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NEW UROFLOWMETRY MEASUREMENT BY WEARABLE AIRBORNE ULTRASOUND CONTINUOUS WAVE DOPPLER SYSTEM

Introduction

Conventional uroflowmetry (UFM) performs an observation of time-serial urinary flow pattern, together with measurements for total voided volume, maximum and average flow rate on voiding phase. Although conventional UFM is a relatively simple and non-invasive examination, it is based on a urine receiving container like a toilet device(s) equipped with various sensors, while the patient must go and urinate to such floor-mounted equipped toilet in hospital. It also causes an unnatural urination due to such unnatural environment, and hence improper understanding of patient status. The present study aims to abolish the concept of equipping the toilet bowl with various sensors while satisfying the need of measuring urinary flow anytime and anywhere in an easy, natural and repeated manner.

Design

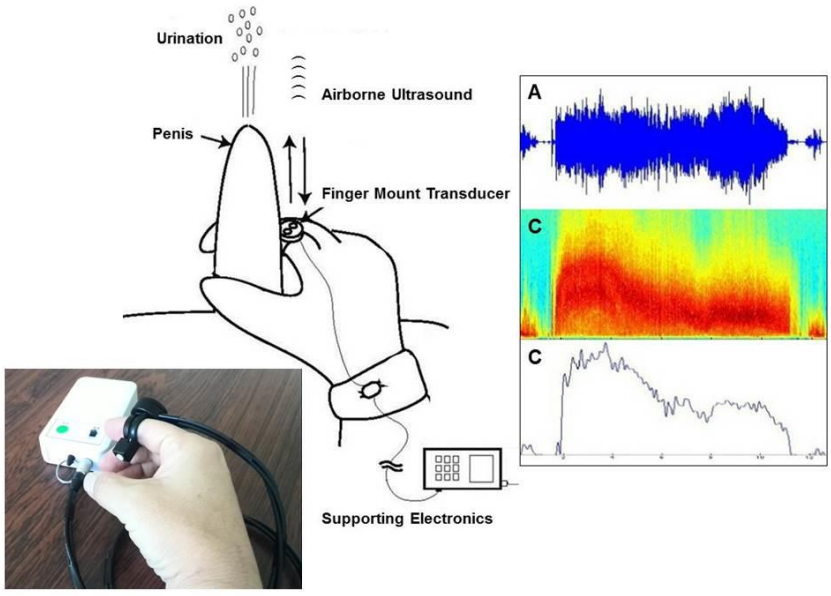
We developed a new UFM device based on the finger-tip mounted 40KHz airborne ultrasound continuous-wave (CW) Doppler system (figure). The frequency spectrogram (A to B) of the Doppler shifted echo of a urinary flow running in the air makes a time-series pattern (C). Signal processing for quantitative measurement was also embedded in the system. The sensor is designed wearable on patient's finger, while transmitter, receiver and supporting electronic circuit are currently built in an independent housing connected via a wireless connection. The new UFM device was used to collect urination data of normal adult volunteers, and compared with conventional UFM device for the compatibility and validity.

Results

The system provides urinary pattern qualitatively and diagnostically equivalent to the one derived from conventional UFM devices. The new UFM system can measure urinary flow of men and women in the same manner. Furthermore, the system can determine urinary flow using the same parameters as used with conventional UFM devices, such as voided volume and urinary flow rate, by locally weighted integration of frequency spectra. The video presents the overview of the system, signal processing procedure, and its results.

Conclusion

It was confirmed from the examination of effectiveness that there is a potential for the clinical application of the new UFM device. The results obtained suggest that the device may greatly change the concept of urodynamics in near future.



References

1. Hinyokika Kiyo. 2012;58(9):465-9.

Disclosures

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