Real Time Study of Urine Flow Analysis

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Abstract: In this paper the design and fabrication of a pc interface for real-time study of urineflow analysis by using uroflowmetry is discussed which is a microcontroller based system programmed using 8051. Uroflowmetry is a non-invasive screening test used to measure the flow of urine during urination. The speed of urine flow is measured electronically and the flow is calculated as milliters of urine passed per second which is done using software. Visual C++ is chosen because of its ability to create a graphical user interface thus eliminating the need of writing numerous lines of codes to describe the appearance and location of elements. The flow rate values are displayed as a graph and this helps in accurate evaluation of the disorders which can be due to an obstruction or urinary retention problem.

Keywords: Uroflowmeter, Qmax, UTI’s, Uroflow patterns, Neurogenic bladder dysfunction

Introduction:
Urodynamics refers to a group of diagnostic procedures that are performed to evaluate voiding disorders. The goal of diagnosis and treatment of these disorders is to protect the kidneys and Keep the patient dry. The Parameters that are measured during a Urodynamics procedure can include Pressure and Flow

Urodynamics are primarily performed for evaluation of the urinary tract. Urodynamics is the term that describes a series of diagnostic tests used to evaluate voiding disorders. These tests will provide answers to clinical questions that arise about a patient's bladder and outlet function, after they have visited the physician with specific complaints

Flow Patterns:
There is no special technique to quantify flow patterns, they must be judged clinically by the classification. Uroflow however cannot absolutely diagnose a specific voiding dysfunction but rather suggest what the problem may be or, in most cases, prompt further evaluation. Uroflow patterns have been classified in several different ways. A normal uroflow patterns is a continuous, usually bell-shaped smooth curve with slight to moderate asymmetry, and any fluctuations in the smooth voiding curve are usually due to abdominal strain or sphincteric activity. Normal curve has been described as rapidly increasing flow rate, reaching one third of voiding time where voided volume is reached before total voiding time is reached in only one third of voiding time. Flow is the standard of measuring all characteristics of urine passed in the uroflowmeter. A Flow study is typically performed immediately after the uroflowmeter. To obtain optimum results, the study should be performed with a weight transducer, to prevent flow obstruction artifact. Abnormally high voiding indicates outflow tract obstruction. And voiding commonly occurs with a low voiding pressure . A poorly sustained voiding may be related to a failing detrusor. An unsustained voiding is likely to lead to residual urine. The detrusor flow usually falls as the sphincter is relaxed and voiding begins. Fluctuating detrusor contractions result in an irregular flow. This situation occurs most often in neurologically abnormal patients, particularly those with multiple sclerosis. The abdominal flow patterns can be described in many different ways.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal Blood Flow</td>
<td>Rbf=1000ml/Min</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>Hct=40%</td>
</tr>
<tr>
<td>Renal Plasma Flow</td>
<td>Rp=600ml/Min</td>
</tr>
<tr>
<td>Filtration Fraction</td>
<td>Ff=20%</td>
</tr>
<tr>
<td>Glomerular Filtration Rate</td>
<td>Glr=120ml/Min</td>
</tr>
<tr>
<td>Urine Flow Rate</td>
<td>V=1ml/Min</td>
</tr>
</tbody>
</table>

Uroflowmetry:
It is a simple, diagnostic screening procedure used to calculate the flow rate of urine over time. The test is noninvasive (the skin is not pierced), and may be used to assess bladder and sphincter function. Uroflowmetry is performed by having a person urinate into a special funnel that is connected to a measuring instrument. The measuring instrument calculates the amount of urine, rate of flow in seconds, and length of time until completion of the void. This information is converted into a graph and interpreted by a physician.
The information helps evaluate function of the lower urinary tract or help determine if there is an obstruction of normal urine outflow. During normal urination, the initial urine stream starts slowly but almost immediately speeds up until the bladder is nearly empty. The urine flow then slows again until the bladder is empty. In persons with a urinary tract obstruction, this pattern of flow is altered, and increases and decreases more gradually. The Uroflowmeter graphs this information, taking into account the person’s gender and age. Depending on the results of the procedure, other tests may be recommended by your physician. Uroflowmetry is a useful Urodynamic tool for the objective assessment of infravesical obstruction, and is helpful in the decision-making process and management of benign prostatic hyperplasia (BPH).1 Single-test office uroflowmetry cannot be regarded as universally reliable for the determination of bladder outflow obstruction (BOO) due to BPH; many patients, in fact, are unable to relax and void as usual at the clinic.

Some authors, besides, found variability between consecutive flow measurements and circadian changes in various voiding parameters, and particularly in maximum flow rate.2, 3 Therefore, any decision based on a single-flow measurement is questionable, since a natural situation is recommended when using uroflowmetry to depict a patient's normal voiding pattern. Data from a home-based portable flowmeter may accomplish this objective. Home uroflowmetry has been well accepted,4 and it gave different information from free uroflowmetry. It provided an estimation of BOO for 46% of the patients if the home mean Qmax was >14 ml/s.4 The calculation of mean parameter values, such as Qmax, becomes possible, in order to reduce the effect of random fluctuation in test results.

Procedure:
Uroflowmetry is a quick, simple diagnostic screening test that provides valuable feedback about the health of the lower urinary tract. It is commonly performed to determine if there is obstruction to normal urine outflow. Medical conditions that can alter the normal flow of urine include, but are not limited to, the following: Benign prostatic hypertrophy (BPH) - a benign enlargement of the prostate gland that usually occurs in men over age of fifty. Enlargement of the prostate interferes with normal passage of urine from the bladder. If left untreated, the enlarged prostate can obstruct the bladder completely. Cancer of the prostate or bladder tumor, Urinary incontinence - involuntary release of urine from the bladder. Urinary blockage - obstruction of the urinary tract can occur for many reasons along any part of the urinary tract from kidneys to urethra. Urinary obstruction can lead to a backflow of urine causing infection, scarring, or kidney failure if untreated. Neurogenic bladder dysfunction improper function of the bladder due to an alteration in the nervous system such as a spinal cord lesion or injury, frequent urinary tract infections (UTI’s).

Uroflowmetry may be performed in conjunction with other diagnostic procedures, such as cystometry and cystography. There may be other reasons for your physician to recommend uroflowmetry.

Conclusion:
Uroflowmetry is a simple, diagnostic screening procedure used to calculate the flow rate of urine over time. The test is noninvasive (the skin is not pierced), and may be used to assess bladder and sphincter function. Uroflowmetry is performed by having a person urinate into a special funnel that is connected to a measuring instrument. This information is converted into a graph and interpreted by a physician. The information helps evaluate function of the lower urinary tract or help determine if there is an obstruction of normal urine outflow. We are using microcontroller 8051, weight transducer and load cell. Uroflowmetry is used to screen the obstruction in the flow of urine, and can screen some diseases like BPH ,BOO, Prostate Cancer through the flow rate. In early days they used Capacitive Dip Transducer to detect the Flow of Urine . but the sedimentation of salts in urine reduces the sensitivity of the transducer,due to Poor maintanence.so they get errors. So we used weight transducer to rectify those errors. And more over we used visual C++ to get graphical array for the results.

References:

