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SHORT COMMUNICATION

Validation of a point-of-care rapid diagnostic test for hepatitis C for use in resource-limited settings

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Background: Treatment of HCV with direct-acting antivirals has enabled the discussion of HCV eradication worldwide. Envisioning this aim requires implementation of mass screening in resource-limited areas, usually constrained by testing costs.

Methods: We validated a low-cost, rapid diagnosis test (RDT) for HCV in three different continents in 141 individuals.

Results: The HCV RDT showed 100% specificity and sensitivity across different samples regardless of genotype or viral load (in samples with such information, 90%).

Conclusions: The HCV test validated in this study can allow for HCV screening in areas of need when properly used.

Keywords: hepatitis C, rapid diagnostic test, resource-limited

Introduction

HCV is responsible for 400 000 deaths a year, with a large proportion of these deaths occurring in low- and middle-income countries.[1] While new curative therapies for HCV are now becoming affordable in more regions of the world, many infected persons remain untreated due to limited access to centralized laboratory testing and cost restrictions for mass testing in areas of need.[2] We aimed to perform an external validation of a rapid diagnostic test (RDT) for HCV using study populations from three different regions of the world.

Material and methods

The studied RDT measures anti-HCV antibodies in serum (anti-HCV cassette, PRECHEK Bio. Inc., Korea) and gives a qualitative result (positive/negative) within minutes based on double antigen sandwich immunoassay. Monoclonal antibodies against HCV antigens are conjugated with colloidal gold, deposited in the pad and immobilized on the test line in the nitrocellulose membrane. As serum is added it rehydrates the gold–antibody conjugate. In positive samples the antigen–antibody–gold complex will migrate towards the test window until the test zone (T), where it is captured by immobilized antibodies, forming a visible line, which indicates a positive reaction. Tests were performed according to the manufacturer's instructions, using serum obtained from hospitals in The Netherlands, Argentina and Ethiopia. The performance of the RDT was assessed by receiver operating characteristic (ROC) curve analysis, using the local diagnostic standard as the reference test (Argentina: ARCHITECT anti-HCV Reagent kit from Abbott, Germany; The Netherlands: LIAISON XL system from Diasorin, Italy; Ethiopia: HCV Rapid Test from Assure Tech, China). Statistical analyses were performed using STATA version 15.1 (StataCorp LP, College Station, TX, USA). Patients coinfected with HIV were not included.

Results and discussion

Serum samples from 141 patients were tested using the anti-HCV RDT. A total of 91 known HCV-positive samples and 50

Table 1. Patient characteristics by country

	The Netherlands	Argentina	Ethiopia
Number	90	41	10
Median age, y[1]	48 (39–55)	46 (40–50)	48 (39–55)
Male gender	67%	61%	67%
Genotype[2]	1 (62%) 2 (13%) 3 (13%) 4 (13%)	1 (66%) 2 (34%)	n/a

[1]Medians are displayed with IQR (Q1–Q3).
[2]Genotype data was unavailable in Ethiopia.

known HCV-negative samples were tested. Ninety samples were tested in The Netherlands, 41 in Argentina and 10 in Ethiopia. The median age of patients was 46 y (IQR 39–54) and 65% were male. HCV genotype was available in 96 patients, with 61 samples belonging to genotype 1, 21 to genotype 2, and 7 each to genotypes 3 and 4 (Table 1). The median HCV RNA level (available in 67 patients) was 800 000 IU/ml (IQR 80 000–4 200 000). The HCV RDT had a sensitivity and specificity of 100% (CI 94.9 to 100 and 92.9 to 100, respectively) in all genotypes and all RNA levels, including <15 copies, which was the lower level of detection for quantitative assays. As the WHO aims to achieve 90% diagnosis of HCV by 2030, it is critical to validate rapid tests in resource-rich as well as resource-limited settings.[3] In this study, we demonstrate that the PRECHEK Bio. Inc. anti-HCV cassette RDT is highly sensitive and specific for the diagnosis of HCV. By testing the RDT in three different countries from three separate continents, as well as testing four different HCV genotypes, we are able to establish that the test is likely to be reliable in a variety of populations. While several point-of-care RDTs are commercially available, many rely on expensive instruments, making them ill-suited for resource-limited settings.[4] In contrast, the RDT tested in this study is a chromatographic immunoassay that does not require extra instrumentation, making it both affordable and appropriate for rural sites. Importantly, test results are available in <10 min. Moreover, the calculated cost of the test is approximately 1–2% that of approved WHO ones (depending on order volume and location), making it realistically affordable for limited settings. Some of the limitations of our study include a relatively small sample size, as well as a lack of assessment of active viral replication (HCV RNA) in all samples. However, we believe the ease of use, rapid result yield and very low cost of this RDT could increase the proportion of patients aware of their HCV status in all geographical regions, thus enabling treatment when possible.

Authors' contributions: JL performed experiments, analyzed data and wrote manuscript; MBP, VR and GvO performed experiments and helped to analyze the data; AS performed testing and contributed to manuscript editing; AB helped analyzed data, contributed to study development and edited manuscript; JDD developed study concept, helped analyzed data, edited the manuscript.

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Competing interests: The authors of this manuscript do not have any conflicts of interest to disclose.

Ethical approval: This study was approved by blanket internal review board for stored samples, Erasmus MC, Rotterdam, The Netherlands.

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