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I recently showed a videotape to a colleague of mine, also a movement disorder neurologist. The patient had an inherited ataxia, which affected motor function but not cognition or behavior. As the patient walked out of the exam room on the videotape, I asked him to turn to the left and walk down the corridor. He turned to the right. I corrected him but he made the error again, and so I commented, “This disease isn’t supposed to affect your thinking, just your movements.” He laughed. I laughed. A positive interaction.

My colleague said, “I made a comment to one of my patients that was just like yours and she fired me. She thought I was demeaning and unsympathetic. She accused me of making fun of her. She was irate.”

It was difficult to imagine anyone who knew my colleague to think he had made fun of his patient. He is a kind, sensitive physician who has never been flippant or dismissive, that I’ve ever seen, and while many people behave differently in different situations, I’ve seen him with patients, students, colleagues and it just doesn’t ring true that he could have, in any way, slighted the patient.

Laughter in the medical office is good. Although many people think that “laughter is the best medicine,” I am not one of them. But I do think it helps lighten the load. It is crucial, of course, to be certain that patients will not respond as my friend’s patient did, so, when in doubt, I don’t joke. I must insert here that I have been informed by many observers that I am known among patients for not smiling, not joking and being overly serious, even to the point of being called “Dr. Smiley.” I do think that joking makes the doctor more accessible, more humane, and it can help make the disorder distinct from the patient. I think of myself as humorous, although it is true that I don’t smile much. Perhaps it’s concern about “laugh lines” as I age. The important thing is that one can laugh at the disorder, not the bearer of the disorder, and it calls for sensitivity and judgment to decide which patients cannot appreciate the difference – these are the ones who will feel insulted. “I have Parkinson’s,” said one of my patients. “Parkinson’s doesn’t have me.” We can laugh at one, not the other.

A man once told me that his father was hallucinating and seeing people in his apartment who weren’t there. This didn’t usually upset his father – except for the time when he saw his upstairs’ neighbor, a woman who regularly came down to check on him, in the apartment when she wasn’t supposed to be there. So he called her on the phone to come down and get rid of herself. Laughing at the disease, not the patient.

I did not laugh when another patient, who had hallucinations of people outside his home, told me, in response to my query, that the hallucinations he saw were always outside and never inside the house. “I double lock the door,” he explained, giving a rational answer to an irrational situation. The door was locked. How could anyone get in? I must admit that I did laugh later on. It took me a while to understand the humor. I would have explained to the patient what was funny. His disease and medications had produced this surreal experience.

It is never good for the doctor to laugh at the patient, or laugh with any other possible interpretation than “with” the patient.

It is never good for the doctor to laugh at the patient, or laugh with any other possible interpretation than “with” the patient.
Psychogenic disorders
Unfortunately, however, we physicians sometimes do laugh at patients. Not long ago there was an outbreak of psychogenic movements among teenage girls in Buffalo, NY. It was widely featured on the national news, on the Internet and in newspapers. It was quite clear to the practiced eye that these were not physiologically-based movements, and the physicians who cared for the girls were quite definite about this, although the news reporters seemed somewhat skeptical. This occurred not long after a young woman became a YouTube sensation when she developed “dystonia” following a flu inoculation. TV stations nationwide reported her story and again, it was quite clear that her movements were psychogenic, much to the chagrin of the anti-vaccination movement. Her disorder transformed over the next few weeks to include an amateur French accent and walking like a crab. It was quite common for physicians discussing and reviewing these videos to laugh at the patients. And it is very common for the audience to laugh when bizarre psychogenic seizures and movement disorders are seen on video.

I admit to this transgression, although it has not happened recently. I became embarrassed when I realized that I was laughing at, and not with, the patient. I was adding insult to injury. If one posits that the movements are involuntary, that they occur due to unconscious mechanisms of the psyche, then they are reflections of emotional pain. It is the brain’s flawed way of “hiding,” transforming or converting psychic distress to a somatic disorder, clearly indicating to the world a person in distress, needing help, able to present a visible wound.

So why do well-intentioned and well-trained doctors, even senior ones, laugh? I think I’ve figured it out. I think that it is for the same reason that adults laugh when a child says he didn’t eat the chocolate although it’s on his hands and face. We laugh because we find ourselves as an opponent in a contest of “fool the doctor,” and the patient’s maneuvers are so obviously “phony” that we laugh to show our disdain for the notion that we can be fooled by something so obviously factitious. I have observed that we don’t laugh when the disorder looks so real we’re unsure. The tremor that looks “organic” until it is unmasked by distracting maneuvers is not amusing, but the histrionic patient who groans and strains, crossing his eyes with the effort of touching his finger to his nose is. After all, who could be fooled by that?

Neurologists have changed their approach to psychogenic disorders. We used to render a diagnosis of “psychogenic,” “functional” or “not organic” and send the patient to a psychiatrist, who might or might not embrace this diagnosis. If not, the patient would continue having more tests and seeing more neurologists. The referring neurologist would wash his hands of the patient, not to be seen again. We have come to see that the disability from psychogenic disorders is every bit as bad, often worse, than the organic disorders on which they’re modeled. We now try to work with the other physicians and therapists. The chances of improving from psychogenic dystonia are a whole lot better than of improving from an organic dystonia. Psychogenic disorders can even be cured.

The bottom line is that pain is pain, whether emotional or somatic. We should never allow ourselves to be drawn into a contest with our patients. No one emerges a winner.

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In the Dark Winter of our Discontent

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“T he rules of fair play do not apply in love and war.” So declared English playwright John Lyly in 1578. However, worded often quoted as “All’s fair in love and war”), the message, as it pertains to warfare at least, is clear: none of the customary rules of civility apply. And yet warfare, in recent centuries at least, is governed – perhaps modulated would be more accurate – by a number of international conventions making certain warfare practices tacitly acceptable and others explicitly not.

The Geneva Convention, convened in 1949, provided rules to insure the safety of non-combatants, particularly health workers, forbade torture, guaranteed access to prisoners of war, established neutral committees to facilitate communication and forbid certain warfare practices such as the deployment of poison gases. Subsequent Geneva protocols also precluded the use of microbial pathogens as vehicles of warfare.

Germ warfare – the deliberate dissemination of disease-causing bacteria or viruses for purposes of harming civilians or military – is now widely condemned by the many Geneva Conventions. Yet there have been many documented instances of planned, deliberate bioterrorism in prior centuries.

Jeffery Amherst (1717–1997) was commander of British forces in North America during the French and Indian War (1754–1773). In 1763, when Pontiac’s army of Native Americans had besieged Fort Pitt, the local officer in command of the British garrison suggested that contaminated blankets from smallpox victims be sent to the Indians in the hopes of deliberately spreading smallpox amongst the besieging tribes. In a letter dated July 9, 1763, Amherst expressed his enthusiasm for “measures as would bring about the total extirpation of the Indian Nations.” A smallpox epidemic amongst the tribes did ensue but whether it was initiated by the infected blankets cannot be proven. Historians, while deploiring Amherst’s zeal for ethnic cleansing, saw little moral distinction between musket ball wounds and smallpox.

Through the coordinated global efforts of teams of epidemiologists and health workers, smallpox was finally eradicated, the last natural case of the disease verified in a Somali male in 1977. No subsequent cases were seen in the next decade and, with a collective sigh of relief, smallpox vaccination programs were halted and smallpox then retreated to the historic past.

Fears still lingered that the smallpox virus might be employed for purposes of terror. In 2001, the Johns Hopkins Center for Civilian Biodefense Strategies hosted a tabletop exercise, entitled, “Dark Winter” to assess the epidemiological implications of a covert smallpox attack upon the United States.

The conference envisioned three shopping centers (Oklahoma City, Philadelphia and Atlanta) each intentionally contaminated with 30 grams (about one ounce) of aerosolized smallpox virus. Each atmospheric contamination would infect about 3,000 individuals in each of the shopping centers. And, based upon past epidemiologic experience, each newly infected person (during a latency interval when this “first-generation” victim was still symptom-free) would infect about 10 additional persons. Thus, before the virologic catastrophe became clinically apparent, the number of infected, in each of three attack areas, would increase tenfold leading to an estimated 30,000 victims. Within a month, the numbers infected would exceed 300,000; and, since many during the symptom-free incubation-interval would have traveled to other cities and other countries, the seeds of smallpox would inadvertently spread.

This blackboard exercise simulating the likely effects of a terrorism
attack employing the smallpox virus indicates the vulnerability of this nation to the deliberate seeding of a civilian population with a lethal pathogen. If a weapon is judged by the amount of damage it causes, in terms of morbidity and mortality per ounce of weaponry, then weaponized smallpox ranks with the nuclear weapons.

Thirty-six virologically uneventful years have passed since any human has been naturally afflicted with smallpox. No one, born after 1977, has been protectively vaccinated. And while this nation still maintains a stockpile of smallpox vaccine, the interval of time between intentional dissemination of the virus and the time when the peril is recognized by public health officials is sufficiently great so as to allow carriers of the lethal virus to have traveled extensively thus increasing the infected population exponentially.

Under the best of circumstances, this tabletop exercise concluded, the mortality would be massive.

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Quotes: Rx for Life

“It is enough for me to contemplate the mystery of conscious life perpetuating itself through all eternity, to reflect upon the marvelous structure of the universe which we dimly perceive, and to try humbly to comprehend an infinitesimal part of the intelligence manifested in nature.”

— Albert Einstein

Submitted by Daniel Lederer, MD, Providence

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National Library of Medicine
Fifty-one years ago, President John F. Kennedy called on the United States to send a man safely to the moon within the decade. This year, Sen. Sheldon Whitehouse urged Rhode Island’s Healthcare Reform Commission to define its corresponding “moon shot” for transforming healthcare. We believe Rhode Island is uniquely positioned to help lead the nation toward a shared vision of that “healthcare moon shot.”

President Kennedy’s call to action has significant parallels to health policy today. He communicated a clear vision with an inspiring, easily understood goal. His justification was compelling: “because that goal will serve to organize and measure the best of our energies and skills, because that goal is one we are willing to accept, one we are unwilling to postpone, and one which we intend to win.”

Our healthcare system is unaffordable, unsatisfying, and unmanageable. Michael Mullen, former chairman of the Joint Chiefs of Staff, described healthcare costs as a national security threat. We must drive healthcare costs down while improving access and quality if we are to develop a sustainable economy. The Supreme Court ruling on the Affordable Care Act and the implications of the recent election for the vision of healthcare we will pursue as a nation represent only the beginning of the work faced by our state and others to fundamentally reform healthcare toward an affordable, high quality healthcare system. Gov. Lincoln Chafee and Lt. Gov. Elizabeth Roberts, and many others, have already taken two crucial steps – establishment of the Healthcare Reform Commission and Health Insurance Exchange, “not because they are easy, but because they are hard,” as President Kennedy said.

Some key next steps for our proposed healthcare moon shot were suggested at the Patient-Centered Healthcare Transformation Think Tank hosted last spring by Brown University’s Department of Family Medicine, building on the Institute for Healthcare Improvement’s “Triple Aim” of healthcare reform:

1. Improved patients’ experience of care (quality and satisfaction)
2. Improved population health
3. Reduced per capita healthcare costs

Local and national experts on health policy, primary care, and health reform attended this think tank. A broad approach to achieve the Triple Aim in Rhode Island arose from this meeting:

- First, we must replace current decision-making based on stakeholder influence with a process that prioritizes public interest. All providers need to participate in systemic cost-containment efforts that improve quality, integration of services, and access. Purchasers and consumer representatives need to insist on better value for the care and coverage purchased.
- Second, we need to clarify what patient-centered healthcare really means. The current preoccupation with “product lines” must give way
to a broader focus on whole patients, families, and communities. This means changing the context in which care is delivered, and reorganizing benefits, funding, and services to enable an entirely new way of caring for our population’s health. In particular, this requires moving from primary care and specialty providers to patients working in partnership with teams to promote health and well being. Control can no longer rest solely in the hands of payers or providers, especially those most powerful; rather it belongs in the hands of patients and their families who can build relationships with teams of providers and others in their lives to achieve a better healthcare experience with improved results, supporting more effective, fulfilling lives.

• Third, to achieve such dramatic changes in one-sixth of our economy, we must organize our efforts around a shared vision of what we are seeking. Think Tank participants noted that Rhode Island has an abundance of nationally recognized leaders in healthcare reform. However, a shared vision can have even greater impact than strong leadership; we need to develop that common understanding, as well as structures and financing to guide concrete strategies to, as President Kennedy said, “organize and measure the best of our energies and skills” and apply them to healthcare transformation. The vision needs to be clear enough so that we all understand its implications, compelling enough that we all accept its primacy, and concrete enough that we can measure our actions according to how well we meet our goals.

**Proposals**

We thus propose our healthcare moon shot. Within the next decade:

• U.S. healthcare will be the best in the world. The World Health Organization (WHO) has ranked the performance of U.S. healthcare 37th, ahead of Slovenia but behind Costa Rica. We should be #1 in the WHO ranking.

• U.S. healthcare will be value based, no longer just the most expensive in the world. According to the Organization for Economic Cooperation and Development (OECD), U.S. healthcare spending per capita is more than twice the OECD median.

This affordable, effective healthcare system will develop from the best of American values and innovation:

• U.S. healthcare will be affordable because it is effective at improving patients’ lives.

This vision requires that providers determine what patients want from their healthcare – figuring out what is meaningful to them and then providing services planned according to what it will take to help patients meet their goals. Ultimately, healthcare value is determined based on patients’ assessment of the relationship between benefits and costs. These processes, which only sound abstract, have been inherent to the performance of psychological services for decades, and they are easily achieved in all routine medical care.

Around the time President Kennedy was calling for the moon shot, Nobel Prize winning economist Kenneth Arrow noted that free market principles of supply, demand, and competition operate differently in personally sensitive healthcare markets, where the goals which are so important to consumers and decisions are made by patients and their providers, not by payers. Reforms that succeed must acknowledge this reality by designing healthcare to use available resources to meet personally important goals in the most efficient way possible.

We are all threatened by the financial and clinical crisis currently dominating healthcare. Successful reform is a goal we can all accept, a battle we know that we must and can win. In the last election, we have decided what vision of healthcare to pursue. We must aim high and expect to achieve our healthcare reform goals. The health of the public, the economic well-being of our state, and the security of our nation depend on it.

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As our population ages and continues to live longer than ever before, there will be a dramatic increase in the burden of musculoskeletal diseases within our society. It is currently estimated that 10,000 Americans will turn 65 every day for the next 20 years, and between 2011 and 2030, the percentage of the American population over 65 years old will shift from 13% to 18%. These “Baby Boomers” will challenge the capabilities of our healthcare system, and place unprecedented demand on our healthcare system to restore joint function and eliminate pain from arthritis to help maintain active, functional, and productive lifestyles.

Over the past 50 years, total joint arthroplasty has become one of the most common and successful types of orthopaedic surgeries, and total hip arthroplasty (THA) is perhaps the most successful surgery that has ever been developed. The high success rates enjoyed by both patients and surgeons following THA have helped to establish the procedure as the “gold standard” against which all other surgical procedures are compared regarding quality of life improvement. Accordingly, the British Lancet celebrated THA as the “Operation of the Century” in 2007.

A recent study of Medicare data presented at the 2012 Annual Meeting of the American Academy of Orthopaedic Surgeons showed for the first time that if patients in matched groups with severe knee osteoarthritis undergo total knee arthroplasty (TKA), patients with TKA actually have a 7-year mortality rate that is half of those who don’t undergo the procedure. Similar findings for THA have also been discussed at recent arthroplasty meetings in advance of publication, suggesting the notion that THA and TKA procedures not only relieve pain from arthritis, but may be viewed in the future as “public health interventions” that may predictably help people lead longer, more comfortable, and more productive lives.

Utilization trends verify the growing importance of total joint replacement within our national healthcare system. A recent JAMA article analyzing Medicare data in the United States reported that primary TKA volume increased 161.5% and revision TKA volume increased 105.9% between 1991 and 2010. These increases were felt to be driven both by increases in the number of Medicare enrollees and by per capita utilization rates.

Although THA and TKA are the most common types of joint replacement surgery, orthopaedic surgeons now have the capability to perform joint replacements in nearly every region of the human body. Total disc arthroplasty for the spine, total shoulder and elbow arthroplasty, and total ankle arthroplasty have also emerged as viable treatments for patients afflicted with degenerative diseases of these joints.

Currently, over 750,000 THA and TKA are performed yearly in the United States, and the numbers are expected to increase exponentially in the coming years. By 2030, it is anticipated that there will be a 274% and a 673% increase in the respective number of THA and TKA procedures performed annually.

Unfortunately, the burden of revision arthroplasty surgeries is also expected to climb at a similar rate as an increasing number of primary joint arthroplasty surgeries are performed annually. Most TKA and THA revisions are currently related to “osteolysis” from plastic wear. Thankfully, in the past decade, improvements in plastics bioengineering have reduced plastic wear rates in artificial joints by up to 1,000 fold. The effect on revision rates remains unclear, but is expected to significantly reduce the need for repeat surgery as longer-term data becomes available.
'Supply Side Crisis'
At the same time, there is a looming public health crisis in hip and knee replacement surgery that has been labeled by experts as a "Supply Side Crisis." The number of young surgeons specializing in total joint replacement is declining, thought to be related both to declining reimbursement rates from cuts to the Medicare system, as well as the demanding nature of providing inpatient care for these patients. Since many senior arthroplasty surgeons are within 10 years of retirement, there is going to be a manpower crisis in arthroplasty surgery for the American public unless more orthopaedic residents and fellows can be skillfully trained to meet demands of an aging population.

With the recent development of Rhode Island’s only academic Total Joint Center at the Miriam Hospital in 2011, we now have the capability to engage and develop the skills of talented young orthopaedic surgeons to help meet this important public health need. As we continually improve the quality and capability of joint replacement surgery in the state, our ability to care for local patients undergoing arthroplasty will be on par with the finest institutions in the country.

In this special volume of the Rhode Island Medical Journal (RIMJ), I have assembled a series of outstanding articles written by expert local authors about aspects of medical and surgical care related to lower-extremity joint arthroplasty. We will develop an improved understanding of the biology of osteoarthritis, explore novel ways surgeons and hospitals are working together to improve arthroplasty care delivery, and review current strategies to manage blood utilization surrounding arthroplasty surgery. We will gain insight into the diagnosis and management of ankle arthritis, and review cutting edge techniques relevant to THA and TKA that include both unique concepts and futuristic treatment options.

I wish to thank the leadership of the Rhode Island Medical Society and the editors of the RIMJ for granting the opportunity to present this unique monograph. I am also deeply grateful for the efforts of each author who contributed their insight and expertise towards making this a valuable collection of articles.

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Establishing a Center of Excellence: The Total Joint Center at The Miriam Hospital

GARY M. FERGUSON, MD, CLINICAL DIRECTOR
JOHN A. FROEHLICH, MD, PROGRAM DIRECTOR

BACKGROUND
Challenges to the delivery of state-of-the-art healthcare to our patients continue to increase in recent years for nations, states, hospitals, physicians, nurses, and support staff. Administrative requirements, documentation demands, and remaining up to date with current principles of care challenge all of us. In the midst of this challenge, The Miriam Hospital has successfully launched a specialized program in orthopedic total joint replacement. In this article, we will describe the development of that program, its guiding principles, challenges, and early results. As a model for the delivery of care, it may also be useful and practical in its application to other specialties.

Stimulated by a journal publication in July, 2008¹ which described the projected increased demand for joint replacement surgery for the next 20 years, the surgical and administrative staffs at The Miriam Hospital launched an overhaul of the total joint replacement program. We were motivated by existing waste in resource integration, sparse shared governance between the administration and surgeons, inadequate alignment of surgical care protocols, and inadequate data-driven outcomes management. We embraced Lean Six Sigma methodology² to insure administration/surgeon shared governance, service integration, and the need to establish program champions in our 247-bed teaching hospital.

ESTABLISHING THE PROGRAM
We began by establishing monthly meetings including surgeons, nurses, recovery personnel, physical therapists, case managers, occupational therapists, the hospital’s chief operating officer, admission personnel, administrative staff, and anesthesiologists. This spanned the course of one year. We went to great lengths to ask each service sector to describe its expertise in detail, written on a storyboard, outlining all features of care delivery relative to that sector. Over time, it became clear how expert, but separate, each service sector was in relation to the whole program. Biases and inherent resistance to change created by years of clinical experience had to be overcome. This process caused all participants to begin to propose specific changes that would help integrate their service expertise to the rest of the hospital-wide total joint replacement program. In some cases, it was necessary to alter protocols to maximize integration. The obvious commitment of surgeon champions to this process was essential.

Revamped patient education process
A good example is the preoperative patient education process. This evolved from an unstructured attempt by preoperative testing personnel to answer patient questions, to a formal patient education session now mandatory and offered by a combined surgeon, therapist, case management, and nursing team. Lean Six Sigma methodology was employed.² This process, popularized by Motorola after the 1970s, seeks to eliminate errors and minimize variability in a business process or in manufacturing. Creating the education session meant integrating the nursing and physical therapy care over several cooperative sessions. Pain management, wound care, timing and location of therapy services, and diet and bowel function management were all integrated to coordinate delivery and minimize potential delays. Special protocols were developed for the planned day of discharge, compared to other days. Surgeon-to-surgeon variability in therapy management, wound care, bowel management, thrombosis prophylaxis, and pain management was addressed through a surgeon committee that meets monthly. This allows us to address all concerns of participating surgeons and reach consensus for a common order set. Once all of these efforts were complete, a combined patient education session for all patients could be delivered. Since its inception, it now consumes 90 minutes during a visit for routine preoperative testing. Our outcomes data shows that
over 80% of patients regard the session as essential or helpful. An institution-wide commitment to co-governance has been the common thread.

Genesis of Joint Center
The monthly institutional meetings mentioned earlier created opportunities for integrating care and led to results like the patient education session. In 2010 Lifespan made a formal financial commitment to fully develop a joint replacement center located at The Miriam Hospital. With this support, an outside consultant was hired to refine our efforts into a fully functioning Joint Replacement Center. This phase began in October 2010, allowing a full Joint Center launch in November 2011. We also visited another regional joint center to glean insight from that program’s development and experience. From the outset, each stakeholder at our institution put his or her signature to a framed Pledge, an eight-point document. This is displayed at several sites in the hospital and describes the program’s commitment to shared governance and data-driven outcomes management.

Shared governance
A governance committee was developed to oversee the entire effort, chaired by the director of Surgical Services and two surgeons. It continues to meet monthly, and members from all service sectors are represented, including purchasing, marketing, and information technology. Co-governance and transparency in management across service sectors is stressed. Our data (referred to as the “dashboard”) is reviewed each month, providing current information on features such as cost consumption, length of stay, transfusion rates, discharge destination, patient satisfaction, etc. (See Table.) It is also tracked on a surgeon-specific basis. This outcome data is then used to pose specific projects to address and facilitate improvement, with a team leader for each project, and a clear deadline for completion. The Committee then reviews the results, and protocol changes implemented as needed. This structure and process has lead to a large number of successful outcomes data-driven program changes.

Patient navigators
Our management now includes the work of a full-time registered nurse/manager to serve as a patient navigator. This individual follows the patient closely throughout the entire hospital experience, providing extra advice, reassurance, and serves as a liaison with case management to facilitate discharge planning and expectations. She also sits on the governance committee to help facilitate continuity of care. Patient-care problems can be brought directly to her attention, and direct surgeon feedback offered. This individual also gives the primary care physician a summary of the hospital experience after each patient discharge. In August 2012, a second full-time nurse practitioner also began assisting the surgeons and nursing staff with direct postoperative medical care for all of our patients.

Multi-disciplinary approach
The basis of the total joint center’s early success is the use of a multi-disciplinary approach with collaboration between various care and service providers. To achieve this we had to learn or re-learn what others do and make a concerted effort to meld these services. Obviously, this requires working not as individuals but rather as a team. The ultimate focus is on the patient and his/her needs. To achieve the goals we set, we used the governance model to reach consensus and achieve well-defined outcomes.

PROGRAM GOVERNANCE
A key organizational component of the Total Joint Center is the governance committee. As mentioned, this is comprised of key service providers to our patients before, during and after discharge. To maintain a focused and direct approach, a dashboard was created with components that were felt to be key to the success of the program and the needs of our patients. The dashboard is a monthly “snapshot” of our trends and associated success as intervention is pursued. The dashboard is divided into four sectors: 1. Financial, 2. Operational, 3. Patient experience and 4. Quality. (See Table.) This design allows us to provide direction to the entire Total Joint Center team and promotes a process of continual inspection/re-evaluation. Using this approach, we have been able to achieve impressive results in our first year of formal operation. Specific components within the dashboard

Table: Total Joint Center of Excellence Management Data Dashboard

<table>
<thead>
<tr>
<th>FINANCIAL</th>
<th>OPERATIONAL</th>
<th>PATIENT EXPERIENCE (From Press-Ganey Survey Scores)</th>
<th>QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Combined Hip/Knee/Shoulder Caseload</td>
<td>• Average Length of Stay</td>
<td>• How Well Was Your Pain Controlled?</td>
<td>• SCIP Criteria: Patients on Recommended VTE Prophylaxis</td>
</tr>
<tr>
<td>• Total Supply Cost per Case</td>
<td>• OR Room Turnover Time</td>
<td>• Likelihood of Recommending Hospital?</td>
<td>• SCIP Criteria: % Of Patients Who Received Timely VTE Prophylaxis</td>
</tr>
<tr>
<td>• Total Labor Cost per Case</td>
<td>• OR First Case On-Time Starts</td>
<td>• Did the Staff Include You in Decisions Regarding Treatment?</td>
<td>• Surgical Site Infections</td>
</tr>
<tr>
<td></td>
<td>• Discharges to Rehabilitation</td>
<td>• Discharge Composite Score</td>
<td>• Patient Falls While in Hospital</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Patients Attending Preoperative Education Class</td>
<td>• Readmissions Within 31 Days</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Transfused Cases for Total Hip and Total Knee Replacement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Transfused Cases with Hemoglobin &gt;/= To 8g/Dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Urinary Catheters Removed by Post-Op Day 1</td>
</tr>
</tbody>
</table>
may be modified (for example, changed to a higher goal), eliminated (no longer appropriate) or a new parameter added.

Specific Trends
Several specific trends are worthy of mention. Prior to the onset of this program, the average length of stay for the total joint patient was 3.7 days. This has continued to trend down and currently is 3.2 days. This alone represents a significant savings to the institution, especially since the number of patients who underwent replacement was 1,208 in calendar year 2012. Greater efficiencies in the operating room have resulted in an average decrease in room turnover time from 41 minutes to 21 minutes in 2012. Prior to this program, the typical patient went to a skilled nursing facility on average 75% of the time. With patient/family education, more comprehensive and consistent pain management, and accelerated inpatient rehabilitation during the hospital admission, this number has decreased to 29%.

We have seen truth to the adage: “If you build it they will come.” The number of participating surgeons has increased from an initial core of 5 to 9 currently, with interest among others in the community to participate. Patient volume has also increased substantially from roughly 750 procedures in 2010 to 1,208 in 2012. Now over 80% of cases start on time in the morning, whereas fewer than 1 in 4 achieved this prior to the program. This feature alone illustrates the effectiveness of establishing a team-oriented multidisciplinary approach. Many perceived this as an “anesthesia issue.” Further analysis showed this to be multi-factorial. Adjustments were made in patient arrival, staffing, a call-in system to assure surgeon availability and adjustment in anesthesia availability. The results are impressive. Rooms are better utilized, work is completed sooner, patients arrive sooner on the nursing floor facilitating care, and patients are available sooner for the initiation of same-day physical therapy.

Achieving these and other goals is important. Equally as important, the program has created a cooperative and cohesive environment, which is appreciated not only by the institution and staff, but also the patients themselves. It is an incredibly positive attribute that promotes further improvements in the program. We have also found that this team cohesion promotes a collegial “buy-in.”

Additional features
Several additional features of the program warrant mention. We were fortunate to have at our disposal the hospital’s data system and an individual very facile in data analysis. This allowed us to rapidly evaluate data and/or issues and create action items that were used to rectify problems or facilitate improvement. Another key to the entire program is its patient-centric approach. As such, the dedicated nurse navigator and nurse practitioner contribute to patient care in the pre-operative, post-operative and post-discharge phases of patient care. They also contribute greatly to building the relationship between the institution, the surgeons and the primary care physicians. Having all stakeholders involved and informed is imperative for optimal patient care. Finally, the surgeon committee, which meets monthly, has provided an important forum for surgeons from different groups to interact, discuss, and share ideas so as to reach consensus on common issues, which leads to streamlining of care and greater efficiencies.

SUMMARY
The Total Joint Center at The Miriam Hospital has been very successful and now serves as a model for other specialties. Key to this program’s success is the cooperative relationship between various stakeholders. Leadership is required yet the input and participation of all is necessary to achieve the desired outcome. To achieve efficiencies, there must be a willingness to deeply integrate clinical services. Again, this requires input from sectors that in the past typically did not communicate with each other. Finally, surgeons and staff need to “pledge” and show their willingness to practice based on sound patient data and modify treatment based on this same data.

We are extremely proud of the results achieved. Also impressive is how, in a very short period of time, we have been able to bring together an extremely dedicated team of professionals who work cooperatively in a seamless fashion. With this approach we are able to meet our strategic goal of providing state-of-the-art, high quality, patient-centric, efficient healthcare.

References

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Pathogenesis and Epidemiology of Osteoarthritis
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ABSTRACT
Osteoarthritis (OA) is a disease of high prevalence that produces substantial morbidity and is a leading cause of physical and psychological disability and expense, including time lost from work, medical care, and disability support. Until recently, the focus of research into the pathophysiology of OA has been on articular cartilage and has not resulted in either biomarkers of OA activity or effective targets for disease-modifying therapy. The contemporary paradigm of OA considers involvement of all joint tissues. It has been shown that, in later-stage OA, bone blood flow and oxygen content are markedly reduced and have a deleterious effect on bone cells, inducing them to release proteins (cytokines) that contribute to the bone remodeling and cartilage breakdown seen in OA.

KEYWORDS: Osteoarthritis, pathophysiology, articular cartilage

Pathogenesis
The contemporary paradigm of osteoarthritis (OA) is that its pathogenesis involves all joint tissues including cartilage, bone, synovium, ligamentous capsular structures, and surrounding muscle. It is characterized structurally by active bone remodeling, degradation of articular cartilage, and synovial inflammation resulting in loss of joint function and angular deformity or malalignment. A focus on the articular cartilage pathology has not led to novel biomarkers or therapeutic targets and many pharmaceutical manufacturers, notably, AstraZeneca, Pfizer, and Stryker Biotech have discontinued their OA research programs because disease modifying drugs were thought unlikely to be developed soon. Although a variety of synovial fluid markers provide insight into the biological response of joints to injury, no chemical or anatomic (imaging) biomarkers have been identified that monitor the development and progression of OA or the response to therapy. Certain factors increase the risk of developing OA, such as repetitive trauma/loading, joint injury, age, obesity, physical activity, bone mineral density (BMD), and in some subgroups, congenital anomalies. OA is thought to be highly cytokine-driven, and is associated with mechanical stress resulting from overloading of subchondral bone from dysplasias, malalignment, and trauma. Interest has been focused recently on small protein mediators (cytokines) that provide chemical signaling or “cross-talk” among involved tissues. These signaling molecules incite inflammation in the synovium, remodeling subchondral bone, and enzyme activation and extracellular matrix degradation in articular cartilage.

Subchondral Bone
Interest in structural remodeling, vascular biology, and osteoblast cytokine expression of subchondral bone in OA has been stimulated by a large number of studies suggestively associating a role for subchondral bone changes in the pathogenesis of OA. Active bone remodeling is associated with the initiation and progression of OA including sclerosis of the subchondral bone plate, alterations in trabecular structure, osteophytes and bone marrow lesions. Some studies with a guinea pig OA model suggest that subchondral bone changes precede degradation of articular cartilage. Additionally, several cytokines have been found in subchondral bone that play major signaling roles associated with cartilage degradation including IL-1, TNF-α and those of the fibrinolytic system including plasminogen, tissue and urokinase plasminogen activators (tPA, uPA), and plasmin.
Vascular Biology of Subchondral Bone in OA
Intraosseous hypertension, venous stasis, and outflow obstruction are associated with bone pain and produce physiologically relevant reductions in perfusion and $pO_2$. These relationships are of extreme importance in understanding the physicochemical environment of OA and its pathologic significance. Collective observations suggest that the physicochemical environment consisting of pressure, blood flow, and oxygen, among others, may constitute signaling mechanisms to osteoblasts resulting in alterations in cytokine expression. Changes in perfusion, then, bear a functional relationship to bone remodeling and cartilage degeneration.

Osteoblasts (bone-forming cells) alter their cytokine expression profile in response to their physicochemical environment, and changes in the physical environment in subchondral bone in OA are well within the range to which osteoblasts are sensitive. Several studies have demonstrated a 2- to 3-fold increase in venous outflow obstruction in late stage OA of the hip. One study, using intraosseous phlebography, also demonstrated markedly delayed venous drainage and occlusion of retinacular veins, with drainage of the proximal femur through diaphyseal intramedullary vein. Several observations have suggested that intraosseous hypertension is caused by increased venous resistance resulting in outflow obstruction and venous stasis.

Intraosseous hypertension produced experimentally by venous ligation results in the histopathological hallmarks of OA – focal avascular necrosis (AVN), trabecular remodeling, thickening of the subchondral bone plate, endosteal and periosteal new bone formation and sclerosis. The pathophysiological consequences of intraosseous hypertension may lie in its association with diminished perfusion and hypoxia, which could serve as parts of a signaling complex to osteoblasts. Several studies describe linear relationships between perfusion and intraosseous pressure. An elevation in intraosseous pressure from 26 to 45mm Hg results in a reduction of intraosseous blood flow by 60%. A decrease in perfusion of 60% has been shown to reduce the $pO_2$ from 75 to 50mm Hg, within the range of hypoxia measured in OA bone. Measurement of intraosseous $pO_2$ shows significant hypoxia in OA.

Osteoblasts Recognize and Respond to Altered Perfusion and Hypoxia
Osteoblasts derived from OA bone express increased amounts and types of cytokines that are related to bone remodeling and cartilage breakdown. The cytokine expression profile of osteoblasts is altered in response to changes in pressure, perfusion, and oxygen concentration of the type and magnitude seen in OA, raising the hypothesis that physicochemical changes observed in OA subchondral bone may serve as disordered signaling pathways to osteoblasts which, in response, alter their cytokine expression profile in ways relevant to bone remodeling and cartilage breakdown.

The relationship between increased bone remodeling and
cartilage degradation in OA has been recognized for many years but understanding the role of subchondral bone in theopathophysiology of OA remains elusive. In particular, the role of the osteoblasts in subchondral bone remodeling and cartilage breakdown remains unclear, as does the significance of recent descriptions of bone marrow edema and altered perfusion. Osteoblasts are also responsive to hypoxia. Osteoblasts subjected to hypoxic conditions with pO2 of 35-40 mmHg, markedly alter the expression profile of growth factors associated with the pathologic findings of OA, increased bone remodeling and cartilage degradation.

**Epidemiology and Economic Impact**

The prevalence of OA is difficult to determine because symptomatic OA (joint pain, swelling, and stiffness) does not always correlate with the pathology of OA. Prevalence of pain associated with joint degeneration varies among joints and among individuals. Individuals with advanced degeneration of the joints may have minimal pain and disability, and for this reason, investigations of the prevalence of OA based on evidence of joint degeneration by itself, such as imaging studies or direct inspection of joints, yield larger numbers of affected individuals than do studies that require evidence of joint degeneration and joint pain together for the diagnosis of OA.

Recent information on the epidemiology of OA originates from population-based radiographic surveys. Population-based studies in the United States suggest prevalence rates comparable to those in Europe, increasing from 1% for severe radiographic disease among people aged 25-34 to 30% in those aged 75 and above. In 1997, a study in the Netherlands demonstrated that of the 1040 participants (aged 55-65), only 13% (135) were free from radiographic evidence of OA studied in the knees, hips, hands, wrists, and thoracolumbar spine. According to some population surveys, evidence of radiographic OA of the knee increases up to 80% for adults over the age of 65.

While most studies have focused on information from radiographic OA, there is increasing interest in the prevalence of symptomatic conditions of OA. This is important in order to determine the healthcare needs and options for patients. Symptomatic OA affects nearly 27 million Americans and is the most common form of arthritis. It is the leading cause of disability in the US. OA has a higher incidence in the hips and knees resulting in pain and stiffness and because these are large weight-bearing joints, it often leads to significant problems with mobility and disability requiring expensive surgical treatments. In the United States alone, more than 350,000 knee and hip replacements are performed each year.

Radiographic and symptomatic OA have been compared with age and gender. Using the Kellgren/Lawrence scale, they found that among different populations (NHANES study, Boston, MA, and Johnston County, NC) the prevalence of symptomatic OA was higher in women (62.9%) than men (46.5%). Nearly half of the participants from the Johnston County, NC, study are expected to develop symptomatic OA by age 85. Another study used age and sex prevalence in persons ≥26 years old and, using 2005 Census Bureau data, estimated that 9,267,000 adults have symptomatic knee OA. As the population over 40 increases, the number of people experiencing symptomatic OA will rise as well. OA contributes to a decrease in activities of daily living, and quality of life, and an increase in loss of work days, all of which result in out-of-pocket costs to the patient. The World Health Organization (WHO) has estimated that 10% of the world’s population over 60 years old suffers from OA, 80% of people with OA experience limitation of movement, and 25% cannot perform major daily activities. One observation reported that of 9,933 participants from the Medical Expenditures Panel Survey (MEPS) who have OA, 92% see physicians during the year, 34% visit at least one OA specialist, 25% see an orthopedist, 11% a physical therapist, and 6% a rheumatologist. Another study found that OA accounted for 7.1 million (19.5%) of all arthritis-related ambulatory medical care visits, of which 4.9 million were female patients, while 2.2 million were male. OA is a major contributor to the total economic burden (1 to 25% of the gross national product of Western nations). In addition, another study reported that OA costs more than $60 billion per year in the US. In 1997 alone, $7.9 billion estimated costs were attributed to knee and hip replacements. In 2000 it was estimated that the total costs in the United States were calculated at $254 billion. Le et al. recently reported that OA patients incur annual total direct costs that were $10,941 higher, on average, than patients without OA. In their article, the total average healthcare costs (outpatient, inpatient, and Rx) for OA patients is $18,435 compared to $7,494 for non-OA patients (Figure 1). Direct costs included hospitalizations, emergency department visits, office visits...
CONCLUSION

There is currently no biological cure for OA. The number of U.S. adults with OA is expected to increase, affecting the healthcare system and society as a whole. Because of these reasons, it will be necessary to find ways of preventing and reducing the progression of OA. Translational research should be directed toward understanding how aging and mechanical loading may lead to joint degeneration, how some joints are resistant to primary OA, and how joints can partially reverse the degenerative process.¹⁸

References


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Advanced Blood Management Strategies for Elective Joint Arthroplasty

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(NOTE: ALL AUTHORS ARE MEMBERS OF THE MIRIAM HOSPITAL’S TRANSFUSION COMMITTEE.)

ABSTRACT

There is a high prevalence of anemia detected in the preoperative work-up of elective surgical patients preparing for total joint replacement. The impact of anemia in this population has significant implications due to elevations in postoperative morbidity and mortality. By using current clinical guidelines and medical evidence, clinicians can improve outcomes for these patients by employing a three-phase approach, focused on preoperative assessment, intraoperative hemostasis, and postoperative blood product management. Strategies to optimize preoperative hemoglobin levels, reduce intraoperative blood losses, and decrease postoperative transfusion rates can independently and collectively improve overall patient care and surgical outcomes following lower extremity total joint arthroplasty.

KEYWORDS: anemia, total joint arthroplasty (TJA), tranexamic acid (TEA)

INTRODUCTION

Anemia becomes more prevalent as our population ages. Based on World Health Organization (WHO) definitions, the prevalence of anemia will reach approximately 11% in the elderly (age >65 years old). The presence and degree of anemia is affected by comorbidities such as diabetes, cardiovascular disease, renal disease, and other inflammatory conditions. Patients often present to orthopedic surgeries for elective joint arthroplasty at older ages and thus, anemia is a common finding among this population.

Prevalence of Anemia in Elective Orthopedic Surgeries

It is recognized that approximately 40% of patients evaluated prior to elective orthopedic surgeries are found to be anemic by WHO definition (women Hb <12 g/dL, men Hb < 13 g/dL.) [WHO, Shander, Saleh]. Preoperative anemia has been shown to be an independent prognostic factor for increased morbidity and mortality following orthopedic surgery. It is well known that preoperative Hb level is a major predictor of perioperative transfusion rates (Salido). Allogeneic transfusions have been shown to increase hospital length of stay, rate of infections and perioperative mortality [Salido, Wu, Beattie]. Some orthopedic surgeries are associated with an anticipated high level of blood loss, thus increasing the possible need for perioperative transfusion. Given the independent risks for morbidity and mortality associated with previously unrecognized preoperative anemia and transfusion rates, guidelines have been developed to address the following areas of need: the preoperative, perioperative, and postoperative periods of patient care.

A standard approach to the detection, evaluation and treatment of anemia in the preoperative period has been identified as an area of unmet need. The Network for the Advancement of Transfusion Alternatives (NATA) developed practice guidelines from a systematic review of the literature. Goodnough, et al. reviewed published literature on the impact of preoperative anemia on clinical outcomes and recommended a standardized approach to detect preoperative anemia. Patients undergoing elective orthopedic surgery should be screened for anemia in order that the underlying cause can be identified and corrected whenever possible.

Preoperative Detection and Management of Anemia

Preadmission testing can occur anytime before a scheduled elective surgery. However, to allow adequate time to detect and correct for anemia, testing should occur as close as possible to 28 days prior to the surgery. For those patients already known to have preexisting anemia, evaluation and treatment should begin as soon as possible.

The most common causes of anemia detected in preoperative testing include iron deficiency anemia, vitamin B12 deficiency, chronic kidney (and associated decreased erythropoietin production), chronic inflammatory diseases, and folate deficiency. As part of the preadmission testing, a complete blood count (CBC) should be drawn and anemic patients identified. Subsequent laboratory tests should screen for the most common etiologies including iron studies, ferritin, vitamin B12, creatinine, and in appropriate patients, folate, thyroid stimulating hormone (TSH), and CRP levels. Algorithms depicting initial and reflexive testing during the work-up of preoperative anemia are available and published [NATA guidelines, Munoz]. Treatment of the underlying cause of anemia should then commence to reach target Hb levels within the normal range (female ≥12 g/dL, male ≥13 g/dL) within 4-6 weeks by the anticipated time of surgery. For iron-deficient patients, replacing iron stores with oral versus intravenous iron is somewhat controversial. Overall,
both have been proven to correct iron deficiencies prior to orthopedic surgeries (Beris, Munoz). Oral iron is least costly and easy to administer, however patients often experience gastrointestinal side effects and replenishing iron stores within the limited time frame can be difficult to achieve. Intravenous iron is now available in much safer forms, however, allergic reactions and anaphylaxis are still reported with all formulations. The ease of administration and ability to replenish iron stores during the time frame allotted preoperatively must be balanced with relatively higher costs compared to oral iron.

In the absence of preoperative iron supplementation, postoperative iron repletion has not been shown effective (Munoz, Beris). This is likely due to postoperative healing and inflammatory cytokines altering hepcidin levels thus impairing iron absorption and mobilization in the postoperative period. Postoperative iron supplementation, oral or intravenous, is not recommended.

For patients in whom nutritional deficiencies have been corrected or ruled out, the use of erythropoietin stimulating agents (ESAs) has been shown to decrease perioperative transfusion requirements (Goodnough). Patients with ferritin values <100 ng/mL or transferrin saturations <20 percent should have iron repletion prior to initiation of ESAs to increase their efficacy. Concurrent iron supplementation with ESAs has also been shown to decrease the dosage of ESAs necessary to correct preoperative anemia.

Anemia should be considered as a treatable symptom of an underlying disease. Preoperative evaluations will sometimes identify more significant comorbidities. If preoperative screening detects evidence of gastrointestinal bleeding, bone marrow disorders or significant renal disease, referrals to specialists such as gastroenterologists, hematologists, or nephrologists may be indicated. A delay in elective surgery may be necessary to insure patient safety and care.

Intraoperative Methods for Reducing Acute Blood Loss Anemia

Attention to meticulous hemostasis has always been paramount during total joint replacement surgery, and remains a crucial element in reducing postoperative anemia. Even when surgeons make a consistent effort to prevent ongoing blood loss via cauterization of peri-articular vessels, there can still be ongoing postoperative bleeding from cut bony surfaces or from bone canals that have been instrumented in the surgery. Efforts to mitigate these “ongoing” blood losses have resulted in improvements in the global understanding and the management of blood loss following arthroplasty surgery.

Two separate meta-analyses, published in 2004 and 2007, both looked at the use of closed suction drainage following orthopaedic surgery in a total of 8959 patients and 9386 surgical wounds. (Parker, Parker) Both reports came to virtually identical conclusions, namely that the use of surgical drains following orthopaedic surgery showed no difference in the rates of wound infection, wound hematoma, or reoperation rates, but did show significantly increased risk for postoperative blood transfusion. Thus, the routine use of closed suction drains within the intra-articular space following hip and knee arthroplasty has no established clinical benefit for the patient, and now has a strong association with increasing the requirement for postoperative blood transfusion.

More recently, mounting clinical evidence has emerged on the role of using tranexamic acid (TEA) at the time of total joint arthroplasty to reduce the rate of postoperative anemia and transfusion. The pooled risk ratio for needing a transfusion after orthopedic surgery was 0.55 in one review of TEA in 10,488 surgical patients. (Ker) A second meta-analysis looked more specifically at the use of TEA in total knee arthroplasty, and found that both the amount of blood lost per patient and the number of blood transfusions needed after surgery were significantly less with the use of TEA. (Yang) Importantly, the risks for myocardial infarction, deep vein thrombosis, and pulmonary embolism was not increased in these large series of cases when administering TEA. The ideal TEA dose and route of administration is still under investigation, since it can be given either by injection to the joint immediately following capsular closure in the OR, or via single-or multiple- intravenous injections given in the peri-operative window. (Maniar) Other methods for intra-operative reductions of blood losses may also prove to be effective, and will be reassessed in the future based on the availability of high-level clinical evidence. For example, the use of neuraxial anesthesia, saline coupled bipolar tissue sealer devices, and the application of topical hemostatic material within the joint are currently under investigation in a number of studies.

Postoperative Tolerance of Normovolemic Anemia and Transfusion Thresholds

The hemoglobin threshold for perioperative transfusion is controversial. Carson et al suggested that symptom-driven transfusion triggers might be an effective blood conserving approach. (Carson 1998) The Transfusion Requirements in Critical Care (TRICC) trial evaluating clinical outcomes in patients in the critical care setting found that a restrictive transfusion strategy had a non-significant decrease in 30-day mortality; this study did not endorse a restrictive strategy in patients with active cardiac disease. (Hebert) Given the degree of blood loss expected during elective hip and knee arthroplasty, postoperative transfusion has been commonplace for many decades. Multiple strategies in the preoperative and intra-operative periods aim to reduce postoperative allogeneic transfusion rates. Concern for increased cardiovascular events and impaired quality of life postoperatively has led some to adopt relatively high hemoglobin trigger thresholds for transfusions in “at-risk” patients.

To address these issues, the FOCUS trial (Transfusion Trigger Trial for Functional Outcomes in Cardiovascular Patients Undergoing Surgical Hip Repair) evaluated higher blood transfusion thresholds [hemoglobin <10 g/dL]
compared with a more restrictive transfusion strategy [hemoglobin < 8 g/dL] on functional recovery, morbidity and mortality in the immediate postoperative period. Carson et al. concluded that a liberal transfusion strategy did not reduce either the rates of death or inability to walk independently on 60-day follow-up. In this study, there was no appreciable reduction of in-hospital morbidity in elderly patients at high cardiovascular risk following hip fracture surgery using the “restrictive” hemoglobin trigger of 8 g/dL. An additional study focused on quality-of-life measures in the immediate postoperative period after hip or knee arthroplasty, concluding that moderate anemia (across all hemoglobin levels between 8 g/dL to >10 g/dL) was not associated with an impaired functional recovery or a decreased quality of life. (Vuille-Lessard) These more recent studies have led some clinicians and institutions to establish more restrictive transfusion thresholds of asymptomatic anemia to 8 g/dL, even for the elderly or in those patients with underlying cardiovascular risks.

CONCLUSIONS
Preexisting anemia detected prior to surgery, intraoperative blood loss, and postoperative allogeneic transfusion rates have been proven as independent prognostic factors for morbidity and mortality associated with elective orthopedic joint arthroplasty. Blood management strategies to optimize preoperative hemoglobin levels, reduce intraoperative blood losses, and decrease postoperative transfusion rates can independently and collectively improve overall patient care and surgical outcomes following lower extremity total joint arthroplasty.

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Management of the ‘Young’ Patient with Hip Disease
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ABSTRACT
Although hip arthritis typically affects older patients, there is a rapidly growing population of “young” patients experiencing debilitating symptoms from hip disease. Most commonly, osteoarthritis and avascular necrosis affect this population, but a variety of other primary structural and metabolic causes can also occur. The expectations of these younger patients are often distinct from geriatric patients, and the challenges in optimizing their care are unique in this demanding population. Selection of the implant, bearing surface, and surgical technique can all impact the success and longevity of total hip replacement. A consideration for respecting the native bone stock is an important consideration that can potentially reduce some of the future challenges of revision arthroplasty in this young population.

KEYWORDS: total hip replacement (THA), neck sparing arthroplasty (NSA)

Diagnosis and Management of Hip Disease in the Young Patient
Advanced arthritis of the hip joint can lead to profound changes in quality of life. Debilitating pain, stiffness, and altered gait biomechanics all affect the ability to stay mobile and maintain gainful employment; these concerns are magnified in the younger patient with hip disease. While hip arthritis typically affects older patients, there is a significant subset of active patients in their 30s, 40s, and 50s who are affected and were previously thought of as, “too young for a hip replacement.” Over the last several decades, advances in hip replacement surgery are allowing us to rethink that position. Two major causes of advanced arthritis in young patients are primary (idiopathic) osteoarthritis and avascular necrosis. Most of the remaining cases are caused by inflammatory arthropathies, infections, trauma and congenital or developmental anatomical abnormalities.

Osteoarthritis
Osteoarthritis is a chronic degenerative condition that is associated with, but not caused by, aging. It can be categorized into primary or secondary causes. Primary osteoarthritis remains idiopathic in nature. While its exact pathophysiology is unknown, some believe that minor developmental abnormalities lead to impingement within the joint, altered biomechanics and ultimately cartilage loss. Secondary osteoarthritis can be due to an identifiable cause such as trauma to the femoral head, post-infection arthritis, slipped capital femoral epiphysis, or hip dysplasia.

As we age, the water content of cartilage increases with a concomitant decrease in protein content, both leading to degeneration. The progressive loss of the cartilage matrix leads to recurrent bouts of inflammation as bone contacts bone, and reactive bone called osteophyte forms around the joint. In the subchondral bone, hardening and cyst formation occurs. Repeated bouts of inflammation also extend into the peri-articular soft tissues leading to deformity and contractions of the capsule, supporting ligaments, and tendons. Put together, these changes lead to pain, stiffness, and gait disturbances. Its commonality among close relatives hints at a genetic predisposition, which is not currently understood.

Avascular Necrosis
Avascular necrosis, also known as osteonecrosis, is the most common reason for advanced hip arthritis in the young patient. Avascular necrosis occurs when the bone in the femoral head loses its blood supply. The weakened bone leads to cyst formation and collapse of the bony architecture with a resulting deformation in the shape of the femoral head. This painful process results in a rapidly progressing arthritis. Common causes are alcohol abuse, prolonged use of corticosteroids, hypercoagulable states (ie. Sickle cell disease or lupus) and trauma to the hip resulting in altered blood flow to the femoral head. Smoking is also postulated to have a role in the microvascular manifestations of the disease.

Many other cases are idiopathic in nature. Initial treatment begins with medical management and may include anti-inflammatory medication. Some studies have demonstrated bisphosphonate use may delay or prevent femoral head collapse; further studies have not supported it. Though many have been investigated, there is no single pharmacological agent that can prevent the naturally advancing course of osteonecrosis.

If significant pain relief is not achieved with conservative care, most patients turn to surgical management. When diagnosed early before collapse of the femoral head, a core decompression can be performed to preserve the joint. In this procedure, a canal is drilled into the femoral head with the hope of reducing the intraosseous pressure to relieve
pain, and stimulate a healing response in the femoral head by increasing blood flow. Typically these techniques relieve pain, but often only delay eventual femoral head collapse. Unfortunately, many of these patients will still develop femoral head collapse and the associated findings of acute-onset severe arthrosis associated with debilitating pain, and will then need a hip replacement.

**Presentation and Management**

Common symptoms of hip arthritis include pain in the groin, especially while weight bearing and increasing with use. The arthritic hip is typically stiff in the morning and the patient may note difficulty getting up from a chair after a prolonged time seated. There is a noted decreased range of motion and activity tolerance, with particular difficulty in donning socks and tying shoelaces. The resulting disuse of the hip second to pain leads to atrophy of the musculature. Muscle weakness, in addition to avoiding weight bearing on the affected extremity, can lead to the development of an antalgic limp. A cane or crutch may be used to offload body weight, and pain may also be referred to the lower back or ipsilateral knee.

Nonsurgical management of arthritis is typically geared toward the inciting factor whether that is stopping an offending agent [steroids, alcohol], or the use of disease modifying anti-rheumatic drugs [DMARDs] in inflammatory arthropathies. Virtually all patients with arthritis can benefit from other nonsurgical interventions such as weight loss, activity modification and anti-inflammatory medications. Each patient is affected differently and it is difficult to know the expected rate of progression in each.

Patients in significant pain and discomfort will typically seek the help of a hip specialist. For those who quickly progress to debilitating arthritis, a replacement may be the only option regardless of age. In the past, younger patients had limited surgical options. Hip arthrodesis, or fusion, had poor results with limited functionality and frequently lead to atrophy of hip musculature and pericapsular contractures making reversal difficult. Deficient hip abductors predispose to dislocation as well.3 Healthy, young, active patients with advanced arthritis are ideal candidates for a replacement due to their good muscle tone and ability to remodel bone and enjoy predictable increases in quality of life. Other surgical options not discussed further can include femoral or acetabular osteotomies for deficiencies in the proximal femur or acetabulum respectively. These are reserved for anatomic or congenital abnormalities that lead to altered hip biomechanics and also significant pain.

**Surgical Options for Hip Replacement in the Young Patient**

A total hip replacement is one of the most reliably successful procedures in orthopaedics. Long-term data has shown that with a well positioned modern prosthesis we can give our patient reliable pain relief that has a very high chance (>80% in most cases) of lasting over twenty years.6,7 While this may be very comforting to a 75-year-old retired patient with relatively low functional demands, it will not suffice for patient with advanced arthritis in their 30s. For this reason, in the past many surgeons were reluctant to perform joint replacement surgeries in young patients for fear of condemning them to multiple revisions over a lifetime of use. With current technology, we can now provide young and active patients with long lasting pain relief with the confidence that we will be able to revise these prostheses in the future if needed.

The ideal hip replacement prosthesis for a young patient would be easily integrated, forming a long lasting bond with the host bone, yet be easily removed if needed. Most modern hip prostheses are made of titanium and are cementless. They use biological ingrowth for osseous integration of both the femoral and acetabular components. The prosthesis is typically coated with thousands of tiny particles that give the surface a roughened appearance. Between these tiny metallic pores are spaces where the host bone actually grows onto the prosthesis.

Bearing surfaces are the parts of the prostheses that glide across one another to allow motion at the joint. In the past, many different products were used including ivory, glass, plastic and metal. Today popular choices include either a metal (cobalt-chrome) on plastic (called polyethylene), ceramic on plastic, ceramic on ceramic. Metal on metal remains an option, but has fallen out of favor due to poor clinical performance and implant recalls.

As the bearing surfaces rub against each other, the materials begin to wear, shedding tiny micron-sized particles, each at a different rate. Previously, plastic wear particles generated when the head of the prosthesis rubbed on the plastic liner were responsible for a phenomenon termed ‘osteolysis.’ Osteolysis is an inflammatory condition led by an activated macrophage response to ingested plastic particles which leads to periprosthetic bone loss resulting in implant loosening or fracture.8 This has largely (but not completely) been solved with the highly engineered “cross-linking” of the polyethylene molecules that makes it almost a thousand times more resistant to wear.

Ceramic bearings are quickly becoming the preferred bearing surface in the young and active patient.6,9,10 These bearings have lower wear rates than metal on plastic components and have less friction between surfaces leading to smoother motion.1 Additionally, by eliminating a polyethylene component, osteolysis is much less a concern.9,10 Another aspect of the modern hip prosthesis that has evolved is the actual design of the femoral implant itself. Several implant designs on the market are ‘bone sparing,’ meaning that less native bone is resected from the femur. Over the past decade, “hip resurfacing” was a popular procedure in this regard. Resurfacing procedures have fallen out of favor recently for several reasons, including the difficulty of placing the prosthesis as well as concerns for metal-on-metal bearing wear and failures.

A “bone-sparing prosthesis” is not a new concept but has been gaining in popularity. This prosthesis is similar in
design to other modern prosthesis but preserves more bone in the femoral neck of the patient. The hope is to allow implant placement while leaving a viable option for revision at a later date. When the femoral bone cut is made, more femoral neck bone is retained, and the proximally coated implant engages and helps preserve this “extra” bone over time. Plastic, metal or ceramic bearing options can still be used.

The level of the femoral bone resection varies based on the arthroplasty technique. (Figure 1) In hip resurfacing (1.2 A) and “mid-head” resurfacing (1.2 B) (available only in Europe), most of the femoral bone is retained. With neck sparing arthroplasty (1.2 C) and conventional total hip arthroplasty (1.2 D), progressively more bone is resected during the operation. With hip revision surgery, native bone is often eroded, leading to and even lower bony resection level (1.2 E). “Neck-sparing” implants allow the surgeon to retain the native bone between cut levels C and D (Figure 1.3), with the concept of native neck bone stock preservation for future revision surgery in the young patient.

SUMMARY

Over the next several decades we will continue to see improvements in implant fixation, bioengineering of bearing surfaces, and prosthesis design that will allow us to reliably replace hip joints in younger and more active adult patients. In addition to continued improvements, careful outcomes monitoring with joint replacement registries will be needed over the next few decades. Ideally, surgeons would like to provide durable, long lasting pain relief to patients, regardless of their age at presentation, and have the ability to safely revise a prosthesis in the future if needed. The ability to perform hip replacement surgery with a forward thought toward future revision will give hip specialists the confidence to treat patients previously thought too young to undergo joint replacement surgery.

Brief Case Example

A 29-year-old man presented with the acute-onset of debilitating pain in his left hip from AVN with collapse secondary to chronic steroid use for immunosuppression of severe lupus. (Figure 2). His symptoms developed over 4 weeks and were incapacitating, requiring the use of two crutches and high doses of long-acting narcotic for comfort. He was treated with total hip arthroplasty using a neck sparing implant and a ceramic on cross-linked polyethylene bearing surface couple. The implants were inserted via the direct anterior approach with a “bone-sparing technique” allowing retention of 1.5 cm of his proximal femoral bone, with anatomic restoration of his hip center of rotation (Figures 3 and 4). His postoperative course showed complete resolution of his pain, dramatic improvement in his hip function, and he was able to begin returning to work as a professional chef after less than 8 weeks of recovery.
References


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Three views of the ankle joint: AP, Lateral and Mortise; note the well preserved joint space.3

INTRODUCTION
The ankle is the most commonly injured joint in the body and is also the most frequently injured area of the musculoskeletal system during athletic activity. In contrast to the hip and knee, primary osteoarthritis of the ankle joint is relatively rare.1 Cartilage destruction due to trauma to the distal tibia, medial and lateral malleoli, and the talus is the most common etiology of arthritis of the ankle. Similarly, cumulative trauma from chronic ligamentous instability can lead to mechanical derangement resulting in insidiously progressive arthritis. Inflammatory arthropathies account for many of the remaining cases.1 Ankle arthritis is painful and can seriously alter day-to-day function by causing pronounced deterioration of gait and weight bearing ability. Pain, swelling, stiffness, and deformity due to ankle arthritis are common afflictions evaluated by a foot and ankle specialist.

Ankle Anatomy
The tibia, fibula and talus compromise the ankle joint. While commonly thought of as a simple hinge joint, the ankle joint is better thought of as a rolling cylinder that rotates on an oblique axis between the medial and lateral malleoli.2 Many ligaments support the bony articulations and hold the talus centered under the tibia and its articulation with the fibula. The tibia and fibula are joined by a complex known as the syndesmosis which is made up of four separate ligaments and is located 2–3 cm above the tibiotalar joint line. These supportive ligaments are very important to the ankle joint stability. Chronic excess movement within the mortise due to ligamentous instability leads to rapidly progressive arthritis. Additionally, the ankle rests directly upon the foot and positional changes or deformities of the foot can have dramatic effects on ankle function, alignments, and symptoms. Due to the significantly smaller surface area of the ankle, the forces transmitted through the joint are much greater than in the hip or knee. During normal walking, forces up to five times body weight are transferred through the ankle, and this increases with running and other strenuous exercise. The cartilage in the ankle is stiffer and more resistant to deformation than other weight bearing joints, allowing it to support these increased loads. Comparisons of articular cartilage samples harvested from knee and ankle joints have demonstrated a higher composition of glycosaminoglycans and proportionally less water content in the articular surface of the ankle. Simply put, the cartilage in the ankle, despite its relative thinness, is denser and stronger than either the distal femur or proximal tibia, and this difference appears consistent among individuals.4

ABSTRACT
The ankle is the most commonly injured joint in athletic and work activities. In contrast, osteoarthritis of the ankle joint is relatively rare and is typically post-traumatic or inflammatory in nature. Common symptoms that prompt an orthopaedic consultation include pain, disability and altered gait mechanics. Non-operative management has been the mainstay for previously undiagnosed patients. For those with advanced disease, ankle fusion or total ankle replacement may be the only surgical options. Though some recent studies have shown patients’ preference for a well functioning ankle replacement, significant long-term follow-up data is lacking. 

KEYWORDS: ankle anatomy, arthritis, arthrodesis, total ankle replacement

Current Thoughts on Ankle Arthritis
SCOTT RITTERMAN, MD; TODD A. FELLARS, MD, MBA; CHRISTOPHER W. DIGIOVANNI, MD
TREATMENT

Treatment options for ankle arthritis include non-operative as well as operative management. Traditional non-operative care techniques which should always be considered the mainstay and first-line management for any patient initially presenting with ankle arthritis. These include activity modification, bracing, weight loss, shoe modification and physical therapy. Additionally, intra-articular corticosteroid injection, anti-inflammatory drugs and perhaps even the newer forms of injected hyaluronic viscosupplementation (although supportive scientific data are currently lacking and it remains a controversial therapy) can reduce inflammation and pain. The vast majority of patients presenting with as yet untreated mild or moderate ankle arthropathy can derive great benefit from utilizing varying combinations of these modalities, often for many years. In the face of advanced arthritic disease these combined therapies often have poor outcomes with little positive effect on symptoms. These patients are most frequently the candidates for whom operative management is considered. Open or arthroscopic debridement and decompression can be useful early when the patient’s chief complaint is mechanical in nature due to impingement, loose bodies or small osteochondral defects. In the case of advanced disease, arthrodesis or total ankle arthroplasty are the surgical options.

Ankle Arthrodesis

Arthrodesis was originally described in the late 1800s. It has been the gold standard for end-stage ankle arthritis for many years and, for most surgeons, remains so today. Despite many reported techniques, the goals have always remained the same: to remove all painful motion from the articulation, restore and maintain alignment, and withstand the significant day-to-day stresses of standing, walking, and even impact activity (in younger patients). Today arthrodesis is performed open or arthroscopically using some combination of plates or screws with bone graft. Using modern methods, roughly 90% of patients are able to achieve bony union and enjoy significant pain relief. Optimal position of fusion restores the weightbearing axis of the lower extremity if deformity was present and places the forefoot in position to be accommodative. Inevitably, some patients will have problems such as infection, delayed or nonunion as well as progressive degenerative changes in nearby joints due to the increased stresses placed on them after ankle fusion. The overall satisfaction rate with ankle fusion in patients remains excellent, although it is clear that walking with a stiff ankle requires certain accommodations and some patients unequivocally dislike the lost ankle motion and never seem to be able to adjust well to that despite an improvement in their pain level.

TOTAL ANKLE REPLACEMENT

Total Ankle Replacement (TAR) was initially introduced in the 1970s as an alternative to ankle fusion for the treatment of debilitating ankle arthritis. The postoperative limitation in motion, altered gait mechanics, and possibility of gradually progressive arthritic development in nearby foot joints caused by ankle fusion remain the longstanding driving factors in the continued search for a better option. Despite the inherent promise, potential advantages, and multigenerational designs associated with replacement of the ankle, ankle arthroplasty has historically never enjoyed the same level of success documented with hip and knee arthroplasty. Early total ankle implant designs were plagued with complications such as implant loosening and subsidence as well as limited function. All of these problems made ankle fusion a more attractive option. Due to recent improvements in design and surgical technique interest in total ankle replacement has returned.

There are currently five commercially available ankle prostheses in the United States today approved by The Food and Drug Administration (FDA), which are considered 3rd generation designs, one of which was designed and patented by one of the authors. Most of the modern prosthetic designs consist of three pieces, two of which are comprised of a metal alloy and the third which makes up an interface composed of a very durable plastic piece made of highly cross-linked polyethylene. The two metal components are usually made of titanium or cobalt-chrome, with one piece designed for insertion into and replication of the distal tibial surface [top of the ankle] and the other designed for replacing the talar dome [bottom of the ankle joint]. While all but one of these devices are fixed bearing, two-piece designs that have the plastic piece fixed to the tibial component, one is a three component “mobile bearing” system, whereby the plastic liner is intended to move freely between the two metal components. To date there exists little if any data which definitively supports a difference in survivorship or outcome between these design concepts, and currently the majority of the purported advantages and disadvantages remain theoretical. The short and midterm follow-up data, supporting a survivorship ranging between 80–95% for approximately 5–10 years postoperatively for these 3rd generation designs, remains promising, and foot and ankle surgeons retain a cautious optimism with these implants, given the historically poor track record of earlier (1st and 2nd) generation design technology.

Design advances

Early designs of ankle replacements were simple hinge joints and were highly constrained. Constraint refers to the restriction of motion and can be rotational, anterior to posterior or medial to lateral. Increased constraint led to higher forces being transmitted to the bone-prosthesis interface and ultimately implant loosening and failure. The current
generation of implants on the market today incorporate different metallurgy and plastic technology, are more anatomic and less constrained leading to more equal transfer of force to the surrounding bone and subsequently lower rates of implant failure.\(^6\)

All prosthetic implants must firmly attach to bone. Most early ankle replacement prostheses were cemented in the distal tibia and required a significant amount of distal tibial bone to be removed. The cement provides an additional surface where failure can occur. Additionally, removal of large pieces of bone to fit the prosthesis and cement made future conversion to a fusion (if required) difficult.\(^7\) Current ankle replacement designs, although typically approved for cemented use, are being predominantly utilized as “press-fit” devices, being implanted directly onto the raw bony surface in a process quite similar to many modern hip replacement designs that take advantage of biological bone ingrowth. These prostheses are coated with tiny beads that have intervening spaces as small as 50 microns. The pores allow for the surrounding bone to literally grow into the prostheses and form a potentially life-lasting bond that retains the capability of remodeling over time. This advancement has led to increased survival not only in total hip replacements but also total ankle replacements. Combined, these advances have led to better fixation, better survival, and lower rates of implant loosening and failure in modern total ankle replacement surgery.\(^6\)

While there have been many improved advances and techniques in ankle replacement there is also mounting evidence to suggest that patients are increasingly preferring ankle replacements because they seem to offload adjacent joints and also mimic a more normal gait cycle as compared to ankle fusion patients on a day-to-day basis. It also remains clear (and is important to remember) that the ideal candidate who would benefit most from ankle replacement has yet to be been fully determined. Importantly, there are several agreed upon contraindications to an ankle replacement.

**Contraindications**

Absolute contraindications include those patients with peripheral vascular disease, active infections, as well as those with neuropathic or Charcot arthropathy. Patients who already have a stiff ankle are less likely to gain motion after joint replacement and should be counseled appropriately. As with any joint replacement surgery infection is always a dreaded complication which can lead to implant failure and necessitate removal and long-term IV antibiotics. If the infection cannot be cleared, below the knee amputation may be considered. Relative contraindications include smoking, young active patients, those with ligamentous laxity about the ankle, overall lower extremity malalignment as well as pre-operative ankle stiffness.

It is clear that the horizon for total ankle replacement looks very promising, but this procedure is still not for every surgeon or every patient. A pooled meta-analysis done several years ago evaluated the intermediate and long-term outcomes of TAR versus fusion and, despite limited and arguably confounding data, confirmed overall comparable results between the groups.\(^8\) Certainly, further investigation is needed in the area of TAR before we truly know who will benefit most from this operation, and for how long. Given the recent promising early results of newer technology there is no doubt that interest in ankle replacement will continue. The ultimate goal for defining a wholly successful total ankle replacement – which would eliminate the need to ever perform an ankle fusion ever again in a manner similar to the evolution of hip and knee replacement surgery supplanting any need for hip or knee fusion surgery – will be to provide our patients with a safe, reliable, durable ankle arthroplasty that 1) preserves ankle motion and function, 2) provides excellent long-term pain relief, and 3) exhibits a 95% 20–25 year survivorship akin to the most successful hip and knee replacements currently available.

Eclipse (Integra Life Sciences) total ankle replacement. Cutting blocks guide the precise bony resection of the distal tibia and talus. The space for the implants is evidence and final implants are placed. Finally before wound closure.\(^9\)
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Brief Report: Total Knee Arthroplasty Performed with Patient-Specific, Pre-operative CT-Guided Navigation

LEE E. RUBIN, MD; KENNETH T. MURGO, BA

ABSTRACT
The clinical success and long-term outcomes of total knee arthroplasty (TKA) are dependent not only on the biomaterials within the prosthetic implant, but also on the surgeon’s ability to correctly position the implants onto the bone. Intra-operative computer navigation and robotic surgery have emerged as options to increase the accuracy of implant placement and enhance the outcomes of TKA, with mixed clinical results to date. Pre-operative CT-guided, patient-specific navigation is a unique method for planning TKA surgery to achieving consistent implant positioning, especially for patients with retained surgical hardware or unusual bony anatomy. This technology has been used in Rhode Island in a limited series of patients to assess the utility of the technique and represents an interesting advance for both orthopaedic surgeons and their patients.

KEYWORDS: patient-specific instrumentation, total knee arthroplasty (TKA), CT-guided navigation

INTRODUCTION
Total Knee Arthroplasty (TKA) is a procedure in which the damaged cartilage surfaces of the knee joint are removed and replaced with smooth articular bearing surfaces. There are many manufacturers who produce TKA implants, and numerous options regarding the design and materials of the prosthetic implants. What is critical across all TKA systems is for the surgeon to place the implants onto the patient’s bone in an anatomic fashion. This results in restoration of knee joint biomechanics and optimal longevity of the implants in vivo over many decades of use.

As the manufacturing process for TKA implants has improved over the years, so too has the technology available to surgeons to help place the devices in the most accurate way possible. Advances in surgical cutting jigs, implant designs, sizing options, and bearing surface materials have all been utilized to enhance the outcomes of TKA. More recently, computer navigation and robotic surgery have emerged as intra-operative options to increase the accuracy of implant placement.

Despite the advanced capabilities of these two techniques, their utility is limited by the potentially significant capital investment costs for the relevant technology. Additionally, while some studies have shown improvements in radiographic assessment of implant alignment with computer navigation, no improvements were seen in the long-term implant survival at an average of 10.8 years following computer-navigated TKA compared to conventional TKA.1 (Studies to date have shown improvements in radiographic implant alignment, but no improvements in short-term knee function or long-term implant survival using computer navigation.)

Preoperative MRI or CT images have been utilized to help plan TKA surgery and generate “patient-specific” custom cutting guides to enhance the accuracy of the procedure. Studies have shown that CT-based navigation can predictably increase the precision of implant placement to within 1.7 degrees of the ideal rotational position2 but has higher costs compared to “conventional” TKA using standard

Figure 1. Stepwise method for generating patient-specific cutting blocks using the DePuy TruMatch System.
Another study showed a 12-minute savings per case in operative time when using the CT-based cutting guides (125.1 minutes versus 137.2 minutes) but also cited cost as potential limitation.

To assist the arthroplasty surgeon with implant choice, sizing selection, and the accuracy of implant placement, a novel technology has been developed for patient-specific instrumentation using pre-operative CT-guided navigation. With this system (TruMatch, DePuy Orthopaedics, Warsaw, IN), a stepwise process is utilized in advance of the TKA surgery (Figure 1). Of note: while a number of other major orthopaedic implant manufacturers (including Smith and Nephew, Biomet, and Stryker) offer the option for pre-operative MRI of the knee joint to create patient-specific cutting guides for TKA surgery, the TruMatch system from DePuy Orthopaedics is currently the only one that utilizes a CT scan from the hip to the ankle to assess and re-create the limb’s mechanical axis in a 3-dimensional plane.

First, a patient is initially assessed with standing knee radiographs to evaluate the severity and location of the osteoarthritis (Figure 2 A and 2 B). Next, a CT scan is obtained from the hip to the ankle, including fine-cut images at the knee joint. A 3-dimensional model of the patient’s native bony anatomy and precisely establishes the mechanical weight-bearing axis from the center of the hip to the center of the ankle (Figure 3A and 3B). The program generates a highly detailed rendering of the patient’s native bone and calculates angular measurements that enable the surgeon to precisely reconstruct the knee before the surgery takes place (Figure 4 A-C). The surgeon interacts with the engineers via a secure web portal; the CT scan images are reconstructed and interpreted by the engineering team remotely in order to create the cutting guides.

The surgeon reviews these images and selects the type of TKA that is optimal, then approves a surgical plan for the patient’s operation. The engineers then generate a custom cutting block for both the femur and tibia, which are packaged and sterilized specifically for that individual patient’s operation. The cutting guides set the saw blade position during the surgery to allow the surgeon to make bone cuts that align exactly with the pre-operative CT template. Once the bony cuts are complete, the implant is cemented into place, yielding a highly accurate implant position that matches the exact specifications of the preoperative CT scan template (Figure 5A and 5B).

This technology is highly promising as it allows the surgeon to comprehensively understand the 3-dimensional anatomy of a patient’s operative knee. By constructing an
Figures 4 A-C. (left) Precise calculation of joint angles, implant position, and bone resections to be used during the surgical procedure.

Figures 5A and 5B. (below) Postoperative AP and lateral views of the left knee following TruMatch TKA showing precise anatomic implant placement.
accurate surgical plan pre-operatively in a virtual environment, changes can be made and problems corrected before reaching the operating room. The TruMatch technology allows for a streamlined operative technique using fewer instruments, and allows for a potentially faster surgical time and operating room turnover.

Importantly, the TruMatch system allows for TKA to be performed in patients with retained surgical hardware in their femur or tibia and for patients with unusual bony deformity, two clinical scenarios that make TKA difficult or impossible using conventional operative techniques.

Patient-specific instrumentation for TKA surgery is an exciting area of advanced technology that will certainly continue to have an impact in the years ahead. Studies will be needed to evaluate the use of this type of technology for conventional knee arthritis surgery, and to compare the outcomes of CT-based versus MRI-based systems for planning customized TKA surgeries in more complex cases.

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Psychotropics and Sudden Cardiac Death
TUAN ANH DINH; JESSICA L. GÖREN, PHARMD, BCPP

ABSTRACT
Over the past two decades there has been a large increase in the number of patients prescribed psychotropic medications. Many of these agents are associated with QTc prolongation which is considered a marker for increased risk of sudden cardiac death due to malignant arrhythmias such as Torsades de pointes (TdP). Psychotropics rarely lead to sudden death in healthy individuals on a single QTc prolonging medication. However, factors such as polypharmacy, recent initiation of a QTc prolonging medication, bradycardia, electrolyte abnormalities and preexisting arrhythmias increase the likelihood of psychotropic-induced sudden cardiac death. Therefore, clinicians must recognize which psychotropics and risk factors are associated with increased risk in order to minimize the risks of psychotropic QTc prolongation.

KEYWORDS: psychotropic, side effect, cardiac, QTc, Torsades, arrhythmia

INTRODUCTION
There has been increasing concern regarding the cardiac side effects of psychotropics. Some psychotropic medications increase the risk of sudden cardiac death. However, these drugs are important for many patients. Therefore, it is important to assess cardiac risks associated with psychotropics. This article will summarize these effects and provide recommendations on cardiac risk assessment for patients treated with psychotropic medications.

The QT interval and Torsades de pointes
The QT interval is the measure of cardiac conduction speed that starts from the beginning of a QRS wave and ends with the T wave on an electrocardiogram (ECG). Usually the length of the QT wave decreases as heart rate increases, so a corrected value [QTc] is used to assess cardiac conduction. QTc is measured in milliseconds and the average QTc is between 430 and 450 milliseconds. (Table 1) Females usually have a slower cardiac conduction rhythm than males and thus a longer QTc.1-3 The QTc varies by up to 10 milliseconds during the course of a day with maximal intervals during the first few hours of awakening.4

Prolonged QTc intervals can lead to ventricular tachyarrhythmia and TdP. While the true incidence of TdP is unknown, the number of reported cases is low. Over a period of 15 years only 761 cases were reported to the World Health Organization.5 Therefore, prolonged QTc has become a surrogate marker for TdP.1,5

It is important to note that drug induced QTc prolongation alone rarely leads to TdP. A review of population studies reported prolonged QTc was associated with TdP in patients with preexisting cardiovascular disease, but not with healthy patients.6 Rather TdP is most likely to occur when prolonged QTc is combined with at least two risk factors such as electrolyte abnormalities, bradycardia or congenital cardiac abnormalities. The most important risk factors appear to be preexisting heart disease, age >65 years, and female sex.6,7 Torsades de pointes may be increased in hospitalized patients because hospitalized patients are more likely to have risk factors such as heart disease, advanced age, bradycardia or electrolyte disturbances than outpatients.8

QTc prolongation is often dose dependent but the maximal effect of many drugs is limited.6 Therefore, massive drug overdoses of QTc prolonging medications do not necessarily result in severe QTc prolongation or TdP.

Psychotropics and QTc
Psychotropics, such as antidepressants and antipsychotics, affect the heart by blocking certain potassium channels. This leads to a blockade of type I \( I_{Kr} \) (a fast potassium channel in the heart), causing a delay in repolarization and thus QTc prolongation.1,2 This is accomplished via either HERG [Human ether-a-go-go Related Gene] blockade or abnormal protein trafficking for HERG. Almost all drugs which can induce TdP block HERG, while a few indirectly affect HERG function.1,2 Drugs which prolong the QTc by alternate means are less likely to result in TdP.

Table 1. Average QTc1-3

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Population-based studies indicate there is a two- to threefold increased risk of sudden cardiac death in patients taking non-cardiac QTc prolonging medications.6,7 Antidepressants are the psychotropic class most commonly associated with TdP (9%).7,9,10 For antipsychotics, it is estimated there are 10-15 sudden cardiac deaths/10,000 years of observation, and only a small proportion of these deaths are likely attributable to TdP.11 Risk of QTc prolongation with other psychotropics such as benzodiazepines and anticonvulsants is low.

Risk of sudden cardiac death is highest in the first 90 days of initiating, increasing the dose or adding an interacting medication. Female sex, polypharmacy, congenital long QT syndrome, electrolyte abnormalities, increasing age and higher doses of QTc prolonging medication all increase the likelihood of experiencing drug induced QTc prolongation.10,11 While studies have reported psychotropics increase patients’ average QTc, the QTc interval typically remains less than 500 milliseconds, considered a clinically relevant indicator of TdP risk.4,10,11 In patients with schizophrenia a reported history of arrhythmia and other metabolic factors had greater influence on the prolongation of QTc interval than use of psychotropics alone.9 Therefore, it seems likely psychotropic induced QTc prolongation is unlikely to lead to TdP in the absence of other risk factors.

Antipsychotics and QTc
Although large epidemiologic studies have reported first- and second-generation antipsychotics are associated with increased risk of sudden cardiac death, the absolute risk of death remains quite low.1,3,6,7,9-14 In addition, while numerous antipsychotics have been shown to prolong the QTc (Table 2), relatively few antipsychotics have been associated with TdP.1,3,13,14 Thoridazine, pimozide and ziprasidone are known to cause the greatest QTc prolongation while quetiapine, risperidone and clozapine are associated with lower risk.1,12-14 Significant evidence of antipsychotic induced TdP is only associated with mesoridazine, thoridazine and haloperidol.1,15 While haloperidol has been linked to TdP, risk is much lower than with thoridazine.1,13,14 Aripiprazole appears to have a lower risk of QTc prolongation, although there is one well documented case report of QTc prolongation with low dose monotherapy aripiprazole.13-16

Antidepressants and QTc
Large epidemiologic trials have demonstrated an elevated risk of sudden cardiac death with tricyclic antidepressants (TCAs). TCAs have been shown to prolong the QTc 10-25 ms and cases of TdP have been reported with most, although not all, TCAs.13-15 Newer antidepressants have less risk of QTc prolongation and sudden cardiac death compared with TCAs although QTc prolongation of 5-12 ms and cases of TdP have been reported for citalopram, fluoxetine and paroxetine.13-15 Reports of QTc prolongation are mixed with the serotonin norepinephrine reuptake inhibitors (SNRIs). However, for both SSRIs and SNRIs, risk appears to be greatest in patients with preexisting risk factors or those with elevated blood concentrations due to over dose, high doses or drug interactions. Bupropion, mirtazapine and trazodone all appear to have minimal risk of QTc prolongation at typical doses.15

### Table 2. Mean QTc prolongation and psychotropics12-15

<table>
<thead>
<tr>
<th>DRUG</th>
<th>MEAN QTc (msec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTIDEPRESSANTS</td>
<td></td>
</tr>
<tr>
<td>TCAs</td>
<td>&gt;16</td>
</tr>
<tr>
<td>Mirtazapine</td>
<td>5-8</td>
</tr>
<tr>
<td>Trazodone</td>
<td>5-8</td>
</tr>
<tr>
<td>Venlafaxine</td>
<td>4.7</td>
</tr>
<tr>
<td>Duloxetine</td>
<td>0</td>
</tr>
<tr>
<td>Fluoxetine</td>
<td>9-16</td>
</tr>
<tr>
<td>Citalopram</td>
<td>8-10</td>
</tr>
<tr>
<td>Escitalopram</td>
<td>4.5</td>
</tr>
<tr>
<td>Paroxetine</td>
<td>1 – 4</td>
</tr>
<tr>
<td>Fluvoxamine</td>
<td>0-2</td>
</tr>
<tr>
<td>Sertraline</td>
<td>0</td>
</tr>
<tr>
<td>Bupropion</td>
<td>0</td>
</tr>
<tr>
<td>ANTIPSYCHOTICS</td>
<td></td>
</tr>
<tr>
<td>Thoridazine</td>
<td>25-30</td>
</tr>
<tr>
<td>Ziprasidone</td>
<td>5-22</td>
</tr>
<tr>
<td>Pimozide</td>
<td>13</td>
</tr>
<tr>
<td>Clozapine</td>
<td>8-10</td>
</tr>
<tr>
<td>Iloperidone</td>
<td>9</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>7</td>
</tr>
<tr>
<td>Quetiapine</td>
<td>6</td>
</tr>
<tr>
<td>Risperidone</td>
<td>0-5</td>
</tr>
<tr>
<td>Olanzapine</td>
<td>2</td>
</tr>
<tr>
<td>Asenapine</td>
<td>2-5</td>
</tr>
<tr>
<td>Aripiprazole</td>
<td>0</td>
</tr>
</tbody>
</table>
Psychotropic Polypharmacy and QTc

The risk of QTc prolongation with antipsychotics and antidepressants is typically dose related. Therefore any combination of medications which results in elevated concentrations of antidepressants or antipsychotics increases the likelihood of QTc prolongation. Conversely, any psychotropic that increases the concentration of non-psychotropic QTc prolonging medications increases the risk of drug induced arrhythmia. Additionally, the risk of sudden cardiac death is increased in patients on multiple QTc prolonging medications, whether the psychotropics are combined with other QTc prolonging psychotropic or non-psychotropic medications. Thus careful consideration should be given to utilization of psychotropic polypharmacy and combinations of psychotropics and non-psychotropic medications.

Monitoring

Psychotropic drugs are known to affect the QTc interval and should be utilized in caution with risk factors such as age >65, female gender, congenital long QTc syndrome, electrolyte abnormalities, polypharmacy and pre-existing cardiac disease. For relatively healthy patients without preexisting risk factors, routine ECG monitoring should be considered for those with episodes of blackouts, fainting, seizures, or with unexplained lightheadedness, palpitations or dizziness. A baseline ECG should be considered in patients who are on multiple QTc prolonging medications or on high risk medications such as thioridazine. An ECG recording should be obtained for patients with any risk factors before treatment with a QTc prolonging psychotropic is started and once the medications are at steady state. If the QTc is mildly elevated consider lowering the dose or utilizing another agent with less potential for QTc prolongation. If the QTc is increased, a pre- and post-baseline ECG will be useful in determining risk of the dose increase. For patients with a prolonged QTc of ≥ 500 milliseconds, consider discontinuing any QTc prolonging medications and/or substituting with medications less likely to prolong the QTc. Also, consider consulting a cardiologist.

SUMMARY

Since psychotropic-induced QTc prolongation is typically dose related, patients should be maintained on the lowest effective doses of psychotropics. Additionally, careful review for drug interactions should be conducted prior to adding any medications to ongoing psychotropic treatment. The risk of psychotropic-induced QTc prolongation is highest when a medication is started, reaches steady state or after dose increases. Therefore, patients successfully treated for >90 days are less likely to experience psychotropic induced arrhythmias unless there are changes in medication treatment or new risk factors. Sudden cardiac death is unlikely in patients without preexisting risk factors and is a rare outcome for those with risk factors. Even for patients with risk factors who may have a prolonged QTc that is < 500 milliseconds, treatment with a psychotropic may be reasonable with appropriate monitoring. Physicians should not be discouraged from psychotropic use unless patients have a contraindication, such as a cardiac arrhythmia or congenital long QT syndrome.

References


TREATMENT RECOMMENDATIONS

The risk of TdP is low in patients who are relatively healthy without cardiac disease. Therefore, for patients who do not have other risk factors, it is reasonable to use psychotropic medications that may prolong the QTc. For patients with prolonged QTc of <500 milliseconds at baseline, psychotropic medications are a reasonable treatment with ECG monitoring. Since the risk is highest during the first 90 days after starting a medication, healthy patients on a stable regimen with a prolonged QTc of < 500 milliseconds can be continued on their current medication regimen. If the patient develops other risk factors, ECG is a useful tool for reevaluating the medication regimen. If the dose of a QTc prolonging medication is increased, a pre- and post-baseline ECG will be useful in determining risk of the dose increase.


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Corrections

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1. Rhode Island Medical Journal
2. MARCH 2013
3. RHODE ISLAND MEDICAL JOURNAL 41
Medical Student-Mothers

JULIE SCOTT TAYLOR, MD, MSc; MARINA M.C. MACNAMARA, MPH; ANNA GROSKIN, MD, MHS; LAURA I. PETRAS, MD

ABSTRACT
Medical training is challenging and parenting is a full-time responsibility. Balancing a family with the significant demands of medical school is a daunting endeavor. Yet there is little research available to guide students, faculty, or administrators. Using one U.S. medical school as a case study, this article provides a comprehensive overview of the common personal and professional challenges that medical students who are also mothers face during their undergraduate medical education, and practical strategies and resources useful in navigating such challenges. This article is also a resource guide for the faculty and administrators who teach, advise, and mentor medical-student parents. For leaders in medical education, the article concludes with suggestions to better support the health and educational experience of medical student-parents: 1) a systematic network of career advisors, 2) scheduling flexibility, 3) formal breastfeeding policies and workplace support, 4) institutionalized supported childcare, and 5) how student-parents may foster the educational health mission of medical schools.

KEYWORDS: Undergraduate medical education, mentoring, maternal-child health, breastfeeding

INTRODUCTION
The proportion of women physicians in the United States continues to increase steadily. According to the Association of American Medical Colleges (AAMC), 47% of first-year medical students in the United States are women compared to 31% in 1983. Medical training is challenging and parenting is a full-time responsibility. As the number of women in medical schools rises, questions about combining parenthood and medical school are increasingly important for both students and administrators alike.

Although several articles have focused on pregnancy and early parenting for female resident physicians, there are few studies that have specifically considered these issues for medical students, and none from the United States. In 2005, although many Japanese medical schools had pregnant medical students, none had an established maternity leave policy. A study from Canada compared the career and parenting satisfaction of physician-mothers across a spectrum of stages of medical training and found job dissatisfaction to be greatest among medical student-mothers. Another study of medical student- and attending physician-mothers at a medical school in Germany found that each group differed in their perception of an ‘ideal’ time to have children, with student-mothers favoring the clinical years of medical school and attending-mothers favoring residency and beyond.

At the Warren Alpert Medical School (AMS) of Brown University, there are typically several medical students in each graduating class who are parents. Here we present a case study of how AMS addresses the issue of parenthood for medical students.

DISCUSSION
Pregnancy During Medical School: Timing
For medical students who do not delay parenting until residency or beyond, for whatever reason, one of the first considerations is whether they can complete medical school in four years with their peers. Alternatively, they may want or need to extend their training by a year, either before or after graduation from medical school. The advantages of finishing school in four years include tuition considerations and avoiding the need to delay residency training by a year. The disadvantage of finishing in four years is the possibility of missing interesting clinical opportunities.

It is important for women who wish to become pregnant during medical school to know they can still finish in four years and proceed directly on to residency if the pregnancy is well-timed with respect to their other educational obligations and if they are planning a relatively short parental leave. To do so, the best timing of a pregnancy and parental leave would be to have a child either at the end of the first year of medical school, in the late spring or early summer, or else sometime during the fourth year, keeping in mind that residency interviewing season for most specialties runs from October until late January.

Pregnancy During Medical School: Other Considerations
For pregnant medical students, major issues to consider are choosing a personal medical provider, occupational exposures, and scheduling clinical rotations.

Although health insurance may impose limitations on choosing providers and hospitals, students usually want to see a provider who does not routinely work with medical
students, in order to maintain some privacy as a patient. Students should feel comfortable requesting that their medical student colleagues not participate in their obstetrical care, thus separating their roles as patient and learner.

All medical students should have up-to-date immuniza-
tions or documentation of immunity. As part of universal precautions, all female medical students who are sexually active with men should be mindful of potential pregnancy. When serving as student-clinicians, pregnant medical students should be attentive to potentially dangerous infectious exposures such as Parvovirus B-19. Other exposures medical student-mothers should minimize include inhalation of embalming fluids such as formaldehyde during anatomy class and exposure to radiation during clinical rotations. Potential exposures may affect a pregnant student’s choice of her clinical rotation schedule during pregnancy. However, pregnancy itself should not preclude students from participating in any clinical rotation. Instead, students should discuss any concerns about possible exposures directly with their supervising resident or attending physician. Pregnant medical students may want to consider the intensity of their schedule, particularly during the third trimester.

Parenting During Medical School: A New Baby
Being home full-time with an infant is very different and may be isolating compared with the previous routine. At Brown, new medical student-mothers are typically encouraged to take a minimum of a six-week break after having a child. Some new parents may need or want additional time.

Key aspects of the positive medical student-parent experience at Brown include:

1) Flexibility in each year of the curriculum allows for time at home with a new baby. For example, because both the pre-clinical and clinical years at Brown are divided into two- to six-week blocks, it is possible to take at least a six-week long break in the middle of the semester. The student may then make up any missed material later.

Further, if students wish to extend their medical education to five years, they may take a ‘Fellowship Year’ after years two, three, or four. Students use this time to complete additional graduate degrees, conduct mentored research, or complete other projects they may have begun before or during medical school. For medical student-parents, this option allows students to create a more flexible schedule for one year before beginning the intensity of residency training.

2) Students at Brown rarely take a formal leave of absence to parent as an official leave results in termination of all university benefits. Instead, using the flexibility of the curriculum or the Fellowship status, where students are engaged in scholarly work, some of which can be done at home, students remain eligible for health insurance and other university benefits, especially with respect to student loans. Outside of the specific medical school requirements, some students must also consider the financial and logistical impact of extending medical school on other service commitments such as the National Health Service Corps (NHSC) or a military scholarship.

Parenting During Medical School: Breastfeeding
Despite the relatively high rates of breastfeeding initiation among physician-mothers compared to all U.S. mothers, they also have fairly high rates of early weaning. An often intensive work schedule resulting in insufficient time to express milk can be exacerbated by the lack of a private space in which to pump breast milk. Indeed, once medical student-mothers have returned to school, they often need to work with sympathetic faculty and administrators to identify time and private space to pump a few times a day. At Brown, some of the stress of combining parenthood with school is alleviated by the systematic development and advertisement of a network of lactation rooms at the medical school and in each of the seven affiliated hospitals.

Parenting During Medical School: Childcare
For any returning medical student in need of childcare, the four major options include family members, daycare centers, in-home providers, and private help at home such as a nanny or an au pair. At Brown University, there is one institutionally affiliated preschool program.

Parenting During Medical School: Managing Professional Obligations as a Medical Student-Parent
Typical professional challenges for medical student-parents include scheduling required and elective rotations, attending residency interviews, and taking national board examinations. Research projects specific to maternal and child health may be of particular interest to these students.

For students who are planning to go directly from medical school to residency, interviewing for a residency program position is a major component of the final year of school. For example, a medical student who has a child early in the fall of her last year of school may be mobile enough to interview in December and January. New breastfeeding mothers scheduling interviews should contact program administrators at least one week in advance to discuss the logistics of pumping during the interview day. This initial contact may serve as a litmus test for the family-friendliness of the training program, which could be an important factor in the matching process. Alternatively, some students will interview for residency when they are pregnant and then have a baby in the spring of their final year of school.

U.S. medical students must take three different day-long medical licensing examinations during medical school: Step 1 at the end of the second year and Step 2 Clinical Skills (CS) and Step 2 Clinical Knowledge (CK) during the final year [details at http://www.usmle.org]. The National Board of Medical Examiners (NBME) provides students with information on expressing breast milk during the USMLE. Breastfeeding students must obtain a written “Personal Item Exemption” (PIE) to bring a breast pump into a testing center at least 30
days in advance of either the Step 2 CS or the Step 2 CK. Students with a PIE do not receive any extra break time or private space in which to express breast milk. In April of 2012, the Supreme Judicial Court in Massachusetts ruled in favor of Sophie C. Currier, a physician-mother who claimed that the NBME failed to accommodate her lactation in 2007.

Parenting During Medical School: Privacy, Self-disclosure, and Boundary Management

From the moment it can be observed, pregnancy is by definition an obligatory self-disclosure act for a student-mother, drawing attention, comments, and involvement from friends and strangers (and patients) alike. Thus, it is also a learning opportunity to practice boundary management for the student-mother-to-be and for her colleagues.13-15 Thus, the student-mother lends another dimension of enhancing the educational mission and professionalism training of the medical school.

Resources for Medical Student-Parents

For medical student-mothers at Brown, there is a network of physician-mothers that has been established under the auspices of the Brown Office of Women in Medicine. Primarily connected via a listserv, MomDocFamily (MDF) is a group that unites more than 200 physician-mothers from all stages of their medical training and careers, allowing students to come into contact with and learn from other women about both personal and professional issues.16

At the international level, MomMD is a career website that provides professional and personal support for women physicians, residents, medical and premedical students. Table 1 includes a variety of resources for medical student-parents, both mothers and fathers, ranging from international organizations to websites to books.

SUMMARY

We have used the experience of medical student-parents at one university as an example of some key issues and possible solutions raised by medical student-mothers. We finish with several recommendations for other medical schools.

1. A systematically identified network of advisors for medical student-parents

Each medical school should have at least one and ideally several faculty members who can work in conjunction with an Office of Women in Medicine or an Office of Student Affairs at a medical school to support, advise, and mentor medical student-parents, especially mothers. At AMS, medical students have access to a robust and personalized advising system through the three new student academies in the Office of Student Affairs.

2. Flexible scheduling to enable medical-student parents to complete their requirements without taking a formal leave of absence

Although medical student-parents may not be able to take as many electives as their non-parenting peers, each school should facilitate completion of graduation requirements while also allowing a minimum of six weeks of family time around the birth of a child, ideally without compromising students’ access to university resources.

3. Breastfeeding policies and systematic breastfeeding support

A medical school-wide policy for lactating medical student-mothers is a simple way for institutions to support their learners in a wide variety of clinical settings, as do an increasing number of breastfeeding laws at the state and national levels in the United States. This policy should include specifics about time and space allowed for breastfeeding or expressing breast milk.

4. Institutionally supported childcare with financial support for student-parents

In the United States, inadequate childcare is a national problem, there is a lack of high quality resources and costs are often prohibitive, especially for students. An on-site or local childcare facility for students, faculty, and staff has the added advantage of creating an informal parenting and advising network at the institution.

5. Systematic opportunities to showcase the positive impact of student-parents on an organization

Although there aren’t yet any long-term outcome data available on the careers of medical student-parents who have graduated from AMS (or, that we are aware of, from any other medical school), the presence of student-parents in a medical school community provides numerous immediate learning and educational opportunities. These families can be celebrated as a health education enhancing feature for student colleagues as well as the university community. While medical student-mothers face daunting and simultaneous personal and professional challenges, this article is designed as a guide to maximize the maternal-child health of future doctors.

Acknowledgements

The authors wish to thank Alexandra Morang, MA, Director of the Office of Student Affairs at Alpert Medical School of Brown University, and Dr. Shmuel Reis.

References

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Marina MacNamara is a fourth-year, medical student-mother at AMS. Anna Groskin, MD is an AMS graduate who completed her family medicine residency at Boston University.
Laura Petras, MD completed a family medicine residency at the University of Virginia.

Disclosures
The authors declare that they have many children but no competing interests.
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Previous Presentations
Some components of this work were presented in a symposium at the Predoctoral Education Conference of the Society of Teachers of Family Medicine in Savannah, GA, on January 25th, 2009.


Table 1. Key Resources for Medical Student-Parents.*

<table>
<thead>
<tr>
<th>National Medical Organizations</th>
<th>Resources Specific to Working Mothers</th>
<th>Resources Regarding Parental Leave</th>
</tr>
</thead>
</table>

*All websites on this list were accessed June 26, 2012.
INTRODUCTION

Suicide remains a leading cause of mortality in the United States. It is the tenth leading cause of death overall and the fourth leading cause of death for persons aged 18-65. Rhode Island has historically reported lower rates of suicide than the nation as whole but the number of suicides steadily increased during the years 2005-2010 (Figure 1). This resulted in a 2010 population rate (135 suicides = 12.9 /100,000) that approximated the U.S. rate for that year (12.4 /100,000). Prospective cohort studies have confirmed that veterans are at increased risk of suicide compared to non-veterans. To explain this, researchers point to higher rates of psychiatric morbidity as well as comfort and familiarity with firearms.

METHODS

The study population included males 18 years of age or older who committed suicide in Rhode Island during the five-year period 2005–2009. There were two female veteran suicides in Rhode Island over the course of the period studied who were not included in the analysis. Data regarding all decedents was obtained from the Rhode Island Violent Death reporting System funded in the State by the national Centers for Disease Control and Prevention (CDC) since 2003. Rhode Island demographics were obtained from 2005–2009 American Community Survey 5-Year Estimates. Both veteran and non-veteran decedents were stratified into four age groups. Where appropriate, Pearson’s chi-squared test of independence was used to assess the relationship between two variables.

RESULTS

Of males aged 18 and above who committed suicide in Rhode Island during 2005-2009, 90 were veterans and 284 were non-veterans. Table 1 displays the demographic patterns of interest observed in the two populations. The mean

<table>
<thead>
<tr>
<th>Race</th>
<th>Veterans</th>
<th>Nonveterans</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>83 (92.2%)</td>
<td>250 (88.0%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1 (1.1%)</td>
<td>18 (6.3%)</td>
</tr>
<tr>
<td>Black</td>
<td>1 (1.1%)</td>
<td>6 (2.1%)</td>
</tr>
<tr>
<td>Asian</td>
<td>0</td>
<td>4 (1.4%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>5 (5.6%)</td>
<td>6 (2.1%)</td>
</tr>
</tbody>
</table>
Table 2 reports the rate of suicide for both veterans and non-veterans of each age group, as well as the relative risk of suicide conferred by veteran status in Rhode Island over the period studied. The annual incidence of suicide in veteran males was 23.8 per 100,000 compared to 18.1 per 100,000 in non-veterans. The veteran population was found to be at significantly higher risk of suicide than non-veterans. Among veterans, the youngest age group had the highest rate of suicide with an annual incidence of 36.3 per 100,000, with the risk decreasing with each generation. The youngest age group was the only individual age group of veterans that was found to have significantly increased risk of suicide compared to non-veterans of similar age, with a relative risk of 2.8.

The most common methods of completed suicide among the veterans studied were firearm (47.8%), asphyxiation (24.4%), and poisoning (15.6%). For the non-veteran group, the most common methods of completed suicide were asphyxiation (41.2%), firearm (26.8%), and poisoning (18.7%). Over the period studied, veterans were significantly more likely to commit suicide by firearm than non-veterans.

The rates of firearm use in veteran and non-veteran suicide decedents of each age group are presented in Table 3. The rate of firearm use in the veteran decedents was highest in the oldest group, with the youngest veteran group second highest. In the 18-34 age group, the rate of firearm use in veterans was about 130% higher than for the similarly aged non-veterans, making this the age group with the highest increased odds of firearm use based on veteran status and the only individual age group for which veteran status was associated with a statistically significant increase in rate of firearm use for suicide.

Of the 90 veteran male suicide decedents, 75 had no prior history of suicide attempts. Among these 75, 37 (49.3%) used a firearm. Of the 15 veteran male suicide decedents with a prior history of suicide attempts, 6 (40%) used a firearm for their completed suicide. Of the 284 non-veteran male suicide decedents, 225 had no prior history of suicide attempts. Of these 225, 69 (31%) used a firearm as their method. Of the 59 non-veteran male decedents with a prior history of suicide attempts, 7 (11.9%) used a firearm for their completed suicide.

### DISCUSSION

The rates of suicide in Rhode Island were lower for both veterans and non-veterans as compared to national rates. For each age group, the rate of suicides was higher in veterans than in non-veterans. Consistent with national trends, the rate of suicide was most pronounced in the younger veteran populations, with the incidence of suicide in the 18-34 veteran group almost three times higher than in their non-veteran counterparts.

Our study did appreciate a significantly higher rate of firearm use in the veteran population compared to non-veteran population. Consistent with national trends, the rate of firearm use was highest in the 65+ veteran population. We found that the youngest population of veterans demonstrated the greatest increased odds of firearm use compared to their non-veteran counterparts.

We observed an interesting difference between the two populations in the method of suicide depending on a history of prior suicide attempts. Specifically, we noted that of decedents with a prior history of suicide attempts, 40% of the veterans used a firearm for their completed suicide compared to only 11.9% of non-veterans. Because
the lethality of firearms approaches 100% in suicide attempts, we can assume that almost all subjects who had a prior history of suicide attempts used a method other than firearm. Thus, our findings suggest that of the subjects that failed suicide with a method other than firearm, veterans may have been significantly more likely to switch their method and complete suicide with a firearm than non-veterans, who would more often continue to use other methods for suicide.

References

Authors
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Rhode Island Monthly Vital Statistics Report
Provisional Occurrence Data from the Division of Vital Records

<table>
<thead>
<tr>
<th>VITAL EVENTS</th>
<th>SEPTEMBER 2012</th>
<th>12 MONTHS ENDING WITH SEPTEMBER 2012</th>
</tr>
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<tr>
<td></td>
<td>Number</td>
<td>Number</td>
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<tr>
<td>Live Births</td>
<td>987</td>
<td>11,676</td>
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<tr>
<td>Deaths</td>
<td>749</td>
<td>9,487</td>
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<td>Infant Deaths</td>
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<td>72</td>
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<td>Neonatal Deaths</td>
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<td>Marriages</td>
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<td>Divorces</td>
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<td>Induced Terminations</td>
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<td>3,706</td>
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<td>Spontaneous Fetal Deaths</td>
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<tr>
<td>Under 20 weeks gestation</td>
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<td>407</td>
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<tr>
<td>20+ weeks gestation</td>
<td></td>
<td>84</td>
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* Rates per 1,000 estimated population
# Rates per 1,000 live births

<table>
<thead>
<tr>
<th>Underlying Cause of Death Category</th>
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<th>12 MONTHS ENDING WITH MARCH 2012</th>
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<tbody>
<tr>
<td></td>
<td>Number (a)</td>
<td>Number (a)</td>
</tr>
<tr>
<td>Diseases of the Heart</td>
<td>187</td>
<td>2,432</td>
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<tr>
<td>Malignant Neoplasms</td>
<td>181</td>
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<tr>
<td>Cerebrovascular Disease</td>
<td>36</td>
<td>419</td>
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<tr>
<td>Injuries</td>
<td>61</td>
<td>759</td>
</tr>
<tr>
<td>COPD</td>
<td>35</td>
<td>531</td>
</tr>
</tbody>
</table>

(a) Cause of death statistics were derived from the underlying cause of death reported by physicians on death certificates.
(b) Rates per 100,000 estimated population of 1,052,567 (www.census.gov)
(c) Years of Potential Life Lost (YPLL).

NOTE: Totals represent vital events, which occurred in Rhode Island for the reporting periods listed above.
Monthly provisional totals should be analyzed with caution because the numbers may be small and subject to seasonal variation.
A 44-year-old female with end-stage liver disease (Child C, MELD 31), and cirrhosis secondary to hepatitis B, C and autoimmune hepatitis was admitted to the medical ICU with symptoms of shock and extensive cellulitis of the lower abdomen. Blood cultures supported clinical suspicion of septic shock related to E. coli bacteremia. The patient quickly developed hypotension refractory to fluid management and was placed on IV pressors and intubated. To better evaluate for a source of the septicemia, CT imaging of the abdomen and pelvis was performed on day 2 showing worsening of previously noted edema of the colon at time of admission [not shown] that was new from a baseline examination performed 4 months prior. The colonic wall edema extended from the proximal ascending to mid descending colon with the enhancing mucosa appearing intact (Figs. 1–4). Given her history of frequent and broad-spectrum antimicrobial therapy and the CT findings above, the possibility of pseudomembranous colitis was considered likely and empiric treatment was started.

Despite surgical debridement of the cellulitic area, and continuing anti-microbial therapy, the patient’s condition continued to deteriorate and she expired several days later. On autopsy, there was diffuse mild edema throughout the entire colon with more focal involvement in the cecum and ascending colon with nodular collections of neutrophils in the submucosa with intact overlying mucosa. These findings were not consistent with a pseudomembranous colitis and are characteristic of phlegmonous colitis (PC) – a clinical entity that has not been widely reported, especially in English language journals and probably more common than previously thought.1-3 Of particular note were the CT findings of intact mucosa overlying extensive colonic wall edema which corresponds to the unique pathology of this entity in which the mucosa remains intact in the presence of apparently massive bacterial translocation.4
Discussion

Although there are numerous radiological findings employed to help distinguish among benign and malignant conditions of the colon, clinical presentation remains the primary guide to developing differential diagnoses based on radiological evidence. There are established associations that increase the likelihood of specific diagnoses when given a set of clinical observations. For instance, typhlitis in the context of an immunosuppressed patient, pseudomembranous colitis with extensive antibiotic therapy or inflammatory bowel disease in the presence of arthritis or pyoderma. These associations are well known and have been incorporated into the standard armamentarium of gastrointestinal radiology; however, less commonly known is the association between chronic hepatic disease and phlegmonous colitis (PC). Unfortunately, nearly all the data found in support of this has been through post-mortem analysis of tissue, and there has been a dearth of reports of PC being diagnosed prior to expiration. As PC was not identified in any of these patients prior to death, it is apparent that this entity has gone unrecognized by clinicians treating these patients. Therefore it is of immediate clinical importance in the management of these patients that PC be considered in the differential diagnoses when these patients present with evidence of septicemia.

Radiologically Similar Entities

As was the case here, radiological evidence of increasing thickening of the colon wall in the context of broad-spectrum antibiotic use and diarrhea often elicits a differential diagnosis of pseudomembranous colitis (PMC). In a study by Fishman et al, it was shown that abnormal bowel wall most often involved the entire colon but also can manifest more regionally in just the sigmoid or ascending/transverse colon. There is a similar appearing entity which is more specifically associated with advanced liver disease and portal hypertension – portal hypertension colopathy (PHC). In a study by Ito et al, there was a 66% incidence rate of PHC in participating cirrhotic patients not correlated with varices. Like PMC, such abnormalities often manifest themselves on contrast studies; however, PHC will also demonstrate lesions disrupting the mucosal layer that remains intact in PC. Although these entities may resemble PC and share a predisposing factor (liver disease which can result in both portal hypertension and increased infectious susceptibility leading to increased antibiotic use), they should result in different enhancement patterns and endoscopic exam due to the distinct natural history of these entities. Given previous recommendation by other authors, colonoscopy, contrast studies (with special attention to the arterial phase) or both might be warranted when presented with a rapidly deteriorating patient with ambiguous radiological colon disease.
**TREATMENT IMPLICATIONS**

PC is a rapidly fatal condition unless treated in a timely manner. As surgical intervention is only indicated in advanced/perforated cases of PmC\(^{14}\) and almost never in PhC\(^{16}\), aggressive treatment of ambiguous disease with surgical exploration is probably not warranted unless there is evidence to raise the suspicion of PC. Surgical treatment, once PC is identified, would be very similar to the surgical treatment of PmC and entail performing a subtotal colectomy followed by vancomycin treatment (pulsed or non-pulsed). Given the time-critical nature of PC intervention, rapid endoscopic examination is probably advisable when given the previously described radiological findings in end-stage liver disease (ESLD) patients. Such direct examination in the case of PC should reveal an intact submucosa without excessive hyperemia.\(^{16}\)

**CONCLUSION**

Whatever the contribution of chronic hepatic disease is to phlegmonous colitis, it appears to be more common than previously thought. We propose with CT findings of colitis in the cecal region, especially in the context of chronic hepatic disease, that PC be included in the differential diagnoses. The literature demonstrates that PC has been uniformly overlooked even when the clinician is presented with evidence of colonic involvement in the critically ill patient with ESLD. Despite lack of established diagnostic criteria for radiological identification of PC,\(^{17}\) we believe the diagnosis can be suggested in the appropriate clinical setting based on the CT findings we have described.

**References**


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Dental Center at RIH Giving Kids a Smile for 80 Years

PROVIDENCE – On February 8, the Samuels Sinclair Dental Center at Rhode Island Hospital celebrated the 11th annual “Give Kids a Smile Day” (GKAS) with underserved and underinsured children throughout Rhode Island receiving dental care in clinics and private dental offices statewide.

As the centerpiece to National Children’s Dental Health Month, and sponsored by the Rhode Island Dental Association and the American Dental Association, GKAS was designed to provide dental care to low-income children who would not otherwise have access to care, while also raising awareness of the importance of dental coverage for children’s health.

Mr. Potato Head, a group of superheroes, and hospital representatives and other volunteers visited children on a special day at the Samuels Sinclair Dental Center at Rhode Island Hospital. From left are: Shirley Spater Freedman, DMD, MPH, director of the center; Thomas Tracy, MD, interim chief medical officer of Rhode Island Hospital; and Timothy J. Babineau, MD, president and CEO of Lifespan and president of Rhode Island Hospital.

“Nationwide, tooth decay affects more than 25 percent of children between two and five years old and 50 percent of children between 12 and 15 years old, according to the U.S. Centers for Disease Control and Prevention,” said Shirley Spater Freedman, DMD, director of the center. “Yet, in Rhode Island, only one percent of the Medicaid budget is allocated for dental services. For many children at our annual Give Kids a Smile event, this will be their first visit to the dentist.”

Children received dental screenings, oral examinations, radiographs, cleanings, fillings and educational materials.

The Samuels Sinclair Dental Center has been providing dental services to underprivileged children and individuals with special needs for over 80 years.
PROVIDENCE – In a meeting by teleconference Wednesday, February 13, 2013, the Corporation of Brown University approved creation of a School of Public Health at Brown beginning July 1. The Corporation’s action, which follows unanimous faculty approval in November, promises to accelerate the rapid growth in research and teaching already underway in what is currently the University’s Program in Public Health in the Division of Biology and Medicine.

Brown will now seek to join the ranks of 49 schools in the United States that have been accredited by the Council on Education for Public Health. The two-year process will begin in June when CEPH votes on Brown’s request to be considered for accreditation, said Terrie Fox Wetle, Brown’s associate dean of medicine for public health, who will become the school’s inaugural dean.

By at least one important measure – earning research funding from the National Institutes of Health – Brown’s public health program would rank among the nation’s top public health schools if it were a school today. Across 11 research centers, Brown’s campus-based public health faculty members attracted more than $40 million of external research funding in the 2012 fiscal year. Hospital-based public health research centers earned more than $18 million for a total of nearly $60 million.

That research funding has doubled during the last 10 years. In fiscal year 2002, campus-based centers earned less than $14.7 million and hospital-based ones earned $13.6 million. During the same period, primary appointment tenure track faculty members have increased to 36 professors from 10. Undergraduates have nearly doubled to 92 last year from 47 in 2002, master’s students have increased more than eightfold to 126 from just 15; and doctoral students have more than tripled to 43 from 13.

The program started as the Department of Community Health within the medical school when it was founded in 1972.
Advantages
Now the program will have additional opportunities to grow and strengthen as a school.

“We are excited for the opportunity to become an accredited school, which is a clear reflection of the level of scholarship and scale we’ve achieved in public health at Brown,” Wetle said. “From here we’ll expand our capacity to address key population health issues in a global society in alignment with Brown’s philosophy and commitment to interdisciplinary excellence, social change, and public service. We’ll build on both our existing strengths and new advances in population health science.”

Wetle noted there are specific benefits to achieving the status of an accredited school. Some funding opportunities are only available to accredited public health schools.

“I believe that our faculty would be highly competitive for these funding opportunities, particularly from the Centers for Disease Control, where several of the calls for proposals are only open to accredited schools of public health,” Wetle said. “Slightly more than 1 percent of our external funding here at Brown is from the CDC as compared to as much as 30 percent for some accredited schools.”

With the same institutional stature as other schools, Brown will also be able to compete for more of the best talent.

“As we recruit the highest quality people, many public health faculty would prefer to be associated with an accredited school of public health which also has a school of medicine,” Wetle said. “Just the prospect of becoming a school has been an important factor in our recent recruiting.”

To date the program has been part of the Alpert Medical School, which is part of the University’s Division of Biology and Medicine. As a school, it will become a distinct administrative entity, reporting directly to the University’s provost.

Dr. Edward Wing, Brown’s dean of medicine and biological sciences, said the two schools, which share many jointly appointed faculty members and MD/MPH students, will continue to work closely together. For example, public health is integral to the Alpert Medical School’s newly announced MD/ScM program in primary care and population health.

Searching for a physician assistant to join your practice?

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PROVIDENCE – While the idea of becoming pregnant with a heart condition might seem a little scary, Margaret Miller, MD, director of the Women’s Medicine Collaborative, says most women with heart disease – including conditions like arrhythmia, heart murmurs, mitral valve prolapse and high blood pressure – will have a healthy baby, especially if they receive the proper care and monitoring.

“There are still some who believe that women with heart disease or cardiac issues shouldn’t get pregnant because it would be too risky. However, that’s definitely not the case. Heart disease and cardiac conditions can be safely managed during pregnancy,” says Miller, an obstetric medicine physician who cares for pregnant women with underlying medical conditions.

“Women with heart conditions should consider a preconception consult, which will give the woman and her physician an opportunity to optimize cardiac function, discuss risks in pregnancy, review medications and make a plan for the pregnancy, as well as labor and delivery,” Miller says. “Many heart medications can be used safely during pregnancy, and in fact, untreated cardiac disease can pose a greater risk than most medications.”

According to Miller, pregnancy is associated with significant changes in the cardiovascular system. Normal physiologic changes can cause many pregnant women to experience heart palpitations, or a fast heart rate, a common – yet harmless – cardiac “symptom.”

There is a heart condition specific to pregnancy called peripartum cardiomyopathy, which occurs in the last month of pregnancy or early postpartum period. It is rare, but Miller says women who experience a significant and new onset of shortness of breath, palpitations, lightheadedness or chest pain in the end of pregnancy or postpartum should be checked by their physician as soon as possible.

While actual heart attacks during pregnancy are very rare, Miller says the rise in obesity and diabetes could lead to more cases in the future. “Most providers do not think about a heart attack in a young woman, but women who have new onset chest pain – especially if it is associated with shortness of breath, sweating, nausea or dizziness – should receive medical treatment right away,” she adds.
Q & A with Dr. Gowri Anandarajah on Spirituality and Medicine

MARY KORR
RIMJ MANAGING EDITOR

PAWTUCKET – In a conversation on the relationship between spirituality and medicine, Gowri Anandarajah, MD, spoke of her formative years in London as a Hindu educated in schools which incorporated Christian beliefs. This gave her an early perspective on Eastern/Western thought.

But it was a singular experience dealing with a critically ill patient as a medical student that ignited her intellectual quest on the role spirituality plays in healing. Subsequently, Dr. Anandarajah has written and lectured on the subject and developed several spiritual care curricula at Brown. She has become nationally known for her scholarly work on the topic.

Dr. Anandarajah is currently director of faculty development and the co-director of the faculty development for global health fellowship for the Brown Department of Family Medicine. She served as residency director from 2008–2011.

Most recently, her interest in the integration of spirituality and palliative care has led her to Home & Hospice Care of Rhode Island, where she is associate medical director.

Q. In your own experience, was there a singular incident in patient care that demonstrated to you a spiritual connection in medicine?
A. Yes. It was when I was a medical student in North Carolina. That’s the Bible Belt and I’m a Hindu. I was in my 20s and I had a patient that I had seen both on the med and psych floors. I spent just a few minutes each day with the family explaining what was going on and giving them support. When she became critically ill, her daughter turned to me and said: ‘You must know the Lord as your savior.’ I was taken by surprise and blurted out: ‘Well actually, I’m a Hindu.’ She looked very puzzled. As I thought about it later, I realized that she was not asking if I was a Christian at all; rather, something I had done made her think in a spiritual context. Her comment was a genuine expression of thanks in the language of her religion. I realized that the essence of spiritual care in medicine is the compassion and understanding we provide to patients, and that it takes no extra time, just being present and genuine listening.

When I joined the Brown faculty in 1992, I would never have predicted this would become a focus of my academic work.

Q. Who encouraged you to pursue this at Brown?
A. In 1995, my chairman in the Department of Family Medicine, Vince Hunt, was interested in a pilgrimage I had taken to India, where I also did some medical work. He encouraged me to talk to the faculty about my trip, and, after he asked three times I finally agreed. He gave me the courage and recognized this aspect of medicine as important. As family doctors we embrace the bio-psycho-social model of health care, whole-person care. I came to realize that while we talk to patients about their sex lives, finances, and everything else, we didn’t have the language or skills to talk about spirituality, especially across the cultural or secular/religious divide. Although there was a fair amount of research being done on this subject, no one was addressing practical skills for physicians, so I ended up being one of the first people in the country to do this. Once I started teaching this subject at Brown, people came out of the woodwork to help – from different disciplines and different spiritual belief systems – it was great!

Q. How do you define human spirituality within the context of medicine?
A. I have found through my own experience that all human beings share what we call spirituality. Some label it within a religious context but many do not. In medicine it surfaces because we are dealing with addictions, severe illness, abortion, death and dying, lives in chaos, grief, or parents struggling with a chronically ill or disabled child.

In those particular moments in peoples’ lives, spiritual issues often rise to the surface. This is where compassion in health care plays a huge role – compassion is forging that spiritual connection. You don’t have to say anything about God or religion.
Part of my role as a doctor is to understand what patients are struggling with, to listen well and find someone who can help. Just as I might call in a social worker or a medical specialist, there are specialists available in spiritual care. It could be someone in his or her community, a faith leader, or a CPE-trained interfaith clinical chaplain.

**Q. Can you elaborate on this with the example of a patient?**

**A.** Spirituality is complex, and occurs within three realms: cognitive or “head” (search for meaning, purpose and truth in life), the emotional or “heart” (feelings of hope, love, connection, inner peace, support), and the behavioral or “hands” (expression of an individual’s spiritual beliefs and values, choices, behavior, rituals, etc).

Let’s use the example of someone who has received a diagnosis of metastatic cancer. The patient’s first reaction is an emotional reaction, but somewhere along the path the patient goes through in the disease process, the question arises: ‘What is the meaning of all of this?’ In the struggle, some people question their beliefs: ‘Am I alone in this?’ ‘What will happen after I die?’ Or, a patient might say: ‘I wonder why this is happening to me?’

As physicians, we like to answer questions, fix things. We are doers. And so we might say, ‘Well the cancer cells are doing this.’ The expression on their face tells you that wasn’t what they were asking. They ask existential questions, seek the big picture, and yet are wrapped in fear at the same time. The person may have deep spiritual questions which come to the surface in hints and clues a physician can pick up. Allowing the question to be asked and pondered – that in and of itself is incredibly healing. We don’t have to have the answers. We just need to be willing to acknowledge the questions.

**Q. Do you have a saying that resonates with you as a physician?**

**A.** In medicine, there is an anonymous 16th-century quote.

> To cure sometimes
> To relieve often
> To comfort always

It reminds me that as doctors, we spend most of our time focusing on cure or relieving the symptoms of chronic illness, physical or mental (which is extremely important). We also focus on paperwork and efficiency. However, if a patient leaves an encounter with us, not feeling just a little better for having seen us, then we have not done what we should be doing “always.” That ‘comfort’ we provide as physicians moves us from being mere technicians of the body to the ideal of the scientist/healer who focuses on the well-being of the whole patient. That is the spiritual aspect of medicine. It requires us to understand what we each need as a human being to keep our own “spiritual cup” full (secular or religious), so we can continue to provide compassionate care to others, without burning out. It is hard, but important for us, as human beings, and for our profession.

**For more information**

**References**


The Rhode Island Medical Society delivers valuable member benefits that help physicians, residents, medical students, physician-assistants, and retired practitioners every single day. As a member, you can take an active role in shaping a better health care future.

RIMS offers discounts for group membership, spouses, military, and those beginning their practices. Medical students can join for free. Earn rewards for referring new members through our “Member-Get-A-Member” campaign.

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**Apply for Membership Online**

Above: State House press conference on health care, Brown MSS at the AMA, CPT update seminar, bike helmet distribution; Upper right: RIMS staff meets with physicians to discuss concerns.
PROVIDENCE – New York University Professor Paul Glimcher, author of several books on neuroeconomics, will be speaking at Brown University on March 4.

The talk concludes the Rhode Island Medical Society’s 2012 Bicentennial lecture series, developed by RIMS’ Bicentennial committee chaired by the Society’s president, Diane Siedlecki, MD, and its symposium subcommittee, chaired by Herbert Rakatansky, MD.

The series is co-sponsored by the Brown Institute for Brain Science and the Norman Prince Neurosciences Institute. The lectures are open to the public.

More information: www.rimed.org

NEW Share your thoughts on RIMS “Communities” online forum

Members can now share their views on a variety of topics with their colleagues and RIMS staff. The RIMS website offers an exclusive, password-protected Member Portal with access to many convenient features and an online “Communities” forum. This is a unique opportunity to express your opinions with RIMS leadership who work to advocate on behalf of Rhode Island physicians and patients.

COMMUNITIES

TOPIC-OF-THE-MONTH

A discussion of the Rhode Island Department of Health’s RI Primary Care Trust
Lifespan honors Hasbro’s Friedman with Selya Award

PROVIDENCE – Lifespan has recognized JENNIFER FRIEDMAN, MD, PhD, a researcher at Hasbro Children’s Hospital, with the 2012 Bruce M. Selya Award for Excellence in Research. Judge Bruce M. Selya presents the award annually from the United States Court of Appeals for the First Circuit.

Friedman, a pediatrician, is also director of clinical studies for the Center for International Health Research at Rhode Island Hospital, where investigators use both laboratory and field studies to solve urgent global health issues. Since co-founding the center in 2005, Friedman has led population-based studies in Brazil, western Kenya and the Philippines. Some of those include designing and implementing a study of how worm infections increase the risk for anemia, malnutrition, and cognitive impairment among children.

Friedman’s research is run collaboratively with the work of Jonathan Kurtis, MD, PhD, director of the center, and the 2011 recipient of the Selya Award.

Fulbright in Kenya

As a postdoctoral Fulbright fellow in western Kenya, Friedman led a study of the impact of insecticide-treated bed nets on malnutrition and body composition in school-age children. She also helped design and implement a study that evaluated the impact of bed nets on malaria among pregnant women and children younger than five years old.

Friedman’s most recent project is an innovative global health and development research project that will investigate the role of fetal inflammation in response to parasitic diseases as a cause of low birth weight. This work will form a basis for further studies to identify biomarkers for fetal inflammation in expectant mothers, which will help identify pregnancies at risk. Doctors may then be able to either correct issues in at-risk babies while they are still in-uterus, or be better prepared to treat them after birth.

Robert Klein, MD, pediatrician-in-chief of Hasbro Children’s Hospital, spoke highly of Friedman in his letter nominating her for the award. “Dr. Friedman is a highly productive and successful clinician and researcher whose innovative work is focused on understanding the prevalence and effects of malaria and parasitic infections during pregnancy and childhood,” said Klein. “She is currently leading one of the largest clinical trials at Lifespan, which can have tremendous public health impact as, if proven effective, 40 million pregnant women worldwide with parasitic infections will be targeted for life-saving treatments.”
PROVIDENCE – Lifespan’s The Miriam Hospital and Hasbro Children’s Hospital were each awarded the Gold level of the Rhode Island Department of Health’s Breastfeeding Friendly Workplace Award, the highest honor an organization can receive.

Recognition as a breastfeeding-friendly workplace is based on the successful establishment of supportive policies, facilities, and resources for breastfeeding employees and clients. Gold level awards are given to organizations that have at least 11 strategies in place for supporting breastfeeding.

“We commend The Miriam Hospital and Hasbro Children’s Hospital for recognizing the proven health benefits of breastfeeding for infants, which include obesity prevention, as well as improved immune function and brain development,” said Michael Fine, MD, director of the Rhode Island Department of Health. “We also recognize and applaud the work of Dr. Lynn Taylor in advocating for policies that support and encourage employees who wish to continue to breastfeed once they have returned to work.”

HEALTH recognizes Miriam, Hasbro as breastfeeding friendly workplaces

MomDocFamily
The Miriam Hospital credits the MomDocFamily group for their advocacy in creating three new mother’s rooms, open to both employees and visitors, located in the emergency room, the operating rooms and in the RISE building. Co-founded by Lynn E. Taylor, MD, an HIV/AIDS specialist at Miriam, the group provides mentorship and support for women physicians facing the challenges and rewards of combining a medical career with motherhood.

The Miriam Hospital also has a written lactation policy that is routinely distributed to all employees, and promotes the ability of patients and employees to breastfeed in public spaces, or in private, if they wish. The benefits of breastfeeding are promoted to all Miriam employees, and the hospital offers flexible work schedules along with lactation support to those who need it.

Since Hasbro Children’s Hospital was named to the Silver level in 2007, it has continued to increase support for breastfeeding employees. The hospital implemented a hospital-wide lactation policy that provides flexibility in nursing employees’ schedules. In addition, a designated lactation room was established on the fourth floor of the hospital, with hospital-grade breast pumps available for use. “Breastfeeding Welcome Here” decals and signage are displayed throughout the building to make hospital visitors aware of their options to breastfeed publicly or privately.

For additional information about the benefits of breastfeeding to mothers and children and employer breastfeeding support, visit www.health.ri.gov/breastfeeding/index.php
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Recognition

Nestor receives Hamolsky Outstanding Physician Award

PROVIDENCE – Rhode Island Hospital emergency medicine physician ELIZABETH “LIBBY” NESTOR, MD, has received the 2012 Annual Milton Hamolsky Outstanding Physician Award from the Rhode Island Hospital medical staff. Nestor was honored for her dedication to ethical practice, outstanding clinical skills and her commitment to medical education. The award is the highest honor the medical staff bestows on one of its own.

A Wakefield resident, she is also a clinical professor of emergency medicine at The Warren Alpert Medical School of Brown University. She earned her medical degree at Northwestern University Medical School, and completed her residency in emergency medicine at the Medical Center of Delaware.

She serves on various professional associations including the Society for Academic Emergency Medicine, Best Practices in Emergency Medicine for McMaster University/Best Evidence in Emergency Medicine among other organizations, and as an oral board examiner for the American Board of Emergency Medicine.

She regularly volunteers with the Rhode Island Free Clinic and takes part in the National Youth Forum, a program that allows high school students to shadow a physician for a period of time during the summer.

The Hamolsky Outstanding Physician Award is presented each year to a physician who has made exceptional contributions to medicine, medical education and research; who has demonstrated leadership; and who has been an exemplary role model.

The award honors Milton Hamolsky, MD, a now-retired endocrinologist who came to Rhode Island Hospital in 1963 and served as the first full-time physician-in-chief. Hamolsky is also the retired chief administrative officer of the Rhode Island Board of Medical Licensure and Discipline and a pioneer of medical education in Rhode Island.

Roger Williams physicians honored

The medical staff of Roger Williams Medical Center honored a pair of outstanding physicians at the recent CharterCARE medical staff holiday event. Honored for excellence in service were DR. BERNARD ZIMMERMANN and DR. RAYMOND MAXIM.

Pictured here at the ceremony are Ed Santos, Chairman of the Board, CharterCARE; Dr. Mark Braun, medical staff president; Dr. Bernard Zimmermann, Dr. Raymond Maxim, and Kenneth H. Belcher, President & CEO.
Women in Medicine: Contributions and Dilemmas
1 AMA PRA Category 1 Credit™ (Enduring)
1 Ethics
This activity will examine factors that contribute to role strain for female physicians, evaluate the difference between patient care given by female physicians and male physicians, and discuss the behaviors consistent with gender discrimination and sexual harassment, including the ethical conflicts they pose.

Best Biopsy Techniques for General Practice
1 AMA PRA Category 1 Credit™ (Enduring)

Documentation and Procedures for Effective Pain Management
1 AMA PRA Category 1 Credit™ (Enduring)

Fraud and Abuse: Compliance is the Key to Prevention
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1 Ethics | 1 TMLT

Is That Health Plan Contract Good for Your Practice?
1 AMA PRA Category 1 Credit™ (Enduring)

Privacy and Security: The New Regulatory Environment

Risk Analysis and Meaningful Use: How to Get Your Practice Ready

How to Create and Maintain Life Balance
1 AMA PRA Category 1 Credit™ (Enduring)
1 Ethics
Area Appointments

Providence – G. DEAN ROYE, MD, has been appointed the new director of general surgery at The Miriam Hospital, effective January 1, 2013.

Dr. Roye will oversee all internal medicine services on the two campuses including patient care and clinical research. She also will serve as executive vice chair of the department of medicine at The Warren Alpert Medical School at Brown University. Both appointments are effective February 1, 2013.

“Dr. Roye’s broad medical background and extraordinary leadership talents make her an ideal choice to lead the division,” said Louis Rice, MD, chief of the department of medicine at Rhode Island and The Miriam hospitals. “The division of general internal medicine cares for a large proportion of the patients admitted to the hospital. As we adjust to the inevitable changes in the way health care is delivered and paid for, Dr. Roye’s expert knowledge of clinical testing gained from her service as medical director of Rhode Island Hospital’s bariatric program will be critical for our design of safe and effective new care paths for hospitalized patients.”

She comes to Rhode Island and The Miriam hospitals from Emory University Hospital in Atlanta, Ga., where she served in numerous roles including medical director of Emory Medical Laboratories and clinical microbiology and molecular diagnostics, as well as attending physician in the division of infectious diseases. Additionally, she served as professor of pathology and laboratory medicine at Emory University School of Medicine.

Dr. Roye earned her bachelor’s degree in biology from Grove City College in Pennsylvania and both her postdoctoral and medical degrees from Case Western Reserve University in Cleveland, Ohio. She completed her internal medicine residency at Brigham and Women’s Hospital in Boston; her fellowship in infectious diseases at Massachusetts General Hospital; and her fellowship in executive leadership in academic medicine at Drexel University College of Medicine in Philadelphia. She is a member of numerous organizations, and serves as chair of the microbiology medical devices panel at the Food and Drug Administration, and is a member of the research committee in the Infectious Diseases Society of America.

Her research interests include antiretroviral resistance in HIV-positive women, and the development of molecular diagnostic tests for various infectious diseases.

WATERBUCKET – Memorial Hospital of Rhode Island recently appointed PURVA AGARWAL, MD, to its medical staff in the Department of Internal Medicine.

Dr. Agarwal earned her medical degree at J.L.N Medical College in Ajmer, India. She completed her internal medicine residency at Memorial Hospital.

Dr. Agarwal is a member of the American College of Physicians. Her clinical interests include general internal medicine, preventative medicine and coordination of care for medically complex patients.
• Offering both 1.5T High Field & Higher Field OPEN MRI Systems
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• Electronic Medical Record (EMR) Interfaces now available
• Preauthorization Department for obtaining all insurance preauthorizations
• Fellowship, sub-specialty trained radiologists
• Friendly, efficient staff and convenient, beautiful office settings
• Transportation Service for patients
Physicians partner with hospital to form South County Cardiology

WAKEFIELD – On February 4, cardiologists STEVEN FERA, MD, NEIL BRANDON, MD; DAVID BADER, MD; DAVID BROZA, MD, and AARON WEISBORD, MD, announced a partnership with South County Hospital under the practice name South County Cardiology.

Polanco named to Blackstone Valley post

PAWTUCKET – JOSE POLANCO, MD, has been named assistant medical director and chief medical information officer at Blackstone Valley Community Health Care. Dr. Polanco, who specializes in internal medicine, most recently served as a primary care physician for the PACE organization of Rhode Island.

Physicians partner with hospital to form South County Cardiology

PROVIDENCE – The Providence VAMC has had an interventional pain management program since 2007. The program has recently added DR. KEITH FRAGOZA to the staff. He is an anesthesiologist and pain medicine physician and is a graduate of the University of Massachusetts Medical School.

Dr. Fragoza completed residency training in anesthesia at Massachusetts General Hospital where he also served as the chief resident. He recently completed fellowship training in pain medicine, also at Massachusetts General Hospital. He has a particular interest in spine-related chronic pain conditions as well as interventional pain therapies for cancer-related pain.

He joins program anesthesiologists, Dr. Afreen Siddiqui and Dr. Frederick Burgess, as well as a nurse practitioner, Sue Bridges.

The Interventional Pain Management Clinic, which offers various levels of acute and chronic pain management interventions, has five clinics and sees scheduled patients three days per week. It also provides a multidisciplinary approach to pain medicine elective for Brown medical students.

In other Interventional Pain Management Program news: DR. FREDERICK BURGESS has been elected to a three-year term on the Board of Directors for the American Society of Anesthesiologists.

DR. AFREEN SIDDQUI has been elected for a two-year term as Vice President of the Rhode Island of Society Anesthesiologists.
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PHILIP ARTHUR O’DOWD, MD, of Barrington passed away February 16, 2013. He was the son of the late John and Elizabeth O’Dowd of Yarmouth, Mass. He is survived by his brother Richard O’Dowd of Pembroke, Mass, and pre-deceased by his sister Jacqueline Trafton of South Berwick, Maine and his brother Mark O’Dowd of Pembroke, Mass. He also had many nieces and nephews. He was a companion of Susan Reiff of Jamestown. Philip shared his medical knowledge with all the people. Compliant with his wish there will be no funeral or service. Donations may be made to the Rhode Island Heart Association, One State Street, Suite 200, Providence RI 02908.

THOMAS JOSEPH PAOLINO, JR., MD, 72, of Warwick, passed away on February 17, 2013 at Brigham and Women’s Hospital in Boston, MA. He was the husband of twenty-five years to Barbara [Quartino] Paolino. Born in Providence, he was the son of the late Judge Thomas Paolino, Sr. and his wife Florence [Dolce] Paolino.

Dr. Paolino graduated from Brown University and George Washington School of Medicine. He did his psychiatric residency at Harvard Medical School. After two years of service with the U.S. Coast Guard, Dr. Paolino was appointed chief of the Upper East Unit at Butler Hospital and joined the faculty at Brown University. He was also an assistant professor of psychiatry at Harvard Medical School and author of numerous articles and books on psychotherapy and had been a practicing physician in Rhode Island for over 30 years.

Besides his wife, he is survived by four children, Pia Paolino of New York, Brianna Lee Paolino of Warwick, Thomas J. Paolino, III of Providence and Adam T. Paolino of Warwick.

Memorial contributions may be made to the Dana-Farber Cancer Institute, P.O. Box 849168, Boston, MA 02284-9168.
Gaza Doctor’s Elusive Quest for Peace Amid Personal Tragedy

MARY KORR
RIMJ MANAGING EDITOR

IZZELDIN ABUELAISH, MD, MPH

About the author

Izzeldin Abuelaish, MD, MPH, was the first Palestinian physician to work in an Israeli hospital, at the Sheba Medical Center in Tel Aviv. He earned his medical degree in Cairo, Egypt, and then received a diploma from the Institute of Obstetrics and Gynecology at the University of London. He completed an ob-gyn residency at Soroka Hospital in Israel, and earned his MPH at Harvard University. He now lives in Toronto, Canada, where he is an associate professor at the Dalla Lana School of Public Health at the University of Toronto.

PROVIDENCE – Within the misery of the Jabalia Palestinian refugee camp in the Gaza Strip, Izzeldin Abuelaish dreamed of one day becoming a doctor. “I never tasted childhood. Life was a misery, surrounded by war, fighting to survive,” the author and infertility specialist said at a recent talk at Brown University.

As the eldest of nine children, he was responsible for helping to support the family, and worked as a laborer before and after school. One day in the eighth grade, while walking the four miles to work, he fell and couldn’t get up. “All the walking back and forth was hard on my arthritic legs,” he said.

He was admitted to a hospital in Gaza City. “The doctors and nurses were Palestinians like me. I knew one of the doctors had running water in his house and a special room called a sitting room where people gathered just to visit,” he said.

But what most impressed him was the medical treatment he received. “That was when and where my dream about becoming a doctor began.”

After graduating from high school in 1974, he earned a scholarship to study medicine in Egypt. “For me, medicine became the human face to save lives. I desperately wanted to save lives in Gaza.” He chose to subspecialize in obstetrics and infertility. “The cry of the newborn baby is a cry of hope,” he said.

He began his career in a Gaza hospital and then worked for the Ministry of Health in Saudi Arabia for three years. Dr. Abuelaish continued his studies in London, and then returned to Gaza and opened up a private evening clinic for the poor. He also worked with a UN relief agency as a field ob-gyn specialist. Eventually he became the first Palestinian doctor to practice medicine in Israel.
At Brown, he spoke with a forceful eloquence and plea for peace that belied the Armageddon of personal tragedy. He described the day three of his daughters died, during a 23-day incursion into the Gaza Strip by the Israeli Army, in an attempt to stop the Hamas rocket launchings into Sderot, the Israeli town closest to the Strip:

“Sixteenth of January, 2009, quarter to 5 p.m. is the day when an Israeli tank shelled my house…the explosion came from my daughters’ bedroom…the sight in front of me was something I hope no other person has to witness…the attack killed three of my daughters and my niece...

“They were girls armed with love and education and dreams. Mayar was the top math student in her school in grade nine. She wanted to become a doctor, like me. Aya wanted to be a journalist and was the poet of the family. And Bessan, at 21, had almost completed her business degree. She took care of her younger siblings after my wife, Nadia, died in 2008 of acute leukemia.”

Another daughter, Shatha, was severely wounded in the shelling, and it was feared she would lose sight in her right eye, which had been dislodged. “If I can’t see with my right eye, I have the use of my left,” she told her father from her hospital bed, where she would remain for four months. “I have to go on, for my sisters.”

She is now studying computer engineering in Toronto, where Dr. Abuelaish moved with his remaining five children after the tragedy.

“As a doctor I will never lose hope as long as the patient is alive. If we can defeat cancer, and HIV/AIDS, we can defeat violence,” he said. “In saving a life we save the world. In killing a life we kill the world. Life has taught me that our enemies are ignorance, greed, fear, violence and hatred. No one is born violent. Violence is a disease. If we want to treat the disease, we need to treat the causes.”

In honor of his lost daughters, Dr. Abuelaish has founded Daughters for Life, a foundation headquartered in Toronto (www.daughtersforlife.com). He said its aim is to empower women and girls through health and education programs in order to promote change for them in the Middle East.

His book, I SHALL NOT HATE, is a powerful memoir of both harmony and dissonance, the title of the lecture sponsored by the Cogut Center for the Humanities.
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A Further Look at some *Ped-* Words

STANLEY M. ARONSON, MD

The March, 2011, Physician’s Lexicon column explored the Greek and Latin roots, *ped-*, *pedi-*, *pes-*, *pais-*, and *paido-*, in a variety of medical terms, thus serving to illustrate their dual meanings (i.e., signifying ‘foot’ as in words such as pedal, peduncle and pedestrian; while also denoting a male child as in words such as orthopedics, orthodontia and pediatrics).

The Indo-European root, *ped-* has also generated a fused root, *ped-cos*, which has evolved over time to mean ‘missing one’s footing.’ And thus, in very early Latin, one encounters, *peccos*, meaning to ‘misplace one’s feet,’ ‘to err.’ The later Latin verb, *peccare*, has thus served to describe, in general, ‘a wrong doing’ or a sin. The current Spanish noun, *pecado*, defines a sin; and a little sin, therefore with a diminutive suffix, becomes a *pecadillo*; and, with only a slight change in spelling, it is transformed into the English word, peccadillo.

Thus, a fundamental word unambiguously defining a foot, in time, became a metaphor for misplacing one’s feet (a medieval ‘foot-in-the-mouth’ syndrome), and then later, ‘an error’ and now, ‘a sin’. The English language is enriched with a handful (or footful?) of derivative words such as peccancy and peccant, all defining a sinful behavior. And by adding the prefix, *im-* (an assimilated form of the Latin, *in-* meaning ‘not’), the word impeccable, something blameless or without fault, is produced.

The past tense of the Latin verb, *peccavi*, becomes the ecclesiastic statement, ‘I have sinned.’ *Peccavi* might have remained quietly in the standard dictionaries of Latin were it not for the conjunction of Latin scholarship, military prowess and a perverse sense of humor by General Charles Napier (1682-1853), veteran of the Peninsular Wars against Napoleon, and commanding general of Great Britain’s armies in the conquest of what is now the nation of Pakistan.

Napier’s armies overran the southern province of Sindh and finally capturing its capitol and port city, Sindh. And so, history books tell us, he sent back his immortal one-word message to Queen Victoria in London, “Peccavi!” [I have Sindh.]
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150 Years Ago:

Rhode Island Hospital is chartered

MARY KORR
RIMJ MANAGING EDITOR

On March 10, 1863, the General Assembly enacted the charter for The Rhode Island Hospital. Providence physicians had been appealing to the state legislature and philanthropic community for funds to open and maintain a general hospital for more than a decade. It wasn’t until Civil War veterans started returning home in 1863 that the General Assembly chartered the Rhode Island Hospital Corporation, at the prodding of Brown University graduate Thomas Poynton Ives. Ives had trained at the College of Physicians and Surgeons in New York and was apprenticed to Dr. L. Ely, a prominent Providence practitioner. The Ives family donated $75,000 to launch the effort. The City of Providence donated a 12-acre site on Eddy Street where an old marine hospital was located. The hospital opened in October 1868. The first patient was a local shoemaker named John Sutherland, who suffered from a deep abscess in the jawbone.

Hospital costs: 125 years ago

In the 1888 volume of Transactions, a predecessor of the Rhode Island Medical Journal published by the Rhode Island Medical Society, four facilities took out full-page advertisements regarding their policies on admissions and costs:

The Butler Hospital for the Insane: For admission to this hospital the law requires that two physicians in actual practice shall certify that the patient is insane and that the guardian or near friend shall sign a request for admission...The prices charged vary from $7 to $50 a week. Persons who are not actually insane, but in such nervous condition that they desire the treatment of the Hospital can be admitted upon voluntary application.

The Rhode Island Hospital: Application for admission to the Hospital shall be made to the Admitting Physician between 9 and 11 a.m. or between 2 and 3 p.m. except on Sundays, by the patient in person if possible...bringing from the attending physician a certificate stating the disease and also the pecuniary circumstances of the patient. In case of accident, the patient may be brought directly to the Hospital without a permit. The Superintendent shall immediately take such action as may be proper to secure to the Hospital payment for the board of such patient.

Providence Lying-in Hospital, Cor. State and Field Streets: The Lying-in Hospital is a private charity, receiving both paying and, in suitable instances, worthy free patients. Terms for paying patients: $20 for patients within the state, and $25 for patients without for the lying-in term of three weeks. $5 per week for waiting patients.

The Newport Hospital: Persons who are unable to pay for medical or surgical assistance will be treated free of charge, as far as the funds of the institution will permit. The regular price for board is $8 per week, more for private rooms.
forces the great toe outward into the valgus position.

In a perfectly normal foot a line drawn through the axis of the great toe should pass through the centre of the heel. This is called Meyer’s line, but in the average adult foot, it passes to the inside of the heel instead of through the middle of it.

In the act of walking the weight falls first on the heel, then is supported by the outer side of the foot and finally, as the foot is flexed at the ankle, the body is lifted by the muscles of the great toe. If the long plantar flexor is pulling in the direction of Meyer’s line it will be seen that the arch is strongly supported, but with the great toe forced outward, the angle at which the muscle pulls is changed, much less support is given, the arch is weakened and the ankle rolls inward, this being the first step toward flat-foot.

When this deformity takes place there is a sinking of the arches of the foot, a rotation of the bones on their long axes, and a gradual change in their shape as they assume the new relations.

The astragalus being the key-stone of the arch is the most important bone.

The weight of the body in the upright position falls upon the astragalus, which is situated above and somewhat to the inner side of the os calcis, consequently even in a perfectly normal foot, when the change is made from a position of absolute rest to one supporting the whole weight of the body, there

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The Atlantic Medical Weekly was published in Providence from 1895 to 1898. In the March 6, 1897 issue, Frank E. Peckham, MD, an orthopedic surgeon at Rhode Island Hospital, discussed flat feet.