

DISCLOSURE

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Prevalence of Electronically Detected Abnormal Heart Sounds in Decompensated Heart Failure Patients Before and After Treatment

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ABSTRACT

Background: Abnormal diastolic heart sounds (S3 and S4) are indicative of elevated ventricular filling pressures and may suggest decompensated heart failure. We hypothesized the prevalence of an electronically detected S3 or S4 would be higher in heart failure patients than in patients without heart failure and that both would decrease after treatment with diuretics or nitroglycerin.

Methods: We collected baseline demographic, clinical and laboratory data in a convenience sample of emergency department patients with signs or symptoms of decompensated heart failure. The presence of an S3 or S4 was determined using the Audicor system, a validated device that algorithmically detects S3 and S4 heart sounds. Patients were stratified by a primary diagnosis of decompensated heart failure (Primary HF), a secondary diagnosis of heart failure (Secondary HF), and a non-heart failure diagnosis (No HF). Data is described with 95% confidence intervals for proportions. Diagnoses were based on attending physician discharge summary.

Results: Of the 426 patients, 362 were included in this analysis. There were 59 patients excluded because of poor quality sound data, 14 excluded because of a failure of the treating physician to document the presence or absence of S3 and S4, and one excluded who left the emergency room prior to being given a final diagnosis. There were 89 patients with a primary discharge diagnosis of decompensated heart failure, and 29 patients with a secondary diagnosis of heart failure.

The prevalence of an S3 detected by Audicor in primary heart failure was 46.1% (35.6-56.9), compared to 23.7% (12.0-40.6) in secondary heart failure and 11.1% (7.5-16.0) in non-heart failure. (Table 1) Similarly, those patients with primary heart failure were more likely to have an S4 (23.6% [15.5-34.0]) than those patients with secondary heart failure (15.8% [6.6-31.9]) and non-heart failure diagnoses (12.3% [8.6-17.4]). When comparing Primary HF patients treated with diuretics or nitroglycerin before (n=) and after (n=) heart sounds analysis, the prevalence of an S3 and S4 decreased from 57.1% (43.3-70.0) and 33.9% (22.2-47.9), respectively to 27.3% (13.9-45.8) and 6.1% (1.1-21.6).

Conclusions: Patients with decompensated heart failure are more likely to have abnormal diastolic heart sounds than patients with dyspnea not related to heart failure. Abnormal heart sounds in a dyspneic patient should alert the physician to an increased likelihood of decompensated heart failure. Prior treatment with diuretics and vasodilators should be considered when interpreting heart sounds.

BACKGROUND

Abnormal diastolic heart sounds (S3 and S4) are indicative of elevated ventricular filling pressures and may suggest acute decompensated heart failure (Primary HF). We hypothesized the prevalence of an electronically detected S3 or S4 would be higher in Primary HF patients than in patients without Primary HF and that both would decrease after treatment with diuretics or nitroglycerin.

METHODS

We collected baseline demographic, clinical and laboratory data in a convenience sample of emergency department patients with signs or symptoms of Primary HF. The presence of an S3 or S4 was determined by physician auscultation as well as by the Audicor system, a validated device that algorithmically detects S3 and S4 heart sounds. Patients were stratified by a primary hospital discharge diagnosis of heart failure (Primary HF), a secondary hospital discharge diagnosis of heart failure (Secondary HF), and a non-heart failure diagnosis (Non-HF). Data is described with 95% confidence intervals for proportions. Diagnoses were based on treating physician discharge summary.

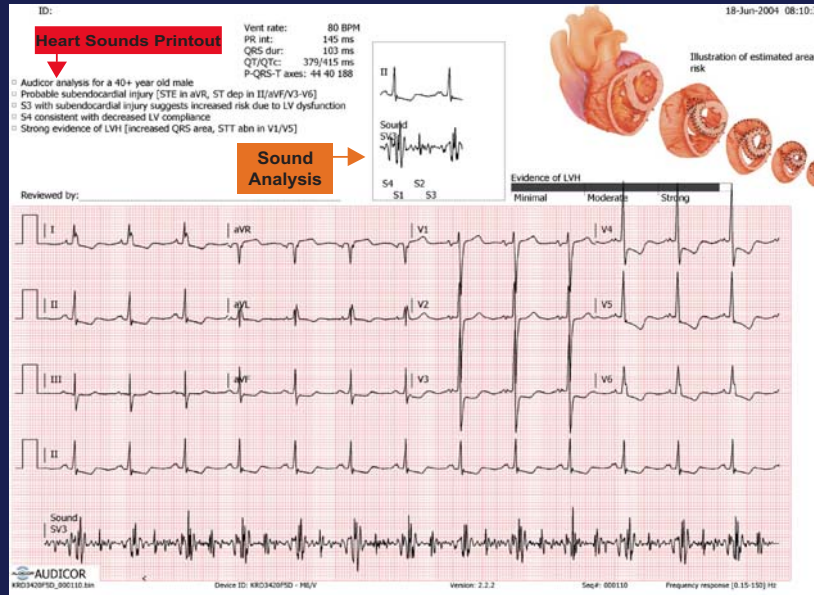


Figure 1 The AUDICOR add-on device (white) attached to an existing ECG.



Figure 2 Placement of the AUDICOR sensors.

RESULTS

Of 426 patients enrolled, 362 were included in this analysis. There were 59 patients excluded because of poor quality sound data, 14 excluded because of a failure of the treating physician to document the presence or absence of S3 and S4, and one excluded who left the emergency room prior to being given a final diagnosis. There were 89 patients with Primary HF, and 39 patients with Secondary HF.

The prevalence of an S3 detected by Audicor in Primary HF was 46.1% (35.6-56.9), compared to 23.7% (12.0-40.6) in Secondary HF and 11.1% (7.5-16.0) in Non-HF. (Table 1) Similarly, those patients with Primary HF were more likely to have an S4 (23.6% [15.5-34.0]) than those patients with Secondary HF (15.8% [6.6-31.9]) and Non-HF diagnoses (12.3% [8.6-17.4]). When comparing Primary HF patients treated with diuretics or nitroglycerin before (n=69) and after (n=20) heart sounds analysis, the prevalence of an S3 and S4 decreased from 57.1% (43.3-70.0) and 33.9% (22.2-47.9), respectively to 27.3% (13.9-45.8) and 6.1% (1.1-21.6).

Table 1 Prevalence of auscultated and electronically detected S3 and S4 for all patients and for patients stratified by hospital discharge diagnoses. Data are given as percents with 95% confidence intervals.

		Non-HF	Secondary HF	Primary HF
S3	Auscultation	3.8 (1.9-7.4)	18.4 (8.3-34.9)	15.7 (9.2-25.3)
	Electronic detection	11.1 (7.5-16.0)	23.7 (12.0-40.6)	46.1 (35.6-56.9)
S4	Auscultation	3.0 (1.3-6.3)	5.3 (0.9-19.1)	7.9 (3.5-16.1)
	Electronic detection	12.3 (8.6-17.4)	15.8 (6.6-31.9)	23.6 (15.5-34.0)
Electronic detection prior to treatment (N=286)	S3	11.6 (7.7-17.1)	18.8 (7.9-37.0)	57.1 (43.3-70.0)
	S4	10.6 (6.8-16.0)	15.6 (5.9-33.5)	33.9 (22.2-47.9)
Electronic detection after treatment (N=76)	S3	8.1 (2.1-23.0)	50.0 (13.9-86.1)	27.3 (13.9-45.8)
	S4	21.6 (10.4-38.7)	16.7 (0.9-63.5)	6.1 (1.1-21.6)

CONCLUSIONS

Patients with acute decompensated heart failure are more likely to have abnormal diastolic heart sounds than patients with dyspnea not related to heart failure. Abnormal heart sounds in a dyspneic patient should alert the physician to an increased likelihood of acute decompensated heart failure. Prior treatment with diuretics and vasodilators should be considered when interpreting heart sounds.