PVT-Index and Meta-Index built from qFibrosis Demonstrated Potential as Prognostic Estimation Models

Using qFibrosis analysis to predict disease and survival outcome of patients with hepatocellular carcinoma after curative treatment

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1 Introduction

- In liver cancer, there is a lack of studies addressing the prognosis value of the stromal background and fibrosis features (i.e., stromal remodelling in tumor microenvironment, collagen realignment in the stromal compartment, collagen fibers and basal membrane) where they play an important role in cancer progression.
- qFibrosis system [1], with SHG/TPEF imaging technology, can identify, quantify and visualize the fibrosis features from biopsies. Well validated on its application in diagnosis and prognosis of Hepatitis B (HBV) and Non-alcoholic Steatohepatitis (NASH).

2 Aim

In this study, we aim to establish a prognostic estimation model by using qFibrosis analysis in liver cancer.

3 Method

- Included 198 patients with HCC and underwent curative tumor resection.
- Analyzed the patients' disease status, survival time, and clinical outcomes of whether portal vein thrombosis (PVT) and metastasis (Meta) developed during follow-up after surgery.
- Imaged patients' liver tissue and liver tumor using stain-free Genesis®200 multiphoton imaging system [2] and assessed using qFibrosis system, and after which 33 + 156 collagen parameters were generated from liver tissue and tumor part, respectively.
- Built two models – PVT -index and Meta-index – to differentiate the patient's clinical outcome of developing PVT and metastasis. The models are validated using leave-one-out method.

4 Results

- Both developing PVT and metastasis were significant indicators for poor prognosis.
- 7 parameters are selected from the parameters of liver tissue and tumor part to build the PVT-index and Meta-index and are shown in Table 1.

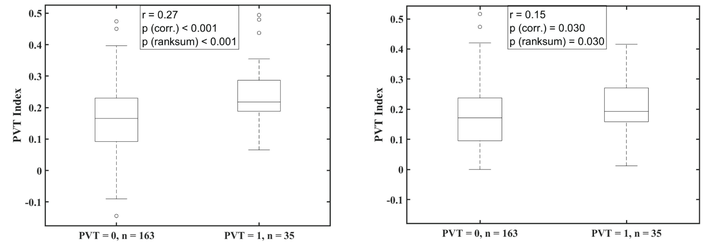
Table 1

Model	Parameter No.	Part	Parameter Name	Description
PVT-index	1	tumour	%Agg	Percentage of aggregated collagen for overall fibrosis in tissue area
	2	tumour	#ShortStr	Number of short strings for overall fibrosis unit tissue area
	3	tumour	norm #ThinStr	Number of thin strings for overall fibrosis unit tissue area divided by number of all strings
	4	tumour	norm StrWidth	Width of all strings for overall fibrosis unit tissue area divided by area of all strings
	5	nontumour	ratio #ThickStr/#ThinStr	Ratio of number of thick strings and thin strings for overall fibrosis unit tissue area
	6	nontumour	#ShortStrPTDis	Number of short and distributed for portal tract fibrosis per unit tissue area
	7	nontumour	#ShortStrZone2Agg	Number of short and aggregated for zone 2 fibrosis per unit tissue area
Meta-index	1	tumour	norm #ThickStr	Number of thick strings for overall fibrosis unit tissue area divided by number of strings
	2	nontumour	#ThinStrPT	Number of thin strings for portal tract fibrosis per unit tissue area
	3	nontumour	#ThinStrPTDis	Number of thin and distributed for portal tract fibrosis per unit tissue area
	4	nontumour	StrAreaPeriCentralDis	Area of distributed for peri-central fibrosis per unit tissue area
	5	nontumour	StrWidthCV	Width of all strings for CV fibrosis per unit tissue area
	6	nontumour	#ThickStrCVDis	Number of thick and distributed for CV fibrosis per unit tissue area
	7	nontumour	#IntersectionCV	Number of intersections of all strings for portal tract fibrosis per unit tissue area

4 Results continued

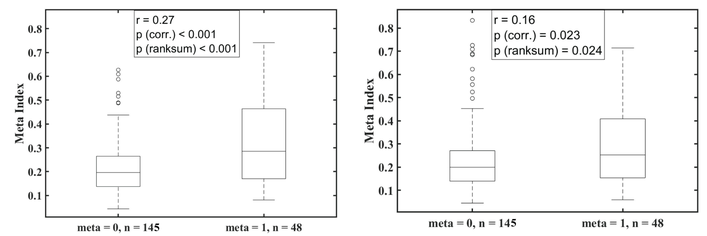
- The PVT-index well differentiates patients developing PVT ($p < 0.001$ for training, $p = 0.030$ for validation), as shown in Fig. 1a.

Fig. 1a



- Meanwhile, the Meta-index also well differentiates patients developing metastasis during follow-up ($p < 0.001$ for training, $p = 0.024$ for validation), as shown in Fig. 1b.

Fig. 1b



5 Conclusions

Prognostic models built from the collagen parameters in the qFibrosis system can predict HCC patient's clinical outcomes of developing PVT and Meta during follow-up after radical treatment and show the transformation of the histopathological features into quantifiable data that could be used to correlate with patient outcome as other clinical biomarkers.

6 Acknowledgements

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7 References

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