URMC Echo COVID-19 Shield

Figure 1. *Echo shield attached to echo machine provides a barrier between the patient and the sonographer (staff in photo from left to right, Jennifer Forbes, Melissa Dean, Kenneth Steinmetz, Douglas Hills and Terry Stoddard).*

Summary

Cardiac imaging with ultrasound requires a sonographer to manipulate a transducer on a patient's chest wall for approximately 20 to 40 minutes to obtain all required views. During the scanning procedure, patients lie on a bed in the left-lateral decubitus position with their left arm raised and tucked under their head, while the sonographer is sitting on the left side of the bed at the level of the left chest and facing the head of the bed[1]. This specific positioning of the patient is required, as it places the heart as close as possible to the chest wall and opens up the intercostal spaces, improving ultrasonic penetration of the chest wall and it allows the sonographer to reach the left side of the chest with the imaging transducer. Unfortunately, this positioning also places the faces of the patient and sonographer in close proximity, which increases the risk of exposure to airborne pathogens exhaled from either party. Our solution to this problem was to break the direct line-of-sight airspace between the patient and sonographer by adding a positionable shield to the left side of the ultrasound cart. The shield consists of a standard pillowcase draped over a stainless steel wire-frame "hanger" bolted to the echo machine which breaks the airspace between the faces of the sonographer and patient. The hanger is designed to allow for 2-axes of rotational adjustment with the third vertical axis adjustment provided by the echo machine itself, as the hanger will move up and down with the machine's

[1] The positioning described is also known as "left-handed imaging". It is also possible for sonographers to stand on the right side of the bed for scanning, but this requires them to reach over the patient, which not only exposes them to the patient's exhaled air, but also dramatically increases exposure to pathogens contained in droplets that might be on their clothing or bedding.

main console. Cleaning the barrier device is easy, as the stainless steel hanger can be disinfected with standard sanitary wipes and the pillowcase is changed between each patient. The advantages of this device for reducing the volume of respiratory droplet pathogens passing from patient to sonographer and vice versa are obvious to all that have used it, but we have not had time to do any formal testing to prove effectiveness. In fact it is important to emphasize that sonographers still need to wear appropriate recommended personal protective equipment depending on the patient's particular circumstances. Where this device is obviously most beneficial is with patients that have not yet received a diagnosis of respiratory pathogens requiring special precautions, especially if they are coughing or have exaggerated respiratory effort. In the era of COVID-19, this now applies to essentially all patients regardless of whether they are out- or in-patients. Our practice during this outbreak is for all sonographers to wear a surgical mask, gloves, eye protection, scrubs, practice very frequent hand washing and use the new echo machine barrier for all patients. Of course, patients with documented COVID-19 infection may require additional measures, such as a negative pressure room and upgrading the mask to N-95, in addition to other measures.

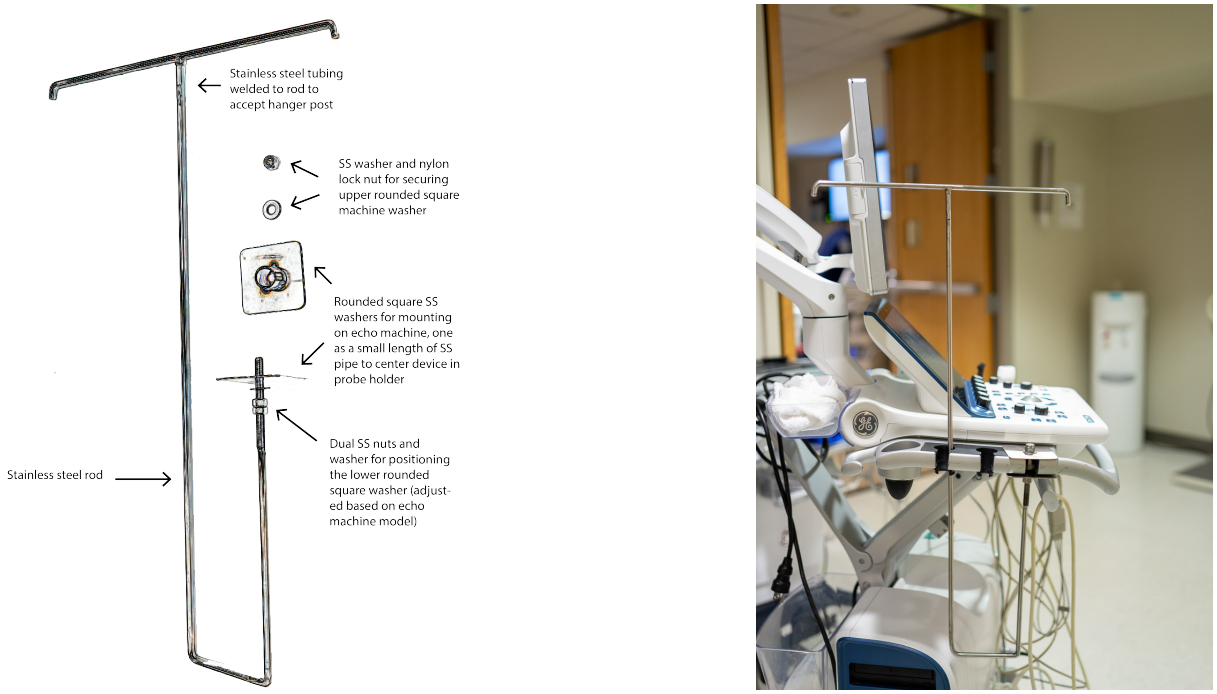


Figure 2. *Echo shield component parts (left panel) and installed on echo machine (right panel). The right panel shows the echo shield stowed in transport position (tall support rod stowed in neighboring probe-holder hole).*

Design

The echo shield was designed to be attached to the echo machine using one of probe-holders as a mounting point. Two rounded square stainless steel "washers" are designed to be forcibly squeezed together firmly grasping the side of the echo machine. The top rounded square stainless steel washer has a short 1-in segment of stainless steel pipe welded to it for centering the washer in the probe-holder hole and preventing it from pivoting side to side. The compression nuts that secure the echo shield to the echo machine are tightened just enough to prevent the rounded square washers from moving while still allowing the hanger to rotate about its vertical axis. The length of the taller hanger rod roughly matches the length of a standard size pillowcase and the length of the lower portion of the support rod was chosen to allow the Echo Shield to be stowed in another empty probe-holder hole. The top hanger rod has rounded ends to prevent the pillowcase from binding when putting it on and taking it off. The top of vertical hanger support rod has a short

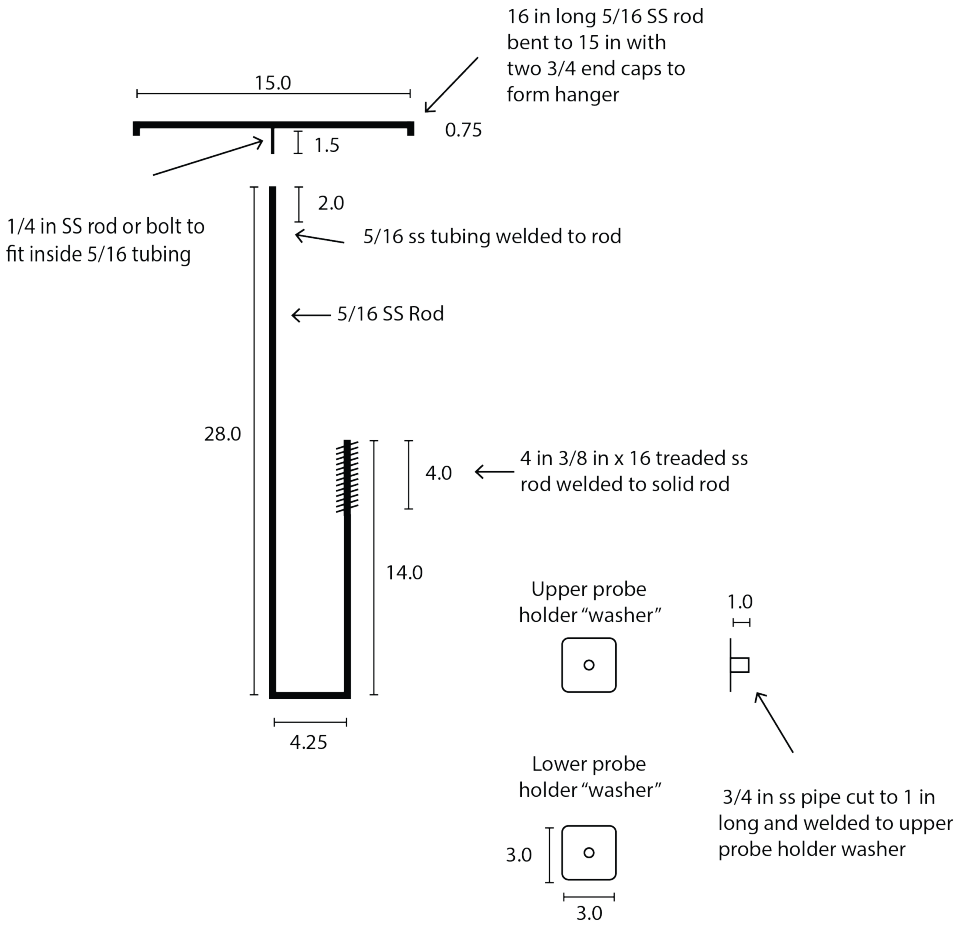
length of stainless steel tubing welded to it to provide a receptacle for a short stainless steel rod[2] for a gravity fit that allows for 360° of rotation of the hanger top.

There are two figures of the hanger included in this document and on the last page is a design sketch detailed enough for a machinist to recreate the echo shield. Figure 1 shows the echo shield in place as it is intended to be used and also highlights some of the URMC staff that brought this idea to fruition. The left panel of figure 2 is an image of the echo shield illustrating the component parts, and the right panel shows the wireframe hanger installed on echo machine in "transport mode".

Credits and contact information for questions

The need for a barrier between the patient's face and that of the sonographer was raised at our first echo COVID-19 response meeting by sonographer Melissa Dean (Melissa_Dean@urmc.rochester.edu) on Thursday morning, March 19. The echo lab director, Dr. Karl Schwarz (karl_schwarz@urmc.rochester.edu) messaged facilities expert, Kenneth Steinmetz (Kenneth_Steinmetz@urmc.rochester.edu), who appeared in the echo lab minutes 15 min later. Dr. Schwarz and Mr Steinmetz quickly hashed out a design for the echo shield and Mr. Steinmetz along with his Facilities partners, Mr Douglas Hills and Terry Stoddard, refined the design and had a functional prototype the next morning (Friday, March 20). The prototype was reviewed by Dr. Schwarz and a variety of sonographers in the lab and a few minor design modifications were made. Mr. Steinmetz, Douglas Hills and Terry Stoddard came in over the weekend and by Monday morning (March 23) had 10 final design Echo Shields ready for installation. We tested the Shields that morning in the URMC echo lab and for portables in Strong Memorial Hospital, and then gave the go-ahead for our Facilities partners to manufacture an addition 40 Shields for installation throughout the whole URMC system of hospitals and clinics (installation by Wednesday, March 25). In just 5-days (including weekend days) all of our clinics and hospitals were protected with a device suggested by sonographer Melissa Dean, and then designed and fabricated by our URMC staff. - Strong work!

[2] We used a 1/4-in stainless steel bolt instead of a similar-sized rod, either of which fit into the lumen of the 5/16-in tubing welded to the end of the 5/16-in rod used to fabricate the device.



Materials List

(1) 5/16 in SS rod 46.25 in long bent in the shape of a "U" has shown
(2) 5/16 in SS rod 16 in long bent in the shape of a "coat hanger" as shown
(3) 5/16 in SS tubing 2 in long welded to the hanger end of the long bent rod to accomodate the hanger support
(4) 1/4 in SS rod 1.5 in long or ss bolt of same size welded to hanger support
(5) 3/8 in threaded SS rod 4 in long welded to the end of the long hanger support to allow for mounting the device on the echo machine's probe holder.
(6) Two 3.0 x 3.0 in SS rounded square "washers" for either side of the machine's probe holder. The upper plate has a 1 in long piece of 3/4 in SS pipe welded to it it for centering in the proibe holder.
(7) Two 3/8 in SS nuts and washer to lock the lower probe-holder washer washer in place.
(8) One 3/8 in nylon lock nut and washer to secure the upper probe holder washer in place