

Ignacio Vives Ponseti (1914-2009)

Ignacio Vives Ponseti developed a noninvasive method for treating congenital club foot in the US during the late 1940s. Congenital club foot is a birth deformity in which one or both of an infant's feet are rotated inward beneath the ankle, making normal movement rigid and painful. Ponseti developed a treatment method, later called the Ponseti method, that consisted of a series of manipulations and castings of the club foot performed in the first few months of life. The Ponseti method provided a non-surgical treatment that generally resulted in better long-term outcomes than the surgical procedures that doctors used prior to Ponseti's work. Ponseti's method for treating congenital club foot improved the quality of life for patients born with the deformity, and his work led researchers to study fetal foot tissues.

Ponseti was born on 3 June 1914 in Ciutadella de Menorca, a Balearic island off the coast of Spain, to Margarita Vives Fedelich and Miguel Ponseti Bibiloni. Both his mother and his father's families had lived on the Balearic Islands for generations. Ponseti had one younger brother, Miguel Vives Ponseti, who was born in 1920, who later became an architect. His family moved to Barcelona, Spain, when he was eight. When he was eleven, he went to secondary school at the Institut Jaume Balmaes in Barcelona. Ponseti's father was a watchmaker, and Ponseti spent his summers working in his father's shop. He later attributed his delicate touch in surgery to the training he received from his father. Ponseti graduated top in his class in 1930 from the Institut Jaume Balmaes, and with scholarship from the City of Barcelona that waived his first year admission fees, he enrolled at the University of Barcelona School of Medicine in Barcelona, where he studied biology in the university laboratory. Outside his studies, Ponseti said he enjoyed music, art, and hiking.

In 1936, after he completed medical school, the Republican army in the Spanish Civil War drafted Ponseti as a surgeon. He finished his final exams on 17 July 1936, the day before the Spanish Civil War began. Before he received his diploma, Ponseti was assigned to Francisco Jimeno Vidal at the Pedro Mata Hospital in Reus, Spain. Ponseti worked with Vidal on treating war wounds and gained experience cleaning and casting bone fractures.

After the 1938 Battle of Ebro, Ponseti transferred from Reus back to Barcelona to work with the neurosurgeon Adolfo Ley Gracia. Ley Gracia taught Ponseti how to suture nerves and transfer tendons, two surgical techniques in high demand due to wartime injuries. However, Ponseti was reassigned to evacuate wounded soldiers via ambulance from war zones. Ponseti transported wounded soldiers to the City Hall of Prats-de-Mollo-la-Prestre, France, and then relocated them to an area near Béziers, France. The area held many wounded soldiers and refugees from the Spanish Civil War. There, Ponseti spent his days performing surgeries on the refugees and his evenings studying internal medicine with a group of other doctors who were also refugees from the war.

In 1939, Ponseti immigrated to Veracruz, Mexico, to avoid being drafted for World War II. Lázaro Cárdenas del Río, then president of Mexico, offered citizenship to all refugees from Spain willing to immigrate to Mexico. Ponseti struggled to find work in Veracruz and nearby cities. Eventually, he began to work as a family doctor in Juchitepec, Mexico. Ponseti traveled to Mexico City, Mexico, for monthly visits with his friend Juan Farill, a professor of orthopedic surgery at the University of Mexico. Farill had created a rehabilitation program at the university for children with mobility and bone disorders. Farill talked to Ponseti about the US, where he had previously studied orthopedic surgery with Arthur Steindler, head of the orthopedic department at the University of Iowa in Iowa City, Iowa.

Ponseti left Mexico for a one-year fellowship to work with Steindler at the University of Iowa in 1941. Ponseti completed the fellowship and accepted Steindler's offer to join the orthopedic faculty

in 1944. Ponseti studied the long-term results of Steindler's prior surgeries. His first focus was on intervertebral disk protrusions, a condition in which one of the vertebral bones in the spine becomes misaligned and presses against spinal nerves, causing a variety of neurological symptoms. Ponseti also taught bone pathology to medical residents and trained army surgeons at Fort Leonard in Fort Leonard Wood, Missouri.

Another of Ponseti's projects involved examining results from surgical treatments of congenital club foot. Ponseti concluded that, of the various orthopedic procedures performed by the University of Iowa's orthopedic surgeons, the long-term results of club foot surgeries were especially poor. Ponseti studied Steindler's records from surgical treatments and follow-ups of the patients born with congenital club foot. He found that, regardless of surgeries to repair club foot, the patients couldn't function normally in daily. Patients who received surgeries for club foot in infancy grew up experiencing pain, stiffness, and lack of mobility in their affected foot or feet. Ponseti reviewed various methods for surgically treating club foot and concluded that surgeons did not realize the scope of irreparable damage they were inflicting on patients.

Ponseti began to study potential alternative techniques to treat congenital club foot. He examined the structure and mechanics of healthy feet and ankles compared to club feet in dissections of stillborn fetuses. He observed that the ligaments of the afflicted feet were overly tight on the inside of the feet and too loose on the outside of the feet, and he hypothesized that the abnormal ligaments could account for the inward rotation of the foot and ankle that is characteristic of congenital club foot. He also noted that the ligaments in an infant's feet are composed of a type of tissue that is especially flexible. Ponseti developed a treatment plan, which consisted of cycles of manually straightening and rotating the foot into a more favorable position, then using a plaster cast to hold the foot and ankle in place. After several cycles, the infant would wear a brace full-time for a number of months, and then while sleeping for several years. His method, later called the Ponseti method, posed little risk to infants and children and could be used in developing nations.

In 1948, Ponseti began to implement his proposed treatment method for congenital club foot. He detailed records of all of his patients and examined their progress. He also began to study congenital scoliosis and in the 1950s started one of the first connective tissue pathology and biochemistry laboratories in the United States. He cofounded the Orthopedic Research Society in 1954. During the holiday season of 1960, Ponseti met Helena Percas, an exile from World War II and a professor of Spanish literature at Grinnell College in Grinnell, Iowa. They married in 1961 and had one son, Bill Ponseti.

In 1963, Ponseti published a follow-up study of the results from his method to treat congenital club foot. The study included ninety-four patients with severe club foot who were treated as infants and reassessed up to thirteen years later. Seventy-eight percent of the club foot patients had a good outcome, though a slight deformity persisted in a third of the patients, and one patient had poor results. None of the feet required any bone surgeries for treatment.

Few doctors noted Ponseti's results. According to Naomi Davis, an orthopedic surgeon that learned the method from Ponseti several decades later, medical schools emphasized orthopedic surgeries to correct club foot, and physicians hesitated to surrender an established skill. Ponseti continued to practice his method and advocated for similar non-surgical treatments methods for other skeletal disorders, such as scoliosis and hip dislocation.

From 1960 to 1980, Ponseti continued his orthopedic surgical work on club foot, spine curvatures, and hip displacements. His research gained traction among doctors, and he began receiving honors and awards in the United States and Europe. In the early 1980s, Ponseti collaborated with Ernesto Ippolito to study the tissues of fetuses with club foot. He also published the results of a long-term follow-up study on patients treated for club foot with his method.

Due to policy, Ponseti retired in 1984, at the age of seventy. He became professor emeritus at the University of Iowa. He studied in the University of Iowa's art department for two years before continuing his efforts to educate doctors and patients on his treatment for congenital club foot. He also assisted other doctors in their studies of connective tissues. The University of Iowa organized an international symposium and the Ignacio V. Ponseti Professorship in his honor. Additionally, both the University of Iowa and New York University in New York City, New York, renamed their club

foot treatment centers in the orthopedic department of their hospitals in honor of Ponseti.

Ponseti's work gained acclaim in the early 1990s when, orthopedic surgeon Stuart Weinstein asked Ponseti to mentor him on the practice of the Ponseti method. Ponseti began training other physicians on his method using plastic bones and elastic bands to represent ligaments in workshops. In 1991, Ponseti left the leadership of the workshops to a colleague. In 1996, Ponseti and his wife wrote and published *Congenital Club Foot: Fundamentals of Treatment*. Although Ponseti had introduced his work in a 1963 research paper, the publication of his book and increased spread of information through the internet led to an increase in interest for his method. Ponseti credited the surge in interest for his method to families of people affected by the club foot who requested non-surgical techniques from their orthopedic surgeons. Physicians and families sought after Ponseti and his method in the US and in Spain throughout the late 1990s and early twentieth century.

Ponseti continued his pursuits in his office and laboratory until 18 October 2009, when he died of a stroke he had experienced several days prior.

Sources

1. Brand, Richard. "Club foot: Etiology and Treatment Ignacio V. Ponseti, MD, 1914-." *Clinical Orthopaedics and Related Research* 467 (2009): 1121-23.
2. Buckwalter, Joseph. "Speech at 90th Birthday Party for Dr. Ignacio Ponseti." University of Iowa Hospitals and Clinics Department of Orthopedics and Rehabilitation, June 8, 2004. <http://www.uiortho.com/index.php/additional-history-links/25-history/220-ponseti-speech-at-90th-birthday-party.html> (Accessed May 4, 2016).
3. Collis, Dennis K., and Ignacio V. Ponseti. "Long-term follow-up of patients with idiopathic scoliosis not treated surgically." *Journal of Bone and Joint Surgery* 51 (1969): 425-445.
4. Dobbs, Matthew, and Shah Khan. "The life and legacy of Ignacio Ponseti." *Indian Journal of Orthopedics* 44 (2010): 114.
5. Dobbs, Matthew B., José A. Morcuende, Christina A. Gurnett, and Ignacio V. Ponseti. "Treatment of idiopathic clubfoot: an historical review." *Iowa Orthopaedic Journal* 20 (2000): 59-64. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1888755/> (Accessed August 15, 2016).
6. Farill, Juan. "Orthopaedics in Mexico." *Journal of Bone and Joint Surgery* 34 (1952): 506-512.
7. "Ignacio V. Ponseti, MD 1914-2009." *Journal of Bone and Joint Surgery* 92 (2010): 526.
8. Ippolito, Ernesto, and Ignacio Ponseti. "Congenital club foot in the human fetus. A histological study." *American Journal of Bone and Joint Surgery* 62 (1980): 8-22.
9. Laaveg, Sterling J., and Ignacio V. Ponseti. "Long-term results of treatment of congenital club foot." *Journal of Bone and Joint Surgery* 62 (1980): 23-31.
10. Love, J. Grafton. "Thoracic-Disk Protrusions." *The Journal of the American Medical Association* 191 (1965): 627.
11. Luttikhuisen, Frances. "Professor Ignasio Ponseti Vives (1914-2009)." *Contributions to Science* 7 (2011): 205-14.
12. Martin, Douglas. 2009. "Ignacio Ponseti, Hero to Many With Club foot, Dies at 95." *New York Times*, October 24, 2009. <http://www.nytimes.com/2009/10/24/health/research/24ponseti.html> (Accessed May 4, 2016).
13. Morcuende, Jose A., Lori A. Dolan, Frederick R. Dietz, and Ignacio V. Ponseti. "Radical reduction in the rate of extensive corrective surgery for clubfoot using the Ponseti method." *Pediatrics* 113 (2004): 376-380.
14. Ponseti, Ignacio. "Causes of failure in the treatment of congenital dislocation of the hip." *Journal of Bone and Joint Surgery* 26 (1944): 775-792.
15. Ponseti, Ignacio. "Morphology of the acetabulum in congenital dislocation of the hip. Gross, histological and roentgenographic studies." *Journal of Bone and Joint Surgery* 60 (1978): 586-599.
16. Ponseti, Ignacio V. *Congenital Clubfoot: Fundamentals of Treatment*. New York: Oxford University Press, 1996.