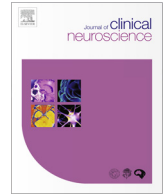




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Review article

European women in neurosurgery: II – Historical characters and living legends

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ABSTRACT

A collaborative global working group of women neurosurgeons in multiple countries at different stages of their neurosurgical careers undertook the task of researching the history of European women in neurosurgery. While doing so, we happened upon many remarkable female neurosurgeons who overcame great adversity, made tremendous contributions to society and institutional neurosurgery, and displayed numerous talents beyond the operating room. In the first part of this paper, we recounted a chronology of female neurosurgeons in Europe, highlighting the most remarkable achievements of women in every decade, from the 1920's to 2020. In this paper, we honor fascinating women in European neurosurgery, both historical characters and living legends. These women have overcome great adversity and have also excelled in a huge variety of pursuits. While some were themselves refugees, we also have uncovered noteworthy examples of women who immersed themselves in humanitarian missions and who tried to better the world through political action. There are stories of women beating the odds, taking on biased institutions and proving their worth, in spite of the prevailing system. Most inspirational, we have discovered through our comprehensive research on the history of women in European neurosurgery that the future is increasingly female.

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1. Introduction

In researching the history of European female neurosurgeons, we discovered many remarkable individuals who overcame great adversity, made tremendous contributions to society and institutional neurosurgery, and displayed numerous talents beyond the operating room. It is impossible to recount all their stories and do all of them justice, but we honor every woman in neurosurgery, for they serve as role-models and examples of what we as individuals can achieve on our own individual journeys. In no particular order, and surely with a great deal of selection bias due to the availability of information to the authors (for a detailed methodology, see Hernández-Durán et al, unpublished manuscript), we recount here some of those fascinating women who have triumphed against the odds and paved a path for future generations.

2. Against all odds

2.1. Resilience personified

One of Spain's first women in neurosurgery, Balbina Ferreras Ferreras (Fig. 1), recalls her arduous journey: "I was the eldest of six children of a coal miner and a housewife. My bumpy education was interrupted for several years due to the lack of a scholarship; I eventually managed to graduate with honors[...] I wanted to attend medical school, but my family could not afford tuition. I had almost given up when, in 1970, the coal labor union tailored a full scholarship for me, their first ever university fellow[...] After graduating from medical school, I was among the top 100 of 14,000 applicants for a residency position in Spain. A neurosurgery chairman, reluctant to train women, tampered with the results. I presented a formal claim to the authorities and the government reinstated my right to choose my specialty, but I had to join a quite hostile neurosurgical department. Within two months, I had already gained my consultants' respect and her chairman's support[...] However, when I was a junior resident, I applied for the European Association of Neurosurgical Societies (EANS) training courses. The Spanish delegate, unaware of my gender, congratulated me on my CV. When he found out I was a woman, he denied me a place, arguing there were men on the waiting list[...] When I finished training, I joined the University Hospital Gregorio Marañón (Madrid) as a consultant neurosurgeon. Soon after my arrival, a chain of events left me and my female colleague, Josefa Ramiro, temporarily in charge of the entire department. Despite skepticism, we managed the situation safely and efficiently, gaining the respect of our colleagues and sparking interest from the media, who reported on the 'first female neurosurgeons in the country.' [1] I developed a successful career, with special interests in vascular and pediatric neurosurgery, and was named a professor at Gregorio Marañón Hospital. I take pride in having supported and guided every woman who has entered the neurosurgical department at Gregorio Marañón Hospital after me[...] I retired in 2012 and am now an enthusiastic mountaineer, an active member of two book clubs, and a philosophy student" (Balbina Ferreras Ferreras, personal communication, 2020).

2.2. Stealthy learning

Poland's **Lubomira Bożyk** lost her father during the 1940s in the concentration camp of Dachau and was herself forcefully relocated to a so-called resettlement camp in Potulice, Poland. Here, young people secretly gathered to share their knowledge on many subjects, piquing Bożyk's interest in medicine. Following the war, Bożyk joined the Medical University of Gdańsk in 1947. She pursued a successful career in neurosurgery in the 1950's, in spite of



Fig. 1. Balbina Ferreras Ferreras, mountain climbing in the winter, reproduced with permission from Balbina Ferreras Ferreras.

her superiors' doubts. Bożyk certainly proved her sceptics wrong, as she continued to practice neurosurgery until her 85th birthday! [2]

2.3. More than just the blonde in high heels

Anne Moore (Fig. 2) was the first female neurosurgeon to be president of the Society of British Neurosurgery (SBNS). She was also vice-president of the Royal College of Surgeons and was awarded an Officer of the Order of the British Empire (OBE) for her contributions to her country [3].

"In all my career, [...] I worked for a series of men who felt that women should not be part of the medical profession, nevermind surgery. One consultant referred to me as the 'vanguard of the monstrous regiment of women' [...], another as, 'that blonde in high heels.' I became so fed up with being asked whether I wanted to have children that I seriously considered having fake tubal ligation scars created so that I could flash them at interviews[...] When I became a registrar, I celebrated by indulging my passion for classic cars and bought a bright red V12 Jaguar XJS. It was a little too long for the spaces in the hospital car park, so I parked it in the rather better spaces on the forecourt. Later that day I heard loud complaints in the surgeons' room about some unknown person who had had the temerity to park in the consultants' car park. I confessed, to be told by David Uttley that, in his day, the registrar rode a bike! [...] Early on, we wrote a paper together, and I attended the SBNS meeting to deliver it. All morning the presenters started their talks with, "Lady and gentlemen!" to everyone's great amusement. To their credit, when I opened with a slightly sardonic, "Gentlemen!" I was greeted with applause. Unsurprisingly, at that time nobody expected their surgeon to be female, and over the years I have been mistaken for everything from a social worker to the person serving the lunch at a meeting. [...] I have



Fig. 2. Anne Moore with a stereotactic frame. Reproduced with permission from Jane Brettle.

experienced patients addressing their responses to the male medical student rather than to me. Fortunately for my sanity, I have always found that sort of thing funny, but things have to change, although seemingly rather slowly. From my perspective, equality will have been reached when people talk about whether you are a good, bad or indifferent neurosurgeon and not about your gender.” (Anne Moore, personal communication, 2020).

3. Taking the lead

3.1. An illustrious community

In Turkey, there are currently 93 board certified female neurosurgeons; eight are full professors and 14 are associate professors, one of the highest proportions of women in academic neurosurgery in Europe. **Emel Avci**, a leader in neuroanatomy, will be the next and first woman president of the Turkish Neurosurgical Society. **Melike Mut Askun** has a Ph.D. in neuroscience, is the first certified surgical neuro-oncologist in her country and a co-founder of the Turkish Society of Neuro-oncology. **Pinar Akdemir Ozisik**, a pediatric neurosurgeon, was the first woman to serve on the Board of Directors of the Turkish Neurosurgical Society. **Fusun Demircivi Ozer**, a fellow of Gazi Yasargil, excels in vascular neurosurgery. **Funda Batay** shines in skull base surgery and is a national champion motorcyclist. **Feyza Karagöz Güzey** is an expert in spinal surgery and a professional book translator. **Ayse Karatas Demirciler** has a Ph.D. in clinical anatomy. Turkish female neurosurgeons shine beyond neurosurgery: **Fatma Özlen** is a professional writer, and **Gülşah Bademci** is a talented caricaturist. (Nurperi Gazioglu, personal communications, 2020).

3.2. The ayes have it

Danica Grujicic, Director of the Center for Neurooncology of the Neurosurgical Clinic in Belgrade, Serbia, was a presidential candidate in the Serbian elections of 2012. Grujicic’s campaign vowed to strengthen the country’s healthcare system and social safety nets. While her candidacy was not victorious, Grujicic remains active through the organization “Together for Youths”, which supports young and talented students in Serbia [4,5]. Another Serbian neurosurgeon active in politics is **Ljiljana Vujotic**, who founded the “Voice of Heart” organization to improve the quality of life of elderly people, refugees and minorities. She is also a plastic surgeon, endocrinologist, and introduced endoscopic skull-base surgery to Serbia [6]. Latvia’s **Gaida Krūmiņa**, is not only trained as

a neurosurgeon, oncologist, and neuroradiologist; she is also the medical advisor to the president of Latvia [7].

3.3. On the up-and-up

Dutch neurosurgeon **Marika Broekman** is trained in constitutional law and is an accomplished neurosurgeon-scientist in the field of neuro-oncology [8]. Her book “Ethics of Innovation in Neurosurgery” deals with all the ethical aspects of introducing novel implants and procedures in neurosurgery, raising questions about how to innovate in vulnerable populations and how to ensure patient safety while also advancing our specialty and training future neurosurgeons [9].

3.4. Training neurosurgeons beyond borders

Francoise Lapierre was the third woman in France to become a neurosurgeon; the second to attain the title of professor of neurosurgery; and the first to chair a neurosurgical department, at Poitiers; and to be president of the French Society of Neurosurgery. Lapierre came from a simple background, and as a young girl worked as a shepherdess. Maybe because of her humble roots, she is a champion of global neurosurgery. In the 1980’s, she travelled on humanitarian missions to Cameroon and Guinea with Médecins sans Frontières. Since the 1990’s, Lapierre has journeyed to Vietnam several times a year to help rebuild their neurosurgical services after the war and train future generations of neurosurgeons in the country, thus establishing a long-lasting collaboration between Vietnam and France [10]. Lapierre’s talents and interests extend far beyond neurosurgery: in her youth, she was a racecar-driver and an airplane pilot. Since her retirement in 2009, she has devoted her time to another passion of hers: Greek culture. Not only does she speak Greek fluently and translate ancient Greek texts, she is also a renowned painter of icons [11].

Similarly, **Évelyne Emery** has followed Lapierre’s footsteps by becoming a professor in neurosurgery. However, her neurosurgical career almost did not happen. During her senior year of medical school, her superiors told her that neurosurgery was not a field fit for a woman, and even after successfully filling the role of the neurosurgical intern in Angers, she was told there was no room for a woman there. Emery then moved to Paris, where she completed her residency, working hard to prove herself in an unwelcoming environment. In 2011, she became one of the few women to chair a neurosurgical department in France, at Caen. Beyond her academic achievements, Emery leads an interhospital

collaboration between Western Africa and France [12]. Every year, a surgeon from Senegal and the Ivory Coast come to France to train, and Emery's team also provides these countries with the equipment to perform neurosurgery in their communities. Further efforts are underway to expand this project to other francophone African countries [13] (Fig. 3).

3.5. Leading mothers

Juana (Juanita) Shiffer (Fig. 4) was born in Montevideo, Uruguay in 1934. She enrolled in medical school to fulfil her dream of becoming a neurosurgeon. During her studies, an affair with a married obstetrics/gynaecology professor led to her becoming a single mother. Due to the conservative attitudes of Montevideo's Jewish community, she left for Israel. She arrived with her baby-son and mother and completed her training in medicine and neurosurgery. After many altercations with her chairman, she resigned to take charge of a small neurosurgery unit at Assaf Harofeh Hospital in a suburb of Tel Aviv. Although that unit was supposed to deal only with trauma, Juanita quickly arranged to have the surgical equipment, operative time, intensive care unit slots, and hospital beds to enable her to treat all neurosurgical conditions. Juanita was a notorious misfit in the then almost exclusively male Israeli neurosurgical community but was successful in becoming an active surgeon whose voice was eventually heard. Juanita also succeeded in raising her son to be an independent and self-assured



Fig. 3. A) Françoise Lapiere showing off her icons in 2017, reproduced with permission from Daniel Brun, La nouvelle république and B) Évelyne Emery in one of her humanitarian missions in Africa, reproduced with permission from Évelyne Emery.



Fig. 4. Juanita Shiffer, 2000, reproduced with permission from Rachel Grossman.

man. Ironically, Juanita succumbed to a stroke in 2002 (Roerto Spiegelman, personal communication, 2020).

In 1993, **Gabriele Schackert** became one of the few women to lead an academic hospital in Germany, and, in 2015, became the first woman to chair the German Society of Surgery. However, she considers her children to be her biggest achievement: "I never thought of giving up my wish to have a family [...] My two sons are my greatest publications."^[14] **Saskia Peerdeman** was the first female neurosurgeon in The Netherlands to become a professor in neurosurgery, while also raising two children on her own. She is a consultant neurosurgeon in Amsterdam and Suriname. In 2018, she was appointed professor of transformative learning in healthcare, as well as vice-dean of medicine at the University of Amsterdam [15]. In 2012, **Rosario Sarabia Herrero**, a proud mother of three, was appointed chair of neurosurgery at the Rio Hortega University Hospital, in Valladolid [16]. She also founded the first neurovascular unit in Spain where neurosurgeons perform endovascular procedures. Like them, **Idoya Zazpe Ceño** became chief of neurosurgery at the Navarra Hospital, Spain, while also raising three children in 2016 [17,18]. France's **Caroline LeGuérinel** also chairs a neurosurgical department in Paris and is a mother of five [19] (Pia Vayssiere, personal communications, 2020).

4. Into uncharted territory

4.1. Stimulating change

Belgian **Veerle Visser-Vanderwalle** is a pioneer in deep brain stimulation. She was the first neurosurgeon to treat Tourette's syndrome, in 1999 [20], and attained professorship both in The Netherlands and Germany. She is currently the chief of stereotaxy in Cologne, and an internationally acclaimed expert in the field of functional neurosurgery.

4.2. Diverse leaders

Two women who share the experience of hiding in bomb shelters during their school years were later to become neurosurgeons and leaders in their adopted countries. **Ruby Mahesparan** fled the war in Sri Lanka during her medical studies. Today, she is an accomplished skull base surgeon and chair of the department of neurosurgery in Bergen, Norway [21]. Similarly, **Katrin Rabiei**, who fled the Iranian Revolution with her family, was the first woman of immigrant descent to become a neurosurgeon and director of spinal surgery in Sweden [22].

Of Korean descent, **Yu-Mi Ryang** is not only one of the few women to chair a neurosurgical department in Germany, but also one of the founders of “Women in Spine” within AOSpine [23]. Also based in Germany, Costa Rican **Silvia Hernández-Durán** (Fig. 5) founded the “Diversity in Neurosurgery Task Force” within the EANS in 2019. She is a competitive swimmer, painter, singer, and polyglot [24].

5. Supernovas, expanding omnidirectionally beyond neurosurgery

5.1. Unladylike

Carys Bannister was born in Recife, Brazil in 1935 to a Welsh-English family. Bannister was home-schooled by her mother, and upon her return to the United Kingdom, she needed many extra lessons to catch up with her peers. After all her hard work, she decided to study medicine, which her mother thought was “not at all lady-like.” Following graduation, Bannister pursued a career in academic neurosurgery. She set up the fetal management unit as a tertiary referral center for neurodevelopmental defects in Manchester, which she ran for her entire career. She was awarded an OBE in 1999. Her passions extended beyond neurosurgery: she was a competitive race car-driver, and, like the Queen, kept corgis [25].



Fig. 5. Silvia Hernández-Durán about to dive in, brain first, 2020, reproduced with permission from Silvia Hernández-Durán.

5.2. A masterful pen

Georgia's **Lika Khorbaladze** has enjoyed extensive training in pediatric neurosurgery, from Tbilisi to Canada and Turkey. Not only does she operate on children's brains, but she also stimulates their minds and imagination through her beautiful stories, which have been published as part of a children's storybook (Fig. 6) (Lika Khorbaladze, personal communication, 2020).

5.3. Neurosurgical artemis

Latvia's first female neurosurgeon, **Ludmila Trusle** started practice in 1959, and continued to work on neurotrauma, neurooncology and peripheral nerve injury for 34 years. Additionally, Trusle was the most famous huntress in Latvia of her time, boasting an exceptional collection of animal trophies (Talivaldis Apinis, personal communication, 2020).

5.4. A balanced mind

Lucia Benvenuti is one of the most beloved role models for women in neurosurgery in Italy. She decided to become a neurosurgeon after encountering her little sister's brain surgeon as a medical student, and remembering all the respect and admiration she had for the profession. In 1974, she was the only woman to apply for neurosurgery residency. She undertook extensive training in vascular neurosurgery in Europe and the United States. Her self-control and focus extend beyond the operating room: she is a black belt master in PakuaChi, a blue belt in TaiChi, and a yoga instructor (Lucia Benvenuti, personal communication, 2020).

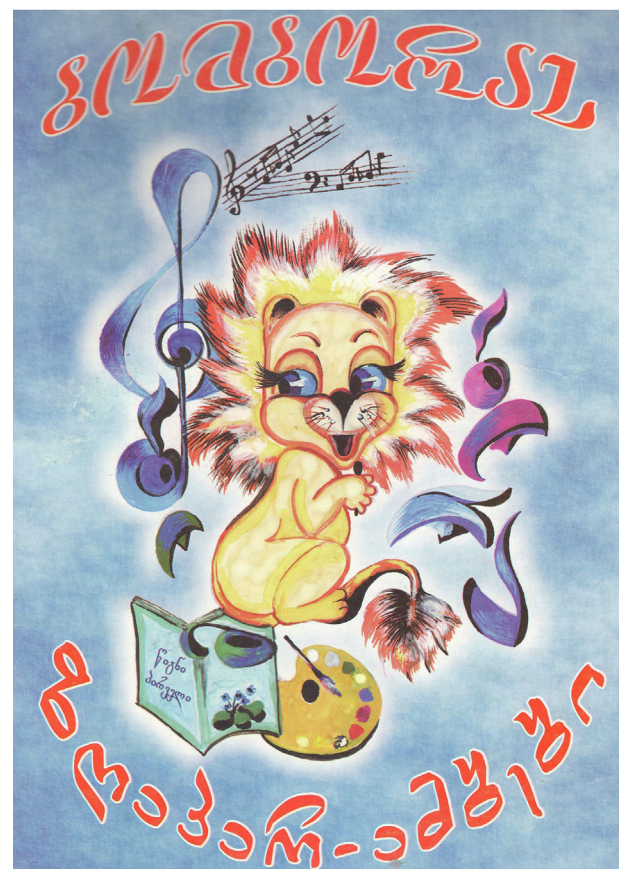


Fig. 6. Excerpt from Lika Khorbaladze's children's story in Brombora's Story Book, in Georgian, reproduced with permission from Lika Khorbaladze.

5.5. Hands-down outstanding

In 2013, **Ana Pastor Zapata** (Fig. 7) was appointed chair of neurosurgery at Galicia's Orense University Hospital, becoming the first female to lead a neurosurgery department in Spain. During medical school, Pastor played in the National Handball Team and she was the first female official handball trainer in Spain. Pastor leads a teaching collaboration with Niger's Nemay Hospital [26].

6. Prophets in foreign lands

6.1. Home is where the scalpel is

For physicians in Iceland to undergo specialty training, they have to travel abroad. Iceland's first female neurosurgeon **Hulda Magnadottir** knew this, as her father had already trained in the United States as a pulmonologist. As a student on the neurosurgery service, a consultant neurosurgeon let Magnadottir evacuate an epidural hematoma, and that became a pivotal moment for her future career. "It was amazing and I was basically hooked, line and sinker included" she recalls. Magnadottir had reservations knowing that neurosurgery training requires great sacrifice and, for those in Iceland, years of international training. So, to get neurosurgery "out of her system", she worked at the neurosurgical department in Iceland. Instead of purging neurosurgery out of her, this experience solidified her desire to become a neurosurgeon. In 1996, she moved to her childhood home in Hanover, New Hampshire, to start a residency position at Dartmouth. After residency, Magnadottir started working in private practice, but she always wanted to return to her home country. In 2004, she was hired to work in Reykjavik, where she did everything from aneurysms to brachial plexus tumors, to trauma and spine. Her family had grown to three children; in an effort to spend more time with them, she returned to the United States to private practice in 2008. Iceland therefore lost its first and, at that time, only female



Fig. 7. Ana Pastor Zapata dodging the crowd in handball, ca. 1976, reproduced with permission from Ana Pastor Zapata.

neurosurgeon. Others have followed, but they have remained prophets in foreign lands: Gudrun Gudmundsottir is an attending neurosurgeon in Aarhus, Denmark; Margret Jensdottir is the director of neurooncology at Karolinska University Hospital in Stockholm, Sweden; and Bryndis Baldursdottir is currently in training in Lund, Sweden. Kristin Lilja Eygloardottir is Iceland's only in-house certified neurosurgeon, but works in the emergency services, due to limited positions in neurosurgery. It is ironic that Europe's leader in gender equality does not provide the work-life balance required for its pioneering female neurosurgeons to remain there, or for other women to flourish in their neurosurgical careers (Hulda Magnadottir, personal communication, 2020).

6.2. The female future of neurosurgery

Anna Miserocchi grew up in a family with a long tradition in medicine (Fig. 8): she represents the third successive generation to have pursued a career in neurosurgery. Anna's grandfather, Enrico Miserocchi, trained in surgery when neurosurgery in Italy did not exist as a separate specialty. He trained in the United States in the 1930's, where he worked closely with Harvey Cushing. In 1940, having returned to Europe and being called to military service during World War II, he put this experience into practice in Albania, treating soldiers affected by neurosurgical injuries. In 1957, he became a founding father of the Italian Neurosurgical Society. A man of many artistic talents, he was a renowned watercolour painter.

His son, Giovanni Miserocchi, followed him into neurosurgery and trained under him. In 1977, he also traveled to North America and trained with Wilder Penfield and Theodore Rasmussen, learning the principles and techniques of epilepsy surgery and awake craniotomies. He was a pioneer of the use of depth electrodes for the investigation of epilepsy in the pre-MRI era, and in the use of awake craniotomy. He had a great love for music and played transverse flute.

After training with her father in Milan, Anna Miserocchi continued the family tradition in epilepsy and awake surgery by training in the United States and the United Kingdom. A leading neurosurgeon of her generation, she was appointed consultant at the National Hospital for Neurology and Neurosurgery in 2015. She is now continuing the subspecialty interest of her father and runs the largest adult epilepsy surgical practice in the United Kingdom. She also shares with her father and grandfather 'a love for arts', being a pianist and a keen painter (Anna Miserocchi, personal communication, 2020).

7. Conclusion

Having gathered extensive and detailed information about the birth and infancy of European women in neurosurgery, we have identified a number of themes. Most of the stories we discovered are great tales of talent, character and achievement. Many of the successful early female neurosurgeons travelled for training and/or permanent positions. Indeed, some of them were even refugees. We have noteworthy examples of women who immersed themselves in humanitarian missions and who tried to better the world through politics. Women who excel in the operating room have also excelled in a huge variety of pursuits in different spheres of life. There are many stories of beating the odds, taking on biased institutions and proving one's worth and ability, even when the system might not be designed to support women as surgeons. We close with the inspiring and hopeful example of the Miserocchi family, whose love of history and the arts, neurosurgery and one another point to a future in which all hard-working individuals who love neurosurgery can thrive.



Fig. 8. Miserocchi family at Mount ca. 19 - the first one (big family, with faces labeled).

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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