An International Survey of the Diagnosis, Management, and Treatment of Hepatitis C in Patients with End-Stage Renal Disease

Mira R. Olson,[1] Kevin S. Grewal,[2] Adam Bingaman,[5] Radi Zaki,[4] Shelby Stewart,[3] John Horton,[6] Victor Araya,[2] Jorge Ortiz[4]

Abstract

***Objectives*: Hepatitis C is one of the leading causes of death from liver disease in the United States, and is frequently associated with renal disease. Two major organizations—the American Association for the Study of Liver Disease and the National Kidney Foundation—have published recommendations regarding the treatment of hepatitis C in the presence of chronic kidney disease; however, these guidelines do not always provide the same recommendations.**

Given the paucity of data on adherence to the current guidelines, a survey was conducted to provide information about the current practices of physicians in comparison to the published guidelines.

***Materials and Methods:* An observational study was conducted via a global survey asking physicians treating patients who had concurrent hepatitis C and chronic kidney disease.**

***Results:* The 218 questionnaires collected requested the physician's subspecialty, the number of transplants performed at the hospital, the usual method of screening for hepatitis C, the preferred route, the indication and frequency of liver biopsy, the use of ribavirin and interferon, the use of hepatitis-C–positive donors in kidney transplant, and consent requirements.**

***Conclusions:* Our results showed that many physicians do not follow current recommendations. We argue that a consensus group be formed to set forth guidelines for the management of hepatitis C to optimize outcomes, and improve overall morbidity.**

Key words: *Ribavirin, Interferon, Dialysis, Transplantation*

Hepatitis C is one of the leading causes of death from liver disease in the United States. The CDC estimates that there are approximately 3.2 million people in the United States currently infected with hepatitis C (1). Because of its association with cryoglobulinemia and subsequent membranoproliferative glomerulonephritis, renal disease is frequently found within this population. This was shown by the higher prevalence of proteinuria in patients with anti-hepatitis C virus (HCV) antibodies than without these antibodies in Taiwan (2). Those with chronic renal disease are also at higher risk of developing hepatitis C infection via contaminated dialysis equipment, exposure from a kidney transplant, or from blood transfusions. The prevalence of HCV infection within the dialysis population is approximately 13% (3). A higher mortality rate also has been observed in chronically infected HCV patients on hemodialysis and/or after renal transplant (4, 5). The goal of hepatitis C treatment in patients on hemodialysis is to minimize the progression of liver disease, and to also clear the virus before possible renal transplant.

Two major organizations, the American Association for the Study of Liver Disease (AASLD) and the National Kidney Foundation have published recommendations regarding the treatment of hepatitis C in the presence of chronic kidney disease; however, these guidelines do not always provide the same recommendations (6, 7). A brief overview of the AASLD guidelines published in 2004 and the Kidney Disease: Improving Global Outcomes (KDIGO)

From the Albert Einstein Medical Center, [1]Gastroenterology, [2]Hepatology, [3]Surgery, [4]Transplant Surgery; [5]the Texas Transplant Institute, Transplant Surgery; and [6]the Beaumont Medical Center, Surgery

***Address reprint requests to:** Dr Jorge Ortiz, Albert Einstein Medical Center, Transplant Surgery, 5501 Old York Road, Klein Building Suite 509, Philadelphia, PA*

***Phone**: +1 (215) 456-8543 **Fax:** +1 (215) 456-8058 **E-mail:** OrtizJor@einstein.edu.*

Experimental and Clinical Transplantation (2009) 4: 203-213

Copyright © Başkent University 2009
Printed in Turkey. All Rights Reserved.

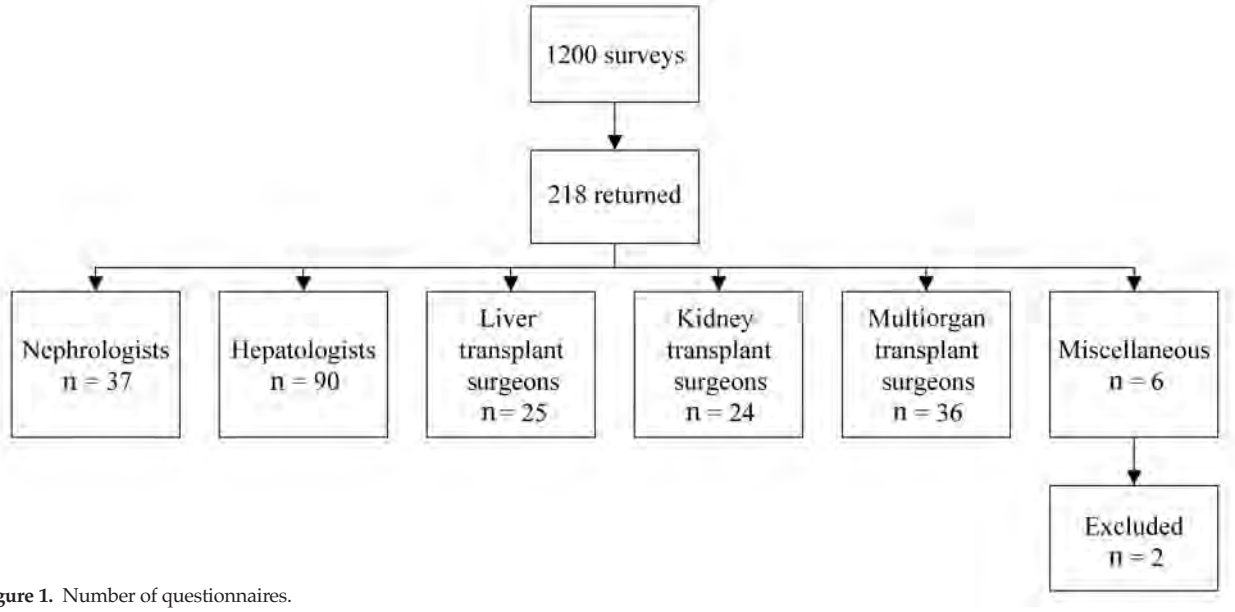

Figure 1. Number of questionnaires.

guidelines published in 2008 is included in Table 2. Many physicians, particularly those at transplant centers, may not necessarily follow the current recommendations and base their management choices on personal experience and new methods. Given the paucity of data on adherence to the current guidelines, this survey was conducted to provide information regarding the current practices of physicians caring for patients with chronic kidney disease infected with hepatitis C in comparison to published guidelines.

Materials and Methods

An observational study was conducted via a global survey inquiring about the clinical practices of physicians treating patients with concurrent hepatitis C and end-stage renal disease. A questionnaire was sent out to 1200 physicians directly involved in the care of pretransplant and posttransplant patients. The questionnaire requested the physician's subspecialty, the number of transplants performed at the hospital, the usual method of screening for hepatitis C, preferred route of liver biopsy, indication, and frequency of liver biopsy, use of ribavirin and interferon, the use of HCV positive donors in kidney transplant, consent requirements, and also allowed for any general comments at the end of the survey. The surveys were collected between January 2007 and July 2008. The results were tabulated and compared to the KDIGO guidelines published in 2008 and the AASLD guidelines published in 2004.

Results

Of 218 questionnaires that were collected from the original 1200 that were distributed, 90 were hepatologists, 37 were nephrologists, 36 were multiorgan transplant surgeons, 24 were kidney transplant surgeons, 25 were liver transplant surgeons, and 6 were categorized as miscellaneous (1 surgical pathologist, 1 nurse, 2 transplant ID specialists, 1 physician assistant, and 1 physician researcher) as seen in Figure 1. Two surveys were excluded owing to incompleteness. Each group had varying levels of experience with liver and kidney transplants as seen in Table 1.

Table 1. Level of transplant experience by specialty.

	n	Average number of liver transplants per year	Average number of kidney transplants per year
Hepatologists	90	70.4	82.6
Nephrologists	37	29.7	243.2
Multiorgan surgeons	36	63.2	116.7
Kidney surgeons	24	53.0	117.7
Liver surgeons	25	157.9	164.3
Miscellaneous	4	10.0	196.3

Method of HCV screening (Figure 2)

The first question asked health care providers about their preferred method of HCV screening. The majority of respondents performed simultaneous HCV RNA PCR and serum antibody detection (49.5%). When broken down by subspecialty, this was the preferred method of 70% of nephrologists, 54% of kidney surgeons, 48% of liver surgeons,

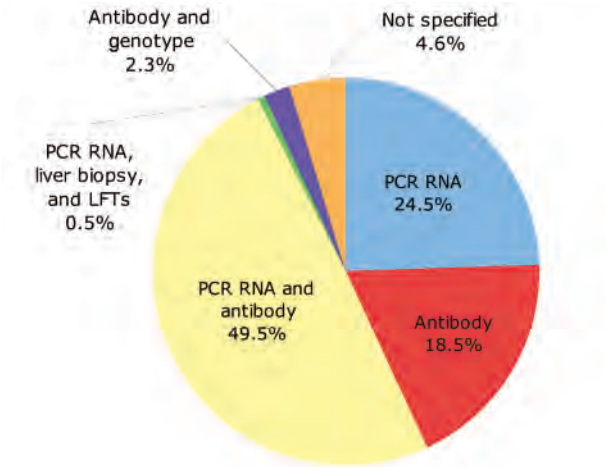

Figure 2. Method of HCV screening, all specialties combined. ***Abbreviations:*** LFT's, liver function test; PCR, polymerase chain reaction; RNA, ribonucleic acid.

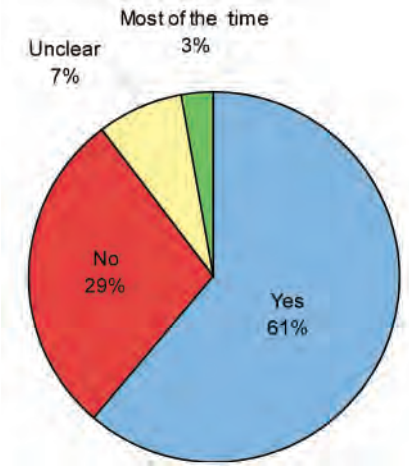

Figure 3. Use of liver biopsy, all subspecialties combined.

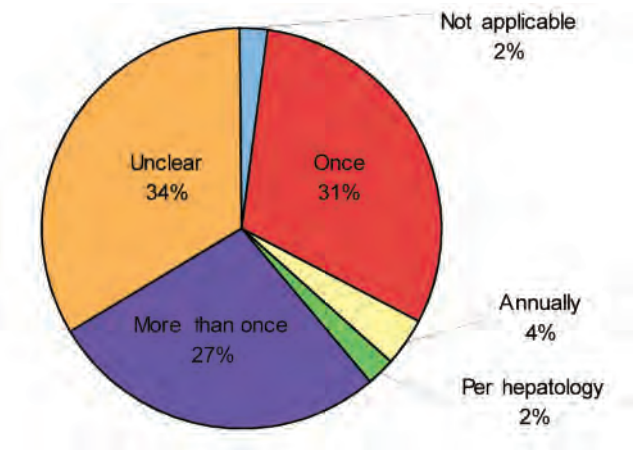

Figure 4. Frequency of liver biopsies, all subspecialties combined.

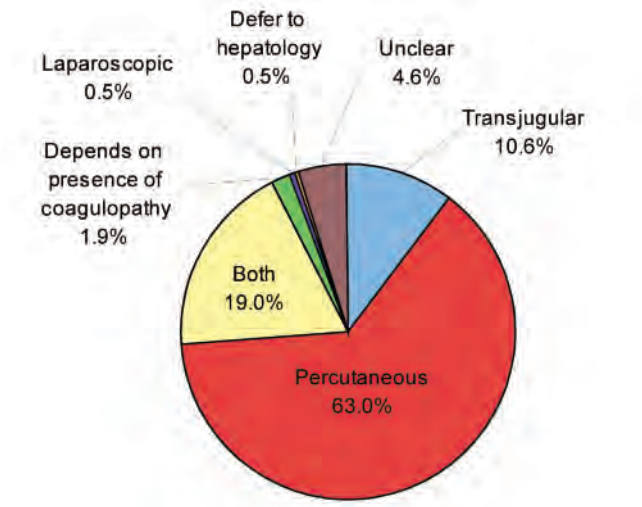

Figure 5. Route of liver biopsy, all specialties combined.

50% of multiorgan surgeons, and 41% of hepatologists. One fourth of all physicians polled relied on HCV RNA PCR alone (24.5%), while 18.5% screened via antibody testing. Those hepatologists screening via single modality were split between serum antibody testing (24%) and PCR (24%), with an equal distribution as seen by liver surgeons and nephrologists. Multiorgan surgeons (28%), kidney surgeons (25%), and nephrologists (16%) chose PCR as the second most-popular option for HCV screening.

Use of liver biopsy (Figure 3)

The second topic pertained to the use of liver biopsies. Routine use of liver biopsy was reported by 61% of physicians polled, while 29% stated that they do not perform liver biopsies in HCV-infected patients on hemodialysis. Kidney surgeons were most likely to request liver biopsies (79%), followed by nephrologists (68%), and hepatologists (61%). Liver surgeons were least inclined to perform liver biopsy (32%).

Frequency of liver biopsies (Figure 4)

When asked to cite their usual interval for liver biopsy, the majority of physicians were unclear (34%), which included 68% of liver surgeons, and 42% of hepatologists. A single biopsy was preferred by kidney surgeons (63%) and nephrologists (43%). Hepatologists were more likely to obtain more than 1 liver biopsy (33%). Twenty-seven percent of specialists reported obtaining more than 1 biopsy, but provided varying intervals. Four-percent stated that they obtained liver biopsies annually, with some citing more-frequent intervals. The shortest interval reported by 1 physician was 3 times per year versus multiple others that requested them every 2 to 4 years.

Preferred route of liver biopsy (Figure 5)

With regard to the route of liver biopsy, the majority of our survey respondents preferred percutaneous liver biopsy (63%), while 10.6% preferred a transjugular - approach. Nineteen percent used both approaches.

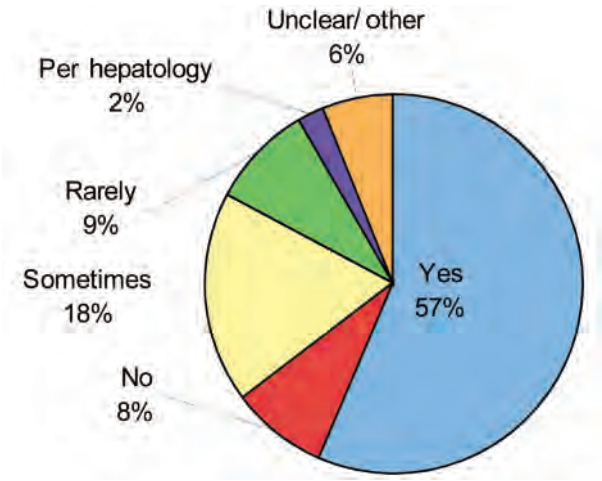

Figure 6. Use of interferon, all specialities combined.

Nephrologists were most likely to request a percutaneous biopsy (78%), followed by hepatologists (64%), and liver surgeons (60%). Only 1.9% reported basing their decision on the presence of coagulopathy.

Use of interferon (Figure 6)

Physicians were also polled regarding their use of interferon with a dialysis population. Many reported using interferon (57%) in patients on hemodialysis, with only 8% reporting that they never use interferon treatment with concurrent end-stage renal disease. Twenty-seven percent stated that they used it "sometimes" or "rarely," and 2% of all physicians polled deferred the decision to treat to the hepatologist. Six percent were unclear or did not answer regarding their use of interferon under these circumstances.

Indications for use of interferon (Figure 7)

Indications to initiate treatment with interferon varied widely. When all physicians were grouped together, 24.1% based their decision on biopsy results. Stages and/or grades that prompted treatment within this population varied widely between respondents. The next largest group (20.4%) chose either not to answer the question or stated that they did not know. The third largest group based their decision to treat on the viral load. Only 5.6% deferred the decision to treat to a hepatologist.

Formulation of interferon (Figure 8)

Physicians also commented on their preferred formulation of interferon. The majority of physicians (26.4%) use peg-interferon alfa 2a. Nineteen percent

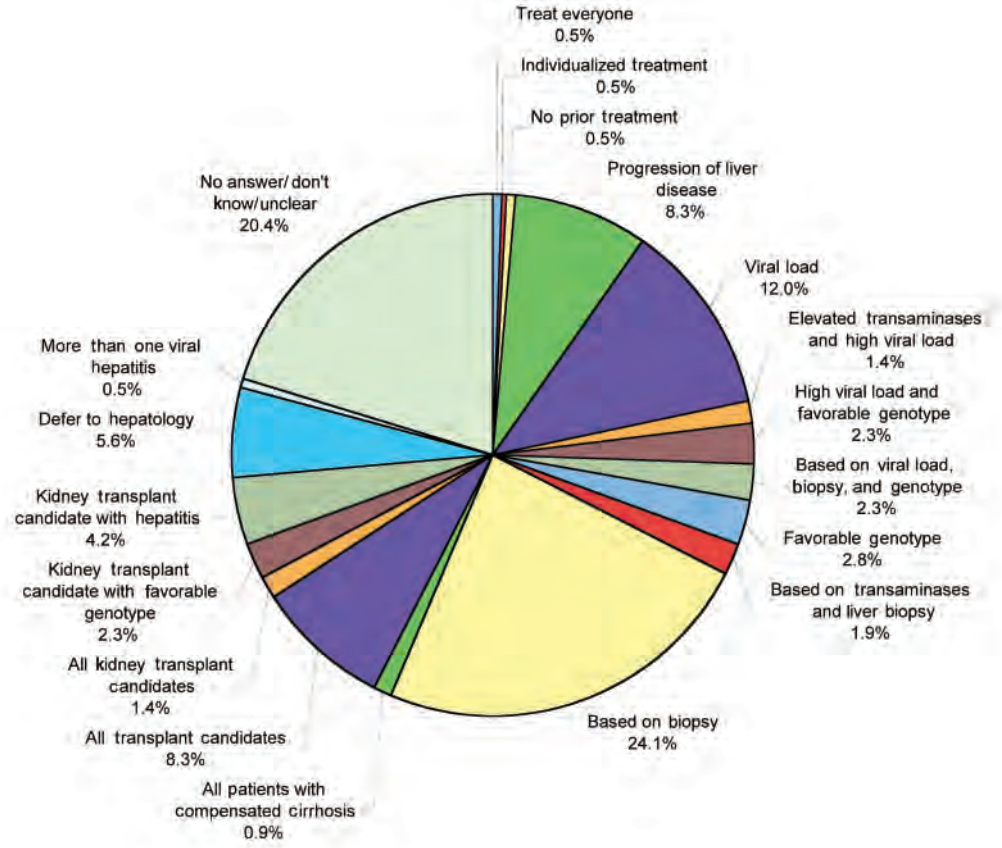

Figure 7. Indications for interferon use, all specialities combined.

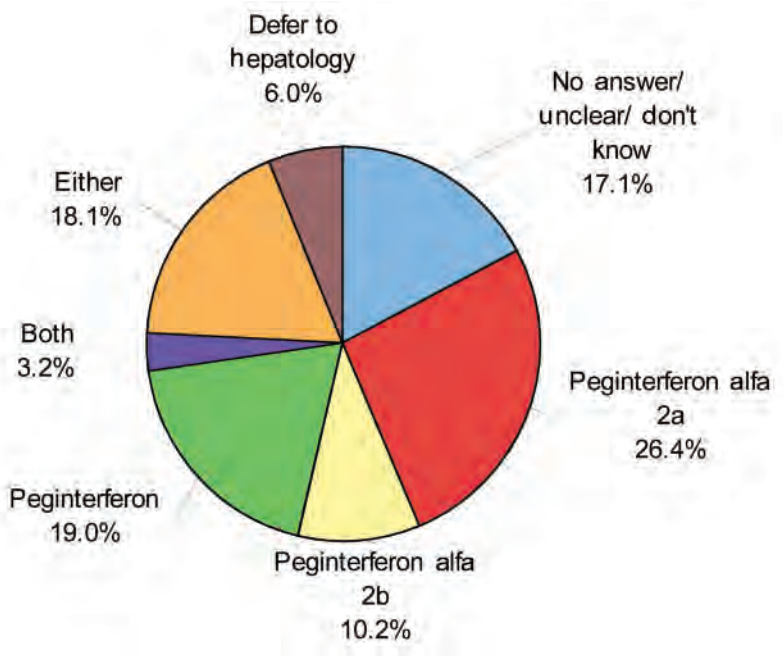

Figure 8. Formulation of interferon used, all specialties combined.

stated that they use interferon, but did not specify which formulation. A total of 37 physicians (17.1%) stated that they either did not know the correct formulation, or chose not to respond to the question—4 of whom were hepatologists. Forty-six physicians reported using more than 1 formulation of interferon in their practices. Doses were either not provided and those provided varied widely. Sample answers included: one-fourth of the standard dosage, standard dosage, the highest dosage that the patient could tolerate, or individualizing the dosage strategy.

Use of ribavirin (Figure 9)

When asked about ribavirin, 40% of all physicians polled stated that they do not give ribavirin, while 38% stated that they use it as part of treatment in dialysis patients. Five percent of physicians deferred the decision to use ribavirin to the hepatologist, while 10% were unclear about the role of ribavirin. When broken down by subspecialty, hepatologists and nephrologists, were less inclined to give ribavirin (51% and 51% respectively). Multiorgan surgeons (64%) were the only group to favor treatment with ribavirin in this circumstance, but the majority (44%) stated that they did not know the recommended dosage. Dosages of ribavirin used varied widely, and ranged from three times daily to biweekly dosing with weight-based dosing versus escalating doses versus up to 1200 mg daily. Additionally, some physicians reported monitoring levels and hemoglobin.

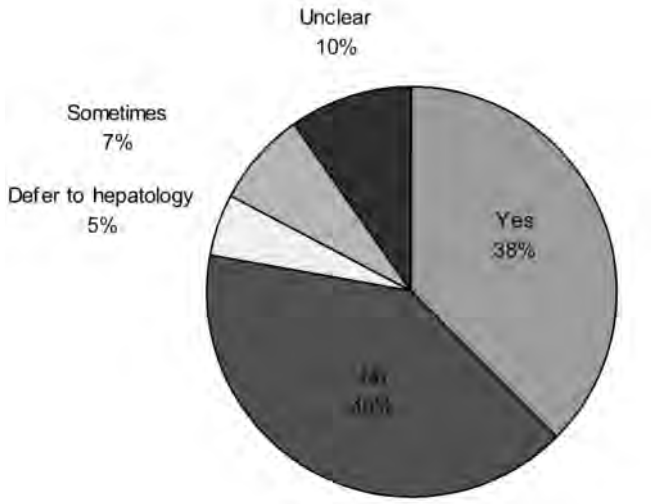

Figure 9. Use of ribavirin, all specialties combined.

Primary decision maker (Figure 10)

Hepatologists were the primary decision makers regarding treatment when all specialties were combined 63.4% of the time. Nephrology and hepatology made a joint decision regarding treatment in 13.4% of cases, although the third largest group chose not to answer the question (9.7%). When the results were tabulated within the specialties, the hepatologists were most often named as the primary decision makers. All other approaches were only cited as being used less than 5% of the time.

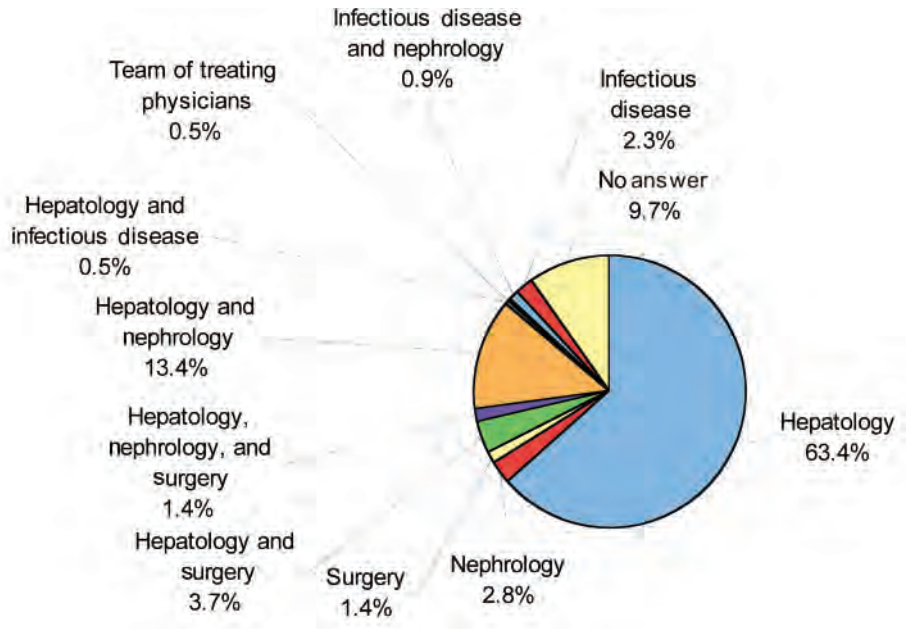

Figure 10. Primary decision maker, all specialties combined.

Use of HCV-positive renal grafts in kidney transplant (Figure 11)

Physicians also were asked to comment on whether or not HCV positive patients were given renal grafts from HCV-infected donors. In our survey, 61% of all physicians answered "yes," 17% stated "no," 8% answered "sometimes," and many gave no answer,, or stated that the issue was unclear (14%). When considered separately among the subspecialties, kidney surgeons (92%) and multiorgan surgeons (89%) predominantly answered "yes." Nephrologists (30%) and liver surgeons (24%) were more likely to respond "no."

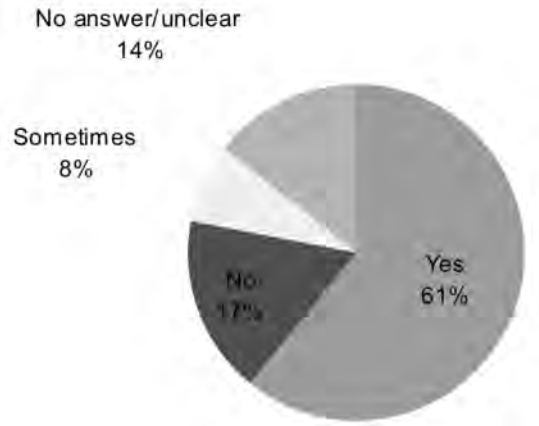

Figure 11. Use of HCV-positive renal grafts in HCV-positive kidney transplant recipients, all specialties combined.

Use of formal, written consent for HCV-positive grafts (Figure 12)

The survey also requested that physicians comment on how frequently they obtain formal, written consent from patients prior to being given a renal graft from an HCV-infected donor. Based on our results, many physicians (61%) obtain formal, written consent when transplanting an HCV-positive kidney into an HCV-positive donor, the majority of which consisted of the surgical subspecialties (71% to 72%). Eight percent stated that they do not obtain formal, written consent, although many stated that they provided additional counseling during office visits or obtained verbal consent. Of those physicians who stated they do not routinely obtain formal, written consent before transplanting an HCV-positive kidney; these

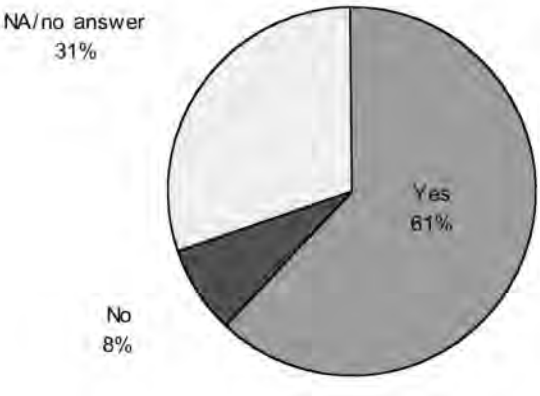

Figure 12. Use of formal written consent when transplanting a HCV-positive kidney, all specialties combined.

physicians were most likely to be multiorgan physicians (17%). Many answered "not applicable," or chose not to answer the question (31%).

Recommendations for the asymptomatic cirrhotic patient (Figure 13)

Recommendations for the asymptomatic cirrhotic patient with end-stage renal disease varied among the different subspecialties. Physicians used dual-organ transplant (45%) most often, kidney transplant alone (19%) less often, or denied transplant completely (15%). Fifty-six percent of multiorgan transplant surgeons recommended dual-organ, while 28% of the same group recommended renal transplant alone or no transplant (6%). Nephrologists also favored dual-organ transplant (62%), although 16% recommended kidney alone versus no transplant (16%).

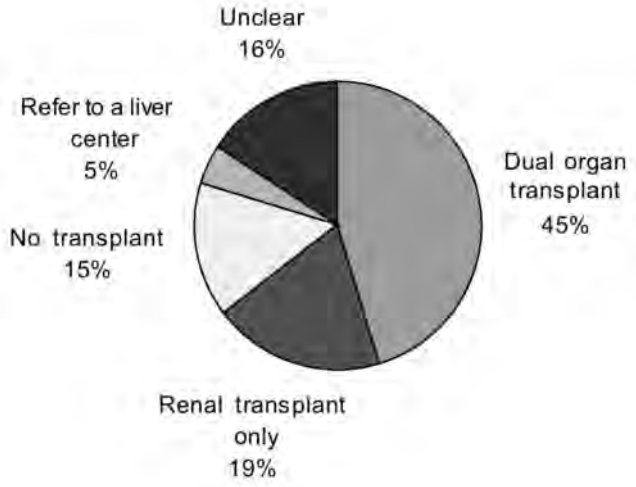

Figure 13. Recommendations for patients with asymptomatic cirrhosis on hemodialysis, all specialties combined.

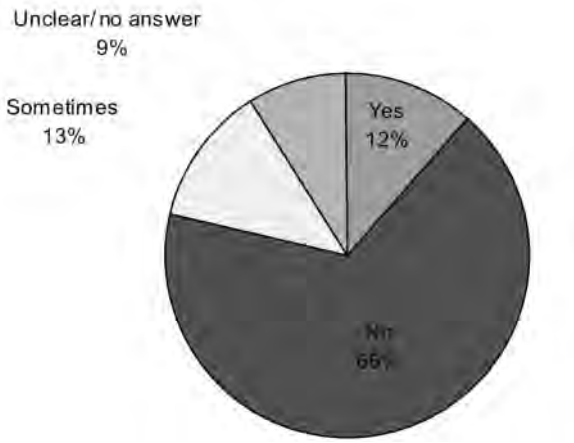

Figure 14. Use of interferon following kidney transplant, all specialties combined.

Use of interferon following kidney transplant (Figure 14)

Regarding treating HCV with interferon after renal transplant alone, the majority do not (66%). Kidney surgeons (75%), nephrologists (73%), and hepatologists (70%) were least likely to use interferon in this situation. Thirteen percent of all physicians polled stated that they use interferon sometimes, which was usually on a "case-by-case" basis, with most stating that they would prefer not to use it at all in this population. Twelve percent of physicians reported treating with interferon, with the highest group being the multiorgan surgeons (17%), followed by hepatology (12%), and nephrology (11%).

Use of interferon following dual-organ transplant (Figure 15)

Survey responses were divided regarding interferon use following dual-organ transplant. Twenty-eight percent reported using interferon, while 29% did not. Nineteen percent reported using interferon on a case by case basis, while 24% either did not answer or stated that they were unsure. Liver surgeons (36%) and hepatologists (36%) were most likely to use interferon in this case. These same 2 groups (liver surgeons, 48%, and hepatologists, 37%) were also least likely to use interferon following dual organ transplant. The majority of physicians who either stated they did not know or chose not to answer the question were kidney transplant surgeons (71%).

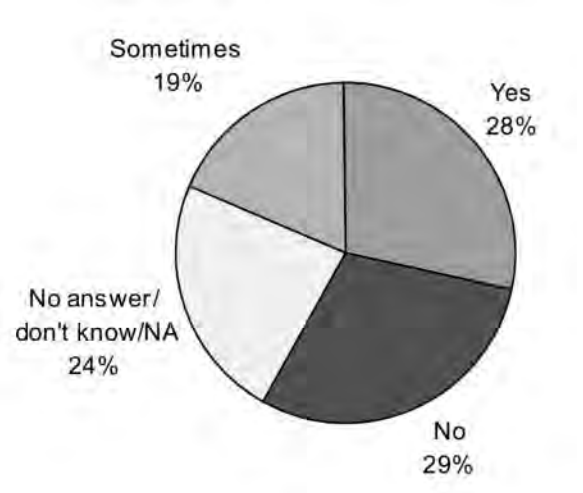

Figure 15. Use of interferon following dual-organ transplant, all specialties combined.

Use of HCV-positive renal grafts in HCV-negative recipients (Figure 16)

The final question asked physicians to comment on the use of HCV positive kidneys in an HCV-negative recipient. Eighty-eight percent would not offer a HCV positive kidney to an HCV negative patient, although exceptions were made (4%) occasionally. Nephrologists were more likely to recommend an HCV-positive graft in an HCV-negative patient (11%).

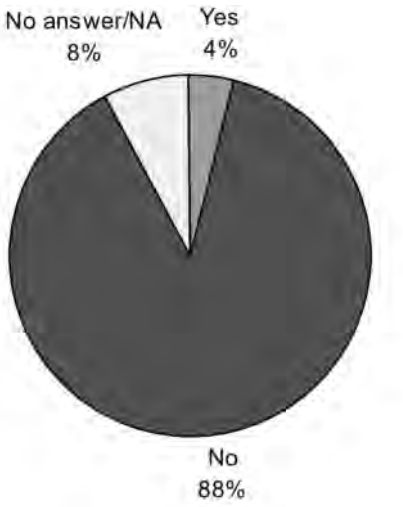

Figure 16. Use of HCV-positive kidney grafts in HCV-negative transplant recipients, all specialties combined.

Discussion

The results of our polling provided a snapshot of current clinical practice for the treatment of HCV in the setting of hemodialysis, renal transplant, and liver-kidney combined transplant. Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances. Our results provided insight into the variable adherence to these published guidelines.

The first question posed on the survey requested information regarding the method of screening for hepatitis C. As reviewed in Table 2, currently both guidelines recommend testing of antibodies first and RNA testing with positive antibody screens. KDIGO also recommends that all possible renal transplant recipients, newly initiated, or change of venue dialysis patients have HCV RNA testing; whereas AASLD recommends this in possible acute HCV infections and patients who may receive antiviral therapy. In patients with unexplained elevations in aminotransferases, or those on hemodialysis in a unit with a high prevalence of HCV, the National Kidney Foundation recommends initial screening via HCV RNA (6). A minority of health care providers (18.5%) followed the guidelines for screening, with the majority instead choosing to screen via simultaneous HCV RNA PCR and serum antibody detection (50%) or HCV RNA PCR alone (24.5%).

The second group of topics pertained to the use, frequency, and location of liver biopsies. While the KDIGO guidelines only recommend biopsies in prerenal transplant candidates, the AASLD recommends biopsies if the results will influence the decision to treat HCV or provide prognostic information (7). Despite being under debate, liver biopsies are routinely obtained by a majority of physicians polled (61%). Twenty-nine percent stated that they do not perform liver biopsies in HCV-infected patients on hemodialysis. That nephrologists and kidney transplant surgeons were most likely to obtain a liver biopsy is expected given the recommendations put forth in the KDIGO guidelines. Both guidelines are in agreement in their recommendation of repeating a liver biopsy every 3 or 4 or 5 years in those patients who have refused antiviral treatment, or in which treatment was deferred (6, 7). Interestingly, the largest group of physicians was unclear (34%) regarding the interval of liver biopsies. When responses were combined, the survey responses revealed that 31% of physicians in the community obtain biopsies more frequently than specified by the guidelines published by either group (4% annually, 27% more than once). KDIGO was the only guideline to recommend 1 route of biopsy (transjugular or transfemoral) if there were certain patient conditions. Although some debate exists regarding the quality and safety of transjugular biopsies, Kalambokis and associates systematically reviewed the literature and found that percutaneous liver biopsy and transjugular liver biopsy are comparable with regards to mortality and complication rates as well as acceptable specimen retrieval (8). Regardless, percutaneous liver biopsy (63%) was the preferred route. Only 1.9% based their decision on the presence of coagulopathy.

Physicians were also polled regarding their use of interferon in the dialysis population. Per the AASLD, if this type of patient is to undergo HCV treatment, monotherapy is the treatment of choice. Of which 55.6% of those polled followed. Alternatively, in the KDIGO guidelines, patients with CKD stages 1 and 2,

Table 2. Summary of applicable AASLD and KDIGO guidelines[1, 2]

	KDIGO	AASLD

Screening for HCV	- Testing for antibodies first
	- HCV RNA testing in:
	  - Positive antibody screen
	  - All prospective kidney transplant recipients
	  - All patients who have recently started hemodialysis or recently changed dialysis facilities
	- Screening initially via HCV RNA in those with:
	  - Unexplained elevations in aminotransferases
	  - Patients on hemodialysis in a unit with a high prevalence of HCV
		- Testing for antibodies first
		- HCV RNA testing in those with:
		  - Positive antibody screen
		  - Immunocompromised host with liver disease of unclear etiology
		  - Possible acute hepatitis C infection
		  - Any candidates for antiviral therapy
		- Quantitative RNA assays and genotype testing on all patients prior to treatment

Recommended use of liver biopsies	- All kidney transplant recipients with HCV should undergo a liver biopsy prior to transplant	- Results will influence the decision to treat the infection - Prognostic information is needed - Planned treatment in patients with end-stage renal disease

Frequency of liver biopsies	- Repeat a liver biopsy every 3-5 years in patients that
	  o Failed treatment
	  o Refused treatment
		- Repeat a liver biopsy every 4-5 years in those patients that
		  o Refused antiviral treatment
		  o Treatment was deferred

Route of liver biopsy	- Use of transjugular or transfemoral liver biopsy in the presence of coagulopathy, ascites, or thrombocytopenia	• No recommendations

Use of interferon	- CKD stages 1 and 2
	  o Pegylated interferon with ribavarin titrated to patient tolerance.
	- CKD stages 3 and above and the chronically infected kidney transplant recipients
	  o Pegylated interferon monotherapy
		• Monotherapy with interferon in patients with end-stage renal disease

Indication for treatment with interferon	- Decisions to treat should be individualized and based on an individualized analysis of risks and benefits	• Treatment should be individualized for patients with chronic kidney disease
Dose of interferon	- Either pegylated IFN alfa-2a 135 μg sub-cutaneously each week or pegylated IFN alfa-2b 1 μg/kg subcutaneously each week	• Peginterferon alfa-2a 135 μg sub-cutaneously each week
Use of ribavirin	- Not recommended	• Not recommended
Use of HCV-positive grafts in HCV-positive recipients	- Grafts from viremic donors should be limited to patients that have chronic hepatitis C	• No recommendations
Use of consent when using HCV-positive grafts	- Patients who will be receiving a kidney from a hepatitis C infected donor should be involved in the decision-making process	• No recommendations
Recommendation for the asymptomatic cirrhotic with end-stage renal disease	- Chronic HCV infection should not be a contraindication to renal transplant	• All patients with chronic renal disease and cirrhosis be evaluated for a dual-organ transplant
Use of interferon following solid organ transplant	- Patients with clinical and histological evidence of worsening liver disease and chronic HCV infection after renal transplant should be treated with interferon monotherapy if the benefits truly outweigh the risk of rejection	• Generally contraindicated unless it is used under the supervision of an experienced transplant center

1. KDIGO clinical practice guidelines for the prevention, diagnosis, evaluation, and treatment of hepatitis C in chronic kidney disease. Kidney Int Suppl, 2008(109): S1-S99.
2. Strader DB, et al., Diagnosis, management, and treatment of hepatitis C. Hepatology, 2004;39(4):1147-1171.

pegylated interferon should be given with ribavirin titrated to patient tolerance. For patients with CKD stages 3 and above and the chronically infected kidney transplant recipients, only pegylated interferon should be used. Although these recommendations are included, they are listed only as suggestions based on "weak" evidence (6). Interestingly, 43% do not use interferon in patients on hemodialysis despite current recommendations.

Per the AASLD, therapy should be considered in all patients with abnormal ALT values, liver biopsy with a Metavir score ≥ 2, compensated liver disease;

however, treatment should be individualized for patients with chronic kidney disease (7). KDIGO guidelines are similar in the decision to treat being based on individualized analysis of risks and benefits (6). This recommendation is purportedly based on "weak" evidence in the KDIGO guidelines, and also states clearly that the indications are not well-defined, although all patients who are hepatitis C-positive should be evaluated for possible treatment (6). The responses regarding indications to initiate treatment with interferon varied widely. The majority based their decision to treat with interferon on a biopsy result; however, the cutoff for grade and/or stage varied widely.

With regard to formulation of interferon and dosage, the answers varied widely. Peg-interferon alfa 2a was the most popular choice, but many practices appear to use more of 1 type of interferon interchangeably, with an even wider variety of dosing regimen. The current guidelines from the AASLD recommend a reduced dose of pegylated interferon (peg-interferon alfa-2a 135 μg subcutaneously each week) in conjunction with close monitoring for toxicity (7). KDIGO recommends renal dosed monotherapy (either pegylated IFN alfa-2a 135 μg subcutaneously each week, or pegylated IFN alfa-2b 1 μg/kg subcutaneously each week) (6).

Use of ribavirin in hemodialysis patients is not currently recommended by either group because of the risk of severe hemolysis. Despite the recommendations, a fair number of physicians (38%) continue to use ribavirin in these patients at varying dosages. These practices reflect current areas of investigation to improve treatment in this hard-to-treat population as a clinical trial based in Taiwan is actively recruiting patients to study the use of low-dose ribavirin in treatment-naïve patients with chronic hepatitis C on hemodialysis (9).

The primary decision maker was most often the hepatologist (63%). There are no clear recommendations designating 1 specialty as being the best at guiding treatment; however, the consensus based on our results is that the hepatologists are most often making treatment decisions.

Concerning the use of HCV positive grafts, the KDIGO guidelines very clearly state that grafts from viremic donors should be limited to patients that have chronic hepatitis C due to higher rates of mortality (6, 10, 11). This topic is not addressed in the AASLD guidelines. Our survey results revealed that there is still hesitancy by physicians to use donor kidneys from viremic patients with 17% of physicians choosing not to use these grafts at all. Only 61% followed guidelines by reporting the use of grafts from viremic patients.

The issue of obtaining formal consent when using a renal graft from a viremic host is not addressed in the current AASLD guidelines; however, the KDIGO guidelines state that patients who will be receiving a kidney from a hepatitis C-infected donor should be involved in the decision-making process (6). No mention is made regarding formal informed consent. Based on our results, the majority of physicians obtain some form of informed consent, despite the lack of recommendations to do so, whether that is office-based counseling; verbal consent; or formal, written consent. The results in this section were limited owing to a high number of physicians that chose not to answer this question, likely because they were not surgeons and therefore not involved in the consenting process.

Recommendations for the asymptomatic cirrhotic patient with end-stage renal disease varied among the different subspecialties. The current AASLD guidelines for transplant recommend that all patients with chronic renal disease and cirrhosis be evaluated for a dual-organ transplant (12). According to the KDIGO guidelines, chronic HCV infection should not be a contraindication to renal transplant; however, the guidelines do not comment on the use of dual-organ transplant. Given the current KDIGO guidelines, it is surprising that 15% of physicians deny patients with chronic hepatitis C as the option of transplant.

With regards to using interferon following solid-organ transplant, the AASLD states that it is generally contraindicated unless it is used under the supervision of an experienced transplant center (7). According to the KDIGO guidelines, patients with clinical and histologic evidence of worsening liver disease and chronic HCV infection after renal transplant should be treated with interferon monotherapy if the benefits truly outweigh the risk of rejection (6). Our survey revealed that very few will treat HCV with interferon after renal transplant alone, with many stating that although they used it "sometimes," they would prefer not to use it at all in this population.

Although the recommendations are similar for dual-organ transplant recipients, the survey responses were divided. Almost a third reported using interferon, while a similar number stated that they

never use interferon. One-fourth of physicians were unclear regarding the role of interferon in this population or chose not to answer the question, while almost 20% stated that they use it on a "case-by-case" basis.

As previously discussed, the KDIGO guidelines are clear that grafts from viremic donors should only be transplanted into viremic recipients. It is interesting to note that 4% of physicians would still offer an HCV-positive kidney to an HCV-negative patient, occasionally. Given that the AASLD does not address this issue, but the KDIGO guidelines do, it is also interesting to note that nephrologists were more likely to recommend an HCV-positive graft in an HCV-negative patient (11%).

Limitations of our study include some level of recall bias. And another criticism could be the legitimacy of polling surgeons, as it may be in favor of straying from the guidelines and possibly skewing some results.

Upon review of the current practices of the physicians who responded to our survey in comparison to the current guidelines published by the AASLD and those published by the National Kidney Foundation, it appears clear that many physicians do not follow the current recommendations with regards to the treatment and management of patients with chronic hepatitis C with end-stage renal disease. Given the success of the use of consensus groups to review the literature and combine expert opinion with evidence-based medicine, many would argue that a consensus group to set forth guidelines for the management of chronic hepatitis C should be formed to provide thorough recommendations to optimize outcomes and improve overall morbidity.

References

1. Armstrong GL, Wasley A, Simard EP, McQuillan GM, Kuhnert WL, Alter MJ. The prevalence of hepatitis C virus infection in the United States, 1999 through 2002. Ann Intern Med. 2006;144(10):705-714.
2. Huang JF, Chuang WL, Dai CY, et al. Viral hepatitis and proteinuria in an area endemic for hepatitis B and C infections: another chain of link? J Intern Med. 2006;260(3):255-262.
3. Fissell RB, Bragg-Gresham JL, Woods JD, et al. Patterns of hepatitis C prevalence and seroconversion in hemodialysis units from three continents: the DOPPS. Kidney Int. 2004;65(6):2335-2342.
4. Fabrizi F, Martin P, Dixit V, Bunnapradist S, Dulai G. Meta-analysis: Effect of hepatitis C virus infection on mortality in dialysis. Aliment Pharmacol Ther. 2004;20(11-12):1271-1277.
5. Fabrizi F, Martin P, Dixit V, Bunnapradist S, Dulai G. Hepatitis C virus antibody status and survival after renal transplantation: meta-analysis of observational studies. Am J Transplant. 2005;5(6):1452-1461.
6. Kidney Disease: Improving Global Outcomes (KDIGO). KDIGO clinical practice guidelines for the prevention, diagnosis, evaluation, and treatment of hepatitis C in chronic kidney disease. Kidney Int Suppl. 2008;(109):S1-S99.
7. Strader DB, Wright T, Thomas DL, Seeff LB; American Association for the Study of Liver Diseases. Diagnosis, management, and treatment of hepatitis C. Hepatology. 2004;39(4):1147-1171. No abstract available. Erratum in: Hepatology. 2004;40(1):269.
8. Kalambokis G, Manousou P, Vibhakorn S, et al. Transjugular liver biopsy–indications, adequacy, quality of specimens, and complications–a systematic review. J Hepatol. 2007;47(2):284-294.
9. Pegylated Interferon Alfa-2a Plus Low Dose Ribavirin for Treatment-Naïve Dialysis Patients With Chronic Hepatitis C. 2007 December 21, 2008 NCT00491244 (this study is currently recruiting participants).
10. Bucci JR, Matsumoto CS, Swanson SJ, et al. Donor hepatitis C seropositivity: clinical correlates and effect on early graft and patient survival in adult cadaveric kidney transplantation. J Am Soc Nephrol. 2002;13(12):2974-2982.
11. Pereira BJ, Wright TL, Schmid CH, et al. Screening and confirmatory testing of cadaver organ donors for hepatitis C virus infection: a U.S. National Collaborative Study. Kidney Int. 1994;46(3):886-892.
12. Murray KF, Carithers RL Jr; AASLD. AASLD practice guidelines: Evaluation of the patient for liver transplantation. Hepatology. 2005;41(6):1407-1432.