exp. may be seen in certain conduction abnormalities such as heart failure, where colour Doppler M-mode is particularly helpful for the rapid and careful evaluation of time-related events. This method allows the display of multiple beats on a single trace, changes to chamber dimensions over the respiratory cycle can be easily identified. For example, reciprocal changes in right and left ventricular dimensions during respiration, which occur secondary to enhanced ventricular interdependence as seen in cardiac tamponade, can be easily identified (Fig. 3.3). M-mode also provides excellent interface definition which may enhance the accuracy of chamber and great vessel measurements. This accuracy is further enhanced by utilising 2D imaging which assists in the precise alignment of the M-mode cursor as well as allowing the identification of anatomical structures transected by the cursor.

Colour Doppler M-mode incorporates both colour flow Doppler imaging (CFI) and M-mode. Therefore, colour Doppler M-mode provides information about time, distance, velocity and direction. This technique can be employed in the assessment of diastolic function of the left ventricle (LV) and can also be used in the timing of cardiac events and for the differentiation of constrictive pericarditis from restrictive cardiomyopathies. In particular, the graphical display of colour Doppler M-mode allows the rapid and careful evaluation of time-related events which may be missed via 2D imaging and CFI alone. An example where colour Doppler M-mode is particularly helpful is the recognition of diastolic mitral regurgitation (MR) which may be seen in certain conduction abnormalities such as heart blocks as well as with acute, severe AR (Fig. 3.4). Colour Doppler M-mode can also be used in the assessment of AR to measure the AR jet height (Fig. 3.5) and/or to determine the presence of pan-diastolic flow reversal in the descending and/or abdominal aorta (Fig. 3.6).

Disadvantages of M-Mode

The predominant limitation of M-mode is its lack of direct spatial information and its one-dimensional nature such that only the structures transected by the M-mode cursor are displayed. Acquisition of data from a single dimension also poses significant limitations in providing information about a three-dimensional structure. When the LV is uniformly shaped with a long (major) axis to short (minor) axis ratio of 2:1, the M-mode-derived ejection fraction is relatively reliable. However, in most pathological states such as coronary artery disease, the long axis to short axis ratio is altered. In this instance, the M-mode-derived ejection fraction is often misleading. Furthermore, accuracy of M-mode measurements is also dependent on the recognition of clearly defined borders, which are often ambiguous. In addition, many of the “older” M-mode measurements for the indirect assessment of LV performance, such as systolic time intervals, are affected by numerous variables and are, therefore, unreliable. Likewise, many of the M-mode “signs” of cardiac diseases such as those described for pulmonary hypertension, vegetations and aortic valve disease, are not specific or sensitive and have been superseded by more reliable and accurate Doppler techniques.

Optimisation of M-mode Traces

Many instrument controls used to optimise 2D images can also be manipulated to optimise M-mode traces. In particular, the gain and TGC should be adjusted to ensure that the blood pool appears echo free and that structures of similar acoustic properties are displayed at similar echo amplitudes. B-colour maps can also be applied to the M-mode trace in an attempt to enhance subtle soft tissue differences (Fig. 3.7). Alignment of the M-mode cursor is of paramount importance when using M-mode for measurements. The M-mode cursor should be aligned perpendicular to the structure being measured. The sweep speed, which refers to the horizontal display rate of the M-mode trace, is adjusted according to information required. For example, sweep speeds of between 60-75 mm/s are adequate for linear measurements while faster sweep speeds of between 100-200 mm/s should be employed for any measurements relating to time. Slower sweep speeds between 25-50 mm/s are useful for observing respiratory variation in right and left ventricular dimensions as seen in cardiac tamponade and constrictive pericarditis.

Further Reading

(listed in alphabetical order)