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EDITORIAL

On the centenary of the first renal concentration tests (Thomas Addis and Marian C. Shevky, 1922)

En el centenario de las primeras pruebas de concentración renal (Thomas Addis y Marian C. Shevky, 1922)

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In the phylogenetic scale, the descendants of the first animals that abandoned the ancestral sea and moved into the solid part of the planet had to develop new functions to survive, one of the most important of which was improving their ability to conserve water.

Felix Hoppe-Seyler (1825–1895), a German physiologist and chemist, took the first step in elucidating the mechanisms involved in renal concentration capacity. Setting up the urine and plasma from the same animal so that they were separated by a membrane, he found that the flow direction was from the plasma to the urine. Slowly and progressively, other advances followed, including those of Heinrich Dreser (1860–1925) (freezing point depression of blood determined cryoscopy, suggestive that urine was more concentrated), Sándor Korányi (1866–1944) (isosthenuria in chronic renal disease), Joaquín Albarrán (1860–1912) (experimental polyuria test), Franc Volhard (1872–1950) (concentration and dilution test) and Reinhard von den Velden (1880–1941) (polyuria-reducing effect of pituitary gland extracts in diabetes insipidus). In the early decades of the XX century, it was already known that ''there is a relation between the inability to produce a urine of high specific gravity and certain extreme grades of renal decompensation''[1].

Thomas Addis (1881–1949) and Marian Shevky wanted to determine ''the variability of the specific gravity in normal persons under conditions specially designed to induce the production of a urine of high specific gravity.'' ''The subject is instructed to abstain from fluids of all sorts after breakfast on one day until he rises from bed on the morning of the following day, and is told to collect a twelve hours' night urine''. The authors observed that the normal urine density value in the test was 1.032 ± 0.00281, and 95% of subjects had density values of 1.028 or greater[1]. One alternative to the test based on fluid restriction was the administration of pituitary gland extracts, and, since 1968, desmopressin (DDAVP) has been available, allowing performance of the concentration test in a short amount of time, even in infants.

A wide variety of conditions can cause decreases in maximum urine osmolality (UOsm), including most tubulopathies, hypercalcemia, low potassium, recovery from acute kidney failure (polyuric phase), renal transplant, acute pyelonephritis, polycystic kidney disease, nephronophthisis or treatment with lithium salts. However, historically, the

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first identified cause of loss of renal concentrating capacity was chronic kidney disease. In 1934, Donald van Slyke (1883–1971) et al. stated that ''when a concentration test yields urine of more than 1.026 specific gravity, one may assume as a rule that the renal function is normal, and the clearance test may be omitted''[2]. In 1966, Franklin Harold Epstein (1924–2008) wrote that ''the ability of the kidneys to excrete a concentrated urine is impaired together with other renal functions whenever the kidneys are progressively scarred and the amount of functioning renal parenchyma is diminished''[3]. Many years later, our group corroborated this observation, that is, that all children with a glomerular filtration rate of less than 70 mL/min/1.73 m^2 exhibit a decreased UOsm[4].

In paediatrics, other very frequent causes of decreased concentration capacity are conditions manifesting with increased pressure in the urinary tract, such as vesicoureteral reflux (VUR)[5] or ureteropelvic junction obstruction. Since VUR grade I to III is not associated with kidney failure, tests need to be performed to help differentiate severe cases of VUR and guide the selection of patients that may require performance of diuretic renal scintigraphy. In this regard, 100% of children with grade IV or V VUR have a decreased UOsm. Conversely, the difference in UOsm values between patients with grade I to III VUR and patients with urinary tract infection but no VUR are not statistically significant[5].

The sensitivity of the UOsm is high. Thus, the abnormality observed most frequently in children with KDIGO stage G1 kidney disease was urinary concentrating ability defect, with a higher prevalence compared to increased albuminuria[6].

Unfortunately, the renal concentration test is not used routinely in many hospitals. We hope that the centenary of the test developed by Addis and Shevky will stimulate its application in institutions where it is not currently used.

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