Assessment of prostate carcinoma architecture through fractal analysis in correlation with Gleason and Srigley grading systems

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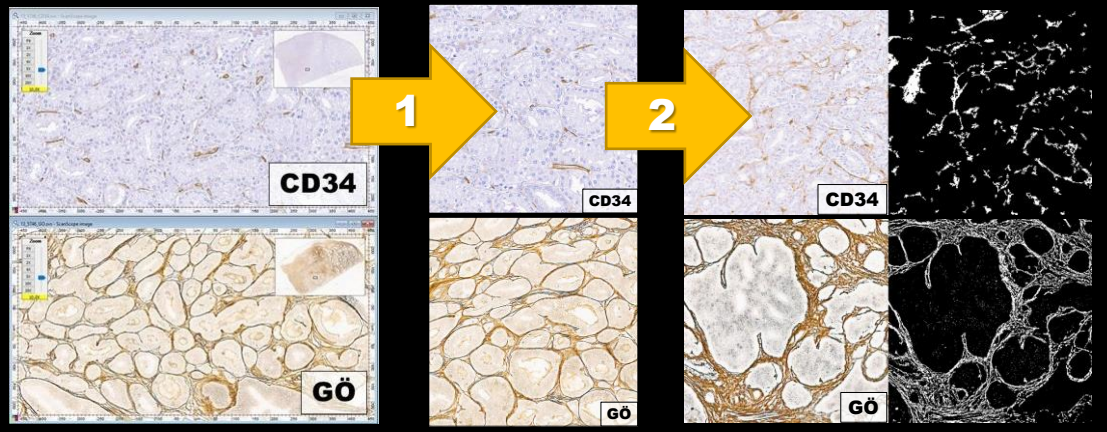


Introduction

The aim of the study is to assess the existence of possible connections between tumour cell architecture (GO) and vascular network architecture (VN) in relation with two different grading systems of prostate carcinoma (PC) described by Gleason and Srigley using the fractal dimension (FD) analysis.

Material and methods

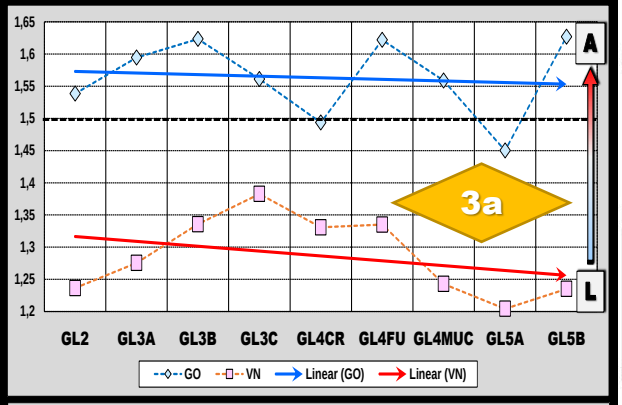
435 prostatic tissue fields with different individual PC patterns according to the above mentioned grading systems were selected and stained on three serial sections with: H&E for grading and Gömöri technique and CD34 immunomarker for assessment of Tumour cells (GO) and vascular network (VN) architecture respectively (Step 1).
Images were binarized using colour focus for CD34 and intensity focus for Gömöri stains (Step 2).
The FD was computed for each binary image using a box-counting algorithm. Values tending to "1" meant a more "Linear type" distribution (Lt-D), while those to "2" meant a more "Area/Surface type" distribution (At-D). The averages (AV) of the two values were clustered and classified using "k-nearest neighbour" approach.

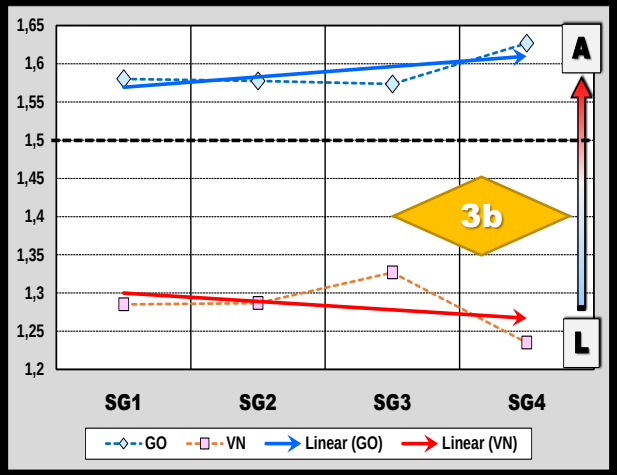
Results and discussion

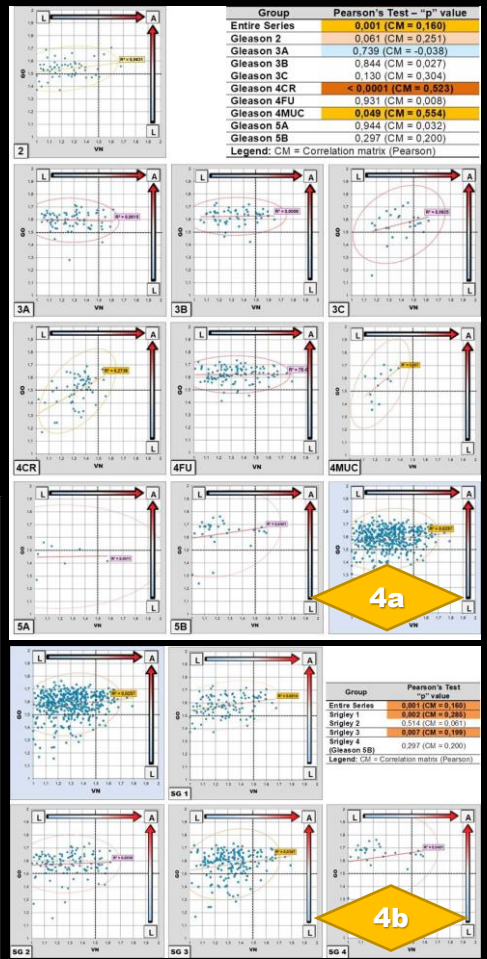
GO AVs had a more ordered smooth ascending trend towards At-D (FD > 1.5) in Srigley system (Step 3b) than in Gleason system (Step 3a) while VN AVs had a clear Lt-D (FD < 1.5) with a descending trend towards high-grade patterns in both systems .
Both AVs had a direct correlation (Pearson's test p value < 0.001 with CM=0.180), evolving either towards At-D or Lt-D together in both systems (Step 4 a and b).

Conclusion

VN follows GO when related one to the other, but they are evolving smoothly divergently in relation with the degree of differentiation especially in Srigley system.







KW: fractal analysis Gleason grading system Srigley grading system