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 occurring 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

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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 sofosbuvir-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, simprevir (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 com-

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 χ² for qualitative values. One-way analysis of variance was used to determine differences among group means. Variables with P less than 0.05 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) | LDV/SOF (N = 162) | SIM/SOF (N = 38) | SOF/VEL (N = 78) | P value |
|--------------------------|------------------------|-------------------|------------------|------------------|---------|
| 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/m²)              | 28.3 (15.0–47.0)       | 28.3 (15.0–47.0)  | 278 (19.0–39.0)  | 28.5 (15.0–43.0) | 0.771   |
| GT-1a                    | 76 (27.3)              | 46 (28.4)         | 12 (31.6)        | 18 (23.1)        |         |
| GT-1b                    | 202 (72.7)             | 116 (71.6)        | 26 (68.4)        | 60 (76.9)        | 0.583   |
| 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 (16.4)        |         |
| 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 (50.6)        | 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 (71.0)        | 28 (73.7)        | 53 (67.9)        | 0.775   |
| ≥ 10                     | 81 (29.9)              | 60 (16.7)         | 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 (x1000/µl)     | 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 (µmol/l)       | 0.9 (0.1–3.9)          | 0.9 (0.1–3.9)     | 1.1 (0.1–4.9)    | 0.9 (0.1–7.9)    | 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 in simeprevir/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 ledipasvir/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
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

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

| Characteristics         | All patients (N=278) | SVR (N=263) | No SVR (N=15) | Univariate P value | Multivariate P value |
|-------------------------|----------------------|-------------|---------------|--------------------|----------------------|
| 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/m²)             | 28.3 (15.0–47.0)     | 28.45 (15.0–47.0) | 25.5 (17.4–33.0) | 0.070              | NA                   |
| BMI (kg/m²)             |                      |             |               |                    |                      |
| < 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                   | 72 (25.2)            | 70 (26.6)   | 3 (20.0)      |                     |                      |
| HCV RNA (IU/ml)         | 80 (29.1)            | 80 (30.4)   | 1 (6.7)       | 0.049              | 0.680*               |
| < 800 000               | 197 (70.9)           | 183 (69.6)  | 14 (93.3)     |                     |                      |
| ≥ 800 000               |                      |             |               |                    |                      |
| Previous treatment      |                      |             |               |                    |                      |
| Naive                   | 219 (78.6)           | 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 (39.4)   | 5 (56.2)      | 0.910              | NA                   |
| Hypertension            | 126 (48.9)           | 129 (49.9)  | 7 (51.1)      | 0.857              | NA                   |
| Coronary artery disease | 27 (9.6)             | 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 (4.4)       | 0.019              | 0.137*               |
| ≥ 1                     | 90 (32.4)            | 81 (30.8)   | 9 (6.6)       |                     |                      |
| MELD score              |                      |             |               |                    |                      |
| < 10                    | 197 (70.1)           | 188 (71.5)  | 9 (6.6)       | 0.341              | NA                   |
| ≥ 10                    | 81 (29.1)            | 75 (28.5)   | 6 (4.4)       |                     |                      |
| 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 (×1000/ml)    | 192.1 (23–548)       | 195 (23–548.0) | 1373 (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 (0.3–27) | 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.
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 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 mono-infection 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 ASTRA-1, ASTRA-2, and ASTRA-3 trials reported

### Table 3. Sustained virologic response (SVR) rates in patients receiving ledipasvir/sofosbuvir by population subgroup

| Responses | SVR12 rate | Univariate P value | Multivariate P value |
|-----------|------------|--------------------|----------------------|
| Overall   | 152/162 (93.8) | 0.079 | NA |
| Age group |            |        |     |
| < 65      | 95/104 (91.3) | 0.128 | NA |
| ≥ 65      | 57/58 (98.3)  |          |     |
| Sex       |            |        |     |
| Male      | 92/100 (92.0) | 0.160 | NA |
| Female    | 60/62 (96.8)  |          |     |
| BMI (kg/m²) |        |        |     |
| < 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 (91.0) | 0.003 | 0.801* |
| 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) | 0.582 | NA |
| CAD       | 14/15 (93.3)  | 0.934 | NA |
| Kidney disease | 10/10 (100) | 0.003 | 0.723* |
| Chronic anemia | 2/3 (66.7) | 0.581 | 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) | 0.581 | NA |
| ALT (IU/l) |        |        |     |
| < 40      | 53/58 (91.4)  | 0.334 | NA |
| ≥ 40      | 99/104 (95.2) | 0.128 | NA |

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 (SVR) rates in patients receiving sofosbuvir/velpatasvir by population subgroup

| Responses | SVR12 rate | Univariate P value | Multivariate P value |
|-----------|------------|--------------------|----------------------|
| Overall   | 35/38 (92.1) | 0.079 | NA |
| 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/m²) |        |        |     |
| < 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) | 0.801* | NA |
| 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 | 0.693* |
| Hypertension | 18/20 (90.0) | 0.472 | NA |
| CAD       | 1/1 (100.0)  | 0.581 | NA |
| Kidney disease | 3/4 (75.0) | 0.017 | 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.
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.

**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.
Table 6. Treatment adverse events

| 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)        | 5 (6.4)          | 0.223   |
| Nausea         | 7 (4.3)           | 0               | 6 (7.8)          | 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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