WATTS FACTOR CURVE SHAPE ANALYZED USING UNSUPERVISED MACHINE LEARNING

W. van Dort, P.F.W.M. Rosier,
T.R.F. van Steenbergen, L.M.O. de Kort

w.vandort-2@umcutrecht.nl

Background and aim

The Watts Factor (WF) is a urodynamic parameter describing the output power of the detrusor voiding contraction (DVC). Although some studies used WF parameters, its curve shape was never assessed. The WF shape could provide new insights into the DVC, which are currently unknown. Unsupervised machine learning (UML) is a tool which can cluster similar WF shapes.

The aim of this study is to assess the WF curve using UML and describe properties of the resulting clusters.

UMC Utrecht

Methods

1656 high-quality pressure-flow studies (PFS) of men with LUTS without relevant history were included in the analysis. The WF was calculated and normalized from 1 (maximal WF) to 0 (minimal WF). The corresponding bladder volume was also normalized from 1 (full bladder) to 0 (end of voiding), and reduced to 10 points, for which the average WF was calculated. The analysis was performed using the UML KShape learning model, which is most suitable for shape analysis. The PFS's were clustered by the UML in three clusters, and urodynamic and clinical differences between the clusters were assessed.

Conclusion

UML found three types of WF curves in men with LUTS, which had significantly different urodynamic and clinical parameters. Patients with a decreasing WF voided significantly better than patients who showed an increase in WF during voiding. This contradicts the current statement in the literature that a decreasing WF correlates with worse voiding.

Results

Most WF curves were clustered in cluster 1, showing an increase in WF during the voiding. Cluster 2 also showed an initial increase, followed by a decrease in WF in the second part of the voiding. Patients in cluster 1 voided significantly worse, compared to cluster 2, with more obstruction and lower voided volume, while displaying a similar detrusor contractility index. Additionally, these patients were older and had a larger prostate. Cluster 3 was more diverse, but always significantly different from either cluster 1 or 2.

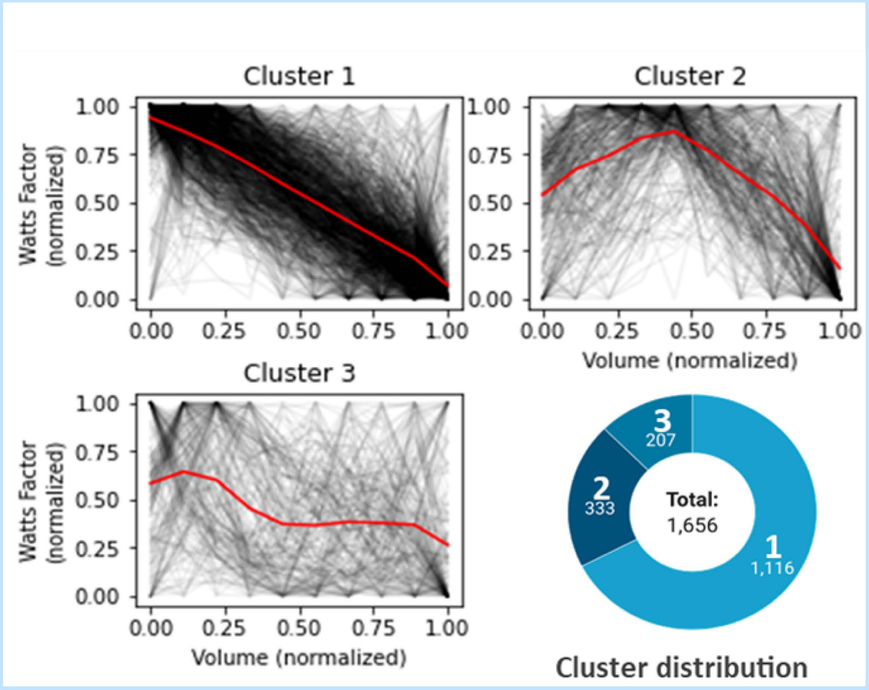

Figure 1: overview of the resulting UML clusters. Cluster 1 showed on average an increase in WF during voiding. This was also initially visible in cluster 2, but here it was followed by a decrease at the end of the voiding. Cluster 3 was more diverse, but always significant different from either cluster 1 or 2.