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Insights into tandem mass spectrometry for the laboratory endocrinology

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In the last decade a great deal of data were produced by the scientific community on the analytical improvements introduced by liquid chromatography—tandem mass spectrometry (LC-MS/MS) in the research and clinical fields. This technology is nowadays recognized as the most promising for the quantitation of small molecules in biological fluids. LC-MS/MS combines the practicability of LC and the inherent elevated sensitivity and specificity of MS. Its potential in terms of improved practicability and sample throughput represent the hope for a definitive reconciliation between quality, economy and productivity of assays for clinical laboratories.

Endocrinology is one of the clinical fields that benefited most from the LC-MS/MS introduction, particularly for steroid hormones measurement. Immunoassays, traditionally used for steroid determination in biological fluids, opened the age of laboratory medicine, giving biochemical information a central role in the management of endocrine diseases that have a considerable impact on Health Systems. Immunoassays dominated laboratory routine for decades; however, as laboratory requirements grew, in terms of numbers of measurements per day, manufacturers moved toward the production of ready-to-use kits for automated platforms, performing direct measurements without any sample pre-treatment. This resulted in the loss of specificity and functional sensitivity caused by matrix interference and cross-reactivity phenomena. The main benefit of immunoassays, that is their impressive throughput, is hampered by the reliability of their results, with particular regard to low circulating steroids, such as testosterone in females and children, 17OHprogesterone, 17β-estradiol and aldosterone, to cite but a few. The scientific community agrees on the fact that immunoassays' unsatisfying results complicate the characterization, the diagnosis and the follow up of endocrine diseases. On the opposite side, early MS-based techniques, represented by gas chromatography—MS (GC-MS), were limited to reference methods and remained confined to highly specialized laboratories. GC-MS requirements, in terms of versatility and sample processing, were not overcome and prevented the application of this technology to large number of samples.

LC-MS/MS represents a way to satisfy clinical and laboratory needs for major, routinely assayed steroids. It also allows the measurement of other important steroid precursors and metabolites, and offers the possibility to build multi-analytical panels tailored over specific clinical needs that considerably improve the informative power of laboratory data.

Driven by the enthusiasm aroused by the analytical performance of LC-MS/MS, this technique is nowadays replacing routine immunometric platforms in the main laboratories.

However, a clear demonstration of the strength of LC-M/MS in terms of clinical effectiveness has still not been provided. Further investigations and evaluations are needed to understand if, and to what extent, the analytical efficiency of LC-MS/MS translates into improved power in the characterization, diagnosis and management of steroid-related diseases.

In this issue we present a revision of the state of the art regarding LC-MS/MS advancement and impact on three major fields: the profiling of vitamin D and its metabolites and their importance in the investigation of metabolic diseases affecting bone, cardiovascular and immune system health; the relevance of testosterone and androgen determination in the characterization and diagnosis of female hyperandrogenism and male hypogonadism, and the assessment of glucocorticoid and mineralocorticoid profiles in the management of the hypothalamic-pituitary-adrenal axis.

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