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Treatment Outcomes With Pegylated Interferon and Ribavirin for Male Prisoners With Chronic Hepatitis C

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Abstract

Goals—To report our experience with pegylated interferon and ribavirin treatment of hepatitis C virus (HCV) RNA-positive inmates at the Rhode Island Department of Corrections.

Background—An estimated 1 out of 3 HCV-infected individuals will spend time in a jail or prison within a 1-year period, making prisons a unique setting for management of chronic HCV.

Study—Chart review of all inmates identified as having initiated HCV treatment between October 2000 and April 2004. HCV-infected individuals were identified by HCV antibody screening at intake for known risk factors, elevated aminotransferase levels, or per individual request. Treatment followed standard guidelines with weight-based dosing of pegylated interferon- α 2b and ribavirin. End points were completion of therapy plus 6 months for sustained virologic response (SVR), therapy discontinuation, and loss to follow-up.

Results—The cohort included 71 male patients, was mostly white (80%), and genotype 1 (65%). All 9 African Americans (AA) had genotype 1. Of 59 patients having liver biopsy, 41 had early stage disease. Overall SVR was 28%. Response rate was lower for genotype 1 compared with genotypes 2 and 3 (SVR 18% vs. 60% and 50%). Of inmates with genotype 1, no difference existed in treatment response by race (SVR 22% AA vs. 18% white). Thirtythree patients completed treatment, 26 stopped for side effects, and 5 for initial nonresponse. Eleven were lost to follow-up.

Conclusions—Acceptable HCV treatment outcomes can be achieved in prisons. Our small study indicates no difference in treatment response by AA versus white race for genotype 1.

Keywords

chronic hepatitis C; pegylated interferon; liver disease; prisoners

Hepatitis C (HCV) is the most common chronic blood borne infection in the United States and affects an estimated 3 to 5 million Americans, or 2% of the population.^{1,2} Chronic HCV is the leading cause of chronic liver disease in the United States, and also the leading cause of death from liver disease.³ It is the leading indication for liver transplantation, accounting for 42% of all liver transplants in the United States in 2004.⁴ Total direct healthcare costs have been estimated at over \$1 billion per year and it is expected that there will be a 4-fold increase in

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the persons at risk for chronic liver disease between 1999 and 2015, suggestive of a rising burden of HCV in our near future.⁵

Hepatitis C is a major concern in correctional settings, with prevalence of chronic HCV in the incarcerated population reported at 12% to 31%.⁶ Approximately 23% of the total inmate population in Rhode Island is HCV-infected.⁷ Certain subpopulations at high risk for acquiring HCV are overrepresented in the correctional population—namely, persons who inject drugs and African American (AA) individuals (HCV prevalence of 72% to 86% and 3.2%, respectively). As many as 83% of the United States' 2 million injection drug users are incarcerated at some time and it is estimated that 29% to 43% of all people infected with HCV in the United States are released from prison or jail during a given year, underscoring the unique potential of the prison system for HCV diagnosis and management.^{6,8} End-stage liver disease (ESLD) is an emerging cause of death in prisons and has been reported as a leading cause in some. Death rates from ESLD in Texas prisons have been reported to be 3 times higher than in the community.⁹ Correctional systems continue to struggle with developing programs to diagnose, evaluate, and treat HCV infection in their patient populations.¹⁰ Controversy exists over the efficacy and cost-effectiveness of treating inmates for HCV, with particular concern surrounding treatment of inmates given their history of addiction and the presumed risk of reinfection with postdischarge repeat injection drug use.^{11,12} There is additional reluctance to treat inmates given high rates of comorbid psychiatric illness which may worsen on HCV treatment, and also the concern that adherence to treatment may be poor owing to lack of social support.

National Institutes of Health (NIH) and Centers for Disease Control and Prevention guidelines, however, have advocated for more aggressive treatment of HCV, and find that a history of substance use is not a contraindication to treatment.^{6,13} Several groups, including our own, have argued that correctional institutions are an important setting for health interventions, including diagnosis, prevention, and treatment of HCV infection.^{14,15} The opportunity is unique given the high prevalence of HCV infection in the inmate population, the ability to more closely monitor adherence to treatment, the availability of substance use treatment, and the ability to closely monitor and address side effects and provide psychiatric care as necessary.¹⁶ In 2003, we reported on the treatment of 93 HCV-infected inmates with standard interferon (IFN)- α 2b and ribavirin (RBV), demonstrating response rates comparable to that in the community.¹⁷ In 2004, Sterling et al¹⁸ reported on the treatment of 59 inmates who underwent treatment with IFN plus RBV, also demonstrating that HCV can be effectively treated in the correctional setting with response rates comparable to that in the published literature. A 2005 Canadian study also demonstrated feasibility and acceptable treatment outcomes with IFN plus RBV.¹⁹ Newer treatment regimens of pegylated IFN (PEG-IFN) plus RBV have improved sustained virologic response (SVR) rates compared with previous regimens in drug trials.^{20–22} To date, only 2 other studies have described HCV treatment with this currently accepted regimen in the incarcerated population—one a small study conducted in a metropolitan Italian prison and the other describing clinical outcomes in the Connecticut Department of Corrections.^{23,24} Both demonstrated acceptable treatment outcomes using PEG-IFN and RBV. There is an underused opportunity within the correctional setting to access individuals who bear a disproportionate burden of the disease. The potential exists to reduce the burden of disease in the community through decreased HCV transmission rates and to ameliorate the public health burden and individual morbidity and mortality of ESLD.

We report our clinical experience with PEG-IFN plus RBV in the treatment of 71 HCV RNA-positive male inmates at the Rhode Island Department of Corrections (RIDOC). Although female inmates were eligible for treatment, their shorter sentences precluded them from inclusion in this analysis.

MATERIALS AND METHODS

Background

The RIDOC is both a jail and a prison. Approximately 15,000 men are admitted each year. The average daily census in 2001 was 3348 with 16,892 admissions. The racial distribution of inmates is 56% white (CA), 29% AA, and 14% Hispanic. Evaluation and management of HCV infection is conducted on site at the RIDOC.

Screening

Universal screening was not performed, but anti-HCV antibody was ordered for patients if they had known risk factors for HCV, elevated serum transaminase levels, or it was requested by the patient. A small number of patients were identified through a voluntary seroprevalence study at the RIDOC. Published 2005 data report the prevalence of HCV at RIDOC to be 23.1%.⁷

Initial Evaluation

Patients were considered for treatment if their expected length of stay was long enough to allow for initial work-up and completion of treatment course (24 vs. 48 wk). All patients with detectable virus were potential candidates for therapy, though treatment was not generally recommended for earlier stages of disease. The decision to treat was reached after an in-depth, individualized, informed consent process that considered other factors such as comorbid addiction, mental health disease, optimal time to treat, and access to treatment. Patients with a history of addiction were counseled and referred to addiction treatment programs. They were not excluded from HCV treatment on the basis of an addiction history, nor was program-based addiction treatment required to initiate HCV treatment. Inmates who had a history of depression or other psychiatric disorder were referred to an on-site psychiatrist for evaluation and clearance and followed closely by the psychiatric team during the course of treatment.

Standard blood work (including complete blood count, Chem 7 panel, coagulation studies, liver function tests, hepatitis A and B serology, hemochromatosis and autoimmunity laboratories, α -fetoprotein) was ordered at baseline. Liver biopsy was recommended but not required to initiate treatment.

Treatment

Treatment was individualized for each patient but generally followed NIH guidelines with weight-based dosing of PEG-IFN- α 2b (12 kd) 1.5 μ g/kg SQ once weekly and RBV 800 to 1200 mg PO daily. Dose reduction and hematopoietic growth factors were used as required for recognized side effects, primarily anemia, and neutropenia. Written, informed consent was obtained before the initiation of therapy. Efficacy was determined by measurement of serum HCV RNA at 12 weeks and/or 6 months into treatment. End-of-treatment response (ETR) was defined as an undetectable serum HCV RNA at end of treatment, and SVR was defined as an undetectable serum HCV RNA at 6 months after end of treatment. The project was funded entirely by the Department of Corrections.

Data Collection

A chart review was undertaken of all inmates identified as having initiated HCV treatment between October 2000 and April 2004 with PEG-IFN by the hepatitis C database maintained by RIDOC. Data were recorded on date of birth, race, prior treatment history, age at treatment with PEG-IFN, weight at initiation of therapy, HCV genotype, liver biopsy date, liver biopsy stage and grade, baseline alanine transaminase (at least 2 pretreatment values if available), follow-up alanine transaminase (if available), HIV status, hepatitis A and B status (serology,

vaccination status, HBV DNA if hepatitis B surface Ag positive). Also recorded was history of injection drug use, noninjection drug use, alcohol use, and past or current (to time of therapy) substance abuse rehabilitation, psychiatric history, psychiatric evaluation, worsening or onset of psychiatric illness after initiation of treatment, and use of psychotropic medications. Data were collected on dose reduction of either PEG-IFN or RBV or use of hematopoietic stimulating factors or other medications required during the course of treatment. End points for treatment with PEG-IFN plus RBV were defined as completion of therapy plus 6 months (for SVR determination), discontinuation of therapy, or loss to follow-up. This study was reviewed and approved by the Miriam Hospital's Institutional Review Board with a prisoner representative.

Statistical Analysis

Analysis of treatment response by race and genotype was by intention to treat. Treatment response by treatment history was analyzed using "as-treated" data, with data for ETR missing for 2 of the 26 previously treated patients and 5 of the 45 treatment-naïve patients, and data for SVR missing for 4 of the 26 previously treated patients and 7 of the 45 treatment-naïve patients. Data analysis was by Fisher exact test using a 2-sided $\alpha = 0.05$ level of significance. Analyses were performed using SAS 9.1 (Cary, NC).

RESULTS

Chart review revealed that 91 male inmates initiated PEG-IFN treatment at the facility between October 2000 and August 2004. Ten were excluded because they were undergoing continued anti-HCV treatment at the time of data collection. Five were excluded who had combined IFN/RBV and PEG-IFN/RBV treatment and not solely PEG-IFN/RBV treatment. Five were excluded whose laboratory results were pending. Thus, a total of 71 male patients reached an end point, as defined above, on HCV treatment with PEG-IFN and RBV. Patient characteristics are summarized in Table 1. Most patients were CA (80%); the cohort included only 9 AA patients (13%). Sixty-five percent of the cohort had HCV genotype 1, 17% genotype 2, 13% genotype 3, and 5% genotype 4. Ninety-nine percent of the inmates had a history of substance abuse, defined as injection drug use, noninjection drug use, or alcohol. Fifty-nine patients received a liver biopsy. Seventy percent of these (41) had early stage disease (defined as stage 0 to 1, 1 to 2, or 2). Twenty-six (37%) had previously been treated with non-PEG-IFN- α , 10 with IFN monotherapy, and 16 with combination IFN/RBV therapy. Data were not available on whether those previously treated were nonresponders or relapsers.

Overall ETR was 39% (28 of 71) and overall SVR was 28% (20 of 71), Figure 1. All 9 AA patients had genotype 1 infection. Of the 57 CA patients, 60% had genotype 1 infection and 35% had genotype 2 or 3 infection. Treatment response by genotype and race is presented in Figure 2. By intention-to-treat analysis, ETR and SVR was 33% and 22%, respectively, in AA patients and 49% and 38% in CA patients. Treatment response differed by genotype. Response rate was lower for genotype 1 (ETR 33%, SVR 18%) compared with genotype 2 (ETR 64%, SVR 60%) and genotype 3 (ETR 56%, SVR 50%). Of inmates with genotype 1 infection, no difference existed in ETR or SVR by race (ETR 33% AA vs. 34% CA; SVR 22% AA vs. 18% CA). Three of the four genotype 4-infected patients had an SVR. As-treated analysis showed no difference in treatment response by treatment history. ETR and SVR was 45% and 34%, respectively, in treatment-naïve patients compared with 42% and 32% in previously treated patients. Of genotype 1 CA patients, 22 out of 34 (65%) were treatment naïve. Four out of the 9 AA patients were treatment naïve. The 2 AA patients who achieved SVR had previously been treated with standard IFN/RBV. Both had early stage disease on liver biopsy (stage 1-early 2 and stage 1). Treatment response by fibrosis stage is presented in Figure 3.

Four patients developed exacerbation of depression during treatment and 3 were treated with antidepressant medication. One patient reported suicidal ideation. No suicide attempts were reported. Thirteen patients developed neutropenia or anemia requiring dose reduction or hematopoietic growth factors. Four known patients were discharged before completing treatment at the facility. Three patients discontinued treatment owing to psychiatric side effects (worsening of depression, irritability, anger), 3 due to neutropenia, 16 for reported side effects including fatigue, weight loss, and musculoskeletal pain, 1 due to concomitant illness, and 3 for unclear reasons. One patient was discharged from the facility for 4 months during treatment. Four patients were lost to follow-up after demonstrating undetectable HCV RNA at the end of treatment.

DISCUSSION

The correctional system has unique possibilities as an appropriate environment for HCV testing and treatment. Data indicate that as many as 29% to 43% of all HCV RNA positive individuals are annual discharges from prisons or jails.⁸ Incarceration may be the only time that many inmates intersect with the healthcare system. Treatment in prisons occurs in controlled, directly observed settings potentially allowing for increased compliance and ability to monitor for side effects and complications.

Minimal data exists on HCV infection and treatment response with current standard therapy of PEG-IFN plus RBV in the correctional setting. Table 2 summarizes all data to date of HCV treatment in this setting. Rates of virologic response to treatment in our cohort are lower than that published in clinical trials in other settings. These response rates are not significantly different from those previously published by our and other groups using non-PEG-IFN. Given the small number of patients in our study, the lower SVR may be explained in part by the number of patients (5 of 33) who were: (1) lost to follow-up after demonstrating a 12-week or 24-week response in viral load (which is highly correlated with ETR and SVR) and completing treatment or (2) lost to follow-up after demonstrating an ETR. The dropout rate was also affected by the inherent flux of the prison population and unforeseeable discharge from the prison in four patients who were initiated on IFN therapy. It is unknown if these patients completed treatment in the community. This highlights the importance of postdischarge planning, adequate community resources, and continuity of care for inmates, in whom the potential exists for successful treatment outcomes.

Lower SVR in our study may also be explained by the fact that a significant proportion of patients (37%) included in this study had previously failed standard IFN therapy (monotherapy or combination IFN/RBV therapy). SVR in retreated nonresponders and partial responders is known to be lower than in treatment-naïve patients.²⁵ It has been demonstrated that retreatment in relapsers with PEG-IFN and RBV can achieve SVR rates approaching, though still lower than, that in treatment-naïve patients.^{26,27} Retreatment response in all groups is also known to be higher in genotype non-1 patients—a minority of patients in this study had genotype non-1 disease. Given the large dropout rate due to adverse effects to PEG-IFN and RBV (26 out of 71, or 37%), one might consider that those patients who had poor tolerability to standard IFN would also be less likely to tolerate PEG-IFN/RBV therapy. Interestingly, we found no difference in treatment response by treatment history. It is unclear if the factors affecting treatment adherence in our analysis were in the end the same for both the treatment-naïve and previously treated groups. It may be that more patients in the treatment-naïve group were discharged from the facility before reaching the chosen end points, or were more likely to discontinue treatment due to side effects, than those who had already failed prior treatment and had a second opportunity for treatment. Of note, the dropout rate due to side effects in this study is higher than in our previous treatment group with standard IFN (37% vs. 12%). This may reflect less of a commitment to treatment on the part of the patients in this study group,

as compared with the standard IFN group. The standard IFN group was the first to be treated for chronic hepatitis C in the RIDOC. These patients were involved in the campaign for access to treatment and seemed particularly determined to complete treatment despite adverse effects. From the clinical experience of the primary treating provider, the treatment group described in this study seemed less motivated to tolerate side effects. The physical demands of incarceration may also adversely impact the ability of inmates to tolerate treatment, though this may be balanced by efforts to not demonstrate weakness in such a setting. The high dropout rate might be overcome by more aggressive management of side effects by the treating team.

Genotype and race have been independently associated with differential responses to HCV therapy—genotype 1 with lower response rates (42% to 46% vs. 76% to 82% for genotypes 2 and 3) and AA race with lower response rates (19% to 28% vs. 52%).^{28,29} It is unclear why AA race is associated with lower response rates—whether host or viral factors, such as higher rates of genotype 1 infection, differences in rates of obesity and concomitant nonalcoholic fatty liver or nonalcoholic steatohepatitis, differences in degree of fibrosis or pretreatment level of viremia, or inappropriate therapy (nonweight-based or genotype-based dosing of RBV). Data are limited as AA persons have been understudied in clinical trials for HCV treatment. The few studies evaluating treatment response by AA versus CA race in nonincarcerated populations demonstrate that differential treatment response persists within genotype 1 disease, with lower rates in AA patients, despite controlling for dose of medication, sex, hepatic fibrosis, and HCV-RNA levels.^{29–31} Although our sample size is small, our data suggest no difference in treatment response by race for genotype 1, similar to findings by Sterling et al¹⁸ at the Virginia Department of Corrections and differing from studies in nonincarcerated populations. Maru et al²⁴ at the Connecticut Department of Corrections did not report values for treatment response by race, but found in their study that black race was not correlated with failure to achieve SVR. This raises the question of what impact the treatment environment has on HCV treatment outcomes—perhaps directly observed therapy and close physician, nursing, psychiatric, and substance treatment support can overcome differences in response rates by race, using current guidelines for PEG-IFN and RBV dosing.

Notably, in our study, the 2 AA patients who achieved SVR had multiple negative prognostic factors for treatment success—AA race, genotype 1 disease, and retreatment. Both had early stage fibrosis on liver biopsy, suggesting particular benefit to treating AA patients at earlier stage disease. In fact, most patients (70% of those with liver biopsy, 58% overall) in our study had known early stage disease, and the overall SVR in our study likely reflects successful treatment response in this subgroup. Although some guidelines recommend deferring treatment for minimal fibrosis, our experience suggests that decisions for treatment should be individualized and consider what opportunities exist for an individual to access treatment in the future and achieve treatment response. The correctional setting may present an opportunity to treat those at earlier stage of disease, when the likelihood of achieving SVR is higher. Limitations to our study include its retrospective nature, small sample size, bias in selection of patients for treatment, and limited access to data through chart review.

Our results support the limited existing data that acceptable HCV treatment outcomes can be achieved in prisons using today's standard-of-care in HCV treatment, PEG-IFN plus weight-based RBV. The HCV-infected population inconsistently intersects with the community healthcare system and inmates bear a remarkable burden of chronic HCV infection. HCV intervention and management in the correctional setting has enormous potential for reducing the burden of disease in the greater public health community and improving health outcomes in this burgeoning population.

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FIGURE 1.

Outcome in 71 male inmates treated for chronic hepatitis C at the Rhode Island Department of Corrections, 2000 to 2004.

FIGURE 2.
Treatment response by genotype and race.

FIGURE 3.
Treatment response by fibrosis stage.

TABLE 1

Characteristics of 71 Male Inmates Treated With Pegylated Interferon and Ribavirin, RIDOC, October 2000 to April 2004

Characteristic	Value
Mean age (range), y	41 (range, 23-56)
Race/ethnicity, n (%)	
White	57 (80)
Black	9 (13)
Hispanic	4 (5)
Asian	1 (1)
Hepatitis C virus genotype, n (%)	
1	46 (65)
2	12 (17)
3	9 (13)
4	4 (5)
Treatment history, n (%)	
Never treated	45 (63)
Prior treatment	26 (37)
Substance abuse history, n (%)	
Substance abuse	70 (99)
Drug	52 (73)
Injection drug	61 (86)
Alcohol	44 (62)
Biopsy stage (0-4), n	
Stage 0	1
Stage 0-1	1
Stage 1	22
Stage 1-2	4
Stage 2	13
Stage 2-3	4
Stage 3	5
Stage 3-4	6
Stage 4	3
No Biopsy	12

RIDOC indicates Rhode Island Department of Corrections.

TABLE 2

Summary of All Intraprison Treatment Studies to Date for Chronic HCV Infection

Study	Sample Characteristics	Sample Size	Treatment	Completed Treatment (%)	Overall ETR (%)	Overall SVR (%)	GT1 CA SVR (%)	GT1 AA SVR (%)
Allen et al ¹⁷	Mean age: 38 percentage male: 96	90	Interferon- α 2b +ribavirin	46	43	29	Unavailable (UA)	UA
Sterling et al ¹⁸	Mean age: 41 percentage male: 83	59	Interferon- α 2b +ribavirin	UA	44	36	33	29
Farley et al ¹⁹	Mean age: 38 percentage male: 100	114	Interferon- α 2b +ribavirin	UA	UA	52	UA	UA
Sabbatani et al ²³	Mean age: 36 percentage male: 98	39	Pegylated interferon- α 2b +ribavirin	26	23	13	Not applicable (NA)	NA
Maru et al ²⁴	Median age: 41 percentage male: 85	68	Pegylated interferon- α 2a or interferon- α 2b +ribavirin	69	63	47	UA	UA
Chew et al (current study)	Mean age: 41 percentage male: 100	71	Pegylated interferon- α 2b +ribavirin	46	39	28	22	18

AA indicates African American; CA, white; ETR, end-of-treatment response; GT, genotype; HCV, hepatitis C virus; SVR, sustained virologic response.