

noma: concise communication. *J Nucl Med* 1983; 24: 1119-1122.

5. Biersack HJ, Thelen M, Torres JF, et al. Focal nodular hyperplasia of the liver as established by ^{99m}Tc-sulfur colloid and HIDA scintigraphy. *Radiology* 1980; 137: 187-190.
6. Sackett JF, Mosenthal WT, House RK, et al. Scintillation scanning of liver on adenoma. *Am J Roentgenol Rad Ther Nucl Med* 1971; 113:56-60.
7. Strashun A, Goldsmith S. Increased focal uptake of Tc-^{99m}IDA hepatobiliary agent by a liver metastasis. *Clin Nucl Med* 1981; 6:295-296.

Xavier Calvert
Jordi Bruix
Francisco Lomeña
Francesca Pons
*Liver Unit and
Nuclear Medicine Department
Hospital Clinic of Barcelona
Spain
Barcelona, Spain*

Alternate R-Wave Gating of Radionuclide Angiograms

TO THE EDITOR: We find the article by Juni and Chen (1) most interesting. It codifies the errors in measurement of diastolic filling from time-activity curves generated by using a number of methods based on standard R-wave gated acquisition. These methods involved several reformatting techniques including forward and backward gating. We would like to point out that time-activity curves generated by forward R-wave gating on every other R-wave² yield diastolic filling curves from which all aspects of ventricular filling can be studied, including early rapid and later atrial filling. This technique eliminates the errors identified by Juni and Chen in standard methods.

In addition, we would like to point out one error in measurement of filling not identified by Juni and Chen. This involves the temporal difference between the onset of electrical and mechanical systole. Since the onset of electrical systole (R-wave) normally precedes mechanical systole by up to 100 msec³, in many patients formation of the time-activity curve by backward gating not only includes the distortion of the systolic portion of the curve as noted by Juni and Chen, but often excludes much of the atrial filling portion of diastole. The alternate R-wave method also overcomes this difficulty.

Thus, we concur with Juni and Chen that forward gating yields the most accurate method of studying diastole but would add that the use of alternate R-wave gating has the

additional benefit of allowing accurate study of the whole of diastole including atrial filling by gated radionuclide ventriculography.

References

1. Juni JE, Chen CC. Effects of gating modes on analysis of left ventricular function in the presence of heart rate variation. *J Nucl Med* 1988; 29:1272.
2. Clements IP, Nelson MA, O'Connor MK, Becker GP, Gibbons RJ, Brown ML. Diastolic measurement from alternate R-wave gating of radionuclide angiograms. *Am Heart J* 1988; 116:113.
3. Weissler AM, Harris WS, Schoenfeld CD. Systolic time intervals in heart failure in man. *Circulation* 1968; 37:149.

I.P. Clements
M.K. O'Connor
R.J. Gibbons
M.L. Brown
*Mayo Clinic
Rochester, Minnesota*

REPLY: The article by Dr. Clements and co-workers (1) was not published until after completion of our paper. Their report describes a simple but elegant means of reducing "count drop-off" in the latter frames of a gated radionuclide ventriculogram by gating off of every other R-wave trigger. This permits counts from the following cycle to contribute to the final frames of short cycles. While this method does not eliminate the effects of arrhythmias, it does appear to substantially reduce distortion in the latter points of the left ventricular time activity curve. Also the alternate R-wave gating technique requires relatively little in the way of hardware.

We agree with the writers' statement that the time delay between electrical and mechanical systole contributes to count drop-off. Both the alternate R-wave and list mode acquisition techniques will help to overcome this.

References

1. Clements IP, Nelson MA, O'Connor MK, Becker GP, Gibbons RJ, Brown ML. Diastolic measurements from alternate R-wave gating of radionuclide angiograms. *Am Heart J* 1988; 116:113-117.

Jack Juni
Charles Chen
*William Beaumont Hospital
Troy, Michigan*