MEASUREMENT OF CARDIAC OUTPUT USING TRANSOESOPHAGEAL ECHO/DOPPLER

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TEE has made incomparable evolution as a contributor for diagnosis and monitoring of critically ill patients due to its ability to provide very important information regarding cardiac geometry and dimensions and ability to assess cardiac functions. The four chamber view and the transgastric short axis view at the level of papillary muscle are the most important views for intraoperative hemodynamic monitoring. On observing aortic valve we find that it takes the shape of Mercedes Benz sign when it is closed, becomes triangular in midsystole and then becomes circular in late systole. For doppler application along aortic valve and left ventricular outflow tract we use deep transgastric view and transgastric view at angle 110 degrees as doppler beam is parallel to blood flow direction in these views which is important for accurate doppler measurements.

\[ \text{CO} = \text{HR} \times \text{SV} \] for stroke volume measurement we can use M-mode, 2D mode and doppler methods. M-mode method is based on measuring end diastolic and end systolic diameters and changing them into end diastolic and end systolic volumes respectively using Teicholz equation \((V=7D^3/2.4+D)\) where \(V\) is volume and \(D\) is diameter. M-mode measurement is useful if uniform heart with no segmental wall motion abnormalities. 2D methods include Area-length method which applies for symmetrical heart and Simpsons rule method which is suitable for both symmetrical and asymmetrical hearts. Doppler measurements can be done through aortic valve, LVOT, mitral valve, RVOT, tricuspid valve and pulmonary valve. However measurements through aortic valve and LVOT are the most accurate. Doppler measurements are based on measuring cross sectional area of an orifice (CSA) and measuring velocity time integral of blood flowing through this orifice (VTI).

\[ \text{SV} = \text{CSA} \times \text{VTI} \]

\[ \text{CO} = \text{SV} \times \text{HR}. \]