Heart Rate Variability Testing in Sexual Dysfunction

Key Words:
heart rate variability, HRV, sexual dysfunction, autonomic dysfunction, dysautonomia, sympathetic nervous system, parasympathetic nervous system, non-invasive heart rate testing

Introduction:

Dysautonomia can result in sexual dysfunction, a complex and disturbing disorder affecting millions of men and women. Heart Rate Variability (HRV) tests, the gold standard for characterizing autonomic nervous system dysfunction, is a simple and non-invasive means of facilitating early diagnosis and appropriate intervention.

Discussion:

Sexual dysfunction is highly prevalent in both genders, ranging from 10%-52% of men and 25%-63% of women.[1] A myriad of factors play causative roles, including disease, age progression, pharmacotherapy, psychosocial difficulties, and those of psychiatric origin. Despite increasing prevalence, this distressing disorder continues to remain underreported due to reluctance by both patient and physician to discuss matters of a sexual nature. Sexual dysfunction can considerably diminish quality of life and requires early diagnosis for development of a successful treatment strategy. Treatments are dependent upon causative factors and include prescription drugs, surgery, alternative therapies, and lifestyle changes.

A complete workup for sexual dysfunction should include medical and sexual history, psychological evaluation, hormone testing, measurement of nocturnal penile tumescence, evaluation of penile, pelvic and spinal nerve function, and assessment of penile and brachial blood pressure. Blood flow impairment significantly contributes to impotence, and systolic penile blood pressure has been shown to be far lower in men with erectile impotence versus potent men. Current research is underway to determine if use of the cuff technique can help contribute to the management of lower urinary tract symptoms often contributing to sexual dysfunction.[2] Changes to blood flow in or out of the penis can also result in dysfunction.[3] Use of a transducer in the prostate/rectal sonogram provides an additional mode for assessing adequate blood flow. Endoluminal ultrasonography, an emerging technology using high frequency transducers, has been validated by preliminary studies as a potentially powerful diagnostic tool.[4]

Sexual dysfunction is frequently the initial manifestation of an autonomic nervous system (ANS) disorder. As such, the clinical workup should also include quantitative assessment of the ANS based on HRV analysis, the gold standard for characterizing ANS dysfunction. Autonomic function tests directly estimate the extent of involvement of the sympathetic and parasympathetic divisions, especially important when evaluating patients with dysfunction of an organic or psychogenic etiology.[5]

The ANS instinctively controls various bodily functions, including innervations of sex organs in both genders. Comprised of the sympathetic and the parasympathetic systems, the latter activates erections and the former is responsible for the ejaculation process. In women, the sympathetic also assists with smooth muscle contractions during orgasm. With ANS disruption, symptoms including sexual dysfunction can arise.[6]

HRV has been used in medicine since the early 1960s, originally in obstetrics. According to the Task Force of the European Society of Cardiology & the North American Society of Pacing and Electrophysiology, “HRV has considerable potential to assess the role of autonomic nervous system fluctuations in normal healthy individuals… HRV studies should enhance our understanding of physiological phenomena, the actions of medications, and disease mechanisms.”[7] Indeed, The American Heart Association and the American Association of Clinical Endocrinologists have both declared HRV as the recommended test for detecting autonomic dysfunction in Diabetes.[8]

Characterized as the beat-to-beat change in heart rate, HRV has long been heralded as an accurate indicator of ANS activity by providing a picture of the interplay between the sympathetic and parasympathetic branches.[9]

HRV is assessed on the basis of ECG R-wave interval analysis during spontaneous breathing and paced respiration. A second procedure involves use of the Finapres to simultaneously record beat-by-beat interbeat interval and blood pressure. These techniques provide the basis for spectral and/or sequence analysis to generate a number of indices related to autonomic function.[10]

HRV can be assessed by Time Domain or Frequency Domain indices. Time Domain measures are based on milliseconds in the beat-to-beat intervals or from the differences between the normal beat-to-beat intervals. The standard deviation of the normal R-R interval is the most clinically significant Time Domain measure. The smaller the standard deviation in R-R intervals, the lower the HRV. The lower the HRV, the greater the risk of ANS dysfunction. Though twenty-four hour assessment recorded with a Holter Monitor has been defined as the standard, a five-minute, in-office assessment has also been found clinically indicative.[11] Frequency Domain measures of HRV provide information on the frequency distribution of the components of RV using power spectral density analysis. Spectral analysis of HRV is characterized by four main components: high frequency (.15Hz -.40 Hz), which measures the influence of the vagus nerve in modulating the sinoatrial node; low frequency (.04Hz-.15 Hz), which provides an index of sympathetic effects on the heart; very low frequency (.003Hz-.04 Hz), which reflects the influence of several factors on the heart, including chemoreceptors, thermoreceptors and the renin-angiotensin system; and an ultra low frequency (.003 Hz).[12]

The Task Force[13] recommends that errors in HRV assessment be minimized by avoiding improperly designed equipment and incorrect techniques. Most commercial equipment includes standard deviation of normal to normal R-R intervals over a 24-hour period (SDNN) or over a brief measuring period; standard deviation of the average NN intervals for the 288 five-minute intervals in a 24-hour continuous ECG recording (SDANN); pNN50 and rMSSD; and total power, ultra-low frequency power, very low frequency power, low-frequency power, high frequency (HF) power, and the ratio of LF/HF.[14] To standardize physiological and clinical studies, two types of recordings should be used whenever possible: short-term recordings of five minutes made under physiologically stable conditions processed by Frequency Domain methods, and/or nominal twenty-four hour recordings processed by Time Domain methods. When statistical Time Domain or Frequency Domain methods are used, the complete signal should be carefully edited using visual checks and manual corrections of individual RR intervals and QRS complex classifications.[15]

A variety of HRV equipment exists on the commercial market, including:
- OmegaWave Technologies, LLC's HRV Assessment System, designed for sports and fitness use.
- Heart Rhythm Instruments, Inc.'s Nerve-Express, designed for quantitative assessment of the Autonomic Nervous System based on HRV analysis.
- ZENCOR Bioview model HRV, which utilizes a proprietary digital filtering algorithm to measure true R-R intervals to within ±1 millisecond accuracy.
- The Heart Tracker and the Heart Rhythm Scanner by Biocom Technologies, which offer analysis of HRV and provide information about cardiovascular diseases, stress and select mental illnesses.
- The CONTAK RENEWAL 3 CRT-D by Guidant, which offers a proprietary HRV Footprint to visualize the patient's heart rate and frequency over the previous twenty-four hours.
- CardioPro, a specialized physiological monitoring and biofeedback application.
- Mini Logger Series 2000 by Mini Mitter, which may be ordered to record telemetrically or by using a directly-wired version of the Polar chest belt.

One of the most advanced systems is the HRV Scan, developed by MedPond, LLC specifically for the purpose of assessment of HRV and autonomic function. All the system components interact with each other based on specific requests and the use of different media for each interaction. The testing unit is a physiological monitoring assessment system designed for the purpose of conducting all the HRV and autonomic assessment tests and consists of a PDA and the SpiroECG1 recording device. Special software installed on the PDA provides all necessary autonomic testing functionality. For more information on this innovative technology, see http://www.hrvresearch.com.

Assessment of HRV is not cost-prohibitive. However, it is imperative to remain current on coding, billing and reimbursement procedures, particularly in the managed care environment. It is recommended that third-party payers be contacted directly to discern rules and regulations governing billing and reimbursement procedures based on the patient's specific coverage. Assignment of accurate code(s) in relation to the patient's issue will ensure timely reimbursement. Autonomic testing is often reimbursed by many third party payers when used for

establishing a more accurate or definitive diagnosis, or contributing to clinically relevant medical decision-making. According to the medical technology developer, Ansar Group, Inc.,.[16] two reimbursable CPT codes were established in 1999 to allow physicians to be paid for autonomic nervous system monitoring. CPT 95921 provides for testing of cardiovagal innervation (parasympathetic), while CPT 95922 provides for vasomotor adrenergic innervation (sympathetic) testing. The International Classification of Diseases (ICD9) offers various related diagnostic codes including disorders of the autonomic nervous system (337), impotence of organic origin (607.84) and decreased libido (799.81), but individual codes and diagnoses will vary by patient.

Summary Conclusion:

Lower HRV rates have been found to be a significant predictor of diseases and even mortality in some patients, ranging from cardiac disease to psychological issues to autonomic dysfunction. Evidence of an autonomic disorder combined with low HRV rates may be indicative of sexual dysfunction and should be further investigated. With high patient compliance and ease of use, HRV is a versatile and cost-effective[17] strategy which can be used to diagnose varied conditions, including sexual dysfunction as related to the ANS. Moreover, this technology can be cost-effectively adapted to the office setting, serving as a valuable diagnostic tool. Further studies and emerging research will elaborate on this important technology and highlight the role of HRV testing as an accessible, first-line diagnostic measure in a number of clinical settings.

Resources:

HRV Research: http://www.hrvresearch.com/
HRV Congress: http://www.hrvcongress.org/
American College of Cardiology: http://www.acc.org
The Heart Math Report: http://www.heartmathreport.com
National Dysautonomia Research Foundation: http://www.ndrf.org/
National Institute of Neurological Disorders & Stroke Dysautonomia:
http://www.ninds.nih.gov/disorders/dysautonomia/dysautonomia.htm

References:

1-Centerwatch publication. “Sexual Dysfunction.” New Medical Therapies Newsletter. Online:

http://www.centerwatch.com/bookstore/pubs_cons_nmtbriefs.html. Accessed June 12, 2005.
2-Griffiths, C.J.; Rix, D., Macdonald, A.M., Drinnan, M.J., Pickard, R.S., Ramsden, P.D. “Noninvasive Measurement of Bladder Pressure By Controlled Inflation Of A Penile Cuff.” Journal of Urology, 167(3):1344-1347, March 2002. Online:

http://www.rmpd.org.uk/abstracts/urodynamics/non_invasive_measurement_of_bladder_pressure.htm. Accessed June 15, 2005.

3-Rufus Green Jr., M.D. FACS. “Urology Notes.” Online: http://www.urologyinstitute.com/html/erectile_dysfunction.html. Accessed June 15, 2005.
4-Sirish Kondabolu, Sardar A. Khan, Jennifer Whyard, Christopher Diblasio, Manasa Ayyala, Srinivas Pentyala. “The Role Of Endoluminal Ultrasonography In Urology: Current Perspectives.” Int Braz J Urol, Issn: 1677-6119. March - April, 2004, Volume 30, Number 2. Online:

http://Www.Brazjurol.Com.Br/March_April_2004/Kondabolu_Ing_96_101.Htm. Accessed June 11, 2005.
5, 6-Chelimsky, Thomas, MD, Director, Autonomic Laboratory at University Hospitals of Cleveland. “Autonomic Testing: Clinical Information.” Online:

http://mediswww.meds.cwru.edu/dept/autonomic/ANSTEST/BROCHUR.HTML. Accessed June 14, 2005.
7, 13, 15-Task Force of the European Society of Cardiology & the North American Society of Pacing and Electrophysiology publication. “Heart Rate Variability: Standards of Measurement, Physiological Interpretation, and Clinical Use.” Online: http://circ.ahajournals.org/cgi/content/full/93/5/1043.

Accessed June 14, 2005.
8-Lipsenthal, Lee, MD. “Heart Rate Variability & Emotional Shifting: Powerful Tools for Reducing Cardiovascular Risk.” Online:

http://www.heartmathreport.com/index.php/C34/. Accessed June 13, 2005.
9- Prendergast, Joseph, M.D. “Autonomic Neuropathy: Diagnosis & Treatment.” Online:

http://www.endocrinemetabolic.com/about/news/art100501.htm. Accessed June 12, 2005.
10-Duke University Medical Center Psychiatry & Behavioral Sciences publication. “Heart Rate Variability.” Online:

http://psychiatry.mc.duke.edu/behcard/Clinical.html. Accessed: June 11, 2005.

11, 12-Dr. Robert Nolan, Coordinator of Behavioral Cardiology Research at the Toronto General Hospital-University

Health Network. “Heart Rate Variability.” Online: http://www.thoughttechnology.com/pdf/CardioProFinal.pdf. Accessed June 12, 2005.
14 – Phyllis K Stein, PhD, Joseph E Mietus, BS and Ary L Goldberger, MD. “Heart rate variability: Uses other than after myocardial infarction.” Online:

http://patients.uptodate.com/topic.asp?file=carrhyth/39703. Accessed June 12, 2005.

16-The Ansar Group publication. “Reimbursement & Insurance Coverage.” Online: http://www.ans-hrv.com/ins.htm. Accessed June 15, 2005.
17- Rollin McCraty, Ph.D, Dana Tomasino, B.A. “Heart Rhythm Coherence Feedback: A New Tool for Stress Reduction, Rehabilitation, and

Performance Enhancement.” Online: http://www.heartmath.com/health/professional/health_studies.html. Accessed June 16, 2005.

About | Fee Schedule | Portfolio Samples | Contact | Home