

24 Hour-Monitoring of Patients with Bladder Voiding Disturbances

K. Wanner, G. Haeussermann, F. Eisenberger and U. Faust

Department of Urology, Katharinenhospital, Stuttgart and Institute for Biomedical Engineering, Stuttgart, Federal Republic of Germany

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Summary. A system was developed and built for recording and processing urodynamic measurements during a 24 h period. The essential requirement was to obtain these signals without psychological stress. The system was small enough to allow the patient to move freely. Semi-conductor pressure transducers were employed for measuring total bladder and rectal pressures and detrusor pressure was obtained by subtraction. Results gained with this method revealed some differences to those obtained with conventional methods.

Key words: Cystometry, Long-term monitoring, Bed-wetting.

INTRODUCTION

Urodynamic examination is a pre-requisite for the diagnosis of urinary voiding disturbances.

The urodynamic parameters which are of interest are: 1. Pressure within the bladder, 2. Pressure within the rectum, 3. Time and event marking, 4. EMG of the pelvic floor, 5. Volume of urine.

PATIENTS AND METHODS

To obtain this data under conditions which were as physiological as possible, these parameters were recorded simultaneously during a 24 h period. On-line processing of the data was not used, but a commercially available tape recorder was modified to meet our needs (Fig. 1). Special plug-in units for the different signal transducers were developed to adapt them to the recorder (Fig. 2). With a normal C 120 cartridge a record-

ing time of 24 h was obtained. To speed up the processing of the recorded data the tape was replayed 60 times faster than recorded. The playback unit employed plug-in demodulators and amplifiers for the different channels (Fig. 3).

The size of the device was kept small to minimize the stress on the patient and to allow free movement yet it provided almost the same capacity to record urodynamic data as the large conventional measuring unit.

The 4 parameters recorded were chosen in order to suit the particular diagnostic problem. For each channel a different type of preamplifier and modulator was plugged into the device to adapt different input signals which kept the system flexible. During use the recorder was wrapped for protection against exposure to moisture (Fig. 4).

The signal for the pressure in the bladder was recorded via a suprapubic catheter. The pressure in the rectum was obtained from a balloon-catheter. Normal semi-conductor pressure transducers were used.

The current was supplied from the battery within the recorder. As the power consumption of these transducers is relatively high compared with that of the recorder a pulsed excitation was used to save 75% of the current without sacrificing sensitivity. By means of this technique recording time was not restricted by battery capacity. When a crystal controlled pulsed excitation was used, a time reference signal was recorded without taking up an extra channel. The signal for urine volume was obtained by measuring the reactance of diapers. This reactance tuned a variable frequency oscillator. The EMG-signal was obtained from an anal electrode.

The reproducibility and reliability of the system were checked in 20 adult patients who had been hospitalised for bladder voiding disturbances of various kinds. These patients underwent con-

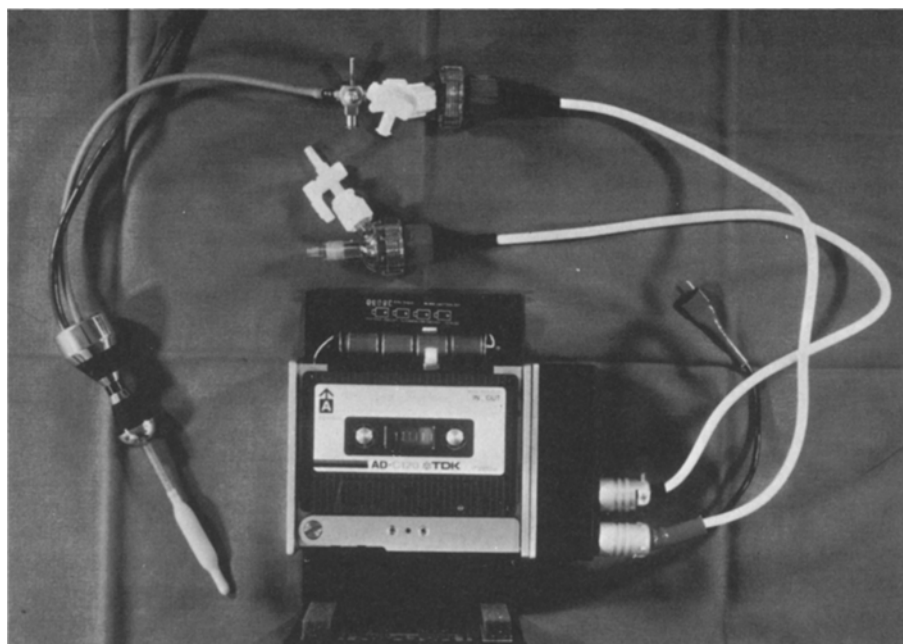


Fig. 1. Transducers and cartridge recorder for 24 h monitoring of urodynamic parameters

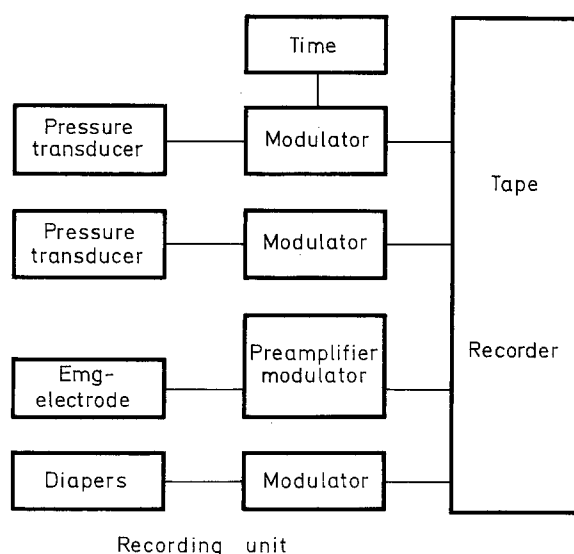


Fig. 2. Block diagram of the recording unit

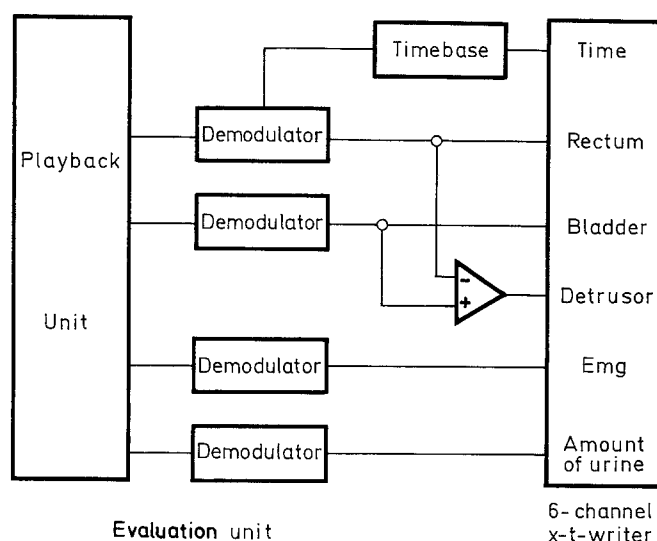


Fig. 3. Block diagram of the evaluation unit

ventional urodynamic investigations which included cystometry and urethral profilometry.

RESULTS

Simultaneous monitoring in the 20 adult patients with the procedure shown above yielded identical data with those obtained after conventional urodynamic investigation.

Forty children who were hospitalised for the investigation of bed-wetting underwent 24 h monitoring and all tolerated the procedure without any problems, whereas the conventional uro-

dynamic study either had to be interrupted because of psychological stress or resulted in false data in some cases.

Physiological filling of the bladder by the kidneys showed a different pressure profile compared with that during filling by means of a catheter. A clear increase in intravesical pressure could be observed during filling through a catheter (Fig. 5), whereas an increase in pressure during the physiological filling phase could be detected in none of the patients examined with our method. The increase of intravesical pressure occurred exclusively during micturition (Fig. 6).

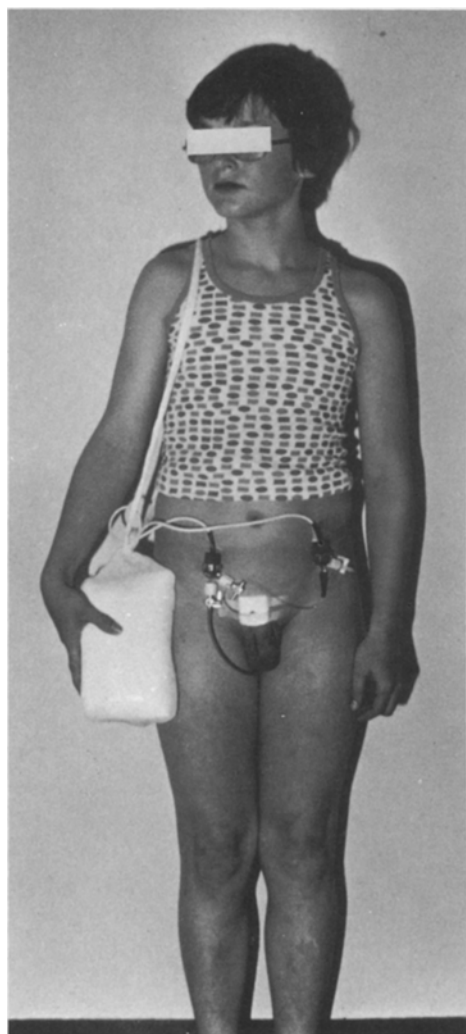


Fig. 4. Child prepared for 24 h monitoring

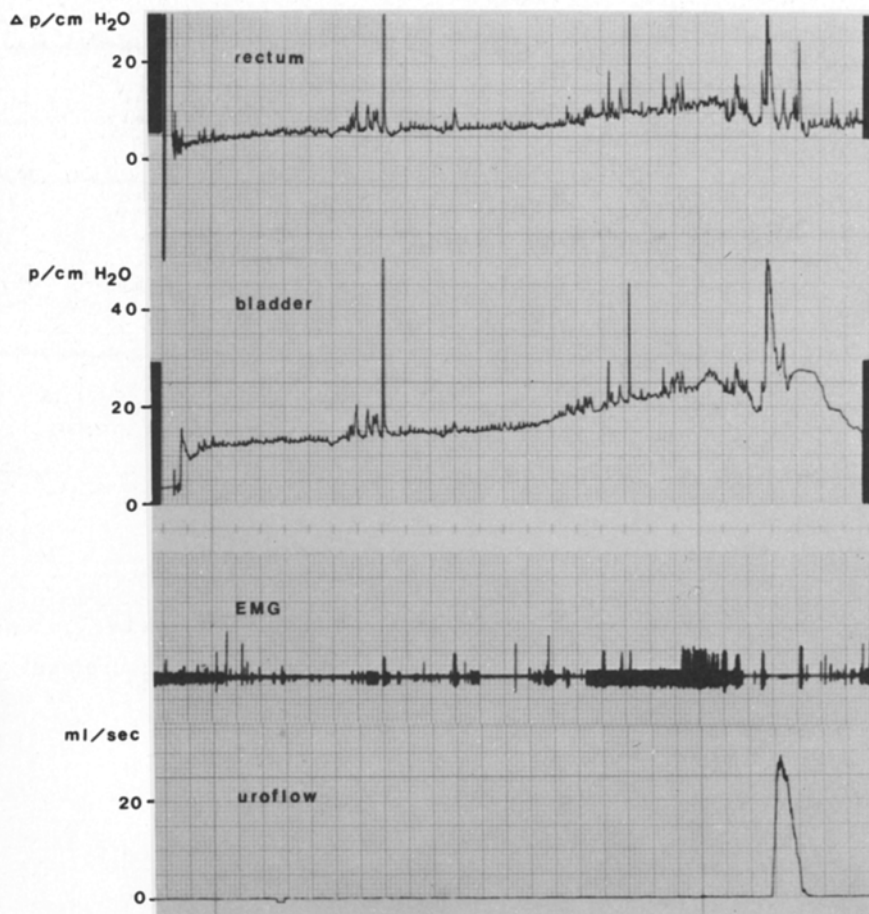


Fig. 5. Increase of pressure within the bladder during filling via transurethral catheter (filling rate 50 ml/min, capacity 300 ml)

DISCUSSION

Urodynamic measurements are usually taken under laboratory conditions (1) and last about 1 h. The bladder is filled via a catheter at a rate of 30 to 50 ml per min, according to an international standard (3). Since this is by no means a physiological method because of the rapid filling of the bladder and because of the psychological stress on the patient during this examination, the results obtained may be false. This turns out to be a problem, especially in the examination of children, for example, when the cause of bed-wetting is to be determined. Bed-wetting can be a normal micturition that cannot be controlled by the child. It is considered normal until the age of 4 and may persist beyond this age, depending on sleeping habits, environmental pressures, heredity, and toilet training (2). Various disorders, such as neuropathy, retarded development, and cerebral damage can result in pro-

longed bed-wetting as well (4). The urologist is interested primarily in bed-wetting as a direct result of acute disease or organic disorders, which he is trying to exclude by applying appropriate diagnostic procedures.

Before now it was not possible to register the pressure within the bladder during the phase of bed-wetting, which is important in gaining reliable information on the activity of the bladder to be able to differentiate between neurogenic bladder voiding disturbances and psychologically caused bed-wetting. This is of importance for the further management of the child.

In order to overcome these problems, we have developed a new monitoring system. Our method has made it possible to register a bladder pressure profile during a 24 h sleep-wake period. Thus bladder activity can be recorded during various phases, both during the day and at night. In some patients a clear increase in bladder activity - as is found in an upper motor neuron

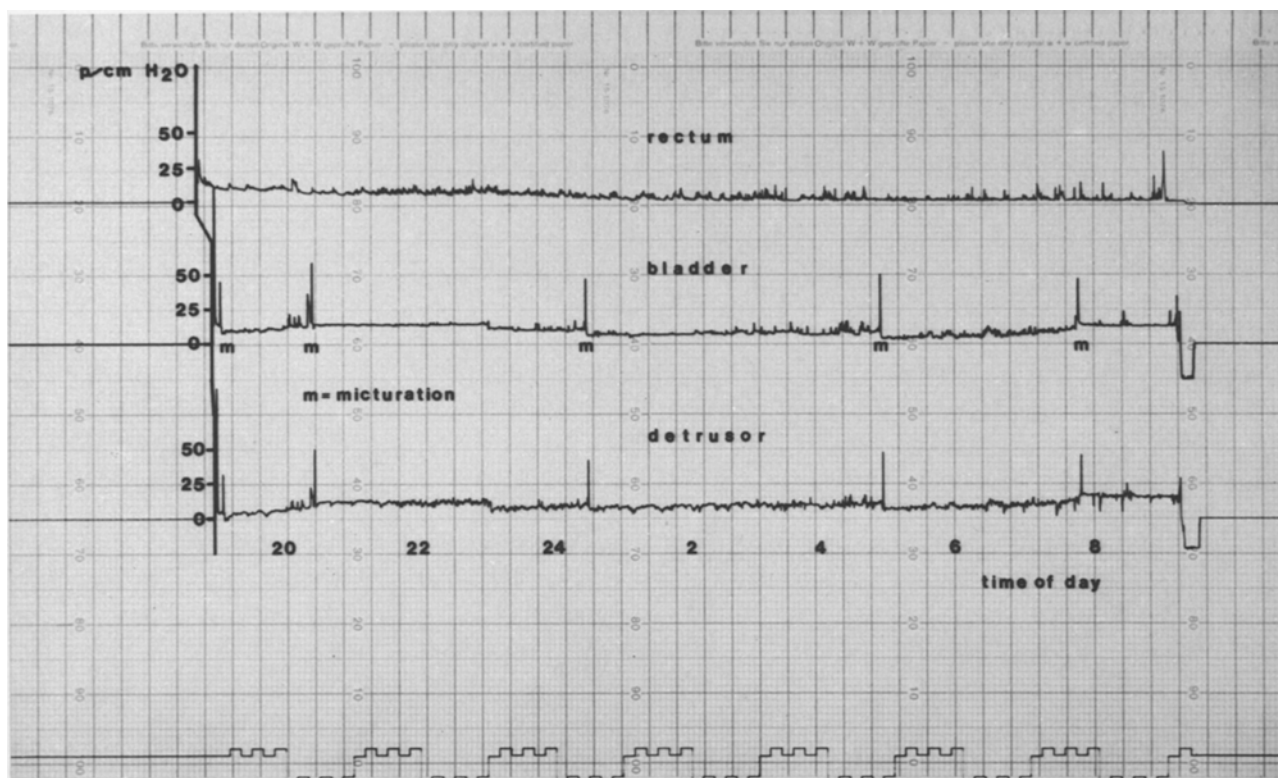


Fig. 6. Activity of bladder and rectum during 24 h measurement

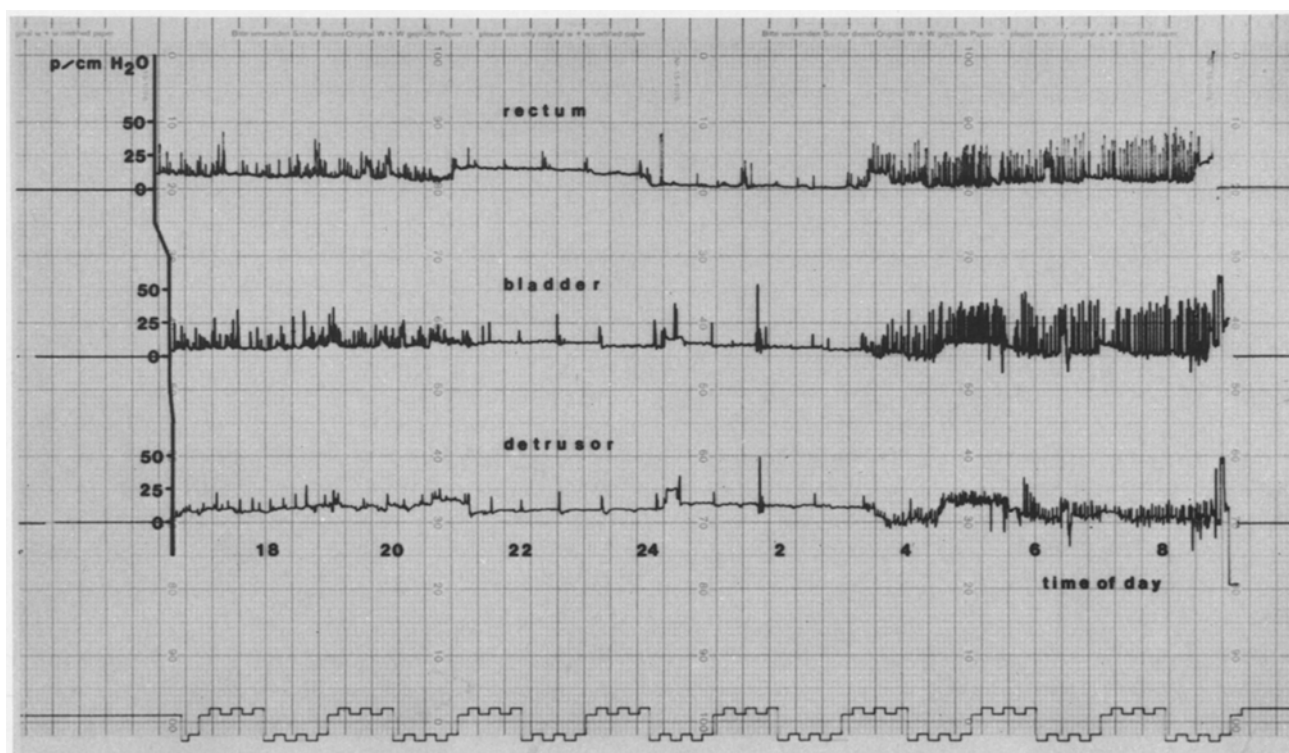


Fig. 7. Activity of bladder and rectum during various phases of a 24 h recording

lesion - was observed during the day, whereas evidently lower activity of the bladder was registered at night (Fig. 7).

It is our opinion that the new procedure offers a better method for acquiring detailed information on the activity of the bladder and this can be particularly useful in the diagnosis of voiding disturbances as well as bed-wetting.

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Prof. Dr. med. F. Eisenberger
Katharinenhospital
Akademisches Lehrkrankenhaus
der Universität Tübingen
Kriegsbergstrasse 60
7000 Stuttgart 1
Federal Republic of Germany