

Automated planning approaches for non-invasive cardiac valve replacement procedures from CT angiography Gao, X.; Gao X.

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Bibliography

- Abdel-Wahab, Mohamed et al. 2014. "Comparison of Balloon-Expandable vs Self-Expandable Valves in Patients Undergoing Transcatheter Aortic Valve Replacement: The CHOICE Randomized Clinical Trial." *Jama* 311(15): 1503–14.
- Achenbach, Stephan et al. 2012. "SCCT Expert Consensus Document on Computed Tomography Imaging before Transcatheter Aortic Valve Implantation (TAVI)/transcatheter Aortic Valve Replacement (TAVR)." *Journal of Cardiovascular Computed Tomography* 6(6): 366–80.
- Adalsteinsson, David, and James A Sethian. 1995. "A Fast Level Set Method for Propagating Interfaces." *Journal of computational physics* 118(2): 269–77.
- Agarwal, Shikhar et al. 2015. "Transcatheter Aortic Valve Replacement: Current Perspectives and Future Implications." *Heart (British Cardiac Society)* 101(3): 169–77.
- Agatston, Arthur S et al. 1990. "Quantification of Coronary Artery Calcium Using Ultrafast Computed Tomography." *Journal of the American College of Cardiology* 15(4): 827–32.
- Bapat, Vinayak et al. 2016. "Transcatheter Aortic Valve Replacement Using Transaortic Access: Experience from the Multicenter, Multinational, Prospective ROUTE Registry." JACC: Cardiovascular Interventions 9(17): 1815–22.
- Bax, Jeroen J. et al. 2014. "Open Issues in Transcatheter Aortic Valve Implantation. Part 1: Patient Selection and Treatment Strategy for Transcatheter Aortic Valve Implantation." *European heart journal* 35(38): 2627–38.
- Bertaso, Angela G. et al. 2012. "Aortic Annulus Dimension Assessment by Computed Tomography for Transcatheter Aortic Valve Implantation: Differences between Systole and Diastole." *International Journal of Cardiovascular Imaging* 28(8): 2091–98.
- Bettinger, Nicolas et al. 2015. "TCT-327 Calcium Volume Score on Contrast-Enhanced Computed Tomography Prior to Transcatheter Aortic Valve Replacement: What's the Most Accurate Threshold Cutoff?" *Journal of the American College of Cardiology* 15(66): B131.
- Biesdorf, Andreas et al. 2012. "Segmentation and Quantification of the Aortic Arch Using Joint 3D Model-Based Segmentation and Elastic Image Registration." *Medical Image Analysis* 16(6): 1187–1201. http://dx.doi.org/10.1016/j.media.2012.05.010.

- Binder, Ronald K. et al. 2012. "Prediction of Optimal Deployment Projection for Transcatheter Aortic Valve Replacement: Angiographic 3-Dimensional Reconstruction of the Aortic Root versus Multidetector Computed Tomography." *Circulation: Cardiovascular Interventions* 5(2): 247–52.
- Blanke, Philipp et al. 2012. "Conformational Pulsatile Changes of the Aortic Annulus: Impact on Prosthesis Sizing by Computed Tomography for Transcatheter Aortic Valve Replacement." *JACC: Cardiovascular Interventions* 5(9): 984–94.
- Bleiziffer, S et al. 2013. "Which Way in? The Necessity of Multiple Approaches to Transcatheter Valve Therapy." *Current cardiology reviews* 9(4): 268–73.
- Carabello, Blase A. 2002. "Evaluation and Management of Patients with Aortic Stenosis." *Circulation* 105(15): 1746–50.
- Cribier, Alain G. 2014. "The Odyssey of TAVR from Concept to Clinical Reality." *Texas Heart Institute Journal* 41(2): 125–30.
- Cueff, Caroline et al. 2010. "Measurement of Aortic Valve Calcification Using Multislice Computed Tomography: Correlation with Haemodynamic Severity of Aortic Stenosis and Clinical Implication for Patients with Low Ejection Fraction." *Heart*: hrt-2010.
- Davidson, Michael J, Frederick G P Welt, and Andrew C Eisenhauer. 2011. "Percutaneous Balloon-Expandable Aortic Valve Implantation: Transfemoral." *Operative Techniques in Thoracic and Cardiovascular Surgery* 16(1): 30–40.
- Davies, Ryan R. et al. 2002. "Yearly Rupture or Dissection Rates for Thoracic Aortic Aneurysms: Simple Prediction Based on Size." *Annals of Thoracic Surgery* 73(1): 17–28.
- Delgado, Victoria et al. 2010. "Multimodality Imaging in Transcatheter Aortic Valve Implantation: Key Steps to Assess Procedural Feasibility." *EuroIntervention* 6(5): 643– 52.
- ——. 2011. "Automated Assessment of the Aortic Root Dimensions with Multidetector Row Computed Tomography." *The Annals of thoracic surgery* 91(3): 716–23.
- Deza, Michel Marie, and Elena Deza. 2009. "Encyclopedia of Distances." In *Encyclopedia of Distances*, Springer, 1–583.

- Dijkstra, Edsger W. 1959. "A Note on Two Problems in Connexion with Graphs." *Numerische mathematik* 1(1): 269–71.
- Dugas, Alexandre et al. 2012. "Reproducibility of Abdominal Aortic Aneurysm Diameter Measurement and Growth Evaluation on Axial and Multiplanar Computed Tomography Reformations." *Cardiovascular and interventional radiology* 35(4): 779–87.
- Ecabert, Olivier et al. 2011. "Segmentation of the Heart and Great Vessels in CT Images Using a Model-Based Adaptation Framework." *Medical Image Analysis* 15(6): 863–76. http://dx.doi.org/10.1016/j.media.2011.06.004.
- Elattar, M a et al. 2014. "Automatic Segmentation of the Aortic Root in CT Angiography of Candidate Patients for Transcatheter Aortic Valve Implantation." *Medical & biological engineering & computing* 52(7): 611–18. http://www.ncbi.nlm.nih.gov/pubmed/24903606.
- Elattar, Mustafa et al. 2016. "Automatic Aortic Root Landmark Detection in CTA Images for Preprocedural Planning of Transcatheter Aortic Valve Implantation." *International Journal of Cardiovascular Imaging* 32(3): 501–11.
- Entezari, Pegah et al. 2013. "Analysis of the Thoracic Aorta Using a Semi-Automated Post Processing Tool." *European Journal of Radiology* 82(9): 1558–64. http://dx.doi.org/10.1016/j.ejrad.2013.03.024.
- Erbel, R. et al. 2014a. "2014 ESC Guidelines on the Diagnosis and Treatment of Aortic Diseases: Document Covering Acute and Chronic Aortic Diseases of the Thoracic and Abdominal Aorta of the Adult. The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European." *European Heart Journal* 35(41): 2873–2926.
- ———. 2014b. "2014 ESC Guidelines on the Diagnosis and Treatment of Aortic Diseases: Document Covering Acute and Chronic Aortic Diseases of the Thoracic and Abdominal Aorta of the Adult * The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European." *European Heart Journal* 35(41): 2873–2926.
- Ewe, See Hooi et al. 2011. "Location and Severity of Aortic Valve Calcium and Implications for Aortic Regurgitation after Transcatheter Aortic Valve Implantation." *The American journal of cardiology* 108(10): 1470–77.

- El Faquir, Nahid et al. 2016. "Definition of the Aortic Valve Plane by Means of a Novel Dedicated Software Program: Proof of Concept and Validation with Multi Slice Computed Tomography." *International Journal of Diagnostic Imaging* 3(1): p63.
- Foldyna, Borek et al. 2015. "CT Evaluation prior to Transapical Aortic Valve Replacement: Semi-Automatic versus Manual Image Segmentation." *The international journal of cardiovascular imaging* 31(6): 1233–42.
- Gao, Xinpei et al. 2014. "Automatic Extraction of Arterial Centerline from Whole-Body Computed Tomography Angiographic Datasets." In *Computing in Cardiology 2014*, IEEE, 697–700.
- Gao, Xinpei, Pieter Kitslaar, Arthur J H A Scholte, et al. 2016. "Automatic Aortic Root Segmentation in CTA Whole-Body Dataset." In SPIE Medical Imaging, International Society for Optics and Photonics, 97850F–97850F.
- Gao, Xinpei, Pieter H Kitslaar, Ricardo P J Budde, et al. 2016. "Automatic Detection of Aorto-Femoral Vessel Trajectory from Whole-Body Computed Tomography Angiography Data Sets." *The international journal of cardiovascular imaging* 32(8): 1311–22.
- Goenka, Ajit H., Paul Schoenhagen, Michael A. Bolen, and Milind Y. Desai. 2014.
 "Multidimensional MDCT Angiography in the Context of Transcatheter Aortic Valve Implantation." *American Journal of Roentgenology* 203(4): 749–58.
- Goldstein, Steven a et al. 2015. "Multimodality Imaging of Diseases of the Thoracic Aorta in Adults: From the American Society of Echocardiography and the European Association of Cardiovascular Imaging." *Journal of the American Society of Echocardiography : official publication of the American Society of Echocardiography* 28(2): 119–82.
- de Graaf, Fleur R, Joanne D Schuijf, Joëlla E van Velzen, Lucia J Kroft, et al. 2010.
 "Diagnostic Accuracy of 320-Row Multidetector Computed Tomography Coronary Angiography in the Non-Invasive Evaluation of Significant Coronary Artery Disease." *European heart journal*: ehp571.
- de Graaf, Fleur R, Joanne D Schuijf, Joëlla E van Velzen, Mark J Boogers, et al. 2010.
 "Diagnostic Accuracy of 320-Row Multidetector Computed Tomography Coronary Angiography to Noninvasively Assess in-Stent Restenosis." *Investigative radiology* 45(6): 331–40.

- Grbic, Sasa et al. 2012. "Complete Valvular Heart Apparatus Model from 4D Cardiac CT." *Medical Image Analysis* 16(5): 1003–14. http://dx.doi.org/10.1016/j.media.2012.02.003.
- 2013. "ADVANCED INTERVENTION PLANNING FOR TRANSCATHETER
 AORTIC VALVE IMPLANTATIONS (TAVI) FROM CT USING VOLUMETRIC
 MODELS Imaging and Computer Vision, Corporate Technology, Princeton, USA
 Computer Aided Medical Procedures, Technical University Munich, Ger.": 1416–19.
- Gülsün, M Akif, and Hüseyin Tek. 2008. "Robust Vessel Tree Modeling." In *Medical Image Computing and Computer-Assisted Intervention--MICCAI 2008*, Springer, 602–11.
- Gurvitch, Ronen et al. 2010. "Multislice Computed Tomography for Prediction of Optimal Angiographic Deployment Projections during Transcatheter Aortic Valve Implantation." *JACC: Cardiovascular Interventions* 3(11): 1157–65.
- Hall, John E. 2015. *Guyton and Hall Textbook of Medical Physiology*. Elsevier Health Sciences.
- Hanneman, Kate et al. 2015. "Pre-and Postoperative Imaging of the Aortic Root." *RadioGraphics* 36(1): 19–37.
- De Heer, Linda M. et al. 2011. "Aortic Root Dimension Changes during Systole and Diastole: Evaluation with ECG-Gated Multidetector Row Computed Tomography." *International Journal of Cardiovascular Imaging* 27(8): 1195–1204.
- Hiratzka, L. F. et al. 2010. "2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM
 Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease:
 A Report of the American College of Cardiology Foundation/American Heart
 Association Task Force on Practice Guidelines." *Circulation* 121(13): e266–369.
- Ho, Siew Yen. 2009. "Structure and Anatomy of the Aortic Root." *European Heart Journal-Cardiovascular Imaging* 10(1): i3–10.
- Iglesias, Juan Eugenio, and Mert R. Sabuncu. 2015. "Multi-Atlas Segmentation of Biomedical Images: A Survey." *Medical Image Analysis* 24(1): 205–19.
- Ihara, Tsutomu et al. 2013. "Three-Dimensional Workstation Is Useful for Measuring the Correct Size of Abdominal Aortic Aneurysm Diameters." *Annals of vascular surgery* 27(2): 154–61.

- Ionasec, Razvan Ioan et al. 2010. "Patient-Specific Modeling and Quantification of the Aortic and Mitral Valves from 4-D Cardiac CT and TEE." *Medical Imaging, IEEE Transactions on* 29(9): 1636–51.
- Jilaihawi, Hasan et al. 2014. "A Revised Methodology for Aortic-Valvar Complex Calcium Quantification for Transcatheter Aortic Valve Implantation." *European Heart Journal-Cardiovascular Imaging* 15(12): 1324–32.
- Kamperidis, Vasileios et al. 2014. "Prognostic Value of Aortic and Mitral Valve Calcium Detected by Contrast Cardiac Computed Tomography Angiography in Patients with Suspicion of Coronary Artery Disease." *The American journal of cardiology* 113(5): 772–78. http://www.scopus.com/inward/record.url?eid=2-s2.0-84893959286&partnerID=tZOtx3y1.
- Kasel, Albert M. et al. 2013. "Standardized Imaging for Aortic Annular Sizing: Implications for Transcatheter Valve Selection." *JACC: Cardiovascular Imaging* 6(2): 249–62.
- Kauffmann, Claude et al. 2011. "Clinical Validation of a Software for Quantitative Follow-up of Abdominal Aortic Aneurysm Maximal Diameter and Growth by CT Angiography." *European Journal of Radiology* 77(3): 502–8.

——. 2012. "Measurements and Detection of Abdominal Aortic Aneurysm Growth: Accuracy and Reproducibility of a Segmentation Software." *European Journal of Radiology* 81(8): 1688–94.

- Kirişli, H. A. et al. 2010. "Evaluation of a Multi-Atlas Based Method for Segmentation of Cardiac CTA Data: A Large-Scale, Multicenter, and Multivendor Study." *Medical Physics* 37(12): 6279–91.
- Kirişli, H a et al. 2010. "Evaluation of a Multi-Atlas Based Method for Segmentation of Cardiac CTA Data: A Large-Scale, Multicenter, and Multivendor Study." *Medical physics* 37(12): 6279–91.
- Kitslaar, Pieter H. et al. 2015. "Segmentation of Branching Vascular Structures Using Adaptive Subdivision Surface Fitting." In , 94133Z. http://proceedings.spiedigitallibrary.org/proceeding.aspx?doi=10.1117/12.2082222.
- Klein, S et al. 2010. "<emphasis Emphasistype='mono'>elastix</emphasis>: A Toolbox for Intensity-Based Medical Image Registration." *IEEE Transactions on Medical Imaging* 29(1): 196–205.

- Krishnaswamy, Amar et al. 2014. "Predicting Vascular Complications during Transfemoral Transcatheter Aortic Valve Replacement Using Computed Tomography: A Novel Area-Based Index." *Catheterization and Cardiovascular Interventions* 84(5): 844–51.
- Kurra, Vikram et al. 2009. "Prevalence of Significant Peripheral Artery Disease in Patients Evaluated for Percutaneous Aortic Valve Insertion: Preprocedural Assessment with Multidetector Computed Tomography." *Journal of Thoracic and Cardiovascular Surgery* 137(5): 1258–64.
- 2010. "Pre-Procedural Imaging of Aortic Root Orientation and Dimensions.
 Comparison Between X-Ray Angiographic Planar Imaging and 3-Dimensional
 Multidetector Row Computed Tomography." *JACC: Cardiovascular Interventions* 3(1): 105–13. http://dx.doi.org/10.1016/j.jcin.2009.10.014.
- Lardizabal, Joel A et al. 2013. "The Transaortic Approach for Transcatheter Aortic Valve Replacement: Initial Clinical Experience in the United States." *Journal of the American College of Cardiology* 61(23): 2341–45.
- Leipsic, Jonathon et al. 2011. "Multidetector Computed Tomography in Transcatheter Aortic Valve Implantation." *JACC: Cardiovascular Imaging* 4(4): 416–29.
- Lesage, David, Elsa D. Angelini, Isabelle Bloch, and Gareth Funka-Lea. 2009. "A Review of 3D Vessel Lumen Segmentation Techniques: Models, Features and Extraction Schemes." *Medical Image Analysis* 13(6): 819–45. http://dx.doi.org/10.1016/j.media.2009.07.011.
- Loop, Charles. 1987. "Smooth Subdivision Surfaces Based on Triangles."
- Lorensen, William E., and Harvey E. Cline. 1987. "Marching Cubes: A High Resolution 3D Surface Construction Algorithm." *Proceedings of the 14th annual conference on Computer graphics and interactive techniques - SIGGRAPH* '87 21(4): 163–69.
- Lou, Junyang et al. 2015. "Manual, Semiautomated, and Fully Automated Measurement of the Aortic Annulus for Planning of Transcatheter Aortic Valve Replacement (TAVR/TAVI): Analysis of Interchangeability." *Journal of Cardiovascular Computed Tomography* 9(1): 42–49.
- Lu, T.-L. C. et al. 2010. "Variability of Ascending Aorta Diameter Measurements as Assessed with Electrocardiography-Gated Multidetector Computerized Tomography and

Computer Assisted Diagnosis Software." *Interactive CardioVascular and Thoracic Surgery* 10(2): 217–21.

- Mack, Michael J. 2012. "Access for Transcatheter Aortic Valve Replacement: Which Is the Preferred Route?** Editorials Published in JACC: Cardiovascular Interventions Reflect the Views of the Authors and Do Not Necessarily Represent the Views of JACC: Cardiovascular Interventions."
 - . 2015. "5-Year Outcomes of Transcatheter Aortic Valve Replacement or Surgical Aortic Valve Replacement for High Surgical Risk Patients with Aortic Stenosis (PARTNER 1): A Randomised Controlled Trial." *The Lancet* 385(9986): 2477–84.
- Mann, Douglas L, Douglas P Zipes, Peter Libby, and Robert O Bonow. 2014. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. Elsevier Health Sciences.
- Mao, Song Shou et al. 2008. "Normal Thoracic Aorta Diameter on Cardiac Computed Tomography in Healthy Asymptomatic Adults: Impact of Age and Gender." *Academic radiology* 15(7): 827–34.
- Metz, C T et al. 2009. "Coronary Centerline Extraction from CT Coronary Angiography Images Using a Minimum Cost Path Approach." *Medical physics* 36(12): 5568–79.
- Müller-Eschner, M. et al. 2013. "Accuracy and Variability of Semiautomatic Centerline Analysis versus Manual Aortic Measurement Techniques for TEVAR." *European Journal of Vascular and Endovascular Surgery* 45(3): 241–47. http://dx.doi.org/10.1016/j.ejvs.2012.12.003.
- Nishimura, Rick A. 2002. "Aortic Valve Disease." Circulation 106(7): 770–72.
- Nkomo, Vuyisile T et al. 2006. "Burden of Valvular Heart Diseases: A Population-Based Study." *The Lancet* 368(9540): 1005–11.
- Okuyama, Kazuaki et al. 2014. "Transfemoral Access Assessment for Transcatheter Aortic Valve Replacement: Evidence-Based Application of Computed Tomography over Invasive Angiography." *Circulation: Cardiovascular Imaging* 8(1).
- 2015. "Transfemoral Access Assessment for Transcatheter Aortic Valve ReplacementCLINICAL PERSPECTIVE." *Circulation: Cardiovascular Imaging* 8(1): e001995.

- Owens, David S et al. 2012. "Aortic Valve Calcium Independently Predicts Coronary and Cardiovascular Events in a Primary Prevention Population." *JACC: Cardiovascular Imaging* 5(6): 619–25.
- Park, Joo Young, Tim McInerney, Demetri Terzopoulos, and Myoung Hee Kim. 2001. "A Non-Self-Intersecting Adaptive Deformable Surface for Complex Boundary Extraction from Volumetric Images." *Computers and Graphics (Pergamon)* 25(3): 421–40.
- Queirós, Sandro et al. 2016. "Automatic 3D Aortic Annulus Sizing by Computed Tomography in the Planning of Transcatheter Aortic Valve Implantation." *Journal of Cardiovascular Computed Tomography* 11(1): 25–32.
- Quint, Leslie E. et al. 2013. "Proximal Thoracic Aortic Diameter Measurements at CT: Repeatability and Reproducibility according to Measurement Method." *The International Journal of Cardiovascular Imaging* 29(2): 479–88.
- Rengier, Fabian et al. 2009. "Centerline Analysis of Aortic CT Angiographic Examinations: Benefits and Limitations." *American Journal of Roentgenology* 192(5): 255–63.
- Rueckert, Daniel et al. 1999. "Nonrigid Registration Using Free-Form Deformations: Application to Breast MR Images." *IEEE transactions on medical imaging* 18(8): 712–21.
- Rutten, Annemarieke, Ivana Isgum, and Mathias Prokop. 2008. "Coronary Calcification: Effect of Small Variation of Scan Starting Position on Agatston, Volume, and Mass Scores 1." *Radiology* 246(1): 90–98.
- Samim, Mariam et al. 2013. "Automated 3D Analysis of Pre-Procedural MDCT to Predict Annulus Plane Angulation and C-Arm Positioning: Benefit on Procedural Outcome in Patients Referred for TAVR." *JACC: Cardiovascular Imaging* 6(2): 238–48. http://dx.doi.org/10.1016/j.jcmg.2012.12.004.
- Sampson, Uchechukwu K A et al. 2014. "Global and Regional Burden of Aortic Dissection and Aneurysms: Mortality Trends in 21 World Regions, 1990 to 2010." *Global Heart* 9(1): 171–80.
- Sawaya, Fadi et al. 2012. "Aortic Stenosis: A Contemporary Review." *Am J Med Sci* 343(6): 490–96.

- Schaap, Michiel et al. 2009. "Standardized Evaluation Methodology and Reference Database for Evaluating Coronary Artery Centerline Extraction Algorithms." *Medical Image Analysis* 13(5): 701–14.
- Schoenhagen, Paul, Samir R Kapadia, et al. 2011. "Computed Tomography Evaluation for Transcatheter Aortic Valve Implantation (TAVI): Imaging of the Aortic Root and Iliac Arteries." *Journal of cardiovascular computed tomography* 5(5): 293–300.
- Schoenhagen, Paul, Jörg Hausleiter, et al. 2011. "Computed Tomography in the Evaluation for Transcatheter Aortic Valve Implantation (TAVI)." *Cardiovascular diagnosis and therapy* 1(1): 44–56.
- Shahzad, Rahil et al. 2013. "Automatic Segmentation, Detection and Quantification of Coronary Artery Stenoses on CTA." *The international journal of cardiovascular imaging*. http://www.ncbi.nlm.nih.gov/pubmed/23925713.
- Shapiro, Samuel Sanford, and Martin B Wilk. 1965. "An Analysis of Variance Test for Normality (Complete Samples)." *Biometrika* 52(3–4): 591–611.
- Shlens, Jonathon. 2014. "A Tutorial on Principal Component Analysis." *arXiv preprint arXiv:1404.1100*.
- Sinning, J.-M. et al. 2013. "Evaluation and Management of Paravalvular Aortic Regurgitation after Transcatheter Aortic Valve Replacement." *Journal of the American College of Cardiology* 62(1): 11–20. http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L3691 82754%5Cnhttp://dx.doi.org/10.1016/j.jacc.2013.02.088.
- Steigner, Michael L et al. 2010. "Iodinated Contrast Opacification Gradients in Normal Coronary Arteries Imaged with Prospectively ECG-Gated Single Heart Beat 320-Detector Row Computed Tomography." *Circulation: Cardiovascular Imaging* 3(2): 179–86.
- Stortecky, Stefan et al. 2014. "Accuracy and Reproducibility of Aortic Annulus Sizing Using a Dedicated Three-Dimensional Computed Tomography Reconstruction Tool in Patients Evaluated for Transcatheter Aortic Valve Replacement." *EuroIntervention* 10(3): 339–46.

- Thévenaz, Philippe, and Michael Unser. 2000. "Optimization of Mutual Information for Multiresolution Image Registration." *IEEE transactions on image processing* 9(12): 2083–99.
- Toggweiler, Stefan et al. 2013. "Management of Vascular Access in Transcatheter Aortic Valve Replacement: Part 2: Vascular Complications." *JACC: Cardiovascular Interventions* 6(8): 767–76.
- Tzikas, Apostolos et al. 2010. "Optimal Projection Estimation for Transcatheter Aortic Valve Implantation Based on Contrast-Aortography: Validation of a Prototype Software." *Catheterization and Cardiovascular Interventions* 76(4): 602–7.
- Underwood, M J et al. 2000. "The Aortic Root: Structure, Function, and Surgical Reconstruction." *Heart* 83(4): 376 LP-380.
- Vahl, Torsten P, Susheel K Kodali, and Martin B Leon. 2016. "Transcatheter Aortic Valve Replacement 2016." *Journal of the American College of Cardiology* 67(12): 1472–87.
- van't Klooster, Ronald et al. 2012. "Automatic Lumen and Outer Wall Segmentation of the Carotid Artery Using Deformable Three-Dimensional Models in MR Angiography and Vessel Wall Images." *Journal of Magnetic Resonance Imaging* 35(1): 156–65.
- Wächter, Irina et al. 2010. "Patient Specific Models for Planning and Guidance of Minimally Invasive Aortic Valve Implantation." In International Conference on Medical Image Computing and Computer-Assisted Intervention, Springer, 526–33.
- Watanabe, Yusuke et al. 2013. "Automated 3-Dimensional Aortic Annular Assessment by Multidetector Computed Tomography in Transcatheter Aortic Valve Implantation." JACC: Cardiovascular Interventions 6(9): 955–64.
- Wendler, Olaf, and Rafal Dworakowski. 2014. "TAVI in Patients Unsuitable for Surgery: A Prognostic Benefit for All?" *Journal of the American College of Cardiology* 63(9): 912– 13.
- Yang, Guanyu et al. 2012. "Automatic Centerline Extraction of Coronary Arteries in Coronary Computed Tomographic Angiography." *International Journal of Cardiovascular Imaging* 28(4): 921–33.
- Zajarias, Alan, and Alain G Cribier. 2009. "Outcomes and Safety of Percutaneous Aortic Valve Replacement." *Journal of the American College of Cardiology* 53(20): 1829–36.

Zheng, Yefeng et al. 2012. "Automatic Aorta Segmentation and Valve Landmark Detection in C-Arm CT for Transcatheter Aortic Valve Implantation." *IEEE Transactions on Medical Imaging* 31(12): 2307–21.