Profiles in Cardiology

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Jean-Baptiste Auguste Chauveau

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Jean-Baptiste Auguste Chauveau (Fig. 1) made major contributions to cardiac physiology and helped invent the technique of cardiac catheterization. Chauveau was born on November 21, 1827, in the French village of Villeneuve-la-Guyod.^{1,2} His father was a blacksmith, which may have stimulated Auguste's interest in veterinary medicine. In 1844 young Chauveau enrolled in the Imperial Veterinary School of Alfort, a prominent school of veterinary medicine near Paris. A bright and ambitious student, he graduated first in his class 4 years later. Following graduation, Chauveau was appointed Chef des Travaux in anatomy and physiology at the Imperial Veterinary School in Lyon. He published an important textbook of the comparative anatomy of domestic animals in 1857.³ This popular monograph was translated into several languages, including Italian and English, and was still in print 50 years later.

In 1855, Chauveau began a series of experiments on the dynamics of cardiac motion and the mechanism of the heart sounds. Laennec's invention of the stethoscope, publicized in his classic 1819 monograph on auscultation, stimulated interest in the heart sounds in health and disease. Victor McKusick and Kenneth Keele have detailed the introduction of auscultation and the attempts of physicians such as Jean-Baptiste Bouillaud, James Hope, and Charles Williams to elucidate the origin of heart sounds and murmurs through careful observation and experimentation.^{4,5} Chauveau found the debate over

the motion of the heart and its sounds intellectually challenging, and this became the focus of his research for several years.

Chauveau was stimulated to study cardiac motion and the heartbeat, in large part, as a result of hearing presentations and reading publications by Joseph-Honoré-Simon Beau, a French physician who had been interested in these subjects since the 1830s. Based partly on observing the heart's motion in frogs, Beau concluded that diastole was the active portion of the cardiac cycle and accounted for the apical impulse. The relationship between the heart sounds and the apex beat had been the subject of debate for decades, and Chauveau, working with Etienne-Jules Marey, invented a new way to study the problem, using intracardiac catheters.^{6,7}

During a visit to Claude Bernard's laboratory in 1859, Chauveau met Dutch physiologist Frans Donders, who encouraged him to make recordings of the cardiac events to refute Beau's theory.⁸ Donders was familiar with Marey's medical thesis on the physiology of the circulation, just published in Paris. This thesis included pulse tracings that Marey had recorded with a sphygmograph he had adapted for the purpose. Later that year, Chauveau met with Marey to discuss his interest in collaborating to clarify the physiology of the cardiac cycle and its relationship to the heart sounds. This merger of talents and interests was rewarded by their successful resolution of the controversy about the timing of cardiac events and their eventual recognition as pioneers of cardiac catheterization.

Working as an anatomist in a veterinary school, Chauveau had access to large animals for his innovative experiments on the heart's motion and sounds. Reflecting his sophistication in comparative anatomy and physiology, he argued that it was better to experiment on large mammals such as horses because, unlike the frog, the horse's cardiovascular system was very similar to that of humans. Chauveau also explained that the horse's heart beats slowly (about one-half as fast as a human's), which made it easier to make observations. Finally, the horse's cardiac chambers were large, which made it possible for Chauveau to introduce his finger into the heart so he could actually feel the motion of the atrioventricular valves as they opened and closed and to insert catheters to measure intracardiac pressures.⁹

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FIG. 1 Jean-Baptiste Auguste Chauveau (1827–1917). From the collection of W. Bruce Fye, M.D., M.A.

As they collaborated, Chauveau and Marey drew upon their unique educational backgrounds, experiences, and interests to develop a new approach to solve a scientific debate. Meanwhile, they set the stage for subsequent developments in cardiac catheterization. In a series of publications, they explained that their experiments proved that Beau's theory was wrong and that systole was an active process that resulted from a dynamic contraction of the heart muscle. Chauveau had already argued, in 1857, that the apical impulse rather than a recoil phenomenon that accompanied the ejection of blood was the result of this systolic contraction. Now, he and Marey set about to prove it.

The novel approach that Chauveau and Marey used to support their theory was to insert a double lumen catheter they had crafted into a horse's heart to record the pressures in the right atrium and the right ventricle and simultaneously record the apical impulse. They adapted a technique that French physiologist Claude Bernard had introduced in 1847, when he first used the newly invented kymograph to record intracardiac pressures through a glass tube that he had inserted into the heart. But Chauveau and Marey were the first to use this technique to conduct physiologic research. They published the preliminary results of their experiments in 1861 and 1862. The following year they collaborated on a well-illustrated monograph that summarized their studies and their conclusions.¹⁰ Marey went further. In 1863, he published a 568-page book that included 235 illustrations and represents the first comprehensive monograph on cardiovascular physiology based on cardiac catheterization.¹¹

André Cournand, who shared the Nobel Prize with Werner Forssmann and Dickinson Richards for their introduction of cardiac catheterization in humans, noted the great significance of the technique that Chauveau and Marey developed, the first to use a cardiac catheter to record phasic changes in intracardiac pressures. According to Cournand, their 1863 monograph represented "the first systematic description and interpretation of intracardiac pressure recordings."¹² (quote, p. 14). These pressure recordings also demonstrated, for the first time, the duration of the phases of the cardiac cycle. Tracings they published showed that the time interval between the onset of atrial systole and the onset of ventricular systole was 0.2 seconds, that atrial systole lasted 0.1 seconds, and ventricular systole lasted 0.4 seconds. They also published simultaneous recordings of intraventricular and intra-aortic pressures, from which they speculated about the influence of left ventricular systole on the character of the aortic pressure curve. Cournand concluded, "Their text goes into important detail regarding numerous other facets of cardiac pressure tracings in health and simulated disease. . . . This work unquestionably is a milestone of the physiology of the heart."¹² (quote, p. 14).

Chauveau turned his attention to other subjects during and after the mid 1860s. Reflecting the growing interest in the germ theory of disease, he began to work on the transmission of tuberculosis. His sophistication in comparative anatomy and physiology and veterinary medicine led him to recognize the risk of transmission of tuberculosis from infected animals to humans. Chauveau entered medical school at Lyon in his forties and graduated in 1876. He continued his investigations into communicable diseases, and his research and contributions reflected his unusual sophistication in animal and human medicine.

In 1886, Chauveau became Professor of Comparative Pathology at the prestigious Museum of Natural History in Paris. His later years were filled with honors. He was president of the French Academy of Science in 1907 and of the French Academy of Medicine in 1913. By this time his research focused on muscle physiology and metabolism. This research led to the discovery that muscle metabolizes glucose. Chauveau died in Paris on January 4, 1917, just a dozen years before Werner Forssmann reported his self-catheterization. Cardiac catheterization, which has been a standard technique in humans for more than fifty years, owes much to the pioneering experiments of Chauveau and Marey undertaken in the 1860s.

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References

1. Espinosa RE, Vlietstra RE, Mann RJ: J.B.A. Chauveau, E.J. Marey, and their resolution of the apex beat controversy through intracardiac pressure recordings. *Mayo Clin Proc* 1983;58:197–202

2. McKusick VA: Jean-Baptiste Auguste Chauveau. In *Dictionary of Scientific Biography*, vol.3, (Ed. Gillespie CC) p. 219–220. New York: Charles Scribner's Sons, 1971
3. Chauveau A: *Traité d'Anatomie Comparée des Animaux Domestiques*. Paris: J.-B. Baillière, 1857
4. McKusick VA: *Cardiovascular Sound in Health and Disease*. Baltimore: Williams & Wilkins, 1958
5. Keele KD: The application of the physics of sound to nineteenth century cardiology: With particular reference to the part played by C. J. B. Williams and James Hope. *Clio Medica* 1973;8:191–221
6. Silverman ME: Etienne-Jules Marey: Nineteenth century cardiovascular physiologist and inventor of cinematography. *Clin Cardiol* 1996;19:339–341
7. Snellen HA: E. J. Marey and Cardiology: *Physiologist and Pioneer of Technology* (1830–1904). Rotterdam: Kooiker Scientific Publications, 1980
8. Hoff HE, Geddes LA: A historical perspective on physiological monitoring: Chauveau's projecting kymograph and the projecting physiograph. *Cardiovasc Res Center Bulletin* 1975;14:3–35
9. Dagognet F: *Etienne-Jules Marey: A Passion for the Trace*. New York: Zone Books, 1992
10. Chauveau A, Marey EJ: *Appareils et Expériences Cardiographiques Démonstration Nouvelle du Mécanisme des Mouvements du Coeur par l'Emploi des Instruments Enregistreurs à Indications Continuéés*. Paris: J.-B. Baillière, 1863
11. Marey EJ: *Physiologie Médicale de la Circulation du Sang basée sur l'Étude Graphique des Mouvements du Coeur et du Pouls Artériel avec Application aux Maladies de L'Appareil Circulatoire*. Paris: Adrien Delahaye, 1863
12. Courmand A: Cardiac catheterization: Development of the technique, its contributions to experimental medicine, and its initial applications in man. *Acta Med Scand Suppl.* 579, 1975

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Images in Cardiology: Hiatal Hernia Masquerading as an Extracardiac Mass on Transesophageal Echocardiogram

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FIG. 1 (A) Transesophageal four-chamber view of the mass (*). Arrow indicates the mitral valve. (B) MRI image of the thorax. Arrow indicates the descending aorta. * = hiatal hernia; LA, RA = left, right atrium; LV, RV = left, right ventricle.

A 66-year-old man presented with shortness of breath and bilateral lower extremities edema. He was found to have atrial fibrillation (170 beats/min). Transesophageal echocardiogram (TEE) showed mild left ventricular hypertrophy with normal function and no thrombus in the left atrium (LA). An extracardiac mass compressing the LA was seen (Fig. 1A). Magnetic resonance imaging (MRI) of the chest showed a large hiatal hernia with fluid in the dilated esophagus above the gastroesophageal junction (Fig. 1B).

Occasionally, masses compressing the LA are identified by TEE or transthoracic echocardiography, mandating further

evaluation. If a hiatal hernia is suspected, use of oral contrast or soda during transthoracic echocardiography may be diagnostic, but during TEE it carries the risk of aspiration. MRI is a powerful noninvasive tool for evaluating such suspected cardiac or noncardiac mass lesions.

Reference

- Menegus MA, Greenberg MA, Spindola-Franco H, Fayemi A: Magnetic resonance imaging of suspected atrial tumors. *Am Heart J* 1992;123:1260–1268