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Anesthesia evolved dramatically from the 1900s, as there came to be successful implementations and novel applications of medical, surgical, and basic science knowledge with technological advances [3, 7, 8]. An extraordinary breakthrough occurred in 1926 when Arthur Guedel introduced the concept of a cuffed endotracheal tube through his experiments with submerging dogs underwater and under anesthesia [9]. The 1930s also provided the initial foundations for the modern concept of morbidity and mortality conferences, as anesthesia docs set up meetings with the coroner to learn about patient deaths from anesthesia [4].

## **2. Rapid growth and development**

Modern anesthesiology dates back to the post-World War II era, with advances from the military experience of the most devastating war in human history becoming integrated into everyday clinical practice [8, 10]. A unique synergy emerged between surgery and anesthesiology – a trend that continues to this day [11]. This trend was further augmented by the influx of the newly available medical workforce, rich with experiences from the war theater [10]. From 1940s to 2000, the pace of progress, fueled by exponential growth in basic and clinical research, further accelerated the transition from “the art” into “the science” of anesthesiology [8, 12].

During the same time, patient safety organizations grew in number nationally and internationally. Increasingly more sophisticated anesthetic devices and adjunctive tools were created in this era [13, 14]. With improvement in technology came improvements in safely administering anesthesia through creative advances in airway equipment (video laryngoscopy), ventilators (safety valves and flowmeters set to prevent delivery of a hypoxic mixture to the patient), infusion pumps, and regional/neuraxial anesthetic kits [13, 14]. Monitors standardized to specifications by the American Society of Anesthesia were introduced and implemented in the 1980s–90s in the US. Subsequent innovations in monitoring devices allowed one to process hemodynamic and physiological information in noninvasive fashions (pulse oximeters, cerebral perfusion monitors, stroke volume variation monitoring, bispectral index (BIS) monitoring, modern point-of-care sonography) [2, 15–17]. Computer technology helped to improve the quality of care in the preoperative assessment stage and provided new opportunities for anesthesia training and simulation for crisis management [3, 18, 19].

## **3. Innovation: the core of anesthesiology’s DNA**

More than 13 million surgeries were performed in the United States from 2019 to 2021 [6]. In the 2000s–2010s, more than 50% of surgical, diagnostic, and interventional procedures are being performed outside of the operating room (OR), including settings such as cardiac catheterization labs, MRI suites, interventional radiology departments, and dental suits. The last three decades showed tremendous growth in the role anesthesia plays in perioperative management. The preadmission testing clinic evolved into a concept known as a perioperative surgical home, where anesthesia staff conducts the management of the preoperative, intraoperative, and postoperative care of a patient [20]. By having patients undergo “prehabilitation”, where they concentrate on conditioning/preparing their mind and body weeks before surgery, would help to maximize wellness and reduce both complications

and postoperative rehabilitation needs [21–23]. In addition, multidisciplinary care pathways and Enhanced Recovery after Surgery (ERAS) protocols are being created that incorporate precision medicine and improve patient outcomes [24, 25]. This new role in anesthesia helped to break down the stigma that anesthesia services are limited to the operating room. Instead, being equipped with a vast knowledge of acute care and lifesaving skills, anesthesia personnel are provided with the opportunity to help transition their quality of care and expertise into meaningful change outside of the operating room.

Modern day anesthesiology also encompasses many dedicated subspecialties, with a focus on critical care, neurosciences, pediatrics, geriatrics, cardiothoracic, obstetrics, and regional and acute pain management [26–31]. As editors of this book, we would like to take the reader on an adventure that will stimulate one's mindset on what is "current and state-of-the-art" in anesthesia practice and its subspecialties. With regards to airway management, a plastic surgery group in Europe provided a unique take on the use of supraglottic airways devices (i-gel LMA™, Intersurgical, UK) in the prone position. Another chapter discusses novel methods to provide paraoxygenation while an airway is being secured. The reader will hopefully embrace our chapters that focus on the anesthetic management of patients undergoing complex cardiac procedures, such as electrophysiology cases, left ventricular assist device (LVAD) placement, and extracorporeal circuit membrane oxygenation (ECMO) cannulation. As more surgical subspecialties have begun to offer minimally invasive and/or robotic procedures, chapters are devoted in this book to highlight Enhanced Recovery after Surgery (ERAS) Protocols in thoracic and neurosurgery cases. To address care for the aging population in the US, many institutions are creating guidelines for optimizing their care before surgery. The book chapter by McHugh offers a great summary of what is being done in the evaluation of the geriatric patient in the preoperative testing phase. To highlight concerns with the ongoing opioid epidemic in the US, there is a dedicated discussion of methods to curtail narcotic use in acute pain management, chronic pain management (interventional procedures), and regional pain management (local anesthetic nerve blocks) chapters. Lastly, we wish to emphasize the importance of collaboration and teamwork with surgical and medical specialties when taking care of a patient, whether it is in the setting of trauma and critical care, in patients with psychiatric disorders, or when managing patients who undergo life-threatening complications, such as cardiac arrest after neuraxial anesthesia.

#### **4. Anesthesia beyond anesthesiology**

The reach of modern anesthesiology does not begin, nor does it end in the operative theater. The future of anesthesia care will undoubtedly focus on topics such as the continued extension of anesthesia-related services to venues outside of the OR and the continued reliance on technology to further improve patient safety and quality of care, such as with telemedicine, the use of artificial intelligent machines, or the "internet of things" (IOT) construct [32–37]. Furthermore, as the world reflects on climate change and methods to prevent ongoing environmental harm, more anesthesia practices may turn to ways to achieve a "greener" operating room, such as minimizing the use of volatile agents and utilizing more total intravenous anesthesia (TIVA) [38, 39]. There is even an opportunity for anesthesia practices to extend beyond a patients' hospital stay. Many institutions foresee their anesthesia staff providing care weeks to months after surgery, as the "primary postoperative



physician” [40, 41]. In addition, the concept of remote monitoring has extended into the home, to provide a “hospital at home” model of care [42, 43]. This highlights the use of anesthesia standard monitors to use at home and have the vital signs tracked over to a virtual remote center.

The clinical realm of anesthesia also does not end with anesthesiology-trained clinicians. For one the concept of “conscious sedation” has been extended to surgeons, gastroenterologists, dentists, intensivists, and emergency medicine physicians, among other specialties [44–46]. Ideally, further education can be provided by anesthesia staff to those eager to learn more about the nuances of airway management and anesthesia administration. Eventually, areas of clinical overlap may develop, with multi-specialty participation in “unified super-specialty areas” – such specialty and content expertise unification can currently be seen in areas such as critical care medicine, traumatology, geriatric medicine, and pain/palliative care [47–50].

## 5. Synthesis and conclusion

This book recognizes the important role that anesthesiologists play within our increasingly complex and modern healthcare system. It also highlights the various present and future roles that anesthesiologists will partake, both in the operating rooms and beyond. We also emphasize the embrace of multidisciplinary and multi-specialty approaches, both of which are inherently natural and seamless to the modern practice of anesthesiology. It is our hope, as the Editors of this unique collection of chapters, that we accurately and effectively portray modern anesthesiology as a true unifying force within the fabric of the contemporary healthcare environment.

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