Saving Mothers Perspective: Use of Butterfly iQ During COVID-19 Pandemic in NYC

A Case Study by:
Rachel Wong, Noel Strong, MD and Taraneh Shirazian, MD

savingmothers.org

980-20320-00 Rev A

"Using Butterfly iQ at the bedside minimized the need to transfer patients, reducing COVID-19 exposure while still allowing us to provide quality OB care."

Introduction

The SARS-CoV-2 (COVID-19) outbreak has spread at an unprecedented rate, resulting in over 1.2 million deaths worldwide. The challenge to contain COVID-19 continues to overwhelm healthcare systems, rendering nosocomial transmission to patients and healthcare workers a major public health focus. While ultrasound is an important diagnostic tool for pulmonary, hemodynamic, and obstetric conditions, minimizing exposure via use of routine imaging is central to reduction of COVID-19 transmission.[1] Handheld ultrasounds have proven beneficial, as they provide similar diagnostic ability to non-portable ultrasounds and can be decontaminated more easily.[1] The Butterfly iQ, a handheld ultrasound, was used to assess two high-risk pregnancies for COVID-19 positive patients in a NYC hospital during the peak of the pandemic.

Background

While it was once limited to obstetrics and echocardiography, ultrasound technology is becoming increasingly utilized in nearly all medical fields,[2] Its usage ranges from diagnosis of hemodynamic conditions, to pericardial or pleural effusion, to intra-abdominal fluid. Advantages of ultrasound include its relatively low cost, portability, user-friendliness, and minimal radiation exposure for patients and clinicians.[2,3]

The Butterfly iQ is part of a new generation of hand-held, (portable) ultrasound devices. It utilizes thousands of metal drums on a silicon chip that both receive and produce sound waves.[4] Images received via the Butterfly iQ's silicon chip can be viewed on the Butterfly iQ app on mobile devices.[4] The Butterfly iQ's chip-based design allows it to feature a variety of presets that automatically adjust scan settings for optimal images based on the system being examined. In addition, it can perform simple size and surface area calculations, and features an obstetric calculations package.[4] The ultrasound findings can be saved to the Butterfly Cloud, allowing other experts to examine the images, collaborate and comment.[5] Most importantly, it costs $1,999 per probe while traditional machines can range from $25,000 to $250,000.[3]

The low cost, portability, and varied clinical use cases of the Butterfly iQ have spurred interest in using it in low- and middle-income countries to improve prenatal care and reduce maternal mortality. Limited access to obstetric ultrasound in developing countries is a significant contributor to negative maternal and neonatal outcomes.[6] Multiple studies have demonstrated the importance of portable ultrasound in improving the diagnosis of first trimester bleeding, malposition, multiple gestation, and placenta previa.[6,7] Other potential findings that portable ultrasound can help identify in low-resource settings include intrauterine fetal demise, anembryonic pregnancies, and non-cephalic cases.[6,8] The prompt detection of these conditions allows for early management and subsequent improvements in maternal outcomes. Even in a pandemic, it is crucial that prenatal care and early detection of prenatal issues continue—regardless of the circumstances, pregnancies continue to happen, and the women who carry them deserve their standard of care maintained.

However, the diagnostic role of the Butterfly iQ can extend beyond prenatal care. Portable ultrasound has the potential to revolutionize medical responses during disasters, trauma, and emergency situations where resources are scarce. For example, in an Iraqi combat environment, a portable ultrasound was used to diagnose a ruptured ectopic pregnancy.[9] Ultrasound's usage in pregnant mothers after the 2010 Haiti earthquake allowed for prompt diagnosis of pulmonary edema, ascites, and intrauterine fetal demise.[10] Handheld ultrasounds have also been used to detect life-threatening cardiopulmonary complications, such as deep vein thrombosis (DVT), pulmonary embolism, and pericardial effusion with tamponade.[2,3] The rapid diagnosis of those complications is especially vital in pregnancy, as it is a well-established risk factor for thromboembolic disorders.[11]

As hospitals around the world battle SARS-Co-V2 (COVID-19), the use of Butterfly iQ and handheld ultrasounds is proving particularly beneficial in reducing viral spread. The world is experiencing shortages in personal protective equipment, and nosocomial transmission of COVID-19 is occurring among frontline workers.[12] As a result, use of routine imaging studies within hospitals has been discouraged to reduce risk of transmission, even though ultrasound is a powerful diagnostic tool for COVID-19 pulmonary and hemodynamic conditions.[1] COVID-19 is highly contagious and may live on the surface of bulky ultrasound machines. The ultrasound machine, keyboards, cords, and wires need to be decontaminated after every patient, in a time - and resource consuming process.[1] As medical personnel become increasingly overwhelmed and disinfection supplies become limited, there may also be less adherence to decontaminating protocols. The use of ultrasound also puts frontline workers at risk of contracting COVID-19 from prolonged close patient contact.[1,2] By contrast, handheld ultrasounds can quickly be decontaminated after use and isolated within a plastic cover to minimize contamination risk.[1] During this pandemic, handheld ultrasounds may be the best option for delivering high quality care and preventing the nosocomial spread of COVID-19.[1]

Clinical Case Examples

The Butterfly iQ was used during the COVID-19 pandemic in a New York City hospital with a large population of infected patients. These two cases provide insight about the Butterfly IQ being the ideal ultrasound to reduce viral exposure.

The first patient was a 32-year-old primigravida with dichorionic diamniotic twins. Patient's past medical history was significant for hypothyroidism. She had an uncomplicated prenatal course. At week 35, her partner exhibited moderate SARS-CoV-2 symptoms and tested positive for coronavirus. She was asymptomatic at the time. Later in the week, she had a telemedicine appointment and exhibited mild SARS-CoV-2 symptoms (nasal congestion and a temperature of 99.0°). During week 36, at another telemedicine appointment, she presented with cough, fever (100.4°), fatigue, and myalgia. Although in-person visits were avoided for as long as possible, the patient's high risk pregnancy with twins warranted a visit during week 37. The patient was treated as a presumptive positive coronavirus case. She was examined in a designated COVID-19 room as the last patient of the day. Because the room didn't have a sonogram, the Butterfly iQ was ideal to check for twin biophysical profile, growth, position, and amniotic fluid index. Using the Butterfly iQ eliminated the need to transfer the patient to a different unit. This minimized her contact with others and reduced the viral spread.

The second patient was a 28-year-old pregnant female undergoing chemotherapy for refractory Hodgkin's lymphoma. During a telemedicine appointment, the patient presented with a cough and backache. Because her partner had upper respiratory symptoms, she expressed concern about being COVID-19 positive and was referred for screening. At 34 weeks, she was seen in-office. Patient tested positive for COVID-19, but symptoms had resolved. At 36 weeks, patient was examined in a designated COVID-19 room without sonogram. The Butterfly iQ was used to determine biophysical profile and amniotic fluid index. A week later, the patient was admitted for induction of labor. The Butterfly iQ was used again for ultrasound assessment upon admission.

Conclusion

The Butterfly iQ proved to be an efficacious and safe sonogram alternative. Using the Butterfly iQ at the patient's bedside minimized the need to transfer patients, reducing COVID-19 exposure while providing quality care. Its initial usage during the COVID-19 pandemic demonstrates potential benefits in other clinical scenarios, such as the (ICU and maternal care in developing countries, etc.).

References

1. Gibson LE, Bittner EA, Chang MG. Handheld Ultrasound Devices: An Emerging Technology to Reduce Viral Spread during the Covid-19 Pandemic. American Journal of Infection Control. 2020. doi:10.1016/j.ajic.2020.05.041

2. Nelson BP, Sanghvi A. Out of hospital point of care ultrasound: current use models and future directions. European Journal of Trauma and Emergency Surgery. 2015;42(2):139-150. doi:10.1007/s00068-015-0494-z

3. Becker DM, Tafoya CA, Becker SL, Kruger GH, Tafoya MJ, Becker TK. The use of portable ultrasound devices in low- and middle-income countries: a systematic review of the literature. Tropical Medicine & International Health. 2016;21(3):294-311. doi:10.1111/tmi.12657

4. Handheld portable ultrasound machine: Butterfly iQ. Handheld portable ultrasound machine | Butterfly iQ. https://www.butterflynetwork.com/. Accessed June 11, 2020.

5. European Society of Radiology statement on portable ultrasound devices. Insights into Imaging. 2019;10(1). doi:10.1186/s13244-019-0775-x

6. Dalmacion GV, Reyles RT, Habana AE, et al. Handheld ultrasound to avert maternal and neonatal deaths in 2 regions of the Philippines: an iBuntis® intervention study. BMC Pregnancy and Childbirth. 2018;18(1). doi:10.1186/s12884-018-1658-8

7. Swanson JO, Nathan RO, Swanson DL, et al. Use of ultrasound and mHealth to improve perinatal outcomes in low and middle income countries. Seminars in Perinatology. 2019;43(5):267-272. doi:10.1053/j.semperi.2019.03.016

8. Milart PHC, Prieto-Egido I, Molina CAD, Martínez-Fernández A. Detection of high-risk pregnancies in low-resource settings: a case study in Guatemala. Reproductive Health. 2019;16(1). doi:10.1186/s12978-019-0748-z

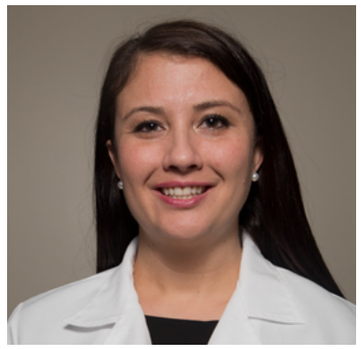
9. Stamilio DM, Mcreynolds T, Endrizzi J, Lyons RC. Diagnosis and Treatment of a Ruptured Ectopic Pregnancy in a Combat Support Hospital during Operation Iraqi Freedom: Case Report and Critique of a Field-Ready Sonographic Device. Military Medicine. 2004;169(9):681-683. doi:10.7205/milmed.169.9.681

10. Goodman A, Black L, Briggs S. Obstetrical care and women's health in the aftermath of disasters: The first 14 days after the 2010 Haitian earthquake. American Journal of Disaster Medicine. 2014;9(1):59-65. doi:10.5055/ajdm.2014.0142

11. Devis P, Knuttinen MG. Deep venous thrombosis in pregnancy: incidence, pathogenesis and endovascular management. Cardiovascular Diagnosis and Therapy. 2017;7(S3). doi:10.21037/cdt.2017.10.08

12. Gogna A, Yogendra P, Lee SHE, et al. Diagnostic Ultrasound Services During the Coronavirus Disease (COVID-19) Pandemic. American Journal of Roentgenology. October 2020:1-6. doi:10.2214/ajr.20.23167

About the authors



Noel Strong, MD

Dr. Strong is a Maternal Fetal Medicine specialist who practices at Mount Sinai Hospital in New York City and is an Assistant Professor at Mount Sinai School of Medicine. She received her MD from the University of Illinois and did her post-graduate training at the Mount Sinai Medical Center in New York City. Dr. Strong frequently accompanies Saving Mothers on pro bono surgery trips and trains local health providers in limited-resource settings.

Taraneh Shirazian, MD

Dr. Shirazian is a practicing gynecologic surgeon and an Associate Professor at NYU Langone Medical Center in New York City. She is also the Director of Global Women's Health at NYU Langone. Dr. Shirazian received her MD through the accelerated program at Brown University and completed her post-graduate residency at the Mount Sinai Medical Center in New York City. She is recognized as an international leader in global women's health and is frequently called on by national media outlets to appear as an expert in this field. She is also an accomplished researcher focused on interventions designed to decrease maternal morbidity and mortality, and her work has been published in many prominent medical journals including the American Journal of Perinatology and ACOG Today.

Rachel Wong

Rachel Wong is a 2nd year medical student at the Sophie Davis Program/ CUNY School of Medicine. She received her degree in Biomedical Science as part of the 7 year BS/MD program. She serves as President of the American Medical Women's Association Chapter, where she has worked with the non-profit, Saving Mothers, to send birth kits to underserved mothers in Africa. Last summer, Rachel interned at Saving Mothers, where she assisted in establishing COVID-19 protocols and obtaining PPE for hospitals in Kenya and Guatemala. She also partook in the Kaiser Permanente Introduction to Integrated Health Care Program, which solidified her interest in reducing racial inequities in healthcare. Rachel hopes to use her career to address structural injustices and advocate for improving access to medical care among vulnerable populations.