Increasing Region of Interest Width Reduces Neonatal Circumferential Strain

Effect of image aquisition paramaters on strain outcome

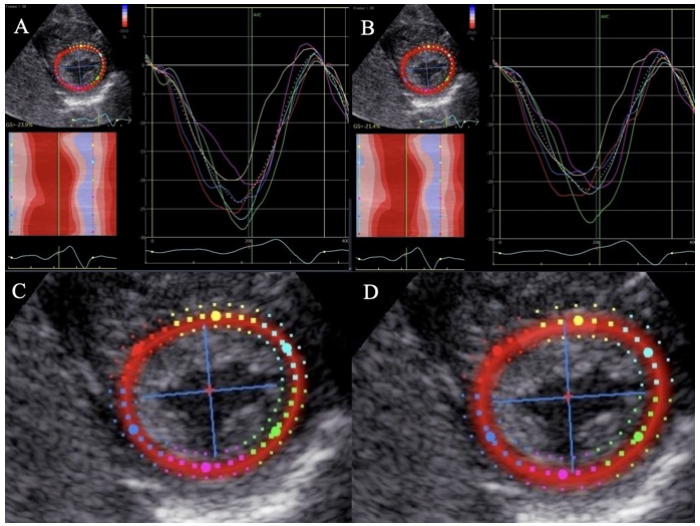
Johannes Mørch & Elisabeth Kolnes
Jmo028@uib.no, eko026@uib.no
University of Bergen

Objective

There is growing interest in speckle tracking echocardiography derived strain as a measure of left ventricular function in neonates. However, knowledge gaps remain regarding the effect of image acquisition and processing parameters on circumferential strain measurements. The aim of this study was to evaluate the effect of using different region of interest widths on speckle tracking derived circumferential strain in healthy neonates.

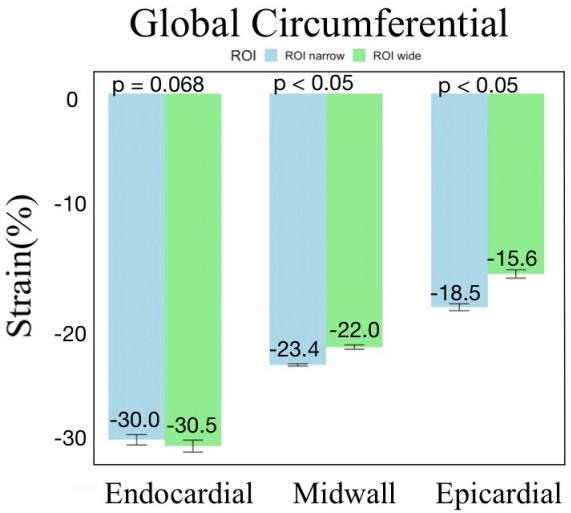
Introduction

Speckle tracking echocardiography has become common in the assessment of left ventricular function in adults [1, 2], and is also gaining traction in the neonatal age group [3]. While traditional metrics such as fractional shortening and ejection fraction are helpful in identifying myocardial dysfunction, they are limited by low reproducibility and sensitivity to ventricular dysfunction [4]. Strain measurements are more sensitive to ventricular dysfunction compared to these measures [5, 6]. Two dimensional speckle tracking echocardiography (2DSTE) has facilitated the application of strain measurements, in part due to its relative angle independence compared to Doppler derived strain measurements[7].



Methods: Thirty healthy term born neonates were examined with speckle tracking echocardiography in the short axis view. Circumferential strain values were acquired and compared using two different region of interest widths. Furthermore, strain values in the different vendor-defined wall layers were also compared.

Results: Increasing region of interest width led to a decrease in global circumferential strain in the midwall and epicardial layers, the respective decreases in strain being -23.4 ± 0.6% to -22.0 ± 1.1%, $p < 0.0001$ and 18.5 ± 1.7% to -15.6 ± 2.0%, $p < 0.0001$. Segmental analyses were consistent with these results, apart from two segments in the midwall. There was no statistically significant effect on strain for the endocardial layer. A gradient was seen where strain increased from the epicardial to endocardial layers.



Conclusion: Increasing ROI width led to a decrease in global circumferential strain in the midwall and epicardium. There is an increase in circumferential strain when moving from the epicardial towards the endocardial layer. Clinicians wishing to implement circumferential strain into their practice should consider ROI width variation as a potential confounder in their measurements

REFERENCES
1. Cameli, M., et al., More than 10 years of speckle tracking echocardiography: Still a novel technique or a definite tool for clinical practice? Echocardiography, 2019. 36(5): p. 958-970.
2. Karlsen, S., et al., Global longitudinal strain is a more reproducible measure of left ventricular function than ejection fraction regardless of echocardiographic training. Cardiovasc Ultrasound, 2019. 17(1): p. 18.
3. El-Khuffash, A., et al., Deformation imaging and rotational mechanics in neonates: a guide to image acquisition, measurement, interpretation, and reference values. Pediatr Res, 2018. 84(Suppl 1): p. 30-45.
4. Potter, E. and T.H. Marwick, Assessment of Left Ventricular Function by Echocardiography: The Case for Routinely Adding Global Longitudinal Strain to Ejection Fraction. JACC Cardiovasc Imaging, 2018. 11(2 Pt 1): p. 260-274.
5. Klaeboe, L.G. and T. Edvardsen, Echocardiographic assessment of left ventricular systolic function. J Echocardiogr, 2019. 17(1): p. 10-16.
6. Bussmann, N. and A. El-Khuffash, Future perspectives on the use of deformation analysis to identify the underlying pathophysiological basis for cardiovascular compromise in neonates. Pediatr Res, 2019. 85(5): p. 591-595.
7. Mondillo, S., et al., Speckle-tracking echocardiography: a new technique for assessing myocardial function. J Ultrasound Med, 2011. 30(1): p. 71-83.

Acknowledgments
The authors would like to thank our main supervisor, Umael Khan, for continuous support and guidance in the making of our article. For their great counselling, we would also like to thank our other supervisors, Gottfried Greve and Tom Omdal. Our gratitude also includes the children, parents, and the Bergen Heart Foundation at the University of Bergen.