consists of more than simply auscultating the heart. Many diseases of the cardiovascular system can affect and be affected by other organ systems. Therefore, a detailed general physical examination is essential. The general appearance of a patient is helpful: Such observations as skin color, breathing pattern, whether pain is present, and overall nutritional status can provide clues regarding the diagnosis. Examination of the head may reveal evidence of hypothyroidism, such as hair loss and periorbital edema, and examination of the eyes may reveal exophthalmos associated with hyperthyroidism. Both conditions can affect the heart. Retinal examination may reveal macular edema or flame hemorrhages which can be associated with uncontrolled hypertension. Findings such as clubbing or edema when examining the extremities, and jaundice or cyanosis when evaluating the skin, may provide clues to undiagnosed cardiovascular disease.

Examination of the Jugular Venous Pulsations

Examination of the neck veins can provide a great deal of insight into right heart hemodynamics. The right internal jugular vein should be used, because the relatively straight course of the right innominate and jugular veins allows for a more accurate reflection of the true right atrial pressure. The longer and more winding course of the left-sided veins does not allow for as accurate a transmission of hemodynamics. For examination of the right internal jugular vein, the patient should be placed at a 45-degree angle—higher in patients with suspected elevated venous pressures and lower in those with lower venous pressures. The head should be turned to the left and light shined at an angle over the neck. Although the internal jugular vein itself is not visible, the pulsations from that vessel are transmitted to the skin and can be seen in most cases. The carotid artery lies in close proximity to the jugular vein, and its pulsations can sometimes be seen as well. Therefore, one must be certain one is observing the correct vessel. This can be accomplished by applying gentle compression at the site of pulsations. An arterial pulse will not be obliterated by this maneuver, whereas a venous pulse likely will become diminished or absent with compression. In addition, an arterial pulse is usually much more forceful and vigorous.

Both the level of venous pressure and the morphology of the venous waveforms should be noted. Once the pulsations have been located, the vertical distance from the sternal angle (angle of Louis) to the top of the pulsations is determined. Because the right atrium lies about 5 cm vertically below the sternal angle, this number is added to the previous measurement to arrive at an estimated right atrial pressure in centimeters of water. The right atrial pressure is normally 5 to 9 cm H_2O. It can be higher in patients with decompensated heart failure, disorders of the tricuspid valve (regurgitation or stenosis), restrictive cardiomyopathy, or constrictive pericarditis.

With inspiration, negative intrathoracic pressure develops, venous blood drains into the thorax, and venous pressure in the normal patient falls; the opposite occurs during expiration. In a patient with conditions such as decompensated heart failure, constrictive pericarditis, or restrictive cardiomyopathy, this pattern is reversed (Kussmaul sign), and the venous pressure increases with inspiration. When the neck veins are examined, firm pressure should be applied for 10 to 30 seconds to the right upper quadrant over the liver. In a normal patient, this will cause the venous pressure to increase briefly and then return to normal. In the patient with conditions such as heart failure, constrictive pericarditis, or substantial tricuspid regurgitation, the neck veins will reveal a sustained increase in pressure due to passive congestion of the liver. This finding is called hepatojugular reflux.

The normal waveforms of the jugular venous pulse are depicted in Figure 3-1A. The *a* wave results from atrial contraction. The *x* descent results from atrial relaxation after contraction and the pulling of the floor of the right atrium downward with right ventricular contraction. The *c* wave interrupts the *x* descent and is generated by bulging of the cusps of the tricuspid valve into the right atrium during ventricular systole. This occurs at the same time as the carotid pulse. Atrial pressure then increases as a result of venous return with the tricuspid valve closed during ventricular systole; this generates the *v* wave, which is typically smaller than the *a* wave. The *y* descent follows as the tricuspid valve opens and blood flows from the right atrium to the right ventricle during diastole.

Understanding of the normal jugular venous waveforms is paramount, because these waveforms can be altered in different disease states. Abnormalities of these waveforms reflect underlying structural, functional, and electrical abnormalities of the heart (see Fig. 3-1B to G). Elevation of the right atrial pressure leading to jugular venous distention can be found in heart failure (both systolic and diastolic), hypervolemia, superior vena cava syndrome, and valvular disease. The *a* wave is exaggerated in any condition in which a greater resistance to right atrial emptying occurs. Such conditions include pulmonary hypertension, tricuspid stenosis, and right ventricular hypertrophy or failure. *Cannon a waves* occur when the atrium contracts against a closed tricuspid valve, which can occur with complete heart block or any other situation involving AV dissociation. The *a* wave is absent during atrial fibrillation. With significant tricuspid regurgitation, the *v* wave becomes very prominent and may merge with the *c wave*, diminishing or eliminating the *x* descent. With tricuspid stenosis, there is impaired emptying of the right atrium, which leads to an attenuated *y* descent. In pericardial constriction and restrictive cardiomyopathy, the *y* descent occurs rapidly and deeply, and the *x* descent may also become more prominent, leading to a waveform with a W-shaped appearance. With pericardial tamponade, the *x* descent becomes very prominent while the *y* descent is diminished or absent.

TABLE 3-3 CLASSIFICATION OF FUNCTIONAL STATUS*

Class I	Uncompromised	Ordinary activity does not cause symptoms; symptoms occur only with strenuous or prolonged activity.
Class II	Slightly compromised	Ordinary physical activity results in symptoms; no symptoms at rest.
Class III	Moderately compromised	Less than ordinary activity results in symptoms; no symptoms at rest.
Class IV	Severely compromised	Any activity results in symptoms; symptoms may be present at rest.

**Symptoms* refers to undue fatigue, dyspnea, palpitations, or angina in the New York Heart Association classification and refers specifically to angina in the Canadian Cardiovascular Society classification.