International POCUS Organization

NEWSLETTER

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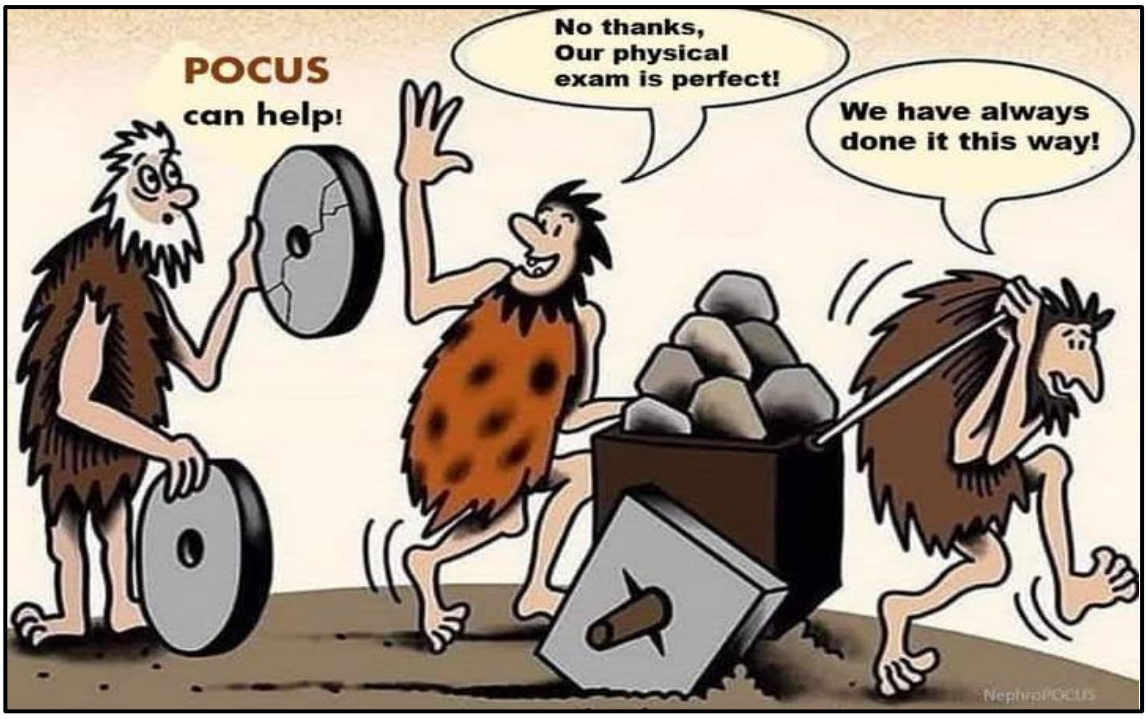


Dear friends, **www.pocus.rs**

Summer is here. Warm summer. For some of us too warm. We are sadly witnessing chilling events all over the globe which mark the beginning of the 21st century not so bright and promising. There is a war in Europe, gangs riots in Haiti, famine in Africa, political crisis everywhere, new diseases spreading, the "old" Covid still threatening... As if we are condemned to live in a state or continuing fear from what the tomorrow brings.

With such gruesome reality, it is in deed hard to find more inspiration and strength to pursue new skills and knowledge, to seek for new boundaries of medical science and art, to reach them, expand them, pass over them... We are often feeling simply just too small and irrelevant to continue even with our regular daily activities, less any additional enthusiastic work, personal development and perfection. We are frequently exhausted with lack of impact on the world around us by our almost meaningless, but sincere attempts to change it, improve it, make proper advancement in a proper direction... Everything sometimes looks just as on the cartoon above - there are people who just simply do not understand.

And I'm not talking here just about POCUS. It's also about attempt to share reason, share logical conclusions and spread at least a bit of wisdom necessary to prevent this sorrow world from annihilation. Will we succeed? Will we prevail? It is up to us. Not just as doctors, diagnosticians, educators and humanists, but as moral human beings, who must appreciate and value human life more than everything and forget about politics, global strategies, personal petty interests, jealousy, xenophobia and primitive destructive instincts.

Some of IPO members are suffering intensively these days because their countries failed to provide normal life for them. Their leaders and those who impact them have created situation which prevent us from normal work, traveling, sharing experiences, living like the citizens of the world, not like prisoners of imaginary state borders and spheres of political interest. I do hope we shall see a brighter tomorrow. For those of you who pray, I ask you to pray. For all the good people in the world, for universal peace and for the future of our children. For those of you who do not pray, like me, but still believe in the necessity of uniting all of our powers and strength, lets work even harder and give even more from all of our harts for the peace that we so desperately need.

Next "IPO Newsletter" will be published in December this year. I hope to see you all alive, healthy and with good news about good lives that you have. Stay strong.

Editor: Ivica Zdravković, Serbia

IPO MEMBERS ON HISPA CONGRESS, BOSNIA 2022

Željka Popovic, MD, primarius
FM & POCUS specialist, Bosnia aind Herzegovina

The second International Congress of HISPA (Hypertension, Infarction, Stroke Prevention Association) in Bosnia and Herzegovina (BIH) was held in Bijeljina (BIH) from 1st to 3rd April 2022. This Cinress was entitled "Comprehensive approach to the protection of the heart and blood vessels - post covid era" The organizers of the congress were the Association of Centers for Hypertension, Prevention of Myocardial Infarction and Stroke /HISPA/, Hospital "Sveti vračevi" in Bijeljina, and the World Association for Vascular Health. The congress was attended by 700 doctors from 12 different countries.

Members of the IPO organizationfrom BiH and Serbia (Prim Dr. Ivica Zdravkovic; Prim Dr. Danijel Atijas, Prim Dr. Željka Popovićc, Dr. Andrea Tomić) had an active participation as lecturers. Particularly noteworthy for IPO was presentation of Dr. Željka Popović entitled "The importance of POCUS diagnostics in the dailywork of a family doctor" which in a fiorm of case report demonstrates the use of ultrasound in daily practice, which quickly leads to diagnosis and treatment of patients, avoiding long waiting lists for examinations. The aim of this particular lecture was to promote POCUS diagnostics as well as breaking myths and fears among doctors who want to deal with ultrasound.

IPO members on HISPA Congress: First on the right Prim. Dr. Danijel Atijas, FM & POCUS specialist

IPO members Dr. Andrea Tomić and Dr. Ivica Zdravković with HISPA president, Prof. Nebojša Tasić (in the middle)

Prim. Dr. Željka Popović, FM & POCUS specialist, Board member of IPO, on HISPA Congress

POCUS OR POCLFAP? Or something...

Ivica Zdravkovic, MD/PhD
GP & POCUS specialist, Serbia

Some eight years ago I had my first experience with FATE protocol - I enrolled the course, got online learning modules, received tests and finally found myself in Linz, Austria for a hands-on workshop where I had my final exam. It was a bit of a shock, because I have never been exposed to such teaching and training concept before. It was simple and straight forward, tailored for doctors who are NOT cardiologists. It was completely different from the way I learned abdominal ultrasound, thyroid gland, breasts, etc. There were no "protocols" at the beginning of this century. At least not in my backyard, not in my country. Ultrasound diagnostics was a sub-specialty and one had to learn same theory and same skills in every detail, just like any radiologist.

Later I was exposed to POCUS concept through my involvement with American POCUS Certification Academy, and thigs became rather different over the last five years. Now POCUS is everywhere. If you type "POCUS ultrasound" in Google advanced search, you'll get 995.000 hits! Just a bit under MILLION! I'd say it's "jumpin' on a bandwagon"... But hey, who am I to judge!

Now, even after such initial amazement with FATE protocol, and after long hours, days and years of learning, writing and contemplating over the eternal enigma: "POCUS versus "comprehensive" ultrasound", I must say I am a bit disappointed. No matter how loud (and a bit aggressive) are the proponents of POCUS concept (and I consider myself one of the leading ones, a real pioneer in my country and region), POCUS is not getting in the direction where it's supposed to go. Why? Because we became slaves of "protocols", which promise to sky-rocket everyone's skills in matter of days. These protocols insist on simplicity even where it is very dangerous to simplify things. Also, protocols frequently neglect some "minor" pathology and conditions - which could be fatally misleading.

Just an example: eFAST protocol (extended Focused Assessment with Sonography in Trauma) teaches us five positions (I call it "Five P's"): examination of lungs for pneumothorax and pleural effusion, examination of pericardium (checking for tamponade), looking pouch of Morrison for ascites or intraabdominal hemorrhage, pouch of Koller for same pathology, and perivesical (suprapubic) space for free fluid. OK, seems quite sufficient, one would say. And includes lots of skills: almost complete lung ultrasound (LUS), at least one or two acoustic windows used in echocardiography, solid knowledge of ultrasound anatomy of upper right and left quadrant of abdomen, and solid knowledge of anatomical structures that make pouch of Douglas and Proust. Now, once the patient is checked by an eFAST certified physician, is it really over? We found no free fluid in pleura, peritoneum and pericard, there is no pneumothorax and that's it? Certainly NO! Did we look for spleen lesions? Does it happen in trauma? Of course, it does. But did we learn thorough exam of spleen on an average eFAST course? No. Did we learn how to recognize dissection of aorta? No. Rupture of diaphragm? Nope! So what do we do? Throw away our eFAST certificate and order a CT? No. Solution is: FORGET THE PROTOCOLS!

As time goes by, ultrasound machines get smaller and smaller. This comes (for the moment) with a prize: smaller the machine, smaller the number of piezoelectric crystals, smaller quality of image, no space for additional software, no enough measurements, frequently no Doppler, or no PW, CW or other features. Take into account these limitations and multiply them with limitations caused by insufficient training "by the protocol" - and what you get? Something that sarcastic observers would call "overrated gadgetry" - an image of POCUS as a bunch of inadequately trained physicians playing with some toys and pretending to do proper ultrasound! And that's exactly the worst possible thing that can happen to POCUS concept. Apparently, something must be done about it. What? Once more: Forget the protocols.

In some articles (even peer reviewed "scientific" papers published in respectable journals) POCUS is presented as yet another protocol!? As if we don't already have too much funny abrevations and protocols for just about anything. People who should help in introducing POCUS as a new step in development of modern medical diagnostic procedure are making it look like just another "crash course". And POCUS is certainly much more than that. It is not even a collection of eFAST, FATE, RUSH, BLUE, FEEL, HIMAP, LUS or GUCCI certificates (yes, "GUCCI" is the latest addition to the "gallery", and surprise - it was not created by Italians, but Portuguese, and it stands for "Global Ultrasound Check for the Critically Ill").

Not only that we have problems with radiologists, cardiologist and other specialists who still think they are God given to perform certain ultrasound exams, we even have family medicine physicians who continue with misinterpretation of POCUS. Check out this introduction from a "scientific" article printed in American Family Physician journal just a few years ago: "Point-of-care ultrasonography (POCUS) refers to limited ultrasound protocols performed at the patient's bedside by a clinician to assess for many conditions such as aortic aneurysm and pleural effusion." Limited? Why? Who sets the limits? And compared to what? I'd say it is completely wrong beginning. Next, it says "POCUS refers to limited ultrasound protocols" - and again, WHY? Why is POCUS reduced to "protocols"? Who changed the very simple definition, contained in the abbreviation? It is, once and forever, Point-of-Care ULTRASOUND. Nothing more, nothing less. Nowhere in the history of POCUS one can read: It is Point-Of-Care Limited Focus Assessed Protocol. Then it would not be called POCUS, but POCLFAP! Or something...

In conclusion: POCUS is at the moment still ages away from becoming regular fifth part of standard physical exam (inspection, palpation, percussion, auscultation, INSONATION). Years will pass before we see it as a part of curriculum in medical schools. Why? Because such is the destiny of all innovations, especially those that rearrange the positions in the system. For some, POCUS is taking away their privileges and image of "sole authority on the subject". They will definitely be against ultrasound machines in every doctor's pocket. For others POCUS will be "a giant leap into responsibility" which they will never make. It takes courage and some simply don't have it. Those of us who have made that step into the future are already experiencing everything good that is coming from one more huge clinical skill. True benefit from POCUS comes once it stops being "limited protocol", but a full scale diagnostic method comfortably used by all who were willing to learn it. Furthermore, time will come (maybe not in my age) when it will no longer be a matter of "dare to try" - but a MUST for anyone who wants to be a real medical professional. Let's not downsize our POCUS knowledge, certificates and specialty by reducing it to a "limited protocol" learned on a weekend workshop. There is nothing "limited" about it: either you do it, or not.

Further reading:

1. J. Tatars et al.: "Global Ultrasound Check for the Critically Ill (GUCCI) - a new systematized protocol unifying point-of-care ultrasound in critically ill patients based on clinical presentation", Dove Medical Press, 2019, Lisbon, Portugal

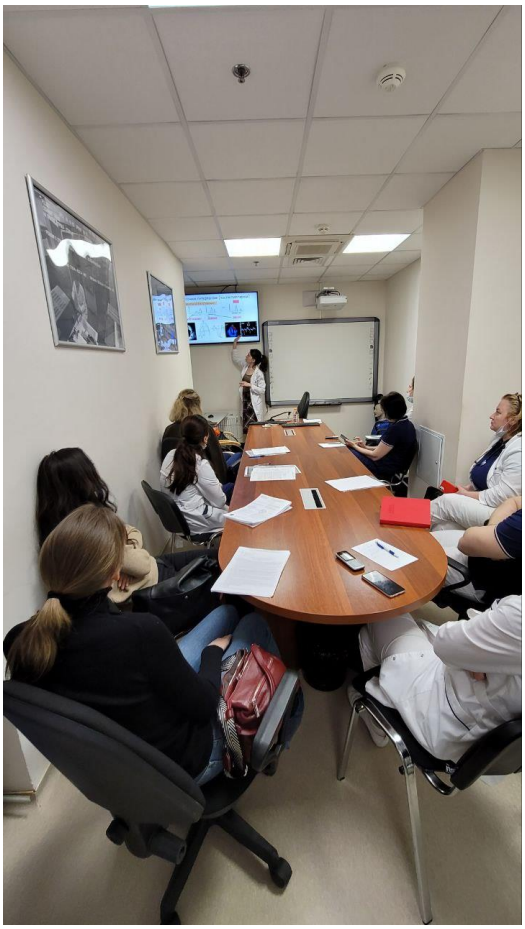
2. J. V. Alonso et al.: "Protocols for Point-of-Care-Ultrasound (POCUS) in a Patient with Sepsis; An Algorithmic Approach", Bull Emerg Trauma, 2019, Bournemouth, UK

3. P. Bornman, T. Barreto: "Point-of-Care Ultrasonography in Family Medicine", American Family Physician, 2018, USA

POCUS MOSCOW NEWS

Vsevolod Lykhin, MD/PhD
Anesthesiology & POCUS specialist, Russia

Dear colleagues, the POCUS MOSCOW Group offers an update on our activities over the past three months. Continuing to develop Point-of-Care Ultrasound, our team has launched a new educational course: "POCUS in Chronic Heart Failure". The course provides students with knowledge and skills in the use of ultrasound to diagnose and correct the tactics of patients with CHF. Particular attention is paid to focal and extended ECHO. Assessment of valve pathology and assessment of volume status. The course is especially relevant for cardiac resuscitation physicians, general practitioners, family physicians. The course lasts for 2 days, and students receive 18 CME after completing the course.

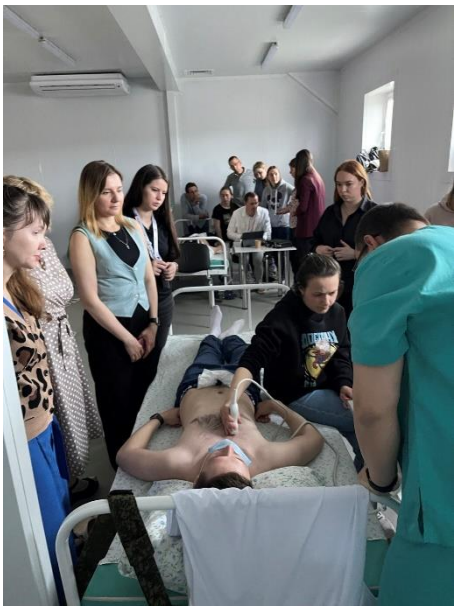


Our group is actively involved in the development of direction POCUS and now we see the only possibility for further strategy is to scale training to major cities and regions of Russia. To increase the involvement of the teaching staff and the medical audience, we have started a program of mass training courses.

The first mass training for 75 people we held in one of the largest new hospitals in Moscow, the Moscow Multidisciplinary Clinical Center "Kommunarka". We organized 10 ultrasound stations at which 10 of our POCUS trainers worked. Such events allow us to create a positive effect on doctors, as well as maintain the team spirit of our group. In the future, we plan to continue developing this area of mass training.

I would like to emphasize that the mass training is not to the detriment of the quality of training, because all the trainers are experts in this area and have been tested in the conditions of our main training area Medical Simulation Center of Botkin Hospital. Only constant training of physicians, in

a sufficient volume, will make it possible to achieve widespread implementation of the POCUS methodology in mass workplace integration. Naturally, this is impossible without teamwork.



One of the new directions is to work with new ultrasound manufacturers. For about a year now, our group has been helping to create and refine the Russian ultrasound equipment SmartScan. At the moment, a 15-inch ultrasound machine in the transformer form factor is presented. The device takes its position in various educational courses. Visit http://smartscan.club/pocus for information about our group and SmartScan equipment.

We also have a telegram channel at https://t.me/pocusmoscow

In agreement with the IPO, we are releasing a free download of our manual:

"**Applied Ultrasonography**". Please, visit the "Downloads" page on our web site. This edition is in Russian, but we plan to issue English and German versions of the manual. The manual contains QR codes that lead to an accompanying video. Enjoy reading.

Regards, POCUS MOSCOW team

Ejection Fraction Evaluation With FAC: How reliable it is?

Ivica Zdravkovic, MD/PhD,
"ID MEDICA" Clinic, Požarevac, Serbia, May 2022

Abstract

Evaluation of ejection fraction (EF) is one of the core arts in both quick ultrasound exam of the heart (FATE, POCUS, etc.) and comprehensive cardiological ultrasound study. There are many methods of qualitative and quantitative assessment of EF and this paper is focused on application of the Fractional Area Change (FAC) method. In a study based on comparative analysis of Teichholz/FC method and FAC method, it is demonstrated that the FAC measurement and calculation needs to be revised in light of the new results. Also, it enables application of FAC method in improvised POCUS heart exam with a convex probe in absence of cardiological measuring and calculations software.

1. INTRODUCTION

This study was inspired by common necessity of getting the best possible results with limited resources: using software poor-equipped ultrasound machines during POCUS (Point-Od-Care-UltraSound) exams in such a way to compensate their technical limitations. For over a decade I am engaged as a sonographer both in my private medical office and in other medical facilities. I am using various probes and software options on a daily base, in order to perform not just "quick" POCUS exams, but also "comprehensive" specialized echosonography studies, such as detailed echocardiography, breast exam, carotid Doppler, abdominal ultrasound etc. During all that time I have developed particular interest in comparing some procedures and finding ways to get certain insight and result in the easiest and fastest way.

This means: if there is a complex procedure or calculation that is required to give us some information about certain anatomical or dynamic function of an organ, lets try making it simpler or using other ways to get to the same goal. Of course, being "innovative" in the area with enormous literature and online resources is rather hard and risky - frequently it ends up with "inventing" something that already exists. Or creating something that "hair-splitters" immediately "put on a cross" as an "unnecessary simplification". (Some radiologists and cardiologists in particular have highly critical stand regarding the entire POCUS concept, calling it "overrated gadgetry" or "laymen playful pretending"...)

As an example of how the POCUS can be usefully performed even without "default" hardware and software, I like to mention the ejection fraction (EF), one of the core information gained through both FOCUS and FATE (FOCUS=Focused Ultrasound, quick partial exam; FATE=Focused assessed transthoracic echocardiography, meaning the same: quick ultrasound evaluation of heart) and "comprehensive" cardiological echocardiography (a.k.a. "Study").

EF is defined as the percentage of blood ejected during systole out of all the blood volume that was present in the left ventricle prior to the systole. (Note: There is also right ventricle EF, and most of the things said for the left ventricle EF, or LVEF, also apply to RVEF; however, this paper is focused on the LVEF). It is perceptual relation between the so called end-dyastolic volume of the left chamber (EDV) and the stroke volume (SV) of the heart. EF is calculated with next formula: EF= (SV/EDV) x 100

There are several "normal" ranges of satisfying EF, and I like to use the one where normal EF is 65% plus/minus 10. Reduced EF means reduced systolic function. The less EF is, the worst are the symptoms of heart failure. It can be easily concluded that EF is a numerical evaluation of cardiac insufficiency. We all know the New York Heart Association NYHA stages of heart insufficiency - the four grades that closely correlate with the EF. And the EF can be also described in four levels: normal (above 55%), mildly decreased (~40-55%), moderately decreased (~30-40%) and severely decreased (under 30%).

There are several ways of measuring EF. We use them accordingly to the equipment we have, or depending on the needs we have. If we use ultrasound just to get the basic info about the condition of the heart, we might be satisfied with "eyeballing" and simple qualitative description of EF (EF good, mildly reduced, etc.). This rough estimation of the LV contractility is frequently sufficient for physician in the ER, ICU or in a GP office. However, quantitative evaluation of EF is frequently proffered, and there are several main methods of calculation:

1. Modified Simpson method - measuring LV volumes
2. Modified Quinones method - linear measurements
3. Teichholz formula based on LV diameter (including Fractional Shortening method, FS)
4. E-point septal separation (EPSS) method
5. Mitral annual plane systolic excursion (MAPSE) method
6. Fractional Areal Change (FAC)
7. Volumetric calculations with MRI

Description of all these methods goes beyond the aims of this paper and is available in numerous other resources. Some of it is a part of the Family Medicine POCUS Curriculum, designed by the International POCUS Organization, IPO, to which I belong. In my regular work I mostly use either a quick qualitative POCUS/FATE method combined with EPSS and MAPSE evaluation, or quantitative Teichholz /FS method based on measuring the internal diameter of LV, the EDD (end-dyastolic diameter) and the ESD (end-systolic diameter). I usually work on Toshiba PowerVision 6000 and Nemio platforms, or on GE Vivid and Logic systems. All of them have cardyological software with measuring and calculations based on fore mentioned formulas.

I have rarely tried the Fractional Area Change (FAC) method until recently, and it came out that this method is surprisingly underrated. This is particularly visible once we try to apply FAC in improvised conditions, such as using the curvilinear probe (convex or "abdominal" probe) and using it not only in standard parasternal short axis position (PSAX), but also in modified subxyphoid position.

Now, before I move on to description of the FAC method and the conclusions I came to, I must once more explain why would we "improvise" with non-cardiac probes in POCUS/FOCUS/FATE.

Most of the currently available handheld (portable) ultrasound systems do not offer full set of specialised measurements. Frequently there are no such options like automatic calculation of EF. Some recent AI-based machines calculate EF according to EPSS, (eg. Clarius wireless probes), but mostly manufacturers of handheld systems claim that POCUS is "not a comprehensive exam" and therefore eyeballing and qualitative evaluation of myocardial function should be sufficient. I tend to disagree with both parts of this position: first, POCUS is NOT necessarily a "quick focused exam", it is simply as it says: Point-Of-Care Ultrasound. So, if one has the time, knowledge and equipment to perform a full comprehensive ultrasound exam at the bedside, it is also POCUS. Secondly, simple eyeballing and qualitative evaluation of LV contractility may be sufficient if we are in a hurry, or when there are obstacles to additionally calculate the EF. But The FAC (as it will be described in the remaining of the paper) is rather quick and easy procedure and requires very basic ultrasound equipment and software.

In addition to portable systems with relatively poor measurements and calculations software (including all of them: Butterfly, V-Scan, Philips Lumify, EagleView, Clarius etc.), there is another problem which pushes us to "improvise" as POCUS diagnosticians. Being POCUS instructor who runs workshops in various public medical facilities, I have realized that phased-array probes (sector probes used for echocardiography) are often missing from the most of the departments except cardiology. So, what is available to colleagues are convex ("abdominal") probes and linear probes, with standard measuring and calculating software lacking LV study options.

Special POCUS curriculum that I have designed for GP/FM physicians is strongly based on these premises:

1. POCUS in primary health care settings shall be performed most often either with a handheld probe or with convex or linear probe, in absence of cardiological probe and software.

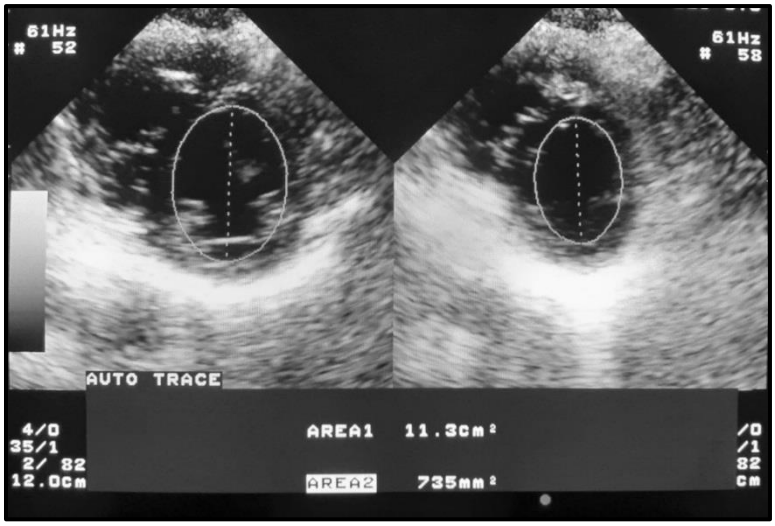
2. There will be only basic common options available to sonographer:

- B-mode grayscale imaging
- Classical measurements: distance, volume, area
- M-mode with distance measurement
- Color Doppler (CD) and Pulse Wave Doppler (PW), allowing measuring of Vmax (PSV) and resistance index.

3. Interpretation of POCUS findings in context of clinical exam will enable physician to draw correct conclusions even with less information from ultrasound scaning.

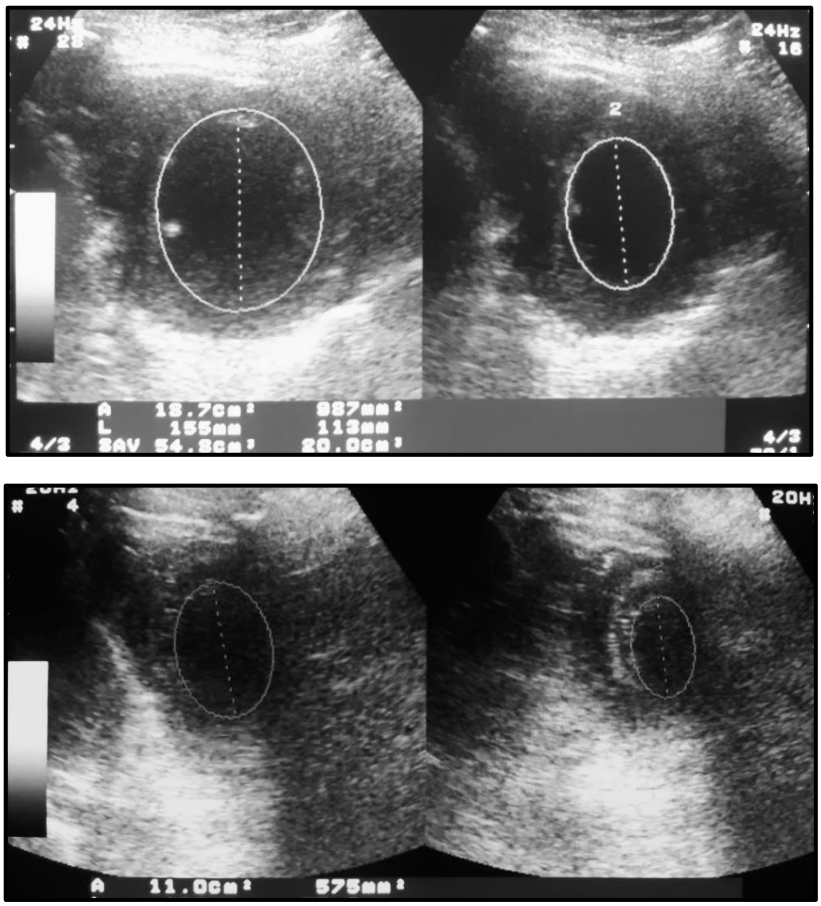
Having all this in mind, I tried to apply FAC method using convex probe.

Fractional area changes (FAC) is difference between transverse section of LV during systole and diastole. Using simple area tool, available in practically any B-mode preset, we can measure end-diastolic area (EDA) of LV, and end-systolic area (ESA). Measuring is done in standard parasternal short axis position (PSAX), at the level of papillary muscles.



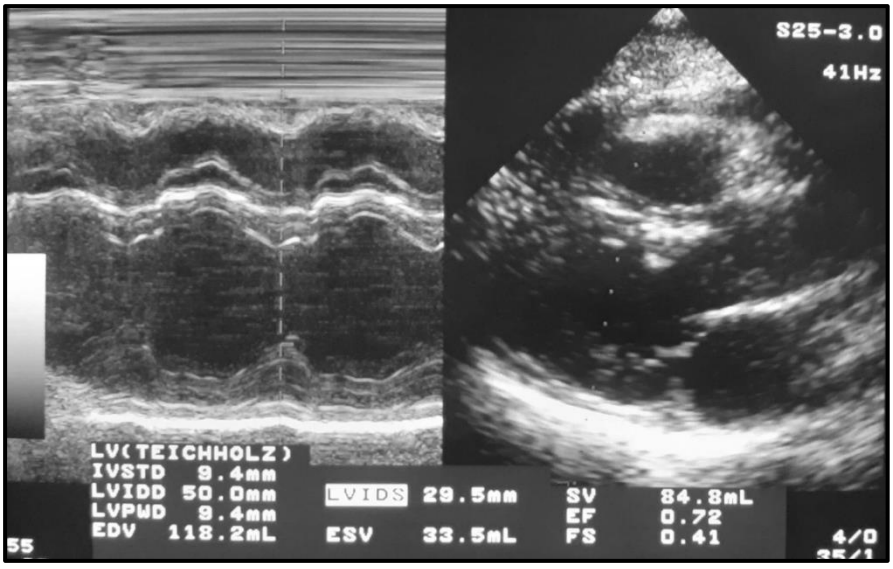
Picture 1: PLAX LV transverse section, EDA and ESA

It can be also done in other transverse sections of LV, and one of them corellating to PLAX is modified subxyphoid position:

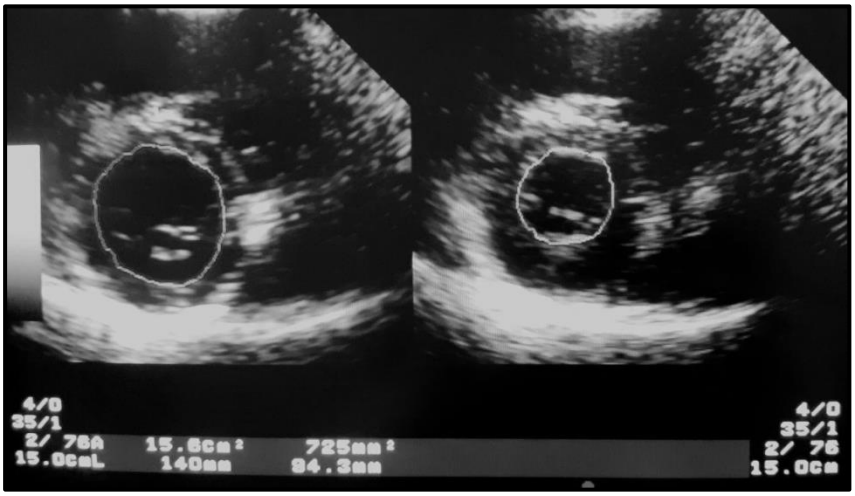


Picture 2 and 3: Same heart, FAC from PLAX and subxyphoid position:
Relation of EDA/ESA is almost the same, at around 47%

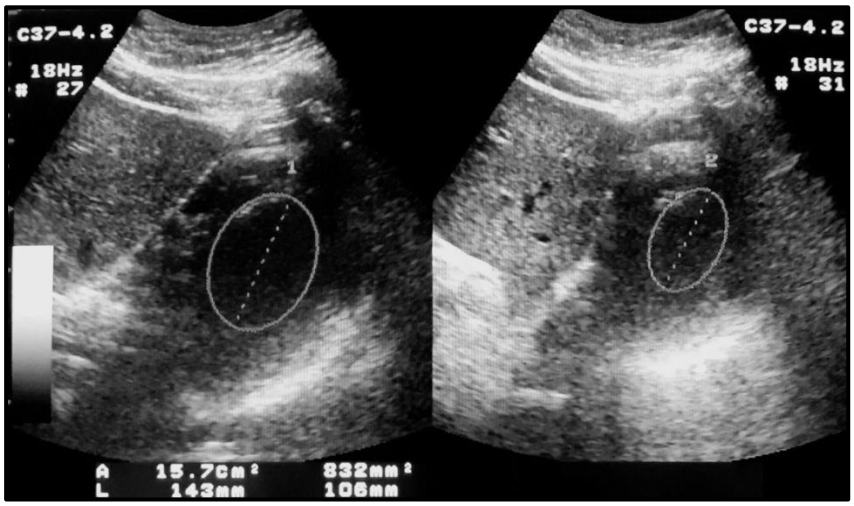
FAC is calculated by following formula: FAC = (EDA - ESA)/EDA



Picture 4: LV in PLAX position, standard EF calculation with Teichholz/FS method.
EF for this patient is 72%



Picture 5: LV in PSAX position, measuring EDA and ESA
Please note: This is the same patient's heart from previous image. Using EDD and standard formula, we get the value of 17,7cm². Also, using ESD and standard formula, we get the value of 6,6cm². Obviously, these values differ from the measured values (15,6cm² and 7,2cm²). Using PLAX calculated values we get the FAC of 63%. Using PSAX measured values we get FAC of 53%. It is significant difference.



Picture 6: Same heart, EDA and ESA measured in modified subxyphoid position.
According to these values, FAC is 47%. This new FAC is even more different from the PLAX-calculated FAC. So, what is the real EF? What is the correct relation of FAC and EF? And where and how to measure EDA and ESA in order to calculate FAC?

FAC	Ejection Fraction
60%	75%
50%	66%
40%	54%
30%	42%
20%	29%
10%	15%

Picture 7: Recommended relationship between FAC and EF available in literature

Goals of this study are, therefore:

1) to check the accuracy of relationship between EF and FAC.
2) to check if convex probe and areal measurments of LV in subxyphoid position can be used in the evaluation of EF

2. METHOD

I used the reports from my clinic, which contained echocardiography results, including EF calculated by the Teichholz/FS method. This method is based on foollowing formula:

$$FS=(EDD-ESD)/EDD$$
$$EF\sim 2FS$$

All patients whose reports were included in the study were examed on Toshiba PowerVision 6000 platform with authomatic software for EF calculation. In one of my previous papers I have demonstrated on a series of measurments that the more precise relation of FS and EF can be presented with following formula:

$$EF=0,9x2FS$$

This correction is not included in this study, because I used authomaticaly generated results from Toshiba ultrasound platform.

It is demonstrated by further calculations that the FAC/EF relation is DIFFERENT from what is currently proposed in available resources. Using all EDD and ESD values for each patient, I calculated the FAC by the standard formula. From their EDD and ESD I calculated EDA and ESA first, using formula:

$$EDA=3,14x(0,5xEDD)^2 \quad \text{and} \quad ESA=3,14x(0,5xESD)^2$$

Results are given in the separate table.

In the second phase, I performed exams on 10 new patients: first with a sector-probe and Teichholz/FS calculation, and then with a convex probe and FAC method. Results confirm that current recommended correlation between FAC and EF should be revised.

3. RESULTS

From the archive of patients I randomly selected 30 reports with performed "comprehensive" echocardiography and measured EDD, ESD and EF. Calculation of EF is done by Toshiba PowerVision 9000 software, according to Teichholz/FS formula. From measured EDD and ESD I calculated EDA and ESA. Using these values, I calculated the FAC for each of the previously measured EF. Here are the results (FAC is given in rounded numbers):

	EDD	ESD	**EF**	EDA	ESA	**FAC**
1	48	28	71	18,0	6,15	66
2	54	30	76	22,89	7,06	69
3	51	36	53	20,41	10,17	50
4	60	37	68	28,26	10,75	62
5	49	26	79	18,84	5,31	72
6	45	31	56	15,89	7,54	52
7	71	55	45	39,57	23,75	40
8	64	44	59	32,15	15,20	53
9	61	45	52	29,21	15,89	46
10	52	38	51	21,22	11,33	47
11	67	50	50	35,24	19,62	44
12	58	50	30	26,41	19,62	26
13	76	64	33	45,34	32,15	29
14	67	58	30	35,24	26,41	25
15	62	50	41	30,17	19,62	35
16	70	52	49	38,46	21,22	45
17	52	40	46	21,22	12,56	41
18	59	46	42	27,32	16,61	39
19	56	44	39	24,62	15,20	38
20	48	29	70	18,08	6,60	63
21	64	56	26	32,15	24,62	23
22	56	36	64	24,62	10,17	59
23	67	49	51	35,24	18,84	46
24	65	57	24	33,17	25,50	23
25	80	61	46	50,24	29,21	42
26	76	59	43	45,34	27,32	40
27	70	53	44	38,46	22,05	43
28	48	31	64	18,08	7,54	58
29	41	23	76	13,19	4,15	68
30	51	38	48	20,41	11,33	44

Table 1: Calculation of FAC from previously measured EDD and ESD

In order to better analyze accuired data, I listed all EF-FAC results from smaller to largest:

FAC	**EF**	**+**
23	24	1
23	26	3
25	30	5
26	30	4
29	33	4
35	39	4
38	41	3
39	42	3
40	43	4
40	44	4
41	45	4
42	46	4
43	46	3
44	48	4
44	49	5
45	50	5

46	51	5
46	51	5
47	52	5
50	53	7
52	56	4
53	59	6
58	64	6
59	64	5
62	68	6
63	70	7
66	71	5
68	76	8
69	76	7
72	79	7

Table 2: EF and FAC values on the same patients and the correction numbers

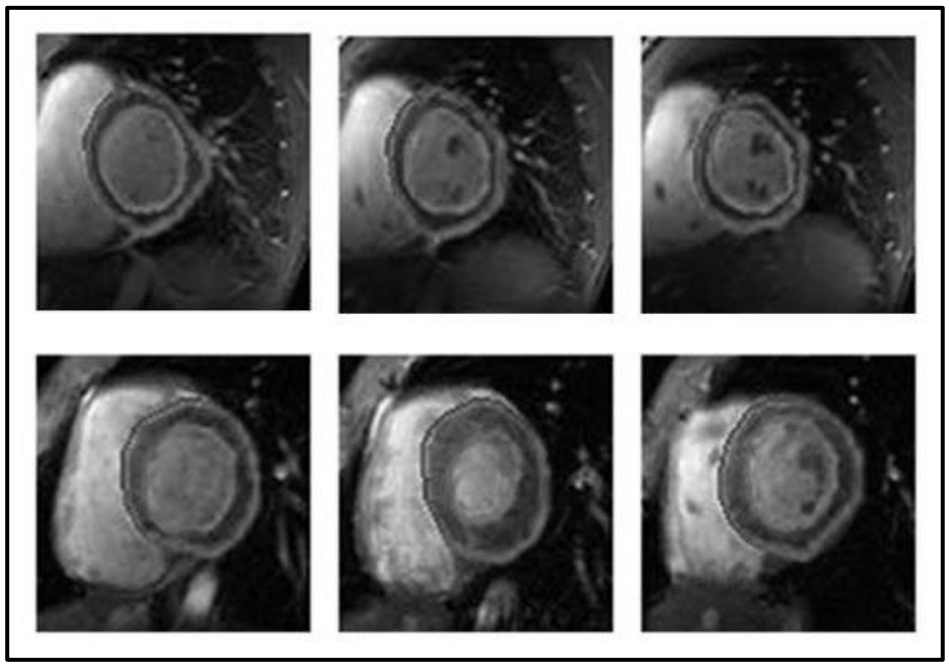
I examed 10 patients first with a sector probe (and used the softvare to calculate EF), then I examed same patients with convex probe and calculated their EF through FAC (EDA and ESA). Here are the results:

Sector probe, EF from PLAX			**Convex probe, FAC from subxyphoid view**		
EDD	**ESD**	**EF**	**EDA**	**ESA**	**FAC**
46	29	66	14,5	5,6	61
53	33	67	15,5	6,4	59
52	31	70	22,1	10,5	52
44	26	71	18,7	9,9	47
56	36	64	21,8	12,2	44
61	52	36	28,2	19,4	31
76	60	30	46,6	27,1	42
51	29	73	16,4	8,2	50
67	53	40	34,2	21,5	37
54	33	75	22,0	7,3	66

Table 3: Comparation of EF calculated from PLAX position and Teichholz/FS formula measured by sector probe, and FAC calculated from EDA and ESA measurment by convex probe in subxyphoid position

4. DISCUSSION

Calculation of EDA and ESA from EDD and ESD by using simple formula for circle surface πr^2 is based on a presumption that the PLAX measured EDD and ESD are exact/correct diameters of the LV, where LV is presumed to be perfectly cylindrical. However, this is not the case. Since transverse section of LV is not a perfect circle, EDD and ESD measured in PLAX position may significantly differ from real diameters. Let's see this on a transverse section of LV acquired from MRI of the heart:



Picture 8: MRI automatc segmentation of the short axis LV

It is obvious that position/angle of the probe greatly affects measurement of EDD and ESD. Not to mention that EDD and ESD may significantly depend on the contractility of the particular portion of septal or posterior wall. If we measure EDD in M-mode in a such maner that we "cut" through a hypokinetic part of previously inflicted myocard, we shall get the smallest movements of the wall, smaller the difference between EDD and ESD, and eventually, smaller EF. Same goes for measurements of EDA and ESA. We must find the portion of the LV where we have the biggest difference between EDA and ESA. Only in this way we shall have exact representative FAC and representative clinically valuable EF.

If we calculate FAC from EDD and ESD by simple transforming them into EDA and ESA, what we get is is a series of numbers that are rather similar to corresponding EF values. This is obvious in Tables 1 and 2. Seems that the lesser is the EF, smaller is the difference between EF and FAC.

From Table 2 one can even conclude that following (approximate) correction should be made to FAC in order to get an approximate EF:

Approximate FAC	Average correction	Approximate EF
< 20	no correction	<20
20-55	+ 5	25-60 (±2)
55-65	+ 6	60-70 (±2)
65-70	+ 7	70-80 (±2)
> 70	no correction	>80 (±5)

Table 4: Suggested corrections to determine an approximate EF from FAC

Obviously, this table is significantly different from numbers corruently propesed (see Picture 7)

But if we look at the figures in the Table 3, things get a bit complicated. Something is wrong, because FAC even corrected as suggested in Table 3 do not give expected and correct EF. And we must presume that the EF values in the Table 3 are correct, because these are result of well established Teichholz/FS formula. So where is the error? Once more, "Errare human um est!". Or, to be precise: be careful and find proper section of the LV. Ask your patient to take a deap breath, so that the heart and LV get lower as the diaphragm goes down. And in that moment, just rotate a bit your probe and you will get that modified subxyphoid view, useful for LV transverse section area measurement. Even with convex probe.

So, to answer that question from the introduction: YES, convex probe and areal measurement of LV in subxyphoid position can be used in the evaluation of EF. The EDA/EDS ratio is pretty mach the same, no matter if it's measured with a convex probe in subxyphoid position, or with a sector probe in PSAX position. And it is all about that ratio. It is all about finding the section where this EDA/EDS ratio is the biggest. It often means repeated measurements in several planes. In addition, just a quick observation of MAPSE (should be above 10mm) and EPSS (should be under 8mm), and we already know that the EF must be somewhere at around 55% or above. And that means that the ratio between EDA and EDS should be approximately 2:1 or higher. (See Table 1).

5. CONCLUSION

FAC is a solid tool for approximate quantitative evaluation of EF. It should be used in combination with MAPSE and EPSS. It can be calculated from EDA and ESA by a simple formula, and these two values can be relatively easy obtained even with a convex probe in a modified subxyphoid position. Roughly estimation is that when MAPSE is above 10 mm, EPSS is above 8 mm and ratio between EDA and ESA is at least 2:1, the EF shall be normal, at 55% or higher. More precise evaluation of EF can be done by correction of FAC as given in the Table 4 od this study. Current recommended relation between FAC and EF is in certain aspects similar to our results, but this new method offers more accurate determination of EF.

6. References

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Update from Canada

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Aprende Canada founder and owner

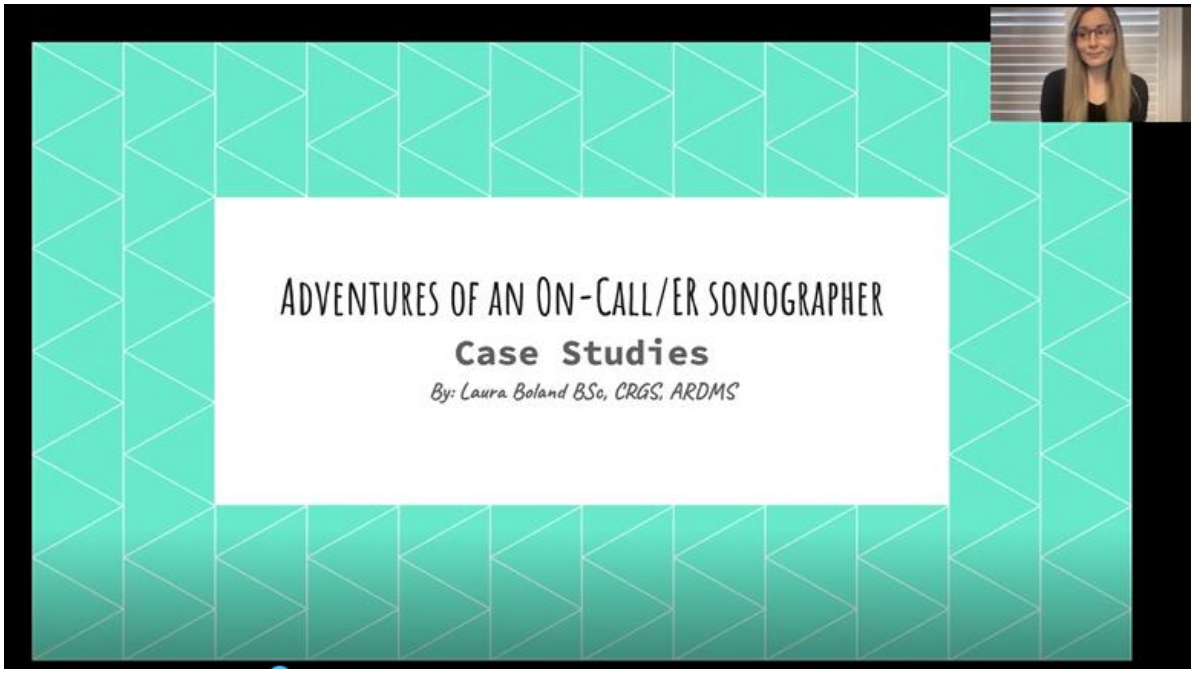
2022 SonoWebinars

The first 7 SonoWebinars for 2022 have been well received and attended.
The remaining 4 SonoWebinars are scheduled for the Fall.

Topics:

- Comprehensive review of guidelines on deep venous thrombosis
- Push and squeeze: the lower extremity vein challenge
- The broader importance of the 11-14 week scan
- Ultrasound Assessment of the Diseased Liver – How new techniques are helping us image the difficult patient
- Adventures of an On-Call/ER Sonographer: Case Studies
- MSK peripheral nerve
- Reconnecting to Wellbeing
- Breast ultrasound
- Neonatal hips
- Three Dimensional Applications in General Sonography
- Mental Health

For those who missed the live SonoWebinars, you can watch the recordings at https://aprendecanada.com/sonowebinars




PUSH AND SQUEEZE:
THE LEV CHALLENGE
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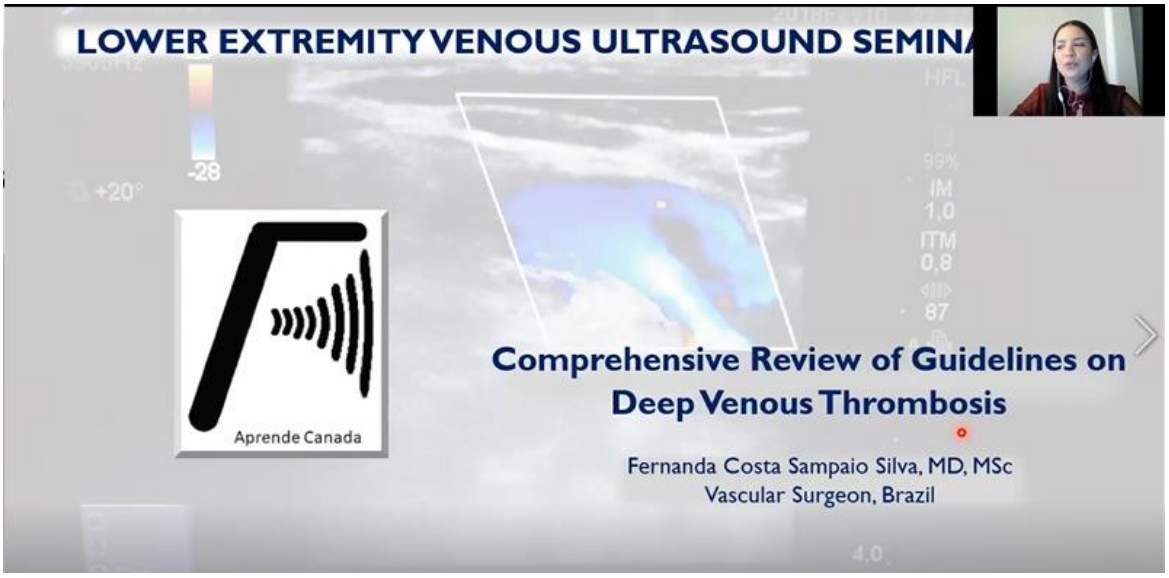

LOWER EXTREMITY VENOUS ULTRASOUND SEMINA
Aprende Canada
Comprehensive Review of Guidelines on Deep Venous Thrombosis
Fernanda Costa Sampaio Silva, MD, MSc
Vascular Surgeon, Brazil


Ultrasound of the
Nerves of the Wrist & Hand
Lisa Billone, DMS, RMSKS
RDMS, RVT, CRGS, CRVS
Hamilton Health Sciences

Aprende Canada Library

We are proud to present content on abdomen, OB/Gyne, MSK, vascular, and superficial structures. Check out our library at https://aprendecanada.com/aclibrary

Aprende Canada YouTube Channel

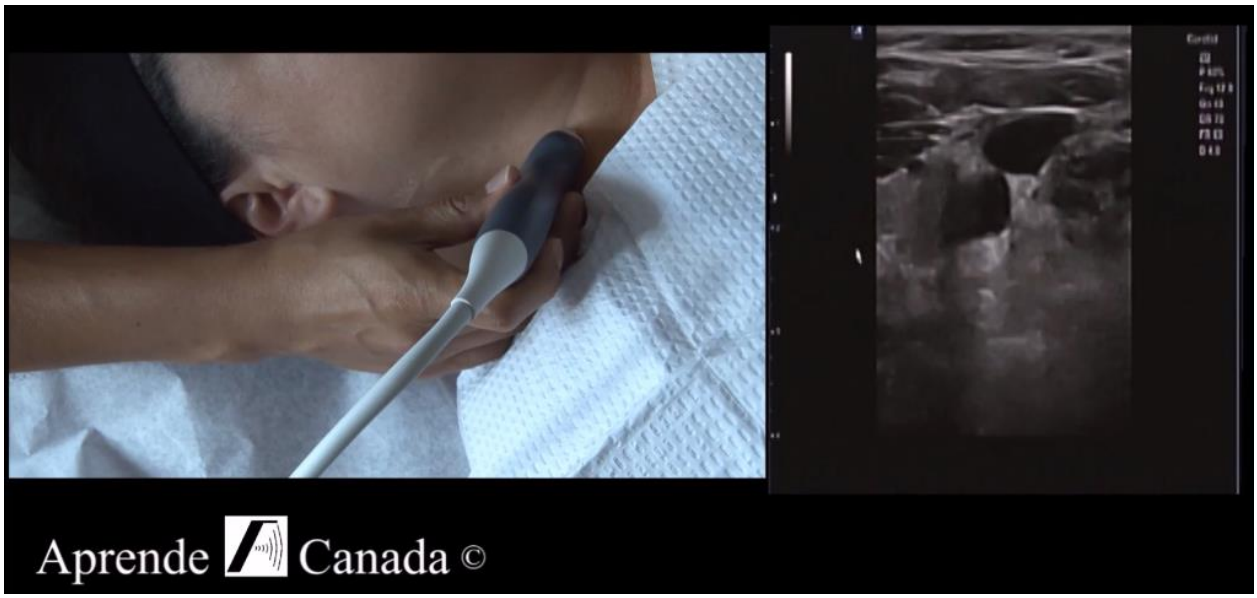
Leonardo Faundez, Canadian sonographer, founder and owner of Aprende Canada offers scanning tips and tricks on several topics. These videos are free and you can watch them at **http://www.youtube.com/c/AprendeCanada** and click on Free Aprende Canada ultrasound scanning tips videos

Announcement

Aprende Canada instructional videos are now part of the Diagnostic Medical Sonography program at Anderson College. These videos include step-by-step instructions on how to perform ultrasound scans on several organs, and therefore, are a fundamental educational tool to sonography students.

By accessing our videos, students learn the scanning technique, tips and tricks before their laboratory and practical exams.

For more information about our instructional videos, please visit
https://aprendecanada.com/instructional-videos



Cardiac and vascular point-of-care ultrasound: current situation, problems, and future prospects

Journal of Medical Ultrasonics (2022)
Authors: Hirotsugu Yamada, Hiroyuki Ito, Mika Fujiwara

This article is available on following link:
https://link.springer.com/article/10.1007/s10396-021-01166-3

Abstract

Although clinical application of ultrasound to the heart has a history of about 80 years, its big turning point was the emergence of a portable ultrasound diagnostic machine. As a result, the place, where echocardiography is performed widely spread outside the examination room, and the people who perform echocardiography have also greatly increased. Emergency physicians, anesthesiologists, and primary care physicians became interested in echocardiography and started using it. Such ultrasound examinations performed by a doctor for assessment of disease condition, management, or guidance of treatment at bedside has been called point-of-care ultrasound (POCUS). Cardiac POCUS is divided into a focused cardiac ultrasound examination (FoCUS) and limited echocardiography. The former is performed by non-experts in echocardiography, such as emergency physicians and anesthesiologists, whereas the latter is usually performed by cardiologists who are experts in echocardiography. FoCUS has an established protocol and evaluation method, and evidence to prove its effectiveness is accumulating. In addition, the COVID-19 outbreak reaffirmed the importance of POCUS. Although FoCUS is becoming popular in Japan, an educational program has not been established, and discussion on how to educate medical students and residents will be necessary. Even if POCUS in cardiovascular medicine becomes widespread, auscultation will still be necessary. Rather, adding cardiac and vascular POCUS to inspection, palpation, and auscultation in the flow of physical examinations will benefit patients greatly.

REVIEW

Ivica Zdravkovic, MD/PhD

Very nice article. A bit surprising too. I would expect that a nation with such advanced technological level like Japan has faster development of educational methods. But no, seems that Japan suffers equally like the rest of the globe from conservative views and too slow changes in medical educational system.

At the beginning of the article one can learn that modern era od echocardiography begun in 1980's. I still remember my professors and elderly colleagues who were cardiologists back in 1980's (and even in 1990's) who didn't have a clue about ultrasound. And I clearly remember some of the first "comprehensive echocardiography" reports made by cardiologist in late 1990's and EVEN TODAY - which are far less "comprehensive" than my first FATE reports.

I would say that there is too much "splitting hair" about POCUS versus "comprehensive ultrasound". Basically, as one advances in knowledge and skills, ultrasonography becomes easier and difference between POCUS (FoCUS) and "comprehensive ultrasound" slowly fades.

I am specialist in general practice (yes, that is a specialty in my country) and I have numerous ultrasound certificates and even title of POCUS specialist - but I am not cardiologist. Still, my reports and findings are accepted even by the highest institutions in our medical system, including Institute for cardiovascular surgery. How? Why? Is it my good reputation? No. It is simply the format of the report, which shows that I have performed 90-100% of all measurments and other procedures same as any other colleague who is cardiologist.

I wrote several books, couple of curriculums and lots of papers on the subject of POCUS and medical diagnostic ultrasound in general. In almost all of these writings I insist that ultrasound (of heart, or any other organ or area) is similar to electrocardiography (ECG): even youngest physitian must know basics of

ECG in order to get a licence for medical practice. Such doctor will look at one ECG and will draw certain amount of information from it - which is probably much smaller than the amount of information drawn by a cardiologist. But still, even basic info from superfitial interpretation of ECG is better than not looking at ECG at all. And there - it is now a common practice throughout the world that doctors in primary healthcare, ER, ICU etc. - ALL USE ECG without any problem (and even without special certification). Well, the same thing must happen with ultrasound.

(Just a side note: In whole this region of Europe, most medical students learn their first "steps" in ECG from legendary Dubin's book "Rapid Interpretation of EKG's". Might I remind you that Dr. Dale Dubin wrote this book when he was 32 years old, and he WAS NOT CARDIOLOGIST, but a plastic surgeon...)

In conclusion:

My dear colleague and friend, **Dr. Vsevolod Lykhin** from Russia, an exceptional POCUS expert and excellent anesthesiologist, made a great "formula" for future education of medical students: an exam traditionally consisted from four methods, or steps: INSPECTION, PALPATION, PERCUSSION and AUSCULTATION. Now we have the fifth step: INSONATION. (insonation: exposure to ultrasound). And that says all. Revolution has begun and it cannot be stopped. So, the faster we introduce POCUS (or INSONATION) to initial levels of medical studies, the better will be the results of daily use of ultrasound.

Recommended reading:

Echocardiography in Prone Positioned Critically Ill Patients: A Wealth of Information from a Single View

by Enrico Giustiniano, Sergio Palma, Massimo Meco, Umberto Ripani and Fulvio Nisi, April 2022, Italy

Abstract

In critically ill patients, standard transthoracic echocardiography (TTE) generally does not facilitate good image quality during mechanical ventilation. We propose a prone-TTE in prone positioned patients, which allows clinicians to obtain a complete apical four-chamber (A-4-C) view. A basic cardiac assessment can be performed in order to evaluate right ventricle function and left ventricle performance, even measuring objective parameters, i.e., tricuspid annular plane systolic excursion (TAPSE); pulmonary artery systolic pressure (PAP), from the tricuspid regurgitation peak Doppler velocity; RV end-diastolic diameter and its ratio to left ventricular end-diastolic diameter; the S' wave peak velocity with tissue Doppler imaging; the ejection fraction (EF); the mitral annular plane systolic excursion (MAPSE); diastolic function evaluation by the mitral valve; and annular Doppler velocities. Furthermore, by tilting the probe, we can obtain the apical-five-chamber (A-5-C) view, which facilitates the analysis of blood flow at the level of the output tract of the left ventricle (LVOT) and then the estimation of stroke volume. Useful applications of this technique are hemodynamic assessment, titration of fluids, vasoactive drugs therapy, and evaluation of the impact of prone positioning on right ventricle performance and right pulmonary resistances. We believe that considerable information can be drawn from a single view and hope this may be helpful to emergency and critical care clinicians whenever invasive hemodynamic monitoring tools are not available or are simply inconvenient due to clinical reasons.

Keywords: **point-of-care ultrasound**; **critical care medicine**; **non-invasive hemodynamics monitoring**; **acute respiratory failure management**; **imaging**

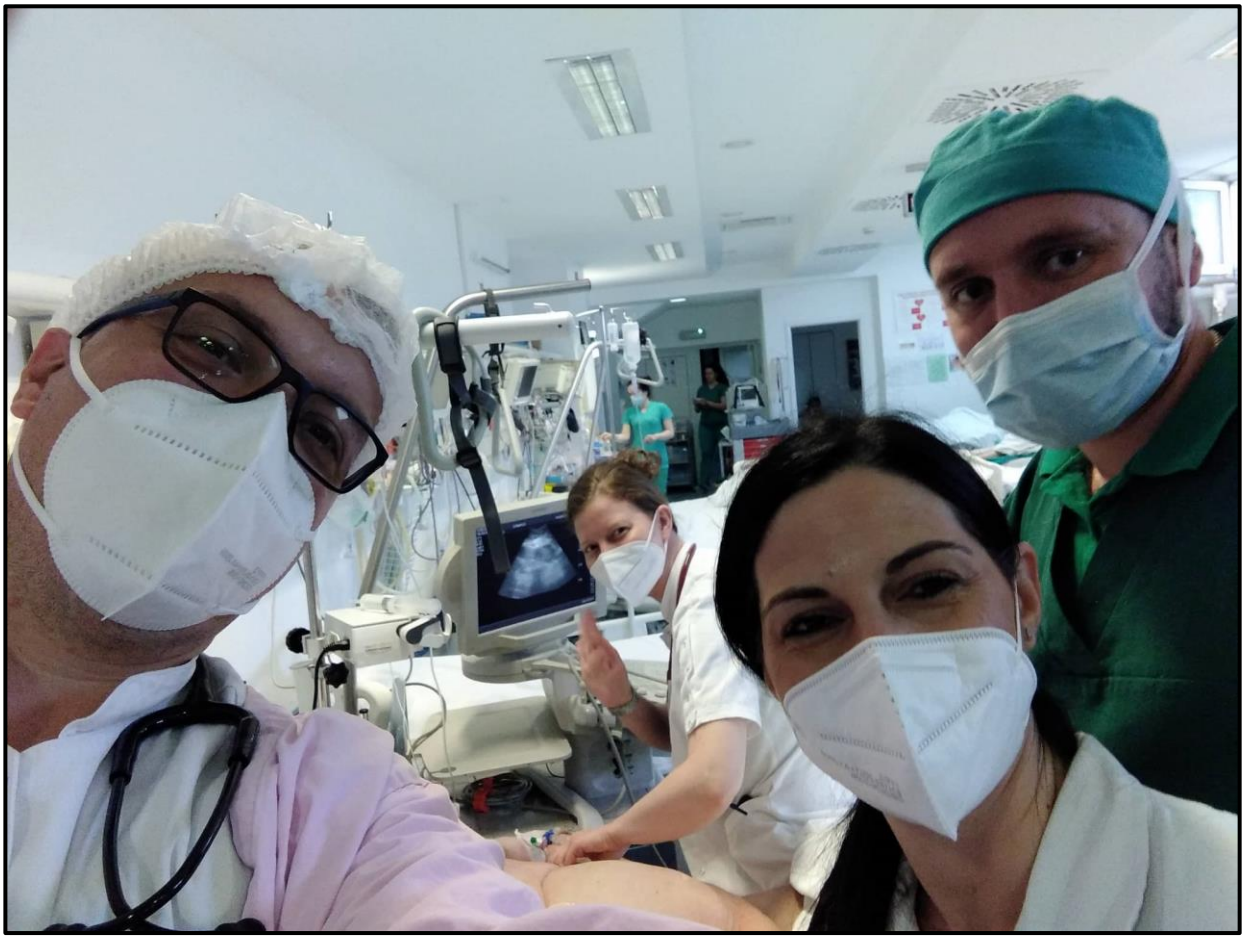
Point of care ultrasound as initial diagnostic tool in acute dyspnea patients in the emergency department of a tertiary care center: diagnostic accuracy study

International Journal of Emergency Medicine, June 2022

POCUS training in General Hospital Pančevo, Serbia

During the first 3 months of 2022, dr. Sava Vojnović has conducted training in eFAST for his collegues in GH Pančevo. The training involved weekly hands on sessions in the ICU unit, and was attended by general practitioners, anesthesiologists and orthopedic surgeons. Doctors in the orthopedic ward also showed an interest in MSK and soft tissue ultrasound, so training was also organized for them. Through this training the following physicians have gained certificates in eFAST:

- Dr. Mihajlo Mitrović – orthopedic surgeon
- Dr. Ilija Dimitrijević – anesthesiologist
- Dr. Aleksandra Živković – anesthesiologist
- Dr. Marijana Knežević – anesthesiologist
- Dr. Sava Veselinović – orthopedic resident
- Dr. Vladan Perić – anesthesiology resident
- Dr. Marija Todorović – anesthesiology resident



Don't worry, POCUS is here!