

Combined pH-impedance testing for reflux: current state of play and future challenges

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Received 29 March 2017
 Accepted 2 April 2017
 Published Online First
 21 April 2017

It is now over 20 years since the introduction of multichannel intraluminal impedance monitoring (MII) in the oesophagus.¹ Soon following, its application in children began in earnest with the widespread availability of paediatric catheters in 2002. MII detects oesophageal bolus movement by measurement of changes in electrical resistance and is used for assessment of reflux in tandem with pH monitoring (MII-pH). MII-pH heralded an advance in our ability to characterise reflux compared with the previous gold standard, pH monitoring alone. Advantages include the ability to detect nonacid and weakly acid reflux, distinguish between antegrade and retrograde bolus movements, differentiate liquid from gas reflux and assess proximal extent of the refluxate. In the intervening period, the translation of this more sophisticated and accurate measurement into improved patient outcomes has, however, not been as demonstrable as would have been hoped for.

The BSPGHAN position statement on MII-pH testing, published in the current issue of the journal, highlights the current state of the technology, practical advice for performance of investigations, as well as many issues and controversies that pertain to the use of the technology in the paediatric setting, and often equally to adult practice.² The position statement, including its recommendations for practice, was formulated by consensus within a seven-member working group following literature review, but systematic evaluation of the quality of evidence supporting the recommendations was not reported. This probably reflects the low quality and lack of availability of evidence underpinning many of the recommendations.

The primary indication for MII-pH in both children and adults remains for the evaluation of refractory reflux symptoms. Its advantage over pH testing alone in this regard is to identify the significant minority of these patients whose symptoms are due to reflux of more than just liquid acid.³⁻⁴ However, even when nonacid reflux is detected by MII, there is a paucity of evidence linking this finding with positive therapeutic outcomes; this fact applies equally to children and adults.⁵⁻⁶ In other words, MII-pH identifies more 'refluxers' who might have otherwise be considered functional in nature, but there is little evidence that these extra cases identified benefit from either optimised medical therapy or surgery. It is for this reason that the consensus of the US Esophageal Diagnostic Working Group was that there is insufficient evidence to justify antireflux surgery in adult patients who have an abnormal number of reflux events on MII-pH but no pathological oesophageal acid exposure.⁷

In a similar fashion, the use of MII-pH in the evaluation of laryngopharyngeal and respiratory symptoms attributable to GORD has been extensively studied, but its precise role remains somewhat unclear. What is apparent is that there is a definite increase in diagnostic yield with the use of MII-pH compared with pH metry alone,⁸⁻⁹ and the increased yield is especially greater in the paediatric population where nonacid and proximal reflux detected by MII-pH seem to play an equally important role as acid reflux.⁷⁻¹⁰ The problem remains, however, that patients with cough attributed to nonacid reflux have poor outcomes from therapy,¹¹ and therefore the consensus for



► <http://dx.doi.org/10.1136/flgastro-2016-100796>



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To cite: Sanagapalli S, Sweis R. *Frontline Gastroenterology* 2017;**8**:154–155.

adults with laryngopharyngeal symptoms is that antireflux surgery is only performed if there is evidence of excessive acid exposure in the distal oesophagus.⁷ The authors of the position statement recommend MII-pH to be used for a far wider variety of indications than would be acceptable in adults. This is reasonable given the greater diversity of manifestations of paediatric GORD, especially in infants,¹² but it must be borne in mind that outcomes data are lacking.

The practice of paediatric medicine is inherently associated with its own unique challenges, and the use of MII-pH in children is no exception. Normal values for MII-pH have been derived from studies performed in healthy adults.^{13 14} Since ethical considerations preclude the same in children, normal values have been derived from extrapolation from adults, as well as from children with GORD symptoms. However, the serious differences between children and adults are likely to impact on the validity of results. For example, positioning of the MII-pH catheter in children is commonly determined using radiology or body height-based calculations, though the validity of findings is suspect without confirmation of sensor positions. Manometric calculation of oesophageal length would be more accurate, but this is not always tolerated. Also, the algorithmic requirement of a drop in impedance across two sensors might not be transferable to children with smaller oesophageal length and width. Moreover, for obvious reasons, demonstration of symptom association might not be possible in a child. Finally, although normal values in adults are acquired unsedated, in children it is not uncommon for intubation to be performed under the influence of a sedative that may affect physiology.

These challenges suggest that results acquired are far from representative. As such, decisions leading to irreversible therapy, such as surgery, based solely on MII-pH findings in the absence of objective evidence of reflux such as florid oesophagitis, should *always* be taken with extreme caution. Although treatments are often aimed at alleviating symptoms in the child, it is important to remember that consequences of such decisions will persist into adulthood. Challenges such as these support the need to develop a more appropriate test that is fit for a child's stature and tolerability, with robust normal values for every age group being imperative to help guide therapy.

Competing interests None declared.

Provenance and peer review Commissioned; internally peer reviewed.

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