# Echocardiography: Reference Intervals & Functional Assessment

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British Society of Echocardiography

## Graded Reference Intervals

| | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|
| **LV Dimensions, Volumes & Mass** | **Normal** | **Mild** | **Moderate** | **Severe** | **Normal** | **Mild** | **Moderate** | **Severe** |
| LVID diastole (mm) | 37–56 | 57–61 | 62–65 | > 65 | 35–51 | 52–55 | 56–59 | > 59 |
| LVID systole (mm) | 22–41 | 42–45 | 46–50 | > 50 | 20–37 | 38–42 | 43–46 | > 46 |
| LVEDV indexed (ml/m²) | 30–79 | 80–91 | 92–103 | > 103 | 29–70 | 71–81 | 82–91 | > 91 |
| LVESV indexed (ml/m²) | 9–31 | 32–36 | 37–42 | > 42 | 8–27 | 28–32 | 33–37 | > 37 |
| LV mass indexed (g/m²) | 40–110 | 111–127 | 128–145 | > 145 | 33–99 | 100–115 | 116–131 | > 131 |

| **LV Function** | **Normal** | **Borderline Low** | **Impaired** | **Severely Impaired** |
|---|---|---|---|---|
| LV ejection fraction (%) | ≥ 55 | 50–54 | 36–49 | ≤ 35 |

| **LA Size** | **Normal** | **Borderline** | **Dilated** |
|---|---|---|---|
| Volume indexed (ml/m²) | < 34 | 34–38 | > 38 |

## Notes

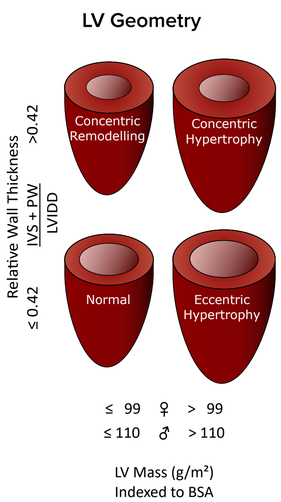
Indexing is vital to the interpretation of chamber dimensions, height and weight should be entered before measurements. These reference intervals are not valid for 3D measurements. Caution should be used in athletes and pregnant subjects. The dataset is based on a largely Caucasian population and ethnic variations do occur. LV & LA volumes should be measured from separate dedicated 4C and 2C views, avoiding foreshortening. Use Simpson's method and index to BSA. LV mass is derived from 2D linear measurements, indexed to BSA. Borderline LVEF% should prompt a full assessment of "normality" (eg, volumes, valves, s', e', GLS & functional studies), other modalities and reference to past studies. A repeat study in 6–12 months should be considered. Avoid the terms mild or moderate LV dysfunction: quote LVEF%. RV & RA areas should be measured from a dedicated focused window and indexed to BSA. Linear measurements remain important to identify regional pathology. Aortic dimensions should be inner-edge to inner-edge at end-diastole, indexed to height, not BSA.

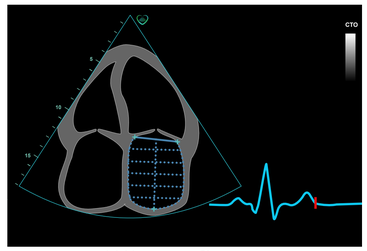
**End-diastole:** frame before MV closes

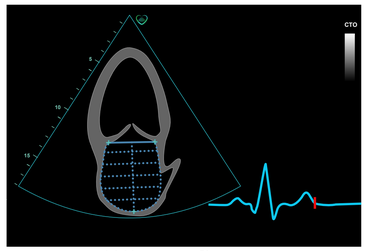
**End-systole:** frame before MV opens, where AV just closes

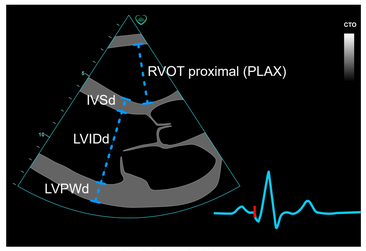
## Reference Intervals

| **LV Dimensions, Volumes & Mass** | **Male** | **Female** |
|---|---|---|
| IVS diastole (mm) | 6–12 | 5–11 |
| PW diastole (mm) | 6–12 | 6–12 |
| LVID diastole (mm) | 37–56 | 35–51 |
| LVID systole (mm) | 22–41 | 20–37 |
| LVEDV (ml) | 53–156 | 46–121 |
| LVESV (ml) | 15–62 | 13–47 |
| LVEDV indexed (ml/m²) | 30–79 | 29–70 |
| LVESV indexed (ml/m²) | 9–31 | 8–27 |
| LV mass (g) | 72–219 | 51–173 |
| LV mass indexed (g/m²) | 40–110 | 33–99 |
| **Mean Mitral Annular s'** | | |
| Age 20–40 | ≥6.4 | ≥6.4 |
| Age 40–60 | ≥5.7 | ≥5.7 |
| Age > 60 | ≥4.9 | ≥4.9 |
| **Aortic Root** (indexed to height) | | |
| Sinus of Valsalva (mm/m) | 13.8–21.8 | 13.1–20.7 |
| Sino-tubular junction (mm/m) | 11.4–18.6 | 11.0–17.8 |
| Proximal ascending aorta (mm/m) | 11.5–19.9 | 11.4–19.8 |
| **RV Dimensions** | | |
| RVOT proximal (PLAX) (mm) | 25–43 | 22–40 |
| RVOT1 proximal (PSAX) (mm) | 24–44 | 20–42 |
| RVOT2 distal (PSAX) (mm) | 16–29 | 14–28 |
| RVD1 Base (mm) | 26–47 | 22–43 |
| RVD2 Mid (mm) | 19–42 | 17–35 |
| RVD3 Long (mm) | 55–87 | 51–80 |
| RVED area indexed (cm²/m²) | ≤ 13.6 | ≤ 12.6 |
| Fractional Area Change (%) | ≥ 30 | ≥ 35 |
| TAPSE | ≥ 17 | ≥ 17 |
| RV s' (cm/s) | ≥ 9 | ≥ 9 |
| **RA Dimensions** | | |
| RA area (cm²) | ≤ 22 | ≤ 19 |
| RA area indexed (cm²/m²) | ≤ 11 | ≤ 11 |

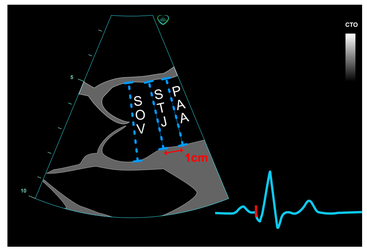




LA Volume by Simpson's

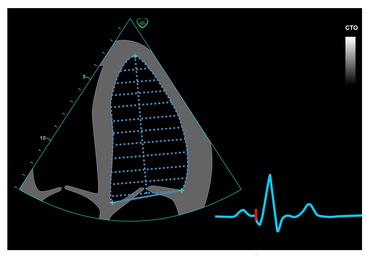

LA Volume by Simpson's

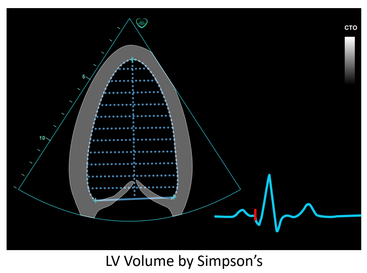


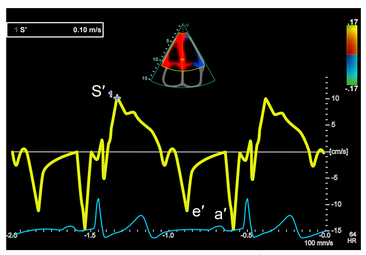
LV & RV Diastolic Dimensions



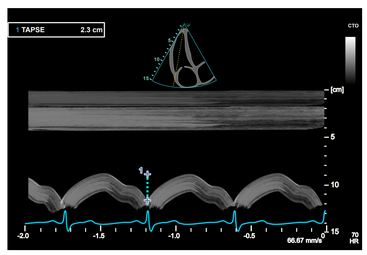
Aortic Dimensions


LV Volume by Simpson's

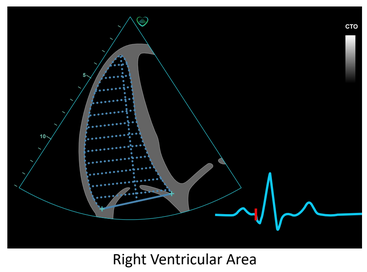

LV Volume by Simpson's

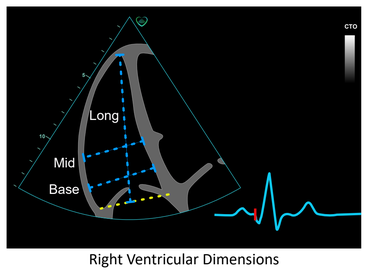


Septal Mitral Annular S'

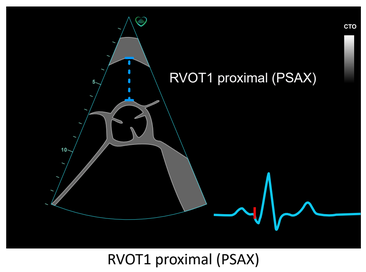


TAPSE

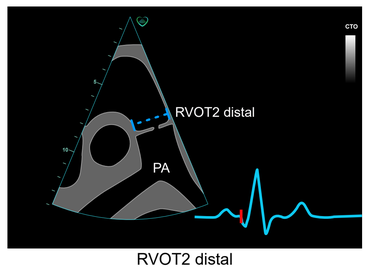

Right Ventricular Area



Right Ventricular Dimensions



RVOT1 proximal (PSAX)



RVOT2 distal

**References:**

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