DOWNLOAD PDF GUIDE TO CARDIAC ULTRASOUND

Chapter 1 : Echocardiography - Wikipedia

Amply illustrated with photographs, figures, and tables, A Practical Guide to Echocardiography and Cardiac Doppler Ultrasound, Second Edition, is a vivid and compelling introduction to echocardiography.

Every year, about 1. About , will die and many could be avoided. Cardiovascular diseases, including CHD and stroke, remain the number one cause of death in the United States, killing more than , Americans each year. Stroke is the 3rd leading cause of death in the US and a leading cause of death worldwide. Worldwide, about 1 in babies are born with cardiac defects. Heart Ultrasound Echocardiography can be very helpful to: This happens when bacteria from the skin, mouth or intestines enter the bloodstream and infect the heart. Assess EF â€”ejection fraction levels heart flow Rule out any of the above mentioned abnormalities Why is Heart Ultrasound the most popular type of heart evaluation? Heart Ultrasound echocardiography has been the most widely-used diagnostic test for heart disease for over 50 years! A sedative is not needed for the most common type of heart ultrasound Injection of a dye is not involved in the most common type of heart ultrasound. Heart Ultrasounds are performed as you lie on a comfortable table Heart Ultrasound scanning equipment is readily available in almost all hospitals and clinics. Other new technology may not be available in every healthcare setting Heart Ultrasound is not a high priced procedure. Other technologies can be much more expensive than getting a heart ultrasound Heart Ultrasound is helpful for the diagnosis of heart health, a variety of heart diseases and ailments. Heart Ultrasounds can be used in all stages of life Ultrasound does not involve any radiation exposure Why Are You Waiting? Heart Ultrasounds are not for everyone, but if you would like to protect your heart health because of a family history of heart disease, are in a high-risk group, or are experiencing any symptoms shortness of breath, pain in your arm, etc. What types of heart ultrasounds are there? The most common type of heart ultrasound performed is transthoracic , which is performed by placing a microphone-like device called the transducer on the outside of the chest wall with a gel-like substance to transmit sound waves into the body. There are also several other types: This procedure measures the speed and direction of the blood flow within the heart. It screens the four valves for leaks. This is the sound of blood moving within your heart. Stress tests are used to diagnose the narrowing of the coronary arteries. This is a harmless solution that has no known side effects. You will need to have an IV started to receive a contrast echocardiogram. This allows the physician to obtain very high quality moving images. You can be sedated during the procedure if you wish. Transesophageal echocardiograms are typically performed to evaluate serious heart conditions. What is it like? A trained cardiac professional a sonographer will move a microphone-like object a transducer- A hand-held device that sends and receives ultrasound signals over the chest area. A small amount of gel used on the end of the transducer helps it glide over the skin. The transducer sends out high-frequency sound waves that are then shown and captured by equipment that includes a video screen and computer. Most people feel not much more than the presence of the gel on their skin during the procedure, but others may feel some pressure from the transducer being pressed down in order to obtain an enhanced image. How Safe Is It? Heart Ultrasound is safer than some other heart imaging techniques because no radiation is involved. The sonographer taking your test will be right in the room next to you during the exam without a protective vest or leaving the room! The final results will be reviewed by a specially trained physician to assure an accurate interpretation. Who Can Have a Heart Ultrasound? Babies even in the womb! How do I find a qualified professional? Looking for someone to perform or read a heart ultrasound? The designation Fellow of the American Society of Echocardiography FASE recognizes the experienced, dedicated ASE member with a diverse set of skills and comprehensive knowledge of all aspects of cardiac ultrasound echocardiography. Click here to find a FASE in your area. How do I find an accredited echo lab? Private offices, clinics and departments within hospitals that are accredited by the Intersocietal Commission for the Accreditation of Echocardiography Laboratories ICAEL voluntarily submit to a review of their daily operations. This is a demonstration of a commitment to quality care. Click here to find an accredited lab in your area. Every year, , Americans die as the result of Sudden Cardiac Death. But a safe, non-invasive procedure could save lives. Widely available heart ultrasounds are as easy on the patient as taking a blood pressure reading. The ejection fraction, or EF, measures the amount of blood pumped with each heartbeat. Recent medical research shows that people with hearts that pump poorly â€” that is, have a low EF â€” are at increased risk for Sudden Cardiac Death. Ejection Fraction EF is a key indicator of heart health and is frequently used to determine the pumping function of the heart. Simply stated, EF is the amount of blood pumped out of the heart during each beat or contraction. This indicates that the heart is pumping well and able to deliver an adequate supply of blood to the body and brain. Heart failure also known as congestive heart failure is a condition in which the heart is not able to pump enough blood to meet the oxygen demands of the body. For heart patients, knowing your EF is key first step to determining your risk for Sudden Cardiac Arrest. How is EF Measured? A commonly used test to determine your EF is a heart ultrasound echocardiogram. By using ultrasound or sound waves, measurements are taken of the heart and with these measurements the pumping function the heart is calculated. Should you know your EF number? If you have heart disease, it is important to have your EF measured regularly, the same way that you have your blood pressure and cholesterol checked regularly. Where do I get a heart ultrasound? A heart ultrasound can be performed in any setting, i. A cardiac sonographer, a health care professional specially trained and certified in cardiac ultrasound, usually performs the ultrasound, and the results are reviewed by a doctor. What happens if the doctor finds a problem? The heart ultrasound specialist physician will explain the findings of the heart ultrasound to your own doctor. You may need to undergo additional tests, or treatment may be recommended. Treatment for heart problems includes medication, surgery, and lifestyle modification. What is the difference between heart ultrasound echocardiogram and an EKG? Heart Ultrasound shows a moving image of a beating heart on a television-like screen. An EKG, or electrocardiogram, measures the electrical currents in the heart. These are different diagnostic techniques used to obtain different information. The EKG tells about the electrical health of the heart while the heart ultrasound health of the heart walls and valves. How long has heart ultrasound echocardiography been around? Ultrasounds began to be used on the heart in a clinical setting in the late s. The technology is still going through improvements and developments. Live, moving pictures keep heart ultrasound as one of the most prescribed diagnostic tests. Do health plans cover heart ultrasound? What is Circulation Ultrasound Vascular Ultrasound? This ultrasound uses the same technology that allows doctors to see an unborn baby inside a pregnant mother. Circulation Ultrasound can be helpful to: Circulation Ultrasound Vascular Ultrasound has been the most widely-used diagnostic test in the detection and treatment of blood vessel problems Ultrasound scanning is noninvasive no needles or injections and is usually painless. Ultrasound is widely available, easy-to-use and less expensive than other imaging methods. Ultrasound imaging uses no ionizing radiation. Ultrasound scanning gives a clear picture of soft tissues that do not show up well on x-ray images. What types of Circulation Ultrasound are there? These images are analyzed todetermine whether or not you have blockages in your arteries, blood clots in your veins, or if an abdominal aortic aneurysm is present. During the test, you will be asked to walk on a treadmill to determine the effects of exercise on your circulation. Blood pressure cuffs are placed on your arms and ankles to obtain measurements during this procedure. The length of the test is 2 hours. Upper or Lower Venous Evaluation â€" This test determines if there are blood clots in the veins of your arms or legs. Narrowing of these arteries can be a common cause of stroke. It usually takes minutes. A trained professional a Sonographer or Vascular Technician will move a microphone-like device called a transducer over the appropriate area. Circulation Ultrasound is safer than some other imaging techniques because no radiation is involved. The sonographer or vascular technician taking your test will be right in the room next to you during the exam. Who Can Have a Circulation Ultrasound? Since Circulation Ultrasound does not involve radiation and is non-invasive, almost anyone even babies and the elderly can safely experience circulation ultrasound. There are no known risks of experiencing a standard diagnostic ultrasound for humans.

Chapter 2 : Echocardiography for Medical Students

Cardiac ultrasound is a valuable skill set for medical professionals in multiple clinical scenarios including trauma, hypotension and cardiac arrest. The proper techniques to image the heart can be mastered with practice and familiarity with the ultrasound machine.

Probe direction for subxiphoid and parasternal views. Drawing illustrating sonographic capture of a long axis parasternal view. This split screen shows a long axis parasternal view of the heart. Heart in long axis parasternal view. Short Axis view of left ventricle LV at the mitral valve base. Short axis parasternal image at papillary muscle mid-section PM of the left ventricle. In this image the various short axis segments of the cardiac wall are labeled. Diagram outlining the wall segments of the left ventricle. This shows a cardiac short axis view at the level of the aortic root in diastole. The image displays the aortic root Ao in systole. A parasternal short axis view is shown at the level of the apex with some visible papillary muscles PM. Heart in short parasternal axis view. Note the operator is holding the probe from a cephalad position. This sonographic image demonstrates the three hepatic veins HV emptying into the posterior located anechoic IVC. The atrial AS and ventricular septum VS is seen clearly oblique to the beam. The same subxiphoid view is shown with the four heart chambers labeled. Subxiphoid view of the heart. This long axis view of the IVC shows an example of a hepatic vein HV draining into the inferior cava, which then immediately drains into the right atrium RA. This is a split screen image of a B-mode and corresponding M-mode ultrasound. This is a phased array sector image displaying all four heart chambers. In this image a large circular pericardial effusion black is distinguished from the left ventricle LV, blue. This patient has a moderate amount of pericardial fluid PE. Figure 16 and These subxiphoid images display additional samples of circular pericardial effusions PE. This clip shows a significant pericardial effusion with diastolic collapse of the RV and pendulum movement of the heart. Shows hyperdynamic cardiac activity. This patient is in cardiogenic shock. A synthesized hypotensive protocol uses common acoustic windows into the torso to image those structures important in maintaining blood pressure. This video shows a heart in severe cardiogenic shock with futile contractions. Split-screen image of B-and M-mode ultrasound. Introduction and Indications Cardiac ultrasound is a valuable skill set for medical professionals in multiple clinical scenarios including trauma, hypotension and cardiac arrest. The proper techniques to image the heart can be mastered with practice and familiarity with the ultrasound machine. As technology continues to improve, the education of future clinical providers becomes the rate-limiting step to fully implement the true potential of ultrasound. The twenty first century emergency physician may soon utilize bedside ultrasound to differentiate critical cardiac patient presentations by answering focused questions such as: Is there a pericardial effusion? What is the cardiac contractility? What is the intravascular volume status of my patient? This chapter will attempt to guide an emergency department medical provider in the necessary skills to acquire and interpret sonographic images of the heart and great vessels in the emergency medicine setting. Anatomy The appearance of cardiac anatomy on ultrasound can sometimes be confusing. It is difficult to derive a three-dimensional mental construct utilizing 2 dimensional images. The best way to learn anatomy is by reviewing the sonographic shapes and patterns displayed in 2 dimensions and continuously relate that to the 3 dimensional configuration. It is important to find sonographic landmarks to provide spatial orientation when viewing the heart from multiple planes. Echocardiography is a dynamic assessment and it is important to examine structures through the entire cardiac cycle. The normal heart sits in the left chest with its base anchored by the great vessels: The cardiac apex points anterior inferior and about 60 degrees to the left. The heart consists of two thicker walled ventricles, two thinner walled atria and four valves that separate flow between the chambers. Blood flows between the anterior and posterior leaflets of the mitral valve into the thick walled left ventricle. The left ventricle LV is thicker walled and is the largest of the four chambers in the normal heart. The LV is by far the main focus in echocardiography and learning nuances of its appearance aids the experienced sonographer. In the longitudinal long parasternal LPS view the cardiac apex is on the left side of the screen while the apex is on the right side of the screen in the subxiphoid SUX view. From the LV, blood flows into the tubular ascending aorta and into the systemic circulation. The aortic valve can be seen in this plane as two of the three aortic leaflets typically the non coronary cusp and right coronary cusp mark diastole closed and systole open. Occasionally the left coronary cusp is seen in this imaging plane. In the short axis parasternal view, tilting the probe cephalad can image the aortic valve in cross section. Superior and inferior vena cava drain into the right atrium and can help orient the sonographer. These structures lead the operator to the right side of the heart. From there, blood flows through the tricuspid valve into the triangular shaped right ventricle. The right ventricle size is determined by forces influencing preload e. It can assume many shapes depending on the disease state. The pulmonary arteries are difficult to see yet can be visualized in the short axis parasternal view. The right heart normally carries deoxygenated blood to the lungs and is separated from the left heart by the interatrial septum and the thick walled interventricular septum. A variety of congenital cardiac malformations are common and should be considered when normal patterns deviate. Cardiac anomalies have varying prevalence among differing populations. The normal heart will change morphology and function with age and comorbid conditions. Typically, cardiac imaging requires the use of intercostal acoustic windows. Imaging in adults requires the use of lower frequencies typically MHz. Curvilinear probes can be used to image the heart, especially in the subxiphoid view. However, rib shadows impede the use of these larger footprint probes with transthoracic imaging. Traditional imaging planes for anatomic structures are transverse short axis and sagittal long axis planes. Structures closest to the transducer are displayed at the top of the image deemed the near field. The deeper structures are displayed at the bottom of the screen in the far field. The focal zone is that area of greatest resolution usually marked with a carat that indicates the transition from the near to far field. All probes have an indicator that demarcates the leading edge of the beam that corresponds to a mark on the monitor. This orientation in cardiac imaging has created much controversy on how to position the probe on the chest wall to obtain the necessary standard images of the heart. Other methods have been described such as rotating the probe degrees and reversing the image on the monitor so the indicator is on the left side of the image standard for abdominal presets. The confusion in the cardiac display is best explained and clarified at the bedside by touching one side of the probe and watching the resultant image on the display. Standard display of cardiac anatomy in the long and short axis, subxiphoid and apical views are the goal for cardiac imaging. The chest can be imaged from a series of acoustic windows and tissue planes. First of all, make sure to document the right patient and medical record number. Cardiac settings enhance the image for optimal motion detection. Apply generous amount of warm gel and position the patient in left lateral decubitus if tolerated. The heart sits in the chest at an angle and can be approached through the intercostal muscles. These intercostals and structures such as the liver gray or black structures in the near field act as acoustic windows to allow sound waves to penetrate to the underlying heart and chest cavity. Comparatively, strong reflectors such as ribs or gas in the stomach obscure visualization into the far field. The ribs obscure the beam from penetrating, therefore it is important to rotate the cardiac probe to align the beam parallel to the ribs in the space and eliminate rib shadows. Common Cardiac Ultrasound Windows Illustration 1: The heart sits obliquely in the left chest with the apex pointing toward the left hip. To obtain the long parasternal view, begin to sweep the probe across the parasternal area in the third or fourth intercostal space. If the mark on the monitor is on the left, than point the probe to the left hip, if the mark on the monitor is on the right, point the probe to the right shoulder. Either way the image is displayed in the same manner for convenience with the curved apex on the left side of the monitor See Illustration 1,2, and 3 and Figures 1 and 2. Look for the landmark mitral valve and rotate the probe to image the aortic and mitral valve in the same long axis plane. Long axis parasternal view of the left ventricle LV , aorta Ao , mitral valve MV, closed and interventricular septum S.

Chapter 3 : Cardiac Ultrasound Machines - KPI Healthcare

The purpose of this buyers guide is to help medical professionals quickly determine the cardiac ultrasound machines with the best value or price to performance ratio. Which cardiac system is best for you depends upon your needs and your budget.

This article has been cited by other articles in PMC. Abstract The use of point of care echocardiography by non-cardiologist in acute care settings such as the emergency department ED or the intensive care unit ICU is very common. In this article, an overview of the most common applications of this focused echocardiography in the ED and ICU is provided. This includes but is not limited to the evaluation of patients experiencing hypotension, cardiac arrest, cardiac trauma, chest pain and patients after cardiac surgery. Echocardiography, emergency department, ICU, point of care, ultrasound. It was shown that a rapidly performed, limited echocardiogram carried out by emergency physicians EPs could confer a mortality benefit to those with penetrating cardiac injuries [1] From this narrow scope, non-traditional users of echocardiography echo such as critical care physicians CCPs and EPs have expanded the applications of cardiac ultrasound to address a broad array of important clinical questions at the bedside. Point of care echo has expanded to the point where in the last two years, consensus statements from medical societies in both emergency medicine [2] and critical care [3] have been published, guiding practitioners on the appropriate scope of echo for these acute care providers. In considering the opposition to this "non-traditional" use of echocardiography, as recently as 10 years ago, [4] one can appreciate the significant progress that these documents signify. Though the emergency department ED and intensive care unit ICU represent distinct clinical environments, the indications and applications of basic echocardiographic assessment are quite similar. This commonality provides the backdrop for this review, which seeks to give the reader an understanding of the current "state of the art" application of this modality across a spectrum of critical illness, whether in the ED or the ICU. Different from diagnostic echocardiography, a limited or "focused" bedside echo is typically devoted to answering very specific clinical questions that are posed in response to a particular differential diagnosis, using the minimum and most efficient echo views and techniques. As such, this review is organized into sections based around common patient presentations, rather than specific diagnoses. Though the focus of the article is cardiac sonography, other applications of point of care ultrasound will be mentioned briefly in some sections. Readers interested in the broader scope of point of care ultrasound, as used in the ICU, ED and beyond, may enjoy the recent review by Moore and Copel [5]. While traditional physical examination and hemodynamic monitoring both invasive and non-invasive often provide extremely valuable information, assessment of cardiac structures by ultrasound can rapidly provide data that would be otherwise inapparent. Diagnostic Accuracy in Hypotension Not all causes of hypotension are amenable to echocardiographic diagnosis. Even under such circumstances, echo and ultrasound remain invaluable by rapidly paring down the long list of diagnostic possibilities. This contribution of ultrasound to medical decision making was shown in a randomized controlled trial where, in addition to usual care, an ultrasound protocol for patients with undifferentiated hypotension presenting to the ED was carried out. This protocol included, but was not limited to, assessment of the IVC, gross LV function and the pericardium. Taking an average of 6 minutes, the protocol lead clinicians to significantly narrow their differential diagnoses and increased overall diagnostic accuracy [6]. LV Function Assessment of LV function is one of the cornerstones of focused, point of care echo and, accordingly, will be mentioned throughout a variety of clinical scenarios in this article. Determining that LV function is normal in patients with hypotension can be invaluable, and should expedite the consideration of non-cardiogenic causes for shock such as hypovolemia or sepsis. In such cases the clinician may be lead to prioritize support for the systemic vasculature with volume or vasopressors rather than supporting the heart itself with inotropic agents. In the alternative scenario where LV function is found to be depressed in a patient who is in shock enhancing cardiac output with inotropic agents may improve oxygen delivery once the patient is adequately fluid resuscitated [7] [8]. In either case, the primary focus must be to determine and treat the underlying cause of shock. The rapid, bedside determination of LV function to assist in diagnosis and management of patients in both the ED and the ICU has shown to be plausible: The simplicity of initiating aggressive fluid resuscitation is often tempered, however, by the difficulty in confidently determining a state of hypovolemia exists. Traditional methods of volume assessment such as jugular venous pressure, measurement of central venous pressure CVP , or use of the PAC have each been scrutinized for their lack of accuracy in critically ill patients [13 - 15]. Conversely, it has long been known that echocardiographic assessment of the inferior vena cava IVC offers a compelling and accurate window in to the right sided filling pressures and overall volume status of the sick [16 , 17]. Over the past decade, physicians using ultrasound at the bedside have studied this application in acutely ill patients. IVC size and respiratory variation have been shown to correlate well with CVP and its limitations or volume responsiveness the more relevant clinical parameter in a variety of patient environments [11 , 18 - 21]. In addition to being technically easy to learn, IVC ultrasound is particularly well suited for the bedside provider rather than the consulting cardiologist or echo technician because frequent reassessment of IVC size after each intervention such as the administration of fluids or inotropes provides important feedback on the effect of these interventions and helps direct the next steps in management. More advanced echocardiographic techniques to assess volume status, including the use of continuous-wave Doppler to observe respiratory variation in volume-time integrals from the LV outflow tract [22] or the use of transesophageal echo TEE to assess superior vena cava size variation[23], have also been described with good results among advanced users in the ICU. Further, Tissue Doppler imaging is available on many portable ultrasound machines which, through assessment of myocardial tissue velocity during passive atrial filling, has shown promise in estimating volume status when studied by both EPs[24] and CCPs [25]. Pericardial Effusion With a broad list of medical causes, pericardial effusion is frequently considered in the differential diagnosis for patients who present with or develop hypotension or shortness of breath in the ED or ICU. The frequency with which pericardial effusions are found and their potential to cause significant hemodynamic embarrassment underscores the utility of limited echo in undifferentiated critically ill patients. In addition to clinical data, the bedside clinician may seek out findings of either atrial or ventricular diastolic collapse to support a diagnosis of tamponade. Supporting the assertion that tamponade is foremost a clinical diagnosis,[31] these findings also show a notable lack of specificity to the "classic" 2D findings of diastolic collapse. As such, awareness of the potential limitations of these findings will help ensure that the clinical picture always takes priority over echocardiographic images in determining the immediate management of this problem. The Septic Patient Timely and aggressive management of severe sepsis and septic shock have become a focal point in ED and ICU culture for the past decade [7]. While the above descriptions of LV function and volume status assessments also hold true for septic patients, the variability in cardiac function seen in sepsis is worthy of its own brief discussion. Sepsis may have broad influences on the cardiovascular system, ranging from diffuse myocardial suppression to LV hyperdynamism. Identifying these findings on point of care echo may prove useful to the bedside clinician. For instance, in a cohort of hypotension ED patiets, hyperdynamic LV function was found to be highly specific for an eventual diagnosis of sepsis and thus has been raised as a potential aid to early diagnosis [32]. In the ICU environment, it has been shown in a series of patients with septic shock that one third of patients suffer myocardial suppression related to their sepsis while the rest generally have hyperdynamic function [33]. These data underscore the value of echocardiography in hypotensive septic patients who, in addition to fluid resuscitation, ultimately may benefit from different forms of hemodynamic therapy â€" inotropes for those with myocardial suppression and vasopressors for those with preserved or hyperdynamic LV function. Immediate life threatening considerations amenable to assessment with echocardiography include myocardial ischemia, aortic dissection and pulmonary embolism. For high risk ED patients with negative investigations, many centers will admit for further risk stratification. Several studies support the use of both non-contrast and contrast echocardiography to risk stratify these patients at the bedside in the ED [35 - 37]. In particular, one study performed 2D echocardiography on consecutive patients with chest pain being evaluated for CAD in the ED. EPs were blinded, and the echo findings were not used for clinical decision making. Though assessment for RWMA is considered an advanced skill for EPs [3] this study raises the question of whether, with appropriate additional training, EPs could harness the negative predictive value of echocardiography to safely discharge their patients with chest pain. To this point, however, with no studies of EP-performed echo assessing for presence of absence of RWMA, echocardiographic assessment for CAD in the ED remains a component of formal diagnostic echo rather than part of any focused or limited bedside exam. Aortic Dissection Aortic dissection is an uncommon but highly lethal condition that typically presents with chest pain and can be difficult to distinguish from acute myocardial infarction. In unstable patients where dissection is suspected, TEE is the diagnostic tool of choice, with sensitivity and specificity comparable to MRI or CT [38]. While the findings of a visible flap in the aorta ascending or descending or new aortic insufficiency on echo are supportive of the diagnosis, the absence of such findings are inadequate to exclude the diagnosis.

Chapter 4 : Ultrasound of the Coronary Arteries

Intravascular ultrasound: This is an ultrasound performed during cardiac catheterization. During this procedure, the transducer is threaded into the heart blood vessels via a catheter in the groin.

The Most Common Heart Ultrasound: Heart ultrasound provides your doctor with moving images of your heart and takes excellent pictures that will help your doctor evaluate your heart health. The most common type of heart ultrasound is non-invasive and very easy on the patient. A specially trained technician, called a cardiac sonographer, uses a gel to slide a microphone-like device called a transducer over the chest area. This allows reflected sound waves to provide a live picture of your heart and valves. Heart Ultrasound uses the same technology that allows doctors to see an unborn baby inside a pregnant mother. No radiation is involved in heart ultrasound, and the technology can be used on people of all ages. Why might I need a heart ultrasound? What is a heart ultrasound transthoracic echocardiogram;TTE; echocardiogram; echo? A heart ultrasound is a useful tool to evaluate the structure and function of the heart and associated vessels. It is a fast, easy and painless evaluation that uses ultrasound waves to produce images of the heart. In North America, the test is performed by a specially trained technologist, called a sonographer, and is interpreted by a specially-trained physician, usually a cardiologist, trained in reading heart ultrasounds. This ultrasound uses the same technology that allows doctors to see an unborn baby inside a pregnant mother. Why has my doctor requested that I have a heart ultrasound echocardiogram? There are many reasons that your physician may request that you have a heart ultrasound. An echo may sometimes also be used to look for the cause of a murmur, to check the size of the heart chambers, to check for fluid around the heart, or to inspect the pumping capability the muscles of the heart if a patient has short of breath or has complained of certain symptoms during exertion. How do I prepare for an echo? There is no special preparation required for a heart ultrasound. You should come as you are and eat or drink as you normally do. If you take medications, you should continue to take them as normal unless your doctor specifies otherwise. You should plan on being at the echocardiography lab for about 45 minutes to one hour. What should I expect? Upon arrival at the lab the friendly staff will greet you. They may request you to provide additional insurance information, and will ask you to register. They may also ask that you provide a prescription or order for your exam. You will then be escorted into an ultrasound room. The room will be dimly lit and will contain an examination table or bed and an ultrasound machine. You may be asked a few questions by the sonographer who will want to know why you are having the test, if you have had previous tests, and if you have ever had open heart surgery. Usually a brief explanation of the procedure will be given as well. You will be asked to remove your clothing from the waist up and women will be given a gown to wear during the procedure. If you need help, the sonographer will assist you in getting onto the exam table, where you will be asked to lie on your left side. The sonographer will then attach ECG lead wires to electrodes adhered to your chest with simple medical tape. The lights may be dimmed to allow the sonographer to see the monitor better. The sonographer will apply ultrasound gel to a microphone-like device called a transducer. The transducer sends and receives the harmless ultrasound waves. Next, the sonographer will begin to acquire ultrasound images and audio recordings by methodically and precisely moving the transducer around on your chest, stomach, and neck. During recording, you may be asked to change your position and to hold your breath. These variations in position and breathing allow the Sonographer to obtain the best quality pictures. The sonographer will press the transducer against your skin and this pressure may be moderate at times to facilitate the transmission of ultrasound waves. If it becomes uncomfortable, please let the sonographer know. You should try to remain still and quiet during the exam. The imaging will take about 30 to 45 minutes. Often, the sonographer will review the study with a supervisor or physician while you are still in the room. You should not be alarmed; the technique to acquire images of the heart is technicallydemanding and sonographers frequently rely on the advice of others as they acquire these images. What will I see and hear on the heart ultrasound machine during my exam? Ultrasound waves used in performing the echocardiogram are not audible to the human ear, so you will not hear the sound waves. For example, the valves of the heart will look like white flap-like moving structures. Areas of the heart where there is fluid or blood look black on the screen. During the exam, you will notice the sonographer placing marks on the screen with small computer calipers. The sonographer uses the calipers to perform various measurements of the size, function and blood flow of the heart. An echocardiogram exam usually includes a Doppler recording of the blood movement or flow within the heart. When color flow Doppler is used in the exam it will appear as different colors moving within the white and black images on the monitor. The different colors represent the different speeds and directions of blood flow in the heart. Doppler examinations often also include an audio signal of the blood flow. These audio signals can be heard and seen. During the audio Doppler recording, you will hear the sound of the blood moving through the heart and the sound of the heart valves opening and closing. The audio signals are also displayed as a graph on the monitor. These graphic recordings help the physician to determine valve function and heart pressures. What happens after the exam? Following the recording of the images, the sonographer will remove the ECG electrodes from your chest, will wipe off the ultrasound gel from your skin, will help you off the examination table and escort you out of the lab. The ultrasound images and Doppler recordings will be submitted to a cardiologist who is a specially-trained physician in reading heart ultrasounds. He or she will interpret the images and will then provide your general physician with a written report. Often, you will not be given any results for one or two days. Generally, the sonographer will not provide you with any results at the time of the examination.

Chapter 5 : Cardiology (Full Guide) â€“ "The" Med Student Ultrasound eBook

CARDIAC ULTRASOUND | THE HOW-TO GUIDE 3 | P A G E 8. If necessary, rotate the probe until the chamber sizes are fully appreciated. 9. Adjust the depth to ensure that beam penetrates beyond the deep borders of the heart.

Transthoracic echocardiogram A standard echocardiogram is also known as a transthoracic echocardiogram, or cardiac ultrasound. In this case, the echocardiography transducer or probe is placed on the chest wall or thorax of the subject, and images are taken through the chest wall. This is a noninvasive, highly accurate, and quick assessment of the overall health of the heart. Transesophageal echocardiogram This is an alternative way to perform an echocardiogram. This allows image and Doppler evaluation from a location directly behind the heart. This is known as a transesophageal echocardiogram. Transesophageal echocardiograms are most often used when transthoracic images are suboptimal and when a more clear and precise image is needed for assessment. This test is performed in the presence of a cardiologist, registered nurse, and ultrasound technician. Cardiac stress test A stress echocardiogram, also known as a stress echo, uses ultrasound imaging of the heart to assess the wall motion in response to physical stress. Finally, images of the heart are taken "at stress" to assess wall motion at the peak heart rate. A stress echo assesses wall motion of the heart; it does not, however, create an image of the coronary arteries directly. Ischemia of one or more coronary arteries could cause a wall motion abnormality, which could indicate coronary artery disease. The gold standard test to directly create an image of the coronary arteries and directly assess for stenosis or occlusion is a cardiac catheterization. A stress echo is not invasive and is performed in the presence of a licensed medical professional, such as a cardiologist, and a cardiac sonographer. Three-dimensional echocardiography[edit] Three-dimensional echocardiogram of a heart viewed from the apex Three-dimensional echocardiography also known as four-dimensional echocardiography when the picture is moving is now possible, using a matrix array ultrasound probe and an appropriate processing system. This enables detailed anatomical assessment of cardiac pathology, particularly valvular defects, [5] and cardiomyopathies. All generic models refer to a dataset of anatomical information that uniquely adapts to variability in patient anatomy to perform specific tasks. Built on feature recognition and segmentation algorithms, this technology can provide patient-specific three-dimensional modeling of the heart and other aspects of the anatomy, including the brain, lungs, liver, kidneys, rib cage, and vertebral column. The ultrasound contrast is made up of tiny microbubbles filled with a gas core and protein shell. This allows the microbubbles to circulate through the cardiovascular system and return the ultrasound waves, creating a highly reflective image. There are multiple applications in which contrast-enhanced ultrasound can be useful. The most commonly used application is in the enhancement of LV endocardial borders for assessment of global and regional systolic function. Contrast may also be used to enhance visualization of wall thickening during stress echocardiography, for the assessment of LV thrombus, or for the assessment of other masses in the heart. Contrast echocardiography has also been used to assess blood perfusion throughout myocardium in the case of coronary artery disease. There are three subspecialties for individual accreditation: Accredited radiographers, sonographers, or other professionals are required to pass a mandatory exam. Cardiologists and sonographers who wish to have their laboratory accredited by IAC must comply with these standards. The purpose of accreditation is to maintain quality and consistency across echocardiography labs in the United States. Accreditation is offered in adult and pediatric transthoracic and transesophageal echocardiography, as well as adult stress and fetal echo. Accreditation is a two part process; first each facility will conduct a detailed self-evaluation, paying close attention to the IAC standards and Guidelines. The facility will then complete the application and submit actual case studies to the board of directors for review. Once all requirements have been met, the lab will receive IAC certification. IAC certification is a continual process and must be maintained by the facility, this may include audits or site visits by the IAC. Under both credentialing bodies sonographers must first document completion of prerequisite requirements, which contain both didactic and hands-on experience in the field of ultrasound. Applicants must then take a comprehensive exam demonstrating knowledge in both the physics of ultrasound and the clinical competency related to their specialty. In , New Mexico and Oregon became the first two states to require licensure of sonographers. One of the most important rolls that the ASE plays is providing their recommendations through the ASE Guidelines and Standards, providing a resource and educational opportunities for sonographers and physicians in the field.

Chapter 6 : Cardiovascular Ultrasound | Echocardiography | DAIC

Point-of-care ultrasound (POCUS) is a powerful diagnostic tool in the emergency department. To identify reversible causes of pulseless electrical activity (PEA), emergency physicians have started integrating POCUS into the evaluation of patients in cardiac arrest, leading to its current.

One key to learning cardiac US is to remember the proper position of the transducer for each view. Each view requires a different transducer position and necessitates practice to achieve mastery. Parasternal Long Axis View The patient should be lying supine, or if necessary due to difficulty visualizing the heart, in the left lateral decubitus position. Some will find it easier to start on the sternum and slide to the 4th LICS. Once in the correct location, make slight adjustments, rock the probe back and forth, and fan until the desired image comes into view. In this location the right heart is most superficial such that in the US image the right heart is sitting on top of the left heart. The important structures to identify in this view are the right ventricle, left ventricle, left ventricular outflow tract, aortic valve, aorta, mitral valve, left atrium, and pericardium. The heart as seen in the parasternal long axis view. In this view the right heart sits on top of the left heart, with the apex of the heart pointed towards the left of the screen. Now the heart is visualized in a plane perpendicular to the plane of the parasternal long axis. Rock and fan until a clear cross-section view of the left ventricle is achieved. Angling the probe up towards the base of the heart opposite of the apex of the heart will bring the aortic valve into view. Fanning the probed away from the base, towards the apex, will bring the mitral valve into view. In the parasternal short axis view fanning away from the base of the heart allows the mitral valve to be visualized. In the parasternal short axis view fanning towards the apex allows the papillary muscles to be visualized. To find the apical four chamber view, locate the apical impulse point of maximal impulse. This will serve as a good starting place for the probe. It may be necessary to move the probe around, but by fanning and rocking one should be able to see all major structures of the heart in one image. The ventricles sit on top of the atria in this view because the probe is closest to the ventricles at the apex of the heart. The mitral and tricuspid valves are found in between the atria and ventricles. In the apical 4 chamber view the left side of the heart is on the right side of the screen and the ventricles sit on top of the atria. A better image is achieved when the patient bends their knees, relaxing the abdominal muscles. The probe is placed right of midline in order to utilize the liver as an acoustic window and avoid the left-sided bowel gas that would scatter the US waves. When attempting to achieve this view, it is necessary to apply significant pressure with the probe against the abdominal wall to send the US waves beneath the rib cage. All four chambers should be visible in this view with the right ventricle closest to the probe, thus, at the top of the screen. The increased pericardial pressure prevents the heart from expanding properly, inhibits ventricular filling and, therefore, dramatically decreases cardiac output. Patients suffering from a pericardial effusion will present with acute onset dyspnea and paradoxical pulse. On US exam, blood in the pericardial space will appear as a dark, anechoic stripe surrounding the heart. Larger effusions are more likely to be circumferential, seen in front of and behind the heart. A pericardial effusion as seen in the apical four chamber view A pericardial effusion as seen in the parasternal long axis view Fluid in the restricted space of the pericardium causes increased pressure and compresses the heart chambers. The right heart, due to its lower pressure, will begin to collapse. As the chamber collapses, it is possible to observe a slight inward serpentine diastolic deflection of the right atrial or right ventricular free wall. In severe effusions, the chamber will experience complete diastolic collapse. Take care to distinguish true diastolic collapse from systolic contraction, as these can easily be mistaken in a tachycardic patient. Real time ECG can help with this distinction. Alternatively, observe the opening of the mitral valve to determine when diastole begins. It is commonly measured using the Simpson method. The Simpson and other methods used to measure EF are beyond the scope of this book. EF measurements are at times inaccurate, and it is up to the physician to know when to trust them or not. For that reason, it is vital that medical students practice cardiac US scanning and familiarize themselves with the appearance of a normal functioning heart. Evaluate the heart for the following characteristics: Inward motion of the endocardium. All parts of the endocardium should contract inwardly in unison during systole. Multiple views will need to be obtained to ensure that no part of the heart is failing to contract. The walls of the endocardium can be described as moving normally, hypokinetically slower , akinetically not moving at all , or dyskinetically moving in the wrong direction. Thickness of the myocardium The myocardium of the left ventricle should be assessed in multiple views. Myocardium that is especially thin 3. Proper motion of the valves Color flow Doppler is very useful when evaluating cardiac valves, as it reveals stenotic or insufficient valves. This modality explicitly captures the abnormal movement of blood flowing through the valves. Other valve abnormalities, like prolapse, scarring, calcification, or thickening can also be detected using US. Geometry of the ventricle Similar to evaluating for wall thickness or wall motion, evaluating for abnormal ventricle geometries can aid in the diagnosis of an acute MI or stable coronary artery disease even before an ECG will pick them up.

Chapter 7 : Ultrasound FAQs

Ultrasound of the coronary arteries is done most commonly as an aid to angioplasty with stent placement, a procedure which expands and keeps the blocked arteries open. This procedure, also called cardiac catheterization, is done in patients at high risk for a heart attack or stroke because of the significant reduction in the diameters of the.

Chapter 8 : Heart Ultrasound

The heart ultrasound specialist physician will explain the findings of the heart ultrasound to your own doctor. You may need to undergo additional tests, or treatment may be recommended. Treatment for heart problems includes medication, surgery, and lifestyle modification.

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to the diagnostic value of cardiac ultrasound in clinical settings relevant to their scope of www.nxgvision.coms led to the conceptof focused use of cardiac ultrasound.