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ORIGINAL ARTICLE

The quantitative ADAM questionnaire: a new tool in quantifying the severity of hypogonadism

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Androgen deficiency is a pervasive problem in the older male population and is thought to be responsible for many symptoms once considered to be the result of normal aging. Numerous methods have been proposed to facilitate the detection of men at risk for androgen deficiency. In this article, we propose a novel screening tool, the quantitative Androgen Deficiency in the Aging Male (qADAM) questionnaire and report its successful use in quantifying the severity of androgen deficiency in a group of older men. Fifty-seven males scheduled to undergo radical prostatectomy for prostate cancer completed the qADAM as well as the Sexual Health Inventory for Men (SHIM) and the Expanded Prostate Cancer Index Composite hormonal/sexual (EPIC_h/EPIC_s) questionnaires. Thirty-four men also had serum testosterone levels measured for comparison. The qADAM showed statistically significant correlation to the SHIM ($P=0.001$), EPIC_h ($P=0.016$), EPIC_s ($P<0.001$), and serum testosterone ($P=0.046$). The qADAM represents a viable alternative to existing questionnaires used to detect androgen deficiency and to assess response to treatment.

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Keywords: androgen deficiency; hypogonadism; testosterone

Introduction

Androgen deficiency is a serious problem in the older male population, thought to affect approximately 1 in 200 men.¹ Although the precise extent to which this process occurs is controversial, the largest study conducted thus far involved 3220 European men and showed a decline in testosterone and free testosterone levels by 0.4 and 1.3% per year, respectively.² The common symptoms of this decline in androgens have not been fully defined, as have those secondary to declining estrogen levels in women. Some symptoms that were earlier thought to be the effects of aging in males have been found to be more prevalent in patients with hypogonadism.³ These include changes in bone mineral density,^{3–6} muscle strength,^{7–9} cognition,¹⁰ body composition,^{11,12} and sexual function.^{13–15} These studies provide evidence of a correlation between decreas-

ing testosterone levels and symptoms, although they fail to give clear evidence for causality.

The Saint Louis University Androgen Deficiency in the Aging Male (ADAM) questionnaire developed by Morley *et al.*¹⁶ has been widely used as a screening tool for detecting men at risk for androgen deficiency since its development in 2000. It was shown to have a sensitivity of 88%, emphasizing its utility as a screening test. It was shown to be less specific, however, at 60%. A recent study by Martínez-Jabaloyas *et al.*¹⁷ in Spain showed a lower sensitivity and specificity than earlier estimated, at 84 and 36.6%, respectively, in 230 patients over age 50. These results point to the need to modify the ADAM questionnaire in order to better facilitate the early diagnosis of patients with hypogonadism.

The standard ADAM questionnaire consists of 10 ‘yes or no’ questions concerning symptoms of androgen deficiency. See Figure 1.¹⁸ These ‘yes’ or ‘no’ questions, though effective at identifying symptoms associated with androgen deficiency, offer no information about the severity of symptoms. Thus, there is no simple and non-invasive way to monitor the response to treatment using this tool alone, unless symptoms completely resolve. We propose a variant of the ADAM questionnaire using a graded response, which we call the quantitative ADAM questionnaire,

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Questions Used as Part of the Saint Louis University ADAM Questionnaire

1. Do you have a decrease in libido (sex drive)?
2. Do you have a lack of energy?
3. Do you have a decrease in strength and/or endurance?
4. Have you lost height?
5. Have you noticed a decreased "enjoyment of life"?
6. Are you sad and/or grumpy?
7. Are your erections less strong?
8. Have you noted a recent deterioration in your ability to play sports?
9. Are you falling asleep after dinner?
10. Has there been a recent deterioration in your work performance?

NOTE. A positive questionnaire result is defined as a "yes" answer to questions 1 or 7 or any 3 other questions.

Figure 1 The Saint Louis University ADAM questionnaire.

or qADAM. See Figure 2. We believe this questionnaire will allow practitioners to more accurately screen for earlier unrecognized androgen deficiency, as well as monitor patients' responses to treatment.

Materials and methods

Male patients who were scheduled to undergo a radical prostatectomy for prostate cancer and who had not undergone neoadjuvant hormonal therapy were eligible for this study. Institutional review board approval was obtained. Each patient was asked to complete the qADAM questionnaire pre-operatively, as well as the Sexual Health Inventory for Men (SHIM) and the Expanded Prostate Cancer Index Composite hormonal and sexual domains (EPIC, EPIC_h, EPIC_s).^{18,19} Patients were encouraged to fill out the questionnaires as honestly as possible, and to fill them out completely. All incomplete surveys were excluded from the study. Patients were asked to have serum testosterone levels drawn for comparison.

qADAM questionnaire

The qADAM questionnaire consisted the 10 questions of the original ADAM, with 'yes' and 'no' replaced by a Likert scale of 1–5, in which 5 represented the absence of a given symptom and 1 represented maximal symptoms.²⁰ All questions were weighted equally. The summation of these responses yielded a total qADAM score between 10 and 50, with 10 being most symptomatic and 50 being least symptomatic.

Questions Used as Part of the qADAM Questionnaire

1. How would you rate your libido (sex drive)?
1(terrible) 2(poor) 3(average) 4(good) 5(excellent)
2. How would you rate your energy level?
1(terrible) 2(poor) 3(average) 4(good) 5(excellent)
3. How would you rate your strength/endurance?
1(terrible) 2(poor) 3(average) 4(good) 5(excellent)
4. How would you rate your enjoyment of life?
1(terrible) 2(poor) 3(average) 4(good) 5(excellent)
5. How would you rate your happiness level?
1(terrible) 2(poor) 3(average) 4(good) 5(excellent)
6. How strong are your erections?
(1= extremely weak 5= extremely strong)
1 2 3 4 5
7. How would you rate your work performance over the past 4 weeks?
1(terrible) 2(poor) 3(average) 4(good) 5(excellent)
8. How often do you fall asleep after dinner?
1(never) 2(1-2/week) 3(3-4/week) 4(5-6/week) 5(every night)
9. How would you rate your sports ability over the past 4 weeks?
1(terrible) 2(poor) 3(average) 4(good) 5(excellent)
10. How much height have you lost?
1(2" or more) 2(1.5-1.9") 3(1-1.4") 4(0.5-0.9") 5(none-0.4")

Figure 2 The quantitative ADAM questionnaire.

Serum testosterone

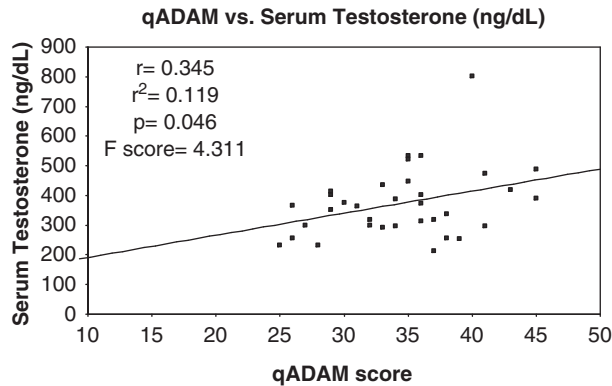
Testosterone measurements were performed using the Beckman Access II platform assay (Beckman Coulter, Fullerton, CA, USA). Only testosterone levels that were drawn on the day that the questionnaires were completed were used in our analysis. Testosterone levels were drawn at random times during the day between 9 AM and 5 PM.

Results

A total of 57 patients completed the qADAM questionnaire. The mean age of the patients studied was 62 ± 10.9 years. The results of the questionnaires were compared using one-way analysis of variance for repeated measurements.

qADAM and serum testosterone

Of the 57 patients that completed the qADAM questionnaire, 34 (60%) consented to have serum testosterone values measured for analysis. Eleven of these patients were hypogonadal, defined as having serum testosterone values ≤ 300 ng ml⁻¹. The qADAM questionnaire positively correlated with the serum



Graph 1 Serum testosterone levels versus the qADAM score.

testosterone values with an $r=0.345$, $r^2=0.119$, $P=0.046$, and an F-score of 4.311. See Graph 1.

qADAM and EPIC

All of the patients in the study group had EPIC scores available for both the sexual (EPICs) and hormonal (EPICh) domains. There was a strong positive correlation between qADAM scores and the EPICs with $r=0.571$, $r^2=0.326$, and a P -value of <0.001 . The F-value was 26.6. See Graph 2. The EPICh also showed a positive correlation with the qADAM questionnaire, with $r=0.0314$, $r^2=0.101$, $P=0.016$, and $F=6.173$. See Graph 3.

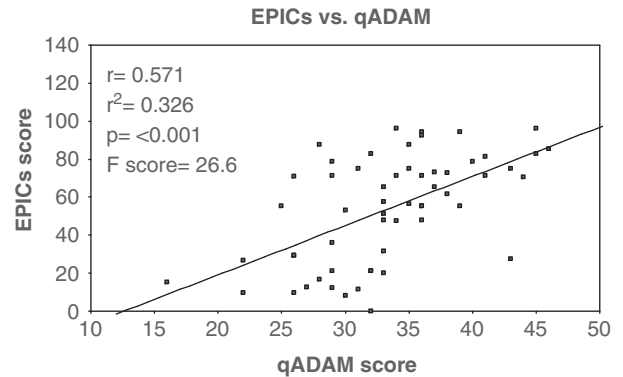
qADAM and SHIM

Fifty-three patients (93%) completed both the qADAM and the SHIM. The qADAM scores showed a strongly positive correlation with the SHIM questionnaire. A linear regression showed $r=0.438$, $r^2=0.192$, $F=12.14$, and $P=0.001$. See Graph 4.

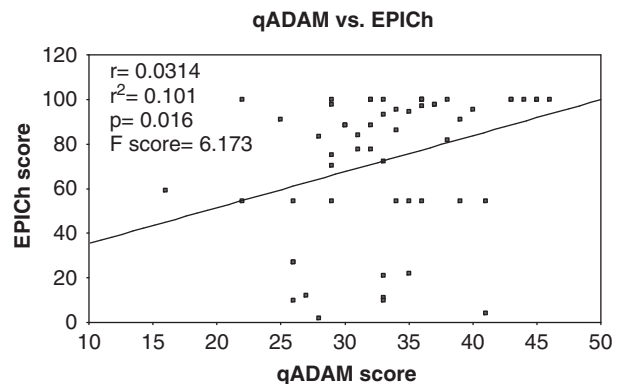
Discussion

Although it is estimated that 40% of men over the age of 45 have low testosterone, our current screening tools lack the specificity to identify most of these patients. Often many of the symptoms of hypogonadism are subtle, with an insidious onset. Consequently, improved surveillance and implementation of routine screening of “at-risk” males could conceivably benefit otherwise unrecognized patients.

Currently, one of the most widely used screening tools is the Saint Louis University ADAM questionnaire. This questionnaire does not allow for the quantification of responses. As a result, it is difficult for clinicians to assess the degree of improvement in



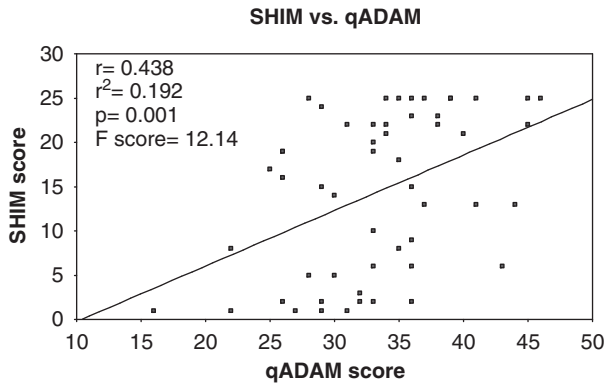
Graph 2 The EPIC sexual domain score versus the qADAM score.



Graph 3 The EPIC hormonal domain score versus the qADAM score.

symptoms after initiating therapy. Heinemann, *et al.*²¹ have proposed another test, the Aging Male Symptom (AMS) rating, a battery of 17 questions graded on a Likert Scale of 1–5. Unlike the ADAM questionnaire, the AMS questionnaire allows one to quantify the degree of improvement in hypogonadal symptoms after initiating therapy. However, like the ADAM questionnaire, the AMS lacks specificity. Moore *et al.*²² conducted a study of 1174 androgen deficient males being treated with testosterone and used the AMS to assess response to treatment. The authors found a sensitivity of 96% but a specificity of only 30%. Additionally, some authors have criticized the AMS as excessively long and cumbersome, making its practical application difficult.²³

We believe that the qADAM is a viable alternative to screening tools such as the ADAM and the AMS. The qADAM correlates with serum testosterone, indicating that it has potential as a screening as well as a diagnostic tool. Furthermore, the qADAM correlated with other instruments of sexual and hormonal function, such as the sexual and hormonal domains of the EPIC and the SHIM questionnaires.



Graph 4 The SHIM score versus the qADAM score.

Several aspects of our experimental design deserve further elaboration. We chose an experimental group composed of 57 men with prostate cancer scheduled to undergo radical prostatectomy. We acknowledge that the diagnosis of prostate cancer may have had an impact on these patients' symptoms of hypogonadism and their qADAM responses. Additionally, our decision to measure testosterone levels over the course of the day may draw some scrutiny. It is known that younger males often show variability in their testosterone level over the course of the day. It is believed by some authors, however, that the diurnal variability in testosterone levels seen in younger males is absent in older males.²⁴ Given that our sample was composed entirely of men older than age 50, we did not feel that the variability in collection times altered the data significantly. Furthermore, we realize that the data presented do not validate the qADAM, but simply show significant correlations with serum testosterone and responses to other questionnaires, such as the ADAM, the SHIM, and the EPIC questionnaires.

Although these initial results have been promising, some aspects of the qADAM should be explored more thoroughly. In particular, future study will be conducted to evaluate the ability of the qADAM to monitor response to treatment over time. Further work to define the sensitivity and specificity of the qADAM using a larger group of patients will also be needed.

Conclusions

The qADAM questionnaire offers a useful alternative to existing tools for screening and assessing hypogonadism. Unlike most other commonly used questionnaires, it provides results that may be quantified and, thus, more easily followed over time. We have shown that the qADAM correlates well with several existing screening tools, as well as

with serum testosterone levels. In light of these results, we believe that the qADAM may be implemented safely and effectively.

Conflict of interest

Drs Khera and Lipshultz are both speakers for Auxilium. All other authors declare no conflict of interest.

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