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Furuno T[1], Machino R[1], Tanaka H[1], Shibata T[1], Kakizaki H[1], Koyanagi T[1]
1. Department of Urology, Hokkaido University Graduated School of Medicine

PREDICTION OF OUTCOMES AFTER TRASNURETHRAL PROSTATECTOMY USING ARTIFICIAL NEURAL NETWORKS

Aims of Study

Pressure-flow study (PFS) is currently used to diagnose the prostatic obstruction and to determine the patients with appropriate indication of transurethral prostatectomy (TUR-P). However, the value of PFS has been argued because of its invasiveness and mostly favorable outcomes of TUR-P even in patients without clear urodynamic obstruction. Thus, we should search for a new tool that will have an integrated ability and enable us to predict outcomes after TUR-P without the use of PFS. We evaluated the performance of a backpropagation artificial neural networks (ANN) in the prediction of outcomes after TUR-P.

Methods

62 patients with symptomatic benign prostatic hyperplasia underwent evaluations with International Prostatic Symptom Score (I-PSS), free-flow uroflowmetry (UFM), filling cystometry and pressure flow study (PFS) before TUR-P. According to the Abrams-Griffiths nomogram, 34 and 28 patients were categorized as obstructed and equivocally obstructed, respectively. Three months after TUR-P, the patients were reevaluated with I-PSS and UFM. Symptomatic and functional outcomes after TUR-P were defined as success if total IPSS was reduced 25% or more and maximum flow rate (Qmax) was improved by 2.5 mL/sec or more, respectively. Symptomatic and functional outcomes of TUR-P were analyzed by using a three-layered backpropagation ANN with 3 to 5 hidden nodes. As the items for input layer, we selected patients' age, IPSS, Qmax, post void residual (PVR), the presence or absence of detrusor overactivity during the filling cystometry, and detrusor pressure at Qmax on PFS. When we trained ANN, symptomatic or functional outcomes were set in the output layer. We trained 3 ANN models. The ANN with non-invasive test (ANN-n) was trained by only non-invasive diagnostic test results (I-PSS, PVR and UFM). The ANN with cystometry (ANN-c) was trained by the parameters of ANN-n plus cystometry results. The ANN with PFS (ANN-p) was trained by all parameters listed above. Each ANN model output predicting values in symptomatic and functional outcomes. The predicting value is ranged 0 to 1. The predicting value 0.5 or more is indicative of successful outcome. We quantified the outcome predicting values calculated with these ANN models and compared the predicting ability of each ANN.

Results

6 and 10 men had unfavorable symptomatic and functional outcomes after TUR-P, respectively. A total of 15 men had unfavorable overall outcomes (either of unfavorable symptomatic or functional outcomes). In the prediction of symptomatic outcomes, ANN-n incorrectly output successful predicting values for 2 of 6 men with unfavorable outcomes. ANN-c and ANN-p correctly output predicting values for all cases. In the prediction of functional outcomes ANN-n, ANN-c and ANN-p incorrectly output successful predicting values for the same 2 men of 10 with unfavorable outcomes. In the prediction of overall outcomes, ANN-n failed to predict unfavorable outcomes in 4 men, and both of ANN-c and ANN-p failed in 2 men.

Conclusions

Basically the success rate of TUR-P was high (about 80 to 90% success in symptoms and function) in the present study. Thus, the most important issue is how to predict less invasively a small number of men who would have unfavorable outcomes after TUR-P. In the present study, ANN-n, ANN-c and ANN-p models had no significant difference in the predicting ability of symptomatic and functional outcomes after TUR-P. These results may suggest that ANN-n could be used for the correct prediction of unfavorable outcomes after TUR-P. If refined with more data (eg. estimated prostatic volume) and more number of patients, ANN-n could eliminate the use of invasive urodynamic study to predict outcomes after TUR-P.

References

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