Thirty years ago, anatomic guidance was the predominant method used to perform procedures of the spine. The addition of fluoroscopy to the pain specialist’s toolkit quickly improved the precision of drug delivery and the breadth of potential structural targets, ultimately defining fluoroscopic guidance as the standard of care for many spine interventions [1]. In a similar manner, the pain section in this issue of Current Opinion in Anesthesiology looks at the tools and therapies that will shape the next few decades of our specialty. The review by Suter (pp. 584–589) provides the reader with an understanding of the critical role of glia in the transition from acute to chronic pain, identifying several potential future therapeutic pathways. Roy et al. (pp. 590–595) present new stimulation modalities and discuss the paradigm shift that is occurring within the field of neuromodulation. Analgesic effectiveness is no longer coupled with the necessity of paresthesia and neuraxial stimulation is no longer limited to the dorsal canal. Solberg et al. (pp. 596–599) review the use of a well-established technology (radiofrequency lesioning) in a novel application (treatment of vertebral fracture pain) challenging some long-held beliefs regarding compression fracture pain. Finally, Perrine et al. (pp. 600–605) provide an excellent overview of ultrasound-guided interventions and discuss the critical necessity of procedural skills for success of these techniques. This study additionally considers opportunities created through the expanded use of ultrasound as a diagnostic tool.

THE NEED FOR NEW DIAGNOSTIC IMAGING MODALITIES

In the assessment of any new technology, we must first critically evaluate our current techniques. Are they effective? Are they safe? Fluoroscopic guidance, the standard for many image-guided spine and pain procedures, allows clear visualization of deep osseous structures; unfortunately, it is unable to discriminate blood vessels, soft tissues, and neurologic structures without the use of contrast enhancement. On the other hand, ultrasound allows imaging of soft tissues without radiation or surgical exposure, but provides poor resolution of deeper structures, particularly those shadowed by bone.

Similar to earlier spine procedures, musculoskeletal and peripheral nerve injections have been historically performed utilizing anatomic landmarks as guidance. However, as Perrine et al. (pp. 600–605) point out, there are limitations to these traditional techniques, such as high failure rates, when compared with image-guided procedures [2]. As procedural tools, ultrasound and fluoroscopy are indeed quite complementary.

MUSCULOSKELETAL DIAGNOSIS

Although indications for the use of ultrasound are still evolving, we have evidence that this technology, if properly utilized by the skilled practitioner, provides accurate diagnosis of musculoskeletal conditions when compared with MRI [3]. Procedural accuracy has also been shown to dramatically improve when ultrasound guidance is used for joint injections [4]. Not surprisingly, accurate medication placement additionally correlates with improved clinical outcomes for these same procedures [5]. These results not only demonstrate the reliability of ultrasound as a diagnostic and procedural tool, but also provide a potential avenue for cost savings with the use of a point-of-care clinic-based evaluation. Ultrasound diagnostic advancements may additionally facilitate the next wave of novel, biologic, and disease-modifying therapies for musculoskeletal pain, allowing for significant improvements in the treatment of degenerative arthropathies and tendinopathies.
PERIPHERAL NERVE DIAGNOSTICS

The study of a common peripheral mononeuropathy, carpal tunnel syndrome, also demonstrates the advantages of ultrasound-based diagnostics. Ultrasound allows for measurements of nerve cross-sectional area, vascularity, and mobility, leading to the ability to diagnose this peripheral mononeuropathy and other compression neuropathies at the time of clinic examination [6]. Furthermore, ultrasound-guided intervention leads to improvements not only in symptoms, but also resolution of electrodiagnostic abnormalities after injection [7].

An expanded role for ultrasound diagnosis additionally includes examination of the peripheral nerve following traumatic injury. For instance, amputation neuromas can now be more reliably identified and treated with the use of ultrasound, facilitating the evolution of diagnostic algorithms and targeted treatment options [8].

FUTURE OPPORTUNITIES

As Yogi Berra once noted, ‘It’s tough to make predictions, especially about the future.’ Nonetheless, glimpses of the future noted in these review articles regarding the mechanistic understanding, advances in visual diagnostics, and precision therapies will undoubtedly play a significant role in defining the standard of care for pain medicine in the coming decade.

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Conflicts of interest

There are no conflicts of interest.

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