HeCaPRED: an AI-based algorithm for HCC prediction in patients with HCV chronic infection after SVR

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BACKGROUND

- Achieving sustained virological response (SVR) reduces the risk of liver decompensation and hepatocellular carcinoma (HCC) in patients with chronic hepatitis C virus (HCV) infection and advanced liver disease.
- However, life-long HCC surveillance is recommended after HCV cure in patients with cirrhosis, but its cost-effectiveness is uncertain, especially in the context of HIV co-infection, where data remain scarce.

OBJECTIVE

To develop and validate a model to predict the emergence of HCC among patients with chronic HCV infection, with and without HIV infection, and advanced fibrosis who achieve SVR with DAA-regimens, using machine learning

METHODS

- **Design:** Multicenter prospective study conducted in the GEHEP-011 cohort (ID: NCT04460157) in 17 hospitals in Spain
- **Patients:** Chronic HCV infection with and without HIV co-infection with: 1) Liver stiffness (LS) prior to treatment ≥ 9.5 kPa; 2) SVR with DAA-based therapy; 3) LS measurement at SVR. Individuals with HBsAg positive, active alcohol consumption (>50g/day) and those with prior hepatic complications (including HCC) were excluded.
- **Main outcome:** occurrence of de novo HCC.
- **Analysis:** The population was split as follows: 67% for model discovery, 33% for validation. A novel ad-hoc AI algorithm was developed to identify patients at low risk of HCC. Such an algorithm builds a binary tree model, where the best feature and its respective value for the cut-off at each tree node was automatically chosen by maximizing a trade-off between the sensitivity (Se), Specificity (Sp), positive predictive value (PPV) and negative predictive value (NPV), regarding only the classification made by that node. Besides, the number (%) of individuals who could be discontinued from HCC surveillance and residual incidence rate (IR) of HCC in each subset were estimated. Surveillance for HCC is considered cost-effective above thresholds of 1.5 and 1.0 per 100 person-years, based on established criteria [1-3]

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A simple model, based on accessible parameters, can identify patients, living or not with HIV, with very low risk of HCC emergence after HCV cure

Figure 1. Decision tree model to predict the risk of HCC

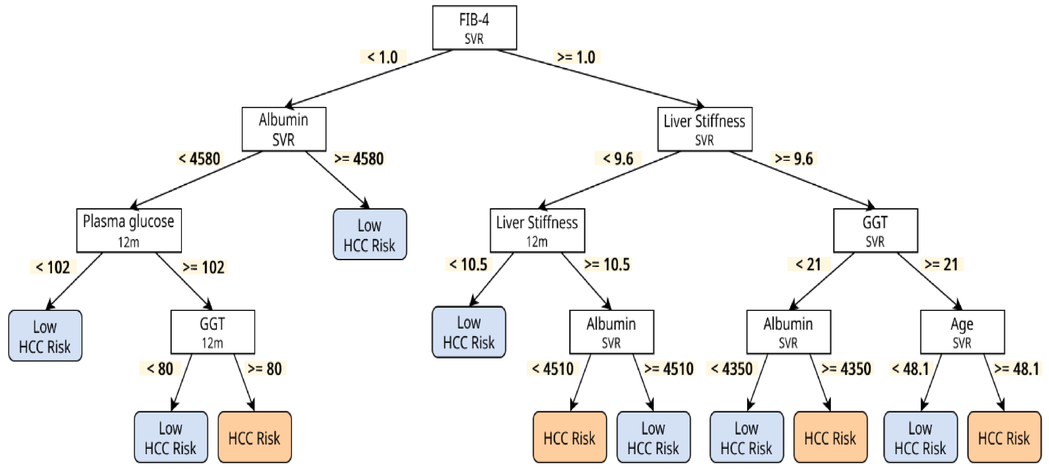


Table 2. HeCaPRED diagnostic performance (N=1,031)

HCC diagnosed during the follow-up (n, %): overall 34 (3%); HCV 22 (%); HIV/HCV 12 (2%)

Set	Se (%)	Spe (%)	PPV (%)	NPV (%)	Discontinuation n (%)	IR (95% IC)
Discovery (n=690)	100 (85-100)	55 (51-59)	7 (5-11)	100 (99-100)	369 (53%)	0
Validation (n=341)	91 (59-100)	55 (50-61)	6 (3-11)	99 (97-100)	183 (54%)	0.08 (0.01-0.58) x 100 PY

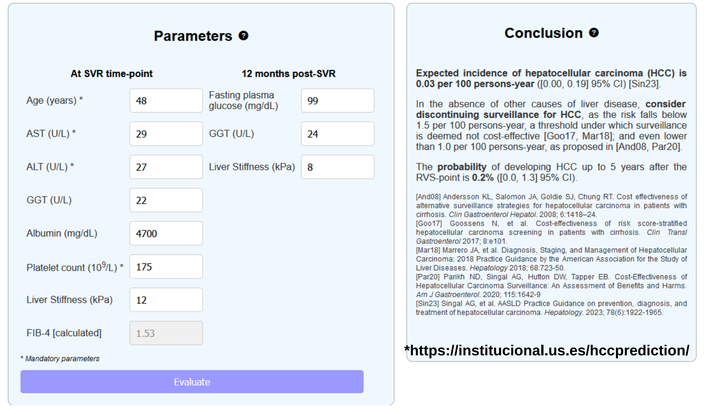
RESULTS

Table 1. Baseline characteristics (N=1,031)

Characteristics	HCV mono-infection (N=434)	HCV/HIV co-infection (N=597)	p-value
Pre-treatment			
Male sex, n (%)	309 (71)	515 (86)	<0.001
Age (years)*	55 (49-62)	52 (49-55)	<0.001
GT3, n (%)	72 (17)	103 (17)	0.779
Past PWID, n (%)	152 (35)	500 (84)	<0.001
LS ≥ 14 kPa, n (%)	250 (58)	356 (60)	0.514
CPT class A, n (%)	400 (46)	477 (54)	<0.001
SVR time-point			
LS ≥ 14 kPa, n (%)	170 (39)	227 (38)	0.709
CPT class A, n (%)	407 (42)	572 (58)	0.081
Platelets count (10⁹/L)*	170 (125-216)	144 (105-195)	<0.001

*Median (Q1-Q3)

Figure 2. HeCaPRED web calculator*



CONCLUSIONS

- **A simple model, based on accessible parameters measured at SVR time-point and 12 months afterwards, can identify patients, living or not with HIV, with very low risk of HCC emergence after HCV cure.**
- **The incidence of HCC in individuals considered at low risk falls quite below the threshold of 1.0%, for which HCC surveillance is not considered cost-effective. In these patients, HCC surveillance may be reasonably given up.**