Special Report

Nina Braunwald: A Female Pioneer in Cardiac Surgery

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Nina Starr Braunwald, the first female cardiac surgeon, made headlines during a time when almost all specialty surgeons were men.

Women have typically been deterred from entering surgical specialties, in part because of their traditional dual burden of managing their households and careers. Instead, female medical students and junior doctors have tended to be more attracted to medical specialties. This was the reality during Dr. Braunwald's venture into medicine in 1949. However, she never allowed negative ideas to keep her from joining a surgical training program.

Under the mentorship of the prominent cardiac surgeons Charles Hufnagel and Andrew Morrow, Dr. Braunwald progressed in her career by conducting research that led to her development and implantation of the first prosthetic mitral valve. She was also a great teacher.

Dr. Braunwald balanced her personal and professional activities admirably, and her example still inspires female doctors to consider careers in cardiothoracic surgery. In this report, we provide details of her impact on cardiac surgery and insights into her successes.
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Being a surgeon of any kind is a career typically associated with men, and this association might explain why men dominate the field of cardiac surgery. Nina Braunwald was one of the first women to undertake a career in this field. After graduating from medical school, she underwent training in general surgery, working under the mentorship of renowned cardiac surgeons. She became the first female cardiac surgeon and the first woman to perform open-heart surgery. In addition, she was the first surgeon of either sex to successfully perform a mitral valve replacement.

Early Years

Nina Starr Braunwald was born to Morris C. and Mary Starr on 2 March 1928 in Brooklyn, New York, where she grew up and completed her public-school education. While young, she discovered that she was good with her hands, as evidenced by her ability to construct things, paint, and draw.

Nina Starr enrolled in the Washington Square College of Arts and Sciences at New York University. However, art was strictly a hobby. She had been influenced at a very young age to pursue a career in medicine by her father, a physician. Her combined desires to become a physician and to use her hands directed her interests toward surgery. After earning her Bachelor of Arts degree in 1949, she began her training in medicine at the New York University College of Medicine. In 1952, she began her internship and residency at New York's Bellevue Hospital. She later became that hospital's first female general surgeon.[1]

Interest in Cardiac Surgery

In 1952, Nina Starr married Eugene Braunwald, her classmate in college and medical school who specialized in cardiology research at Bellevue Hospital. Nina Braunwald thus gained insight into the field of cardiology. During her residency, she took a year off to complete a postdoctoral fellowship with Charles Hufnagel, a talented cardiac surgeon at Georgetown University. She then earned a Master's degree in Surgery and transferred to Georgetown to complete her residency, and she became a chief resident. Working alongside a pioneering surgeon in this emerging specialty sparked her interest in cardiac surgery. To her, it seemed like the next big frontier, and she was enthusiastic about undertaking its challenges.[2]

In 1958, Dr. Braunwald seized the opportunity to receive training as a cardiac surgeon from Andrew Morrow, the chief of the Clinic of Surgery at the National In-

stitutes of Health (NIH) in Bethesda, Maryland (Fig. 1). With Morrow's constant support and guidance, she entered academic surgery and in 1963 became the first woman to be certified by the American Board of Thoracic Surgery (Fig. 2). In 1965, she was promoted to be deputy chief under Morrow at the NIH and continued to conduct groundbreaking research in cardiac surgery. In 1968, she moved with her husband to the University of California, San Diego (UCSD) and was appointed an Associate Professor of Surgery. Eventually, she established a cardiac surgical program at UCSD and served as its acting director.[2]

Mentors

To become a cardiac surgeon, Nina Braunwald needed immense support and determination. Two prominent mentors in her life were Drs. Hufnagel and Morrow. Hufnagel fueled Dr. Braunwald's interest in the field by presenting its tremendous future possibilities. He was the first to design an artificial valve to replace the native aortic valve.[3] Dr. Braunwald assisted Hufnagel during operations, despite not yet having completed her surgical residency. At NIH, Eugene Braunwald introduced Nina to Morrow, a close colleague. Morrow spent the next 10 years providing Dr. Braunwald with in-depth training in cardiac surgery and readily gave her recognition as first author in many of their collaborative research papers. He also nominated her for awards and memberships in prestigious societies and promoted her within professional networks, enabling her success.

After leaving Morrow's service, Dr. Braunwald, now lacking the level of support that he had provided, faced new professional challenges, but she was well equipped. The environments established by Morrow and Hufnagel had bypassed prevailing norms of discrimination, ensuring that she could succeed on her own.

First Successful Mitral Valve Replacement

Having been inspired by the many patients whose mitral valves were damaged after rheumatic heart disease, Dr. Braunwald's chief research interest was the development of artificial heart valves. While still under Morrow's guidance, she and Theodore Cooper had investigated a prosthetic valve as a total replacement for the native mitral valve. She designed a prosthesis, called the Braunwald-Morrow valve, which had flexible polyurethane flaps for valve leaflets and Teflon ribbons for chordae tendineae (Fig. 3).[4,5] She tested the valve in 24 dogs and was soon satisfied that it was ready for human implantation. On 11 March 1960, the 32-year-old Braunwald—assisted by Morrow—performed the world's first successful mitral valve replacement in a 44-year-old woman who had end-stage cardiac failure caused by mitral regurgitation. The procedure was performed with the use of a cardiopulmonary bypass (CPB) machine, to the design of which Dr. Braunwald

Fig. 1 *Nina Braunwald (far left) and Andrew G. Morrow (far right) performing surgery. (Photograph courtesy of the Office of History, National Institutes of Health and the National Library of Medicine.)*

Fig. 2 *Nina Braunwald in 1963, the year she was certified by the American Board of Thoracic Surgery. (Photograph courtesy of Dr. Eugene Braunwald.)*

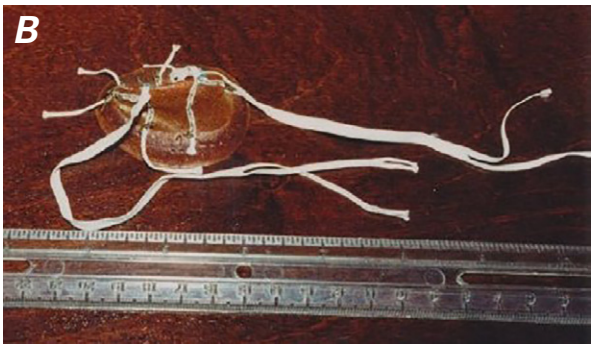

Fig. 3 ***A****) Nina Braunwald working in her laboratory.* ***B****) The Braunwald-Morrow mitral valve. (Photographs courtesy of the Office of History, National Institutes of Health and the National Library of Medicine.)*

had contributed. After completing the operation, she did not rest until the patient was discharged from the hospital and the surgery was presumed successful.[4] She later developed the Braunwald-Cutter valve, a cloth-covered mechanical valve that was implanted successfully into thousands of patients throughout the 1960s and 1970s.

Additional Research Contributions

Working with Kenneth Moser at UCSD, Nina Braunwald had a pioneering role in developing pulmonary thromboendarterectomy, a treatment for chronic thromboembolic pulmonary hypertension (CTEPH). After she left UCSD, the cardiovascular center there became a proverbial Mecca for patients who had CTEPH and today has the world's largest program for this procedure.[6]

Dr. Braunwald also worked on developing a glue to replace sutures, using a cross-linked gelatin as a tissue adhesive; however, it failed to deliver the desired results.[7]

Beyond valvular disease, Nina was interested in the treatment of congenital heart diseases. In 1972, she moved to Boston to work at the Children's Hospital Medical Center, which was affiliated with the Harvard Medical School. She contributed to surgical procedures for treating ventricular septal defects. The use of CPB was associated with a high operative mortality rate, which inspired her to develop a CPB unit for pediatric and neonatal use.[8]

Working Against All Odds

Nina Braunwald had to prove again and again not only that she was a good surgeon, but that she was just as competent as a man—if not better. Gender bias prevailed on individual and institutional levels. Despite her substantial achievements in teaching, research, and clinical care at NIH, UCSD, and Harvard University, she was never honored with an endowed professorship at any of these prestigious institutions. She was nevertheless strongly motivated and highly persistent. When her colleagues got to know her better, they concluded that she knew exactly what she was talking about, and they saw her spectacular results in the surgical theater. Although Dr. Braunwald never proclaimed herself to be a "feminist," she derived satisfaction from proving her excellence as the first female cardiac surgeon. She had detractors; however, she did not permit others' opinions to hinder her career progression. Moreover, she readily gained the respect of her patients, who never objected to being operated on by a woman.

Role as a Mentor

Hufnagel and Morrow had provided optimal academic and clinical training for Nina Braunwald. In emulating her own mentors, Dr. Braunwald was a role model to her students who chose to pursue surgical careers. She worked intensively with small groups of research fellows, which helped her to build very close professional and personal relationships; indeed, she often got to know each person's family. She freely gave people credit for her work with them, thus positively influencing their careers. Although she had no women trainees, the news of a female cardiac surgeon had spread. Ann Kosloske, a junior doctor, sought advice from Dr. Braunwald about pursuing a surgical career. Kosloske described her as a "tiny woman, barely 5 feet tall…but all business and would tell it like it is." The two never worked together; however, just a few supportive words from Dr. Braunwald mattered enormously in enabling Dr. Kosloske to find her own "cutting-edge surgical program."[9]

Throughout her career, Dr. Braunwald was heavily involved in teaching. She taught medical students, surgical residents, and even the surgical house staff. She was appointed Deputy Chief of the Clinic of Surgery at NIH (1965–1968), Associate Professor of Surgery at UCSD (1968–1972), and Associate Professor of Surgery at Harvard Medical School (1972). At each institution, she emphasized the importance of academic research, and she held leadership positions in programs focusing on scientific research and teaching, such as the medical scientist program at Harvard.

In the News

Nina Braunwald carved herself a distinguished niche in the so-called "man's world" of cardiac surgery. However, she never actively pursued recognition. Eugene Braunwald explained that his wife never sought media coverage, nor did she avoid it; she was rather amused by such attention. As she attained prominence, an early feminist movement caused the media and the public to be intrigued by her determined, goal-oriented personality. Dr. Braunwald was gracious in regard to the publicity but adamantly placed her career, patients, and family first. She was unwilling to sacrifice the chief elements of her life merely to be in the limelight.

A Mother and a Wife

As the mother of 3 daughters, Dr. Braunwald tried to balance her personal life and career demands (Fig. 4). She would awaken very early each morning to do chores and spend time with her children—Karen, Allison, and Jill. Unless an emergency arose, she would always be back home for dinner. On many occasions, she would go back to her patients after putting her children to bed. Her family supported her in all that she did. She made every family moment count, and she never made her husband or daughters feel that she was unavailable or inattentive. Even when pregnant, she continued performing surgery until 2 weeks before each daughter's birth—stopping only when her enlarged abdomen kept her too far from the operating table.

Dr. Braunwald wanted to see her girls grow up, get married, and succeed in all aspects of their lives. Karen became a doctor of psychology; Allison, an academic endocrinologist; and Jill, a healthcare attorney. Nina Braunwald lived long enough to be involved in the life of her oldest grandchild, and that meant a great deal to her. In her personal life, she was much like other women.

Legacy

Nina Braunwald died on 5 August 1992, at age 64 years. Eugene Braunwald established a foundation that continues to support women who seek careers in academic cardiac surgery. The Thoracic Surgery Foundation for Research and Education offers the Nina Starr Braunwald Research Fellowship. The Association of Women Surgeons annually confers the Nina Starr Braunwald Award to women who fulfill exceptional roles in academic cardiac surgery.

Fig. 4 *Nina and Eugene Braunwald with family.*

(Photograph courtesy of the Office of History, National Institutes of Health and the National Library of Medicine.)

Perspective and Questions

Decades after Nina Braunwald's career flourished, women still labor under preconceptions that deter them from pursuing careers as cardiac surgeons. Why are women so underrepresented in cardiac surgery? Only 12% of cardiac surgeons in Australia were women in 2013,[10] as were only 11% in Canada in 2015.[11] What factors apply? Are women inadequately encouraged to join surgical specialties, or do they receive inadequate support after joining?

One answer seems to be that early involvement, determination, hard work, and support from mentors all contribute greatly to a woman's ability to become a successful academic surgeon. Nina Braunwald remains a role model for all—women and men—who aspire to a career in cardiac surgery.

Acknowledgment

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