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Editorial

Bisphenol A: An environmental factor implicated in renal vascular damage☆

El bisfenol A: un factor ambiental implicado en el daño nefrovascular

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Introduction

In recent years, exposure to certain chemical substances has become a part of everyday life. Such is the case with bisphenol A (BPA), or 2,2,-bis(4-hydroxyphenyl) propane, a molecule used to synthesize polycarbonate plastics and epoxy resins. It is used extensively in the production of babies' bottles, water and soft drinks bottles, and as the inner coating of cans and other food and drink containers. It is not surprising, then, that in 2009 around 6 000 000 metric tonnes of BPA were generated worldwide.[1]

Numerous studies have demonstrated that more than 90% of the population in the USA have detectable urinary levels of this compound and that the level of exposure of the population is above the recommended values: 50 μg per kg per day.[2] In a recent study conducted in Spain, Cutanda et al.[3] reported that BPA was present in the urine of 97% of the population studied.

Exposure to BPA occurs mainly via the oral route, but also from dental sealants, through the skin, and by inhalation of cleaning products. Even more concerning is the fact that studies conducted in Spain,[4] China, and Japan.[5] have shown contamination of subterranean water and rivers with BPA.

Numerous studies[1,5–8] consider that BPA interfere with to be an endocrine regulation. It has been studied the potential relationship between the oestrogenic activity (xenoestrogen) of BPA and different endocrine and metabolic abnormalities including hepatic and thyroid disorders, obesity, insulin resistance, and increased susceptibility to diabetes.[9]

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From a renovascular perspective, the first concerns emerged in 2008 when Lang et al.[10] found a significant correlation between a high urinary concentration of BPA and cardiovascular diseases in patients with type 2 diabetes.[8,10] The present review will analyse first the critical role of renal function on BPA excretion, and secondly will analyse the experimental evidence that provides a solid scientific basis for translational clinical studies that implicate BPA in renovascular damage.

Accumulation of bisphenol A in patients with chronic kidney disease

It has been established that after ingestion, BPA is conjugated in the liver with glucuronic acid, where it loses its oestrogenic activity and is then excreted to the intestine. Both BPA and its metabolites are excreted in urine.[1–3,6] Therefore, patients with chronic kidney disease (CKD) have higher serum levels of BPA than the general population[11]. A negative correlation has been observed between estimated glomerular filtration rate and the serum concentration of BPA.[7] A recent study by Krieter et al., analysed a cohort of 152 patients with CKD and 24 controls; a significant increase in plasma concentrations of BPA was observed in CKD 3–5. The highest concentration of BPA was obtained in patients with CKD 5 (dialysis) with values of up to 6 times higher than controls without kidney disease.[11,12]

Currently, the BPA clearance by dialysis has not been established. This is a complex issue since the dialysis membranes themselves contain variable amounts of BPA. This has been proven by studies that demonstrate the presence of BPA in the effluents of polymethylmetacrylate, cellulose, cellulose

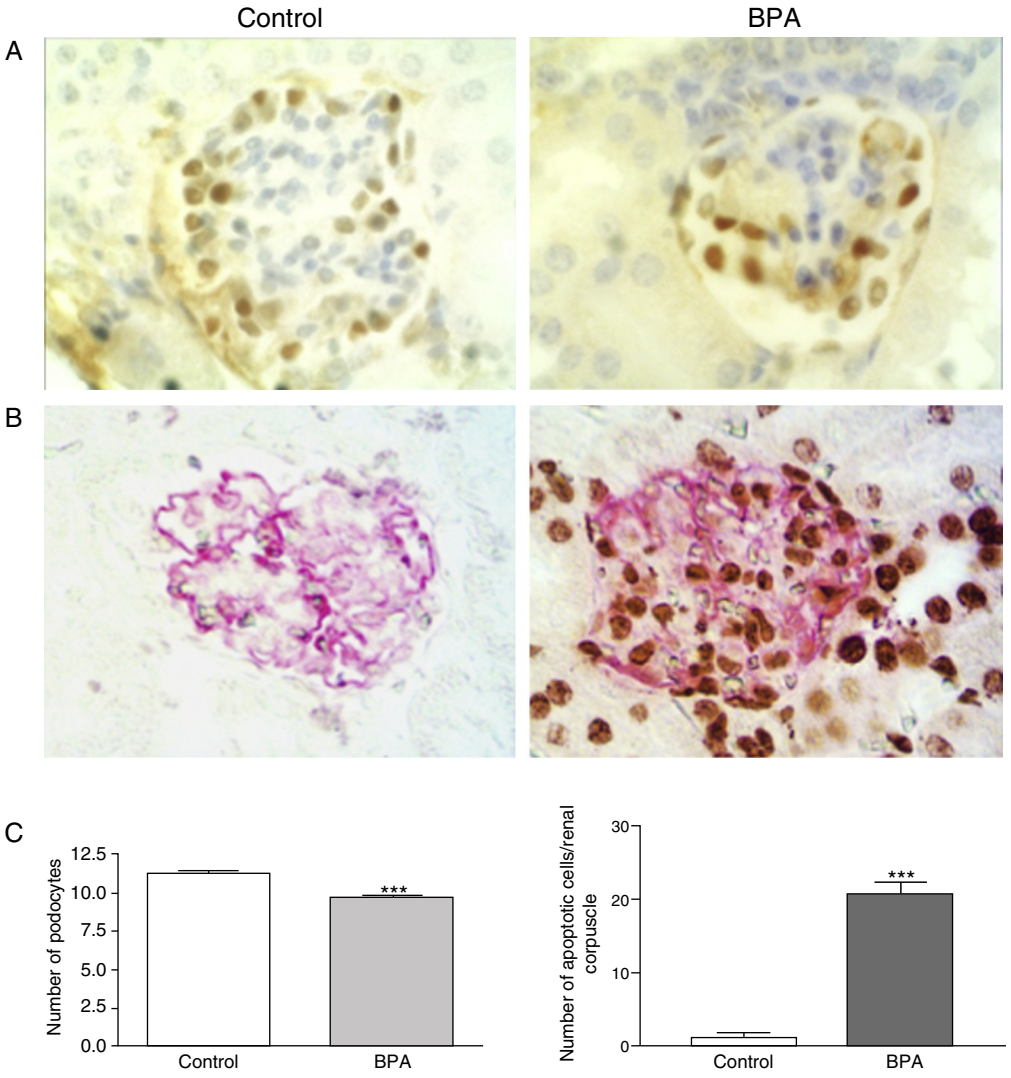

Fig. 1 – BPA produces podocytopoenia in mice. (A) Immunohistochemistry for WT-1. In mice treated with BPA the number of podocytes (brown nuclei) was lower than in controls. 300×. (B) TUNEL assay (black nuclei) combined with immunohistochemistry for podocin (grey expansions). The renal corpuscles of those mice treated with BPA showed a higher number of apoptotic podocytes than controls. 300×. (C) Left, graph representing the statistical analysis of the number of podocytes. Right, histogram representing the number of apoptotic cells in mice treated with BPA and in controls. ***P < .001 using ANOVA for analysis of variance.
***Source*: Olea-Herrero et al.[14] reproduced with permission.**