Upper extremity arterial ultrasound worksheet

17 Ultrasonic evaluation of low-limb arteries The purpose of non-invasive tests for lower limb arterial disease is to provide objective information that can be combined with medical history and physical examination to serve as the basis for decisions relating to subsequent evaluation and treatment. One of the most critical decisions concerns whether a patient requires therapeutic intervention and should undergo additional imaging studies. Catheter contrast artery has generally been considered as the definitive test for lower limb arterial disease, but this approach is invasive, expensive and inadequate for screening or long-term follow-up tests. In addition, arteryography provides anatomical and non-physiological information, and is subject to significant variability at the time of interpretation.1.2 Magnetic resonance angiography (MRA) and computed tomographic angiography (CAA) can also provide an accurate anatomical assessment of lower limb arterial disease without some of the risks associated with catheter arteryography.3–5 There is evidence that the application of these less invasive approaches to arterial imaging has decreased the use of diagnostic catheter arteryography.6 The method More valid physiological to detect hemodynamically significant lesions is a direct measure of intra blood pressure, but this method is impractical in many clinical situations. As discussed in Chapter 14, non-effigy or indirect physiological tests for lower limb arterial diseases, such as measuring systolic ankle blood pressure and segmental limb pressures, provide valuable physiological information, but give relatively little anatomical detail.7 Duplex scanning expands the capabilities of indirect tests by obtaining anatomical and physiological information directly from sites The initial application of duplex scans focused on the clinically important problem of extracranial carotid artery disease. The focal nature of carotonic atherosclerosis and the relatively surface location of the caroton fork have contributed to the success of these early studies.8 Continued clinical experience and technological advances, especially the availability of low frequency duplex transducers, have made it possible to obtain image and flow information of vessels deeply located in the abdomen and lower limbs. This chapter reviews the current state of the scan for the initial assessment of low-limb arterial disease. The most specialized applications of intraoperative evaluation and monitoring after arterial interventions are covered in chapter 18. A standard duplex ultrasound system High resolution B-mode images, pulsed Doppler spectral wave shape analysis, and doppler color flow images is suitable for scanning the lower extremity arteries. A One transducers is often necessary for a full examination of lower limb arterial duplex. Low frequency transducers (2 MHz or 3 MHz) are best for evaluating the aorta and ilif arteries, while a higher frequency transducer (5 MHz or 7.5 MHz) is suitable in most patients for infra-inguine vessels. In general, the most frequent transducer should be used that provides adequate depth penetration. The color flow image helps identify vessels and flow abnormalities caused by arterial injuries (Figures 17-1 and 17-2). The ability to visualize flow through a ship improves the accuracy of the placement of the volume of pulsed doppler samples to obtain spectral wave shapes. Thus, the color flow image reduces exam time and improves overall accuracy. Power Doppler is an alternative method for displaying flow information that is particularly sensitive to low flows. The power doppler display also depends less on the direction of the flow and angle of the ultrasonic beam than the Doppler color, and tends to produce a more arteriogram ship image. Duplex instruments are equipped with predefined or combinations of ultrasound parameters for grayscale images and Doppler that can be selected by the examiner for a particular application. These predefineds may be useful, especially during the learning process, but these parameters may not be suitable for all patient examinations. A complete understanding of the ultrasonic parameters that are under the control of the examiner (i.e. color gain, color speed scale, wall filter) is essential to optimize arterial duplex scans. Similar to other arterial duplex scanning applications, the lower limb assessment relies on high-quality B-mode images to identify the artery of interest and facilitate the precise placement of the pulsed Doppler sample volume for spectral wave shape analysis.9 Both color flow and power doppler images provide important flow information to guide the spectral doppler interrogation. These imaging modalities are also valuable for recognizing anatomical variations and identifying arterial diseases by showing plaque or calcification. However, it should be noted that doppler color flow and doppler image power are not replacements for spectral wave analysis, the main method for classifying the severity of arterial disease.10 When examining an arterial segment, it is essential that the ultrasonic probe moves sequentially at small intervals along the artery in order to evaluate blood flow patterns in an overlap This is necessary because the flow alterations caused by arterial injuries are along the ship for a relatively short distance. Experimental work has shown that high-speed jets and turbulence associated with arterial stenosis are cushioned at a distance of only a few diameters from the ship.11 Consequently, no localized flow abnormalities could lead to underestimate of the severity of the disease. Because local flow alterations are usually evident with color flow images (see Figure 17-1), pulsed doppler flow samples can be obtained at more widely spaced intervals when using the Doppler color flow. However, it is advisable to evaluate the characteristics of the flow with spectral wave-shaped analyses at frequent intervals, especially in patients with diffuse arterial disease. The lengths of the hidden arterial segments can be measured with a combination of B mode, color flow and power doppler images visualizing the occlusion point proximally and the distal place where the flow is reconstituted through collateral vessels. Because distal flow speeds in an ocluded segment may be low, it is important to adjust the instrument's Doppler image parameters to detect low flow rates. For ultrasonic examination of the aorta and iliad arteries, patients must be fasting for about 12 hours to reduce intestinal gas interference. Satisfactory aortoiliac doppler signals can be obtained from approximately 90% of people who are prepared in this way. In general, it is advisable to examine patients early in the morning after a fast night. The patient is placed in a critical condition. initially installs supine with the hips rotated externally. A left side decubitus position can also be advantageous for the abdominal part of the exam. An electric blanket placed on the patient avoids vasoconstriction caused by low ambient temperatures. For a full blood test of low limb, the scan begins with the upper part of the abdominal aorta. An earlier approximation of the aorta is used, with the transducer placed just below the xyloid process. Both ultrasonic images and Doppler signals are best obtained in the longitudinal plane of the aorta, but cross-sectional views are useful for defining anatomical relationships, evaluating branch ships and determining the transverse lumen (Figure 17-3). If specifically indicated, mesenteric and kidney vessels can be examined at this time, although these do not need to be routinely examined when evaluating the lower limb arteries. The aorta is dissected at its fork, which is displayed by placing the transducer at the level of the umbilicus and using an oblique approach (Figure 17-4). The illicit arteries are examined separately at the groin level with the transducer placed at the level of the iliad crest to evaluate common and dystal and proximal iliatic arteries (Figure 17-5). This may require the application of considerable pressure with the transducer to displace overlapping intestinal loops. The origin of internal iliad is used as a milestone to separate the common iliad from the outer iliad artery. Each lower limb is examined in turn, starting with the common femoral artery and working After studying the common deep femoral arteries and deep proximal femoral arteries, the surface femoral artery is followed as it spreads through the thigh. In the distal thigh, it is often useful to turn the patient into the position prone to examining the popliteal artery. However, some examiners prefer the image of the popliteal segment with the supine patient and the leg rotated externally and bent to the knee. As the popliteal artery is scanned in a longitudinal view, the first branch found below the knee joint is usually the anterior tibial artery. The tibial and peroneal arteries distal in the trunk can be difficult to fully examine, but they can usually be imagined with color flow or power doppler. The identification of these vessels is facilitated by viewing the adjacent paired veins (see Figure 17-2). These vessels are best evaluated by identifying their origins of the distal popliteal artery and scanning themselves distally or finding the arteries in the ankle and working proximally. Several large branches can often be seen originating from the femoral and popliteal superficial distal segments. These are easily displayed with color flow or power doppler images and represent the geniculate and corked arteries. Doppler pulsed spectral wave shapes are recorded from any area where speeds or other flow alterations are noted. Recordings must also be made in the following standard locations: (1) the proximal and distal abdominal aorta; (2) common, internal and external iliatic arteries; (3) common femoral and proximal arteries; (4) proximal, medium and distal surface femoral artery; (5) the popliteal artery; and (6) tibial/peroneal arteries in their origins and at ankle level. As with other arterial duplex scan applications, Doppler angle correction is required for precise speed measurements. Although a 60 degree angle is usually obtainable, angles below 60 degrees can be used to provide clinically useful information. A full examination of the aortoiliac system and arteries in both lower limbs may require 1 to 2 hours, but a single leg is usually evaluated in less than 1 hour. An example of a vascular laboratory worksheet for lower limb arterial duplex scanning is shown in figure 17-6. Jager and colleagues12 determined standard values for arterial diameter and maximum systolic flow speed in the lower extremity arteries of 55 healthy subjects (30 men, 25 women) from 20 to 80 years (Table 17-1). Although women had smaller arteries than men, the maximum speeds of systemic flow did not differ between men and women in this study. However, peak systemic speeds (PSVs) decreased steadily from the iliad to the popliteal arteries. There is no significant difference in speed measurements between the three arteries in normal subjects. TABLE 17-1 Average arterial diameters and peak systolic flow speeds * Artery diameter ± SD (cm) Speed ± SD (cm/sec) External iliad 0.79 ± SD (cm/sec) External iliad 0.79 ± ± 0.13 119.3 ± 21.7 Common femoral 0.82 ± 0.14 114.1 ± 24.9 Surface femor (proximal) 0.60 ± 0.12 90.8 ± 13.6 Surface femoral (distal) 0.54 ± 0.6 1 93.6 ± 14.1 Popliteal 0.52 ± 0.11 68.8 ± 13.5 SD, standard deviation. Data from Jager KA, Ricketts HJ, Strandness DE Jr: Duplex scan for the evaluation of arterial disease of the lower limbs. Bernstein EF, editor: Non-invasive diagnosis techniques in vascular disease, St. Louis, 1985, Mosby, pp 619-631. Spectral wave shapes taken from normal lower limb arteries show the characteristic pattern of tripasic speed that is associated with peripheral arterial flow (Figure 17-7). This flow pattern is also evident in the color flow imaging.13 The initial phase of high speed and forward flow resulting from cardiac sessola is followed by a brief reverse flow phase in the early diastole and a final phase of low-speed flow, forward to the end of diastole. The reverse flow component is a consequence of relatively high peripheral vascular resistance in normal low limb arterial circulation. Reverse flow becomes less prominent when peripheral resistance decreases. This loss of reversal of flow occurs in normal lower limbs with vasodilatation that accompanies exercise, reactive hyperemia, or warming of the limbs. The reverse flow component is also absent from severe lyclusive injuries. A similar tripasic flow pattern is seen in the peripheral arteries of the upper limbs (see chapter 15). The flow pattern in the central flow of normal lower limb arteries is relatively uniform, with red blood cells all having almost the same speed. Therefore, the flow is laminated, and the corresponding spectral wave shape contains a narrow band of frequencies with a clear area under the systemic peak (Figures 17-7 and 17-8). Arterial lesions interrupt this normal pattern of laminar flow and lead to characteristic changes that include increases in PSV and an extension of the frequency band known as spectral enlargement. Only golden members can continue reading. Sign in or sign up to continue