VENOUS HUM IN CARDIAC AUSCULTATION

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The venous hum, a continuous murmur usually of maximum intensity in the supraclavicular area, is a common auscultatory finding. Heard particularly in children, it is of no known pathological significance. Its importance lies rather in its often close resemblance, because of its continuous or predominantly diastolic character, to pathological murmurs. Our interest in the venous hum stems from the observation of numerous patients in the cardiology and pediatric clinics of the Medical College of South Carolina, in whom the murmur was transmitted down to various areas of the precordial where its presence was of concern in auscultation.

In this presentation the clinical features of venous hum are discussed as they pertain to cardiac auscultation. Emphasis is placed on procedures that permit the differentiation of this murmur from murmurs of pathological significance on the basis of clinical findings alone.

Most present-day textbooks of cardiology and pediatrics give brief, if any, mention of venous hum. In the older literature it received considerably more attention and was, in fact, one of the earliest recorded auscultatory findings. Laennec \(^1\) seems to have been describing the venous hum (which he believed to arise in the carotid arteries) when he wrote "Sometimes...particularly when seated in the carotids, the thrill is much more extended than the diameter of the artery, and seems more superficial; it is sometimes perceptible over a space of two inches in breadth on the side of the neck. In this case the thrill is continuous and without any pulsative momentum; and its sphere seems more extended, the lighter the pressure is made with the finger." He notes later a case of an adult in whom the sound could be heard only in one position, having "...no thrill or belows-sound in the heart or arteries when lying down, or sitting up in the usual manner; but if he raised himself in bed supporting himself on his elbow, a slight but very distinct purring thrill and also belows-sound became perceptible over the extent of an inch square, a little above the right clavicle..." Laennec described clearly the to and fro nature of the continuous murmur "...as if the artery were become a vibrating string, from which two or three notes were drawn out in succession, by advancing and drawing back the finger upon it." His observation that the murmur occasionally has a musical quality is picturesque: "In four cases I have met with this sound (which is literally musical) in the carotid arteries. In one of these cases, I at first conceived the sound to arise from an instrument in the apartment below. On a close examination it was found, that the musical notes were associated with a slight vibration of the artery, which, during its diastole, seemed to brush the edge of the stethoscope."

During the 1830's in England Hope \(^2\) made careful clinical studies of "the loud murmur of the internal jugulars." He demonstrated that its origin was venous rather than arterial as Laennec had supposed: "On depressing the finger with sufficient force to obliterate the vein, without obliterating the carotid artery, the continuous murmur, together with the musical notes, instantly cease: which is conclusive proof that both are seated in the vein." His theory as to actual method of genesis of the sound seems as reasonable as any, that "in order to produce the murmur of the internal jugular in perfection, it was necessary to avert the face while the neck was kept perpendicular and the chin well raised. The mode in which this position acts is, in my opinion, by placing the vessel in a moderate state of tension, which is favorable to the vibration of its walls, and also increases the sonorous effect of pressure accidentally exercised on it at any particular point, as, for instance, by the sternomastoid muscle where it crosses in front of the vein. Accordingly, when the head is restored to its natural position, or is depressed, the vein is relaxed and the murmur ceases or greatly diminishes." Hope also noted that "the venous murmur is on a much lower key than the arterial belows murmur," that it "experiences augmentations corresponding with each arterial diastole," that it "becomes louder during inspiration,—especially about its end, and weaker during expiration," and that "by the adroit management of pressure with the stethoscope over or near large veins, the venous murmur may often be raised by a gradual swell, into a more or less musical hum, such as is yielded by a child's humming top." Hope then added, "I propose to denominate this the Venous Hum." There is little to add to these clinical descriptions of more than a hundred years ago.

The prevalence of venous hums in children was investigated by Landis and Kaufman \(^3\) in a 1912 study in which they reported finding it in 84 of 99 children under 15 years of age examined at the Phipps Institute. In all it was described as a continuous murmur heard in the erect position and diminishing or, usually, disappearing completely in the recumbent position. Of the 84 cases it was heard loudest on the right side of the neck in 42, on the left in 17, and equally loud on both sides in 25. They felt that, contrary to the opinion of some of the earlier writers, the murmur had no definite relationship to anemia except, perhaps, that in anemic individuals there was perhaps less tendency for the sound to disappear on recumbency. It was their contention that "the venous hum

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is present in the majority of children under 15 years of age, tending to diminish in frequency as that age is reached, and finally disappearing.

The auscultatory pitfall of mistaking a venous hum for a murmur of pathological significance was pointed up by Palmer and White in 1928 when they reviewed 14 cases referred for cardiac evaluation. They stressed the frequency with which the venous murmur appears at the precordium, transmitted downward from its site of origin, and its characteristic similarity to the continuous murmur of patent ductus arteriosus.

Of 250 children examined in Sweden, Graf, Moller, and Mannheimer found a venous hum in well over 50% under the age of 9, the incidence decreasing to about 30% at 12 to 15 years of age. In their series it was no more frequent on the right than the left side of the neck and could be heard equally well on both sides in half the cases. They likewise cited the continuous nature of the murmur, its accentuation on inspiration and on turning the head to the opposite side, its obliteration by jugular compression, and its maximum intensity at "the triangle of Sedillot, . . . the angle between the clavicle and the insertion of the sterno-eleido-mastoid muscle."

In addition to this clinical study they measured the sound frequencies in 40 cases as recorded by a system of "calibrated phonocardiography." Their results indicated that, in a venous hum, "the amplitude most often has its maximum in the frequency range of 50-175 cycles per second and often reaches 500 cycles per second."

Tausig in her book on congenital heart disease stresses the diastolic accentuation of venous hum. Its differentiation from the murmur of patent ductus arteriosus is aided by "the most characteristic of all features of the venous hum . . . its change in intensity with changes in position of the head and neck."

Our own study of the venous hum has not been a statistical one. We have not attempted to ascertain its incidence among patients admitted to the pediatric and outpatient clinics of the Medical College of South Carolina, but it is our impression that the incidence of a venous hum of sufficient intensity to be heard on careful auscultation of the entire precordial area is somewhat less than the incidence of an audible venous hum in the neck. We have, rather, attempted to study some characteristics of the sound itself in a group of 14 patients, all under 10 years of age, seen at this institution during a two month period. In most of these patients the hum was discovered as an incidental finding on routine physical examination. In a few cases cardiac evaluation had been requested, presumably on the basis of this auscultatory finding.

METHODS

Graphic recordings were made of the sounds as displayed on the screen of a double-beam cathode ray oscilloscope employing a method described in a previous report. By means of varying the recording (sweep) speed, two time-scales were used, one comparable to that of the phonocardiogram and the other a much faster speed revealing the wave forms and component frequencies of the sounds in detail.

An electronic heart sound pickup, recently developed in collaboration with the General Motors Research Laboratories, was used in direct contact with the body surface in place of a conventional phonocardiographic microphone. The pickup was designed primarily for low frequency pickup, and, in general, gave a slower recording of the heart sounds over a wider range of frequencies than the cathode ray oscilloscope. It was found to be especially useful in differentiating the frequency and amplitude characteristics of the cardiac sounds in various positions of the patient and in the study of children where the patient的合作性及对调查的配合度有限。
(subaudible) frequency recording but has a useful range of 2 to 500 cps. In order to selectively emphasize frequencies in the audible range—those that compose the actual sounds heard on auscultation—low frequencies were attenuated by means of filters in the electronic am-
amplifier so that, e.g., all those below 30 cps appear in these tracings at least 15% of their actual amplitude. Otherwise the relatively slow movements of venous and
carotid pulsation would obliterate the much smaller sound vibrations. Such filtering is of course not essential with the use of ordinary microphone pickups that are themselves insensitive to very low frequencies.

**SOUND TRACINGS**

The continuous nature of the venous hum murmur is illustrated in figure 1A, recorded from the aortic area of

the precordium of a child aged 7. This is a slow-speed recording with the simultaneous electrocardiogram below for purposes of timing. Some increase in amplitude of

the murmur is observable during diastole, though this small difference is probably a minor factor in produ-

cing what to the ear is a prominent diastolic accentuation

of the sound. Figure 1B shows in contrast systolic accentuation of another continuous murmur, that of pa-

tent ductus arteriosus in a child aged 8. The two murmurs appear—and sound—otherwise quite similar.

In figure 2 portions of the same venous hum as re-

corded from the right supraclavicular area are expanded in
time so that each trace represents 0.13 second. A tri-

angular wave form of 100 cps frequency is included above as a time reference. Figure 2A, part of the systolic

phase of the hum, is essentially a noise type of pattern, like that of most heart murmurs, and is made up predomi-

nantly of an irregular assortment of frequencies on

the order of 50 to 100 cps with a few as high as 200 cps.

A diastolic portion of the hum, made at the same ampli-

fication, is depicted in figure 2B. It is seen to differ from

the systolic sound in that it contains many promi-

nent waves of higher frequency, ranging up to 250 cps, as well as being of somewhat greater over-all amplitude. In addition there are runs of more regular vibrations, tending to have a sinusoidal type of wave form, a char-

acteristic that was perceptible on auscultation as a cer-

tain musical quality in the hum. Doubtless the greater proportion of these higher frequencies, to which the ear is far more sensitive, is another reason for the audible ac-

centuation during diastole.

**CLINICAL CHARACTERISTICS**

The venous hum, a common auscultatory finding in
children, is frequently transmitted to the precordium where it may be heard with considerable intensity at the aortic and pulmonic areas, and occasionally as far down as the apex. Its point of maximum intensity is, however, readily traceable to the supraclavicular fossa, at a site approximately overlying the internal jugular vein, on one or both sides. Unlike the murmur of patent ductus arteriosus, which it resembles superficially, the venous hum has a diastolic rather than a systolic accentuation. Its fre-

quency, and hence its pitch, tends to be higher during the diastolic phase, often with some degree of musical quality.

The following characteristic features of venous hum are of value in differentiating it from murmurs of patho-

logical significance on clinical grounds alone. 1. It is louder with the subject in the sitting or erect position and diminishes or, usually, disappears altogether in rec-

umbency. 2. When the stethoscope is placed at the point of maximum intensity over the jugular vein, light pressure tends to increase intensity of the murmur while

heavy pressure abolishes the sound. 3. On auscultation over the precordium, firm pressure with the finger on one or both jugular veins will cause a murmur due to venous

hum to disappear completely. 4. Turning the subject's head away from the side of origin of a venous hum in-

creases the murmur's intensity. The effectiveness of this maneuver is greater if the chin is raised rather than lowered. In some subjects presence of a hum is depend-

ent upon this position, and in most subjects it disappears when the head is turned toward the side of origin. It should be borne in mind that not infrequently venous hums arise in both sides of the neck, the quality of their sounds sometimes differing on the two sides. 5. Careful auscultation will usually reveal that a venous hum is more prominent during inspiration than during expira-

tion. 6. Other postural changes, particularly those of the pectoral girdle as produced by weight-bearing on the

arms, often have a marked (but less predictable) effect in producing or abolishing a hum.

Auscultatory characteristics of venous hums are more variable. Some tend to be more rough or groaning in character, especially their systolic components, while others are of higher pitch, of a musical, squeezing, or even blowing nature. The former types are usually heard best with a bell stethoscope, because of the attenuation of lower frequencies encountered in use of a diaphragm-

type chest piece. The venous hum sound can simulate to a remarkable degree many murmurs of intracardiac ori-

gin, a consideration that merits occasional reemphasis in its bearing on cardiac auscultation.

**SUMMARY**

The venous hum, a physiological extracardiac mur-

mur heard in a high percentage of children and in some adults, is characteristically a continuous murmur with accentuation during diastole. From its point of maximum

intensity in one or both supraclavicular fossae, it is fre-

quently transmitted downward over the precordium, where it may simulate remarkably murmurs of patho-

logical significance.

16 Lucas St. (16) (Dr. Groom).

**Foetor Hepaticus**—The breath of patients with severe paren-

chymal liver disease often has a characteristic odor, foetor hepaticus. . . . Attempts to isolate from the breath the compound producing the foetor have failed because of the very small quantities involved and the difficulty of getting a seriously ill patient to breathe against the resistance of a collecting system. In patients with a strong oral foetor a very similar smell may be present in the urine. . . . Methyl mercaptan was isolated from the urine of a patient with massive hepatic necrosis; some dimethyl disulphide was probably also present. It might be expected that, in the body, methyl mercaptan would be either oxidized to dimethyl disulphide or methylated to dimethyl sulphide. We believe that foetor hepaticus is caused by the elimination of one or more of these compounds in the breath. Little is known of the pharmacology of these compounds, but by analogy with closely related compounds they may well be toxic.—F. Challenger, M.D., and J. M. Walsh, M.D., Foetor Hepaticus, Lancet, June 18, 1955.