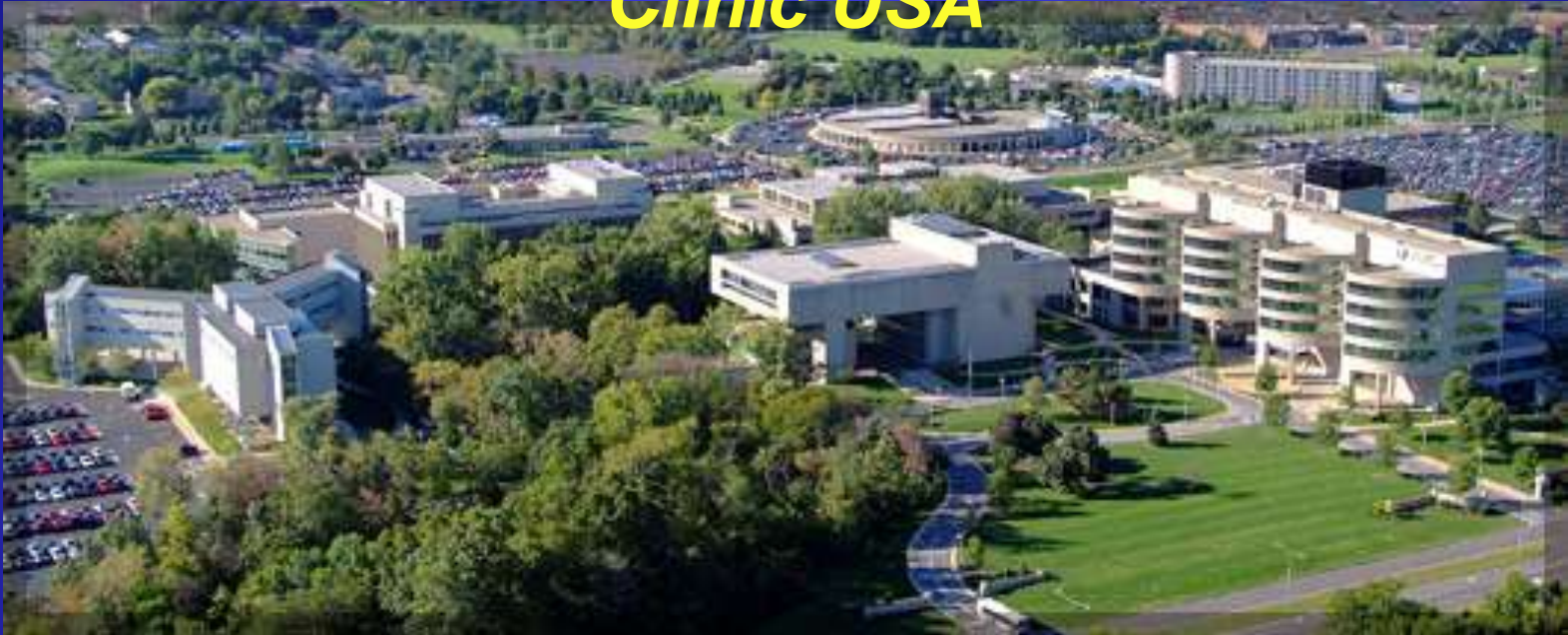


***Innovative Syncope Services at the  
University of Toledo Autonomic Disorders  
Clinic USA***



***Beverly Karabin, PhD, MSN, APN***

***Blair P. Grubb MD***

***The University of Toledo Medical Center***

***Cardiac Electrophysiology and Autonomic Disorders Clinic***

# University of Toledo Medical Center



Academic  
Medical  
Center



LEVEL I  
Trauma  
Center





Cardiac Arrhythmia Center

Pulmonary Hypertension and Right Ventricular Failure Clinic

The Syncope and Autonomic Disorders Clinic

# *UTMC Syncope and Autonomic Disorders Clinic*



1 Physician

**Dr Blair Grubb**

**Professor of Medicine and  
Pediatrics, Director Cardiac  
Electrophysiology and  
Autonomic Disorders Clinic**



1 Nurse Practitioner

2 Registered Nurses (tilts)

2 Medical Assistants



# *UTMC Syncope Clinic Academic year 2006/07*

*Total patients seen: 2,528*

*New Patients: 561*

*ER Consults : 39*

*In Patient: 44*



# UTMC Clinic 2011

- Approximately 3000 patients yearly
  - 2000 Nurse practitioner visits
  - 1000 Physician visits
- 600 new patient visits yearly

# Syncope

Up to 1 million patients are  
evaluated annually in the US  
for syncope

Olshansky et al, AJC 2000



*So just how many people are we  
talking about?*

Estimated # of patients with orthostatic  
intolerance syndromes:

Vanderbilt (1999) : 500,000 in U.S.

*Robertson et al Am J Med Sci  
1999;317:75-77*

NIH Estimate (2002) : 750,000 to  
1,000,000 in USA

*Goldstein et al Annals of Int Med  
2002;137:753-763*

The cost of syncope  
evaluations in the US alone  
has been estimated to exceed  
*\$800 Million* per year

# *UTMC Syncope Clinic Cost Effectiveness*

*Diagnosis rate: 93%*

*Average cost per diagnosis: \$5000*

*Average cost in USA: \$16,000*

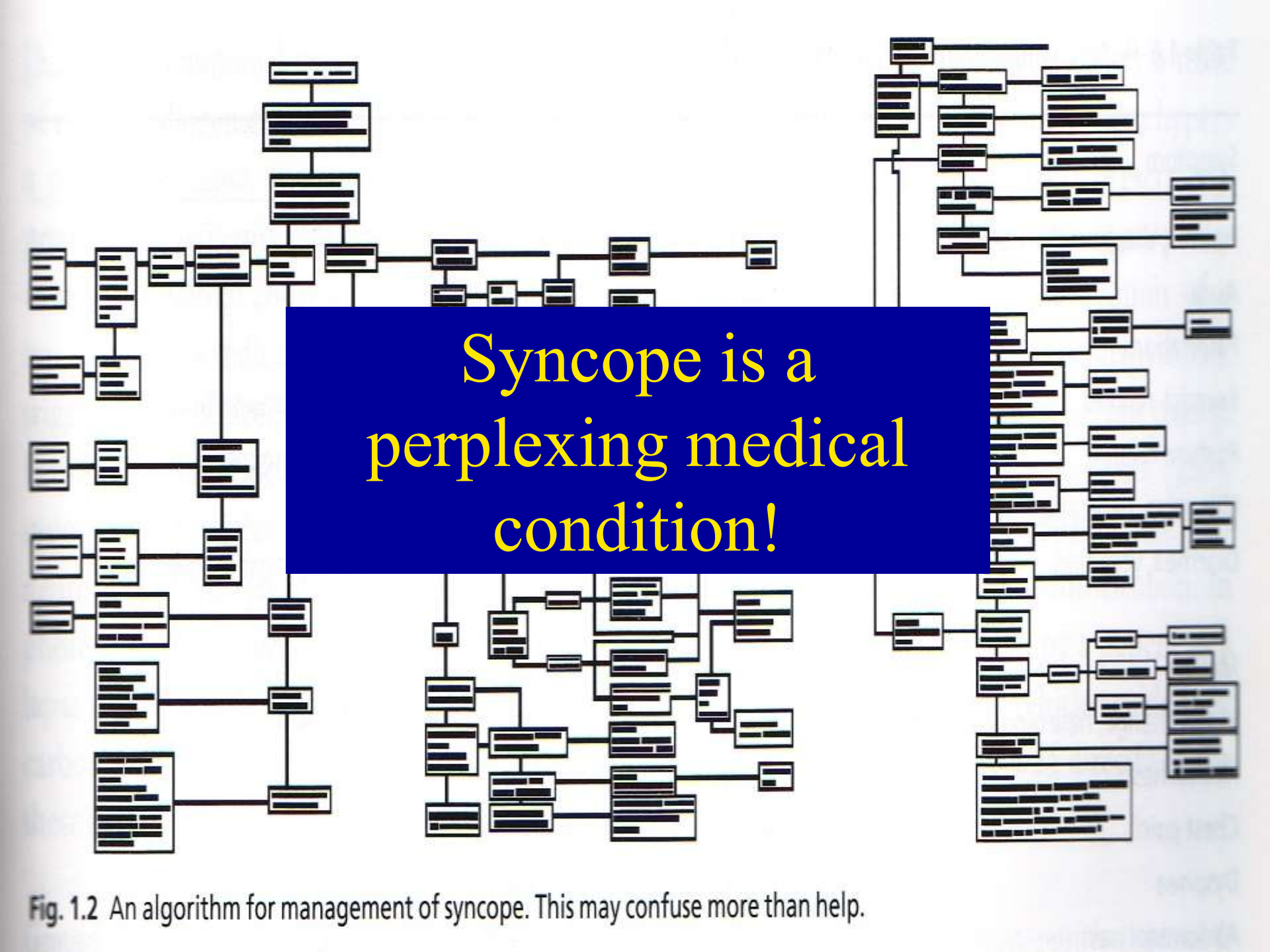


What Drives Costs in Syncope?

# Benign/innocent vs. lethal causes of syncope

- Our efforts to find the cause are rooted in this anxiety
- The search for the cause of syncope usually results in a great expense
- Most clinicians order a battery of unnecessary tests
- Most of the diagnostic testing is negative
- Repeated evaluations and hospitalizations after an initial negative assessment is unrewarding
- As a result this approach is extremely cost ineffective.

(Grubb & Olshansky,2005)

A complex flowchart for the management of syncope. The chart is composed of numerous rectangular boxes, each containing several lines of illegible text, connected by a network of lines. The layout is highly convoluted, with many branches and loops, making it difficult to follow. In the center of the diagram is a large, solid blue rectangle containing the text "Syncope is a perplexing medical condition!" in a yellow, serif font. The overall appearance is that of a highly detailed and potentially confusing medical algorithm.

Syncope is a  
perplexing medical  
condition!

Fig. 1.2 An algorithm for management of syncope. This may confuse more than help.

No specific battery of tests is ever indicated or useful, extensive testing is risky, expensive and not necessary.

Diagnostic evaluation must be guided by a **meticulous history and physical.**

If you don't find answers: don't order tests: go back to the H&P

# Usual Workup...should not be usual!

Holter monitor

CT scan

EEG

MRI scan

Glucose tolerance test

ENT referral

Echocardiogram

Consult with astrologist



# Evaluation



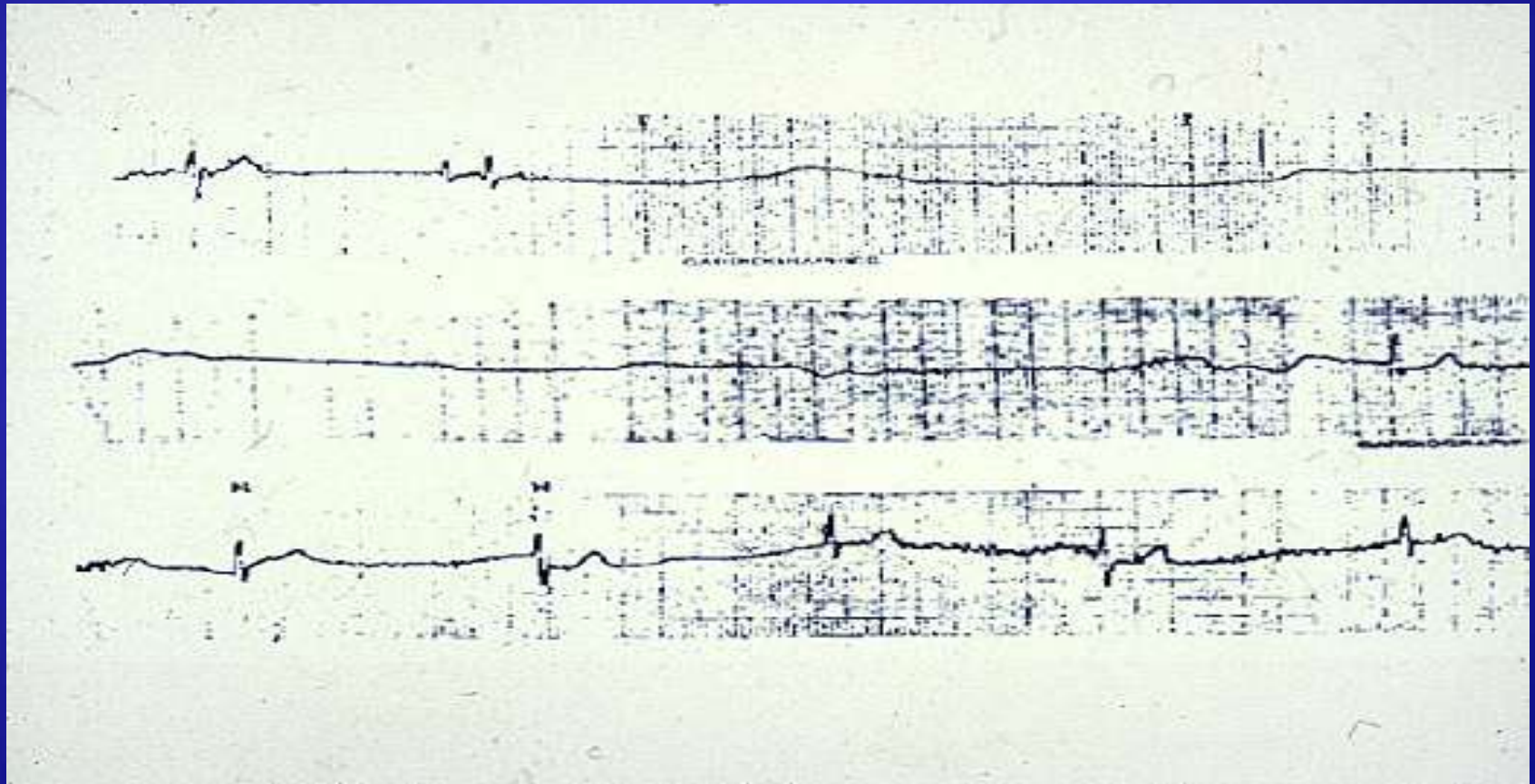
1. Careful History
2. Complete Physical (including neurologic exam)
3. ECG
4. Echocardiogram
5. Early determination of the presence of heart disease is crucial because these patients are at highest risk of death, especially those with left ventricular dysfunction and CAD.

**Table 1.10** The electrocardiogram: to evaluate syncope.

<i>Finding</i>	<i>Significance</i>
Normal or non-specific	Common, does not rule out serious cause
Complete heart block	Pacemaker indicated
Second-degree heart block	Correlate with symptoms. Pacemaker may be indicated
First-degree heart block	No obvious significance in most cases
Delta waves	Wolff–Parkinson–White pattern. Possible supraventricular tachycardia
Sinus bradycardia	Non-specific – may indicate sick sinus syndrome
Myocardial infarction	Acute: arrhythmia, hemodynamic problem Old: risk for death, arrhythmia
Epsilon waves	Right ventricular dysplasia
Bundle branch block	Possible heart block, or ventricular tachycardia
QT prolongation (> 0.500)	Possible torsade de pointes
Ectopic beats	No known significance
Atrial fibrillation	May indicate underlying structural heart disease, arrhythmic cause
Supraventricular tachycardia	Rare. Likely cause for syncope
Ventricular tachycardia	Rare. Likely cause for syncope
Paced rhythm	Pacemaker malfunction

Holter monitoring is generally not useful in syncope evaluation unless patient has recurrent (daily episodes)

In several large studies using the Holter monitor, the correlation between arrhythmic abnormalities and syncope was  $< 5\%$



# Echocardiograms

- The yield is likely to be low, but lack of perspective data; use clinical judgment
- Echocardiograms are helpful to delineate structural and obstructive causes of syncope: left ventricular function and valvular heart disease
- If EKG is normal, no history of heart disease, and normal physical exam, the echo does not have to be done urgently.

# Exercise stress test

- Ischemia suspected
- Syncope with exercise or exertion

# HUTT

- False positives less than 10%
- False negative one in ten
- Our practice:
  - Baseline test: 70 degree angle; 30 mins
  - If necessary; low dose isoproterenol 1ug/min: titrate to increase hr 25-30% over baseline supine then tilt 70 degree 10 mins



## Syncope of unknown origin and the implantable loop recorder(ILR)

- Indicated for those with recurrent unexplained syncope who have failed a non-invasive work-up
- Allows prolonged monitoring to aid in the detection of elusive, infrequent arrhythmias
- We can obtain a symptom-rhythm correlation in patients suspected of having an arrhythmia

# ILRs: optimal patients

- Suspect arrhythmia
- Abrupt onset of syncope
- Minimal or no prodrome
- Bodily Injury
- Convulsive syncope
- Prolonged LOC
- Exercise induced syncope with a negative EP study, stress test, EKG,echo.
- {Return to employment: those with high risk occupations for syncope}.

# Predictors of Asystolic or Bradycardic Response on ILR Monitoring

(Kanjwal, K., Kanjwal, Y., Karabin, B., & Grubb, B., 2008)

**Aim: Retrospective study to determine predictors of asystolic or bradycardic responses during ILR monitoring**

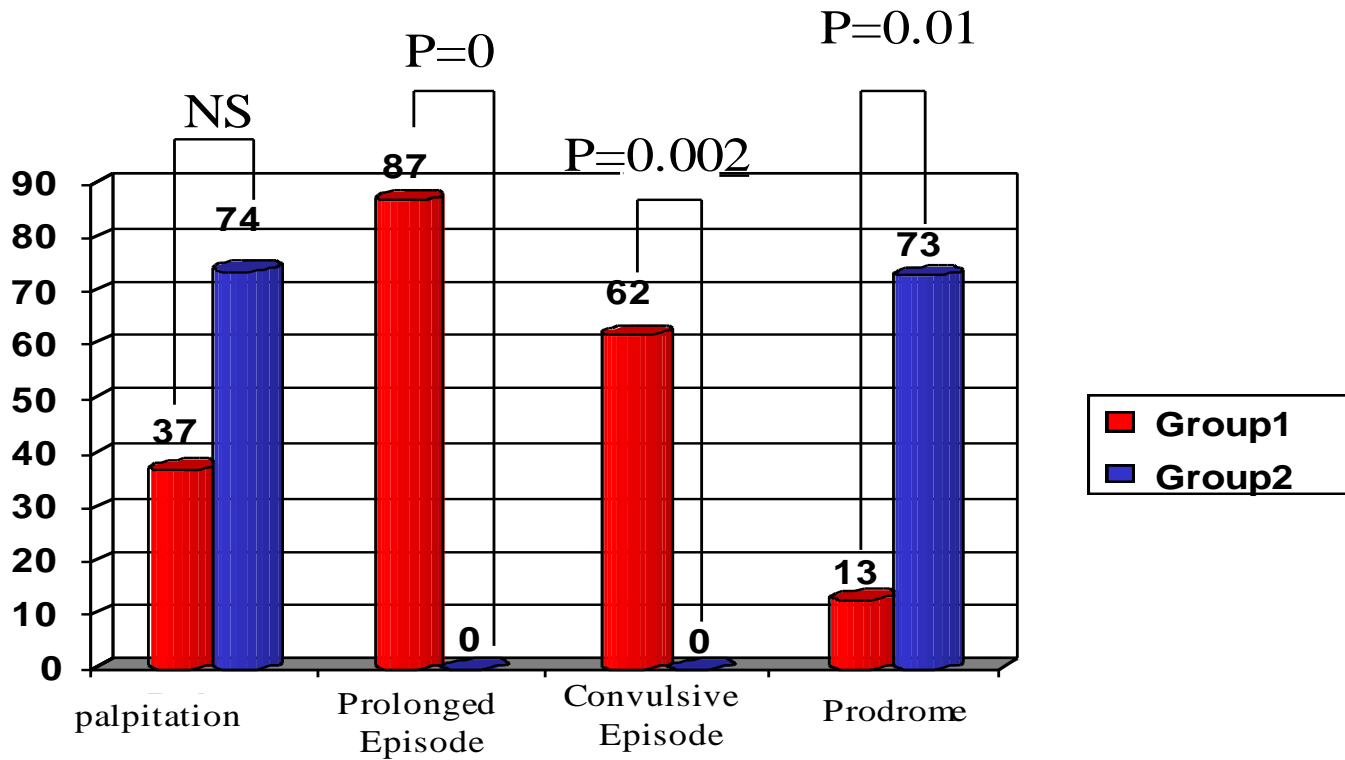
# Methods

- Chart review patients with bradycardia or asystole on ILR monitoring
- Clinical characteristics of episodes
  - Convulsive vs nonconvulsive
  - Brief (<10 mins) or prolonged (>10mins)
  - Prodrome vs no prodrome

# Baseline clinical characteristics in two groups of patients

<b>Clinical Characteristics</b>	<b>Group1 (N=8)</b>	<b>Group 2 (N=11)</b>	<b>P</b>
<b>Age</b>	<b>39±11</b>	<b>46±23</b>	<b>NS</b>
<b>Race (Caucasian)%</b>	<b>90</b>	<b>94</b>	<b>NS</b>
<b>Male: Female</b>	<b>3:5</b>	<b>2:9</b>	<b>NS</b>
<b>Symptoms</b>			
<b>Palpitations %</b>	<b>37</b>	<b>74</b>	<b>0.125</b>
<b>Convulsive syncope %</b>	<b>62</b>	<b>0</b>	<b>0.002</b>
<b>Episodes &gt; 10 min %</b>	<b>87</b>	<b>0</b>	<b>0.0001</b>
<b>Prodrome %</b>	<b>13</b>	<b>73</b>	<b>0.009</b>

# Clinical Predictors of an Asystolic Response during ILR Recording



Research Paper

## **Clinical Symptoms Associated with Asystolic or Bradycardic Responses on Implantable Loop Recorder Monitoring in Patients with Recurrent Syncope**

**Khalil Kanjwal, Yousuf Kanjwal, Beverly Karabin, Blair P. Grubb** ✉

Department of Medicine, University of Toledo Medical Center, Toledo OH 43614, USA

✉ Correspondence to: Blair P Grubb, MD, Director Electrophysiology Services, Division of Cardiology, Department of Medicine, Health Sciences Campus, University of Toledo Medical Center, Mail Stop 1118, 3000 Arlington Ave, Toledo OH 43614, USA

Received: 2009.02.16; Accepted: 2009.04.08; Published: 2009.04.09

### **Abstract**

**Background:** Implantable loop recorders (ILR) have been found to be useful in the diagnosis and management of syncope of unclear etiology. The clinical symptoms of abnormalities seen during ILR monitoring have not been adequately studied.

**Aim:** The aim of this retrospective study was to determine the clinical symptoms which were the best predictors of asystolic or bradycardic responses during ILR monitoring.

**Methods:** Patients with either asystole or bradycardia recorded during ILR monitoring were analyzed from our database. The clinical characteristics of these patients were compared to the patients with ILR's who did not have recorded bradycardic episodes. The episodes were characterized as being convulsive or nonconvulsive, brief (<5 minutes) or prolonged (> 5 minutes), and having had a prodrome or no prodrome.

**Results:** Eleven patients (4 males and 7 females; age  $39 \pm 11$  years) had asystole or bradycardia on ILR monitoring. Eleven patients (2 males and 9 females; age  $46 \pm 23$ ) had no bradycardiac events. Palpitations, convulsive syncope, prolonged episode, and prodrome were present in 37% vs. 74% ( $P = 0.125$ ), 62% vs. 0% ( $P = 0.002$ ), 87% vs. 0% ( $P=0$ ), and 73% vs. 13% ( $P=0.009$ ) patients, respectively, in the asystole/bradycardia and non-bradycardia groups. In the asystole/bradycardia group eight patients had bradycardia (HR < 20) for > 10 seconds and three patients had asystole > 10 seconds.

**Conclusion:** Convulsive syncope, prolonged loss of consciousness during syncopal episode, and absence of prodrome or aura are clinical predictors of asystole or bradycardia on ILR monitoring.

**Key words:** Implantable loop recorders, bradycardia, asystole, convulsions.

### **Introduction**

Ambulatory cardiac monitoring with Holter or external loop recorders is frequently employed in the evaluation of patients with recurrent syncope. However, several non-randomized studies demonstrate a relatively low (<40%) diagnostic yield from this approach [1-5]. Implantable loop recorders (ILR's), by contrast, allow for a more prolonged period of monitoring as well as automatic activation during events

resulting in a higher diagnostic yield than traditional monitoring techniques [6-12]. During ILR monitoring of patients with recurrent syncope, bradycardic events are encountered more frequently than are tachycardiac ones [13-15]. The clinical symptoms most predictive of significant bradycardic events (such as prolonged sinus pauses or complete heart block) recorded during ILR monitoring have not been well

*The ED is frequently the point of first contact for patients with syncope*

*A well structured and thoughtful system of evaluation can be effective in evaluation and reduce unnecessary admissions.*



## *Evaluation of Syncope in the ED*



### *Three studies evaluated risk level of syncope patients in the ED:*

1. Martin et al. *Ann Emerg Med* 1997; 29:459 - 66
2. Colavicchi F et al. *Eur Heart J* 2003; 24: 811
3. Sarasin FB. *Acad Emerg Med* 2003; 10: 1312

# *Evaluation of Syncope in the ED*



*In each study markers of adverse outcomes were:*

- 1. Abnormal ECG**
- 2. CHF**
- 3. age greater than 45 or 65 years of age**
- 4. absence of Prodrome**
- 5. History of ventricular arrhythmias**

# *ED Evaluation of Syncope*



Quinn et al evaluated a decision tool for evaluating the 7 day risk of a serious outcome after presenting to the ED with syncope

Quinn et al. *Ann Emerg Med* 2006; 47: 455

# *ED Evaluation Of Syncope*

Quinn et al:

## *Predictors of Serious Outcome:*

1. Abnormal ECG
2. SOB/DOE
3. Hct < 30%
4. SBP < 90 mmHg
5. CHF

**Table 24.1** Risk stratification of patients with syncope.\*

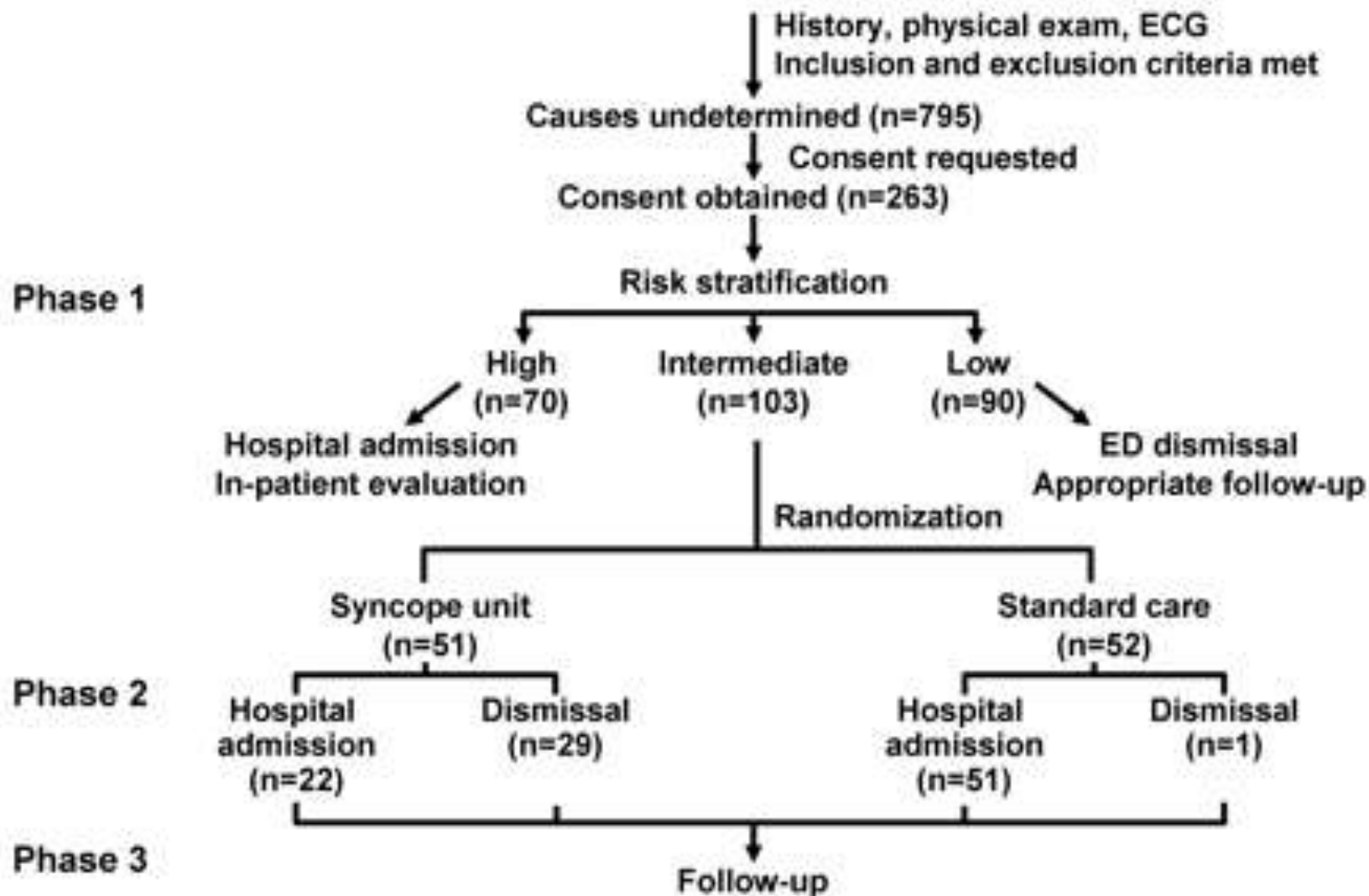
<i>High-risk group</i>	<i>Intermediate-risk group</i>	<i>Low-risk group</i>
Chest pain compatible with acute coronary syndrome	Age $\geq$ 50 yr	Age < 50 yr
Signs of congestive heart failure	Previous history of coronary artery disease, myocardial infarction, heart failure, cardiomyopathy without active symptoms, or signs on cardiac medications	With no previous history of cardiovascular disease
Moderate/severe valvular disease		Symptoms consistent with reflex-mediated or vasovagal syncope
History of ventricular arrhythmia	Bundle branch block or Q wave without acute changes on ECG	Normal cardiovascular examination
ECG/cardiac monitor findings of ischemia	Family history or premature unexplained sudden death (<50 yr)	Normal ECG findings
Prolonged QTC (<500 ms)		
Trifascicular block of pauses between 2 and 3 s	Symptoms not consistent with reflex-mediated vasovagal cause	
Third-degree AV block	Cardiac devices without evidence of dysfunction	
Persistent sinus bradycardia between 40 and 60 bpm	Physician's judgment that a cardiac syncope is possible	
Atrial fibrillation or nonsustained ventricular tachycardia without symptoms		
Cardiac devices (pacemaker or defibrillator) with dysfunction		

\*This risk stratification scheme was used in the SEEDS.



# Evaluation of Syncope in the ED: SEEDS

## ED Evaluation for Syncope (3,502 Patients During Study Period)



# *SEEDS Trial : Syncope Unit vs. Standard Care in the ED*

## Standard Care

1. Cardiac Monitoring
2. Nasal Oxygen
3. IV Fluid
4. Further evaluation at the discretion of the ED Physician

## *SEEDS Trial : Syncope Unit vs. Standard Care in the ED*

### Syncope Unit:

1. Cardiac Telemetry for up to 6 hr.
2. Hourly vital signs with orthostatic BP and HR
3. Echo if abnormal ECG or physical findings
4. Tilt table testing , carotid sinus massage, and EP consult available to ER physician

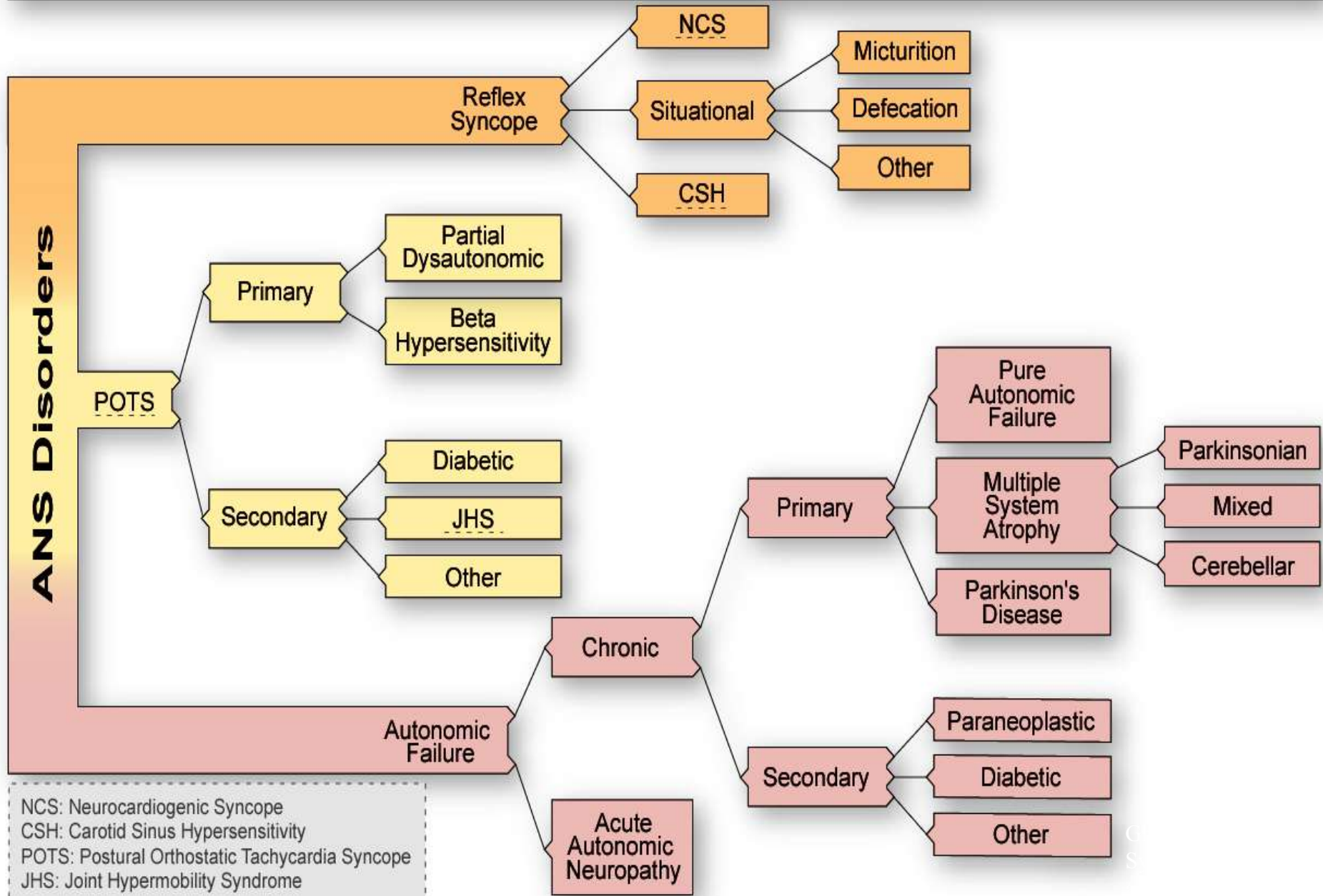
## *SEEDS Trial : Syncope Unit vs. Standard Care in the ED*

1. Presumptive diagnosis found in 67 % of the Syncope Unit patients vs 10 % of Standard Care
2. Hospital admission 43% in Syncope Unit pt vs 98% among Standard Care pts.
3. Total length of pt-hospital days reduced by >50% in Syncope Unit pts.
4. On follow up all cause mortality and recurrent syncope were the same for both groups

*Roughly 45% of the patients seen in the UTMC Syncope clinic referred for refractory NCS will be found to have a different type of autonomic disorder*



**Figure 1. Disorders of the Autonomic Nervous System Associated with Orthostatic Intolerance**



# Orthostatic Intolerance Syndromes

- NCS/ NMH/ Reflex syncope
- Postural Tachycardia Syndrome (POTS)
- Autonomic Failure Syndromes
- The syndromes may overlap
- Treatment is similar
- Mechanisms are different
- All may lead to syncope or transient loss of consciousness (TLOC) {fainting, blackouts}

The autonomic centers control most of the functions considered essential to life itself

- **Heart Rate**
- **Blood Pressure Control**
- **Body Temperature**
- **Bowel Motility**
- **Sweating**
- **Breathing**
- **Genital-urinary function**

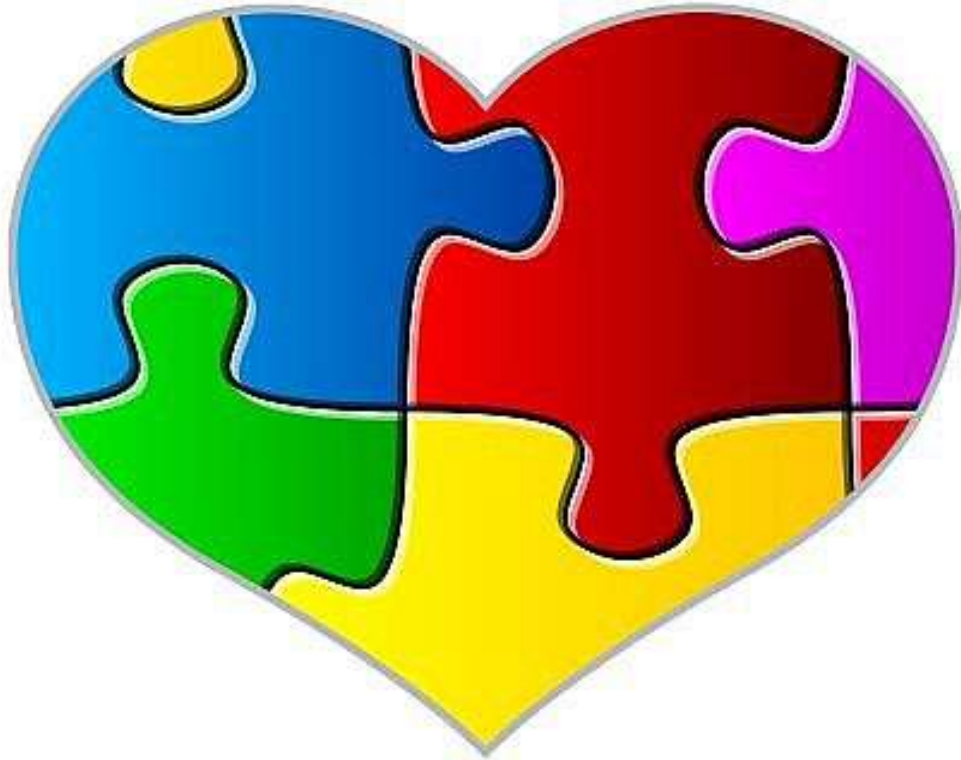
# Symptoms of Dysautonomia.

- **Rapid heart rate (tachycardia)**
- **Slow heart rate (bradycardia)**
- **Orthostatic hypotension**
- **Orthostatic intolerance**
- **Syncope and near syncope**
- **Severe dizziness**
- **Excessive fatigue**
- **Exercise intolerance**
- **Migraines/headaches**
- **Gastrointestinal issues**
- **Nausea/diarrhea/constipation**

# Symptoms of Dysautonomia

- **Insomnia**
- **Joint / muscle pain / joint hypermobility / muscle weakness**
- **Menstrual irregularities**
- **Shortness of breath**
- **Thermoregulatory control issues**
- **Anxiety**
- **Low mood**
- **Tremors**
- **Frequent urination**
- **Cognitive impairment (brain fog)**
- **Visual blurring or tunneling**
- **Seizures/convulsive syncope**

# Symptoms in POTS Pts. (%)

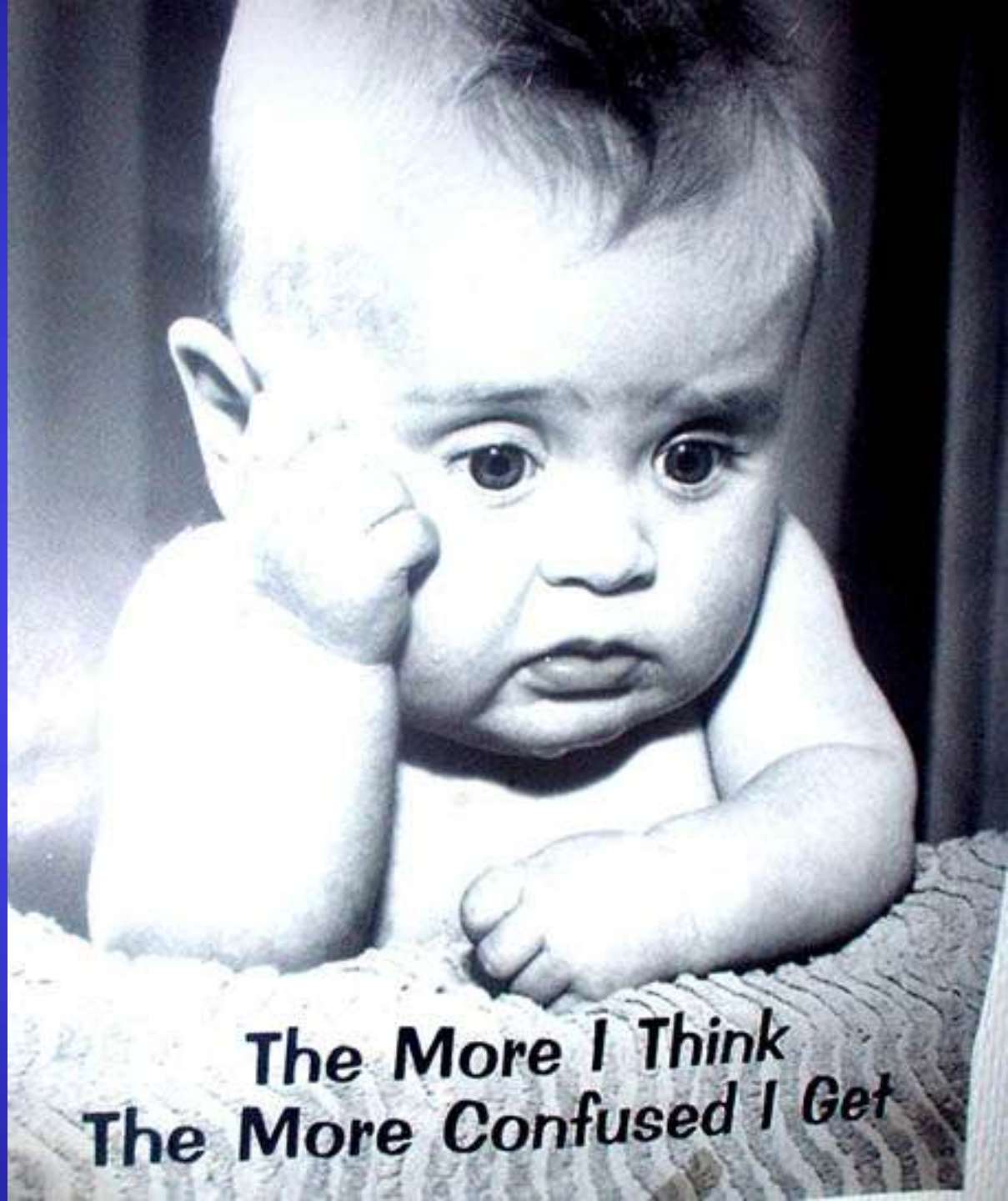


SO I HAVE A DIAGNOSIS, NOW WHAT?



**DRUG THERAPY  
POTS**

**WHERE TO START?**



**The More I Think  
The More Confused I Get**

# Methylphenidate in POTS: UTMC

- Non randomized retrospective analysis 24 patients with POTS. Dx based on pt hx, PE, HUTT. Mean follow up  $9 \pm 3$  months.
- Severe OI and refractory to common medications.
- Endpoint: Symptom control. Assessed subjectively from charts and provider communications.
- 18 patients completed followup. Nausea (4).





## Methylphenidate in POTS: Results

- 18 patients completed 6 month follow up.
- 14/18 (77%) patients reported marked improvement in their symptoms.
- 9/12 (75%) patients with recurrent syncope reported no syncope at 6 months follow up.
- 14/18 (77%) patients reported marked improvement symptoms of fatigue and presyncope.
- 4 patients continued to have OI and 3 recurrent syncope

# *Pyridostigmine*

The Vanderbilt group published a randomized double blind placebo controlled crossover trial of pyridostigmine in POTS pts. finding that it reduced heart rate + blood pressure changes as well as symptoms (Circulation 2005)

The Mayo group published a double blind placebo controlled crossover trial of pyridostigmine in OH, finding that it prevented a fall in BP without causing supine hypertension (Ann Neurol April 2006)

# Pyridostigmine in the treatment of postural orthostatic tachycardia: A single center experience

Kanjwal, Sheikh, Karabin, Elmer, Kanjwal, Grubb (2010)



- Retrospective analysis
- 203 patients (183 women, 20 men) with POTS refractory to other therapies given pyridostigmine 30 mg tid titrated to 90mg tid.
- Significant improved orthostatic intolerance 52% of those who could tolerate (168).
- Fatigue(55%), palpitations (60%), presyncope (60%), syncope (48%).

## Pyridostigmine: UTMC study

- Symptom reduction correlated with significant improvement hemodynamic parameters after treatment compared to baseline

Standing heart rate  $94 \pm 19$  vs  $82 \pm 16$   
( $p < 0.003$ )

Standing DBP  $71 \pm 11$  vs  $74 \pm 12$  ( $p < 0.02$ )

- Most common adverse effect GI problems nausea and diarrhea (17%) reported.

**In a subgroup of POTS patients refractory to other therapies pyridostigmine reduces standing HR, improves standing DBP and**

# Pyridostigmine: UTMC study limitations

- Small, non randomized, non controlled analysis
- Improved symptoms likely related to changes in hemodynamics, although this study lacked standard criterion for evaluating efficacy
- Study lies foundation for larger clinical trials, which could also predict which patients are more likely to benefit from pyridostigmine therapy





## Modafinil in POTS

- Retrospective nonrandomized analysis 60 patients with OI.
- Fatigue prominent symptom
- Failed multiple trials stimulants
- Each patient received modafinil (100-200mg daily). Mean follow up  $9 \pm 3$  months
- A treatment was considered successful if the patient reported symptomatic relief from fatigue.

# Results: modafinil POTS

- 60 patients , age  $29 \pm 15$ , 52 women.
- Migraine (57%) and joint hypermobility syndrome (33%) common comorbidities.
- 60/40 patients reported initial improvement.
- Of the 40 patients, 4 had recurrence of fatigue after 3 months.
- 36 patients continued to demonstrate symptom relief from fatigue for more than 6 months

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# Octreotide in the treatment of Refractory OI

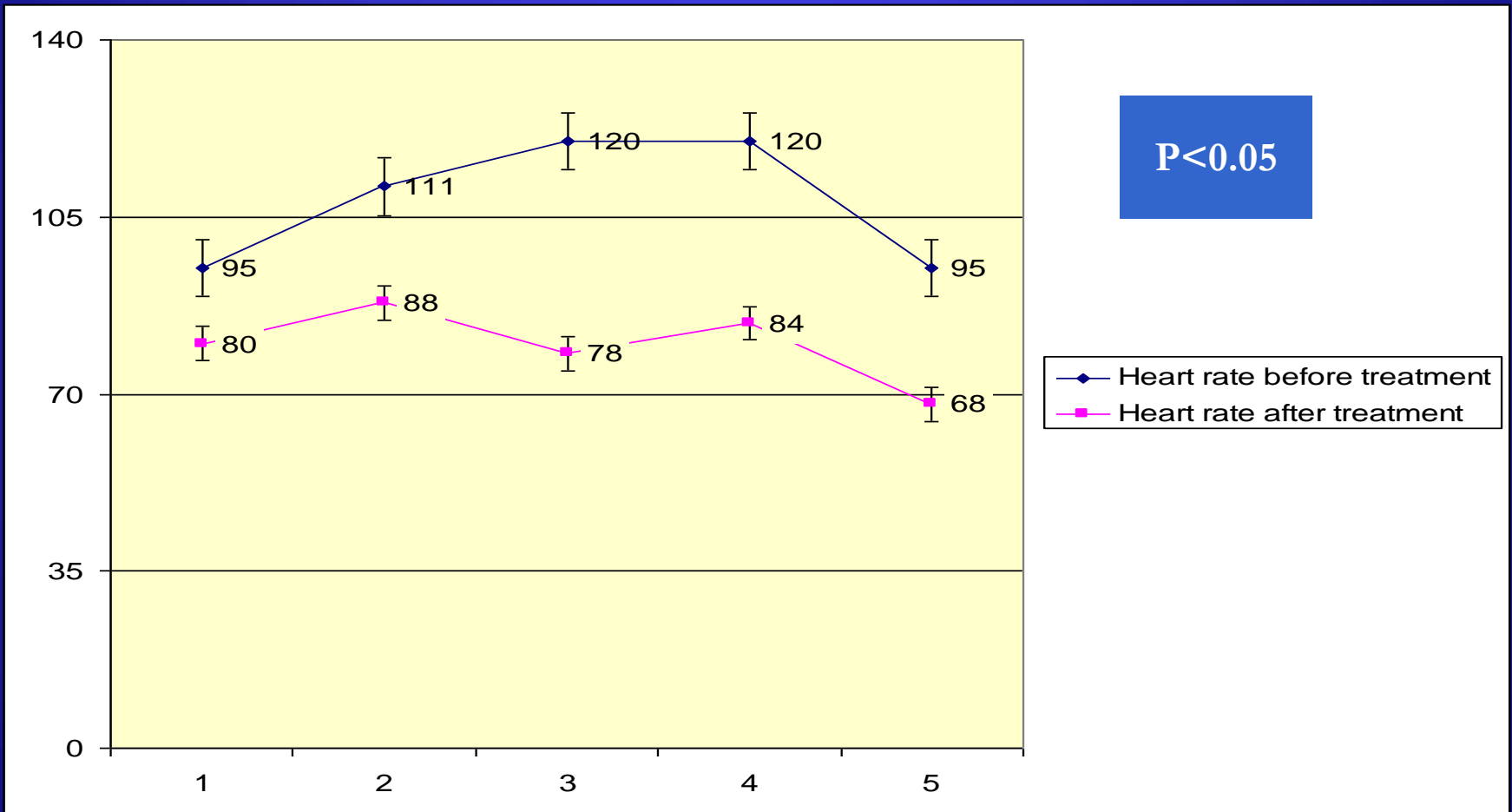
- There have been reports on the use of Octreotide in patients with orthostatic hypotension, postural tachycardia syndrome and orthostatic syncope. However there are little if any data on the use Octreotide in patients with refractory OI who fail multiple medications



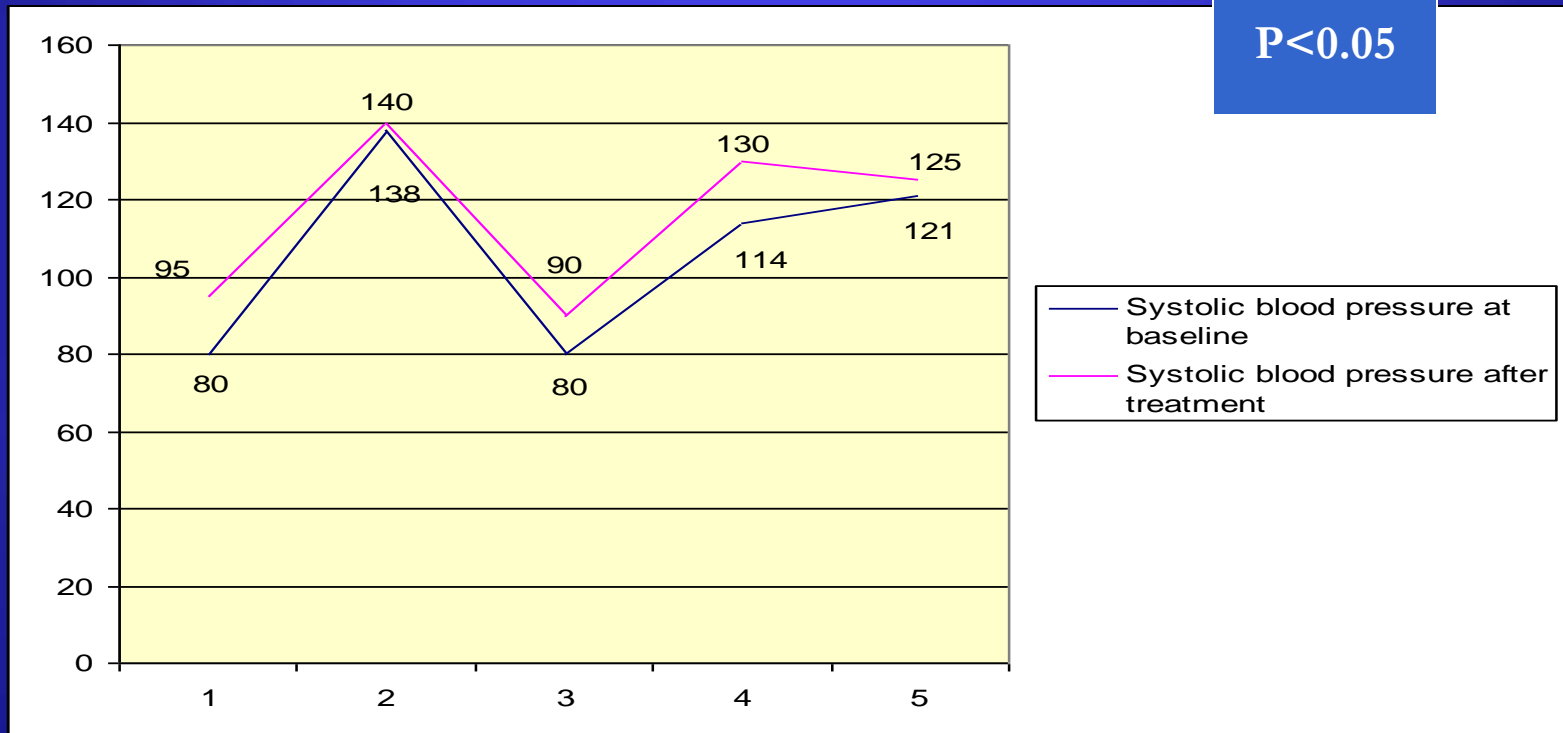
# Octreotide in Refractory OI

- **Symptoms of Syncope and orthostatic palpitations improved in 6 (50%) of the patients.**
- **Standing heart rate was significantly reduced after octreotide administration ( $80 \pm 8$  vs  $108 \pm 13$ )  $P < 0.05$ .**
- **The standing systolic blood pressure was increased after octreotide administration  $107 \pm 26$  vs  $116 \pm 22$ .**
- **Three patients (25%) reported complete elimination of syncope while as another three had reduction in the frequency of their syncope. However symptoms of fatigue improved only in 2(29%) of the 7 patients.**

# Effect of Octreotide on Heart Rate



# Effect of Octreotide on Standing SBP



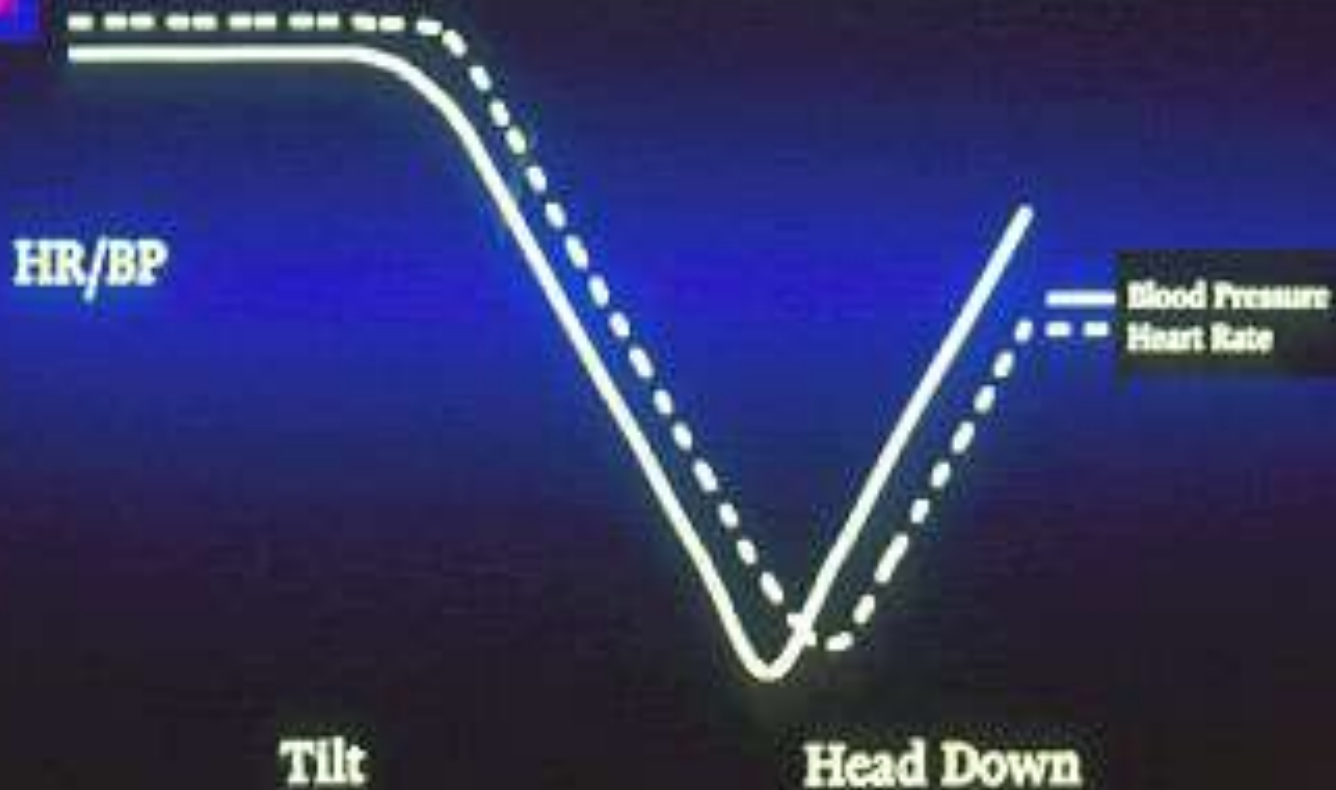
# Pacing and refractory NCS

- Subgroup of patients suffer from profound bradycardia or asystole during syncope
- Permanent pacing explored as a potential therapeutic modality
- Initial trials somewhat promising
- Later controlled trials failed to show benefit
- These trials hampered by the fact that they employed traditional pacing devices only capable of sensing heart rate alone

**NCS: Blood pressure falls prior to heart rate, thus rate dependent pacing is problematic.**



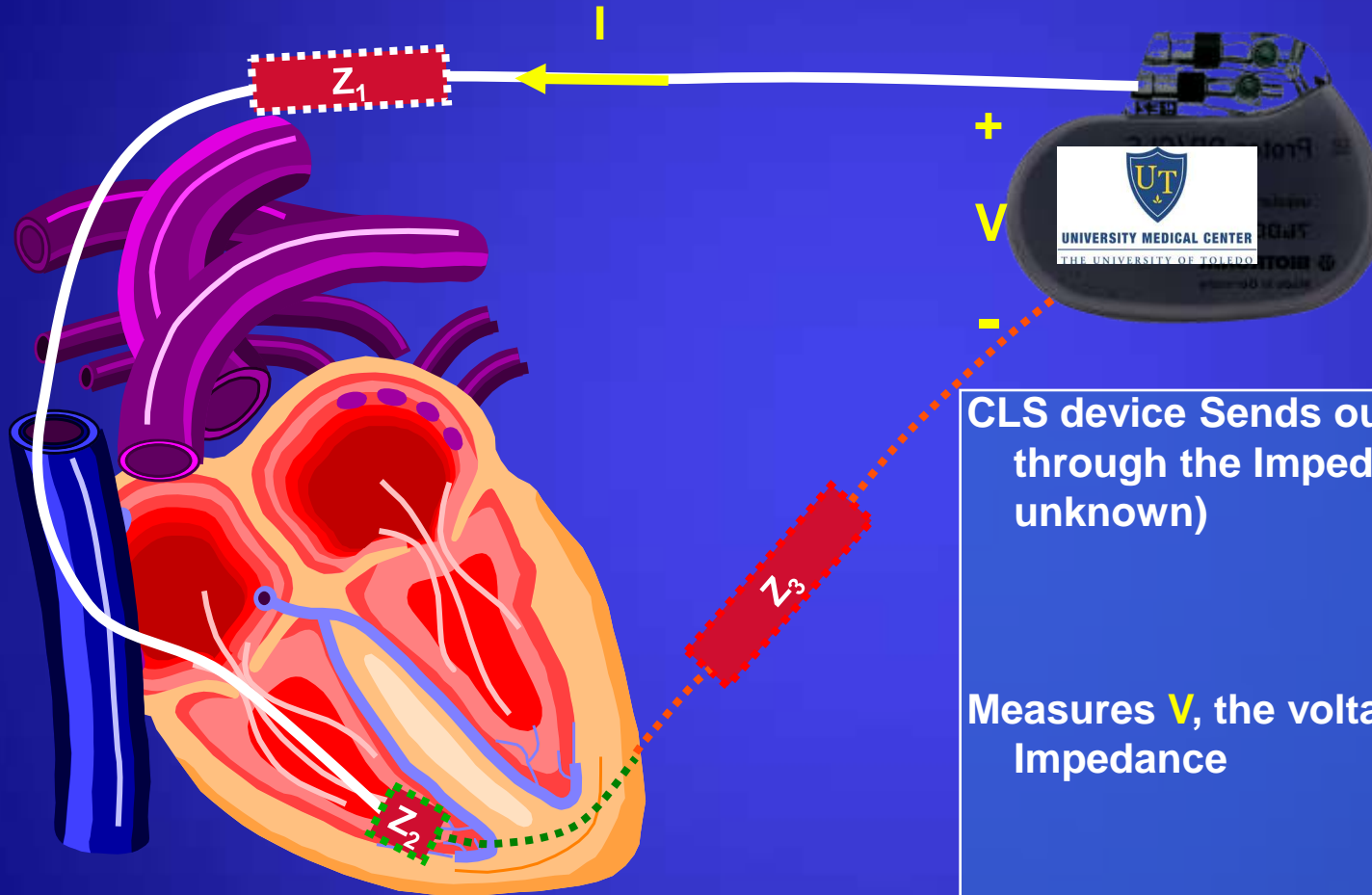
## Classic Neurocardiogenic (Vasovagal) Response



# Closed loop pacing: CLS

- Employs a sensing system using standard leads and a continuous electrical current that measures myocardial contractility, thereby providing a potential way to detect the onset of NCS at a much earlier point in time than that provided by standard pacing systems
- Capable of measuring right ventricular impedance on a beat-to-beat basis.
- CLS takes multiple impedance measurements throughout a ventricular contraction. Using these measurements, CLS establishes a reference curve which reflects contraction dynamics during a “rest” state. The result is increased pacing in response to changes in contraction dynamics.
- Device can be programmed to pace at higher rate when impedance suddenly rises (low volume to rt ventricle).

# CLS measures impedance as an Oh-m meter



CLS device Sends out constant current  $I$  through the Impedance  $Z$  (value unknown)

Measures  $V$ , the voltage drop across the Impedance

Use Ohm's law to calculate the impedance:  $Z = V/I$



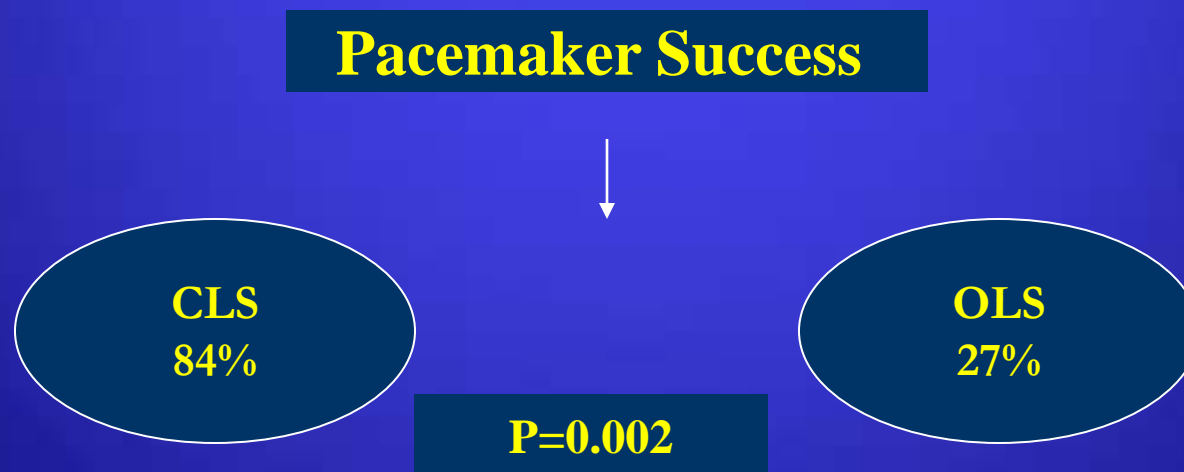
# Baseline characteristics

<b>Age</b>	<b>41 ± 11</b>
<b>Females</b>	<b>30(85%)</b>
<b>Mean Follow-up (Months)</b>	<b>12 ± 3</b>
<b>Total Number of Devices</b>	<b>44</b>
<b>Total number of Patients</b>	<b>35</b>
<b>Number of Patients receiving Cylos Biotronik CLS</b>	<b>32</b>
<b>Number of Patients receiving OLS</b>	<b>12</b>
<b>Number of Patients in Cylos group with prior OLS implants</b>	<b>9</b>



# *Criteria for Pacemaker Success*

1. **No recurrence of syncope**
2. **Syncope burden decreased by  $\geq 50\%$**
3. **If only presyncope occurred**
4. **If the syncope occurred but with significant warning symptoms following pacemaker implantation**



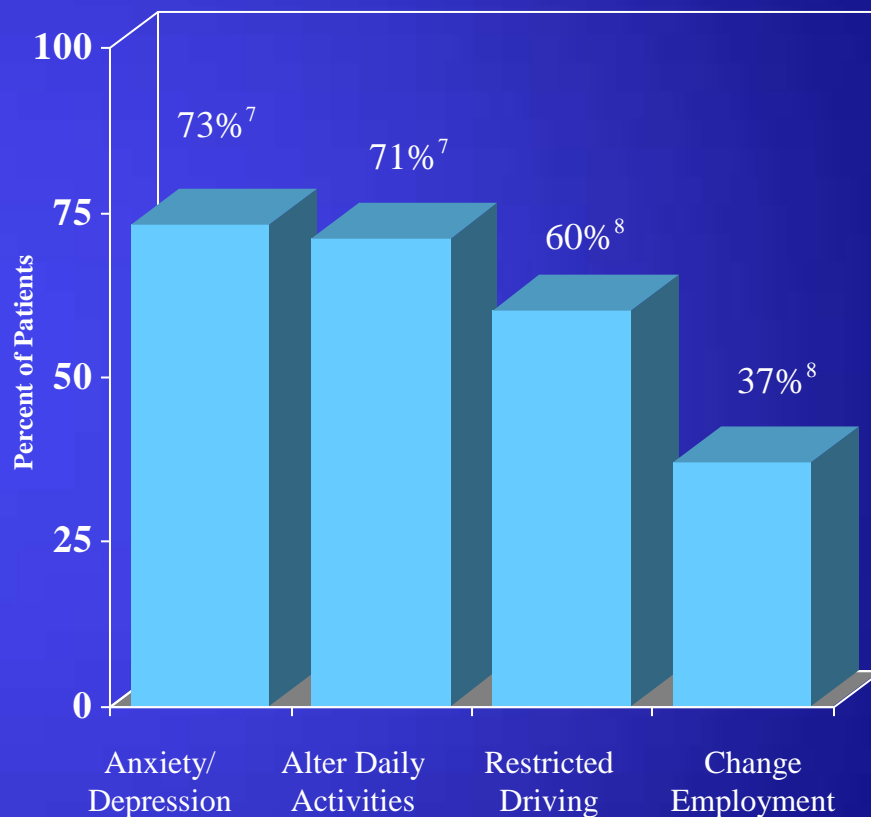


# Impact of Syncope

## Cost

- 40% will experience syncope at least once in a lifetime<sup>1</sup>
- 1-6% of hospital admissions<sup>2</sup>
- 3% of ER visits per year<sup>3</sup>
- 10% of falls by elderly are due to syncope<sup>4</sup>
- Syncope evaluation and treatment exceeds \$750 million per year in the U.S.<sup>5</sup>
- Estimated U.S. hospital costs are in excess of \$10 billion<sup>6</sup>

## Quality of Life Impact



<sup>1</sup> Kenny RA, et al. eds. *The Evaluation and Treatment of Syncope*. Futura;2003:23-27.

<sup>2</sup> Kapoor W. *Medicine*. 1990;69:160-175.

<sup>3</sup> Day SC, et al. *Am J Med*. 1982;73:15-23.

<sup>4</sup> Campbell A, et al. *Age and Ageing*. 1981;10:264-270.

<sup>5</sup> Olshansky B. *Syncope: Overview and approach to management*. In: Grubb B and Olshansky B. eds. *Syncope: Mechanisms and Management*. Armonk, NY:Futura;1998:15-71.

<sup>6</sup> Kenny RA, Kapoor WN. *Epidemiology and social costs*. In: Benditt D, Blanc J-J, et al. eds. *The Evaluation and Treatment of Syncope*. Elmsford, NY: Futura;2003:23-27.

<sup>7</sup> Linzer, *J Clin Epidemiol*, 1991.

<sup>8</sup> Linzer, *J Gen Int Med*, 1994.

POTS patients suffer a degree of functional impairment similar to that of patients with COPD or CHF

*Benrud-Larson et al, Quality of life in patients with postural tachycardia syndrome. Mayo Clinic Proceedings 2002: 77, 531-537*



*Approximately 25% of POTS/OI patients are considered functionally disabled and unable to work*

*Benrud-Larson et al ; Correlates of functional disability in patients with Postural Tachycardia syndrome: Preliminary Cross sectional findings. Health Psychology 2003; 22: 643-648*



# Disorders of orthostatic intolerance impair QoL

- Relationships
- Academics
- Employment
- Finances

## An unpredictable illness



“The only thing predictable about dysautonomia is that it is unpredictable”

# Conclusion

- *Disorders of the autonomic nervous system often cause alteration in the normal blood pressure and heart rate mechanisms that supply blood to the brain. As a result, patients affected with these disorders suffer from a number of daily symptoms that are not well recognized or understood by clinicians. Increased awareness of these disorders can help to improve the quality of life in these individuals.*



(National Council on Disability, 2003. <http://www.ncd.gov>)