Sofosbuvir based regimens in the treatment of chronic hepatitis C genotype 1 infection in African–American patients: a community-based retrospective cohort study

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Background Direct-acting antiviral (DAA) drugs have been highly effective in the treatment of chronic hepatitis C (HCV) infection. Limited data exist comparing the safety, tolerability, and efficacy of DAAs in African–American (AA) patients with chronic hepatitis C genotype 1 (HCV GT-1) in the community practice setting. We aim to evaluate treatment response of DAAs in these patients.
Patients and methods All the HCV GT-1 patients treated with DAAs between January 2014 and January 2018 in a community clinic setting were retrospectively analyzed. Pretreatment baseline patient characteristics, treatment efficacy with a sustained virologic response at 12 weeks post-treatment (SVR12), and adverse reactions were assessed.
Results Two-hundred seventy-eight patients of AA descent were included in the study. One-hundred sixty-two patients were treated with ledipasvir/sofosbuvir (SOF) ± ribavirin, 38 were treated with simeprevir/SOF ± ribavirin, and 38 patients were treated with SOF/velpatasvir. Overall, SVR at 12 weeks was achieved in 94.6% in patients who received one of the three DAA regimens (93.8% in ledipasvir/SOF group, 92.1% in simeprevir/SOF group, and 97.4% in SOF/velpatasvir group). Previous treatment experience, HCV RNA levels and HIV status had no statistical significance on overall SVR achievement ($P = 0.905$, 0.680, and 0.425, respectively). Compensated cirrhosis in each of the treatment groups did not influence overall SVR of 12. The most common adverse effect was fatigue (27%). None of the patients discontinued the treatment because of adverse events.
Conclusion In the real-world setting, DAAs are safe, effective, and well tolerated in African–American patients with chronic HCV GT-1 infection with a high overall SVR rate of 94.6%. Treatment rates did not differ on the basis of previous treatment and compensated cirrhosis status. Eur J Gastroenterol Hepatol 30:1200–1207

Introduction

Hepatitis C virus (HCV) is a significant global health burden with substantial evidence indicating its negative impacts clinically, economically, and on the overall quality of life [1]. Chronic HCV infection is also a common cause of hepatocellular carcinoma (HCC) and hepatic cirrhosis [2]. As a result, the eradication of HCV is an important endpoint as the sustained virological response (SVR) has been associated with the reversal of hepatic fibrosis and decreased rates of HCC [3,4].

HCV genotype 1 (HCV GT-1) is approximately responsible for 75% of HCV infections in the USA [5], and is also the most prevalent HCV infection globally, with 46.2% of all HCV cases [6]. In the USA, HCV infection is more prevalent in African–Americans (AA) than in any other racial group, representing 22% of total HCV infection and according to National Health and Nutrition Examination Survey III Study, prevalence of HCV infection is twice that in AA than in whites (3.2 vs. 1.5%) [7]. According to Center for Disease Control data in 2016, reporting of HCV in AA is 7.7/10 000 vs. 36.4/10 000 compared with Whites and rate of HCV-related deaths was the highest among AAs vs. other ethnicities (7.42/100 000 vs. 3.97/100 000 for Whites vs. 5.69/100 000 for Hispanics) [8].

Treatment of HCV has recently shifted toward more tolerable, safe, and effective oral regimens, which represents an opportunity to reduce the burden of disease within the population. Despite the burden of HCV being high AA, this population has been traditionally underrepresented in clinical trials. The inner-city community of New York City in which our study was carried out shows a majority of patients infected with HCV GT-1 being of AA descent. Consequently, we sought to (i) establish the

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population characteristics for HCV GT-1 infection among AA receiving DAAs and (ii) evaluate the efficacy, tolerability, and safety of three sofobuvir-based DAA regimens and assess the variables that impact sustained virologic response (SVR) rates.

Patients and methods

The Institutional Review Board approved the study protocol and the patients were recruited from two specialty clinics attached to the two large community hospitals: Interfaith Medical Center and New York-Presbyterian Brooklyn Methodist Hospital.

Patients

A total of 278 AA patients with chronic HCV GT-1 were treated with DAAs between January 2014 and January 2018. Definition of AA was based on the US Census Bureau as follows: refers to a person living in the USA and having origins in any of the Black racial groups of Africa, which includes Sub-Saharan African, Kenyan, Nigerian; and Afro-Caribbean such as Haitians and Jamaicans. None of the patients included in this study discontinued the treatment because of adverse events (AEs) associated with treatment medications.

The 278 patients included in this retrospective cohort study received at least 12 weeks of treatment with one of the recommended combination regimens in standard doses for chronic HCV infection. Three different treatment regimens were used in our study. The choice of treatment regimens used was made from the American Association for the Study of Liver Disease guidelines. Ledipasvir (LDV) 90 mg/day + sofosbuvir (SOF) 400 mg/day, LDV 90 mg/day + SOF 400 mg/day + ribavirin (RBV) 1000 mg/day if less than 75 kg and 1200 mg/day if at least 75 kg, simeprevir (SIM) 150 mg/day + SOF 400 mg/day, SIM 150 mg/day + SOF 400 mg/day- + RBV 1000 mg/day if less than 75 kg and 1200 mg/day if at least 75 kg, and SOF 400 mg/day + velpatasvir (VEL) 400 mg/day. Duration of treatment for all patients was 12 ($N=257$) to 24 weeks ($N=21$).

Study assessments

Pretreatment baseline characteristics (Table 1), laboratory studies, baseline HCV viral load, treatment efficacy with a SVR at 12 weeks after completion of treatment (SVR12) were assessed. The safety and tolerability of antiviral drug regimens were assessed by reviewing the documented common or severe AEs, treatment completion rate, and reduction in the medication dosage or discontinuation of medications.

Liver fibrosis assessment was performed with invasive liver biopsy in 120 patients and noninvasive testing with a fibrosure test and the aspartate aminotransferase-to-platelet ratio index score in the remaining patients. Patients who had clinical, laboratory, and radiological evidence of cirrhosis were treated without any further assessment of fibrosis. The diagnosis of liver cirrhosis was based on clinical symptoms, laboratory parameters including fibrosure score of at least 0.75, imaging modalities (ultrasonography and or computed tomography scan) and histopathology whenever indicated. Compensated cirrhosis was defined as the absence of ascites, jaundice, hepatic encephalopathy, and variceal bleeding as defined by the American Association for the Study of Liver Disease.

Treatment response was assessed with HCV RNA viral load (IU/ml) at 4 weeks after initiation of treatment, at the end of treatment, and 12 weeks after completion of treatment. The test was performed using COBAS AmpliPrep/COBAS TaqMan HCV Quantitative Test, v2.0 (Roche Molecular Diagnostics) with the lower limit of quantification of HCV RNA 15 IU/ml. SVR12 was defined as the undetectable viral load at 12 weeks after the end of treatment.

Statistical analysis

Data were expressed as the mean ± SD. Univariate analyses were performed using Student's *t*-test for quantitative values and χ^2 for qualitative values. One-way analysis of variance was used to determine differences among group means. Variables with P less than 0.005 in univariate analysis were evaluated using multivariate regression analysis. Covariates used for the model was age, HIV status, and previous treatment status. Two-sided P values were calculated for all tests, with P less than 0.05 considered as statistically significant. Statistical analysis was performed using Excel Statistics program for Windows 2011 (XLSTAT, USA).

Results

Characteristics of patients at baseline

Demographic characteristics at baseline are shown in Table 1. Mean age of the cohort was 61.4 ranging from 28 to 94 years. Majority of the patients were GT-1a [202 (73.7%)], male [170 (61.2%)], and treatment naive [219 (78.8%)]. Comorbidities at baseline include diabetes [89 (32%)], hypertension [136 (48.9%)], coronary artery disease [27 (9.7%)], kidney disease [21 (7.6%)], and chronic anemia [four (4%)]. There was no statistical difference in the baseline of the treatment groups except the LDV/SOF group (higher number of HIV positive patients).

Treatment regimens

Among the 278 patients with chronic HCV GT-1 infection, 162 (58.3%) patients were in LDV/SOF group, 38 (13.7%) in SIM/SOF group, and 78 (28.1%) patients in SOF/VEL group (Fig. 1).

Therapeutic response and treatment predictors

The overall SVR12 was 94.6% (263/278). In univariate analysis, it was identified that patients who achieved SVR12 as compared with those who did not achieve SVR12 had a statistically significant relationship among patients with HCV RNA of at least 800 000 vs. less than 800 000 ($P=0.049$), aspartate aminotransferase-to-platelet ratio index score of less than 1 vs. at least 1 ($P=0.019$) and between Child–Pugh class A vs. B ($P=0.019$). However, after adjusting baseline characteristics in multivariable logistic regression models, none was identified as a predictor of treatment response ($P=0.680$, 0.137, 0.548, respectively). SVR12 was not affected by HIV status, the presence of comorbidities, compensated cirrhosis or previous treatment (Table 2). Overall, SVR12 rates were high and similar in all treatment groups (Tables 3–5). SVR12 rates based on previous treatment and cirrhosis status are shown in Figs 2 and 3, respectively.

Table 1. Demographic and clinical characteristics of patients at baseline with treatment regimen

Characteristics	All patients (*N* = 278)	Treatment regimens			*P* value
		LDV/SOF (*N* = 162)	SIM/SOF (*N* = 38)	SOF/VEL (*N* = 78)	
Age (years)	61.4 (28–94)	61.2 (33–83)	63.4 (32–87)	60.7 (28–94)	0.342
Sex					
Male (%)	170 (61.2)	100 (61.7)	17 (44.7)	53 (67.9)	0.054
Female (%)	108 (38.8)	62 (38.3)	21(55.3)	25 (32.1)	
BMI (kg/m^2)	28.3 (15.0–47.0)	28.3 (15.0–47.0)	27.8 (19.0–39.0)	28.5 (15.0–43.0)	0.771
GT-1a	202 (72.7)	116 (71.6)	26 (68.4)	60 (76.9)	0.563
GT-1b	76 (27.3)	46 (28.4)	12 (31.6)	18 (23.1)	
HCV RNA (IU/ml)					
< 800 000	81 (29.1)	47 (29.0)	14 (36.8)	20 (25.6)	0.459
≥ 800 000	197 (70.9)	115 (71.0)	24 (63.2)	58 (74.4)	
Previous treatment					
Naive	219 (78.8)	124 (76.5)	29 (76.3)	66 (84.6)	0.331
Experienced	59 (21.2)	38 (23.5)	9 (23.7)	12 (15.4)	
Comorbidities					
Diabetes	89 (32.0)	43 (26.5)	12 (31.6)	34 (43.6)	0.297
Hypertension	136 (48.9)	77 (47.5)	20 (52.6)	39 (0.5)	0.831
Coronary artery disease	27 (9.7)	15 (9.3)	1 (2.6)	11 (14.1)	0.141
Kidney disease	21 (7.6)	10 (6.2)	4 (10.5)	7 (8.9)	0.563
Chronic anemia	4 (1.4)	3 (1.9)	1 (2.6)	0	0.424
HIV status					
Positive	60 (21.6)	44 (27.2)	2 (5.3)	14 (17.9)	0.008*
Negative	218 (78.4)	118 (72.8)	36 (94.7)	64 (82.1)	
APRI score					
< 1	188 (67.6)	104 (64.2)	25 (65.8)	59 (75.6)	0.200
≥ 1	90 (32.4)	58 (35.8)	13 (34.2)	19 (24.4)	
MELD score					
< 10	197 (70.1)	116 (71.6)	28 (73.7)	53 (67.9)	0.775
≥ 10	81 (29.1)	46 (28.4)	10 (26.3)	25 (32.1)	
Child–Pugh score					
Class A	241 (86.7)	143 (88.3)	31 (81.6)	67 (85.9)	0.534
Class B	37 (13.3)	19 (11.3)	7 (18.4)	11 (14.1)	
Laboratory tests					
Hemoglobin (g/dl)	13.3 (8.3–18.0)	13.2 (8.3–18.0)	13.4 (9.2–16.7)	13.3 (8.6–16.0)	0.780
Platelets (×1000/ml)	192.1 (23–548)	187.9 (53–548)	184.5 (23–459)	204.7 (55–375)	0.171
Albumin (g/dl)	3.7 (0.8–4.8)	3.7 (1.3–4.8)	3.7 (2.5–4.7)	3.7 (0.8–4.8)	0.755
AST (IU/l)	62 (10–680)	60 (15–198)	60 (16–210)	67 (10–680)	0.817
ALT (IU/l)	67 (11–1197)	60 (11–204)	72 (12–264)	78 (11–1197)	0.438
Bilirubin (mg/dl)	0.9 (0.1–7.0)	0.9 (0.1–3.9)	1.1 (0.1–4.9)	0.9 (0.1–7.0)	0.759

Data are presented as mean (range) or *n* (%).
ALT, alanine transaminase; APRI, AST-to-platelet ratio index; AST, aspartate transaminase; HCV hepatitis C virus; LDV, ledipasvir; MELD, model for end-stage liver disease; RNA, ribonucleic acid; SIM, simeprevir; SOF, sofosbuvir; VEL, velpatasvir.
*Only variables with the $P < 0.05$ in univariate analysis were assessed.

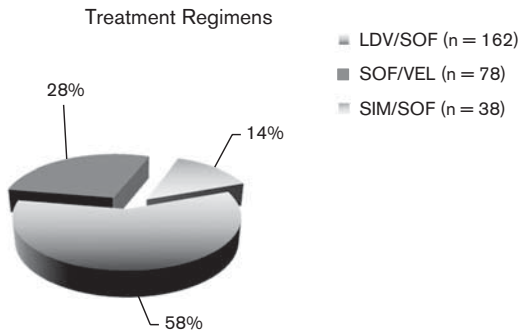

Fig. 1. Treatment groups with different regimens. LDV, ledipasvir; SIM, simeprevir; SOF, sofosbuvir; VEL, velpatasvir.

Virologic response ledipasvir/sofosbuvir group

In this group, 93.8% achieved SVR. In univariate analysis, patients with HCV RNA less than 800 000 had higher SVR rates compared with those with at least 800 000 (100 vs. 87%, $P = 0.037$). But this finding was not confirmed in multivariate analysis after adjusting for baseline characteristics ($P = 0.373$). Presence of cirrhosis and other comorbidities including diabetes, chronic kidney disease, coronary artery disease, chronic anemia, etc. did not impact SVR rates significantly (Table 3).

Virologic response in simeprevir/sofosbuvir group

The group SIM/SOF achieved 92.1% SVR as shown in Table 4. Analysis of gender yielded statistically significant difference in both univariate and multivariate regression scale, with *P* values of 0.022 and 0.031. However, differences between SVR rates of diabetes and cirrhosis yielded statistical significance in univariate analysis, although, on multivariate regression, they did not simulate the same ($P = 0.003$ vs. 0.073 and $P = 0.003$ vs. 0.801, respectively).

Virologic response in sofosbuvir/velpatasvir group

Overall SVR rate for SOF/VEL group is 97.4 as shown in Table 5. Analysis of this group yielded no significant difference on SVR rates on all treatment predictors of this group.

Adherence and safety

Out of 278 patients in this study, 128 reported at least one (45.9%) AE. They are presented in Table 6. There were no

Table 2. Demographic and clinical characteristics of patients at baseline by treatment response

Characteristics	All patients ($N=278$)	Treatment response		Univariate P value	Multivariate P value
		SVR ($N=263$)	No SVR ($N=15$)		
Age (years)	61.4 (28–94)	61.5 (28–87)	59.0 (33–94)	0.363	NA
Age group					
<65	175 (62.9)	164 (62.4)	11 (73.3)	0.392	NA
≥ 65	103 (37.1)	99 (37.6)	4 (26.7)		
Sex					
Male	170 (61.2)	158 (60.1)	12 (80.0)	0.124	NA
Female	108 (38.8)	105 (39.9)	3 (20.0)		
BMI (kg/m^2)	28.3 (15.0–47.0)	28.45 (15.0–47.0)	25.5 (17.4–33.0)	0.070	NA
BMI (kg/m^2)					
<30	174 (62.9)	164 (62.4)	10 (66.7)	0.737	NA
≥ 30	104 (37.4)	99 (37.6)	5 (33.3)		
GT-1a	205 (73.7)	193 (73.4)	12 (80.0)	0.571	NA
GT-1b	73 (26.3)	70 (26.6)	3 (20.0)		
HCV RNA (IU/ml)					
$<800\,000$	81 (29.1)	80 (30.4)	1 (6.7)	0.049	0.680*
$\geq 800\,000$	197 (70.9)	183 (69.6)	14 (93.3)		
Previous treatment					
Naive	219 (78.8)	207 (78.7)	12 (80.0)	0.905	NA
Experienced	59 (21.2)	56 (21.3)	3 (20.0)		
Comorbidities					
Diabetes	89 (32.0)	84 (94.4)	5 (56.2)	0.910	NA
Hypertension	136 (48.9)	129 (94.9)	7 (5.1)	0.857	NA
Coronary artery disease	27 (9.7)	26 (96.3)	1 (3.7)	0.682	NA
Kidney disease	21 (7.6)	20 (95.2)	1 (4.8)	0.894	NA
Chronic anemia	4 (1.4)	3 (75)	1 (25)	0.805	NA
HIV status					
Positive	60 (21.6)	58 (22.1)	2 (13.3)	0.425	NA
Negative	218 (78.4)	205 (77.9)	13 (86.7)		
APRI score					
<1	188 (67.6)	182 (69.2)	6 (0.4)	0.019	0.137*
≥ 1	90 (32.4)	81 (30.8)	9 (0.6)		
MELD score					
<10	197 (70.1)	188 (71.5)	9 (0.6)	0.341	NA
≥ 10	81 (29.1)	75 (28.5)	6 (0.4)		
Child–Pugh score					
Class A	241 (86.7)	231 (87.8)	10 (66.7)	0.019	0.548*
Class B	37 (13.3)	32 (12.2)	5 (33.3)		
Laboratory tests					
Hemoglobin (g/dl)	13.3 (8.3–18.0)	13.2 (8.3–18.0)	13.7 (11.4–15.9)	0.297	NA
Platelets ($\times$1000/ml)	192.1 (23–548)	195 (23.0–548.0)	137.3 (65.0–260.0)	0.008	NA
Albumin (g/dl)	3.7 (0.8–4.8)	3.7 (0.8–4.8)	3.5 (2.2–4.1)	0.057	NA
AST (IU/l)	62 (10–680)	61.4 (10–680)	72.7 (21–210)	0.578	NA
ALT (IU/l)	67 (11–1197)	66.6 (11–1197)	72.9 (16–264)	0.783	NA
Bilirubin (mg/dl)	0.9 (0.1–7.0)	0.9 (0.1–7.0)	1.1 (0.3–2.7)	0.597	NA

Data are presented as mean (range) or n (%).
ALT, alanine transaminase; APRI, AST-to-platelet ratio index; AST, aspartate transaminase; HCV, hepatitis C virus; MELD, model for end-stage liver disease; RNA, ribonucleic acid; SVR, sustained virologic response.
*Only variables with the $P<0.05$ in univariate analysis were assessed.

severe AE observed in the entire cohort. All patients tolerated treatment well. Fatigue, headache, nausea, rash, and thrombocytopenia were among the most common AEs observed. None of the AEs were statistically significant among the three groups except for the absence of rash, observed in the SOF/VEL group.

Discussion

Historically AA patients with HCV GT-1 have had lower response rates to interferon-based treatment than other races [9]. Wilder and colleagues in a systematic review demonstrated that the burden of HCV within the AA populations within the USA is not reflected in the diversity of clinical trial participants. The percentage of AAs observed participating in hepatitis C clinical trials was approximately half the expected amount. Hence, the group of people most significantly affected by this disease is underrepresented in clinical trials [10]. According to a veteran's affairs (VA) study conducted by Kanwal *et al.* [11] AA patients had 21% lower odds of receiving DAAS than white patients. Medical comorbidities and substance abuse predicted HCV treatment ineligibility in underserved African Americans [12]. These existing data trends indicate more real-world studies are required to assess response rates, particularly in susceptible populations. Our study meets this criterion, as it provides real-world data on safety, efficacy, and tolerability of DAAs in an inner-city community hospital setting with a high AA population. Existing clinical studies have shown an excellent response to DAAS in HCV GT-1 infection [13–17].

In a VA retrospective study by Benhammou and colleagues with a large cohort of 1068 patients treated with DAA, a subgroup analysis of HCV GT-1 patients ($n=872$) revealed that AA ethnicity was a significant predictor of non-SVR12, with an adjusted odds ratio of 0.48 (95% confidence interval = 0.29–0.80). In the same study, AA patients with GT-1 ($n=358$) were analyzed and advanced liver disease was

Table 3. Sustained virologic response12 rates in patients receiving ledipasvir/sofosbuvir by population subgroup

Responses	SVR12 rate	Univariate *P* value	Multivariate *P* value
Overall	152/162 (93.8)		
Age group			
<65	95/104 (91.3)	0.079	NA
≥65	57/58 (98.3)		
Sex			
Male	92/100 (92.0)	0.160	NA
Female	60/62 (96.8)		
BMI (kg/m^2)			
<30	99/105 (94.3)	0.742	NA
≥30	53/57 (93.0)		
HCV RNA (IU/ml)			
<800 000	47/47 (100)	0.037	0.373*
≥800 000	105/115 (87.0)		
Genotype			
1a	108/116 (93.1)	0.543	NA
1b	44/46 (95.7)		
Previous treatment			
Naive	117/124 (94.4)	0.614	NA
Experienced	35/38 (92.1)		
Comorbidities			
Diabetes	41/43 (95.3)	0.629	NA
Hypertension	73/77 (94.8)	0.622	NA
CAD	14/15 (93.3)	0.934	NA
Kidney disease	10/10 (100)	NA	NA
Chronic anemia	2/3 (66.7)	NA	NA
Cirrhosis			
Absent	116/120 (96.7)	0.673	NA
Present	40/42 (95.2)		
HIV status			
Positive	42/44 (95.5)	0.599	NA
Negative	110/118 (93.2)		
ALT (IU/l)			
<40	53/58 (91.4)	0.334	NA
≥40	99/104 (95.2)		

Data presented as *n*/*N* (%).
ALT, alanine transaminase; APRI, AST-to-platelet ratio index; HCV, hepatitis C virus; MELD, model for end-stage liver disease; NA, not available; RNA, ribonucleic acid; SVR, sustained virologic response.
*Only variables with the $P < 0.05$ in univariate analysis were assessed.

Table 4. Sustained virologic response 12 rates in patients receiving simeprevir/sofosbuvir by population subgroup

Responses	SVR12 rate	Univariate *P* value	Multivariate *P* value
Overall	35/38 (92.1)		
Age group			
<65	17/18 (94.4)	0.472	NA
≥65	18/20 (90.0)		
Sex			
Male	14/17 (82.4)	0.022	0.031*
Female	21/21 (100.0)		
BMI (kg/m^2)			
<30	22/24 (91.7)	0.642	NA
≥30	13/14 (92.9)		
HCV RNA (IU/ml)			
<800 000	13/14 (92.9)	0.642	NA
≥800 000	22/24 (91.7)		
Genotype			
1a	23/26 (88.5)	0.149	NA
1b	12/12 (100.0)		
Previous treatment			
Naive	26/29 (89.7)	0.226	NA
Experienced	9/9 (100.0)		
Comorbidities			
Diabetes	9/12 (75.0)	0.003	0.723*
Hypertension	18/20 (90.0)	0.472	NA
CAD	1/1 (100.0)	0.581	NA
Kidney disease	3/4 (75.0)	0.117	NA
Chronic anemia	1/1 (100)	0.581	NA
Cirrhosis			
Absent	26/26 (100.0)	0.003	0.801*
Present	9/12 (75.0)		
HIV status			
Positive	14/14 (100)	0.409	NA
Negative	61/64 (95.3)		
ALT (IU/l)			
<40	13/13 (100.0)	0.128	NA
≥40	22/25 (88.0)		

Data presented as *n*/*N* (%).
ALT, alanine transaminase; APRI, AST-to-platelet ratio index; HCV, hepatitis C virus; MELD, model for end-stage liver disease; NA, not available; RNA, ribonucleic acid; SVR, sustained virologic response.
*Only variables with the $P < 0.05$ in univariate analysis were assessed.

found to be a significant predictor of SVR12 failure (odds ratio = 0.35; 95% confidence interval = 0.12–0.97) [18]. This is in contrast to our study, where results yielded high SVR12 of 94.6% independent of AA ethnicity and advanced liver disease.

Julius and colleagues did a retrospective analysis of phase 3 data of LDV/SOF in AA patients. They found that AA patients had rates of SVR12 (≥90%) similar to those in non-Black patients, regardless of treatment history, HIV status, or cirrhosis status [15]. Our study also showed similar results with overall SVR12 of 94% in the LDV/SOF group that is our primary treatment group ($N = 162$) and no significant differences in response rates with previous treatment history, HIV status, and cirrhosis status.

Several studies have shown a low response in AA patients treated for 8 weeks [19–24]. The American Association for Study of Liver Disease/Infectious Diseases Society of America (AASLD/IDSA) guidelines for the treatment of HCV state that shortening of therapy for less than 12 weeks is not recommended in AA patients, patients with HIV infection and patients with known interleukin-28B polymorphism CT or TT [25]. In our study, 267 patients were treated for 12 weeks with high overall SVR rate and none of the patients were treated for 8 weeks in our study. Recently, an observational study by Marcus and colleagues reported that there is no significant difference in SVR with 8 vs. 12 weeks in HCV GT-1 Black patients treated with LDV/SOF. Treatment response for AA patients with 8 vs. 12 weeks was 95.6 and 95.8, respectively [26], and these study findings did not support AASLD/IDSA guidelines. More extensive clinical trials are needed in future involving DAAs with a shorter duration of treatment in AA patients as shorter treatment courses might be more widely used without compromising efficacy.

In an HCV/HIV co-infection clinical trial, Naggie *et al.* [27] found that Black patients had lower SVR12 rates versus White patients, 90 vs. 99% ($P < 0.001$), and higher relapse rates. These results differ from our study that included 60 patients with HCV/HIV GT-1 co-infection, of which 44 patients were treated with LDV/SOF, 14 patients with SIM/SOF and two patients with SOF/VEL. In our cohort of co-infections, there was no impact of AA race on SVR rates between HCV GT-1 monoinfection and HCV–HIV GT-1 co-infection. Our findings were similar to Bhattacharya *et al.* [28], who in a VA real-world cohort also showed similar results that included HCV mono-infected and HIV/HCV co-infected AA.

SOF/VEL is a pan-genotypic regimen. SVR rates are high in HCV GT-1 and treatment remains efficacious in previously treated and compensated cirrhotic patients [16,29,30]. Asselah *et al.* [31] in a retrospective analysis of ASTRAL-1, ASTRAL-2, and ASTRAL-3 trials reported

SVR rates of 98% in HCV GT-1 patients with 12 weeks of treatment and response rate in cirrhotic patients was 96%. However, the number of AA patients in all the clinical trials involving SOF/VEL regimen is insufficient. Our current study included 78 AA patients that represent a significant cohort compared with all the current trials. All patients in our study were treated with SOF/VEL for 12 weeks and the response rate was 98%. The response did not vary based on previous treatment and cirrhosis status.

Thirty-eight patients were treated with SIM/SOF in our study. We observed a treatment response of 92%, with no differences with either previous treatment status or liver cirrhosis. All the cirrhotic patients in this treatment group were treated for 24 weeks with the addition of RBV. Black females achieved higher SVR12 rates in our study. Similar findings were also reflected in a real-world. The SONET study where overall response rate was 92% and AA females had higher SVR rates (97%) compared with AA males (90%) [17].

SOF-based DAAs included in our study were generally well tolerated and AEs are consistent with other DAA-based studies in the literature [13–17]. Common adverse effects were fatigue, headache, nausea, arthralgia, and rash. In addition, anemia was noted in patients who were taking DAA concurrently with RBV. None of the patients discontinued therapy because of any AE in any group.

Our study is unique in the assessment of real-world effectiveness, tolerability, and safety of SOF-based regimens in a large cohort of HCV GT-1 patients. Another strength of the study is the representation of a significant number of AA patients treated with SOF/VEL, which is in contrast to existing literature where treatment outcomes in AA patients are rarely reported because of disproportionate representation. Key limitations of our study include using a retrospective design, insufficient documentation of AEs, and lack of viral resistance testing in all the study patients.

Table 5. Sustained virologic response12 rates in patients receiving sofosbuvir/velpatasvir by population subgroup

Responses	SVR12 rate	Univariate *P* value	Multivariate *P* value
Overall	76/78 (97.4)		
Age group			
<65	53/53 (100.0)	0.056	NA
≥65	23/25 (92.0)		
Sex			
Male	52/53 (98.1)	0.170	NA
Female	24/25 (96.0)		
BMI (kg/m^2)			
<30	43/45 (95.6)	0.121	NA
≥30	33/33 (100.0)		
HCV RNA (IU/ml)			
<800 000	20/20 (100.0)	0.151	NA
≥800 000	56/58 (96.6)		
Genotype			
1a	59/60 (98.3)	0.146	NA
1b	17/18 (94.4)		
Previous treatment			
Naive	64/66 (97.0)	0.166	NA
Experienced	12/12 (100.0)		
Comorbidities			
Diabetes	34/34 (100.0)	0.118	NA
Hypertension	39/39 (100.0)	0.104	NA
CAD	11/11 (100.0)	0.168	NA
Kidney disease	7/7 (100.0)	0.175	NA
Chronic anemia	0	NA	NA
Cirrhosis			
Absent	68/69 (98.6)	0.081	NA
Present	8/9 (88.9)		
HIV status			
Positive	2/2 (100)	0.732	NA
Negative	34/36 (94.4)		
ALT (IU/l)			
<40	38/38 (100.0)	0.107	NA
≥40	38/40 (95.0)		

Data presented as *n*/*N* (%).
ALT, alanine transaminase; APRI, AST-to-platelet ratio index; HCV, hepatitis C virus; MELD, model for end-stage liver disease; NA, not available; RNA, ribonucleic acid; SVR, sustained virologic response.

Conclusion

In the real-world setting, DAAs are safe, effective, and well tolerated in AA patients with chronic HCV GT-1 infection with a high overall SVR rate of 94.6%. Treatment rates did not differ based on previous treatment and compensated cirrhosis status.

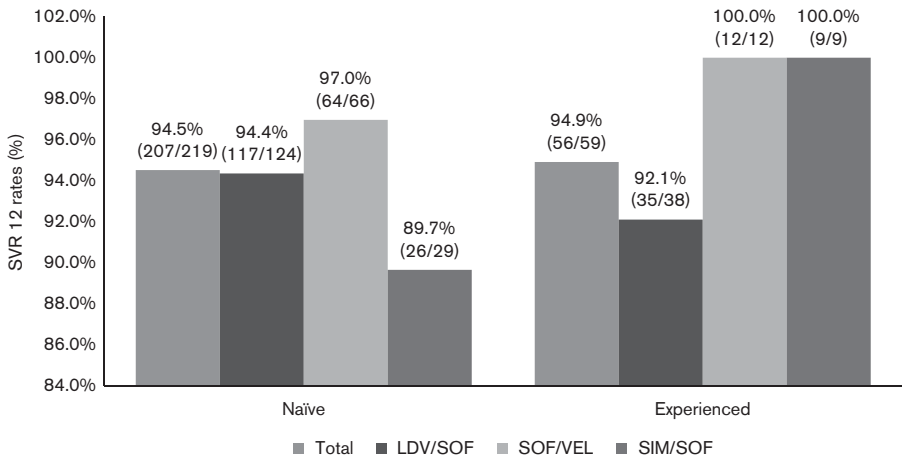

Fig. 2. Treatment response in treatment naive and experienced patients. LDV, ledipasvir; SIM, simeprevir; SOF, sofosbuvir; SVR, sustained virological response; VEL, velpatasvir.

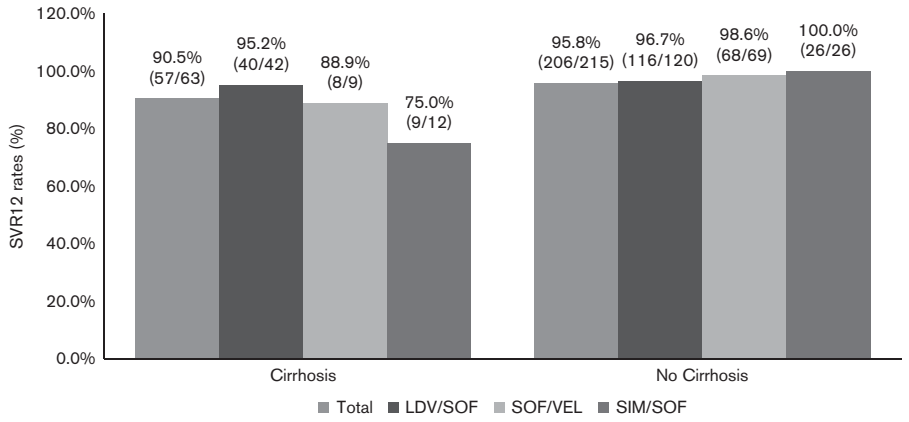

Fig. 3. Treatment response based on cirrhosis status. LDV, ledipasvir; SIM, simeprevir; SOF, sofosbuvir; SVR, sustained virological response; VEL, velpatasvir.

Table 6. Treatment adverse events

	Treatment regimen			
Adverse events	LDV/SOF ($N=162$)	SIM/SOF ($N=38$)	SOF/VEL ($N=78$)	P value
Fatigue	44 (27.2)	12 (31.6)	19 (24.4)	0.711
Insomnia	2 (3.1)	2 (5.3)	0	0.078
Headache	6 (37.0)	4 (10.5)	4 (5.1)	0.223
Nausea	7 (4.3)	0	5 (6.4)	0.386
Vomiting	1 (0.6)	0	0	0.698
Diarrhea	1 (0.6)	0	0	0.698
Constipation	1 (0.6)	0	1 (1.3)	0.724
Abdominal pain	2 (3.1)	0	0	0.486
Rash	8 (4.9)	7 (18.4)	0	<0.001
Arthralgia	9 (5.6)	0	3 (3.8)	0.308
Anemia	5 (3.1)	1 (2.6)	1 (1.3)	0.704

Data presented as *n* (%).
LDV, ledipasvir; SIM, simeprevir; SOF, sofosbuvir; VEL, velpatasvir.

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Conflicts of interest

Dr. Mohanty is on the Speakers Bureau for Gilead Science, BMS, and Abbvie Pharmaceuticals. For the remaining authors, there are no conflicts of interest.

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