example of a 46 year old man who presented with pulmonary edema [8]. Operative findings included documentation of perforation of the left coronary cusp, and the presence of a large abscess of the posterior aspect of the aortic root arising from the left sinus of Vasalva. Furthermore, there was severe mitral regurgitation resulting from a flail medial scallop of the posterior leaflet [8].

Aortic valve endocarditis can also present with acute myocardial infarction (AMI). In one 73 year old woman with aortic stenosis, this was attributable to right coronary artery compression secondary to periannular aortic valve abscess [9]. Other aetiopathogenetic mechanisms which have been cited for endocarditis-related AMI include coronary artery embolism and obstruction of the coronary ostium by a large vegetation [10].

The aortic valve is also one for which Streptococcus pneumoniae has a special predilection [11]. According to a review of published cases (111 adults) of pneumococcal endocarditis covering the period 2000 to 2013 the aortic valve is the one most commonly involved (53% of cases) by this disorder, outranking the mitral valve (40.5% of cases) and the tricuspid valve (12.6% of cases). Pneumonia was an associated feature in 45.9%, and meningitis in 40.5%. The association of endocarditis, pneumonia and meningitis (so-called Austrian syndrome) occurred in 26.1%. What is more, peripheral stigmata of infective endocarditis were present in only 4.5% of cases [11]. In one referral centre a comparison between pneumococcal vs non pneumococcal endocarditis (28 cases vs 56 cases) during the period 1991–2013 showed that smoking, alcoholism, heart failure and shock were all significantly ($P < 0.01$ in all instances) commoner in pneumococcal than in non pneumococcal endocarditis. Absence of previously known valve disease was also significantly ($P = 0.047$) commoner in pneumococcal endocarditis. Furthermore, in 32% of pneumococcal cases no murmurs were detected on presentation [12]. Echocardiography failed to detect vegetations in 11% of cases [12]. Patients with pneumococcal endocarditis required surgery significantly ($p < 0.001$) earlier than patients with non pneumococcal endocarditis, and there was a trend towards higher 5-year mortality in pneumococcal endocarditis [12].

In conclusion, IE-presents many diagnostic challenges, some of them unique to intravenous drug abuse, and others unique to involvement of the aortic valve. In both contexts a high index of clinical suspicion is required among emergency physicians.

Acknowledgment

I have no funding and no conflict of interest.

Oscar M.P. Jolobe
Manchester Medical Society, Simon Building, Brunswick Street, Manchester M13 9PL, United Kingdom
E-mail address: oscarjolobe@yahoo.co.uk.

https://doi.org/10.1016/j.ajem.2018.07.051

References

[1] Long B, Koyfman A. Infectious endocarditis: an update for emergency clinicians. Am J Emerg Med 2018;36(9):1686–92.
[2] Akinosoglou K, Apostolakis E, Marangos M, Pasvol G. Native right sided infective endocarditis. Eur J Intern Med 2013;24:510–9.
[3] Stout KK, Verrier ED. Acute valvular regurgitation. Circulation 2009;19:3232–41.
[4] Hamirani Y, Dietl CA, Voyles W, Peralta M, Begay D, Raizada V. Acute aortic regurgitation. Circulation 2012;126:1121–6.
[5] Domingues K, Marta L, Monteira I, Leal M. Native aortic valve pneumococcal endocarditis-fulminant presentation. Rev Bras Intensive 2016;28:83–6.
[6] Ansari J, Garcha GS, Huang H, Bakaeen FG, Virani SS, Jneid H. Acute aortic valve rupture from infective endocarditis after transrectal prostate biopsy: a call to revise the AHA Guidelines for Prevention of Infective Endocarditis. Clin Med Insights 2013;6:29–33.
[7] Rajesh G, Raju D, Krishnan MN. Continuously regurgitating mitral valve: systolic and diastolic mitral regurgitation in a case of severe aortic regurgitation and complete heart block. Heart Asia 2013;5:172–3.
[8] Pulido JN, Lynch JJ, Mauermann WJ, Michelana HI, Rehfeldtn KH. Diastolic mitral regurgitation in a patient with complex native mitral and aortic valve endocarditis: a rare phenomenon with potential catastrophic consequences. Semin Cardiothorac Vasc Anesth 2016;20:100–3.
[9] Jenny BE, Almanaseer Y. Aortic valve endocarditis complicated by ST elevation myocardial infarction. Tex Heart Inst 2014;41:668–70.
[10] Haristein ME, Marroquin OC. External coronary artery compression due to prosthetic valve bacterial endocarditis. Catheter Cardiovasc Interv 2014;83:E168–70.
[11] de Egea V, Munoz P, Valerio M, de Alarcon A, Lepe JA, Miro JM, et al. Characteristics and outcome of *Streptococcus pneumoniae* endocarditis in the XXI century. Medicine 2015;94:1–11.
[12] Daudin M, Tattevin P, Lelong B, Fleher E, Lavoue S, Piau C, et al. Characteristics and prognosis of pneumococcal endocarditis: a case control study. Clin Microbiol Infect 2016:527e5–8.

Hospital Information Technology is critical to the success of a point-of-care ultrasound program

Over the past two decades, advances in point-of-care ultrasound (POCUS) technology have not only made it more accessible to providers, but also allowed its integration into the increasingly electronic workflow of the modern healthcare system. The breadth of this integration includes most aspects of a typical POCUS clinical workflow as well as image archival and retrieval, documentation, quality assurance and billing. Attempts to modernize existing processes often lead to alienation of low-end users, which in turn negates the intended benefits of the technology. In this brief commentary, we will define the roles of hospital Information Technology (IT) professionals and Clinical Informaticists (CIs) in modernizing ultrasound (US) workflows and their importance to the success and maintenance of POCUS programs.

An ideal modern POCUS workflow has been outlined by the Emergency Ultrasound Section of the American College of Emergency Physicians [1]. In this workflow, patient identifying information is populated into the US machine at the beginning of each patient US encounter either through an order placed in the electronic medical record (EMR) and wirelessly transmitted to the machine, or through a scanned barcode on the patient wristband. Once US images are obtained and saved on the US machine hard drive, the physician must then interpret and document the findings in the EMR. This can be completed either on the machine and electronically synchronized with the EMR or within the EMR itself. Most modern EMRs contain templated notes for US interpretations and automated billing and coding processes. These templates can be built and optimized to ensure that all critical aspects of the examination are accurately reported. This includes the indication for examination, scope of study, views obtained, findings, interpretation and attestation.

After the POCUS examination is performed and interpreted, reliable and accessible permanent image archival allows for US images to be integrated into the EMR. This is important for patient care, quality assurance, billing and reimbursement. Increasingly, POCUS examinations are being stored on the hospital picture archiving and communication system (PACS). This requires that the US machines communicate with PACS, preferably through a wireless connection. Additionally, the use of a middleware or US workflow solution, such as QPath (Telexy Healthcare, BC, Canada), has been shown to drastically improve US billing [2]. Given the number of components involved in this workflow, building interfaces that accurately share documentation between systems will cut down on redundancy and make the workflow easier to integrate for the end user. As noted by Zwank et al., this requires working closely with

analysts with expertise in EMR order creation, radiology information systems, PACS and EMR documentation [3].

IT professionals are those who implement and support hospital hardware and software, while CIs are a diverse group of specialists who facilitate the utilization and application of health IT [4]. CIs and IT specialists are invaluable in electronic workflow design as they have a thorough understanding of the systems that must be in place to make these integrations successful. Working with these individuals, Lewiss et al. demonstrated a significant improvement in overall compliance in US documentation and billing [5].

In our experience, working closely with members of the hospital IT team is not only invaluable in the implementation of a modernized US workflow, but also to its ongoing success. After the initial integration of an electronic US workflow, close communication allows for rapid troubleshooting and system improvements. Most recently, our CIs aided in restructuring our templated US interpretation/procedure notes to make them more succinct and to link specific CPT billing codes directly to the documentation. The hope is that this will both increase compliance by healthcare providers, as well as ease the process for our coding and billing specialists.

In the future as US machines become even more portable and ubiquitous in use both in and out of the hospital, the importance of the IT specialist will only increase. One such endeavor will be the expanding role of tele-sonography, remote guidance and training of novice US users [6]. Having sound infrastructures in place will ease the transition of more novel and remote uses of clinical US into daily practice. The integration of POCUS images into EMRs could also promote new forms of clinical decision support, with automated image analysis and machine learning facilitating improved quality of care [7, 8]. Similarly, the creation of a seamless US workflow allows for potential replication throughout hospitals and healthcare systems.

POCUS has made major strides in becoming a mainstay in Emergency Departments and other clinical settings throughout the healthcare system. In the coming years, US devices will continue to become less expensive and more compact and portable, making its clinical use even more widespread. POCUS programs on a departmental and healthcare system level will need to utilize the expertise of IT specialists to ensure that these clinical US studies are accurately and securely archived, documented and reimbursed.

None.

None.

Arthur K. Au
Department of Emergency Medicine, Thomas Jefferson University, Philadelphia, PA, United States of America
Corresponding author at: 1020 Sansom Street, Room 239 Thompson Building, Philadelphia, PA 19107, United States of America.
E-mail address: arthur.au@jefferson.edu.

Srikar Adhikari
Department of Emergency Medicine, University of Arizona, Tucson, AZ, United States of America

Benjamin H. Slovis
Department of Emergency Medicine, Thomas Jefferson University, Philadelphia, PA, United States of America

Peter B. Sachs
Department of Radiology, University of Colorado, Aurora, CO, United States of America[c]

Resa E. Lewiss
Department of Emergency Medicine, Thomas Jefferson University, Philadelphia, PA, United States of America

https://doi.org/10.1016/j.ajem.2018.08.007

References

[1] Byrne, M, Geria, R, Kummer, T, Leech, S, Lewiss, R, Noble V, et al., Emergency ultrasound: workflow white paper. ACEP https://www.acep.org/how-we-serve/sections/emergency-ultrasound/running-a-program/#sm.000922c0l166fdmb10zlqzauh6wkh [accessed 24 July 2018].
[2] Adhikari S, Amini R, Stolz L, O'Brien K, Gross A, Jones T, et al. Implementation of a novel point-of-care ultrasound billing and reimbursement program: fiscal impact. Am J Emerg Med 2014;32(6):592–5.
[3] Zwank MD, Gordon BD, Truman SM. Refining the wild wild west of point-of-care ultrasound at an Academic Community Hospital. J Am Coll Radiol 2017;14(12):1574–1577.e3.
[4] Hersh W. A stimulus to define informatics and health information technology. BMC Med Inform Decis Mak 2009;15:9–24.
[5] Lewiss RE, Cook J, Sauler A, Avitabile N, Kaban N, Rabrich J, et al. A workflow task force affects emergency physician compliance for point-of-care ultrasound documentation and billing. Crit Ultrasound J 2016;8(1):5.
[6] McBeth P, Crawford I, Tiruta C, Xiao Z, Zhu G, Shuster M, et al. Help is in your pocket: the potential accuracy of smartphone- and laptop-based remotely guided resuscitative telesonography. Telemed J E Health 2013;19(12):924–30.
[7] Shen D, Wu G, Suk H. Deep learning in medical image analysis. Annu Rev Biomed Eng 2017;19(1):221–48.
[8] Sjogren AR, Leo MM, Feldman J, Gwin JT. Image segmentation and machine learning for detection of abdominal free fluid in focused assessment with sonography for trauma examinations. J Ultrasound Med 2016;35(11):2501–9.