High Resolution Esophageal Manometry (HREM): Metrics and Motility disorders

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The Challenge

TN ISGCON MID TERM VIRTUAL MEET

"GI SELECT"

September 18th & 19th, 2020

Respected Sir/ Madam,

We cordially invite you for our ISG TN Chapter midterm meeting on 18th and 19th, September (Friday and Saturday) from 5 pm to 8 pm on both the days. The virtual meeting will be held on Zoom platform. We have chosen 12 important and basic topics relevant to our day to day practice which will be useful for our members and students. Since most of the government institutions are getting manometry and EUS we have added those topics as well. Kindly mark the dates and attend our virtual mid-term meeting.

- **Perception:** Manometry is non-essential for GI practise

  Esoteric: "Toys for boys"

- **My Task:** Explain the reasons for such perception

  Clear misconceptions & Highlight its place in GI practise

Evaluating Esophageal Disorders

- Endoscopy – Assess structure
  Abnormal >> Treat cause
  Normal >> ???

- Most clinicians stop here & start working up the treatment ladder (“Therapeutic trial”)

Can we get closer to the diagnosis
>> Treat by choice… not by chance

Evaluating Esophageal Disorders

- Upper GI endoscopy – Assess structure
- High Resolution Manometry (HREM) –
  Assess function of esophageal body and LES
- 24h pH study – Assess content (acid exposure)

Manometry

- Measures PRESSURE exerted by wall muscles resulting in motility of luminal contents
- Interplay of pressures between different segments result in pathology

HREM: Indications

- Evaluation of dysphagia:

  Exclude achalasia, hypercontractility

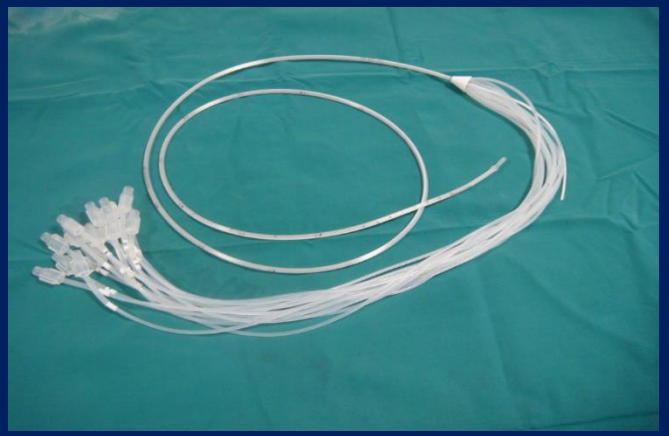
- Prior to surgery:

  To assess esoph. dysmotility, LES pressure

- Persistent symptoms: GERD, belch
- Atypical symptoms: Chest pain, cough

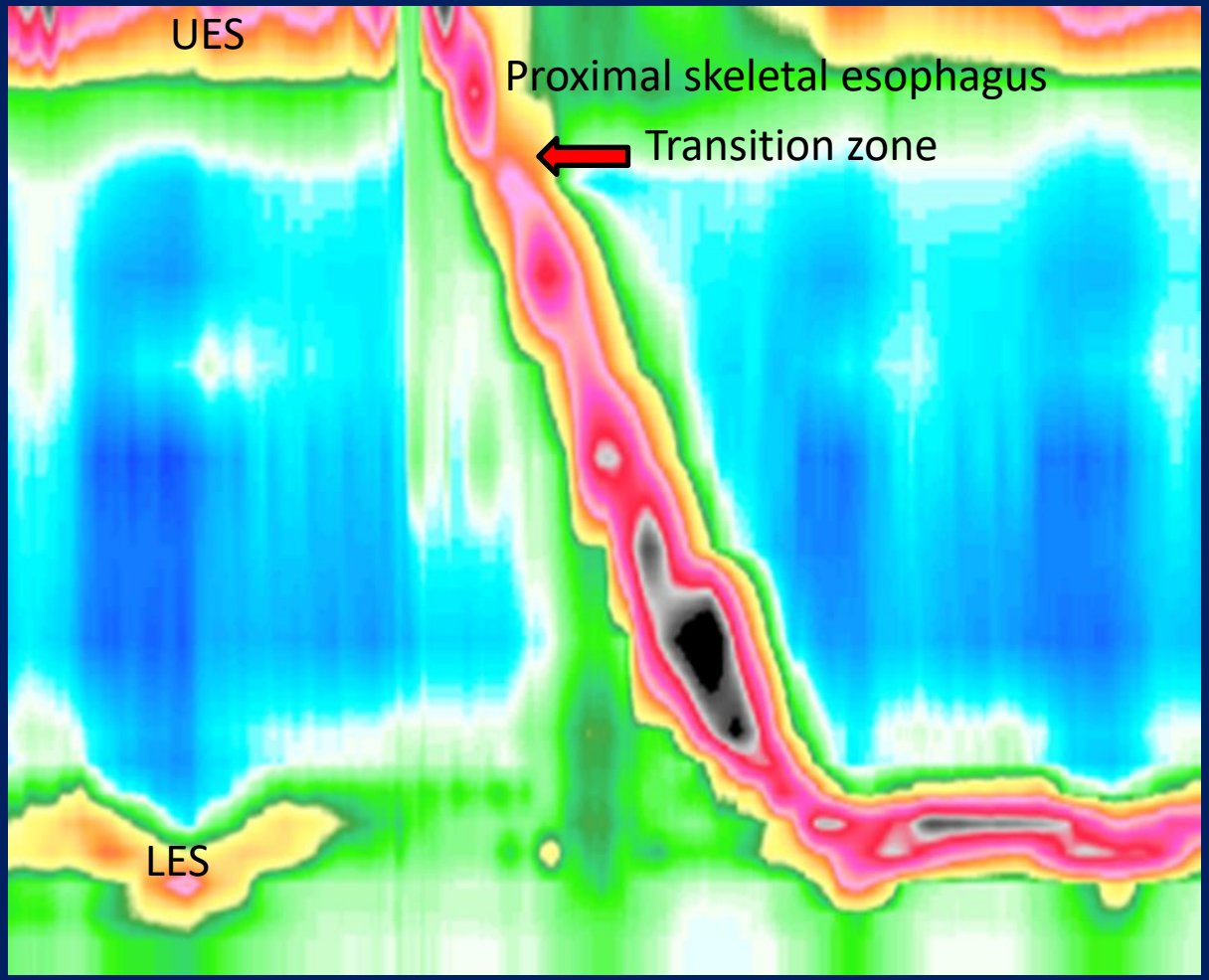
HREM: Test Protocol

- At least 6h fasting Off PPI, prokinetics: 5-7d
- Catheter placed in upper stomach via nostril
- Supine posture
- Basal recording (swallow free)
- 10 x 5ml water swallows



- Additional manoeuvres:
  - Multiple rapid swallows (5x2ml in 10s) – Peristaltic reserve
  - Sitting posture study
  - Solid bolus
  - Rapid water drinking (200ml)

Normal HREM: Colour Plot



Reporting HREM >> Chicago Classification

Chicago Classification: HREM Metrics

Objective measurements:

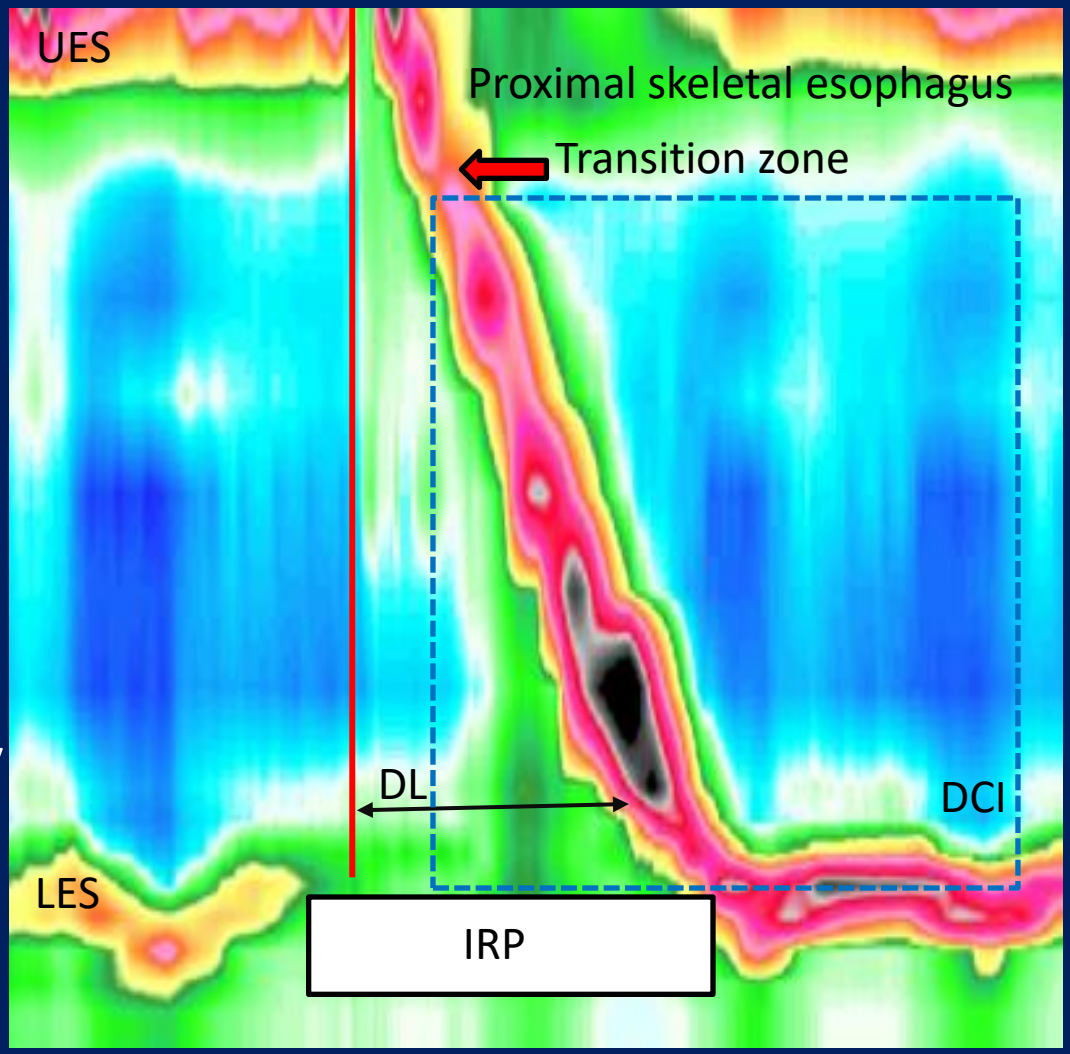
Integrated relaxation pressure (IRP): Dynamic Relaxation of LES

Distal Latency (DL): Contraction time to reach pre-LES

Distal contractile integral (DCI): Contraction Force in body

Peristaltic break:

Co-ordination of contraction



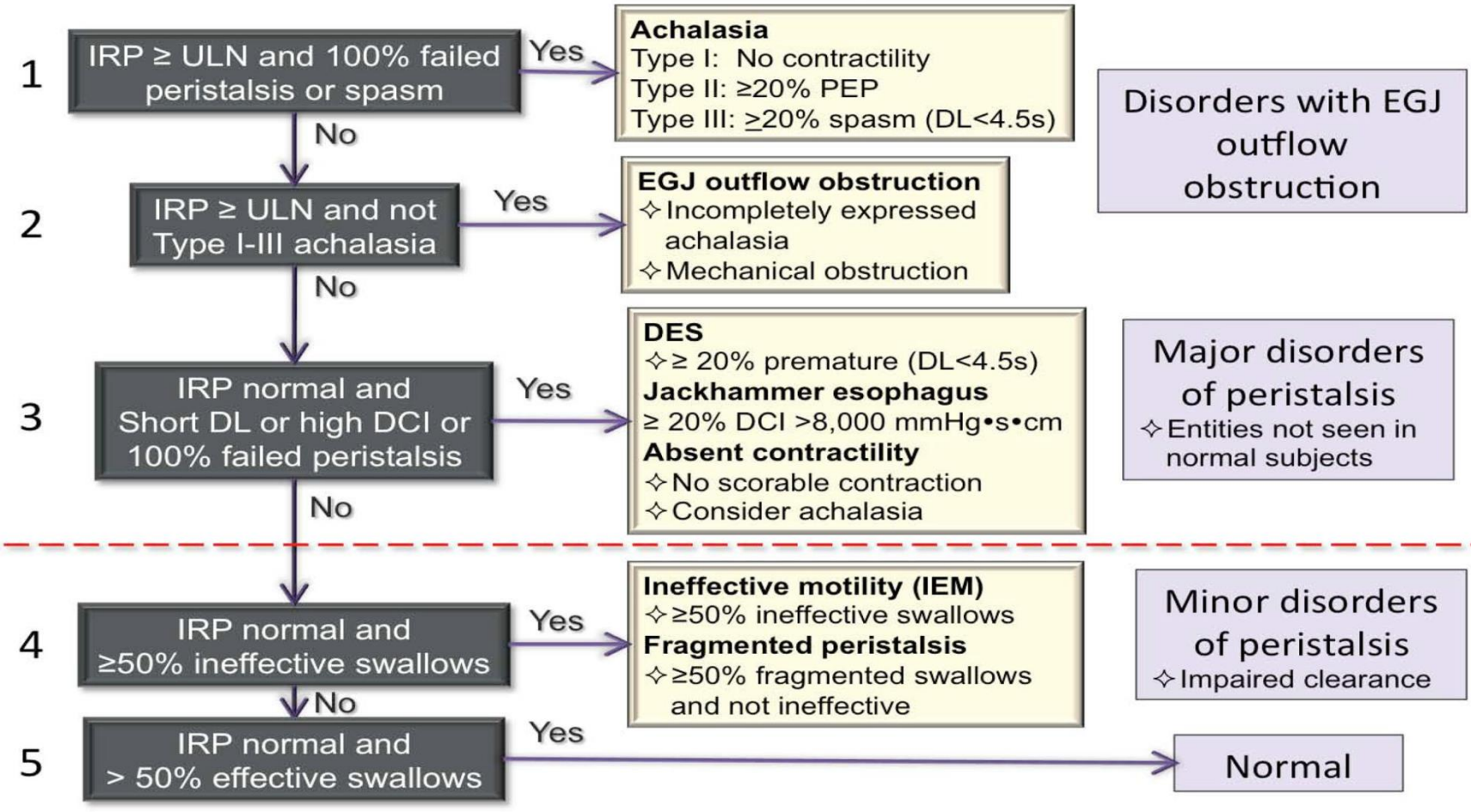
CC metrics: Values

CC metric	Abnormal threshold	Associated disorder
IRP	> 15mmHg (median of 10 swallows)	Achalasia EGJ outflow obstruction
DL	< 4.5s (20% sw)	Diffuse esophageal spasm
DCI	> 8000 mmHg/cm/s (20% sw) < 100 mmHg/cm/s (100% sw) 100-450 mmHg/cm/s (50% sw)	Hypercontractile Absent contractility Ineffective motility
Peristaltic break	> 5cm (50% sw)	Fragmented

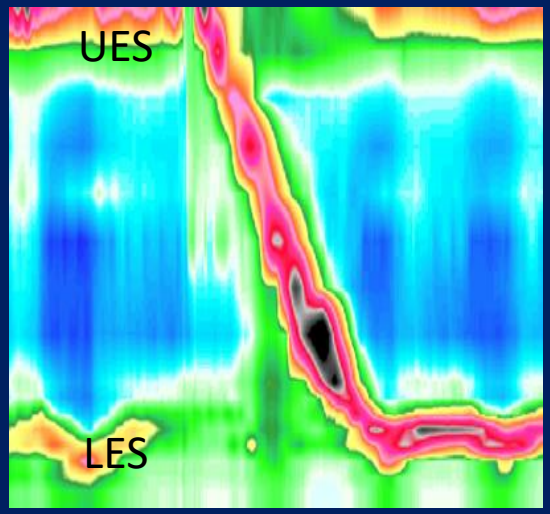
Remember: Final diagnosis should always be based on analysis of all 10 swallows

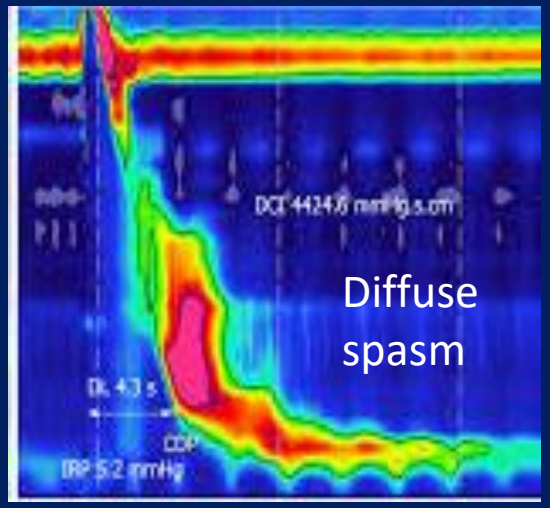
The Chicago Classification v3.0

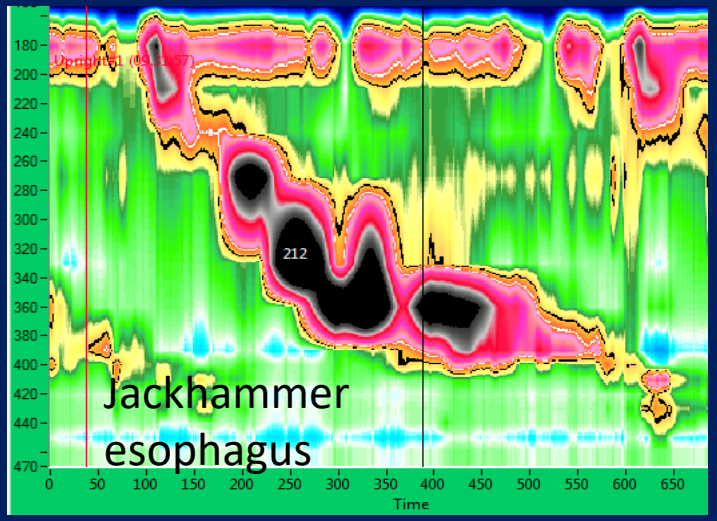
Hierarchical analysis

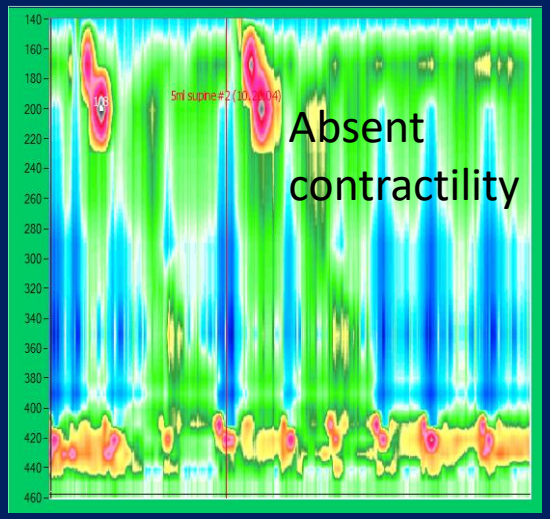


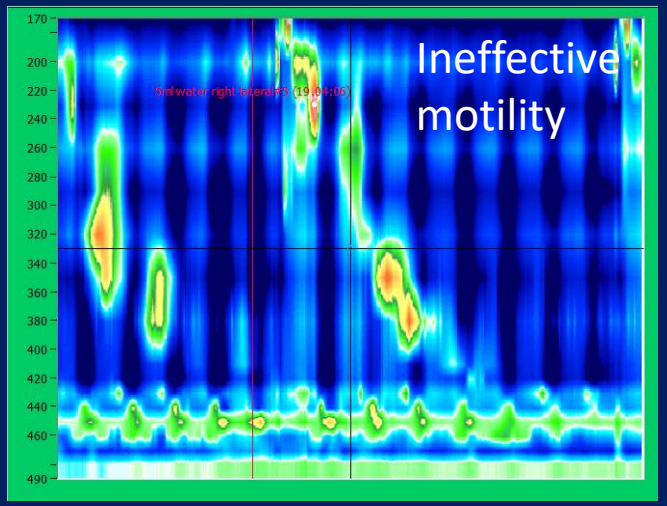
HREM – Diagnoses

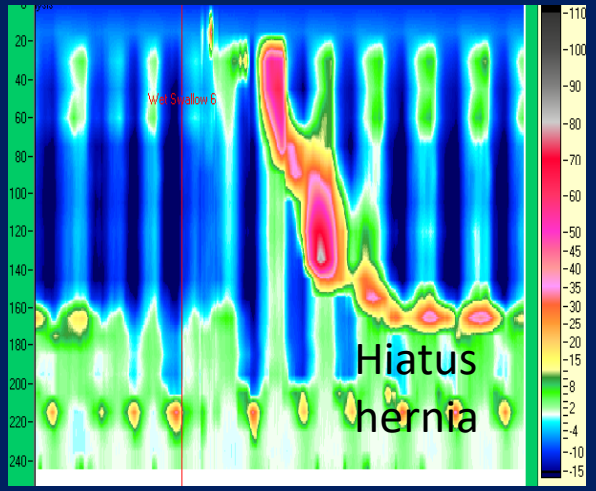






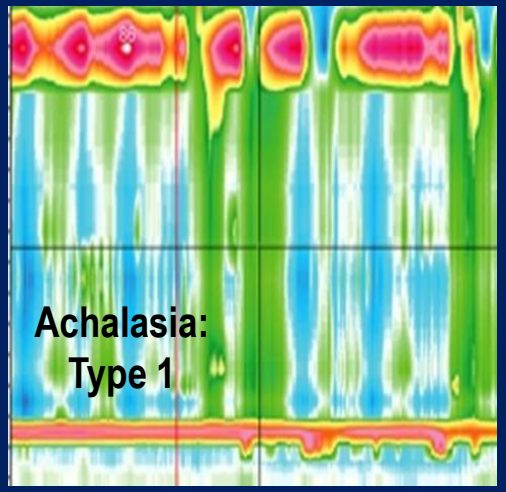


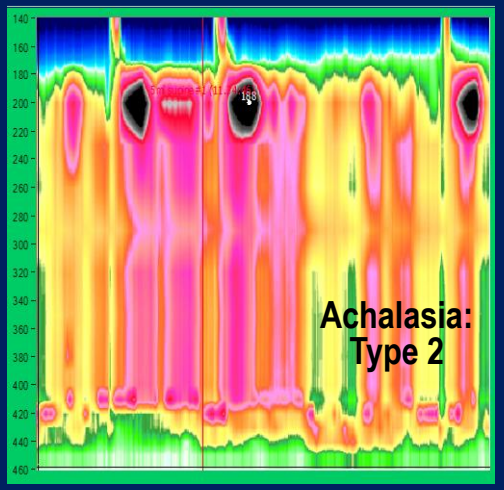


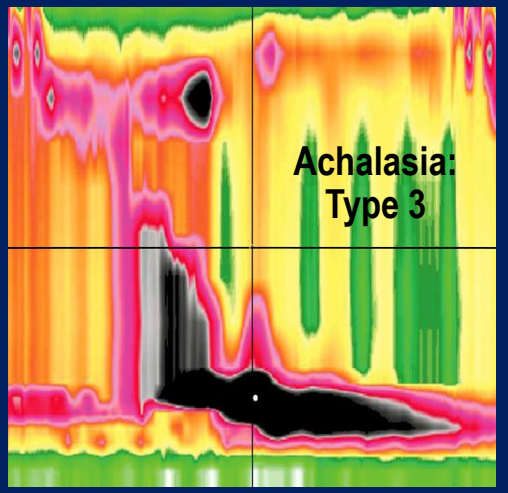


HREM for achalasia: The current gold standard

50% miss rate with endoscopy and barium study





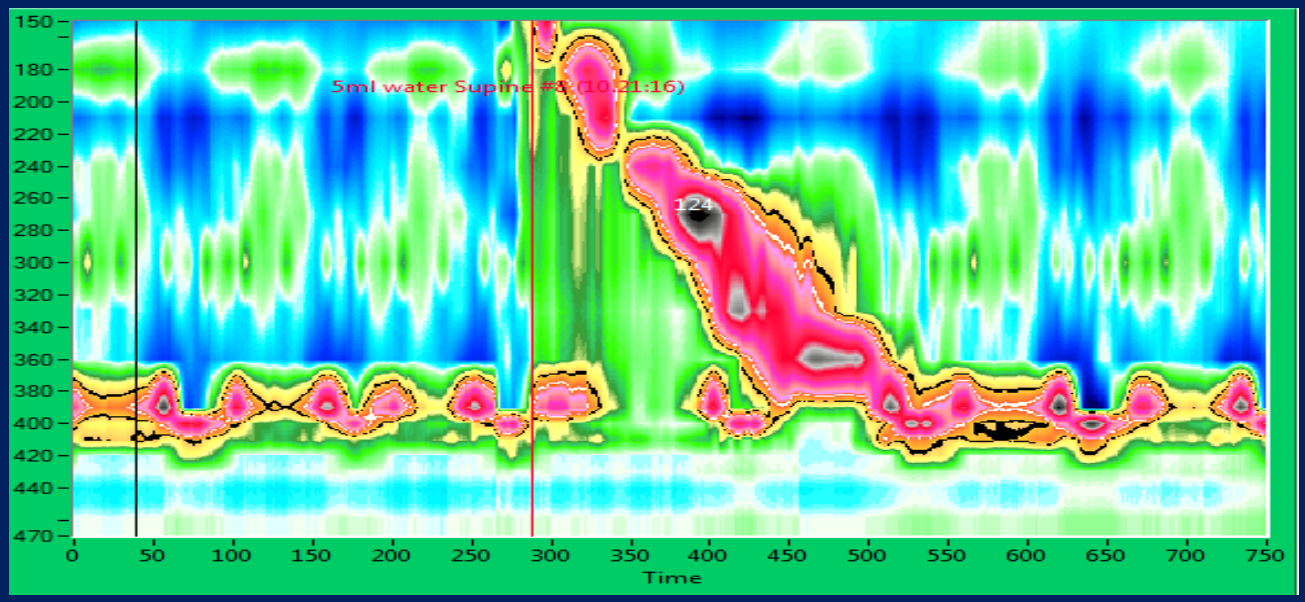


PD/Myotomy PD POEM

Confirms diagnosis **Choice of therapy by subtype**

Vaezi MF, Pandolfino JE, Vela MF. ACG clinical guideline: diagnosis and management of achalasia. Am J Gastroenterol. 2013;108(8):1238–1249.
Ihara E, Muta K, Fukaura K, Nakamura K. Diagnosis and Treatment Strategy of Achalasia Subtypes and Esophagogastric Junction Outflow Obstruction Based on High-Resolution Manometry. Digestion 2017;95:29-35

EGJ Outflow Obstruction



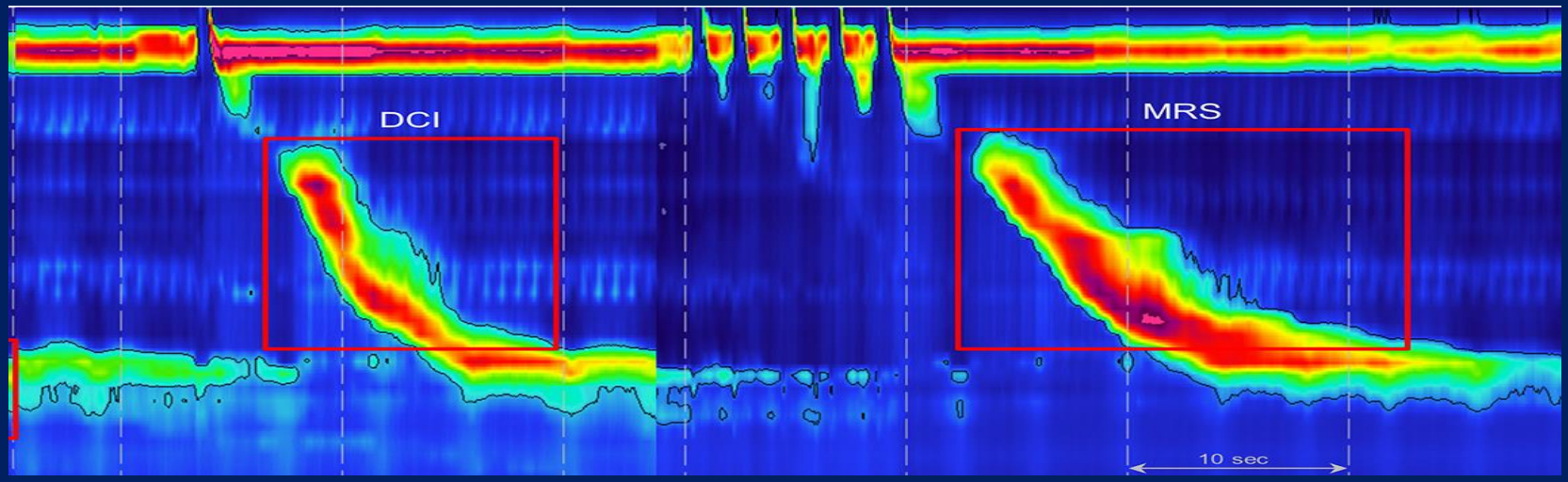
- Raised IRP Normal peristalsis
- Anatomic or functional issues at OGJ

  Consider -

  Early achalasia / variant

  Extra-luminal causes Hiatus hernia

Peristaltic reserve (PR)



- Done in subjects with Ineffective motility by CC
- DCI Ratio of:
  Summative wave after 5x2ml rapid water swallows/Mean DCI of 10 x 5ml water swallows
- Ratio > 0.8 = good peristaltic reserve
- Low Reserve: risk of post-surgery dysphagia (65% sensitivity)

Perception: HREM unhelpful in GI practise >> non-essential

- Looks like achalasia / EGJ OO… but IRP < 15
- Looks like hypercontractile, patient has dysphagia… but DCI < 8000
- Too many IEM reported … don't know what to do

Why does HREM seem unhelpful ?

Iron deficiency Anaemia

- Western normal 13g/dl
- Indian normal 11.5g/dl

Message: Use appropriate cut-offs for each setting

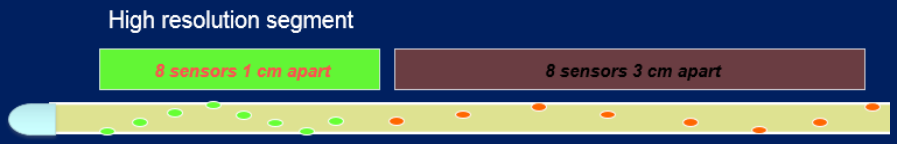
In HREM: CC cut-offs based on -

- 36ch solid-state system used in Americans volunteers
- 16ch water perfused system in India: Same cut-off used

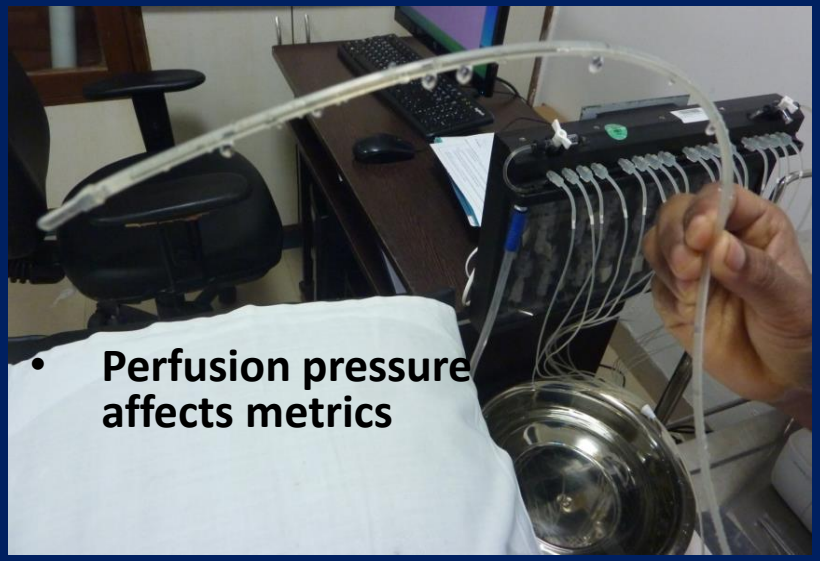
System, Channels, Populations different

One size does not fit all

Water perfused & Solid state catheter



- Sensors zigzag



- Perfusion pressure affects metrics

- Sensors circumferential
- No perfusion issues

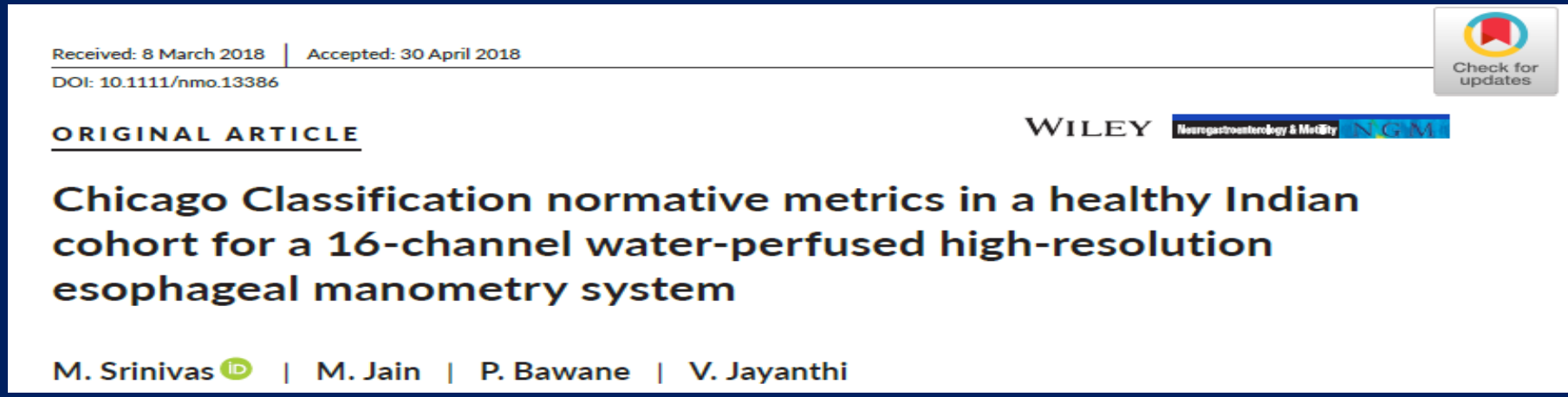
Use system specific normative values for reporting

Variations in water perfused systems

Study	Catheter type	Diameter	Volunteers	Basal LESp (95P)	IRP (95P)	DCI (5-95P)	DL (5P)
Burgos-Santamaría[4]	22-ch water-perfused	4 mm	16 (Spain)	54	20	285-2820	6.1
Tseng[7]	22-ch water-perfused	4.2 mm	66 (Taiwan)	46.5	20	99-2186	6.2
Capovilla[5]	24-ch water-perfused	-	20 (Italy)	34.3	8.8	557-1726	7.0
Kessing[6]	36-ch water-perfused	4.7 mm	50 (The Netherlands)	29.8	18.8	142-3674	6.2
Chicago Classification[1]	36-ch solid-state	4.2 mm	75 (USA)	35	15	5000 (95P)	4.5 (Minimum)

- No correlation between catheters of same system
- Need to use catheter specific cut-offs

16ch water perfused system: Indian normative values



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Check for updates

ORIGINAL ARTICLE

WILEY Neurogastroenterology & Motility NGM

Chicago Classification normative metrics in a healthy Indian cohort for a 16-channel water-perfused high-resolution esophageal manometry system

M. Srinivas | M. Jain | P. Bawane | V. Jayanthi

- Based on 530 water swallows (53 healthy volunteers)
- Age, Gender, BMI did not affect metrics

- Normal values

  IRP: 95th percentile DL: Minimum value

  DCI: 10th – 100th percentile

  > 100th P – Hypercontractile < 5th P – Absent contractility

  5th to 10th P – Ineffective motility

16ch water perfused system: CC metrics – Indian normative values

CC metric	Abnormal threshold		Associated disorder
	CC value	Indian value	
IRP: median (mmHg)	> 15	> 13	Achalasia / EGJ OO
DL (s)	< 4.5s (20% sw)	< 4.5s (20% sw)	Diffuse esophageal spasm
DCI (mmHg/cm/s)	> 8000 (20% sw) < 100 (100% sw) < 450 (50% sw)	> 4500 (20% sw) < 70 (100% sw) < 350 (50% sw)	Hypercontractile Absent contractility Ineffective motility
Break (cm)	> 5cm (50% sw)	> 5cm (50% sw)	Fragmented

- **IRP and DCI lower in our system compared to CC values**
- **Applying Indian cut-offs:**

More Achalasia / EGJ OO **More Hypercontractile**

Fewer Ineffective motility

Variations in water perfused systems

Study	Catheter type	Diameter	Volunteers	Basal LESp (95P)	IRP (95P)	DCI (5-95P)	DL (5P)
Srinivas	16-ch water-perfused	3.5 mm	53 (India)	37.6	13	72-3276	4.6 (Minimum)
Burgos-Santamaría[4]	22-ch water-perfused	4 mm	16 (Spain)	54	20	285-2820	6.1
Tseng[7]	22-ch water-perfused	4.2 mm	66 (Taiwan)	46.5	20	99-2186	6.2
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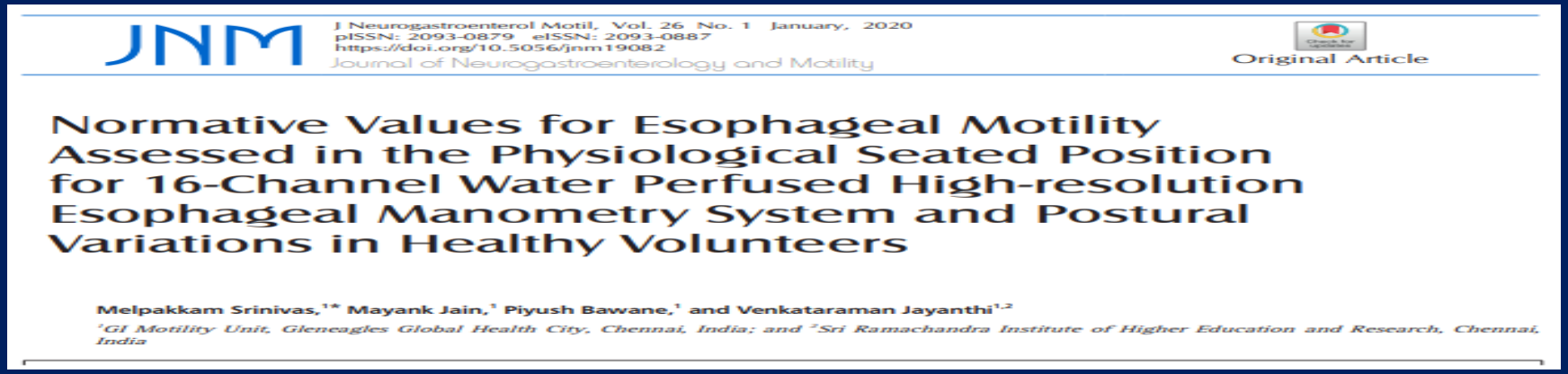
- No correlation between catheters of same system
- Need to use catheter specific cut-offs

16ch water perfused system: Postural variations



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Journal of Neurogastroenterology and Motility

Original Article

Normative Values for Esophageal Motility Assessed in the Physiological Seated Position for 16-Channel Water Perfused High-resolution Esophageal Manometry System and Postural Variations in Healthy Volunteers

Melpakkam Srinivas,[1]* Mayank Jain,[1] Piyush Bawane,[1] and Venkataraman Jayanthi[1,2]
[1]GI Motility Unit, Gleneagles Global Health City, Chennai, India; and [2]Sri Ramachandra Institute of Higher Education and Research, Chennai, India

CC metric	Abnormal threshold		Associated disorder
	Supine value	Sitting value	
IRP: median (mmHg)	> 13	> 13.9	Achalasia / EGJ OO
DL (s)	< 4.5s (20% sw)	< 4.5s (20% sw)	Diffuse esophageal spasm
DCI (mmHg/cm/s)	> 4500 (20% sw) < 70 (100% sw) < 350 (50% sw)	> 4500 (20% sw) < 30 (100% sw) < 115 (50% sw)	Hypercontractile Absent contractility Ineffective motility
Break (cm)	> 5cm (50% sw)	> 5cm (50% sw)	Fragmented

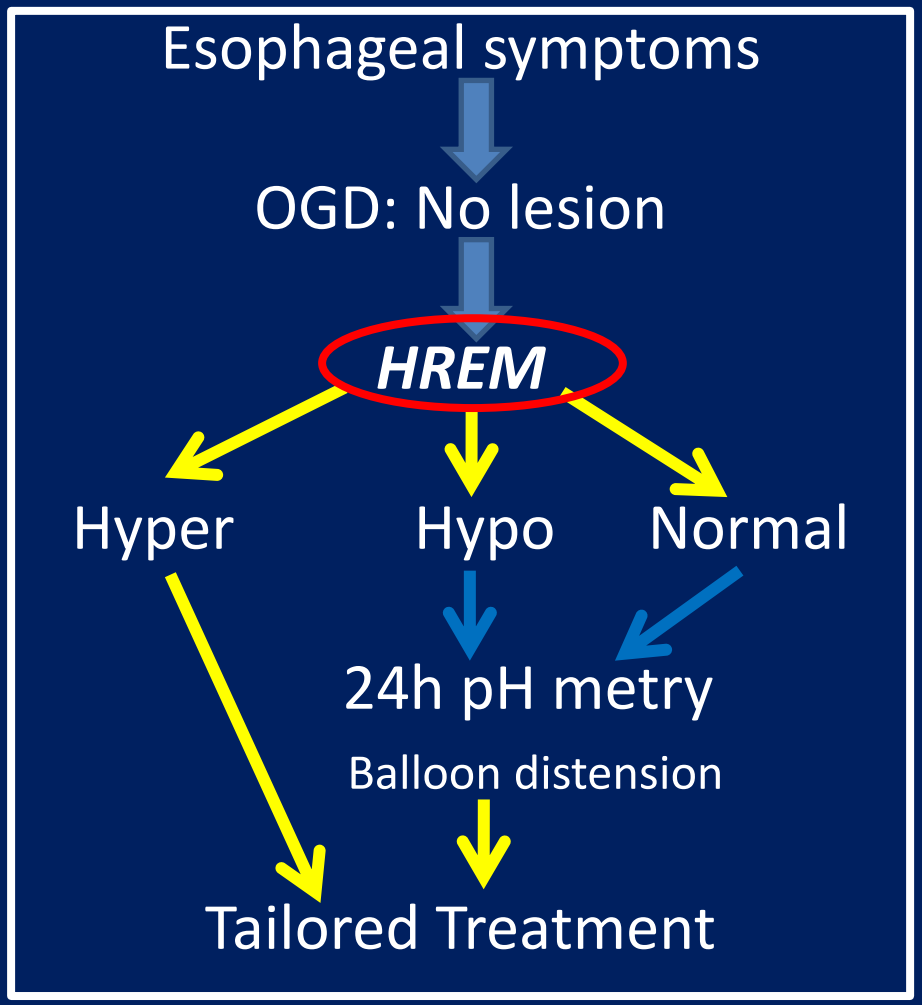
Supine versus Sitting values: Higher IRP and Lower DCI in sitting

Important to use posture – specific cut-offs

SUMMARY

HREM: An under-utilised tool

- Identifies structural issues in functional disorders



HREM: An under-utilised tool

- **Clinical Applications**

  Confirm and subtype achalasia

  Diagnose hypercontractility & aperistalsis

  Assist surgeon to choose wisely in HH & GERD

HREM: An under-utilised tool

- System & posture specific cut-offs must be applied to generate clinically relevant reports

	Abnormal Threshold (Supine posture)	
IRP: median (mmHg)	> 13	Achalasia / EGJ OO
DL (s)	< 4.5s (20% sw)	Diffuse esophageal spasm
DCI (mmHg/cm/s)	> 4500 (20% sw) < 70 (100% sw) < 350 (50% sw)	Hypercontractile Absent contractility Ineffective motility
Break (cm)	> 5cm (50% sw)	Fragmented

Apply Indian cut-offs:

More Achalasia / EGJ OO **More Hypercontractile**

Fewer Ineffective motility

Confident Clinicians **Satisfied Patients**

THANK YOU