ANESTHESIA
Our PolicyOwners℠
are Informed.

MagMutual offers industry-leading patient safety and risk management resources to reduce inherent risk for patients and healthcare practitioners. And we now offer complimentary access to UpToDate®, providing clinicians with the most current evidence-based clinical content to make the most informed treatment decisions.

We are your partner in managing risk – offering the essential coverage and support to keep you informed, safe, protected and rewarded.

In the practice of medicine and beyond – MagMutual is in your corner.

www.magmutual.com
CONTENTS
Vol. 88, No. 1, 2017

Contributors

ANESTHESIA

5 Anesthesia: A Question of Balance Medicine
By Christopher W. Hackney, M.D.

6 Prescribing Opioids: A Question of Balance
By P. Tennent Slack, M.D.

8 Perioperative Multimodal Analgesia: Strategies in Reducing Opioid Requirement
By Trusharth Patel, M.D.

13 The Use of Dexmedetomidine in Pediatric Anesthesia
By Lydia Josephs, M.D.

16 Ketamine: An Old Drug for a New Problem
By Steven M. Walsh, M.D.

19 Regional Anesthesia: A Focus on Peripheral Nerve Blocks
By Christopher W. Hackney, M.D.

SPOTLIGHT

22 Future of Healthcare
By Helen K. Kelley

Cover image by Dan Carmody, Studio 7 Photography
As a provider, you want the best for your patients.

At Emory Heart & Vascular Center, we combine excellence in clinical care, translational research and medical education, placing us among the top heart health centers in the country by U.S. News & World Report.

When you refer your patient, you can count on access to new techniques and procedures as well as groundbreaking clinical trials, with an individualized treatment plan to meet your patient’s specific needs.

Collaboration with you and among our cardiothoracic surgeons, cardiologists, vascular surgeons, cardiac imaging experts and specialists ensures patients have the best possible outcomes.

We offer you and your patients our comprehensive resources and expertise, and we welcome your consults.

Call 404-778-5050 to refer a patient.
CONTRIBUTING WRITERS

GUEST EDITOR

Christopher W. Hackney, M.D.
Dr. Hackney received his B.S. in Biology from the University of Georgia followed by his medical degree from the Medical College of Georgia. He completed a surgical internship followed by anesthesia residency at the Medical University of South Carolina. He is board certified in general anesthesia and currently practices at North Fulton Anesthesia Associates.

Steven M. Walsh, M.D.
Dr. Walsh currently serves as President of the Medical Association of Georgia. He attended Emory University for his undergraduate degree. He received his M.D. and residency training from the Medical College of Georgia. He is board certified in general anesthesiology and is a founding and managing partner of North Fulton Anesthesia Associates.

Lydia Josephs, M.D.
Dr. Josephs is board certified in both pediatric and general anesthesiology. She received her B.A in Chemistry from the University of Chicago. She went on to receive her M.D. from University of Michigan-Ann Arbor. She completed residency in Anesthesiology and Fellowship in Pediatric Anesthesiology at University of Texas-Southwestern. She is currently in private practice in the Atlanta area with MAK Anesthesia.

Trusharth Patel, M.D.
Dr. Patel is a board-certified anesthesiologist whose interests include the clinical safety of perioperative pain management interventions. He received his undergraduate degree in Neuroscience and his M.D. from Vanderbilt University. He completed his internship and anesthesia residency at Washington University in St. Louis. He is currently in practice as an assistant professor of anesthesiology at Emory University.

P. Tennent Slack, M.D.
Dr. Slack currently serves as clinical co-chair of the Medical Association of Georgia’s “Think About It” campaign. He received his undergraduate degree at the Georgia Institute of Technology followed by his M.D. at Emory University. He completed his residency training in anesthesiology at Emory University followed by a pain medicine fellowship at the Medical College of Georgia. He is board certified in both pain medicine and general anesthesiology and practices at Northeast Georgia Physicians Group in Gainesville.

TOP INDEPENDENT DOCTORS REWARDED FOR QUALITY CARE

Privia Medical Group is a high-performance, multi-specialty group of the nation’s top independent physicians. We are a physician-led group catalyzing the growth of private practices by partnering with commercial and government payers so our doctors are rewarded significantly for high-quality, patient-centered care.

Watch our video to learn more: http://go.priviahealth.com/AtlantaMedicine_Privia

Call 404.448.2542 or email georgiadoctors@priviahealth.com

MDatl.com
News and Resources for Atlanta Physicians

- News for and about Atlanta physicians
- Medical articles written by Atlanta physicians
- Medical events calendar
- Practice management articles
MEDICAL PROFESSIONAL LIABILITY INSURANCE
PHYSICIANS DESERVE

Offering top-tier educational resources essential to reducing risk, providing versatile coverage solutions to safeguard your practice and serving as a staunch advocate on behalf of the medical community.

Talk to an agent/broker about NORCAL Mutual today.

© 2015 NORCAL Mutual Insurance Company.

n0681
Anesthesia revolves around the idea of maintaining balance. Throughout the operative period, anesthesiologists seek to maintain hemodynamic balance in patients undergoing surgical stress.

This is best accomplished not by one particular anesthetic but again through a balance of volatile agents, IV sedatives, opioids, local anesthetics and muscle relaxants. John Silas Lundy began promoting this idea of a balanced approach in 1926, and it still holds true in nearly every anesthetic we provide.

The idea of balance provides that each piece of the anesthetic plays just as important role as the next. However, balance also implies the idea of imbalance. A patient receiving too much or too little of one anesthetic suffers the consequences.

The metaphor of imbalance can also be applied to the current opioid epidemic throughout the country. The source of this epidemic can be traced to an imbalance in opioid prescribing practices in the late 1990s and early 2000s. The over-reliance on using prescription opioids to treat pain symptoms led to much easier access to opioids throughout the country. Ultimately this would prove to be the perfect recipe for rampant opioid abuse.

The articles presented in this edition, I believe, help provide a global outlook on pain management in the perioperative environment and how important an issue it has become in this era of widespread opioid abuse. Each author has taken care to highlight techniques that anesthesiologists are implementing to help promote patient safety and comfort. Dr. P. Tennent Slack, an advocate for the reduction of prescription opioid abuse in Georgia, has also provided prescribing guidelines that should benefit all physicians in helping prevent opioid abuse practices.

Trying to restore balance is not easy. By working together, all physicians may be able to correct the standards in favor of more responsible opioid use.
On considering the implications of a recent MedScape article, “The Opioid Crisis: Anatomy of a Doctor-Driven Epidemic,” it would seem that the attention that is focused on the issue of the prescription opioid overdose problem has finally reached critical mass. As physicians and prescribers, we find ourselves at the epicenter of a controversy that is fundamentally a practice-of-medicine question. Unfortunately, the medical community at large has not approached the prescription opioid problem from a practice-of-medicine perspective, and we have consequently invited forces outside of medicine to have a growing influence over this arena. Most physicians would agree, however, that opioids play a vital role in the treatment of pain in a wide variety of settings and that physicians are best positioned to influence how and when an opioid should be used.

As many of you know, the Centers for Disease Control and Prevention (CDC) recently issued opioid prescribing guidelines that have garnered considerable attention. These kinds of guidelines are nothing new. Guidelines often contain finer points that don’t always achieve universal agreement, and the CDC’s recommendations are no exception. As opposed to many other medical treatment scenarios, the book on opioid-based pain treatment is written not in black and white but in gray, which further promotes a lack of consensus. This ambiguity resides at the heart of the confusion and controversy surrounding how to rationally use this important tool in the pain-treatment toolbox.

As part of its ‘Think About It’ campaign, the Medical Association of Georgia Foundation has developed a Six-Point Opioid Prescribing Platform that captures the essence of discriminating opioid prescribing. This platform has been approved and endorsed by the Medical Association of Georgia (MAG), the Georgia Society of Interventional Pain Physicians (GSIPP) and the Georgia Society of Addiction Medicine (GSAM).

These organizations believe that these simple points can be useful in day-to-day treatment decisions across the spectrum of pain treatment, from acute to chronic, and can be used to promote more discriminating opioid prescribing. At the end of the day, however, the decision to deploy opioid therapy is a medical judgement, and as such there will always be unintended consequences. As physicians, the best we can do is to mitigate undesirable outcomes through discriminating prescribing.

The Six-Point Opioid Prescribing Platform

1. How definable is the source of pain?

As is true with the treatment of any disease process, the risk-benefit assessment of a therapeutic intervention is influenced by our ability to define the disease. In cases where the source of pain is poorly defined, this should be considered when deciding whether or not to use opioid therapy. A poorly defined source of pain does NOT mean that opioid therapy shouldn’t be used.

2. Consider all treatment options.

The gamut of pain treatment options ranges from biofeedback techniques to surgery. Treatment options should clearly begin with the lowest risk treatments, which often involve the temporary cessation of pain-inducing activities, ice/heat, NSAIDs, etc. The decision to use opioid therapy should ALWAYS occur within a paradigm of risk-benefit assessment rather than a reflexive action.
3 SCREEN for risk of addiction/abuse.

There are a number of different screening questionnaire tools, some of which are quite extensive, others of which are very simple. As a practical matter, however, there are a handful of high-yield questions that should ALWAYS be asked when initiating opioid therapy: “Have you or a family member ever had a problem overusing pain pills that have been prescribed following an injury or painful procedure?” “Have you or a family member ever had a substance or alcohol abuse problem?”

4 If opioids are prescribed, target the LOWEST effective dose and the LOWEST number of pills per prescription.

An excellent way to do this is to simply ask the patient, “What is the lowest dose and least number of pills I can prescribe for you in one bottle?” This immediately assigns responsibility to the patient and gives the prescriber an insight into the patient’s understanding and expectations surrounding opioid therapy. Be aware of Georgia’s 911 Medical Amnesty Law, which allows you to prescribe or co-prescribe naloxone (typically an intranasal delivery system) to a patient for use by non-medical personnel for emergency opioid overdose rescue.

5 Educate the patient.

- Advise the patient of the risks/benefits of opioid therapy
- Advise the patient that sharing or using other people’s prescription medication is ILLEGAL
- Advise the patient of proper prescription drug storage and disposal methods. (Note: All of the above are highlighted in the ‘Think About It’ patient pamphlets that can be obtained by calling 678.303.9282 or going to rxdrugabuse.org.)

6 Monitor the patient for opioid overuse/diversion.

If opioid therapy is sustained, use Georgia’s Prescription Drug Monitoring Program (PDMP). Information on how to sign up for and use the PDMP is available at the Georgia Drugs and Narcotics Agency, http://gdna.georgia.gov/georgia-prescription-drug-monitoring-program or call 404.656.5100.
America’s opioid epidemic is growing at a staggering rate, with the number of deaths related to opioids exceeding 28,000 in 2014. There were 1,206 deaths in Georgia alone related to opioids during the same year.

It is estimated that half of opioid-related deaths come from prescribed opioids. The rate of opioid prescribing from specialists is on the rise, and a third of prescribed opioids are coming from surgeons. Unfortunately, not all specialties have adequate training in the management of acute and chronic pain. It is the lack of training and/or resources that can result in continued inappropriate prescribing of opioids after surgery rather than a judicious wean off of potent pain killers.

Strategies to minimize opioids should be practiced by all physicians involved in the management of pain in the perioperative period to prevent opioid addiction and opioid-related deaths. Multimodal treatment strategies, both pharmacologically and non-pharmacologically, in the perioperative setting have been led by anesthesiologists to minimize the requirement for opioid medication. The initial multimodal treatment strategy starts prior to surgery in the preoperative setting and is often coordinated by an anesthesiologist either in a preoperative clinic evaluation or immediately prior to surgery.

Pre-emptive analgesics typically are non-opioid medications given to a patient immediately prior to a surgery before the onset of a surgical stimulation and the ensuing cascade of neurotransmitter signaling of pain, with the goal of reducing intra-operative and post-operative opioid requirements by improving patients’ pain experience. The medical literature does not support reduced intra-operative opioid requirements with pre-emptive strategies but does support its benefit in reduced post-operative pain scores and reduced opioids post operatively.

Pre-emptive analgesic medications commonly used include acetaminophen, typically 1,000 mg, NSAIDS such as Celebrex at 200 mg, gabapentin in doses of 600 to 900 mg, and pregabalin 75-150 mg. Concerns around NSAIDS in the

The rate of opioid prescribing from specialists is on the rise, and a third of prescribed opioids are coming from surgeons.
perioperative setting raised by surgeons include increased risk for bleeding complications and nonunion of bone.

Though there is a lack of medical data to support such concerns, the use of NSAIDS may be case-specific and dependent on the surgeon’s comfort level to administer them prior to surgery. Concerns with the gabapentinoids such as gabapentin and pregabalin include excessive post-operative sedation, which can delay discharge time. The gabapentinoids have shown reduced post-operative opioid requirements and post-operative pain scores in the first 24 hours after surgery. They can additionally reduce chronic persistent post-surgical pain 6 months down the road in certain types of surgeries.

Intraoperative strategies to reduce opioid requirements have changed dramatically with the advent of regional anesthesia. There is strong evidence to support the use of regional anesthesia, specifically neuraxial analgesia or paravertebral block in thoracic and abdominal surgeries. It was believed that optimal timing of the placement of a block or initiation of neuraxial infusion was prior to the surgical insult, but there is limited data to support this theory. As long as regional techniques are performed prior to awareness after anesthesia, the benefits in improved pain experience, reduced opioid requirements and faster recovery are realized.

Post amputation phantom limb pain seems to be reduced with both patient-controlled opioid analgesics and epidural analgesics in the perioperative period compared to as-needed intravenous opioids, suggesting that adequate perioperative pain control can reduce central sensitization and chronic pain after limb amputation. However, regional techniques have shown superior pain control and reduced analgesic requirements in a variety of surgeries.

Other intraoperative strategies have primarily focused on multimodal pharmacological treatments, including lidocaine infusion, magnesium infusion, dexmedetomidine infusion and ketamine infusion to promote an opioid sparing effect and improved post-operative pain scores. Lidocaine infusion given intraoperatively for abdominal surgeries may have a small effect on improved pain scores but only in the early phase of 0-4 hours. It does not appear to have a lasting effect beyond this period.

Dexmedetomidine infusion intraoperatively for abdominal surgeries does seem to offer a small opioid sparing effect with reduced need for rescue doses of opioids in the first 24 hours but do not offer much difference in pain scores. Hypotension intraoperatively was attributed to the dexmedetomidine infusion in studies of this medication. Large studies on the use of intravenous magnesium intraoperatively are lacking.

There are smaller studies demonstrating an opioid sparing effect when given neuraxially or perineurally, but this is not routinely performed in most hospitals given the lack of larger studies to support this practice. One can extrapolate the potential benefits of magnesium to intravenous administration given its fairly benign side effect profile.

Ketamine works via NMDA antagonism. There is medical data to support its ability to reduce opioid consumption and pain scores in the postoperative period if given as an infusion intraoperatively. It typically is well tolerated with low psychotomimetic side effects seen postoperatively and can be a reasonable option for opioid sparing.

Multimodal strategies implemented in the postoperative period can be initiated by a hospital pain service, typically lead by an anesthesiologist, or by the surgical team. Treatment options commonly used are mostly pharmacological, but some non-pharmacological treatments are available.

Most pharmacological therapies carried into the postoperative period can be initiated intraoperatively. For instance, ketamine can be continued as a sole infusion or combined with patient-controlled analgesic pumps containing opioids. Ketamine's benefit in orthopedic or abdominal surgeries is unclear but has shown reduced opioid consumption, pain scores and desaturation in thoracic surgeries.

Strategies to minimize opioids should be practiced by all physicians involved in the management of pain in the perioperative period to prevent opioid addiction and opioid-related deaths.

Neuraxial analgesics administered via an epidural catheter are typically continued in the postoperative period, with a combination of opioid and local anesthetic for 3 to 5 days. Pain scores have consistently been demonstrated to be superior for thoracic and abdominal surgeries with an epidural compared to intravenous opioids.

Urinary retention may occur with an epidural infusion, extending the need for a bladder catheter. This can increase the risk for urinary tract infections, but if the bladder catheter is changed periodically, this may mitigate the risk. If there is a high concern for opioid-related complications in a specific patient, neuraxial infusion of local anesthetic alone
can often provide adequate analgesia, assuming that the surgical site does not span too many dermatomes.

Other postoperative pharmacological multimodal therapies to minimize opioid analgesics include acetaminophen, NSAIDS, gabapentinoids, lidocaine infusion, topical lidocaine transdermal patches and muscle relaxants. Until recently, acetaminophen in an intravenous formulation was only available in Europe. It is now widely available in the U.S. and has shown improved pain scores and opioid sparing effect in the ambulatory surgical setting.

NSAIDS can have significant analgesic properties in the postoperative period when risk for surgical bleeding is minimal. Ketorolac is a commonly used postoperative NSAID given its intravenous formulation and its analgesic equivalency to 10 mg intravenous morphine for every 30 mg of intravenous ketorolac. NSAIDS can be effective adjuncts to opioids and regional anesthesia as they work by inhibiting prostaglandin mediated pain signaling after tissue injury, which is not blocked with regional anesthesia techniques.

As mentioned above, the gabapentinoids can also offer opioid sparing effects but can be limited by their sedative effects. Lidocaine infusions are not routinely continued in the postoperative setting given pro-arrhythmogenic effects but may be an option if other multimodal treatments have failed. Topical lidocaine in the form of a transdermal patch or ointment can also serve as an adjunct in postoperative pain control. Unfortunately, the data to support its ability to reduce opioids is lacking.

Various muscle relaxants such as baclofen, tizanidine or cyclobenzaprine may also offer some relief from muscle spasms experienced after surgery, especially spine surgery, but can be limited by their sedative effect. Similarly, benzodiazepines can offer relaxation of anxiety from pain as well as serve as a muscle relaxant, thus reducing pain and opioid requirement. One must be cautious in the additive effects on sedation when benzodiazepines are combined with opioids.

Non pharmacological treatment options in the postoperative period include ice and Transcutaneous Electrical Nerve Stimulation (TENS). Ice can offer local sensory blockade and reduce swelling. When placed around surgical incisions, it can offer improved pain control and potentially have some effect on opioid sparing. Similarly, TENS can offer local pain relief near an incision by stimulating non-painful sensory signaling, thus serving to mask painful signaling. Unfortunately, the medical evidence to support routine postoperative TENS unit use is equivocal. The cost and resources for placement of the TENS leads can also be a limiting factor.

Some of the new strategies on the horizon for perioperative multimodal analgesia include drugs that can work on
endogenous analgesic peptides such as opiorphin and its stable form, STR-324. This drug inhibits the breakdown of enkephalins and provides analgesia devoid of respiratory or hemodynamic effects.\(^\text{10}\) There is also research focusing on binding of AMPA receptors in the nucleus accumbens to increase excitatory output and reduce postoperative pain possibly devoid of all side effects of opioids.\(^\text{11}\)

In conclusion, there are several therapies that can be initiated in the preoperative, intraoperative and postoperative setting that can have an opioid sparing effect by improving patients’ experience of pain after surgery. These strategies should be offered when appropriate to curb the development of dependence on opioids, a growing problem in America.

Patients should also be informed of opioid take-back programs offered by local DEA offices to destroy unused opioids. This can help reduce opioid abuse and misuse by eliminating access to continued opioids after the surgical stimulus subsides.

References:

\[\text{endogenous analgesic peptides such as opiorphin and its stable form, STR-324. This drug inhibits the breakdown of enkephalins and provides analgesia devoid of respiratory or hemodynamic effects.}\] \(^\text{10}\) There is also research focusing on binding of AMPA receptors in the nucleus accumbens to increase excitatory output and reduce postoperative pain possibly devoid of all side effects of opioids.\(^\text{11}\)

In conclusion, there are several therapies that can be initiated in the preoperative, intraoperative and postoperative setting that can have an opioid sparing effect by improving patients’ experience of pain after surgery. These strategies should be offered when appropriate to curb the development of dependence on opioids, a growing problem in America.

Patients should also be informed of opioid take-back programs offered by local DEA offices to destroy unused opioids. This can help reduce opioid abuse and misuse by eliminating access to continued opioids after the surgical stimulus subsides.

\[\text{endogenous analgesic peptides such as opiorphin and its stable form, STR-324. This drug inhibits the breakdown of enkephalins and provides analgesia devoid of respiratory or hemodynamic effects.}\] \(^\text{10}\) There is also research focusing on binding of AMPA receptors in the nucleus accumbens to increase excitatory output and reduce postoperative pain possibly devoid of all side effects of opioids.\(^\text{11}\)

In conclusion, there are several therapies that can be initiated in the preoperative, intraoperative and postoperative setting that can have an opioid sparing effect by improving patients’ experience of pain after surgery. These strategies should be offered when appropriate to curb the development of dependence on opioids, a growing problem in America.

Patients should also be informed of opioid take-back programs offered by local DEA offices to destroy unused opioids. This can help reduce opioid abuse and misuse by eliminating access to continued opioids after the surgical stimulus subsides.

\[\text{endogenous analgesic peptides such as opiorphin and its stable form, STR-324. This drug inhibits the breakdown of enkephalins and provides analgesia devoid of respiratory or hemodynamic effects.}\] \(^\text{10}\) There is also research focusing on binding of AMPA receptors in the nucleus accumbens to increase excitatory output and reduce postoperative pain possibly devoid of all side effects of opioids.\(^\text{11}\)

In conclusion, there are several therapies that can be initiated in the preoperative, intraoperative and postoperative setting that can have an opioid sparing effect by improving patients’ experience of pain after surgery. These strategies should be offered when appropriate to curb the development of dependence on opioids, a growing problem in America.

Patients should also be informed of opioid take-back programs offered by local DEA offices to destroy unused opioids. This can help reduce opioid abuse and misuse by eliminating access to continued opioids after the surgical stimulus subsides.

\[\text{endogenous analgesic peptides such as opiorphin and its stable form, STR-324. This drug inhibits the breakdown of enkephalins and provides analgesia devoid of respiratory or hemodynamic effects.}\] \(^\text{10}\) There is also research focusing on binding of AMPA receptors in the nucleus accumbens to increase excitatory output and reduce postoperative pain possibly devoid of all side effects of opioids.\(^\text{11}\)

In conclusion, there are several therapies that can be initiated in the preoperative, intraoperative and postoperative setting that can have an opioid sparing effect by improving patients’ experience of pain after surgery. These strategies should be offered when appropriate to curb the development of dependence on opioids, a growing problem in America.

Patients should also be informed of opioid take-back programs offered by local DEA offices to destroy unused opioids. This can help reduce opioid abuse and misuse by eliminating access to continued opioids after the surgical stimulus subsides.

\[\text{endogenous analgesic peptides such as opiorphin and its stable form, STR-324. This drug inhibits the breakdown of enkephalins and provides analgesia devoid of respiratory or hemodynamic effects.}\] \(^\text{10}\) There is also research focusing on binding of AMPA receptors in the nucleus accumbens to increase excitatory output and reduce postoperative pain possibly devoid of all side effects of opioids.\(^\text{11}\)

In conclusion, there are several therapies that can be initiated in the preoperative, intraoperative and postoperative setting that can have an opioid sparing effect by improving patients’ experience of pain after surgery. These strategies should be offered when appropriate to curb the development of dependence on opioids, a growing problem in America.

Patients should also be informed of opioid take-back programs offered by local DEA offices to destroy unused opioids. This can help reduce opioid abuse and misuse by eliminating access to continued opioids after the surgical stimulus subsides.
World-class healthcare from WellStar is now even closer to home.

This year, WellStar became the largest health system in Georgia. Providing comprehensive care across the state, WellStar consists of 11 hospitals, 2,900 physicians and advanced practitioners on medical staff, 240 medical office locations, outpatient centers, health parks, a pediatric center, nursing centers, hospice and homecare.

For information about WellStar, please call 770-956-STAR (7827) or visit wellstar.org.
For many years, the sight of a screaming, crying child emerging from anesthesia was the hallmark of a successful anesthetic. A cranky child exhibited signs of a clear airway and adequate circulation, leading to discharge from the post anesthesia care unit.

Pediatric post-surgical pain had been classically underappreciated and thus undertreated. Over time, however, the attitudes toward pediatric pain have evolved along with the specialty of pediatric anesthesia as a whole. We now know that being in pain can be emotionally traumatic for a child, leading to behavioral and developmental setbacks later on in life.

Now we are seeing that even our choice of anesthetic has the potential to impact a child long after the surgical encounter. In order to make hospitals more hospitable for a child and parent, we must give the assurance of safe anesthesia practice in addition to adequate pain control.

Anesthesiologists are continually using research to improve the safety, quality and efficacy of anesthetics. In recent years, the drug dexmedetomidine has come to the forefront of pediatric anesthesia. In U.S. hospitals, the use of dexmedetomidine in the pediatric setting has doubled between 2010 and 2015.

Not only is dexmedetomidine an effective anesthetic and analgesic, but it is also an answer to problems found in pediatric anesthesia: 1) the need for an ‘opioid sparing’ or ‘multimodal technique’, and 2) the concern about the toxicity of common anesthetics, which may impair the brain development of babies and young children. In fact, recent animal model data suggest that dexmedetomidine can actually protect the developing brain from the neurotoxicity of other anesthetics.

Dexmedetomidine (now off patent from trade name Precedex) is an alpha 2 receptor agonist. It has sedative as well as analgesic properties and was ap-
Pediatric post-surgical pain had been classically under appreciated and thus undertreated.

In addition, opioids have many negative side effects. Effects such as respiratory depression can be even more prevalent in newborns given the immaturity of their hepatic and renal metabolism and consequent accumulation of drugs. Prolonged use of opioids for children who undergo several procedures (e.g., burns) can cause hyperalgesia. In other words, opioids can cause patients to become even more sensitive to pain.

Opioids continue to be the tried-and-true option for surgical pain control, but adjunctive medications are a good idea to diminish some of the undesirable side effects.

An area of intense interest in pediatric anesthesia is the effect of anesthetics on a child’s developing brain. Several anesthetics, such as sevoflurane, nitrous oxide, ketamine, propofol and benzodiazepines, have all been implicated in neurodegenerative changes in developing animal brains. Whether or not these results can be translated to long-term cognitive impairment in humans is currently being studied.

This brings special attention to a drug like dexmedetomidine, which has not shown these neurodegenerative changes in animal brains when used at low clinical doses. In fact, animal studies have shown the diminution of neuronal cell death when dexmedetomidine was used concurrently with anesthetic gases, ketamine or propofol, thus making it neuroprotective.

SmartTots, a collaborative effort by the FDA and the International Anesthesia Research Society (IARS), coordinates and funds research in this area. One of the currently ongoing Smart-Tot studies, Toxicity of Remifentanil and Dexmedetomidine (T-Rex), aims to look at dexmedetomidine and the opioid remifentanil as a potentially neuroprotective anesthetic regimen that can be used as alternative to inhalational anesthetics during long procedures. Of course, in a prospective clinical trial, the neuropsychological assessment of children exposed to dexmedetomidine will take years to complete.

There are several barriers to the study of pediatric medications, which is why about 50 percent of drugs used in children are ‘off-label’. Further study is definitely needed on the use of dexmedetomidine in children. So far, dexmedetomidine is recognized as a safe and effective sedative and analgesic. The studies done on its neuroprotective qualities thus far are quite promising. Depending on the clinical scenario, dexmedetomidine is worth adding to our anesthetic/analgesic arsenal.
Keeping the **game fair**...

...so you’re not **fair game**.

Your Georgia medicine
is getting hit from all angles.

You need to stay focused and on point—
confident in your coverage.

Get help protecting your practice,
with resources that make important
decisions easier.

---

ProAssurance
Treated Fairly

**Healthcare Liability Insurance & Risk Resource Services**

ProAssurance Group is rated [A+ (Superior)](https://www.ambest.com/ratings/) by A.M. Best.

---

Want to reduce risk? [ProAssurance.com/Seminars](https://www.proassurance.com/seminars)
Ketamine was first synthesized in 1963. It underwent human testing in 1965 and was approved by the FDA in 1970. Ketamine saw its first widespread use as an anesthetic during the Vietnam conflict.

Although the drug has many benefits as an anesthetic, its use was dramatically curtailed due to the incidence of postoperative emergence phenomena, often described by patients as “nightmares.” It has more recently seen a resurgence using low-dose techniques in the treatment of acute pain in the opioid-tolerant patient.

Acute pain management for the opioid-tolerant patient is a challenge that has grown with the opioid crisis. The opioid crisis is a result of the perfect storm between the population demographic and alleged undertreatment of pain.

Type in “pain” as a Google search, and one will find more than 31 million results. Pain is a symptom most all physicians face daily. The most challenging form of pain is chronic pain. Winston Parris, M.D., so eloquently stated “After all systemic illnesses are cured, after all metabolic imbalances are corrected, after all diseased organs are removed and broken bones repaired, chronic pain may emerge and continue to persist.”.

Ketamine is a potent NMDA receptor blocker. It depresses the thalamus and limbic systems, preventing central nervous system centers from receiving or processing sensory input.

The Health and Medicine Division of the National Academies of Sciences, Engineering and Medicine puts the number of patients suffering with chronic pain at over 116 million people. This is greater than the sum of all Americans with diabetes, coronary heart disease, stroke and cancer.
The problem of an increasing incidence of chronic pain is compounded by a 20-year campaign of alleged undertreatment of pain. This led the American Pain Society to introduce the “pain as the 5th Vital Sign” phrase in 1996; expert opinion favoring the liberalization of opioid for the treatment of non-cancer pain; the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) in 2000 establishing the right of the patient to have pain assessment and management; and aggressive marketing by the pharmaceutical industry.¹

Thus, the use of prescription opioid analgesics has seen a dramatic increase. The U.S. comprises less than 5 percent of the world population but uses more than 80 percent of the global supply of painkillers. The U.S. Department of Veterans Affairs reports hydrocodone prescriptions at a Fayetteville, Va., facility went from 1,100 in 2001 to 47,000 in 2013.

The National Vital Statistics System reports the rate of prescription painkiller sales has quadrupled from 1999 to 2010. By 2012, there was enough narcotic prescribed for every U.S. adult to have a bottle of pills. There are now more people that die each year from accidental drug overdose than in auto accidents.

Thus, the incidence of treating acute pain in the presence of chronic opioid therapy is a growing challenge. It is well known that chronic opioid use leads to opioid tolerance. New research, however, tells us that opioid tolerance can develop very quickly, even with short-term therapy during acute pain episodes.

For the patient on chronic opioid therapy requiring acute pain management, in view of this new finding of acute opioid tolerance, it is easy to understand the potential for rapid escalation in opioid dosing. Patient safety data tells us increasing doses for patients who respond poorly or incompletely from the analgesic benefit of opioids remain vulnerable to the inherent risks of the drug. For these reasons, anesthesiologists have identified the opioid-sparing potential ketamine provides.

Ketamine belongs to a select class of drugs whose site of action is the NMDA receptor. Abnormal NMDA function may cause neurologic disorders including Alzheimer’s disease, amyotrophic lateral sclerosis, depression, epilepsy, multiple sclerosis, Parkinson’s disease and schizophrenia. The consequence of the constant excitation of the NMDA receptor during pain presents clinically as opioid tolerance, hyperalgesia, and allodynia.²

Ketamine is a potent NMDA receptor blocker. It depresses the thalamus and limbic systems, preventing central

---

AT YOUR SERVICE
With 10 Metro-Atlanta locations conveniently inside medical office buildings, our close proximity to your practice office allows Concord Pharmacy to serve your patients’ medicine needs quickly. Services include: fulfilling specialty pharmaceuticals and compounding.

Directing your patients to Concord Pharmacy provides your patients convenience and increases the likelihood of compliance.

---

37 YEARS OF HISTORY SERVING ATLANTA’S MEDICAL COMMUNITY
Look for 2 new locations in 2017!
For a complete list of locations, visit ConcordRX.com.
Ketamine saw its first widespread use as an anesthetic during the Vietnam conflict.

nervous system centers from receiving or processing sensory input. This is the mechanism through which ketamine creates anesthesia, amnesia and analgesia.3

Other sites of action include an inhibition of catecholamine reuptake that can lead to increasing heart rate, cardiac output, and pulmonary and systemic blood pressure. Ketamine may also inhibit neuronal serotonin uptake resulting in an increased risk for emesis.4,5

Renewed interest in ketamine has shown the benefits of low-dose (subanesthetic) concentrations, referred to as “subanesthetic ketamine.” Subanesthetic ketamine provides benefits as an adjunct to regional, general and postoperative pain therapy, resulting in effective opioid sparing. Subanesthetic ketamine has been shown to decrease opioid tolerance and hyperalgesia in the postoperative pain setting with a minimal side effect profile.

In a study where intraoperative subanesthetic ketamine was used on patients with chronic back pain undergoing back surgery, patients showed a 40 percent decrease in morphine equivalence in the 48-hour postoperative period, pain intensity scores were 30 percent lower and little difference was seen in side effects as compared to the control group. Another significant finding was a 60 percent reduction in narcotic use on the six-week postoperative follow-up.6

Another study on patients undergoing major abdominal surgery compared subanesthetic ketamine in two groups against a control group. One group received ketamine only during the intraoperative period. The second group received ketamine in both the intraoperative and postoperative period.

The perioperative period group showed a 50 percent reduction in narcotic use compared to both the control and intraoperative group. Pain intensity was significantly lower in the intraoperative and perioperative group compared to the control group. The perioperative group showed the greatest decline in pain intensity. The side effect profiles were similar in all groups.

Interestingly, nausea, a recognized side effect of both narcotic and ketamine, was lowest in the perioperative ketamine group. This may suggest an additional advantage of narcotic sparing with ketamine.5

A meta study looking at the intraoperative and postoperative effects of ketamine on pain intensity, narcotic sparing and side effects in various acute surgical pain settings have shown similar results.7

The opioid sparing benefits of subanesthetic perioperative ketamine has caused many facilities across the nation to adopt this treatment technique. The Mayo Clinic has published their approach to initiation, maintenance and monitoring of this therapy.

The Mayo Clinic has chosen to use this therapy on three surgical populations to include total joint reconstruction, multilevel spine surgery, and thoracotomy or laparotomy. The selection criteria include patients who are chronic opioid users, consuming more than 30 mg oral morphine equivalents per day.

Postoperative infusions are not administered to patients with a history of schizophrenia or those patients with discharge plans for the next morning. As of 2015, Mayo Clinic physicians have experience in treating more than 500 patients without any serious adverse events. They recommend perioperative ketamine for consideration in hospitals with an acute pain service providing 24-hour coverage to patients.8

In conclusion, the data shows opioid overuse in our country has become a crisis. For anesthesiologists, opioid sparing techniques in both the chronic and acute pain arena is our challenge and responsibility. We are seeing anesthesiologists updating their practices to include opioid sparing techniques such as subanesthetic ketamine.

An important point is that the anesthesiologist using ketamine for pain management has opened a new line of attack to this opioid crisis. This brings to the forefront a renewed interest in ketamine and the NMDA receptor. Thus, one can anticipate that novel ketamine-related treatments for patients in pain will emerge. ■

References
"Is this something new?” This is the most common question I am asked when discussing peripheral nerve blocks with patients.

While various regional techniques have been employed for over a century, the widespread use of peripheral nerve blocks has become a relatively recent phenomenon in the field of anesthesia. At the end of the 19th century, cocaine started to show promise as a powerful anesthetic for medical procedures. Cocaine’s inception opened the doorway as a potent surgical anesthetic, however that doorway also lead to addiction and dependency for many practitioners.

In its first decades of use, cocaine not only proved to be habit forming but also carried with it the risk of cardiac toxicity. Innovations into less cardiotoxic formulations, such as procaine and lidocaine, helped pave the way for our current generation of local anesthetics. Bupivacaine and ropivacaine are now the most commonly used anesthetics for peripheral nerve blocks. These medications are vastly superior in improving
block duration than previous generations. Combined with peripheral nerve blocks, modern local anesthetics can provide 12 to 24 hours of pain relief. So while cocaine’s abuse potential limited its utilization, newer local anesthetics combined with peripheral nerve blocks have become powerful tools in minimizing opioid usage and subsequent long-term abuse potential.

Peripheral nerve blocks involve the targeted administration of local anesthetic to functionally “block” stimulation from a specific area of the body during a surgical procedure. Visualization with an ultrasound machine aides in localization of nerves and the guidance of a needle through which local anesthetic is administered.

Due to variations in diameter and myelination, local anesthetics affect nerve fibers differently, but the main targets for anesthetization are the type C fiber nociceptors and type A delta fibers. Interrupting the conduction of a pain stimulus from a surgical area can diminish and in many situations eliminate surgical pain.

Orthopedic surgery has historically been the most well-served using regional anesthesia. A peripheral nerve block along the cords of the brachial plexus can effectively anesthetize the forearm and hand for surgery. The shoulder itself can also be blocked by an injection at the level of the roots of the brachial plexus.

The lower extremity is susceptible to peripheral nerve blocks in a similar manner. Both the femoral and sciatic nerve are easily isolated to benefit any number of procedures involving the leg and foot.

Visualization of peripheral nerves directed by ultrasound allows for more precise administration of local anesthetics. In addition, ultrasound also allows better visualization of the spread of local anesthetic during the procedure. In this way ultrasound has made for much safer placement of peripheral nerve blocks as well improvement in onset and duration.

Peripheral nerve blocks for orthopedic procedures are not only important for reducing perioperative pain, but also in providing early physical therapy in many procedures such as total knee arthroplasties. For these procedures, a variant of the femoral nerve block, the adductor canal block, is employed and serves to anesthetize the femoral nerve distal to the motor fibers innervating the quadriceps.

This technique allows for postoperative pain relief at the surgical site and avoids undesired motor weakness of the quadriceps. Both promote early mobility and enhanced range of motion after total knee arthroplasty.

Although direct visualization of the nerves with ultrasound is the approach to many blocks, newer techniques have focused on the development of fascial plane blocks. Specifically, the transversus abdominis plane (TAP) block and the pectoral nerves (PEC) block are allowing anesthesiologists to block areas where traditional nerve anatomy is more diffuse.
While various regional techniques have been employed for over a century, the widespread use of peripheral nerve blocks has become a relatively recent phenomenon in the field of anesthesia.

Under ultrasound guidance, the TAP involves spreading a large volume of local anesthetic between the inner oblique muscle and the transversus abdominis muscle to provide anesthetization to the anterolateral abdominal wall, including the deep muscle and fascia. The TAP block has seen most success in proving to reduce post-operative opioid consumption for a variety of abdominal procedures both open and laparoscopic.

More recently, the PEC block is giving anesthesiologists a better way to provide anesthetization to the anterior chest wall and axilla during a variety of breast procedures. These patients have an exceptionally high incidence of postoperative nausea and vomiting (PONV), which can be improved by reducing opioids through the placement of a PEC block.

However, the PEC block and other fascial plane blocks are limited in their ability to produce a definitive block. Because their efficacy relies on the distribution of local anesthetic through a fascial plane, the outcome can be highly variable depending on a patient’s anatomy. For larger resections involving the anterior chest wall, such as partial and total mastectomies, a paravertebral block is more commonly employed. A paravertebral block is performed more proximally along the transverse processes of the spine to target the dorsal and ventral rami at a specific vertebral level. In doing so, a more complete band of anesthesia can be provided to one or more dermatomes along the chest wall.

These blocks represent only a fraction of an anesthesiologist’s arsenal in combating perioperative pain. Still, peripheral nerve blocks serve as only one part of an anesthetic plan, as they are usually combined with a general anesthetic to better optimize patient comfort. And while opioids may not be entirely eliminated from many patients’ anesthetic regimens, they are greatly diminished for those patients undergoing a procedure with a peripheral nerve block in place.

Among the anesthesia community, there has always been concern over the perioperative use of opioid pain medication. Opioids carry a range of side effects, from the rather innocuous post-operative itching to life-threatening respiratory depression. However, the current opioid epidemic has placed a greater precedence on reducing opioid use in an attempt to prevent future dependency issues.

Peripheral nerve blocks have been proven safe and effective in the vast majority of procedures, including outpatient surgery. In addition, there are fewer complications associated with peripheral nerve blocks than traditional neuroaxial anesthesia, including spinal and epidural injections. These procedures have their place in helping minimizing opioid consumption as well, but place patients at a higher risk of hypotension and potential bleeding.

Peripheral nerve blocks also lend to the advent of newer block techniques, which are helping facilitate greater implementation of regional anesthesia in all surgeries.

Many physicians are also looking at the potential for block additives, including dexmedetomidine, tramadol, dexmedetomidine, and clonidine to enhance the effect of a peripheral nerve block or extend its duration. Peripheral nerve catheters are also becoming more effectively used to extend block duration past the traditional 24 hours of a traditional single injection.

So while the use of local anesthetic with peripheral nerve blocks promises improved pain relief for patients in the post-operative period, anesthesiologists are also able to provide a much needed alternative to opioid pain medications.

References
The landscape of healthcare in America is facing rapid change, from the way care is delivered to a renewed focus on the physician-patient relationship. Here, three Atlanta-area physicians weigh in on what they believe the future of healthcare holds for physicians and patients.

**Shared decision-making, technology help drive healthy behaviors**

According to Mary L. Wilson, M.D., president and executive medical director of Kaiser Permanente of Georgia, technology and involving patients in the decision-making about their own care are effective tools for better creating better outcomes, both for today and in the future.

"One of Kaiser Permanente’s primary tenets is finding methods that successfully encourage healthy behaviors in our patients. We look at every physician visit as an opportunity to talk about healthy habits with the patient, and we cue that conversation up through the patient’s EMR,” she said. “The EMR prompts the nurse and physician to ask probing questions about the patient’s lifestyle, including exercise and eating habits, to gauge whether or not the patient is open to discussing ways to improve their health. If the patient indicates interest in making changes and the physician intervenes at the right moment, there is a much higher rate of success.”

Wilson says that the EMR will continue to play a role in the future in patient satisfaction and better health.

“The EMR helps us link with patients so that we can ask the right questions and encourage them to share in decision-making,” she explained. “We find that patients are likely to have better outcomes if they play a part in designing their own healthcare. And the EMR is a tool that helps us help our patients achieve their goals.”

Wilson adds that Kaiser, in response to patients’ growing interest in and reliance on technology, is looking at ways to make medical records more accessible.

"Here in Georgia, we’re thinking about having open notes in patient charts so that the patient can access his or her whole medical record online any time they want,” she said.

**Returning to a patient-centric system**

Thomas E. Bat, M.D., president of the Medical Association of Atlanta and CEO of North Atlanta Primary Care, PC, says he believes the recent presidential election holds important ramifications for our current healthcare system.

“For years, I’ve said that regardless of who’s running the show in Washington, managed care would probably never go away. Now, all bets are off. I think it’s possible that Donald Trump could tear up healthcare as we know it and move us away from the current system,” he said.

“The question is, how will he actually accomplish that?”
While he believes in an open market for healthcare insurance, Bat feels that the Affordable Care Act has ended up doing exactly the opposite of what it was intended to do and that rising costs are beyond what the average American can afford. Ultimately, he feels that the future of healthcare lies in restoring the physician-patient relationship as the very core of the way care is delivered to every citizen.

“Our current protocol determines how long patients have to wait for treatment and limits how physicians evaluate their patients and prescribe treatment. We’re forced to deliver care that is determined by a government-based treatment plan rather than on what we know the individual patient needs. Additionally, most physicians go into medicine to actually be doctors, but they end up frustrated with the system that governs the way they deliver care,” he said.

“The current administration says there are no other alternatives. But we need to go back to a world where a doctor is a doctor and a patient is a patient. If we don’t find a way to create a physician-patient-centric system to reward physicians for working hard and patients for taking care of themselves, we all lose.”

**Patient-centered doctors to usher in new age of healthcare**

James Sams, M.D. and CEO of Privia Medical Group Georgia also believes that the doctor-patient relationship will move to the forefront of how healthcare is managed in the future.

“I’m very excited and optimistic about the profession of medicine. I think the next Golden Age of Medicine is in front of us and within our grasp,” he said. “And I believe it will be ushered in by physicians who are truly capable of being patient-centered.”

Sams feels that physicians are faced with making an important choice right now that will determine their future and their success.

**Social Media and Healthcare**

Just about everyone in America, from children to seniors, uses some form of social media. So it’s not surprising that social media has changed the way that people seek out information. Social media has become a powerful marketing tool and one that will likely continue to influence decision-making, including the choices people make regarding their health.

Here are five interesting statistics that show how social media has impacted the healthcare system in America:

1. Forty-one percent of people said social media would affect their choice of a specific doctor, hospital, or medical practice. *(source: Demi & Cooper Advertising and DC Interactive Group)*

2. Sixty percent of physicians report that one of their most popular activities on social media is following what colleagues are sharing and discussing. *(source: Health Care Communication)*

3. Parents are more likely to seek medical answers online: 22% use Facebook and 20% use YouTube. Of non-parents, 14% use Facebook and 12% use YouTube to search for health care related topics. *(source: Mashable)*

4. Sixty percent of doctors say social media improves the quality of care delivered to patients. *(source: Demi & Cooper Advertising and DC Interactive Group)*

5. Thirty percent of adults are likely to share information about their health on social media sites with other patients, 47% with doctors, 43% with hospitals, 38% with a health insurance company and 32% with a drug company. *(source: Fluency Media)*

“In my opinion, the future value in practicing medicine, both professionally and economically, will be given to physicians who make the choice to be patient-centered,” he said. “Achieving better outcomes at lower costs will be their focus, thereby unlocking this new value.”

Sams adds that patient-centered physicians will always keep in mind that their greatest responsibility is to their patients.

“If we prescribe care that our patients cannot afford, we’re not being their advocates or doing them a service,” he said.
The Medical Association of Atlanta’s Sponsors

**PLATINUM**

- **The Doctors Company**
  
  The Doctors Company is fiercely committed to defending, protecting, and rewarding the practice of good medicine. We are the nation’s largest physician-owned medical malpractice insurer, with 77,000 members, 4.3 billion in assets, and $1.8 billion in surplus.
  
  Learn more at [www.thedoctors.com](http://www.thedoctors.com)

- **Mag Mutual**
  
  As the Southeast’s largest mutual professional liability insurer, MAG Mutual empowers physicians to focus on delivering quality care by leading the way in proactive patient safety resources, unrivaled claims defense and expert risk management services.
  
  [www.magmutual.com](http://www.magmutual.com)

- **Kaiser Permanente**
  
  With more than 400 primary- and specialty-care practitioners, The Southeast Permanente Medical Group (TSPMG) is part of Kaiser Permanente’s integrated health care delivery system. Our physicians are connected through one of the largest electronic medical record systems in the U.S., helping us lead the way in improving clinical practice and overall health care quality.
  
  [physiciancareers.kp.org/ga](http://physiciancareers.kp.org/ga)

**GOLD**

- **Privia Medical Group**
  
  Privia Medical Group, a high-performance multi-specialty medical group, combines technology, team-based care, and unique wellness programs to help leading doctors better manage the health of their populations and manage high-cost chronic disease. Our group enjoys close partnerships with leading national payers, with reimbursement programs that reward high-quality care.
  
  [http://go.priviahealth.com/atlantamedicine](http://go.priviahealth.com/atlantamedicine)

**SILVER**

- **Birch Communications** • [www.birch.com](http://www.birch.com)
- **Bank NY Mellon** • [www.bnymellon.com](http://www.bnymellon.com)
- **Favorite Healthcare Staffing, Inc.** • [www.favoritestaffing.com](http://www.favoritestaffing.com)
- **RiverMend Health Centers** • [www.georgiadetoxandrecoverycenters.com](http://www.georgiadetoxandrecoverycenters.com)
- **Habit, Arogeti, & Wynne, CPAs** • [www.hawcpa.com](http://www.hawcpa.com)
- **Owen, Gleaton, Egan, Jones & Sweeney, LLP** • [www.og-law.com](http://www.og-law.com)
- **Suntrust** • [www.suntrust.com/medical](http://www.suntrust.com/medical)

**Join the MAA today!**

For membership information, contact David Waldrep, Executive Director at 404-881-1020.

The Medical Association of Atlanta (MAA) is a non-profit association dedicated to the advancement of organized medicine in Atlanta.
AT NORTHSIDE HOSPITAL, YOU’LL FIND TOP DOCS ALL OVER. FROM OB/GYN TO GERIATRICS AND EVERYTHING IN BETWEEN.

For Your Lifetime of Care.

ADDICTION PSYCHIATRY
ALLERGY & IMMUNOLOGY
CARDIAC ELECTROPHYSIOLOGY
CARDIOVASCULAR DISEASE
CHILD NEUROLOGY
CLINICAL GENETICS
COLON & RECTAL SURGERY
DERMATOLOGY
DIAGNOSTIC RADIOLOGY
ENDOCRINOLOGY, DIABETES & METABOLISM
FAMILY MEDICINE
GASTROENTEROLOGY
GERIATRIC MEDICINE
GERIATRIC PSYCHIATRY
GYNECOLOGIC ONCOLOGY
HAND SURGERY
HEMATOLOGY
INFECTIONOUS DISEASE
INTERNAL MEDICINE
INTERVENTIONAL CARDIOLOGY
MATERNAL & FETAL MEDICINE
MEDICAL ONCOLOGY
NEPHROLOGY
NEUROLOGICAL SURGERY
NEUROLOGY
NEUORADIOLOGY
OBSTETRICS & GYNECOLOGY
OPHTHALMOLOGY
ORTHOPAEDIC SURGERY
OTOLARYNGOLOGY
PATHOLOGY
PEDIATRIC INFECTIOUS DISEASE
PEDIATRIC UROLOGY
PEDIATRICS
PLASTIC SURGERY
PULMONARY DISEASE
RADIATION ONCOLOGY
REPRODUCTIVE ENDOCRINOLOGY
RHEUMATOLOGY
SURGERY
THORACIC & CARDIAC SURGERY
UROLOGY
VASCULAR & INTERVENTIONAL RADIOLOGY
VASCULAR SURGERY

Northside Hospital
Northside.com