Purpose: Urolithiasis is a common urological condition that causes significant pain and suffering. Until recently, few studies had been done to examine how quality of life is affected in stone formers. We hypothesized that patients with multiple recurrent episodes of urolithiasis have worse health-related quality of life. Thus, we identified specific factors that impact health-related quality of life in patients with urolithiasis.

Materials and Methods: In an institutional review board approved study, we recruited 386 patients through mailings and through the outpatient clinic who were evaluated at our institution for urolithiasis in the last 5 years. Each patient was asked to answer questionnaires on stone disease, including SF-36®, a validated 36-item health care quality of life survey.

Results: Of the 386 patients recruited for study, 115 responded to our inquiry. Variables such as surgical complications, time from last stone episode, number of emergency room visits, and number of surgeries correlated with the SF-36 domains.

Conclusions: Urolithiasis is associated with severe physical and psychological effects that lead to clinically significant impairment in quality of life. Our findings confirm and expand the findings of previous groups showing the many ways in which stone formation can affect patient quality of life. Appreciation of these effects in the acute and chronic treatment settings may change the way that the disease is approached.

Key Words: urolithiasis, quality of life, questionnaires, chronic disease, recurrence

UROLITHIASIS is a common medical problem that results in significant distress. While a single stone episode can cause significant morbidity, approximately 50% of stone formers have a repeat attack in the next 5 years.1 During an acute attack patients may experience severe pain, nausea, vomiting or infection. This may result in missed work as well as visits to the physician office or emergency room and surgical procedures. The chronic nature of the disease and the severe disruption to normal life have the potential to severely impact patient QOL.

During the last half century advances in medicine and the aging of our population have changed the nature of disease in our country to primarily chronic conditions.2 As a result, successful disease treatment no longer only focuses on morbidity and mortality. Equally important is the measure of QOL.3,4 Disease severity is better determined by patient perception than by laboratory values and imaging. Research in this area has expanded in urology and throughout medicine. For example, cardiology research showed that common pharmacological treatment
guidelines improved survival and morbidity but did not improve patient QOL. In urology this effort is seen with the American Urological Association symptom score, which is supplemented by a QOL measure.

Until recently little study had been done of the ways in which QOL is affected in stone formers. In 2007 Penniston and Nakada reported that patients with urolithiasis showed decreased QOL compared to healthy adults. Using the SF-36 validated QOL questionnaire they specifically found that stone patients had lower scores on the general health and bodily pain domains, and female stone formers reported lower average QOL scores than male respondents with lower scores signifying worse QOL. In 2009 Bensalah et al reported multiple factors that impact QOL in patients with urolithiasis, including BMI, age and the number of surgical procedures that a patient underwent. Recently Rabah et al examined HRQOL in stone patients after lithotripsy. Patients were compared with a control group and after successful treatment of the disease QOL in patients with urolithiasis was no different than in controls.

We hypothesized that patients with multiple recurrent urolithiasis episodes have worse HRQOL than a random collection of healthy American adults. We further identified specific factors that impact HRQOL in patients with urolithiasis.

METHODS

In an institutional review board approved study patients with urolithiasis who were seen at our urology clinic from 2005 to 2010 were recruited and a total of 386 were asked to participate. Patients were asked to complete 2 questionnaires, including the Emory Urology Stone Questionnaire and the validated SF-36 QOL instrument. Questionnaires were mailed or handed directly in clinic to patients for return. Nonresponders to mailed questionnaires were issued a reminder call and asked to respond, if so willing.

The Emory Urology Stone questionnaire gathers data on patient age, gender, BMI, sex, race, education level, income, employment status, family history of stone disease, number of lifetime kidney stones, number of procedures for stone disease, age at onset of stone disease, number of ER visits due to stone disease, medication for stone disease, dietary changes, surgical complications and missed work days due to stone disease in the last year. Age adjusted Charlson comorbidity index scores were calculated by chart review according to standard calculation guidelines.

Patients were also asked to complete the common, validated SF-36 HRQOL questionnaire, which has 36 questions divided into 8 domains, including physical function, role limitations due to physical health problems, bodily pain, general health perception, emotional well-being, role limitations due to emotional problems, vitality and social function. The 8 domains are scored on a range of 0 to 100 with lower scores indicating worse QOL.

Statistical Analysis

Hypothesized determinants of QOL in patients with kidney stones, including age at first stone, number of lifetime stones, months since last stone episode, number of surgeries, number of work days missed, number of ER visits, stone medication, dietary changes due to stone disease and age adjusted Charlson comorbidity index, were dichotomized using the median value as the cutoff. We constructed 2 × 2 tables and calculated crude ORs and 95% CIs. SF-36 domains were compared across different patient subgroups by potential predictors and differences in scores were tested by the 2-sample t test. Analysis was done using SAS® 9.2.

RESULTS

A total of 386 patients were invited to participate in the study, of whom 115 (29.7%) participated and made up our cohort. Table 1 lists participants and nonparticipants by age, BMI, race, gender and marital status. There were no statistically significant differences between responders and nonresponders for these variables. Mean ± SD age at first stone was 39 ± 16.15 years, the mean number of lifetime stones was 12 ± 25.25 and mean time from the last stone episode was 32 ± 66.93 months. When comparing males to females, statistical differences were noted for older age, more married, less unemployed, higher income and higher Charlson comorbidity score. Men were also older at the first stone presentation, underwent fewer surgeries and missed fewer days of work.

Using SF-36, results in stone formers were compared to results in the average American population. Stone formers had significantly decreased QOL across 6 of the 8 domains, including physical function, role limitations due to physical health problems, bodily pain, general health perception (each p < 0.001), vitality (p = 0.001) and social function (p = 0.01), compared to a random collection of healthy American adults (see figure).
When examining differences between men and women, female stone formers reported statistically lower QOL (table 2). These scores were statistically significant in the bodily pain, vitality and emotional role health limitation domains.

We analyzed our hypothesized stone factors across the 8 QOL domains and found significant relationships in several areas. Patients who self-reported surgical complications showed lower scores in the physical health role limitations (p < 0.010) and social functioning (p < 0.048) domains. Time from last stone episode (less than 1 month) correlated with lower QOL scores for bodily pain (p < 0.001) and physical health role limitations (p < 0.026). Number of ER visits (greater than 1) also correlated with lower scores on the bodily pain domain (p < 0.050). Number of surgical procedures (greater than 2) correlated with decreased QOL in the emotional health role limitations domain (p < 0.049). Table 3 shows the association of significant stone variables with QOL.

DISCUSSION
We examined HRQOL in patients with urolithiasis, a common urological condition affecting 6% to 12% of the population of our nation. With a recurrence rate of around 50% within 5 years, for many patients stone disease is a chronic condition with acute episodes.

An important growing trend in medical research is analysis of the way that chronic disease affects QOL. By examining the ways in which stone disease or any other chronic disease negatively influences QOL health care practitioners can better tailor treatment modalities. Managing perceptions and expectations in patients with urolithiasis can be as important as reducing the stone burden. By recognizing that stone formers may be impacted in ways other than bodily pain physicians may better counsel patients and reassure them that the experience is normal.

QOL issues are not new to urology. In 1992 after the creation of the American Urological Association symptom score WHO expanded on the lower urinary tract symptom screening tool with an additional QOL questionnaire. Similarly in the field of prostate cancer research new studies are being done to examine long-term changes in QOL after prostate treatment.

Table 2. Gender differences in stone former HRQOL

<table>
<thead>
<tr>
<th>QOL Domain</th>
<th>Mean ± SD Stone Formers</th>
<th>Mean ± SD Males</th>
<th>Mean ± SD Females</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical functioning</td>
<td>74.6 ± 27.9</td>
<td>76.65 ± 27.97</td>
<td>71.60 ± 27.78</td>
<td>0.3407</td>
</tr>
<tr>
<td>Role-physical</td>
<td>67.5 ± 41.5</td>
<td>71.69 ± 40.73</td>
<td>61.41 ± 42.40</td>
<td>0.1962</td>
</tr>
<tr>
<td>Bodily pain</td>
<td>67.3 ± 28.3</td>
<td>72.20 ± 25.74</td>
<td>60.27 ± 30.49</td>
<td>0.0259</td>
</tr>
<tr>
<td>General</td>
<td>59.7 ± 23.7</td>
<td>62.59 ± 24.30</td>
<td>55.59 ± 22.45</td>
<td>0.1198</td>
</tr>
<tr>
<td>Vitality</td>
<td>53.4 ± 24.5</td>
<td>56.81 ± 23.03</td>
<td>45.67 ± 24.66</td>
<td>0.0044</td>
</tr>
<tr>
<td>Social functioning</td>
<td>78.0 ± 27.1</td>
<td>81.99 ± 26.75</td>
<td>72.34 ± 26.83</td>
<td>0.0602</td>
</tr>
<tr>
<td>Role-emotional</td>
<td>77.8 ± 35.4</td>
<td>83.82 ± 31.28</td>
<td>68.84 ± 39.38</td>
<td>0.0259</td>
</tr>
<tr>
<td>Mental health</td>
<td>73.8 ± 19.0</td>
<td>76.55 ± 18.25</td>
<td>68.81 ± 18.16</td>
<td>0.0621</td>
</tr>
</tbody>
</table>

When examining differences between men and women, female stone formers reported statistically lower QOL (table 2). These scores were statistically significant in the bodily pain, vitality and emotional role health limitation domains.

We analyzed our hypothesized stone factors across the 8 QOL domains and found significant relationships in several areas. Patients who self-reported surgical complications showed lower scores in the physical health role limitations (p = 0.010) and social functioning (p = 0.048) domains. Time from last stone episode (less than 1 month) correlated with lower QOL scores for bodily pain (p = 0.001) and physical health role limitations (p = 0.026). Number of ER visits (greater than 1) also correlated with lower scores on the bodily pain domain (p = 0.050). Number of surgical procedures (greater than 2) correlated with decreased QOL in the emotional health role limitations domain (p = 0.049). Table 3 shows the association of significant stone variables with QOL.

DISCUSSION
We examined HRQOL in patients with urolithiasis, a common urological condition affecting 6% to 12% of the population of our nation. With a recurrence rate of around 50% within 5 years, for many patients stone disease is a chronic condition with acute episodes.

An important growing trend in medical research is analysis of the way that chronic disease affects QOL. By examining the ways in which stone disease or any other chronic disease negatively influences QOL health care practitioners can better tailor treatment modalities. Managing perceptions and expectations in patients with urolithiasis can be as important as reducing the stone burden. By recognizing that stone formers may be impacted in ways other than bodily pain physicians may better counsel patients and reassure them that the experience is normal.

QOL issues are not new to urology. In 1992 after the creation of the American Urological Association symptom score WHO expanded on the lower urinary tract symptom screening tool with an additional QOL questionnaire. Similarly in the field of prostate cancer research new studies are being done to examine long-term changes in QOL after prostate treatment.
cancer treatment and determine differences among treatment modalities.

Stone formers in our study showed decreased QOL compared to societal norms, as defined by a collection of random, healthy adults by Ware et al, who authored the SF-36 study. These differences were seen in 6 of the 8 QOL domains, including physical function, role limitations due to physical health problems, bodily pain, general health, vitality, and social function. This finding is similar to those in previous studies of stone disease that demonstrated decreased HRQOL, although they showed decreases in different domains.

Similar to Penniston and Nakada, we noted gender differences in HRQOL in our population. Female stone formers were more likely to have lower scores for bodily pain, vitality, and emotional health role limitations than male stone formers. It is difficult to speculate why these differences exist. The chronic pain of stone disease may have more of an emotional effect on female stone formers. Knowing that women are affected by stone disease in different ways than men may allow for different management strategies since treatment success may be judged on slightly different terms. For example, if stone disease negatively affects energy and emotional levels in females more than in men, physicians may be more apt to screen for depression in this population.

Bensalah et al noted that an increased number of surgical procedures correlated with decreased QOL. We examined similar variables as well as a number of additional disease specific variables. Patients who reported surgical complications were more likely to have lower scores in the domains of physical health role limitations and bodily pain. As Bensalah et al indicated, this may be attributable to the fact that 20 of the 36 questions on the SF-36 questionnaire ask about experiences in the last 4 weeks. Similar to previous studies, a higher number of surgical procedures correlated with decreased QOL in the emotional health domain. Finally, the number of ER visits correlated with bodily pain. This result makes intuitive sense since increased pain would lead to more ER visits rather than vice versa.

In addition to comparing HRQOL differences at our institution with those at other institutions, the additional value of our study is that we further describe which disease variables impact QOL. By identifying which variables are most closely associated with poor QOL physicians will be better able to assess the disease impact and subsequently develop individualized treatment plans.

Appropriate treatment can lead to improved QOL. Rabah et al examined HRQOL in stone cases after lithotripsy. Patients were compared with a control group and after successful treatment QOL domains for patients with urolithiasis were no different than for controls. This offers encouragement that with successful treatment for stone disease QOL measures will also improve.

Also interesting are the factors that were not significant. While dietary changes and medical therapy are potential interventions, they had no association with QOL across any of the domains. One may have hoped that these interventions would decrease the number of stone attacks and so improve reported QOL but this was not seen. Conversely the sacrifices needed to make lifestyle changes and the side effects of medication were not significant enough to make a measurable difference.

Our study has limitations, of which the most significant is its 30% response rate. Despite significant efforts most patients to whom we reached out did not submit responses. While medical studies that relied on mailed questionnaires averaged a 60% response rate according to the report by Asch et al, the study by Penniston and Nakada that is most similar to ours showed a similar 36.4% response rate. When examining demographic information, we found no differences in age, race, gender or BMI of participants vs nonparticipants. Nonetheless, this introduces the possibility of selection bias.

Our demographic data also demonstrates that we had a predominately white cohort. Hayes et al noted racial/ethnic differences in HRQOL in patients with coronary artery disease. While this limitation was likely due to geographic trends and referral patterns at our institution, further studies of HRQOL in stone formers are warranted that provide a more racially heterogeneous cohort. A further limitation is that since our institution is a tertiary referral center, we are more likely to see complex stone disease and our patients may not be indicative of stone formers across the country overall.

Also, most of our patients do not receive all care in our health system. We used self-reported information on the number of ER visits, complications and changes to diet and medication, which created potential bias. Also, in addition to urolithiasis, many of our patients have multiple comorbidities that may affect QOL. Other studies of chronic disease showed similarly poor QOL. For example, McClish et al noted a decrease in multiple SF-36 domains in patients with sickle cell disease, chronic hemodialysis, cystic fibrosis and asthma.

Finally, since we examined only correlations, we could not determine cause and effect. For example, there was no way to know whether patients with surgical complications were more likely to report poor social functioning or those with poor social
functioning were more likely to believe that there were surgical complications.

Future research of QOL in patients with stone disease should focus on comparing objective stone characteristics, such as stone size or composition, as they relate to HRQOL. The question of the best measure of QOL in our stone cases should also be asked. As Donnelly et al recently pointed out, SF-36 may not be an adequate tool with which to measure QOL in stone cases with time. Change in stone status does not always correlate with improvement in QOL score. Additional study should also be done to create more validated, disease specific measures of QOL.

CONCLUSIONS

Stone disease should be regarded as a chronic disease with acute exacerbations. Urolithiasis negatively influences patient HRQOL across physical and mental domains. Better understanding of the disease specific and individual characteristics that impact QOL will allow for better treatment of the entire patient. Also, identifying individuals with urolithiasis who are at greater risk for decreased HRQOL allows the urologist to potentially mitigate modifiable risks and address affected HRQOL domains to provide improved patient care.

REFERENCES