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EDITORIALS/ÉDITORIAUX

LETTER TO EDITOR

ORIGINAL ARTICLE / ARTICLE ORIGINAUX

PROGRAM DESCRIPTION

THE PRACTITIONER/LE PRACTITIEN

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Is Northern Ontario School of Medicine there yet?

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I am proud to be on faculty at the Northern Ontario School of Medicine (NOSM), a school at the forefront of rural and decentralised educational reform. NOSM's success in these efforts has led to extravagant claims such as 94% of graduates practising in Northern Ontario.[1] For 6.6 million rural Canadians at the 2016 census,[2] this is an impressive number, so you would be forgiven to think that the NOSM has fulfilled its social mandate and we are overflowing with graduates in rural Northern Ontario. Except that, we most definitely are not.

From unpublished workforce data from Health Force Ontario, over the last 3 years, there has only been a net recruitment of eight physicians to all of rural Northern Ontario. We can account for four of those gains in my community of Temiskaming Shores, so perhaps some of us are overflowing. The claim of 94% is no comfort to many other communities in deficit, just down the highway from us. Where has the promise gone wrong?

Northern Ontario is a political construct of a carefully demarcated territory that happens to be resource driven and thinly populated. NOSM was created to deal with unmet needs for physicians in the territory and can be forgiven for putting things in a combined rural *and northern* (emphasis mine) lens.

Northern Ontario is 44% rural by population. The 94% headline is derived from a statistic in a single paper that actually represents 48 family physicians practising in Northern Ontario from 51 trained over 3 years. Those family physicians did both their undergraduate medicine and postgraduate family medicine at NOSM (only 25% of the undergraduate class did both their undergraduate and postgraduate training at NOSM and went into family medicine). The largest share of that cohort went to northern cities. Only 18/51 of them (36%) ended up in a northern rural practice or an average of about six NOSM-trained students per year entering rural practice across all of Northern Ontario.

No wonder, many faculty see learners from NOSM, but not back as colleagues.

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L'ÉMNO y est-elle arrivée?

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Je suis fier de faire partie du corps professoral de l'École de médecine du Nord de l'Ontario (ÉMNO), une école d'avant-garde. Le succès de l'ÉMNO à ce titre a donné lieu à des affirmations extravagantes, telles que 94% des diplômés pratiquent dans le Nord de l'Ontario.[1] Pour les 6,6 million de Canadiens et Canadiennes vivant en région rurale au recensement de 2016,[2] ce chiffre est impressionnant. On vous pardonnera alors de penser que l'École de médecine du Nord de l'Ontario a rempli son mandat social et qu'on ne sait que faire des diplômés qui pratiquent dans le Nord de l'Ontario. Sauf que c'est tout à fait faux.

Selon des données non publiées sur la main-d'œuvre de ProfessionsSantéOntario, seuls 8 médecins ont été recrutés depuis 3 ans dans toutes les régions du Nord de l'Ontario. Ma communauté de Temiskaming Shores compte 4 de ces nouveaux médecins, alors peut-être que certains d'entre nous débordent. Ce chiffre de 94% ne rassure pas non plus les autres collectivités en déficit, à seulement quelques kilomètres d'ici. Comment SE fait-il que la promesse n'ait pas été tenue?

Le Nord de l'Ontario est le concept politique d'un territoire minutieusement démarqué qui s'avère dépendre des ressources et être peu peuplé. L'ÉMNO a été créée pour répondre aux besoins non comblés des médecins du territoire et on lui pardonne de passer les choses au tamis rural *et nordique* (les italiques sont de moi).

La population du Nord de l'Ontario est à 44% rurale. Le fameux 94% découle d'une statistique d'un seul article représentant 48 médecins de famille qui pratiquent dans le Nord de l'Ontario sur 51 des médecins formés sur 3 ans. Ces médecins de famille ont fait leurs études de médecine de premier cycle et leur spécialisation en médecine familiale à l'ÉMNO (seuls 25% des étudiants de premier cycle ont fait leurs études de premier cycle et leur formation spécialisée à l'ÉMNO ET pratiquent en médecine familiale). La plus grande part de cette cohorte s'est établie dans les villes du Nord. À peine 18 médecins sur 51 (36%) ont abouti dans une pratique rurale du nord, soit en moyenne environ 6 étudiants par année formés à l'ÉMNO entrent en pratique rurale dans toutes les régions du Nord de l'Ontario.

Pas étonnant que les professeurs voient les apprenants de l'ÉMNO, mais ne les revoient jamais comme confrères ou consœurs.

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President's Message. Access or continuity?

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I am presently doing a locum in Moose Factory, and in this historical but isolated location, I am reminded of technologies that have improved communication among health-care professionals and with patients. The two-way radio allowed isolated nursing stations to communicate with physicians. This was followed by the telephone and the fax machine, then the Internet that allowed notes and images to be transferred. In Moose Factory, when I order an X-ray on a patient in the Emergency Department, the report, read by a radiologist in Timmins, is often available when I go back to reassess the patient.

Virtual care is a recent development in patient care. Initially, virtual care required telemedicine equipment that was only available in hospitals and clinics, and a nurse would be present with the patient to assist with examination. Now, it can be done from the comfort of one's home, or in some cases, from a local pharmacy.

Many rural communities have a doctor shortage, and free-standing clinics can improve access for patients. This must be balanced against their lack of continuity. We know that continuity of care reduces mortality[1] and decreases system costs.[2] Patients generally value access over continuity for acute problems but value continuity for chronic issues, multimorbidity and "checkups.[3,4]"

Family medicine is dependent on context, and local physicians are familiar with available resources and referral pathways, as well as economic and social issues that may affect the patient's health. Physicians providing stand-alone, episodic virtual care should be encouraged to spend clinical time in the community that they service, so that they too can understand their patients' context.

Some physicians who are unable to work full time in a rural community may be able to support a rural population through regular in-person visits supplemented by virtual care when they are not in the community.

And finally, virtual care could be used by physicians to see their own patients, who are unable to come to the office and do not need physical exams, so that continuity is maintained.

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Message du Président. Accès ou continuité?

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Je fais actuellement une suppléance à Moose Factory et ce lieu historique, mais isolé me fait penser aux technologies ayant amélioré la communication entre les professionnels de la santé et les patients. La radio bidirectionnelle permettait aux postes des infirmières en région isolée de communiquer avec les médecins. Le téléphone et le télécopieur ont suivi, puis l'internet a permis de transférer notes et images. À Moose Factory, lorsque je demande une radiographie pour un patient de l'urgence, le rapport, lu par un radiologiste à Timmins, m'attend déjà souvent lorsque je retourne évaluer le patient.

Les soins virtuels sont un progrès récent en matière de soins aux patients. Au début, les soins virtuels nécessitaient de l'équipement de télémédecine qui n'était disponible que dans les hôpitaux et les cliniques, et une infirmière devait être présente pour aider à examiner le patient. Aujourd'hui, cela SE fait dans le confort du foyer et, dans certains cas, depuis une pharmacie de la localité.

De nombreuses communautés rurales accusent une pénurie de médecins, et les cliniques ayant pignon sur rue améliorent l'accès des patients. Cela doit être équilibré avec l'absence de continuité. Nous savons que la continuité des soins réduit la mortalité[1] et abaisse les coûts sur le système.[2] Les patients accordent en général plus de valeur à l'accès plutôt qu'à la continuité pour leurs problèmes aigus, mais préfèrent la continuité pour les problèmes chroniques, les morbidités multiples et les examens généraux.[3,4]

La médecine familiale dépend du contexte et les médecins locaux connaissent les ressources offertes et savent à qui recommander les patients; ils connaissent aussi les problèmes économiques et sociaux pouvant influer sur la santé du patient. Il faut encourager les médecins qui dispensent des soins virtuels seulement ou épisodiques à passer du temps en clinique dans la collectivité qu'ils servent afin de mieux comprendre le contexte de leurs patients.

Certains médecins qui sont incapables de travailler à temps plein en communauté rurale pourraient servir la population rurale en effectuant régulièrement des visites en personne pour suppléer les soins virtuels lorsqu'ils sont absents de la collectivité.

Et finalement, les soins virtuels permettent aussi aux médecins de voir leurs propres patients qui sont incapables de SE rendre au bureau et n'ont pas besoin d'un examen physique, de manière à assurer la continuité des soins.

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Letter to Editor

Physician attendance during interhospital patient transfer

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Dear Editor,

We read the publication on 'Physician attendance during interhospital patient transfer in Ontario: 2005-2015' with great interest.[1] Wonnacott *et al*. concluded that 'physician-attended ambulance transfer in Ontario is largely provided by family physicians in suburban to remote settings'.[1] We would like to share some ideas on this issue. There is no doubt that having a physician attend during the interhospital transfer is useful. Nevertheless, the decision to transfer has to be carefully considered.[2] In remote areas, there might be a limited number of physicians and it might not be possible for a physician to attend the patient transfer. In our setting, i.e. in a developing Asian country, it is usually not possible to have a physician attend during the interhospital transfer in remote areas. Generally, nurses play this role. In a worst case scenario, the facilities for transfer of patients are limited and the ambulance is sometimes lacking. To overcome the problem, a good plan for implementing a good transfer system is required. Training of specific personnel in the transfer process might be a good management tool for the lack of facilities and workload of medical personnel in remote areas in a developing country.

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Conflicts of interest: There are no conflicts of interest.

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Authors' Reply

Dear Sir/Editor,

In reply to your Letter to Editor regarding 'Physician attendance during interhospital patient transfer in Ontario: 2005-2015', I would like to clarify that, even within Ontario, physician-attended transfer of patients is the exception, rather than the rule. Most transfers can be managed by Emergency Medical Service (EMS) personnel, the provincial air ambulance service and/or a combination of nursing and respiratory therapist personnel, with telephonic support from a physician. The decision to transfer with a physician in attendance is highly dependent on the personnel and resources of the hospital and medical system in question, the anticipated needs of the patient being transferred and the weather and geographic details of the transfer itself. The letter from Dr Joob clearly illustrates the role that local factors play in transfer decisions. Dr Joob suggests training of personnel specifically for transfer purposes. This occurred within Ontario during our study period, 2005–2015, as the provincial air ambulance service ORNGE expanded significantly. We speculate that this may be why physician-attended air ambulance transfers from remote origins fell during our study period, and this likely represents a boon to the patients and hospitals in these remote regions.

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Original Article

Use of point-of-care ultrasound for the assessment of intravascular volume in five rural New Zealand hospitals

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Abstract

Introduction: Measuring the diameter of the inferior vena cava (IVC) or the height of the jugular venous pressure (JVP) with point-of-care ultrasound (POCUS) is a practical alternative method for estimating a patient's intravascular volume in the rural setting. This study aims to determine whether or not POCUS of the IVC or JVP generates additional useful clinical information over and above routine physical examination in this context.

Methods: Twenty generalist physicians, working in five New Zealand rural hospitals, recorded their estimation of a patient's intravascular volume based on physical examination and then again after performing POCUS of the IVC or JVP, using a visual scale from 1 to 11.

Results: Data were available for 150 assessments. There was an only moderate agreement between the pre- and post-test findings (Spearman's correlation coefficient = 0.46). In 28% (42/150) of cases, the difference was four or more points on the scale, and therefore, had the potential to be clinically significant.

Conclusion: In the rural context, POCUS provides new information that frequently alters the clinician's estimation of a patient's intravascular volume.

Keywords: Inferior vena cava, point-of-care, rural, ultrasound, volume assessment

Résumé

Introduction: La mesure du diamètre de la veine cave inférieure ou de la hauteur de la pression veineuse jugulaire à l'aide de l'échographie au point de service est une méthode pratique pour estimer le volume intravasculaire d'un patient en région rurale. Cette étude vise à déterminer si oui ou non l'échographie au point de service de la veine cave inférieure ou de la pression veineuse jugulaire génère un surcroît d'information clinique utile par rapport à l'examen physique de routine dans ce contexte.

Méthodologie: Vingt médecins généralistes de 5 hôpitaux des régions rurales de la Nouvelle-Zélande ont noté sur une échelle visuelle de 1 à 11 leur estimation du volume intravasculaire des patients basée sur l'examen physique, puis après une échographie au point de service de la veine cave inférieure ou de la pression veineuse jugulaire.

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Résultats: Des données se rapportant à 150 évaluations étaient disponibles. La concordance entre les résultats d'avant le test et d'après le test n'était que modérée (coefficient de corrélation de Spearman = 0,46). Dans 28 % (42/150) des cas, la différence était de quatre points ou plus sur l'échelle et avait donc le potentiel d'être cliniquement significative.

Conclusion: En contexte rural, l'échographie au point de service fournit de nouveaux renseignements qui altèrent fréquemment l'estimation du volume intravasculaire par le clinicien.

Mots-clés: Échographie, évaluation du volume, point de service, rural, veine cave inférieure

INTRODUCTION

An ability to estimate the intravascular volume in patients with heart failure, dehydration, or shock is an important skill. Clinical estimation of intravascular volume by physical examination of the jugular venous pressure (JVP) is, however, often inaccurate.[1-3] Estimates of the failure to accurately visualise the JVP by physical examination range from 10% to 80%.[4,5] The alternative is central venous pressure (CVP) monitoring, which is invasive and impractical in many clinical contexts. Point-of-care ultrasound (POCUS) is now emerging as a further, and practical, option for intravascular volume assessment.[6,7] POCUS techniques for intravascular volume assessment include: (i) measuring the diameter and collapsibility of the inferior vena cava (POCUS-IVC) or (ii) the height of the JVP (POCUS-JVP).[4,6]

Studies undertaken in emergency medicine and specialist outpatient settings suggest that POCUS is more accurate than physical examination. In a study of cardiology clinic patients, the discordance between POCUS-IVC and JVP by physical examination was 32%, with POCUS proving more accurate.[8] In another study, physical examination of the JVP by medical students had a sensitivity of only 13%, rising to 86% when undertaken by experienced cardiologists, the same sensitivity the medical students achieved with POCUS-IVC after a brief POCUS training session.[2]

Despite being more accurate than physical examination, the ability of POCUS-IVC to predict CVP and fluid responsiveness remains controversial. One systematic review of 21 studies concluded that POCUS-IVC measurement was a 'valid method of estimating CVP' and given its 'ease and safety' recommended its 'broader adoption'.[6] A second review of 17 studies concluded that respiratory variation of IVC diameter has limited ability to predict fluid responsiveness (pooled sensitivity = 0.63 and specificity = 0.73).[7]

The value of POCUS has been more clearly demonstrated in particular clinical situations. POCUS-IVC is a good predictor of fluid responsiveness when the measurements are either very low or very high,[9,10] when the primary problem is volume loss (dehydration or blood loss) and when it is combined with other POCUS examinations (lung and cardiac).[10] POCUS-IVC has a proven role in heart failure, identifying (in combination POCUS of the lungs and heart) heart failure as the cause of acute breathlessness[5,11] and as an independent predictor of heart failure prognosis (comparable to brain natriuretic peptide).[12] It is, however, still unknown if using POCUS-IVC to guide treatment improves outcomes for heart failure patients.

Rural physicians are increasingly incorporating POCUS into their clinical practice, and POCUS-IVC and JVP are, collectively, the second most commonly performed examinations by rural generalist physicians in New Zealand (NZ).[13,14] POCUS does, however, add to the time it takes to assess a patient and requires an investment in training and equipment. Its role has not previously been examined in the rural context, and it is not known how often the experienced rural physician gains additional new useful clinical information by taking the time to perform POCUS-IVC and JVP, and how often, they are merely confirming the impression of a patient's volume that they have already obtained by the physical examination.

The aim of this study is to determine as follows: (i) the quality of interpretation of POCUS-IVC and JVP imaging; (ii) the indications for POCUS and (iii) the correlation between the findings of physical examination and the findings of POCUS plus physical examination, for the assessment of intravascular volume, in the rural context.

METHODS

This report presents results for the subgroup of POCUS-IVC and JVP examinations undertaken as a part of a larger study into the POCUS practice of 28 rural generalist physicians (the participants). All the participants were trained in general practice and/or rural hospital medicine by the Royal NZ College of General Practitioners and were working in six small NZ rural hospitals/health services, ranging in size from 10 to 30 inpatient beds and serving communities with resident populations between 6500 and 36,000. The study recorded the frequency of scan types undertaken, the quality of the images obtained and the impact on patient management, over a 9-month period. This was achieved by asking the participants to complete a questionnaire pre- and post-test and by reviewing the POCUS images and patient's clinical records.[13,14] Results and more detailed methods for the larger study, including the characteristics of the participants and their rural hospitals, are reported elsewhere.[13,14]

During the study, the participants were encouraged to continue using POCUS, as they normally would while undertaking their routine clinical duties. This included choosing when to perform a POCUS-IVC or POCUS-JVP. Before undertaking POCUS for volume assessment, the participant recorded on a questionnaire, their estimate of the patient's volume based on their physical examination findings, using an 11-point visual analogue scale. The middle of the scale, six, meant that the patient was euvolaemic. The lowest end of the scale – one, indicated the patient was severely hypovolaemic and at the other end-11, severely volume overloaded. After completing the POCUS, the participants reevaluated the patient's volume and recorded a post-test result using the same scale. The questionnaire also recorded the indication for the POCUS scan and the participant's assessment of the quality of the images they had obtained.

The participants were asked to keep electronic copies of POCUS-IVC images which were reviewed at a later date by a sonographer. POCUS of the JVP involves measuring the height relative to the angle of Louis, something that cannot be checked with saved images.

Statistical analysis was performed using the SPSS version 23 (SPSS Statistics Version 23. IBM Corporation. Armonk. New York. United States). Descriptive statistics were used to describe outcomes. The Spearman's correlation coefficient and a Bland–Altman plot were used to illustrate the correlation between the physical examination and combined (POCUS and physical examination) findings.

Ethics approval was obtained from the NZ Multi-region Ethics Committee MEC/10/09/091.

RESULTS

Twenty participants in five different rural hospitals undertook 154 POCUS assessments of intravascular volume over the study period. There was considerable variation among the five hospitals in the frequency of POCUS-IVC and JVP scanning (between 5 and 85 scans).[13] No POCUS-IVC or JVP scans were performed in the sixth hospital and by eight of the participants. The median age of the patients scanned was 72 years, ranging from 13 to 98 years. The IVC was scanned in 126 patients, the JVP in 10 and 18 patients had both IVC and JVP scanned.

The indication for POCUS was available for 97% (150/154) of the patients. The most common indications were: (i) potential dehydration and (ii) heart failure [Table 1].

On 7 (4.8%) out of 144 occasions, participants reported being unable to obtain images of the IVC that were of diagnostic quality. None of the participants reported difficulty in obtaining images of the JVP. Sixty-six IVC images were available for review by the sonographer. This review identified two errors (2/66), in both cases, the aorta had been mistaken for the IVC.

The physical examination and POCUS estimations of the patient's volume were recorded

Table 1: Indication* for point-of-care ultrasound scan of the inferior vena cava/jugular venous pulse by the rural physicians

	n (%)
Blood loss	7 (5)
Undifferentiated collapse	2 (1)
Heart failure	55 (37)
Dehydration	73 (48)
Renal failure	3 (2)
Sepsis	10 (7)
Total	150 (100)

*Presentation or actual/potential diagnosis.

on the questionnaire for 97% (150/154) of the patients. The mean difference between the estimation of volume by the physical examination and combined POCUS/physical examination was 1.9 steps (standard deviation 1.45) on the visual scale. There was an only moderate agreement between the findings as illustrated in the Bland–Altman plot [Figure 1] and by the Spearman's correlation coefficient (0.46, n = 150, P = 0.000). Figure 2 illustrates the frequency of the differences between the physical examination and combined POCUS/physical examination findings. For 21% (31/150), there was no difference between the findings and for a further 19% (28/150), the difference was only one on the visual scale, and therefore, unlikely to be clinically relevant. In 28% (42/150) of cases, the difference was four or more points, and therefore, likely to be clinically significant. In the remaining 32% (49/150), the difference was two or three, which may or may not have been clinically significant. Thirty percent (9/30) of patients who were clinically volume overloaded were hypovolaemic by POCUS, and 15% (14/93) of patients who were clinically volume depleted had volume overload on the basis of POCUS.

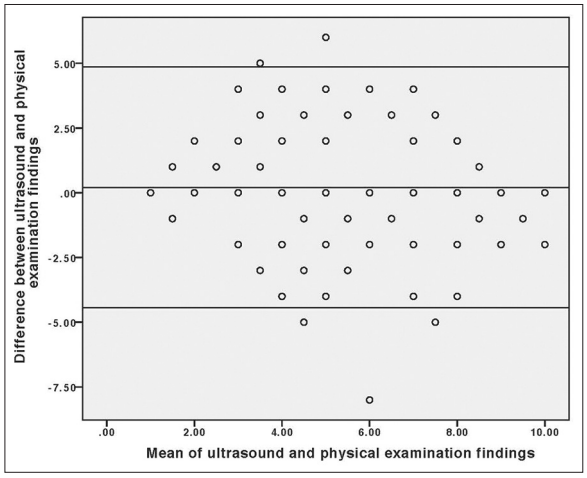

Figure 1: Bland–Altman Plot of correlation between point-of-care ultrasound and physical examination findings for estimation of intravascular volume. (The scatter in the plot demonstrates the frequently large differences in the estimations of intravascular volume, based on POCUS plus physical examination versus physical examination alone, for patients regardless of whether their intravascular volumes are low, normal, or high). X-axis: Mean of estimation of patient's volume by (1) physical examination and (2) ultrasound plus physical examination. Y-axis: Difference between the estimation of patient's volume by (1) physical examination and (2) ultrasound plus physical examination. Both axes are based on a visual scale of estimated intravascular volume status from 1 to 11. 6 = the patient was euvolaemic. 1 = patient was severely hypovolaemic and 11 = severely volume overloaded.

DISCUSSION

In this study, POCUS frequently altered a physician's impression of a patient's intravascular volume compared to the one they had formed on the basis of physical examination alone. It was not uncommon for a patient judged to be hypovolaemic by physical examination to be considered volume overloaded after POCUS and vice versa. Sometimes, the differences were large [Figure 2]. On the basis of these results, POCUS is providing new clinical information in this context.

Bowel gas in the upper abdomen sometimes obscures the IVC (particularly in unfasted patients), as happened on seven occasions in this study. The two instances identified in this study in which participants mistook the aorta for the IVC are more concerning. This is an avoidable error and one that needs to be noted by those who practise and teach POCUS.

The success rates for obtaining POCUS-JVP images of diagnostic quality in this study (100%) are the same as in other published studies.[15] Because it is such a superficial structure, POCUS-JVP is technically straightforward and easy to learn.[4,16] The participants chose to perform POCUS-IVC more often than POCUS-JVP.

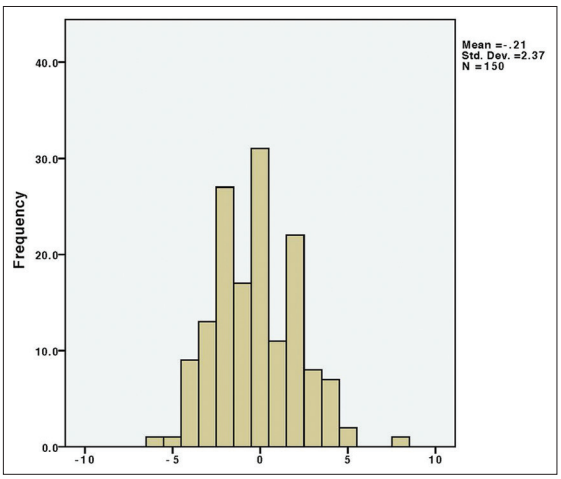

Figure 2: Frequency of differences between point-of-care ultrasound findings and physical findings. X-axis: Difference between the estimation of patient's volume by (1) physical examination (pre-test) and (2) ultrasound plus physical examination (post-test). Based on a visual scale of the estimated intravascular volume status from 1 to 11. Zero means no difference between the findings.

This is likely to be because POCUS of the IVC has a stronger evidence base and as a more central vein, is likely to be a better predictor of the CVP.[6] POCUS of the IVC may also be more convenient, especially if the patient is already lying flat for a physical or other POCUS examination. POCUS-JVP usually requires the patient to be carefully repositioned.

The results of this study support existing evidence that POCUS-IVC and POCUS-JVP are easily learned techniques that are more reliable than physical examination.[2,4,6,8]

Strength and limitations

The real-world nature of this study is a strength. The participants in the study decided when to perform POCUS and which technique to use, based on the clinical indications, just as they would in their routine clinical duties. It is likely the patients in this study comprised a group that was particularly hard to assess clinically, chosen because the physician was still uncertain about their volume status after a physical examination. The variation between physical examination and POCUS findings in this study is, therefore, likely to be larger than would be expected if a random or consecutive series of patients had been scanned. The same real-world nature of the study is responsible for its limitations. The numbers are small and it is unknown if participants recorded data for all of the patients they scanned during the study. Participants also frequently failed to save images of their POCUS scans. The study also did not directly measure whether or not the POCUS findings resulted in a change in clinical management.

The participants in this study were practising the typically broad scope of rural generalist medicine in NZ that traverses primary, secondary and emergency care. This rural generalist scope frequently involves managing acutely unwell undifferentiated patients with limited access to diagnostics, including invasive monitoring.[17] It is not surprising that physicians working in this context will make use of new diagnostic modalities, such as POCUS, that can be practically adopted and resourced in their context.[13]

Further research is needed to determine if POCUS for volume assessment results in improved patient outcomes.

CONCLUSION

POCUS of either the JVP or the IVC are practical alternatives for the estimation of a patient's intravascular volume that can be reliably performed by rural physicians. In many instances, the results obtained differed markedly from those obtained by physical examination alone, and therefore, had the potential to alter the patient management. When a rural doctor with the relevant POCUS skills is unsure of a patient's volume status, it is worthwhile for them to take the time to perform POCUS of the JVP or IVC.

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Conflicts of interest: There are no conflicts of interest.

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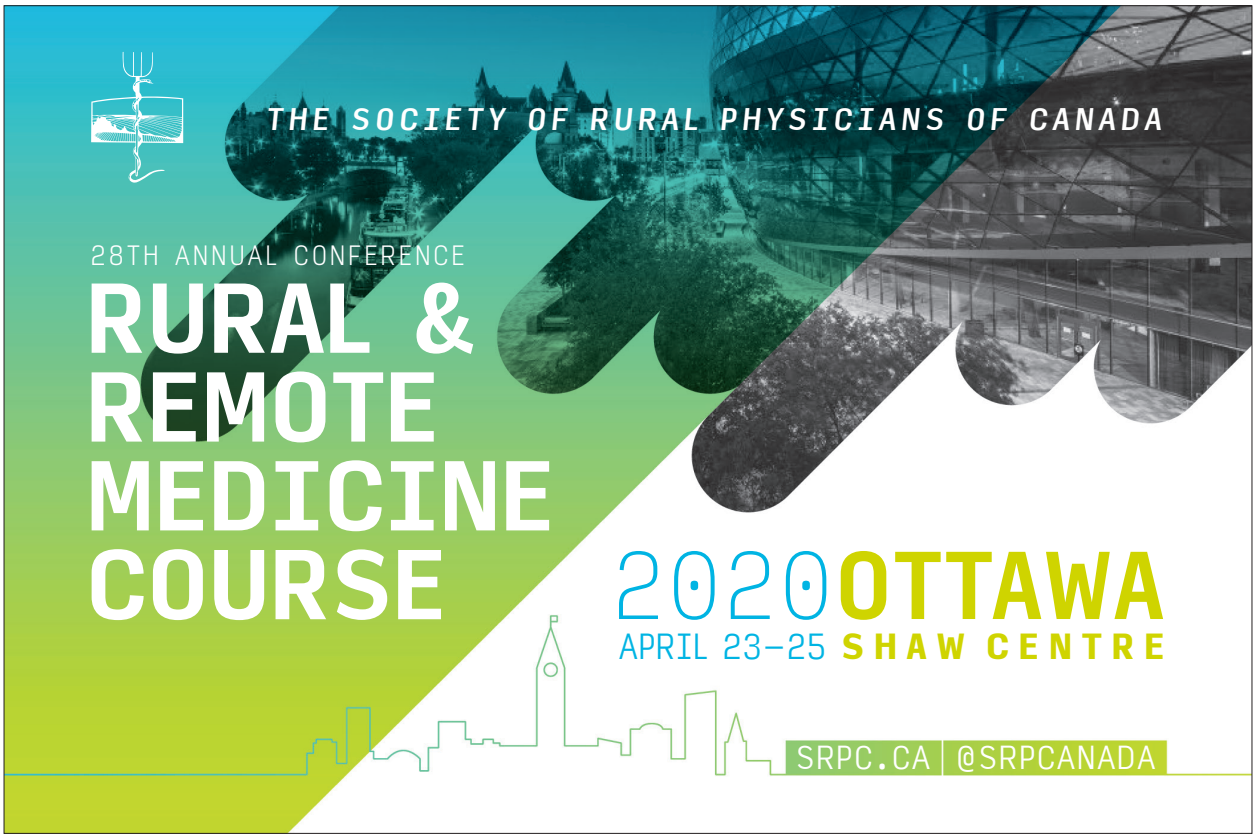

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Program Description

Project ECHO: Building capacity to manage complex conditions in rural, remote and underserved areas

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Abstract

There is a need to bring specialized medical expertise to rural and remote areas. Project ECHO offers a method to move knowledge from specialists in academic centres using videoconference, case-base learning, and best-practices knowledge sharing. Ontario has implemented ECHO since 2014 and has demonstrated favourable outcomes among primary care clinicians.

Keywords: Chronic illness, mental health, pain, primary care, rural health

Résumé

Le besoin existe de transférer l'expertise médicale spécialisée dans les régions rurales et éloignées. Le projet ECHO est une méthode de transfert des connaissances des spécialistes des centres universitaires à l'aide de vidéoconférences, d'apprentissage basé sur les cas et de partage des pratiques exemplaires. L'Ontario a lancé le projet ECHO en 2014 et le projet a donné des résultats favorables chez les cliniciens de première ligne.

Mots-clés: Maladie chronique, santé mentale, douleur, soins de première ligne, santé rurale

INTRODUCTION

People in rural and remote areas have difficulty accessing specialty care because specialists are highly concentrated in large cities.[1] Many disadvantaged patients living in underserved areas fail to receive needed care because they cannot afford travelling long distances.[2] Efforts to recruit and retain specialists in these regions face significant obstacles. New approaches are needed to ensure that people in rural and remote areas receive the same quality of care as those in more densely populated regions.[2] One solution to this problem is for specialists to share their knowledge and skills with primary care providers (PCPs), training them to deliver effective specialised care for chronic disorders.

Project extension for community healthcare outcomes (ECHO) is a unique educational model that does just this. In ECHO, an academic hub of specialists works with PCPs via video conferencing. The specialists provide brief didactic lectures and

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the PCPs present cases from their practices to facilitate case-based learning. In contrast to other pedagogical models, ECHO is designed for bidirectional teaching between the specialists and PCPs, and it may be an effective method to increase the scope of practice of rural generalist physicians. This paper describes the ECHO model, discussing its strengths and weaknesses.

PROJECT ECHO: A UNIQUE EDUCATIONAL MODEL

ECHO[1] was developed in New Mexico in 2004 by Sanjeev Arora, a hepatologist, during a period when the state had the highest per-capita rate of viral hepatitis in the US, and there was a need to deliver high-quality care to rural, underserved and socially disadvantaged populations.[3,4] Currently, there are ECHOs for more than 65 complex conditions around the world including mental health in adults and children,[5] hepatitis C,[6] HIV,[7] substance use disorders,[5] diabetes and endocrinology,[8] geriatrics,[9] chronic pain,[10,11] autism,[12] multiple sclerosis[13] and palliative care[14] The ECHO model has also been used for non-medical education in topics such as training people in rural government offices to do continuous quality improvement.[15]

Project ECHO combines several medical education methods to enhance PCP care. It uses videoconferencing to connect groups of PCPs from rural or urban areas with an academic or tertiary care interprofessional specialist hub on a regular schedule [Figure 1].[7] In this way, a group identity is created that fosters inter-professional learning. ECHO proposes that we should move knowledge, not people, because the best care is local care. The mission of Project ECHO is to expand the capacity of PCPs to provide best practice care for common, complex or chronic diseases in rural and underserved areas and to monitor outcomes.

ECHO clinics also combine didactics with case-based learning. Sessions typically begin with a brief didactic from a hub specialist, with embedded case material. This is followed by one or many real de-identified case presentations. These cases are presented by ECHO participants and are drawn from their own practice. The PCPs ask clarifying questions and make recommendations, as do the specialists. The core operating principle

Figure 1: Picture of an extension for community healthcare outcomes session.

is that every participant at the ECHO clinic has expertise to share, whether it is knowledge of the regional culture affecting medical care or the latest evidence-based treatment. There is a culture of 'all teach, and all learn'.[16] Rural generalists have an opportunity to increase their scope of practice by attending ECHO sessions in various topics of medicine. This may improve physician's job satisfaction, retention in rural areas and self-efficacy. Project ECHO's model of medical education and care management empowers clinicians to provide enhanced care for more people, right where they live.

THE FOUR PILLARS OF EXTENSION FOR COMMUNITY HEALTHCARE OUTCOMES

The four pillars of ECHO are: (1) using videoconference technology to leverage scarce healthcare resources, (2) specialists sharing best practices with PCPs, (3) case-based learning and (4) continuous monitoring of program outcomes.

Videoconferencing

ECHO breaks down the walls between specialty and primary care by conducting regular videoconferencing sessions that connect remote practitioners who present their de-identified patients to an academic ECHO expert interprofessional team that provides guidance to enable the practitioners to treat their patients themselves. The ECHO model has the potential to improve patients' access to specialty care by increasing primary care clinicians' capacities. The

ECHO model is not the same as telemedicine, where the main goal is to improve access using technology to allow specialists to deliver care directly to patients by videoconferencing.

Sharing best practices

ECHO provides a channel, whereby specialist mentors can share best practices with local clinicians to reduce variation in care to improve outcomes. ECHOs increase clinicians' capacities to deliver specialty treatments by engaging these clinicians where they live through a continuous learning process. Moreover, the facilitation process used in ECHO clinics breaks down the barriers between the specialists and PCPs. In an environment of equal status and mutual respect, partners learn from the specialists and vice versa, as well as the PCPs learning from each other. The goal of the ECHO clinic is that PCPs will be answering questions for each other with materials or with insights that they have learned several weeks before.

The ECHO model also uses the concept of Force Multiplication via the hub and spoke design. The goal is that by learning through interaction with a hub, spokes will evolve to become centres of excellence and start providing specialist care to their geographical region [Figure 2]. Participants in the ECHO Ontario Chronic Pain and Opioid Stewardship program used a variety of ways to disseminate the ECHO knowledge to non-participating colleagues: several engaged in 'corridor consultation' or passing on knowledge informally to a colleague, while others used a more systematic approach (e.g., distribution of materials) to share the idea with a second clinic in a different location [Figure 2].[17]

Case-based learning

ECHO uses a case-based learning process to develop specialty expertise among PCPs. Many medical education models employ a purely didactic approach, which does not resemble the supervised apprenticeship approach characteristic of medical training. During ECHO sessions, de-identified cases from the PCPs (the 'spokes') are sent securely to the ECHO clinic (the 'hub') using standardised intake forms, and specialists can preferentially triage the most complex cases presented to be seen face-to-face at their academic centre. For example, the pain specialists in the hub will expedite patients at higher risk of opioid-related complications. After the case discussion, the hub members prepare a summary with all the recommendations and community resources that are relevant to the case discussed. The summary is sent not only to the person who presented the case, but also to all participants in that session, so they can generalise the learning.

Continuous outcome monitoring

ECHOs continuously monitor their program outcomes. The monitored outcomes are typically self-reported effects on ECHO participants. Physicians, nurses, nurse practitioners, physician assistants and pharmacists who participate in these programs report increased knowledge, empathy and self-efficacy in dealing with these chronic conditions.[18] Patient outcomes of the ECHO viral hepatitis program (i.e., sustained viral response), published in the New England

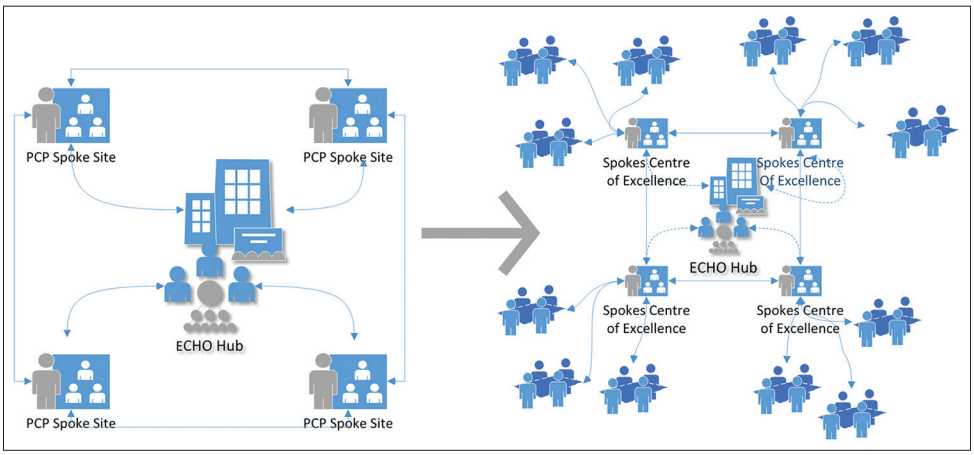

Figure 2: Concept of force multiplication.

Journal of Medicine,[4] were identical in the rural/prison communities compared to academic clinics and demonstrated less serious adverse events in the rural and prison communities.

EXTENSION FOR COMMUNITY HEALTHCARE OUTCOMES AND CLINICIAN ENGAGEMENT

ECHO does not charge clinicians to participate. However, participation does require time during which they could be earning by seeing patients. So why do they participate? For healthcare professionals working in rural communities, the main benefits of participating in ECHO include: no-cost continuing medical education, professional interaction with colleagues and access to specialists.

Patients living in rural, remote and underserved areas receive best practice care without having to travel to urban centres to see a specialist. Specialists who live far from the patient will frequently have little information about the culture and healthcare resources of the communities where these patients live. Instead, specialists serve as mentors and colleagues sharing their medical knowledge and expertise with local PCPs. Specialists also learn during the sessions because the recommendations are generated by the whole community attending a session. ECHO serves as a community of practice where PCPs receive support and develop the skills they need to treat a particular condition.[19]

The results of six focus groups conducted with spokes from the ECHO Ontario Chronic Pain and Opioid Stewardship reported that being in ECHO led to improvement in clinical knowledge and skills in patient–provider interaction.[17] Participants also reported passing the knowledge they gained through ECHO to their colleagues and patients. Finally, they said that ECHO provided them with a sense of community. The main disadvantages of being in ECHO were the amount of time allocated to the didactic versus case presentations, time constraints for participation in the weekly sessions and some issues around the virtual connection.

DISCUSSION

Efforts to help PCPs enhance their diagnosis and treatment competencies of complex disorders are not new. The most frequently used educational model is the specialist-centred lecture or workshop. [20] This model has been demonstrated to increase PCP comfort and confidence in their skills.[21] However, it rarely leads to sustained practice change.[22] Based on pedagogical research, suggestions for improvement to this model are to provide small group learning settings, make the learning interactive and to find ways to make it personal and relevant to learners, e.g., using cases for illustration.[23]

Another strategy is the distance-expert consultation model. Instead of providing a workshop or lecture, a PCP connects to a tertiary care expert for a consultation, usually by phone. In addition to enabling a PCP to move forward with an individual patient, the distance-expert consultation model aims to 'build PCP capacity' to manage more complex cases over time through repeated learning on a case-by-case basis. For example, Massachusetts, Washington and New York all have large scale programs for psychiatric child and adolescent phone consultation.[21,24,25] These programs have demonstrated provider satisfaction with phone consultations. Only the Washington program studied practice change. Using Medicare and pharmacy claims data, they demonstrated that easily accessible phone consultation increased the care provided to foster care youth and increased the population rate of prescription of attention-deficit hyperactivity disorder medications. A variant of the consultation model is e-consult, in which the specialist answers a clinical question by E-mail. E-consults have been shown to be effective in saving patient costs of travel to specialists and decreasing referrals for tertiary care assessments.[26]

Formal education and phone consultation are the most common methods for enhancing PCP care for complex disorders. However, their effects on long-term practice change have been disappointing, although the effects of distance consultation may be better.

Project ECHO, in contrast to other pedagogical models, uses bidirectional teaching between the specialists and PCPs that may also be an effective way to increase a rural generalist physician's scope of practice. It is also a platform that enables regular contact with colleagues who are facing similar challenges and finding potential solutions to complex cases, i.e., a community of practice.

Limitations of ECHO

Several limitations of the ECHO model should be acknowledged. Although ECHO is committed to monitoring its outcomes, in practice, it is difficult for an ECHO to identify changes in how its participants deliver care or how those clinicians' patients are functioning. This means that whereas there are plentiful data indicating that clinicians find the ECHO experience satisfying, there are few rigorous tests of whether it benefits patients. In addition, there are important predictions of the ECHO model which have not been tested. For example, ECHO should reduce wait times in specialty clinics by improving access for the most complex patients who most need tertiary interprofessional care. To our knowledge, however, this has never been tested.

In addition, ECHO is not a panacea for access to specialty care, nor does it claim to be. ECHO seeks to be a force multiplier for specialist skill in the care of chronic illnesses, by transferring skills from specialist to PCPs. However, this will not work in regions that suffer from an acute shortage of PCPs. A recent study of Saskatchewan and Alberta showed that some rural areas had both significantly fewer PCPs/1000 residents and higher proportions of residents aged 65 years or older, indicating that these regions likely had higher demands for health services.[27,28] Similar problems are likely to be prevalent in Ontario and other parts of Canada. In general, it is likely that many of the areas that suffer from shortages of specialists likewise suffer from shortages of PCPs. This suggests that ECHO would be most effective in the context of a program that also increased rural access to primary care.

There are several issues concerning ECHO that should be explored in future research. It would be helpful to establish a detailed map of patient accessibility to specialty care and then examine whether ECHO is succeeding in recruiting participants from those underserved areas. We also need additional tests of whether physician practice actually changes after participation in ECHO and of whether patients benefit when their doctors participate in ECHO.

CONCLUSIONS

ECHO is a movement to demonopolise knowledge and amplifies local capacity to provide best practice care for underserved people all over the world. The ECHO model is committed to addressing the needs of the most vulnerable populations by equipping communities with the right knowledge, at the right place, at the right time.

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Country cardiograms case #66

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This article has been peer reviewed.

QUESTION

A 56-year-old male patient is sent to a remote emergency room (ER) in British Columbia, with a week-long history of wheezy chest, persistent cough, production of yellowish sputum and shortness of breath. He has previously been diagnosed with chronic obstructive pulmonary disease (COPD). Relevant findings on examination include being afebrile, a respiratory rate at rest of 16/min, oxygen saturation in room air of 90% and crackles in the right upper lung zone. His chest X-ray shows pneumonic consolidation in the right lobe and hyperinflated lung fields and flattened diaphragms, suggestive of COPD. A 12-lead electrocardiogram (ECG) is also obtained [Figure 1]. What are the striking features seen in this ECG that may be of relevance to the likely diagnosis of pneumonia superimposed on COPD?

For the answer, please see page 122

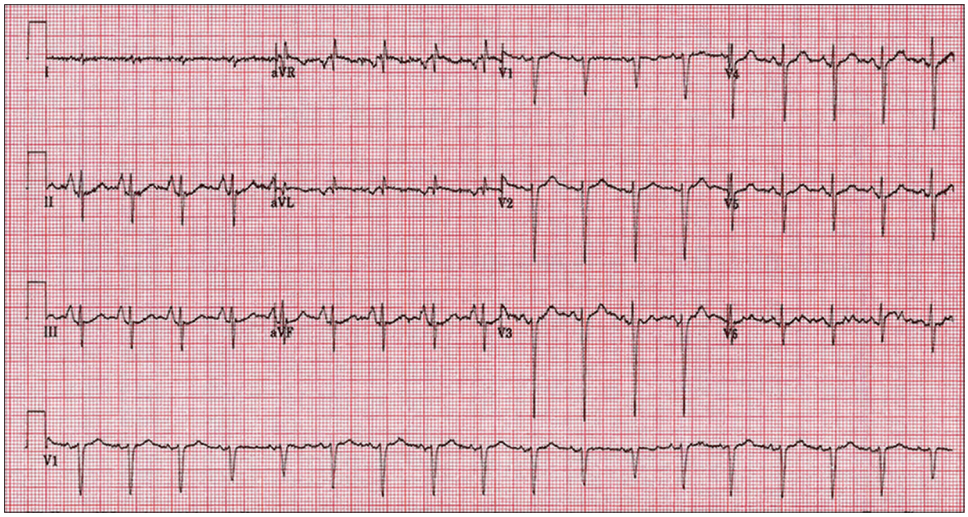

Figure 1: Electrocardiogram of a 56-year-old male patient in a remote emergency room.

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Country cardiograms case #66: Answer

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Sinus tachycardia is present in Figure 1, with a rate of 108/min. PR interval, QRS duration and QT interval are within normal limits. Left axis deviation is present (–80°). ST-T configuration is within normal limits, but P waves are markedly tall (3.5 mm) and peaked in leads II, III and aVF. Examination of the rhythm strip reveals a pattern whereby the amplitude of the QRS complex fluctuates substantially in a regular pattern, with a frequency of 16/min. The greatest QRS amplitude is 15 mm and the smallest QRS amplitude is 9 mm.

Two features of note are the amplitude of the P waves and the fluctuating amplitude of the QRS complexes.

The peaked, tall P waves (3.5 mm) meet criteria for right atrial abnormality (2.5 mm is the standard cutoff). 'Right atrial abnormality' is arguably a more appropriate term than the alternative 'right atrial enlargement'. Such P waves are also known as P *pulmonale*. In patients without a history of primary pulmonary hypertension, tricuspid stenosis or congenital heart conditions such as pulmonary stenosis or tetralogy of Fallot, the common cause of such P waves is chronic lung disease. They suggest the development of cor pulmonale.

The frequency of the pattern of changing QRS amplitude seen in lead V1 in the rhythm strip is the same as the patient's noted respiratory rate. The likeliest cause for this pattern is 'respiratory alternans'. This term needs to be distinguished from 'pulsus alternans' (a physical sign of alternating strong and weak arterial pulse beats) and 'electrical alternans', in which QRS amplitude or axis on the ECG varies from beat to beat, and which has classically been associated with a diagnosis of large pericardial effusion.

The changing amplitude pattern, which is likely related to the breathing cycle, suggests a change in impedance, in which when the patient inhales, the amount of air between the heart and the chest wall increases, and hence, the QRS amplitude decreases. Diaphragmatic breathing can also cyclically change the position of the heart. While this is a physiological phenomenon and can even be construed as a healthy sign, the question arises as to why it is seldom evident to the marked degree seen in Figure 1 and whether such ECG changes may be exacerbated in patients with COPD.

In this case, the relatively slow respiratory rate, absence of fever and only slightly decreased oxygen saturation seem reassuring. The ECG findings of right atrial abnormality and substantial variation in QRS amplitude related to the breathing cycle suggest that the patient may be in more difficulty than is apparent from the traditional vital signs. Especially given this patient's relatively young age of 56 years, assessment of risk factors is indicated (including inquiring about a history of smoking and a positive family history of emphysema that might suggest a condition such as alpha-1 antitrypsin deficiency) along with further investigations such as pulmonary function testing and echocardiography.

In a remote ER setting, with relatively few diagnostic aids immediately available, the ECG has the capacity to independently provide potentially useful information that may influence management, as in this case.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

For the question, please see page 121

Case Study

Catch of a lifetime – *Erysipelothrix rhusiopathiae* bacteraemia, septicaemia, endocarditis and osteomyelitis in a Newfoundland crab fisherman and butcher

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This article has been peer reviewed.

CASE PRESENTATION

Initial presentation

A 71-year-old Caucasian male from rural Newfoundland presented to the Emergency Department (ED) complaining of reduced energy with fainting, shivering and chills during the prior 2 days. The patient's medical history included coronary artery disease, where 11 years prior he had five coronary artery bypass grafts placed. He also had a percutaneous drug-eluting stent and is currently being followed for severe mitral regurgitation. In addition to his cardiac history, he also has hypertension and dyslipidaemia. His surgical history includes a cholecystectomy 3 years ago following admission for obstructive jaundice. He consumes alcohol very rarely and gave up smoking 16 years ago after a 30 pack-a-year smoking history. He lives with his wife in their own home in rural Newfoundland. He is an active commercial crab fisherman and also involved in secondary processing of crab at a local fish plant.

Physical examination was normal, and preliminary investigations revealed normal complete blood count, electrolytes and renal function. Blood and urine cultures were also performed. The patient was prescribed trimethoprim-sulfamethoxazole and was asked to follow-up in a family practice clinic.

On return to the clinic, two days post-treatment, the patient reported improved symptoms. Urine cultures were negative for bacterial growth, but blood cultures were positive for the growth of Gram-negative bacilli; however, the specific species was not identified. The patient reported an allergy to penicillin and was discontinued on trimethoprim-sulfamethoxazole, provided 500 mg of oral azithromycin and continued on 250 mg of oral azithromycin for the next 4 days. Two days later, his blood culture was specifically reported as *Erysipelothrix rhusiopathiae*.

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2–3 weeks after initial presentation

During the following month, the patient presented twice to the ED. Contrasting from his initial presentation, he complained of right-sided pleuritic abdominal pain. He was without fever or other signs or symptoms of infection. The patient was treated with topical antibiotics, an antinausea medication, and was told to use a heating pad on his spine. He was informed that his pain was possibly due to a musculoskeletal cause. He did not find any relief with prescribed treatment regiments.

4 weeks after the initial presentation

The patient returned to the ED with a fever of 38.6 (measured with a home monitor), weakness and continued right-sided pleuritic abdominal pain. He appeared generally unwell and had reduced energy and appetite. Specifically, he stated that he was too tired to cut firewood, and his family agreed this was entirely abnormal for him. He reported no weight loss or changes in voiding. Laboratory investigations reported that BUN was elevated at 9.7 mmol/L, lactate was elevated at 2.2 mmol/L and D-dimer was significantly elevated at 927 ng/m. The patient had a subsequent computed tomography scan of his chest and abdomen, but no abnormalities were detected. The patient also had blood and urine cultures taken. The patient was diagnosed empirically with sepsis and instructed to return to the ED every 24 h to receive 2 g of intravenous ceftriaxone for 1 week.

On return to the ED 4 days later for his antibiotic infusion, the urine cultures were negative; however, the blood cultures were again positive for *E. rhusiopathiae*. The patient reported feeling better after taking the ceftriaxone, so he was instructed to continue with the current medication for the remaining 3 days and scheduled for an urgent echocardiogram to assess his cardiac function and rule out endocarditis.

Repeat blood cultures were all negative for bacterial growth. The follow-up echocardiogram showed no obvious vegetation or thrombus, normal size and systolic function and a mitral valve leaflet prolapse with moderate mitral valve insufficiency that has been stable since 2016.

6–10 weeks after initial presentation

During the next 5 weeks, the patient presented once each week to either the ED or his family doctor with non-specific musculoskeletal pain in his neck and back. He was treated with steroids, diazepam and morphine during his visits but without any lasting relief. During these visits, he did not have any fever, weakness or other signs of infection.

11–13 weeks after initial presentation

Six weeks after the patient's treatment for sepsis, he returned to the ED with continuing back pain and a fever of 38.0°C. The patient reported pain on movement and was now using a walker to aid in his mobility. At rest, he was pain-free. He was subsequently admitted to hospital with a repeat blood culture, and a computed tomography scan of his lumbar spine was performed. The patient's blood cultures were again reported positive for *E. rhusiopathiae*. The patient's computed tomography scan showed degenerative changes and a 'moth-eaten' appearance at L5, indicating possible diskitis or osteomyelitis at this level. The patient also had a new loud diastolic murmur heard at the left sternal border.

As an inpatient, he was treated with 2 g of intravenous ceftriaxone every 24 h, along with several other medications including a beta-blocker and an antiplatelet medication given the patient's high risk of cardiac complications. The patient was treated for 12 days, during which time repeat blood cultures confirmed sterilisation of the patient's blood. The patient was discharged with a peripherally inserted central catheter line and was continued on 2 g of intravenous ceftriaxone every 24 h for the next 6 weeks.

24 weeks after initial presentation

Upon a follow-up bone scan, whole body gallium scan and echocardiogram after completion of an antibiotic regimen, the patient showed no signs of osteomyelitis or other degenerative changes at any level, no vegetation or thrombus on the cardiac valves, normal cardiac size and normal systolic function.

DISCUSSION

E. rhusiopathiae is a 'facultative, non-spore-forming, non-acid-fast, small, Gram-positive bacteria'.[1] The organism has been reported as infecting humans and other animals since the late 19th century[2] but has been relatively rare with fewer than 200 cases of *E. rhusiopathiae* infection reported in the literature as of July 2018 and only 51 of those cases involving septicaemia. *E. rhusiopathiae* can be distinguished from other Gram-positive rods through a variety of tests. The organisms it is most often mistaken for include *Listeria*, *Brochothrix*, *Corynebacterium* and *Kurthia*. *E. rhusiopathiae* can be distinguished from *Listeria, Brochothrix* and *Corynebacterium* by the inclusion of lysine and glycine in its cell wall as opposed to mesodiaminopimelic acid. It can also be distinguished from *Kurthia* using a catalase test.[1]

The organism can be found in many locations, including both terrestrial and marine environments. *E. rhusiopathiae* is able to survive for extended periods of time in its environment and has been known to infect a variety of animals including swine, turkeys, chickens, ducks, emus, sheep, lambs, fish and shellfish. *E. rhusiopathiae* infections have most often been reported due to occupational exposure, such as by butchers, farmers and fish and seafood handlers.

Three forms of *E. rhusiopathiae* infection are recognised in humans today: a localised cutaneous lesion form i.e., erysipeloid, a generalised cutaneous form and a septicaemic form often associated with endocarditis.[1] Erysipeloid is the most common form of infection in humans, with the septicaemic form being the rarest. The septicaemic form *E. rhusiopathiae* is usually subacute in nature but can cause severe valvular disease. *E. rhusiopathiae* endocarditis is a particularly virulent infection as even with appropriate treatment and management the mortality rate is 40%, much higher than the endocarditis caused by other organisms.[3]

In this particular case, the patient was frequently in contact with snow crab (*Chionoecetes opilio*), which are a known carrier of *E. rhusiopathiae*. He worked both as a commercial fisherman and a seasonal employee at a processing plant, where he specifically was involved in a technique referred to as crab butchering. Crab butchering involves separating the legs, body and claws of cooked crab and then shelling each piece to remove the meat inside. This is a labour-intensive, highly-skilled process,[4] during which workers continually handle sharp, broken crab shells, leading to a high risk of puncture and exposure to pathogens, with the patient self-reporting frequent skin punctures while handling crab in both avenues of employment. As such, crab butchers are likely at an increased risk of work-related *E. rhusiopathiae* exposure. While *E. rhusiopathiae* is a rare pathogen, physicians should have a higher index of suspicion for this disease in populations with increased environmental exposure to the bacteria, such as crab butchers and other similar professionals.

While this case does highlight a rare and interesting infection, it also offers several developments in the presentation and management of *E. rhusiopathiae* sepsis for physicians treating the disease.

First, this case is one of very few to show a progression of *E. rhusiopathiae* sepsis to osteomyelitis and degenerative disc changes, highlighting some of the rarer and more deadly complications of this infection. This case, along with the few cases seen previously in the literature with this complication,[5] helps characterise the presentation of osteomyelitis secondary to *E. rhusiopathiae* sepsis. This allows physicians to identify these issues early and determine which patients are at risk for developing these serious complications.

In addition, our patient is one of the only reported cases to show recurrence of *E. rhusiopathiae* infection after treatment as well as showing an extended length of infection compared to most reported cases of *E. rhusiopathiae* sepsis. The mean duration of symptoms in one case series was found to be 6.6 weeks,[3] whereas our patient had symptoms lasting over 12 weeks. While the cause of this recurrence and extended infection time is difficult to determine, this case demonstrates to physicians that these extended courses are possible so that they may be aware of them in their patients.

Although no cause of this extended course has been identified, one factor may have been the reduced length of initial treatment the patient received. Our patient received 1 week of antibiotic treatment, while most others gave 6–8 weeks of treatment initially.[5] Given that our patient did have recurrence of his disease, this provides evidence for physicians to use a prolonged course of antibiotics when treating *E. rhusiopathiae* sepsis, even on the first presentation.

Finally, this case confirms that while penicillin has been identified as the first-line treatment

for *E. rhusiopathiae* sepsis,[6] third-generation cephalosporins can be used to effectively treat this condition in patients who are unable to take penicillin.[7]

CONCLUSION

This case report depicts a case of septicaemic *E. rhusiopathiae* potentially after occupational exposure to snow crab (*C. opilio*). The patient showed a progressive infection, commencing as bacteraemia progressing to a septicaemic blood infection with likely endocarditis and finally developed into an osteomyelitis in the lumbar spine. While initial treatments of 1 week of intravenous ceftriaxone were unsuccessful, in the long term, a 10-week course of ceftriaxone proved effective, and the patient experienced a full recovery within 3 months of discharge from hospital. This case identified several important teaching points for healthcare providers to ensure effective prevention and management of this rare yet virulent pathogen.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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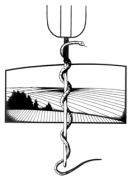

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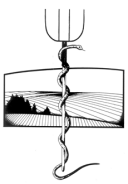

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