REVIEW ARTICLE

Women in Surgery: Bright, Sharp, Brave, and Temperate

Elisabeth C McLemore, MD; Sonia Ramamoorthy, MD; Carrie Y Peterson, MD; Barbara L Bass, MD

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Abstract

Women make up an increasing proportion of students entering the medical profession. Before 1970, women represented 6% or less of the medical student population. In drastic contrast, nearly half of first-time applicants to medical schools in 2011 were women. However, the ratio of women to men is less balanced among graduates from surgical residencies and among leadership positions in surgery. Less than 20% of full professor, tenured faculty, and departmental head positions are currently held by women. However, this disparity may resolve with time as more women who entered the field in the 1980s emerge as mature surgeons and leaders. The aim of this article is to review the history of women in surgery and to highlight individual and institutional creative modifications that can promote the advancement of women in surgery. A secondary aim of the article is to add some levity to the discussion with personal anecdotes representing the primary author's (ECM) personal opinions, biases, and reflections.

An Unrecognized Personal Bias

During the Second Annual Women in Surgery Conference at the University of California, San Diego on November 16, 2011, Carol Scott-Conner, MD, referenced a 15th-century author describing the attributes of an ideal surgeon: "the mind of Aesculapius, the eye of an eagle, the heart of a lion, and the hands of a woman." At first one might conclude that this refers to the physical characteristics of a woman's hand; however, the author was more likely highlighting the temperate nature of women and the respect and care with which they care for patients and treat illnesses.

Patients frequently ask why I (ECM) became a surgeon. Women are attracted to surgical careers for reasons similar to their male colleagues: influential role models, intellectual challenges, technical aspects, and decisiveness.[1-3] My reasons for entering the field of surgery are not unique. I wanted to effect immediate change in individuals inflicted with disease amenable to surgical intervention. During my surgical rotations in medical school, I had an immediate sense of belonging. I had an instant affinity to the surgical leadership principles that prioritize respect, honesty, efficiency, problem solving, and praise for executing arduous tasks.

I have been fortunate to have both men and women mentors. However, it was not so long ago that women in medicine, much less surgery, were not so fortunate as to have examples of both men and women who had gone before them. They were the first women in medicine, surgery, academics, private practice, boards of governors, departmental leadership, and in every imaginable position.

Despite my (ECM's) firsthand experience as a woman in surgery, I recently discovered that my own perceptions were heavily influenced by stereotypes. I was stunned by my naiveté regarding the following riddle: One evening, a father was driving with his son. The two were heading home from an awards banquet. The father was a prominent surgeon and had been nominated for Surgeon of the Year. Unfortunately, the father and son were involved in a car accident. The paramedics arrived at the scene and the father and son were taken to different hospitals for medical evaluation. The father suffered a minor concussion and was admitted to the hospital for observation. Unfortunately, the son needed emergency surgery for his injuries. The surgeon on call that evening upon seeing the son said, "I cannot operate on this patient, this is my son."

How is this possible? My initial solution proposed that the patient was the son of a same-sex couple and had two fathers who were both surgeons. Then, it dawned on me … the surgeon on call was the patient's mother. How could I, a woman, a wife, a mother, and a surgeon, be so shortsighted? Despite my own personal journey, my unconscious bias still drifted toward the assumption that the surgeon was male.

History of Women in Surgery: Foreign Film, Documentary, or Action-Adventure?

If Hollywood created a film on the history of women in surgery, it might be difficult to categorize: foreign film, documentary, or action-adventure? Furthermore, how do we categorize women in medicine? Is the proper descriptor "woman physician" or "physician who happens to be a woman"? Similarly, is the proper phraseology "woman surgeon," or "surgeon who is also a woman"? My (ECM's) preference is for the latter in both instances. However, the lengthy wording may be prohibitive in written and spoken language.

The history of women in surgery has been well documented by Debrah A Wirtzfield, MD.[4] Women held prominent positions as surgeons in ancient times, as is recorded in surgical texts from Egypt, Italy, and Greece. However, during the Middle Ages, the notion of a woman's ability to lead dissipated. This was particularly true in medicine and surgery, but also in a variety of other professional and nonprofessional roles in which leadership was deemed a necessary attribute. Similarly, in the last century, pioneering women surgeons in North America were frequently denied surgical residency positions despite having graduated from prestigious medical schools and universities.[4]

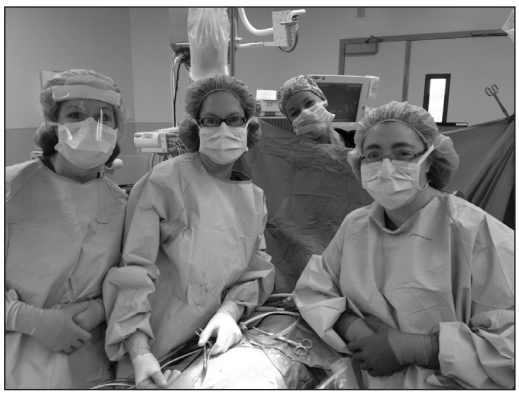
Elisabeth C McLemore, MD, is an Assistant Professor of Surgery at the University of California San Diego. E-mail: emclemore@ucsd.edu. **Sonia Ramamoorthy, MD,** is an Associate Professor of Surgery at the University of California San Diego. E-mail: sramamoorthy@ucsd.edu.**Carrie Y Peterson, MD,** is Chief Resident of Surgery at the University of California San Diego. E-mail: cypeterson@ucsd.edu. **Barbara L Bass, MD,** is the John F and Carolyn Bookout Distinguished Endowed Chair of Surgery at The Methodist Hospital in Houston, TX. E-mail: bbass@tmhs.org.

Modern surgical training in North America was a frontier rarely explored by women in the 19th century. One of the most memorable stories illustrating some of the initial difficulties faced by women in medicine and surgery is the account of James Barry, MD (1795–1865).[4] Dr Barry graduated from the prestigious Edinburgh Medical School at the age of 17. Thereafter, he joined the army and was a surgeon during the Napoleonic wars. In 1820, he performed one of the first successful cesarean sections at the request of a wealthy patron whose wife was unable to progress during labor. Dr Barry was often referred to as the "beardless lad." Rumor had it that he was involved in at least one long-term relationship with another man. At the time of his death, it was discovered that Dr Barry was actually a woman, with findings at autopsy consistent with a history of pregnancy.[4]

In 2005, in an invited editorial describing her experience as a woman in surgery, Jo Buyske, MD, wrote, "Most women surgeons of my era, and certainly those before, have spent our careers being as sexually invisible as possible while attending to the business of learning and practicing surgery. The goal was to be accepted as a surgeon, not a woman surgeon. Now, to be a surgeon and thrown into the spotlight as women is blinding. Being asked to write this editorial made me both proud and uneasy."[5] I (ECM) experienced similar feelings of uneasiness when asked to write this article.

First Things First: Women Trailblazers in Surgery

Mary Edwards Walker, MD, (1832–1919) was the first recognized woman surgeon in the US and the second woman to graduate from a medical school in the US (Syracuse Medical College, New York, 1855; Elizabeth Blackwell, MD, was the first woman graduate, in 1849).[1,6,7] Dr Edwards Walker's husband was a fellow classmate in medical school, Albert Miller, MD. Dr Edwards Walker went into practice with her husband, however the surgical practice failed. Thereafter, she practiced medicine as a nurse for several years. In 1863, she became the first woman surgeon in the US Army. Two years later, she received the Congressional Medal of Honor for service during the Civil War. This honor was revoked in 1917 by the US Congress, as she—like many other earlier recipients—did not serve directly on the front lines of battle. She had not returned the medal at the time of her death, in 1919. In 1977, the Congressional Medal of Honor was reinstated by President Jimmy Carter. A postage stamp was issued in 1982 to commemorate Dr Edwards Walker. An unintentionally incomplete list highlighting many firsts for women in surgery can be found in Table 1.[1,6,7] The information contained in Table 1 is the cornerstone of this article, offering an opportunity to learn about the major accomplishments that have been made by women in surgery during the last few centuries.



All-women operative teams: University of California San Diego Thornton Hospital operative team.

(Left to Right) Lynn Gardea, RN; Elizabeth Pocock, MD, chief resident; Sara Meitzen, MD, anesthesiology resident; Elisabeth McLemore, MD, attending surgeon.

Current State of the Union: Women in Surgery

Thankfully, the field of surgery has significantly evolved. Tamar Earnest, MD, said it best: "Were it not for the undaunted spirit of a few exceptional women, many barriers would still exist to discourage women from becoming surgeons."[1] These exceptional women frequently give praise to the influential mentors throughout their careers, who should also be recognized for their part in this evolution. One fine example among many is Claude Organ, MD. Dr Organ's 1993 editorial entitled "Toward a more complete society"[8] details the goals and societal benefits of participation, contribution, and leadership of women and other minorities in the field of surgery.[8] Julie A Freischlag, MD, Halsted Professor, Surgeon-in-Chief, and Chair of Surgery at Johns Hopkins Medical Institutions, has a revolutionary and refreshing perspective on diversity: "We need to recognize that diversity—managing and leading across differences—is not an initiative or a program; it should be a competency that anyone who manages people must learn if he or she is to be an effective leader."[9]

Before 1970, women represented 6% or less of the medical student body population.[10] In drastic contrast, the number of first-time applicants to medical schools in 2011 reached an all-time high, and nearly half were women (32,654 students, 2.6% increase from 2010, 47% women).[10] In 2010, more than 2500 medical students applied for a general surgery residency, with 35% of the applicants being women (932 women, 2662 total applicants).[10] However, despite these improvements, women continue to be a minority in other surgical specialties, numbering less than 15% of applicants to residency training programs in thoracic surgery, urology, orthopedic surgery, and neurological surgery.[10]

The proportion of women among graduates from surgical residencies and in leadership positions in surgery is less balanced. In the academic setting, approximately 41% of assistant professors are women. At first glance, it is encouraging to see so many women in academic medicine. Unfortunately, there is a steep downward trajectory. Women represent only 29% of associate professors, 17% of full professors, and 19% of tenured faculty. Only 12% of departmental head positions are currently held by women.[7,11,12] However, we remain cautiously optimistic.[13]

"Attaining leadership is a long process. Women only began entering surgery in significant numbers in the late 1980s and the 1990s … Those residents from the 1980s are starting to emerge as mature surgeons and leaders. There is a certain mandatory developmental lag while those same women first learn the skills of surgery, develop a body of research, and then learn how to work on a committee, to mediate, negotiate, chair a group, and finally to emerge a leader. These women are all in the pipeline."—Jo Buyske, MD, 2005.[5]

Field Guide: The Obstacle Course

To maneuver through an obstacle course, you first need to know where it is. Left to your own devices, you may quickly find yourself ten miles up the wrong mountain. You need a mentor, a guide to show you land mines to avoid—quite literally in some instances. The more mentors you have throughout your career, the better the variety of perspectives, recommendations, and advice you will receive.[14] There are two main types of mentors: active and passive. The active mentor will invest time and energy to get to know your strengths, weaknesses, goals, and aspirations. The active mentor will assist you in your development and maturation and will often keep a watchful eye on your career, creating doors of opportunity without your immediate knowledge. The passive mentor is less likely to invest time but may unknowingly provide a great role model for what to do or not do. You will need to seek out mentorship in most cases. Interestingly, structured mentoring (assigned mentoring within a department

Table 1. Pioneering women in the field of surgery

Pioneering surgeon	First for women in surgery	Year	Additional accomplishments
Mary Edwards Walker, MD	First woman to become a surgeon in the US	1863	Congressional Medal of Honor (1865)
(Mary) Alice Bennett, MD	First woman to obtain a PhD from the University of Pennsylvania (anatomy) First woman superintendent of the women's section of the State Hospital for the Insane in Norristown, PA	1880	Improved the treatment of women patients with mental illness by abolishing restraints and introducing occupational therapy at a state hospital First woman President of the Montgomery County Medical Society of Pennsylvania (1890)
Harriet B Jones, MD	First woman licensed to practice surgery	1885	One of the first women to serve in the West Virginia legislature
Mary Amanda Dixon Jones, MD	Proposed and performed the first total hysterectomy for uterine myoma	1888	Trailblazer in portraying herself in a nontraditional female role
Bertha Van Hoosen, MD	Founder and first President of the American Medical Women's Association	1915	Honorary member of the International Association of Medical Women Author of *Petticoat Surgeon,* an autobiography (1947)
Barbara B Stimson, MD	First woman certified by the American Board of Surgery	1940	First woman member of the New York Surgical Society and American Association for the Surgery of Trauma Major in the Royal Army Medical Corps throughout World War II
Major Margaret Craighill, MD	First woman commissioned as an officer in the US Army	1943	A surgeon and obstetrician
Alma Dea Morani, MD	First woman admitted to the American Society of Plastic and Reconstructive Surgery	1947	First woman surgical resident at the Woman's Medical College of Pennsylvania (1931)
Tenley Albright, MD			First woman to serve as an officer on the US Olympic Committee Chair of the National Institutes of Health National Library of Medicine's Board of Regents First American woman to win a gold medal in figure skating
Nina Braunwald, MD	First woman elected to the American Association for Thoracic Surgery	1960	Led the operative team that performed the first successful prosthetic mitral heart valve replacement in the world, which she designed (1960) Developed the first cardiothoracic program at University of California San Diego (1968)
Virginia Kneeland Frantz, MD	First woman President of the American Thyroid Society	1961	First woman surgical intern at New York Presbyterian Hospital (1922) Along with Dr Whipple, described the secretion of insulin by pancreatic tumors (1935)
Nina Braunwald, MD Ann McKiel, MD Nermin Tutunju, MD	First women certified by the American Board of Cardiothoracic Surgery	1961	
Frances Conley, MD	First woman tenured full professor at a US medical school	1971	First woman surgical intern at Stanford University Hospital (1966) First woman to finish the San Francisco's Bay to Breakers Foot Race (1971)
Dorothy Lavinia Brown, MD	First African-American woman to become a Fellow of the American College of Surgeons	1971	First African-American woman surgeon in the South (1957) First African-American woman to serve in the Tennessee state legislature (1966)
Ernestine Hambeck, MD	First woman certified by the American Board of Colorectal Surgery	1973	Founder of the STOP Colon/Rectal Cancer Foundation (1997)

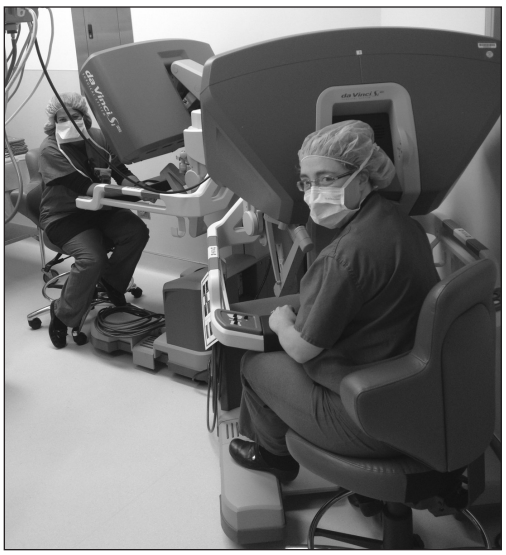
(Continued on next page.)

or institution) has been found to be a cost-effective measure that translates into improved skill acquisition and improved retention in academic medicine.[15]

All women attempting to perform dual professional and domestic roles will encounter obstacles. A variety of domestic assistance options are available, from cleaning services to food preparation to household maintenance to child care. There is also a wide variety of creative solutions. For instance, our coworkers' domestic partners have firsthand experience and a comprehensive understanding of the demands of the surgical profession. If a coworker's household is primarily managed by a domestic partner, s/he will likely have well-researched recommendations for child care, education, medical and dental care, social networks, local dining venues, reliable contractors, home remodeling agencies, etc. Befriend your colleagues' domestic partners if the

(Continued from previous page.)

Pioneering surgeon	First for women in surgery	Year	Additional accomplishments
Rosalyn P Scott, MD	First African-American woman trained in thoracic surgery	1977	First African-American woman granted membership in the Society of University Surgeons First Mary A Fraley Fellow at the Texas Heart Institute (1980) Founding member of the Society of Black Academic Surgeons and the Association of Black Cardiovascular and Thoracic Surgeons
Alexa Irene Canady, MD	First African-American woman to become a neurosurgeon in the US	1984	Chief of neurosurgery at Children's Hospital of Michigan Woman of the Year, American Women's Medical Association (1993)
Olga Jonasson, MD	First woman in the US to chair an academic department of surgery	1987	Director, Department of Education and Surgical Services of the American College of Surgeons (1993) First woman to receive the Nina Starr Braunwald Award (1994 Foundation Award, Association of Women Surgeons)
Julie Ann Freischlag, MD	First woman vice president of the Society for Vascular Surgery	1987 2011	Surgeon-in-Chief, Johns Hopkins Medical Institutions (2003) Editor, Archives of Surgery Associate Editor, *American Journal of Surgery*
Susan Veronica Karol, MD	First woman of the Tuscarora Indian Nation to become a surgeon	1988	First woman appointed Chief of Surgery at Beverly Hospital in Beverly, MA
Brigadier General Rhonda L Cornum, MD	First woman flight surgeon to enter combat	1991	Author, *She Went to War: The Rhonda Cornum Story* Director, US Army Comprehensive Soldier Fitness Program
Kathryn Dorothy Duncan Anderson, MD	First woman appointed officer of the American College of Surgeons First woman President of the American Pediatric Surgery Association First woman President of the American College of Surgeons	1992 1999 2005	Secretary of the American College of Surgeons (1993) Chief of Surgery, Children's Hospital Los Angeles
Karen Guice, MD	First woman elected President of the Association of Academic Surgery	1993	Military Health System's chief information officer
Patricia Numann, MD	First woman Chair, American Board of Surgery	1994	Founder of the Association of Women in Surgery Second woman elected President of the American College of Surgeons
Linda Graham, MD	First woman elected President of the Society of University Surgeons	1994	Adjunct Professor, Case Western Reserve University Department of Biomedical Engineering
Lori Arviso Alvord, MD	First Navajo woman to be board-certified in general surgery	1994	Bridged traditional Navajo healing and conventional Western medicine to treat the whole patient
Leigh Ann Curl, MD	First and only woman orthopedic surgeon in the National Football League	2002	Inducted into the Academic All-America Hall of Fame (1998)
M Jennifer Derebery, MD	First woman President of the American Academy of Otolaryngology	2003	Advancing the science of autoimmune inner ear diseases with National Institutes of Health-funded research
Ann Lowry, MD	First woman elected President of the American Society of Colon and Rectal Surgeons	2007	President and CEO of Colon and Rectal Surgery Associates (2008)
Jo Buyske, MD	First woman elected president of the Society of American Gastrointestinal and Endoscopic Surgeons	2010	Associate Executive Director, American Board of Surgery (2007)
Carol Scott-Conner, MD	First woman member of the Southern Surgical Society	2011	Second woman Chair of a Department of Surgery Author, *A Few Small Moments, an autobiography* (2011)



All-women operative team: University of California San Diego dual robotic surgeon console colorectal surgery team.

(Left to Right) Sonia Ramamoorthy, MD; Elisabeth McLemore, MD.

opportunity presents itself—these may very well become some of the most grounded friendships you will have.

Without further delay, let's address the topic of pregnancy—the "nine-letter word" in most professional environments, closely followed by the other "nine-letter word," maternity, and maternity leave. I will make no declarations as to the ideal timing of pregnancy or parenting style. I have come to the understanding that the term "planned parenthood" is an oxymoron. It would be nice if a survivorship screening program was developed for parents and families during the first five years after childbirth. All malapropism and intentional humor aside, parenthood during surgical training and professional practice is going to occur so long as there are human beings inhabiting the earth.[16] Therefore, we prepare for it in a fashion similar to the way we prepare for coverage during holidays, societal meetings, and business meetings. Appropriate maternity and paternity policies within our own institutions and practices exist and foster an environment of equality. "Parent leave," if you will, for newborn care, parent-teacher meetings, and scholarly and extracurricular events should be so common that we find ourselves surprised when there is no one currently on parent leave, rather than being shocked at the coverage that is needed to support the leave.[17,18]

"Yes, it is worth it. And yes, you can be a successful surgeon, parent, and spouse—just not always at the same time."

Although considerable improvements have been made in the realm of sex discrimination in the workplace, there is always room for improvement. Zhuge and colleagues have identified notable barriers to achieving leadership positions and recommended adaptive interventions.[11] The reader is encouraged to review the article by Zhuge and colleagues as individual and institutional interventions are revealed and may enlighten both parties as to some creative solutions. For example, at the individual level, renegotiate assignment of family responsibilities. At the institutional level, schedule departmental meetings at more practical times. The absolute need for mentorship is also emphasized.[11]

Dyrbye and colleagues recommend additional creative institutional strategies, including daycare in the workplace, adjustable timelines for promotion and tenure, and domestic partner employment assistance during recruitment of women surgeons.[19] Creative adaptations of surgical residency programs, including part-time paternity and maternity leave, are of increasing interest to students and trainees.[2] These creative residency employment tracks continue to train competent surgeons.[20,21]

A career in surgery includes an often daunting time commitment to clinical work. Despite the longer work days required of surgeons, a study comparing women who are surgeons with other women who are physicians found that career satisfaction was similar between both groups.[22] Women in surgical careers were not more likely to report feeling that they worked too much, had too much work stress, or less control of their work environment. Women in surgical careers were less likely to want to change their specialty if they had the option of reliving their lives.[22]

"Is it worth it?" This is a frequent question from medical students and aspiring young surgeons alike. "Can you be a successful surgeon, parent, and spouse?" My (ECM's) answer to these questions is, "Yes, it is worth it. And yes, you can be successful in all three areas—just not always at the same time." Some days you will be most successful as the surgeon. Other days you will be most successful as the parent. And other days, you will be most successful as the spouse or domestic partner. For the other roles you play—daughter, sister, co-worker, mentor, mentee, friend, coach, teacher, etc—you will have various degrees of success as well. One of my (ECM's) mentors from medical school had engraved on her mantel the mock-Latin aphorism:, Illegitimis non carborundum. The underlying message is similar to the well-known phrase from the children's story *The Little Engine That Could,* "I think I can, I think I can, I think I can …" Mind your health, cherish your friends and family, learn from your mistakes, and take pleasure in all of your successful moments.

Conclusion: Nurture the Creative Pipelines to Success

As women continue to increase in number and mature in leadership positions in surgery, active mentorship is vital to nurture the variety of pipelines to success. Leaders in surgery, unite and assist your colleagues in attaining a sense of control over lifestyle. Although there will always be roadblocks, regardless of race, ethnicity, sex, and a myriad of other differences associated with unjustified perceptions, it is important to persevere in the ongoing education and evolution of our minds and craft.[21]

It is often easier to lose momentum at a roadblock and turn back than to forge a new path. However, true greatness, true happiness, true meaning is found in the discovery of new frontiers, both professional and personal. In the field of surgery, there is a multitude of frontiers awaiting bright, sharp, brave, and temperate leaders. Let us continue to promote the advancement of women and other minority groups in surgery, including positions of leadership. In her presidential speech at the American Society of Colon and Rectal Surgeons Annual Meeting, Ann C Lowry, MD, very appropriately referenced Robert Frost, "Two roads diverged in a wood, and I—I took the one less traveled by, and that has made all the difference."[23] ❖

Acknowledgments

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A Surgeon Should Be

A surgeon should be youthful or at any rate nearer youth than age; with a strong and steady hand which never trembles, and ready to use the left hand as well as the right; with vision sharp and clear, and spirit undaunted; filled with pity, so that he wishes to cure his patient, yet is not moved by his cries, to go too fast, or cut less than is necessary; but he does everything just as if the cries of pain cause him to emotion.

—De Medicina, Aulus Aurelius Cornelius Celsus, 25 BC – 50 AD, Roman encyclopeadist