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Letters to the Editor

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Response to Drs. Iliadou and Eleftheriadis Regarding "Auditory Processing Disorder (APD) as the Sole Manifestation of a Cerebellopontine and Internal Auditory Canal Lesion"

I congratulate Drs. Iliadou and Eleftheriadis on a very interesting case study. Their article clearly demonstrates the value of behavioral tests beyond the standard audiometric test battery. I would like, however, to take issue with their conclusion that, "this clinical case stresses the importance of testing for APD with a psychoacoustical test battery despite current debate of lack of a gold standard diagnostic approach to APD." While this sentiment is consistent with the clinical guidelines provided in AAA (2010), it does not provide clarity for the highly controversial construct of APD.

The term "gold standard" as used in audiology is ambiguous. It has been used to describe a patient group (Singer et al, 1998; Musiek, 1999) or test battery (Loo et al, 2013). However, according to the Standards for Reporting of Diagnostic Accuracy Studies (STARD; Bossuyt et al, 2003), the term "gold standard" refers to a reference standard test. A reference standard is the best available method for establishing the presence or absence of a target disorder. Without a reference standard, it is not possible to determine the diagnostic accuracy (or validity) of an index test. In other words, when there is no reference standard, there is no way to determine the percentage of true-positive, false-positive, true-negative, or false-negative test results in a diagnostic accuracy study. A standard-less approach to diagnostics promotes uncertainty. This is what it means to conduct an evaluation with a diagnostic test or battery without the benefit of a gold or any reference standard.

This case study demonstrates at a basic level that certain tests appear to be sensitive or insensitive to the presence of a cerebellopontine (CP) and internal auditory canal (IAC) lesion. These tests include the following: puretone thresholds, tympanometry, ipsilateral stapedial reflexes, word recognition score (WRS; also described as speech audiometry), speech in babble (SinB), dichotic digits (DD), duration pattern sequence (DPS), pitch pattern sequence (PPS), Random Gap Detection Test (RGDT), gaps in noise (GIN), otoacoustic emissions (OAEs), auditory brainstem response (ABR), and magnetic resonance imaging (MRI). Each of these tests could be used as an index test in a diagnostic accuracy study. In addition to the CP and IAC lesion discussed in the case study, a few other target disorders may be identified. The SinB score gives evidence of a speech recognition in noise disorder (Vermiglio, 2014), and the DD score is evidence of amblyaudia (Moncrieff, 2011).

Index tests, target disorders, and reference standards should be considered in the context of a complete diagnostic system. Table 1 lists a few examples of diagnostic systems based on the elements found in the case study. For systems 1–8, it is possible to determine the diagnostic accuracy of the index tests for the identification of the presence or absence of the respective target disorders. In these studies, the results of the index tests would be compared to the results of an appropriate reference standard. This comparison will reveal the percentage of true-positive (sensitivity) and true-negative (specificity) results. The reference standard must be an independent verification of the index test results (Bossuyt et al, 2003). Diagnostic systems 1–8 include clearly defined index tests (or test batteries), target disorders, and reference standards. For system 9, there is no reference standard ("gold" or otherwise). Therefore, it is not possible to determine the diagnostic accuracy of the index test battery for an APD. The reason that there is no reference standard for APD is that APD is not a legitimate disorder (aka clinical entity).

Table 1. Diagnostic Systems Based on Some of the Elements Presented in the Case Study

Diagnostic System	Index Test	Target Disorder (Clinical Entity)	Reference Standard
1	MRI	CP and IAC lesion	Surgical confirmation
2	WRS	CP and IAC lesion	MRI
3	SinB	CP and IAC lesion	MRI
4	DD	CP and IAC lesion	MRI
5	ABR	CP and IAC lesion	MRI
6	SinB	Speech recognition in noise disorder	Self-report
7	DD	Amblyaudia	Possibly self-report
8	WRS, SinB, DD, PPS, RGDT DPS, GIN	CP and IAC lesion	MRI
9	WRS, SinB, DD, PPS, RGDT DPS, GIN	APD	None

Note: ABR = auditory brainstem response.

Vermiglio (2014) has recommended the Sydenham–Guttentag criteria for the identification of clinical entities in audiology. These criteria state that a clinical entity must (a) have an unambiguous definition, (b) represent a homogeneous patient group, (c) represent a limitation for the patient, and (d) facilitate diagnosis and intervention. Vermiglio used this method of reasoning to argue that a speech recognition in noise disorder is a clinical entity. On the other hand, APD does not meet these criteria and therefore is not a clinical entity. Legitimate disorders or clinical entities facilitate the procurement of reasonable reference standards.

A "lack of a gold standard" (or reference standard) is not a trivial matter. Its absence means that there is no way to know the diagnostic accuracy of a given index test. Diagnostic accuracy studies provide guidance for clinicians in regard to the appropriateness of a test protocol or battery. A diagnosis based on tests of unknown diagnostic accuracy is a diagnosis that cannot be validated.

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