


[Home](#) > [Journal](#) > [Biomedical & Life Sciences](#) > [JBISE](#)
[Indexing](#) | [View Papers](#) | [Aims & Scope](#) | [Editorial Board](#) | [Guideline](#) | [Article Processing Charges](#)
[JBiSE](#) > Vol.6 No.1, January 2013



Multi-center pragmatic studies evaluating the time indicator of cardiac perfusion reserve

PDF (Size: 128KB) PP. 1-7 DOI: 10.4236/jbise.2013.61001

Author(s)

Lin Xiong, Shouzhong Xiao, Qiang Zhou, Xianrong Wu, Zifu Xiao, Xingming Guo, Delin Lu, Wanrong Zhao, Xiaojun Wu, Xiaobo Yan, Yanxia Zhao, Jianming Liu

ABSTRACT

Background: Since the greater part of coronary blood flow takes place during the diastolic phase of each cardiac cycle, a time indicator of myocardial perfusion reserve, the ratio of diastolic to systolic duration (D/S ratio), was presented. The objective of this study was to evaluate the accuracy and precision, the biological implication, and the applications of D/S ratio. Methods: Multi-center pragmatic studies evaluating the time indicator of cardiac perfusion reserve were performed. Related experiments, clinical trials, and surveys were conducted at 5 centers. Results: The results showed that the measurement of D/S ratio is both accurate and precise; the mean values of D/S of all of the 3 species studied (human, rabbit, and rat) were greater than 1. These application studies on D/S ratio showed that a close negative correlation existed between D/S ratio and New York Heart Association Functional Classification (NYHA FC) ($r = -0.659$, $p < 0.01$); normal persons were mostly distributed at NYHA FC I and at high value of D/S ratio; the patients with cardiovascular disease were mostly at low value of D/S ratio; the difference of D/S between pregnant women with pre-eclampsia and either normal pregnant women or non-pregnant women were significant ($p < 0.05$); athletes had higher D/S ratio than non-athletes (2.04 ± 0.33 vs 1.82 ± 0.27 , $p < 0.01$). Conclusions: D/S ratio has important biological implication, which is a safe, easy, reliable, and effective indicator, can be used to evaluate fitness levels, served as a pathophysiological marker for screening of cardiovascular disease (CVD), for predicting risk of cardiac events, and for evaluating the severity and prognosis of CVD.

KEYWORDS

Ratio of Diastolic to Systolic Duration (D/S); Accuracy; Precision; Cardiac Reserve; Cardiac Safety; Fitness

Cite this paper

 Xiong, L., Xiao, S., Zhou, Q., Wu, X., Xiao, Z., Guo, X., Lu, D., Zhao, W., Wu, X., Yan, X., Zhao, Y. and Liu, J. (2013) Multi-center pragmatic studies evaluating the time indicator of cardiac perfusion reserve. *Journal of Biomedical Science and Engineering*, 6, 1-7. doi: 10.4236/jbise.2013.61001.

References

- [1] Abe, M., Tomiyama, H., Yoshida, H. and Doba, N. (2000) Diastolic fractional flow reserve to assess the functional severity of moderate coronary artery stenoses: Comparison with fractional flow reserve and coronary flow velocity reserve. *Circulation*, 102, 2365-2370. doi: 10.1161/01.CIR.102.19.2365
- [2] Xiao, S., Guo, X., Sun, X. and Xiao, Z. (2002) A relative value method for measuring and evaluating cardiac reserve. *BioMedical Engineering On-Line*, 1, 6. doi: 10.1186/1475-925X-1-6
- [3] Xiao, S., Guo, X., Wang, F., Xiao, Z., Liu, G., Zhan, Z. and Sun, X. (2003) Evaluating two new indicators of cardiac reserve. *IEEE Engineering in Medicine and Biology Magazine*, 22, 147-152. doi: 10.1109/MEMB.2003.1237516
- [4] Cooke, G.A., Marshall, P., Al-Timman, J.K., Wright, D.J., Riley, R., Hainsworth, R. and Tan, L.B. (1998) Physiological cardiac reserve: Development of a non-invasive method and first estimates in man. *Heart*, 79, 289-294.
- [5] Xie, M., Xiao, S., Liu, T., Yi, Q., You, F., Guo, X., Shao, Y., Huo, J., Du, D., Xu, D., Wu, W., Xiao, Z., Yang,

- [Open Special Issues](#)
- [Published Special Issues](#)
- [Special Issues Guideline](#)

[JBiSE Subscription](#)
[Most popular papers in JBiSE](#)
[About JBiSE News](#)
[Frequently Asked Questions](#)
[Recommend to Peers](#)
[Recommend to Library](#)
[Contact Us](#)

Downloads: 437,461

Visits: 1,228,608

Sponsors >>

[International Conference on Bioinformatics and Biomedical Engineering \(iCBBE\)](#)

- Y. and Guo, W. (2012) Multi-center, multi-topic heart sound databases and their applications. *Journal of Medical Systems*, 36, 33-40. doi:10.1007/s10916-010-9443-x
- [6] Yang, X. and Zeng, W. (2011) Determination of cardiac reserve in preterm infants. *Turkish Journal of Pediatrics*, 53, 308-313.
- [7] Yang, X. and Zeng, W. (2010) A relative value method for measuring and evaluating neonatal cardiac reserve. *Indian Journal of Pediatrics*, 77, 661-664. doi:10.1007/s12098-010-0058-5
- [8] Huang, G., Xin, H. Shi, L., Huang, G., Xiao, Z., Xie, M., Yang, Y. and Xiao, S. (2010) A preliminary survey on two new indicators of infantile cardiac reserve. *Laboratory Medicine and Clinic*, 7, 1304-1308.
- [9] Yang, Z., Li, C. and Xiao, S. (2003) A survey of three new non-invasive indicators of cardiac reserve of 6-12 years old children. *Chinese Journal of Medical Research*, 3, 388-390.
- [10] Huo, J., Yi, Q., Xiao, S., Xie, M. and Xiao, Z. (2011) Analysis of cardiac reserve in children with ASD before and after intervention. *Journal of Chongqing Medical University*, 36, 203-205.
- [11] Li, C., Li, M., Jiang, M., Zhou, Y., Yang, L., Wei, X. and Xiao, S. (2003) A study of the heart reserve index in the coal miners. *Journal of Occupational Health and Damage*, 18, 85-87.
- [12] Shao, Y., Zhang, Y. and Liu, O. (2012) Using phonocardiography to investigate maternal cardiac reserve function in gestational hypertension and pre-eclampsia. *Journal of Obstetrics and Gynaecology Research*, 39, 53-60. doi:10.1111/j.1447-0756.2012.01897.x
- [13] Zhang, Y., Shao, Y., Xiao, S. and Guo, X. (2010) A clinical study of cardiac reserve mobilizing condition for pregnant women. *Journal of Biomedical Engineering*, 27, 1224-1228.
- [14] Shao, Y., Zhang, Y., Qi, H., Xiao, S. and Guo, X. (2009) Clinical analysis of cardiac reserve function and outcome of preeclampsia. *Chinese Journal of Obstetrics and Gynecology*, 44, 736-739.
- [15] Xiao, S., Fang, X., Zhan, Z., Sun, X. and Xiao, Z. (2002) A clinical study in middle-aged and elderly persons on heart itself blood supply time during diastole with a non-invasive method. *Chinese Journal of Medicine*, 2, 961-962.
- [16] Fraser, G.E., Luke, R., Thompson, S., Smith, H., Carter, S. and Sharpe, N. (1995) Comparison of echocardiographic variables between type I diabetics and normal controls. *American Journal of Cardiology*, 15, 141-145. doi:10.1016/S0002-9149(00)80063-6
- [17] Friedberg, M.K. and Silverman, N.H. (2006) Cardiac ventricular diastolic and systolic duration in children with heart failure secondary to idiopathic dilated cardiomyopathy. *American Journal of Cardiology*, 97, 101-105. doi:10.1016/j.amjcard.2005.07.127
- [18] Friedberg, M.K. and Silverman, N.H. (2006) The systolic to diastolic duration ratio in children with heart failure secondary to restrictive cardiomyopathy. *Journal of the American Society of Echocardiography*, 19, 1326-1331. doi:10.1016/j.echo.2006.05.024
- [19] Friedberg, M.K. and Silverman, N.H. (2007) The systolic to diastolic duration ratio in children with hypoplastic left heart syndrome: A novel Doppler index of right ventricular function. *Journal of the American Society of Echocardiography*, 20, 749-755. doi:10.1016/j.echo.2006.11.014
- [20] Alkon, J., Humpl, T., Manlihot, C., McCrindle, B.W., Reyes, J.T. and Friedberg, M.K. (2010) Usefulness of the right ventricular systolic to diastolic duration ratio to predict functional capacity and survival in children with pulmonary arterial hypertension. *American Journal of Cardiology*, 106, 430-436. doi:10.1016/j.amjcard.2010.03.048
- [21] Sehgal, A., Athikari-samy, S.E. and Adamopoulos, M. (2012) Global myocardial function is compromised in infants with pulmonary hypertension. *Acta Paediatrica*, 101, 410-413. doi:10.1111/j.1651-2227.2011.02572.x
- [22] Koestenberger, M., Friedberg, M.K., Ravekes, W. and Nestaas, E. (2012) Non-Invasive Imaging for Congenital Heart Disease: Recent Innovations in Transthoracic Echocardiography. *Journal of Clinical & Experimental Cardiology*, S8, 2.