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EDITORIAL

Neonatal point-of-care ultrasound in Mexico

Ecografía neonatal en el punto de atención en México

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The medical use of ultrasound dates to 1937, when the Dussik brothers (neurologist and physicist) used a 1.5 MHz transmitter to recognize variations in amplitude by scanning the human brain[1]. In 1946, the first ward for the care of preterm infants was created at the Mexico Children's Hospital commanded by Federico Gómez Santos, under the leadership of Jesús Álvarez de los Cobos[2]; he published the first book on neonatology in Mexico and probably in Latin America, entitled "El Niño Prematuro," published by Ediciones Médicas del Hospital Infantil de México on April 27, 1956[3]. Imaging studies were limited to conventional radiography, with the need to move newborns to the radiology room. Notably, the book had the participation of Maximiliano Salas from the Department of Pathology, including anatomical pieces and microphotographs, in a great effort to understand disease pathophysiology. The pioneer of ultrasound use in Obstetrics and Gynecology, Ian Donald, divided obstetricians, some of whom referred to him as the "mad, redheaded Scotsman"[4]. At present, Gynecology and Maternal-Fetal Medicine would be unthinkable without its main diagnostic and follow-up tool. As for lung ultrasound (LU), the first report of its use to diagnose pleural effusion dates to 1967[5]. By 1978, true portable ultrasound equipment was available, generating a lot of experience in the eighties[6].

In Mexico, María de los Ángeles Segura Roldán was a pioneer in the neonatal use of point-of-care cranial ultrasound, publishing her studies in the Boletín Médico del Hospital Infantil de México (BMHIM), establishing a school of ultrasound performed by the neonatologist (Fig. 1)[7,8]. Programs of point-of-care cranial ultrasound performed by neonatology were founded in different institutions, including the Institute of Social Security and Services for State Workers, the Mexican Social Security Institute, and the National Pediatric Institutes. Furthermore, in the BMHIM, in 1984, the use of ultrasound to assess the patent ductus arteriosus of preterm infants was reported by the neonatal team from Centro Médico Nacional 20 de Noviembre (where the first modern Neonatal Intensive Care Unit was founded in July 1975)[9]. In the late 1990s and early 2000s, targeted neonatal echocardiography (TNE), initially known as functional echocardiography, emerged in Australia and New Zealand. In Canada, the first formal neonatologist echocardiography program was launched at SickKids, Toronto, by Patrick J. McNamara, in collaboration with pediatric cardiology in 2005, and the first guidelines were published in 2011[10]. Unlike cardiac point-of-care ultrasound, TNE is an expert, comprehensive, standardized examination of heart structure and function where extensive training is mandatory. In 2016, thanks to the support of the Board of Trustees of the Federico Gómez, Mexico Children's Hospital, training in TNE was achieved, and the neonatal hemodynamic assessment program at the patient's bedside began in 2017 and lasted until 2023[11].

Regarding LU in 1996, Daniel Lichtenstein proposed the bedside LU protocol known as BLUE (Bedside Lung

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Figure 1. María de los Ángeles Segura Roldán, pioneer of neonatal point of care ultrasound in Mexico, performing cranial ultrasound at the bedside. Picture courtesy of Rolando Jiménez Guerra, Neurosurgery, Instituto Nacional de Perinatología, Isidro Espinosa de los Reyes.

Ultrasound in Emergency). Although it demonstrated its usefulness and is considered a benchmark today, it took 12 years to be accepted and published[12]. Since the year 2000, hundreds of studies have been published demonstrating the usefulness of LU in Neonatology[13]. In 2017, the Federation of Neonatology of Mexico held the Neonatal LU workshop with Nadya Yousef and Danielle De Luca, with the objective of replicating the technique in the country. In 2020, the first text on LU in Neonatology in Mexico was published, holding workshops around the Republic[14].

This supplement of the BMHIM compiles the work of 15 neonatologists with training in LU, including a multidisciplinary group of pulmonologists, cardiologists, radiologists, and infectious disease experts. The guidelines for the performance and reporting of LU in Mexico are presented, compiling the experience of 8 years of its performance in the country, as well as more than 35 workshops around the republic and Latin America, training about 1000 neonatologists. Renowned experts around the world with recognized neonatal LU programs kindly provided the group with information on technical aspects of implementation and standardized reporting in their countries.

Continuing with the spirit of the first publications of the Federico Gómez, Mexico Children's Hospital, Pathology, and Veterinary Medicine were summoned to integrate a Pictorial Essay demonstrating the semiology of LU in animal models and human cases in which the diagnosis was confirmed by biopsies, autopsies, or tomographic reconstructions. In the same way that Maria de los Ángeles Segura Roldán compared her ultrasound findings with computed tomography and was amazed when she observed her findings during neurosurgery and neuroendoscopy, a profound study of cases is presented. As with any technique that expands the limits of our physical examination (like originally Leopold Auenbrugger or René Laënnec did), the commitment to the patient needs to be profound, and clinicopathological correlation is fundamental[15].

The third study shows the usefulness of LU to guide surfactant administration and make differential diagnosis during immediate and transitional care in a perinatal hospital; as demonstrated in other studies, LU is the tool with the best performance for diagnosing surfactant deficiency and nasal continuous positive airway pressure failure, overcoming the current test that is a cutoff of ≥ 30% of inspired fraction of oxygen[16].

The fourth study demonstrates the findings of cardiopulmonary and thymus ultrasound of 47 patients with acute viral infection. During the SARS-CoV-2 pandemic, viral surveillance increased in our country. Viral infection LU characteristics are described, confirming what's described in literature[17]; consolidations and pulmonary hypertension were factors associated with mortality, while the survivors demonstrated an increased thymus in its dimensions, maybe representing an adequate immune response.

Finally, a physiological study is reported describing the hemodynamic effects of a tension pneumothorax (documented by TNE) detected by a sonographic algorithm for life-threatening emergencies. The Sonographic Algorithm for Life-Threatening Emergencies protocol by Nadya Yousef was adapted in our country, and it has proved its efficacy in referral and perinatal centers[18].

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