Cardiovascular applications of ultrasound

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References

[1] Bom, N., Lancée, C. J. and Honkoop, J.: Ultrasonic viewer for cross-sectional analysis of moving cardiac structures. Biomed. Engng. 6, 500–508 (1971).
[2] Trendelenburg, P.: Physiologische und pharmakologische Versuche über die Dünndarmperistaltik. Arch. exp. Path. Pharmakol. 81, 55–129 (1917).
[3] Van Nueten, J. M.: The effect of diphenoxylate on the peristaltic reflex of the guinea pig ileum. Arch. int. Pharmacodyn. 171, 243–245 (1968).
[4] Van Nueten, J. M., Geivers, H., Fontaine, J. and Janssen, P. A. J.: An improved method for studying peristalsis in the isolated guinea pig ileum. Arch. int. Pharmacodyn. 203, 411–414 (1973).
[5] Van Nueten, J. M. and Janssen, P. A. J.: Difenoxine (R 15403): The active metabolite of the diphenoxylate (R 1132). Arzneimittelforsch. 22, 518–520 (1972).
[6] Wells, P. N. T.: Physical principles of ultrasonic diagnosis. Publ.: Academic Press, London-New York (1969).

DISCUSSION TO PART II

RECORDATI: In the Istituto Ricerche Cardiovascolari in Milan, the sonomicrometer technique has been used to measure right atrial dimensions in open-chest cats. The piezoelectric crystals were sutured externally on the atrial walls, facing each other along a transverse diameter. The technical details and the frequency response of the system were similar to those reported by L. D. Horwitz and V. S. Bishop (Cardiov. Res. 6, 163, (1972)). Fig. 6 shows recordings of arterial blood pressure (AP), right atrial pressure (RAP), right atrial diameter (RAD) and ECG in a cat with a spontaneous heart rate of 141 beats/min. Five different phases can be distinguished in the atrial dimensional changes. Phase 1 corresponds to the atrial filling and is accompanied by a simultaneous increase in atrial pressure (V wave). The maximum diameter, the end-diastolic diameter, is reached at the end of phase 1, as indicated by an upward arrow. During phase 2, starting at the opening of the A–V valves, the

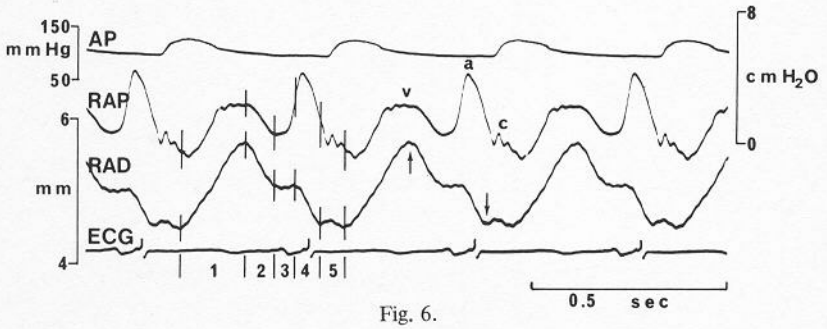

Fig. 6.

atrial diameter begins to decrease; during this passive atrial emptying the rapid ventricular filling occurs. The decrease in diameter is accompanied by a parallel fall in atrial pressure (*y* descent). During phase 3 the diameter remains relatively constant (atrial dyastasis). However, atrial systole begins during this phase, as indicated by the sharp rise in atrial pressure. The systolic isolength period (which lasts about 30 msec) indicates the existence of an isovolumic phase of atrial contraction. Active atrial emptying (atrial systole) occurs in phase 4, during which the peak systolic pressure (a wave) is attained. The diameter level reached at the end of this phase, the end-systolic diameter, is indicated in the figure by a downward arrow. The dimensional changes in phase 5, corresponding to the *c* wave of the atrial pressure curve, are produced by the movements of the A–V valves and of the A–V ring during ventricular contraction.

The sonomicrometer technique can be usefully applied in studies on the dynamics of a thin-wall, low-pressure cardiac chamber. The direct determination of atrial pressure–volume relationships is furthermore basically important in evaluating the natural stimuli which initiate the nervous activity of vagal (A. S. Paintal, Ergbn. Physiol. 52, 74, (1963)) and sympathetic (A. Malliani et al., J. Physiol. 229, 457, (1973)) afferent fibres with atrial sensory endings. endings.