Applying Micro-Raman Spectroscopy to Improve the Diagnosis of Urine Cytology

Introduction Objective

Urine cytology is the most widely used examination in the detection and follow-up of bladder cancer. It's a non-invasive diagnostic method and seems more acceptable than invasive examination, like cystoscopy. But for low-grade lesions, urine cytology is of limited value because of operator dependency and the low sensitivity rate. This study applied micro-Raman Spectroscopy(MRS)-based approach to urolithelial cells on the microscope of urine cytology to improve the diagnostic rate.

Material and Methods

In this study, urine cytology from bladder epithelial cells in the urolithelial cell carcinoma(38) and normal cells(33) were analyzed with MRS-based approach. Urine sample was a stained smears and nucleus of the urolithelial cell was used for Raman signal measurement. Raman spectra of the smears was listed as the following: 1000 cm^{-1} (phenylalanine band), 725 cm^{-1} (adenine, CH^2 deformation), and 538 cm^{-1} (adenine, S-S).

Results

The peak area of integration or its intensity variation decreased with the grade of malignancy potential of urolithelial cells. The results between MRS-based approach and pathologic diagnosis are compared to each other, and were set into the partial least squares (PLS) program for further analysis; the sensitivity was 97% and specificity was 100%. 725/1000 cm^{-1} peak area were used for construction of the ROC curve (receiver operating characteristic); the sensitivity revealed 81.8%, and the specificity disclosed 90.3%.

Conclusions

Micro Raman spectroscopic measurement for urine cytology analysis revealed a good accuracy to facilitate the clinical diagnosis. This method could provide an objective evidence to help pathologist and urologist to make an improved diagnosis especially in the gray zone