

specially-trained pediatric anesthesiologists. Parents of healthy children don't have the same hospital experience and thus have a more naive perspective. Just think about your child; if you are the parent, wouldn't you want your child cared for by someone who cares for children every day?

Training Options

Pediatric anesthesiology is an exciting blend of both pediatrics and anesthesiology. Some people decide that they wish to combine the practices of pediatric anesthesiology and pediatric critical care medicine. If that is the chosen path, two residencies are currently required, followed by fellowship training.

The training options include the following:

1. Traditional internship, anesthesiology residency followed by fellowship in pediatric anesthesiology – 5 years
2. Pediatric internship, anesthesiology residency followed by fellowship in pediatric anesthesiology – 5 years
3. Pediatric residency, anesthesiology residency followed by fellowship in pediatric anesthesiology – 7 years
4. Pediatric residency, anesthesiology residency followed by both pediatric critical care and pediatric anesthesiology fellowships – 8 to 9 years

If I Choose to Train as a Pediatric Anesthesiologist, What Are My Career Options?

1. Clinical pediatric anesthesiologist
 - a. Pediatric hospital – 100 percent pediatric cases
 - b. Combined adult and pediatric hospital – depending on the hospital, you might do a mixture of adult and pediatric cases
2. Academic pediatric anesthesiologist
 - a. Clinical specialist
 - b. Educator
 - c. Research track
3. Combined pediatric anesthesiologist and pediatric intensivist
 - a. Clinical specialist
 - b. Educator
 - c. Research track

How Do I Investigate My Interest in Pediatric Anesthesiology as a Career Choice?

Do electives in anesthesiology, pediatric critical care medicine and possibly the neonatal intensive care unit. Talk to the pediatric anesthesiologists in your institution, and pick their brains about what they like and what they dislike about what they do. Ask them how they would train and talk about different career options in the field of pediatric anesthesiology.

CHAPTER 22 Geriatrics and Anesthesia: Everything You Wanted to Know About Anesthesia But Were Too Afraid to Ask

Michael C. Lewis, M.D.

Professor and Chair of Anesthesiology
University of Florida, College of Medicine
Jacksonville, FL

An aging population carries huge consequences for the practice of anesthesiology. Aging issues affect most aspects of anesthesiology. This chapter aims to describe the demographic and physiological changes of aging. I hope after reading this you will join me in being driven to solve some of the challenges that this ever-enlarging patient group offers.

An Ever-Increasing Elderly Population

The roots of this change lay in advances in medicine and progressive social policy. After World War II, fertility rates increased. There was a “baby boom” from 1947 to 1964, and now this generation is growing old. Since Americans are now living longer, the age of the oldest segment of the population has also steadily increased over the last century. The “oldest – oldest” is the fastest growing segment of the elderly population. The number of people over 65 years old has tripled in the last 100 years and is anticipated to further double in size by the year 2040. Such improved life expectancy continues to enlarge that fraction of the surgical patient population that is considered elderly.



Reprinted with permission, The Cleveland Clinic Center for Medical Art & Photography © 2015. All Rights Reserved.

What is Different About These Patients?

Organ function with aging is usually well-maintained under basal conditions. When an organism can maintain a steady state in the face of increased physiological demand, it is said to demonstrate a good functional reserve. Aging manifests as an inability to enhance function in the face of increased demand.

What Physiological Changes are Associated With Aging?

■ Cardiovascular System (CVS)

- Progressive replacement of supple cardiac and vascular tissue by stiff, fibrotic material. The left ventricle (LV) must work harder to eject blood into a rigid aorta. Left ventricular hypertrophy (LVH) develops. This hypertrophy impairs filling because of increased ventricular wall stiffness in early diastole. Loss of the sinus rhythm, a common event during anesthesia, may depress cardiac output and arterial pressure more markedly in the elderly.
- Aging is associated with a decrease in parasympathetic outflow while overall sympathetic neural activity increases. The administration of β -adrenergic agonists elicit reduced responses in the elderly while β -blocking drugs retain their effectiveness.
- The maintenance of hemodynamic homeostasis largely depends upon the baroreflex. Arterial stiffening may reduce the ability of the baroreceptors to transduce changes in pressure.

■ Respiratory System

There are four “core” characteristics of pulmonary aging:

- Reduction in muscle mass and power
- Changes in compliance
- Reduction in diffusion capacity
- Decline in control of breathing

■ Renal System

- Aging results in both structural and functional changes in the kidney that affect drug metabolism and kinetics as well as predisposing the patient to fluid and electrolyte abnormalities.
- Renal mass is lost between ages 40 and 80, mostly from the cortex. Microscopically there is a reduction in the number of functional glomeruli, but the size and capacity of the remaining nephrons increase to partially compensate for this loss.
- Over 30 years of age, renal blood flow (RBF) declines progressively. A majority of this reduction in RBF occurs in the cortex.

- Glomerular filtration rate (GFR) decreases by approximately 1 mL/min/year beginning by age 40. This decline in GFR is accompanied by a gradual loss of muscle mass and is rarely associated with an increase in serum creatinine. Serum creatinine is therefore a poor indicator of GFR in these patients.
- Under normal circumstances, age has no effect on electrolyte concentrations or the ability of the individual to maintain normal extracellular fluid volume. However, the adaptive mechanisms responsible for regulating fluid balance are impaired in the elderly and the aging kidney has a decreased ability to dilute and concentrate urine.

■ Metabolism Temperature Regulation

- The mitochondria provide the power for all the metabolic functions. The energy required to maintain basic cellular functions is termed basal metabolic rate (BMR) and this falls with advancing age. Decreased BMR is associated with decreased β -receptor sensitivity. This blunting of the β -response has been used to explain predisposition to obesity in the elderly.
- The changes in body composition with aging are due to an increase in the percentage of body fat, loss of protein and intracellular dehydration.
- Body mass index (BMI) is a standardized measure of body habitus. It is defined as the weight of an individual divided by the height squared (kg/m^2). Obesity is defined as a BMI greater than 30, and morbid obesity is defined as a BMI of greater than 40. Visceral, intra-abdominal and intra-muscular fat increases with age.
- Body temperature regulation is impaired in the elderly, making them prone to hypothermia. Anesthesia impairs thermoregulatory responses in all patients but produces even greater impairment in the geriatric population. Perioperative hypothermia lasts longer in geriatric patients. Elderly patients are at greater risk than younger patients from the adverse effects of hypothermia.

■ Neurological

- Postoperative delirium, a transient mental dysfunction, can result in increased morbidity, delayed functional recovery and prolonged hospital stay in the elderly.
- Possibly related to the occurrence of postoperative delirium is the incidence of postoperative cognitive decline. These two concepts are not the same. Those who suffer cognitive loss are generally fully alert and oriented.

■ Follow Basic Rules of Geriatric Anesthesia

- Use smaller doses of medications, as they will have a more profound effect.
- Use shorter acting drugs (i.e., remifentanyl).
- Don't rush! Drugs take longer to work.
- Decreased organ function may increase risk of complications; therefore, choose drugs with fewer side effects.
- Use drugs with less accumulation (i.e., propofol).

Summary

America is experiencing a great challenge, facing the effects of the graying of the population and its impact on our health care system. The preoperative evaluation of the elderly patient is usually more complex. This complexity with increasing age is possibly due to the greater number and severity of coexisting illnesses. The functional status can be difficult to predict, making it a challenge to sufficiently evaluate the patient's ability to respond to the stresses associated with surgery.

CHAPTER 23

Regional Anesthesia

Joseph M. Neal, M.D.
Anesthesiology Faculty
Virginia Mason Medical Center
Clinical Professor of Anesthesiology
University of Washington

Regional anesthesia is the subspecialty of anesthesiology that focuses on the local anesthetic blockade of peripheral nerves and the neuraxis. This is a subspecialty that overlaps acute and chronic pain medicine, in addition to pediatric, obstetric and ambulatory anesthesia. Moreover, regional anesthesia is an essential component of surgical anesthesia, where its applications range from simple plexus blocks for ambulatory hand surgery, to femoral nerve block for analgesia following total knee replacement, to the placement of a thoracic epidural as a key contribution to the multimodal management of colon surgery.

Why Regional Anesthesia?

The regional anesthesia practice of many anesthesiologists is limited to placing lumbar epidurals for labor analgesia. They are missing all the fun! Performing spinal and epidural anesthesia, placing continuous perineural catheters, or anesthetizing the brachial plexus with a single injection is technically challenging and, yes, fun. It breaks the tedium of managing each and every patient with general anesthesia. However, professionalism dictates we have better reasons for choosing an anesthetic technique than our own entertainment. Indeed, regional anesthesia has a number of advantages as either an isolated technique or an adjunct to general anesthesia. Compared to fast-track general anesthetic techniques, upper extremity regional techniques promote faster hospital discharge, fewer opioid-related side effects, and better analgesia during the first 24 hours after surgery. A spinal or epidural anesthetic for knee arthroscopy allows the patient to watch the surgeon repair his or her knee, while epidural anesthesia allows a mother to be awake during the cesarean delivery of her child. As a component of multimodal analgesia, thoracic epidurals play a critical role in perioperative management by promoting faster return of bowel function and fewer pulmonary complications following major abdominal or chest surgery. In short, regional anesthesia is a valuable, enjoyable and ever-broadening facet of anesthesiology practice.

So Why is Regional Anesthesia Not a Part of Everyone's Practice?

Despite its advantages, the actual practice of regional anesthesia can be challenging. The most important impediment to its widespread acceptance is the lack of quality training of residents by well-qualified faculty. This situation is improving. In 1980, most residents' exposure to regional anesthesia was limited to obstetrics. Training in the subspecialty varied widely, ranging from hundreds of spinal anesthetics in some programs, to only three spinal anesthetics in other programs.¹ By the year 2000, the vast majority of residents exceeded the Anesthesiology Residency Review Committee's minimal caseload experience for spinal and epidural anesthesia (50 each), and their experience included not only obstetrical indications but also pain medicine and surgical anesthesia uses. Inter-program variation in regional anesthesia training had narrowed. Despite these gains, 40 percent of residents still failed to attain minimal experience in performing peripheral nerve blocks (n=40).² As would be expected, the more training residents receive in regional anesthesia, the more likely they are to actually perform blocks in practice.³ Indeed, a survey of regional anesthesia fellowship graduates found that regional anesthesia remains a significant part of their caseload, whether in academic or private practice.⁴