Characterization of Pharyngeal Hypocontractility Patterns During Deglutition: High Resolution Impedance Manometry Findings

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Introduction

Adequate pharyngeal contractility is important for the clearance of the bolus, the protection of the airways, and the triggering of esophageal peristalsis (Hendrix T, 1993; Yip H *et al*, 2007; O'Rourke A *et al*, 2014; Walczak C *et al*, 2017).

Pharyngeal contractile vigor can be objectively measured using high resolution impedance manometry (HRIM). Historically, two HRIM metrics have been mainly used to quantify pharyngeal contractility: the mean peak pressure (PeakP) and the pharyngeal contractile integral (PhCI). The international working group (Omari T *et al,* 2019) reached a consensus on the use of the PhCI and regional pharyngeal contractile integrals to study pharyngeal contractility in HRIM.

Aim

1. To investigate the existence of different patterns of pharyngeal hypocontractility and their distribution in patients with pharyngeal dysfunction
2. To investigate the association between pharyngeal hypocontractility and upper esophageal sphincter (UES) dysfunction in a clinical population

Methods

A retrospective chart review was conducted on patients consecutively for videomanometry between **January 1st, 2018** and **February 28th, 2019.**

Inclusion criteria

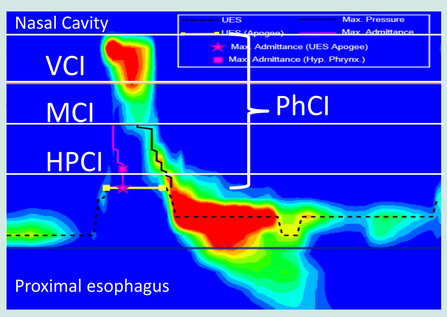
Abnormal (**<5th percentile**; Omari T, 2018) **pharyngeal contractile integral** or **regional** contractile integrals (velo- or meso- or hypo-pharyngeal integrals).

Data acquisition

HRIM with solid state catheter 36 pressure sensors and 16 impedance segments (Unisensor USA Inc., Portsmouth, NH). Boluses with 1% NaCl. Data acquired at 20 Hz (Solar GI, MMS, The Netherlands).

HRIM analysis

Pressure flow analysis was performed on **10ml liquid** swallows using the **Swallow Gateway™** open access analysis portal. PFA metrics for pharyngeal contractility and UES function were derived (Table 1). Patients were classified based on a **proposed HRIM scheme** (Table 2).



	Metric	Abbreviation	Unit
UES FUNCTION	UES Maximum Admittance Highest admittance value recorded during bolus flow through the UES	UES Max Adm	mS
	Intra-Bolus pressure Pressure recorded at 1 cm superior to the UES apogee at the time point of maximal admittance	IBP	mmHg
	UES Integrated Relaxation pressure Median of the lowest non-consecutive 0.20-0.25 second pressure within the UES relaxation window	UES IRP	mmHg
PHARYNGEAL CONTRACTILITY	Pharyngeal Contractile Integral Average contractile pressure from the velopharynx to the upper margin of the UES during swallowing, multiplied by duration and length	PhCI	mmHg.cm.s
	Velopharyngeal Contractile Integral Analogous to the PhCI in the region of the velopharynx	VCI	mmHg.cm.s
	Mesopharyngeal Contractile Integral Analogous to the PhCI in the region of the mesopharynx	MCI	mmHg.cm.s
	Hypopharyngeal Contractile Integral Analogous to the PhCI in the region of the hypopharynx	HPCI	mmHg.cm.s
	Hypopharyngeal Peak Pressure Average maximum contractile pressure recorded in the hypopharynx	PeakP	mmHg

Table 1: HRIM metrics

CATEGORY		CRITERIA	SUBCATEGORIES OF PHARYNGEAL HYPOCONTRACTILITY
DISORDERS OF UES RESTRICTION	PROPULSIVE UES OUTFLOW RESTRICTION	UES IRP >95th pc Normal pharyngeal contractility	
	NON-PROPULSIVE UES OUTFLOW RESTRICTION	UES IRP >95th pc Pharyngeal contractility <5th pc	ABSENT PHARYNGEAL CONTRACTILITY PhCI = 0 mmHg INEFFECTIVE PHARYNGEAL CONTRACTILITY PhCI <5th pc FRAGMENTED PHARYNGEAL CONTRACTILITY Normal PhCI with VCI/MCI/ HPCI <5th pc
DISORDERS OF PHARYNGEAL PROPULSION		Normal UES IRP Pharyngeal contractility <5th pc	ABSENT PHARYNGEAL CONTRACTILITY PhCI = 0 mmHg INEFFECTIVE PHARYNGEAL CONTRACTILITY PhCI <5th pc FRAGMENTED PHARYNGEAL CONTRACTILITY Normal PhCI with VCI/MCI/ HPCI <5th pc
NORMAL UES AND PHARYNGEAL PROPULSION		Normal UES IRP Normal pharyngeal contractility	

Table 2. HRIM clinical scheme for pharyngeal swallowing

LEGEND UES IRP = integrated relaxation pressure at the upper esophageal sphincter; PhCI = pharyngeal contractile integral; VCI = velopharyngeal contractile integral; MCI = mesopharyngeal contractile integral; HPCI = hypopharyngeal contractile integral; pc = percentile

Results

In total**, 38 patients** were included and **137 swallows** were analysed

Abnormal PhCI was found in **67%** of the patients. Regional weakness was observed in the **mesopharynx** (**95%** of the patients), the **hypopharynx** (**50%**) and the **velopharynx** (**16%**).

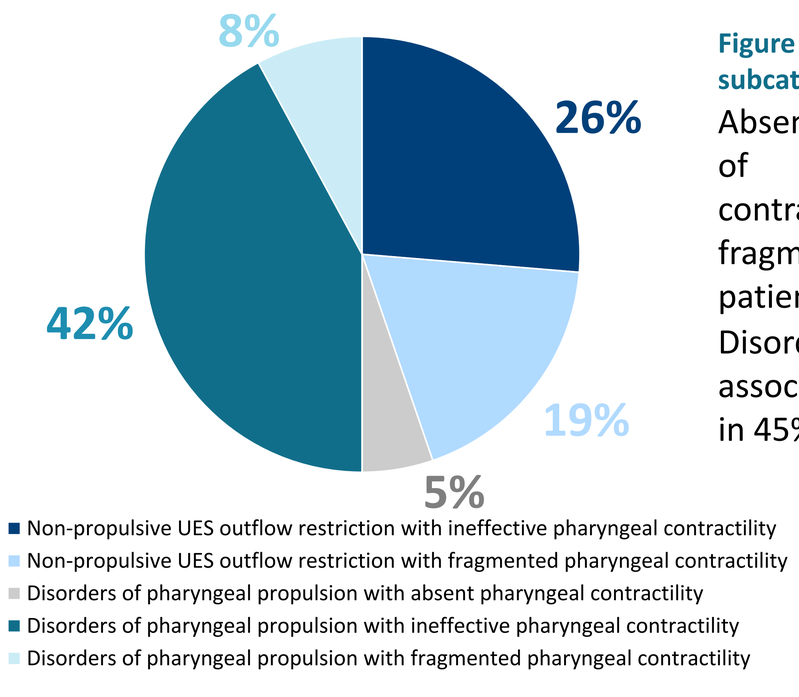


Figure 1. Distribution of patients (N=38) in the subcategories of the HRIM clinical categorization

Absent pharyngeal contractility was found in 5% of the patients, ineffective pharyngeal contractility in 68% of the patients, and fragmented pharyngeal contractility in 27% of the patients.

Disorders of pharyngeal contractility were associated to disorders of UES outflow restriction in 45% of the patients.

UES PFA metric	Spearman's correlation	
	r	p
UES Max Adm	-0.124	0.149
IBP	0.247	**0.004**
UES IRP	0.301	**<.001**

Table 3. Correlations distributions between PhCI and UES HRIM metrics

PhCI significantly correlated to IBP and UES IRP

UES HRIM metric		Normal PhCI N=45	Abnormal PhCI N=92	Chi-squared χ2	p
UES Max Adm	normal	37 (27%)	73 (53.3%)	1.3	.521
	abnormal	8 (5.8%)	19 (13.9%)		
IBP	normal	41 (29.9%)	86 (62.8%)	3.19	.203
	abnormal	4 (2.9%)	6 (4.4%)		
UES IRP	normal	19 (13.9%)	69 (50.4%)	14.6	**.001**
	abnormal	26 (19%)	23 (16.8%)		

Table 4. Chi-squared analysis of the distributions of normal and abnormal UES HRIM metrics between PhCI normalcy categories (N=137 swallows)

Patients with a fragmented pharyngeal contractility (normal PhCI) were more likely to present an abnormal UES IRP

Conclusion

Based on the pharyngeal contractile integrals, two main types of pharyngeal hypocontractility are present in the clinical population of patients: ineffective and fragmented pharyngeal contractility. Totally absent peristalsis in uncommon. In almost half of the patients, pharyngeal propulsion disorders are combined to disorders of UES restriction. Results of the study can guide clinicians and researchers to define a HRIM-based classification of pharyngeal motility disorders, analogous to the Chicago Classification of esophageal motility disorders.

Disclosure

TO and NR hold patent on AIMplot technology. No financial disclosures by all authors.

More info

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