On the Fabric of the Human Body and Modern Ultrasound Imaging

Christopher J. Gilligan, M.D., James P. Rathmell, M.D.

ANDREAS Vesalius (1514–1564), Professor of Anatomy at the University of Padua, Imperial Physician to Holy Roman Emperor Charles V, and author of the seven-volume De Humani Corporis Fabrica (On the Fabric of the Human Body), is noted for his hands-on direct observation of human anatomy and the meticulous drawings of his work he prepared for his students. In the current era of genomics and proteomics, the study of basic human anatomy may seem antiquated and unimportant. However, for interventional pain treatments, precise understanding of the relevant anatomy remains the foundation for safety and effectiveness.

In the field of pain medicine, the present-day physician and anatomist Nikolai Bogduk, M.D., Ph.D. (Professor, University of Newcastle, Newcastle, Australia) advanced our knowledge of the sensory innervation of the vertebral column and then built on that work to demonstrate the safe and effective use of radiofrequency treatment for spinal pain. Our knowledge of anatomy and how it relates to many painful conditions remains inadequate. We perform interventions for sacroiliac joint pain routinely, yet the innervation of the sacroiliac joint and how to use our knowledge of that anatomy remain the center of controversy. In this edition of Anesthesiology, van Eerd et al. in Maastricht present a meticulous and detailed study on the sonographic anatomy and landmarks of the cervical spine. They constructed an anatomical model of the cervical spine and a laser-precise, three-dimensional measurement device that allowed them to correlate ultrasound images and specific gross anatomical features of the spine. With this model, they developed a clear and reproducible technique for accurately identifying each of the cervical vertebral levels using ultrasound. Test-retest analysis demonstrated that their technique identifying each cervical vertebral level with ultrasound is extremely reproducible. They describe useful and distinct sonographic landmarks: the cranial base, the mastoid process, the arch of C1, the transverse process of C1, and several more. They note that C6 can be distinguished from C7 on ultrasound because C6 has both an anterior and posterior tubercle and C7 has only a posterior tubercle. They also confirmed that these same landmarks are visible in vivo. Throughout their article, the authors provide high-quality sonographic images and corresponding anatomic drawings of the cervical spine that are clear and instructive. Although others have provided some description of the sonographic anatomy, this new article stands out for its precision, rigor, and reproducibility. Their anatomic work sets the stage for meaningful application of ultrasound for image-guided needle placement during cervical interventions. Equally important, their model and measuring device can help us to provide better training in use of ultrasound.

Caution is in order. We cannot assume that van Eerd’s findings can be generalized to all humans. They used a single human cervical vertebral column embedded in a medium that allowed for realistic ultrasonographic imaging. They and others will likely expand on this work by assuring that their findings can be generalized to populations and used in performing treatments like radiofrequency treatment of the cervical facets. We will also have to learn how their recommendations must be modified to account for common anatomical variations. This work describes only the bony anatomy, but a major advantage of ultrasound is the ability to visualize vessels, nerves, and other relevant soft tissue structures. Thus, a much needed extension of this work will be to...
develop ultrasound techniques that incorporate descriptions of all relevant bony and soft tissue structures and how they are best imaged. For now, we applaud van Eerd et al. for their careful study, like Vesalius, of basic human anatomy to guide the optimal use of ultrasound to visualize the cervical spine, and we encourage others to return to the anatomy lab as they investigate how best to apply modern imaging techniques in clinical practice.

Competing Interests
The authors are not supported by, nor maintain any financial interest in, any commercial activity that may be associated with the topic of this article.

Correspondence
Address correspondence to Dr Rathmell: rathmell.james@mgh.harvard.edu

References