

Moving the needle towards the democratization of echocardiography: a case report

Jonathan dos Santos ^{1,2*}, Patrícia Borges Fernandes ^{2,3},
Francisco Rocha Gonçalves ², and Alexandra Gonçalves ²

¹ACeS Baixo Tâmega, UCSP Celorico de Basto, Assento, Britelo, 4890-221 Celorico de Basto, Portugal; ²Department of Medicine, Faculty of Medicine of Porto University, Alameda Prof. Hernâni Monteiro, 4200-319 Porto, Portugal; and ³USF São Miguel Arcanjo, ACeS Vale do Sousa Sul, Rua, Marquês de Pombal, 682, 4560-682 Penafiel, Portugal

Received 8 January 2019; first decision 6 March 2019; accepted 25 September 2019; online publish-ahead-of-print 22 October 2019

Background

Echocardiography has been traditionally performed in echo labs and the potential benefits of its use by primary care physicians (PCPs) are still unexplored. We present a case where POCUS (point-of-care ultrasound) was used as a complement of physical examination by a family doctor, allowing a prompt clinical decision in a heart failure (HF) patient.

Case summary

An 85-year-old woman, living independently, asks her family doctor for a home consultation due to increasing dyspnoea. On examination, severe dyspnoea and bilateral ankle oedema was noted and a point-of-care echocardiogram was performed by the primary care physician, who observed: severely compromised left ventricular systolic function, moderate mitral and tricuspid regurgitation, and severe dilation of the inferior vena cava. As a result, the diagnosis of HF with decreased ejection fraction was formed supporting the therapeutic decision.

Discussion

This case represents an elderly patient with dyspnoea, without previous HF diagnosis. The primary care physician, used portable ultrasound as a complement of physical examination, which confirmed a HF diagnosis, allowing a prompt decision-making on therapy. POCUS, can be a powerful tool to expedite treatment in different settings, including the home consultations by PCPs.

Keywords

Point-of-care ultrasound • Pocket ultrasound • Heart failure • Primary care physician • Case report

Learning points

- Point-of-care ultrasound, when used by primary care physicians with training, allows detection of important functional and structural cardiac abnormalities.
- A pocket ultrasound can be used as a physical examination complement, supporting the differential diagnosis of dyspnoea and efficient decision-making process.

Introduction

Echocardiography has been traditionally performed in echo labs, but in the latest years, it has been expanded to other environments, such as hospital urgent care. The advantages of the use of echocardiography by primary care physicians (PCPs) is unexplored, although PCPs are in the front line evaluation of most of the patients.¹

We present a case report of a patient with heart failure (HF) where echocardiography was instrumental for comprehensive

* Corresponding author. Tel: +351 225 513 600, Email: jonathansantos@med.up.pt

Handling Editor: Nikos Papageorgiou

Peer-reviewers: Georg Goliash and Hugo Rodriguez-Zanella

Compliance Editor: Anastasia Vamvakidou

Supplementary Material Editor: Vishal Shahil Mehta

© The Author(s) 2019. Published by Oxford University Press on behalf of the European Society of Cardiology.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact journals.permissions@oup.com

patient evaluation and clinical decision, illustrating a significant improvement in the efficiency of primary healthcare.

Timeline

4 years prior to presentation	No prior history of heart failure at presentation
At presentation	85-year-old woman requests family doctor home consultation due to progressive dyspnoea Dyspnoea [New York Heart Association (NYHA) Class III–IV], orthopnoea, pulmonary rales, and bilateral ankle oedema Point-of-care ultrasound with pocket echo by family doctor: severely compromised left ventricular systolic function, severe dilation of the inferior vena cava Treatment: spironolactone 25 mg daily; increased furosemide 40 mg 3 times daily
1 month later	Dyspnoea (NYHA Class II–III) Conventional echocardiography: reduced ejection fraction (30%) Replaces ramipril to sacubitril/valsartan
2 months later	Heart failure symptoms relief Titrate sacubitril/valsartan dose

Case presentation

We present a case of an 85-year-old woman with medical history of arterial hypertension, obesity, and atrial fibrillation, living

independently in her own house. Her regular medication included ramipril 10 mg od acenocoumarol, bisoprolol 5 mg od, pantoprazole 20 mg od and furosemide 40 mg od. We speculate patient had been advised by a different healthcare provider on this high diuretic dose due to swollen legs or other signs of congestion.

The patient requests her family doctor for a home consultation by aggravated dyspnoea. She was found with fatigue, tiredness, orthopnoea and dyspnoeic at rest. Physical examination revealed a blood pressure of 100/60 mmHg, heart rate of 98 b.p.m., elevated jugular venous pressure, third heart sound, pulmonary rales in the lower third of both lungs, and bilateral ankle oedema. Her medical records showed a glomerular filtration rate of 55 mL/min and an echocardiogram performed 4 years prior showed normal biventricular function without signs of pulmonary artery hypertension and mild mitral regurgitation. In regard to the severity of the symptoms, the patient was suggested to pursue further evaluation and treatment at the local hospital, but she refused to leave her house. On-site, the PCP with echocardiography training (certified online course and a practical training in an echocardiography lab for 6 months) performed a point-of-care ultrasound (POCUS) Lumify®. The study showed: severely compromised left ventricular (LV) systolic function ([Figure 1](#), [Supplementary material online, Video S4](#)), moderate mitral ([Figure 2](#)), and tricuspid regurgitation ([Figure 3](#)), severe dilation of the inferior vena cava ([Figure 4](#)), severely dilated left atrium (52 mm in long-axis view), dilated right atrium (minor axis of 49 mm in four-chamber view), normal LV size (47 mm in diastole parasternal long-axis view), normal right ventricular (RV) size (basal and mid diameter of 39 and 29 mm), and normal RV function (tricuspid annular plane systolic excursion of 19 mm). Ultrasound B-lines were not assessed at this time. The study was shared live using a real-time programme (REACTS) with a cardiologist who confirms the findings. As a result, the diagnosis of HF with decreased ejection fraction (EF) was performed supporting the therapeutic decision: furosemide 40 mg was increased to three times daily and spironolactone 25 mg was introduced once

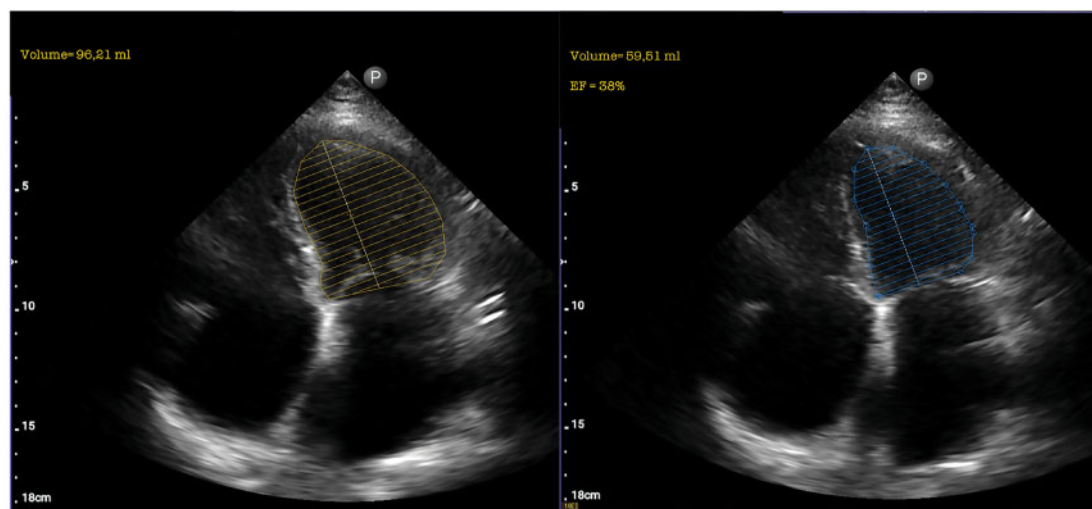


Figure 1 A four-chamber view with end-diastolic and systolic volumes. Reduced ejection fraction of 38% ([Supplementary material online, Video S4](#)).

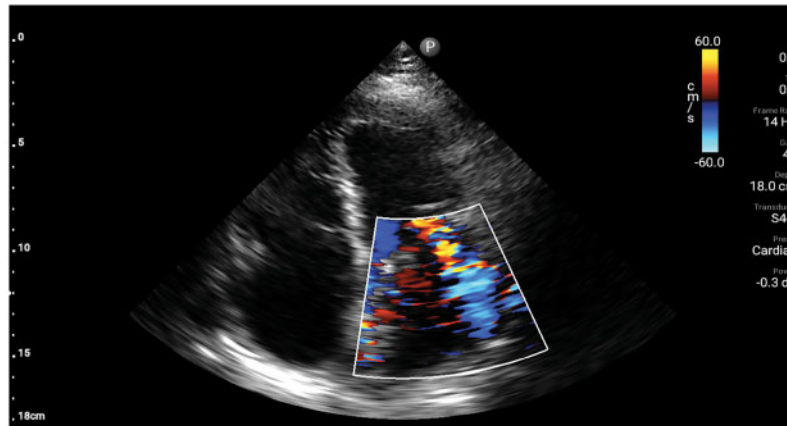


Figure 2 A four-chamber view with moderate mitral regurgitation.

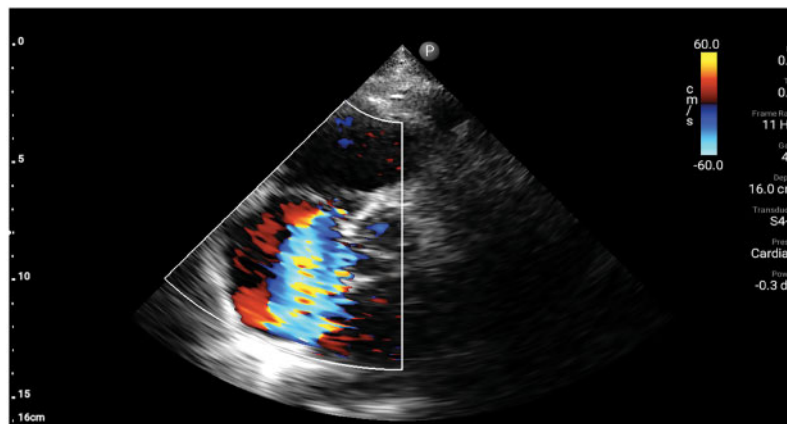


Figure 3 Parasternal short-axis view with moderate tricuspid regurgitation.

daily. The patient had weekly visits from the community nurse and one month later, a conventional echocardiogram confirmed the POCUS findings, quantifying left ventricular ejection fraction in 30% and pulmonary artery pressure in 44 mmHg. At this time, ramipril was replaced by sacubitril/valsartan 24 mg/26 mg td. The patient refused additional studies or hospital referral, which limited our ability to study the cause of HF. At two months, follow-up the patient was tolerating treatment and presented in Class II of New York Heart Association and the sacubitril/valsartan was titrated accordingly.

Discussion

Heart failure prevalence has been increasing in the last decades, alongside with population aging, especially in developed countries.¹ However, the diagnosis of HF, as a clinical syndrome can be challenging,

particularly in elderly patients, being the information provided by ultrasound fundamental for diagnosis and therapeutic management.²

This case represents an 85-year-old female patient with dyspnoea, without previous HF diagnosis, refusing to leave her home, to whom the PCP successfully used portable ultrasound as a physical examination complement. The comprehensive evaluation allowed a confident diagnosis of HF at patient's home and a timely and targeted therapy avoiding hospital admission, showing that the use of ultrasound by a trained primary care physician increases the efficiency of medical care for the diagnosis and treatment of HF. The available studies are very limited and no cost-effectiveness studies have been done to prove the use POCUS as a toll by PCPs, however, this technique has been proven to be a useful, reliable and fast tool in emergency department and as a bedside physical examination complement.³⁻⁶

In addition to HF recognition, HF should be monitored and medication optimized periodically. PCPs can play a critical role in this regard, in close collaboration with cardiologists, evaluating elderly

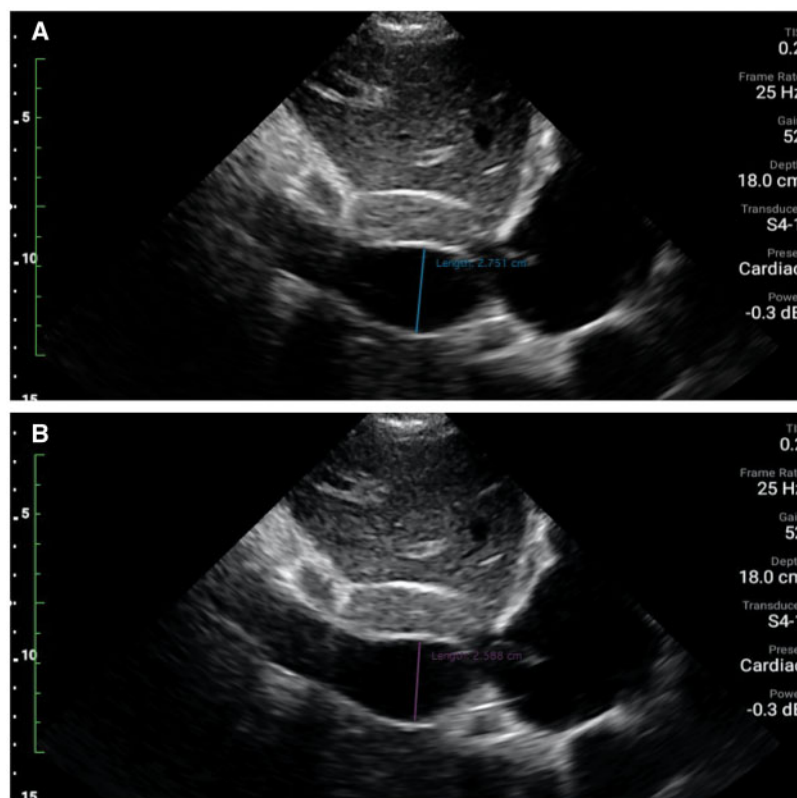


Figure 4 In subcostal view, enlarged inferior vena cava at expiration (A) and inspiration (B) shows respiratory variation >50%.

patients who require home visits. In fact, a randomized clinical trial in patients with HF with optimal medical therapy showed no differences in death and hospital admissions between patients followed by cardiologists with those followed by referral PCP.⁷

Conclusions

In summary, the crescent ageing population presents new demands to the healthcare system and chronic diseases such as HF are more commonly being diagnosed and treated by PCPs, who by using portable ultrasounds, as ‘fifth pillar to bedside physical examination’ will significantly improve patient care.²

Lead author biography



Jonathan dos Santos was born in Paris in 1987 and grew up in Amarante (Portugal). He’s a family physician who believes that primary health care are on the mainstay of any healthcare system. He’s a point-of-care ultrasound (POCUS) user so that physical examination has for him an extra

value. In 2012, Jonathan has completed the master of medicine at Coimbra Medical School (FMUC). He has been enrolled in 2016 in the PhD program of medicine at the Porto Medical School (FMUP); In 2018 he has completed the family and general medicine fellowship at ‘USF Terras de Souza’ in ‘ACES Vale de Sousa Sul’; from February 2019 he’s a clinician at “UCSP Celorico de Basto” in “ACeS Baixo Tâmega”.

Supplementary material

[Supplementary material](#) is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: Pocket ultrasound of this study is an investigation grant support from Philips; Alexandra Goncalves, MD, PhD, MMSc is a Philips employee.

References

1. Ponikowski P, Voors AA, Anker SD, Bueno H, Cleland JGF, Coats AJS, Falk V, González-Juanatey JR, Harjola VP, Jankowska EA, Jessup M, Linde C, Nihoyannopoulos P, Parissis JT, Pieske B, Riley JP, Rosano GM, Ruilope LM, Ruschitzka F, Rutten FH, van der Meer2P; Authors/Task Force Members; Document Reviewers. 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. *Eur Heart J* 2016;**37**: 2129–2200.
2. Narula J, Chandrasekhar Y, Braunwald E. Time to add a fifth pillar to bedside physical examination: inspection, palpation, percussion, auscultation, and insonation. *JAMA Cardiol* 2018;**3**:346–350.
3. Bobbia X, Pradeilles C, Claret PG, Soullier C, Wagner P, Bodin Y, Roger C, Cayla G, Muller L, de La Coussaye JE. Does physician experience influence the interpretability of focused echocardiography images performed by a pocket device? *Scand J Trauma Resusc Emerg Med* 2015; **23**:52.
4. Kimura BJ. Point-of-care cardiac ultrasound techniques in the physical examination: better at the bedside. *Heart* 2017;**103**:987–994.
5. Laursen CB, Sloth E, Lassen AT, Christensen R, Lambrechtsen J, Madsen PH, Henriksen DP, Davidsen JR, Rasmussen F. Point-of-care ultrasonography in patients admitted with respiratory symptoms: a single-blind, randomised controlled trial. *Lancet Respir Med* 2014;**2**:638–646.
6. Zanobetti M, Scorpiniti M, Gigli C, Nazerian P, Vanni S, Innocenti F, Stefanone VT, Savinelli C, Coppa A, Bigjarini S, Caldi F, Tassinari I, Conti A, Grifoni S, Pini R. Point-of-care ultrasonography for evaluation of acute dyspnoea in the ED. *Chest* 2017;**151**:1295–1301.
7. Schou M, Gustafsson F, Videbaek L, Tuxen C, Keller N, Handberg J, Sejr Knudsen A, Espersen G, Markenvard J, Egstrup K, Ulriksen H, Hildebrandt PR, NorthStar Investigators, all members of The Danish Heart Failure Clinics Network. Extended heart failure clinic follow-up in low-risk patients: a randomized clinical trial (NorthStar). *Eur Heart J* 2013;**34**:432–442.