Roberto Caldeyro-Barcia (1921–1996) [1]

By: Mandile, Olivia Keywords: Obstetrics [2]

Roberto Caldeyro-Barcia studied fetal health in Uruguay during the second half of the twentieth century. Caldeyro-Barcia developed Montevideo units, which are used to quantify intrauterine pressure, or the force of contractions during labor. Intrauterine pressure is a useful measure of the progression of labor and the health of a fetus [3]. Caldeyro-Barcia's research on fetal health often contradicted common obstetric practices, prompting him to publically challenge practices such as induction [4] of labor using oxytocin, forced pushing during labor, and birth position in which the woman lays on her back during labor. Caldeyro-Barcia's methods of monitoring intrauterine pressure and development of Montevideo units furthered research in maternal and fetal health and improved the use of medical interventions during labor and delivery.

Caldeyro-Barcia was born on 26 September 1921 in Montevideo, Uruguay. His mother, Elvira Barcia, came from a family with a medical background and his father, Joaquin Caldeyro, was a physician. Caldeyro-Barcia attended primary school at the English School in Montevideo, where he met fellow student Ofelia Stajano, whom he would later marry. As a teenager, Caldeyro-Barcia attended the Elbro Fernandez School in Montevideo, and began to court Stajano.

In 1938, Caldeyro-Barcia entered the University of Uruguay's Faculty of Medicine in Montevideo, where he studied medicine. During his time in school, Caldeyro-Barcia and Stajano became engaged. The couple married a year later in January 1946 and had six children, Ofelia, Lucia, Roberto, Carlos, Eduardo, and Martin.

At the University of Uruguay, Caldeyro-Barcia researched contractions of the uterus [5] during labor alongside Hermógenes Alvarez, an associate professor in obstetrics and gynecology. During delivery, a pregnant woman's uterus [5] contracts to push the fetus [3] out. During their research together, Caldeyro-Barcia and Alvarez obtained the first known recording of intrauterine pressure, or the force of those contractions. To measure intrauterine pressure, they placed a microballoon in the uterus [5]. As the uterus [5] contracted, the balloon was compressed. That compression indicated the pressure of the contraction. Using the data gathered through microballoons, Caldeyro-Barcia and Alvarez then compared the force of contractions during normal labors and labors that were not progressing normally.

In 1947, Caldeyro-Barcia graduated with honors from the University of Uruguay in Montevideo, Uruguay, with a medical degree. After graduation, he became an assistant professor of physiology at the University of Uruguay. He continued to work with Alvarez, and shortly after obtaining the first recording of intrauterine pressure, they developed Montevideo units to quantify the force of contractions. Montevideo units are calculated by subtracting the baseline pressure of a uterus [5] from the highest pressure of each contraction throughout ten minutes, then summing the pressures. They are used during delivery to help physicians monitor the progress of labor. If the sum of the pressures is approximately two hundred Montevideo units, then labor is progressing as needed. However, if the force of contractions are significantly below the normal range, the contractions are not strong enough to dilate, or open, the cervix [6] wide enough for the fetus [3] to enter the birth canal. The invention of Montevideo units by Caldeyro-Barcia and Alvarez was an important development for physicians to monitor labor. According to Otto Armas, professor in gynecology at the Central University of Venezuela in Caracas, Venezuela, the invention of Montevideo units resulted in more rational and calculated use of oxytocin, a drug commonly used to progress labor.

Throughout the next decade, Caldeyro-Barcia and Alvarez studied the effects of uterine contractions on fetal heart rate. In the 1950s, Caldeyro-Barcia and Alvarez found that during contractions the fetal heart rate goes down. They noted two different types of decreased fetal heart rate, Type I dips and Type II dips. In Type I dips, the fetal heart rate falls during the contraction as a result of head compression and recovers immediately after the contraction is over. In Type II dips, the fetal heart rate falls during the contraction but takes a significant amount of time to recover once the contraction is over. Type II dips can indicate that the fetus [3] is not receiving enough oxygen, which can result in adverse health effects and calls for medical intervention to deliver the infant safely. In 1952, Caldeyro-Barcia and Alvarez presented their research on monitoring intrauterine pressure and fetal heart rate during labor in England. Following their presentation, their techniques for monitoring contraction force and fetal heart rate became widely accepted within the medical community.

In 1959, University of Uruguay appointed Caldeyro-Barcia chairman of the newly created Department of Obstetric Physiology. During his time as chairman, he began studying the effects of oxytocin on the uterus [5]. Physicians routinely administered oxytocin, a hormone [7] released during contractions and labor, to artificially induce labor in pregnant women. Though induction [4] by oxytocin was common at the time, the side effects of the procedure were unknown. To study potential side effects, Caldeyro-Barcia monitored fetal health during oxytocin induced deliveries. He found that thirty-eight percent of oxytocin induced contractions caused Type II dips, which indicated that the fetus's health was compromised. Caldeyro-Barcia also found that Type II dips caused by oxytocin induced contractions may even result in fetal death.

In 1969, Caldeyro-Barcia organized a conference titled “Perinatal Factors Affecting Human Development” to address obstetric interventions such as induction [4] by oxytocin. At that conference, he presented his research on oxytocin and Type II dips, and argued that oxytocin should only be used when medically necessary and not in inductions that are elective, or not medically necessitated.

In the 1960s, Caldeyro-Barcia researched labor activity, including methods for delaying preterm labor. Caldeyro-Barcia and his colleagues began developing tocolytics, medications used to halt premature labor [8] by inhibiting contractions of the uterus [5]. According to Caldeyro-Barcia’s colleague Erich Staling, prior to tocolytic medications, preterm labor would often result in Cesarean sections, a procedure in which the fetus [3] is surgically removed from the woman’s uterus [5]. Cesarean sections often resulted in higher rates of maternal and infant complications. The development of tocolytics enabled physicians to prevent many preterm births and reduce the frequency of invasive measures like Cesarean sections.

In 1970, Caldeyro Barcia became the first director of the Latin American Center of Perinatology and Human Development in Montevideo. During his tenure as the director, Caldeyro-Barcia explained labor as a natural activity and stressed that the role of a physician or midwife was to facilitate the process rather than to intervene. To preserve the natural physiology of labor, he created a birthing chair that allowed laboring mothers to remain in an upright position, as opposed to the more common position where laboring women lay on their backs. In the upright position that Caldeyro-Barcia advocated for, a pregnant woman’s pelvic opening is wider than it is while lying down, allowing labor to progress more quickly. A faster labor also decreases the need for forceps or Cesarean sections. The upright position also lessens the pain of contractions by working with gravity instead of against it, pushing the fetus [3] into the birth canal. Several years later, Caldeyro-Barcia presented his recommendations on maternal posture during childbirth at a symposium in Rio de Janeiro, Brazil. The *West of England Medical Journal* published those recommendations posthumously.

In 1977, Caldeyro-Barcia studied the effects of forced pushing during labor on fetal health. At the time, physicians and midwives encouraged laboring mothers to push forcefully and for a prolonged amounts of time to speed delivery. Caldeyro Barcia’s research demonstrated that forced pushing during labor results in an insufficient oxygen supply to the fetus [3]. Insufficient oxygen supply can damage the fetus [3]. For that reason, Caldeyro-Barcia encouraged laboring mothers to push when they naturally felt the need, rather than when their physician encouraged it.

At the age of 60, Caldeyro-Barcia retired from his position as director of the Latin American Center of Perinatology and Human Development. He then became the Director of the Maternal-Child Health Program at the Ministry of Public Health of Uruguay in Montevideo. Throughout his career, Caldeyro-Barcia travelled frequently, and while travelling he found that many Uruguayan scientists had left Uruguay for countries with better working conditions. In 1987, Caldeyro-Barcia helped establish the Basic Sciences Development Program in Uruguay in Montevideo, Uruguay. The program was created to facilitate the return to Uruguay of scientists who had left the country and who wanted to return.

Caldeyro-Barcia served as president of numerous organizations, including the Department of Obstetric Physiology at the University of Uruguay, the Latin American Center of Perinatology and Human Development in Montevideo, Uruguay, the International Federation of Gynecologists and Obstetricians in London, United Kingdom, and the Basic Sciences Development Program in Montevideo, Uruguay. He also cofounded the *Journal of Perinatal Medicine*, an international journal that covers topics in the field of obstetrics and neonatology, including pregnancy [9], labor, and the time immediately following birth. Caldeyro-Barcia was nominated three times for a Nobel Prize, although he never received the award.

Toward the end of his life, Caldeyro-Barcia developed diabetes and heart disease. He died at the age of seventy-five in Montevideo on 2 November 1996, following heart surgery.

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