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Editorial

Clinical neurophysiology standards of EMG instrumentation: Twenty years of changes

See Article, pages xxx–xxx

"*Twenty years is nothing*" was what Carlos Gardel said in his famous tango "*Volver*" (to return). Regarding a clinical diagnostic procedure using different technological devices in the XXI century, this is absolutely not true. In 1999, when the previous guideline of the International Federation of Clinical Neurophysiology (IFCN) standards for electromyography was written (Bischoff et al., 1999), the use of computers in EMG devices with the analog-to-digital conversion had only been applied in clinics for a few years. Today the sampling techniques, multiscreen displays, averaging procedures, report generation, databases and communication with other devices such as electronic clinical records, among other aspects of EMG, have experienced an explosive development. Moreover, instrumentation and technical factors of EMG can distort neurophysiological signals resulting in changes which may be identical to those seen in diseases; it is essential for clinical neurophysiologists to be aware of these factors. Also, standard instrumentations ensure comparison of results among EMG laboratories, which is fundamental nowadays to determine normative data and cutoff neurophysiological values for diagnostic and prognostic purposes.

In the current issue of *Clinical Neurophysiology*, Tankisi and colleagues published a consensus report endorsed by the IFCN that updated the current status of the standards of instrumentation of EMG (Tankisi et al., 2019). This consensus document, written by a globally distributed expert panel, summarizes and discusses the essential neurophysiological technical aspects of instrumentation, such as EMG hardware and software, temporary storage, trigger and delay line, averaging, electrode types, stimulation techniques for EMG examinations, together with EMG artifacts, safety rules, databases and report generators.

Of course, the massive advances in technology and computer science in recent decades have impacted the equipment used in neurophysiological practice. The difference in technological devices is made clear when comparing Fig. 1 of the article by Bischoff et al. (1999) with Fig. 1 of the article by Tankisi et al. (see Fig. 1). The difference not only expresses the development of technical devices but also a significant difference of what is considered necessary in the production of a clinically useful report and the management of neurophysiological data.

During the last 20 years, the access to information regarding diseases and laboratory procedures, as well as patients' and relatives' concerns regarding safety have also increased significantly. The number of patients using defibrillators, pacemakers and different drug treatments, including old and new anticoagulants, has also increased (London, 2017). Patients request information on the objectives of the tests, safety and potential risks of a procedure demanding a clear, solid and consistent response. A guideline that is backed by the IFCN supporting a response by the practicing clinical neurophysiologist is useful and a good guide for daily clinical practice, improving quality of care of patients (Murad, 2017).

Recent advances in computer technology and data analytics have also given rise to the field of big data and machine learning. This new field has the potential to transform medicine, incorporating and combining genomic and other omics data, as well as electronic health records. The final goal of these approaches is personalized medicine, which demands interdisciplinary expertise (Hulsen et al., 2019). To share and analyze big data, EMG reports and data should have common EMG terminologies and dataset structure. In this sense, communication between EMG laboratories based on these standards would enable the exchange of neurophysiological data, improving diagnostic criteria and research collaboration between different centers. An excellent example of this is the international multicenter ESTEEM project (Pugdahl et al., 2017, Vingtoft et al., 1994), which has been collecting EMG data for the development of standards and guidelines for EMG practice, since 1992. In the same line of thought, recently, an IFCN committee has been commissioned to consider a standard format, so that data can be shared among investigators and analyzed on any EMG machine. The present article is a crucial step to achieve this goal.

In summary, new electromyography "standards" were necessary and the Tankisi and colleagues article presented in this issue of *Clinical Neurophysiology* is bridging this gap.

Declaration of Competing Interest

We have no conflict of interest related to the present work.

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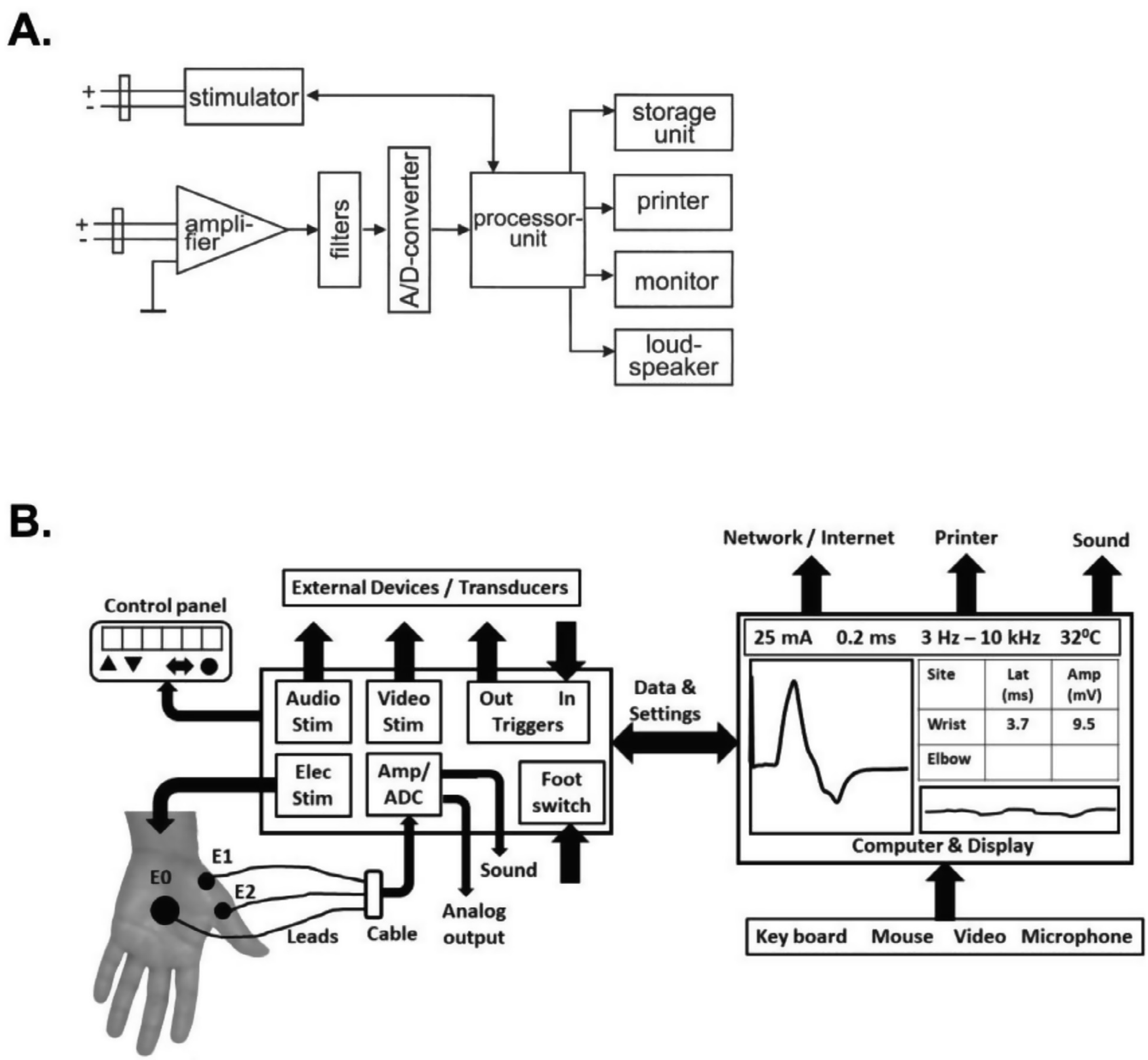

Fig. 1. Components needed in an electrodiagnostic system. (A) Schematic drawing of an EMG machine (from Bischoff et al., 1999); (B) Updated look of the organization of components and accessories to an electrodiagnostic system suggested by Tankisi et al. (2019).

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