvasive biomarkers in hidradenitis suppurativa: Evaluation of analytical and clinical validity	The British Journal of Dermatology, 2021	32602132	Sonographic epidermal thickness and dermal tunnel diameter have acceptable levels of analytical validity in the assessment of hidradenitis suppurativa (HS) lesions. Power Doppler intensity demonstrates acceptable clinical and analytical validity, suggesting it is a valid imaging-based biomarker in HS.

Guidance

First author & last author, institution	Title	Journal, date	PubMed ID (PMID)	Conclusion from abstract
Narang & Thomas, Bluhm Cardiovascular Institute, Northwestern University, Chicago, Illinois, USA	Utility of a Deep-Learning Algorithm to Guide Novices to Acquire Echocardiograms for Limited Diagnostic Use	JAMA Cardiology, 2021	33599681 OPEN ACCESS	This deep-learning (DL) algorithm allows novices without experience in ultrasonography to obtain diagnostic transthoracic echocardiographic studies for evaluation of left ventricular size and function, right ventricular size, and presence of a nontrivial pericardial effusion, expanding the reach of echocardiography to clinical settings in which immediate interrogation of anatomy and cardiac function is needed and settings with limited resources.

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