

## Overall diagnostic accuracy of third and fourth heart sounds "modest" yet worth listening for, study says

May 10, 2005 | Shelley Wood

**San Francisco, CA** - Calling into question the "time-honored" tradition of using third and fourth heart sounds to identify cardiac abnormalities, a new study indicates that the overall diagnostic accuracy of diastolic heart sounds is "modest" at best.<sup>[1]</sup> Yet **Dr Andrew D Michaels** (University of California, San Francisco), senior author of the study, insists that the art of auscultation is still an important one and that hearing diastolic heart sounds during the clinical exam remains an important first step before resorting to more expensive imaging tests.

"If you master the practice of auscultation you can examine a patient and tell a lot about the ventricular or valvular abnormalities of that patient, just by using visual cues, palpation, and auscultation," Michaels told **heartwire**. "It's much easier to learn how to read an echocardiogram than it is to be an expert auscultator, but we should still strive to be expert auscultators."

The study appears in the May 11, 2005 issue of the *Journal of the American Medical Association*.

Michaels, with first author **Dr Gregory M Marcus** (UCSF) and colleagues, point out that the third (S3) and fourth (S4) heart sounds—traditionally heard on auscultation—have for decades been used to diagnose left ventricular dysfunction, despite several reports detailing poor diagnostic accuracy and wide interobserver variability. The phonocardiogram, used to obtain audioelectrocardiographic recordings of diastolic heart sounds, has emerged as the closest thing to a gold standard for testing for S3 and S4.

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To test the diagnostic validity of diastolic heart sounds, Marcus et al used phonocardiographic analysis along with cardiac catheterization, transthoracic echocardiography, and blood tests to detect third and fourth heart sounds, left ventricular end-diastolic pressure (LVEDP), LV ejection fraction (LVEF), and B-type natriuretic peptide (BNP) levels, respectively, in 90 patients. They report that while the sensitivity of S3 and S4 to detect elevated LVEDP, reduced LVEF, or elevated BNP was relatively poor, their specificity was much higher, particularly for S3.

### Specificity and sensitivity and diastolic heart sounds at predicting LV dysfunction

| Heart sound               | Elevated LVEDP | Reduced LVEF | Elevated BNP |
|---------------------------|----------------|--------------|--------------|
| <b>S3 sensitivity (%)</b> | 41             | 52           | 32           |
| <b>S4 sensitivity (%)</b> | 46             | 43           | 40           |
| <b>S3 specificity (%)</b> | 92             | 87           | 92           |
| <b>S4 specificity (%)</b> | 80             | 72           | 78           |

"What was interesting was that most patients with heart failure did not have a third or a fourth heart sound, but if the algorithm *did* detect an abnormal heart sound, it was very specific in identifying that the patient very likely did have heart dysfunction," Michaels explained. "This is similar to the way we hear and use heart sounds clinically. We often don't hear an abnormal heart sound, but if we do, we think that identifies a patient with some kind of LV dysfunction. And this computerized algorithm was pretty insensitive, it didn't pick up a lot of the patients with heart dysfunction, but if it did pick up an abnormal heart sound, it could really identify patients with ventricular dysfunction."

To **heartwire**, Michaels explained that the current findings are only part of a larger research project assessing both the phonocardiograms and physician auscultation skills. In another study currently in review, the same group has shown that the ability to detect diastolic heart sounds is lowest in interns, slightly higher in residents, even better in cardiology fellows, and greatest among cardiology attendings. Even cardiology attendings, however, were not as good as the phonocardiograms, Michaels stated. "With each increase in the level of training the physicians did a little better, but the phonocardiogram did the best."

### Validating auscultation itself?

Despite the poor sensitivity of the test for ruling out LV dysfunction, Michaels believes that auscultation or a phonocardiographic tracing can add to the early evaluation process. He gives the example of a patient with ambiguous clinical signs and a BNP in the intermediate range, where hearing an abnormal heart sound would bolster a diagnosis of LV dysfunction.

Marcus et al's study also provides much-needed validation, however mixed, of auscultation itself. As Michaels explains, medicine today, particularly in the US, relies heavily on high-tech tests, which he ascribes to "the whole American reliance on technology; a cultural attitude."

At the same time, he points out, there are components of the standard physical exam that are being done today and have been done for the past hundred years without being systematically tested. "I think it would be helpful for us to do these types of studies to ask, well, how good really is the third or fourth heart sound when you listen to it on your stethoscope at picking up objective measures of heart dysfunction?"

He continues, "We can say from the other research we've done that physicians at higher level of training perform better than more junior physicians and that phonocardiography appears to perform the best. But even with the best test that we have, either by an attending cardiologist or a phonocardiogram, the test is insensitive, so if you do not detect a third or fourth heart sound, you should not dismiss that patient as not having heart failure. But if you do detect it, you can feel much more confident that that patient has heart failure, and further treatment is warranted."

*Michaels is the recipient of an unrestricted educational grant from Inovise Medical Inc (Portland, OR), manufacturer of the audioelectrocardiographic-tracing device used in this study.*

### Source

1. Marcus GM, Gerber IL, McKeown BH et al. Association between phonocardiographic third and fourth heart sounds and objective measures of left ventricular function. *JAMA* 2005; 293:2238-2244.

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