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The Use of Penile Plethysmography in a Medicolegal Evaluation

Since the pioneering research of Masters and Johnson [1], it has been widely recognized that sexual arousal in the human male and female is associated with a clear pattern of physiological changes. During the first part of the sexual response cycle both men and women demonstrate a vasocongestive reaction in the genital organs. In the healthy adult male a penile erection is caused by the vascular engorgement of the spongy corpora of the penis [2]. In fact, the penis contains three cylindrical bodies of erectile tissue: the corpora cavernosa are the two dorsal cylinders, and the corpus spongiosum is the ventral cylinder through which passes the urethra. Each of these cylinders is composed of many small compartments separated by bands of smooth-muscle tissue. The arterioles supplying blood to these tissues are derived from the internal pudendal artery. Contractions of the muscles at the base of the penis appear to play a minimal role in the normal process of erection.

The measurement of male sexual arousal is readily achieved through a variety of physiological recording devices [3]. The common principle behind the numerous methods of penile plethysmography is the determination of increased blood volume in the penis. The most direct method of measurement is the volumetric plethysmograph [4]. In fact, we have reviewed a number of volumetric devices [3] that use either air or water as a displacement medium after a fixed-volume container has been placed over the penis. Although this method provides a very precise measure of the changes in penile volume, it is rather cumbersome and difficult to use. Nevertheless, the volumetric plethysmograph has been effectively used in laboratories in Canada [5] and Australia [6].

Because penile volume and circumference are usually highly correlated, it is possible to use penile circumference gages in the assessment of male sexual arousal. The circumference gages will not provide quite as much precision as the volumetric devices, but they are much more adaptable and easy to use. Two such gages have been extensively tested in the United States. The first type consists of a semiconductor strain gage embedded in a plastic cuff that is placed around the penis. Dr. David Barlow of Brown University has used this type of gage in a large number of research studies [3]. The other simple circumference device is a mercury-in-rubber gage that measures changes in penile circumference from changes in the resistance of the mercury column (as the gage is stretched the resistance of the mercury column will increase). In a major comparison study [7] this mercury gage was found to be both accurate and reliable. In our laboratory we have also found this gage to be the instrument of choice in a variety of studies on male sexual arousal [8-10].

Although the volumetric and circumference devices are the most commonly used methods for scientific assessment of erection, other techniques are also available. For example,

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placement of a sensitive thermistor on the shaft of the penis will show temperature changes as tumescence occurs. The increased blood flow into the penis will be associated with an increase in local body temperature. This method is somewhat indirect, however, and has not been sufficiently evaluated in controlled research studies.

Penile measurement devices are typically attached to a standard physiological polygraph. The amplifiers and strip-chart of the polygraph provide a very sensitive, precise, and readily quantifiable record of penile tumescence. Both volumetric and circumference methods have been used in a wide variety of basic research studies and clinical applications [3]. Several interesting medicolegal applications have been developed during the past decade. Medicolegal use of penile plethysmography can be considered separately in terms of criminal and civil cases.

Penile Plethysmography in Criminal Cases

Psychiatric evaluation of the sex offender can play a role in both criminal court proceedings and sex offender rehabilitation programs. In this respect, data from objective penile plethysmography tests can be of great assistance in differential diagnosis and psychiatric prognosis. For example, studies in the Department of Psychiatry at the University of Tennessee Center for the Health Sciences [11] have shown that different categories of rapists can be differentiated by the penile plethysmography method. By recording tumescence responses during presentation of specially prepared audiotape recordings, these researchers were able to discriminate those rapists with the highest frequency of rape, those who had injured their victims, and those who had chosen children as their victims.

Dr. Kurt Freund of the Department of Psychiatry, University of Toronto, has conducted a number of studies [12,13] investigating the sexual response of homosexual pedophiles. This category of sex offenders is felt to be particularly offensive by most community standards. In Dr. Freund's research studies, penile plethysmography has been used to differentiate a number of different classifications within the more general category of sex offenders. For example, by means of penile measurement, we can differentiate three different types: androphilic, ephebophilic, and homosexual pedophilic. The androphiles prefer physically mature male partners, the ephebophiles choose pubescent males, and the homosexual pedophiles are attracted to younger children. Clearly, it is this last group that elicits the strongest community reactions. At Rutgers Medical School we are using the mercury-in-rubber penile strain gage to evaluate cases of homosexual pedophilia.

Penile plethysmography is also useful in the ongoing evaluation of patients in sex offender rehabilitation programs. In particular, termination of treatment with such patients is of critical importance. There is a major need for objective assessment of sexual arousal in the presence of critical stimuli. Once it has been objectively determined that the sex offender no longer responds to the critical stimulus, the prognosis after release is clearly improved. Sex offenders who show continuing erotic interest in deviant stimuli should be retained in treatment before release. At times the penile plethysmograph readings can even be incorporated into the essential treatment technique [14].

Penile Plethysmography in Civil Cases

During the course of a normal night's sleep, we all pass through a series of sleep stages. In the sleep stage referred to as "REM" (Rapid Eye Movement) sleep, healthy adult males will show a clear penile tumescence response [7]. Such REM periods occur approximately every 90 min and will usually last from 5 to 15 min. Thus, during a 7-h night of sleep, the normal male will have four to six REM periods, each one of which is associated with observable penile tumescence.

Even though most dreaming occurs during the REM period, it does not seem that the

sleep erection is directly related to the dream content. Neutral or unpleasant dream imagery is just as likely to be associated with penile tumescence as dreams which are erotic in nature. At this time there are no completely satisfactory explanations of the sleep erection. The best we can say is that its universal occurrence implies that it has important survival value for our species.

Measurement of sleep erection is a relatively simple affair. Before the subject falls asleep the penile plethysmograph (usually mercury-in-rubber gage) is placed around the penile shaft. Electroencephalogram and electromyogram electrodes are also attached to provide an indication of when the subject has entered the REM period. Once the subject has become accustomed to the recording devices, he is required to pass the night sleeping in the experimental room with the devices attached. Most subjects adapt rather easily to this situation and are able to fall asleep in an hour or two. In rare cases two or three nights are required to accustom the subject to the laboratory situation.

Dr. Charles Fisher of the Mount Sinai Sleep Laboratory in New York has reported on the use of the sleep erection test in the diagnosis of impotence [15]. Specifically, Dr. Fisher has found that men who are experiencing impotence problems as a result of a clear organic factor such as diabetes will show little or no sleep erection at all. It seems that the peripheral neuropathy associated with the disease in these men will effect the innervation of the blood supply to the penis to the extent that the sleep erection is eliminated. Patients with spinal cord injury at the sacral level will similarly show no sleep erection. On the other hand, when the impotence problem is clearly functional or psychogenic in origin (usually as a result of anxiety or guilt), the patient will show a much stronger pattern of sleep erection. Dr. Karacan at Baylor Medical School has also reported on the use of this test in the differential diagnosis of impotence, and we have also recently begun using this test at Rutgers Medical School.

Like any clinical test, the sleep erection test is not entirely foolproof. Dr. Fisher has found certain rare cases where the sleep record does not provide a clear-cut distinction between organic and psychogenic causes. In such cases the test is normally repeated, or additional psychiatric and medical evaluation is obtained. However, in the great majority of cases, the sleep erection test provides objective, reliable evidence of the degree of organic involvement in the erectile disorder. An accompanying paper deals in more detail with the normal difficulties in establishing a differential diagnosis in traumatic impotence cases [16].

The differential diagnosis of impotence is particularly important in establishing prognosis for treatment. The techniques of Masters and Johnson have been effectively used in impotence cases of psychogenic origin. By working with both the husband and wife in a structured therapy program, we are able to overcome sexual anxiety and guilt and restore normal erectile function, normally within a relatively short time. However, when the impotence is due to organic factors such as diabetes or traumatic injury, the methods of Masters and Johnson are unlikely to achieve results. In some instances, corrective surgery (including penile prosthesis) can be helpful. In most cases of impotence resulting from organic disease or injury the prognosis for treatment is rather poor.

With respect to the medicolegal use of the sleep erection test, the evidential issues related to the sleep test are discussed in an accompanying paper [17]. The sleep record is an objective, potentially valid method for evaluating the nature of the impotence problem, but the normal court procedures will require that the test be conducted and reported under the appropriate medical supervision.

Summary and Conclusion

This paper has reviewed the methods of penile plethysmography. In most laboratories penile volume or circumference is assessed by a variety of different recording devices. Of

these different devices, we have found the mercury-in-rubber strain gage to be highly reliable and easily adaptable for clinical use.

The measurement of penile tumescence has been used in evaluation of the sex offender. In this respect the method can be used to differentiate categories of rapists or pedophiles. Such evaluation can influence both sentencing and rehabilitation decisions.

The sleep erection test has been used to diagnose impotence of organic or psychogenic origin. In certain civil cases, this test may be used to evaluate the nature and prognosis of impotence resulting from traumatic injury.

Objective measurement of sexual potential has proven of considerable value in the practice of sex therapy. This paper has indicated certain potential uses of penile plethysmography in a medicolegal context. At Rutgers Medical School we are continuing to investigate new applications of the technique in diagnosis and treatment of a variety of sexual disorders.

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