

CURRICULUM VITAE

Name Avery Lee Buchholz MD MPH

Title Assistant Professor Neurosurgery
University of Virginia

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Education

2003 B.S., Biology, The Citadel, Military College of South Carolina
2010 M.D., University of Wisconsin School of Medicine and Public Health
2010 M.P.H., Injury Prevention, University of Wisconsin School of Medicine and Public Health

Professional Experience

2003-2005 Research Specialist, Department of Medicine Division of Cardiology Medical University of South Carolina. (Advisor: Donald Menick PhD). Project: gene regulation and failure in cardiac hypertrophy
2005-2008 Medical Student Research, Department of Orthopedics and Rehabilitation University of Wisconsin School of Medicine and Public Health. (Advisor: Lee Kaplan MD). Project: treatment and prevention of PARC lesions
2012-2016 Sports Medicine Concussion Team, Medical University of South Carolina. Organized and presented community education regarding concussion protocols and return to play. Clinical assessment of post concussion patients.
2014-2015 Graduate Medical Education Committee, Medical University of South Carolina.
2017-present AOSNA Strategic Initiative Task Force on Knowledge Translation
2018-present NASS Resident and Fellow Education Committee member

Internship, Residency and Clinical Fellowship

2010-2011 Intern, Medical University of South Carolina Department of General Surgery, Charleston, SC
2011-2017 Resident, Medical University of South Carolina Department of Neurological Surgery, Charleston, SC
2015-2016 Chief Resident, Medical University of South Carolina Department of Neurological Surgery, Charleston, SC. (Advisor: Sunil J Patel MD)
2016-2017 Complex Spine Fellow, University of Virginia Department of Neurological Surgery, Charlottesville, VA. (Advisors: Christopher I Shaffrey MD, Justin S Smith MD)
2016-2017 AO Spine North America Fellow, University of Virginia Department of Neurological Surgery, Charlottesville, VA. (Advisors: Christopher I Shaffrey MD, Justin S Smith MD)

Licensure and Certification

2010 South Carolina medical license, LL32799
2016 Virginia medical license, Limited license
2017 South Carolina medical license, MD32799
2017 Virginia medical license, 0101263406

Military Service

2005-2010 Second Lieutenant, Wisconsin Army National Guard 13th MEDD, Medical Service Corp
2010-2017 Captain, South Carolina Army National Guard Medical Command, Medical Service Corp

Academic Appointments

2017-2018 Assistant Professor, Department of Neurological Surgery Medical University of South Carolina, Charleston, SC
2018-Present Affiliate Faculty, Department of Neurological Surgery Medical University of South Carolina, Charleston, SC
2018-Present Assistant Professor, Department of Neurological Surgery, University of Virginia, Charlottesville, VA

Hospital Appointments

2017-Present Medical University of South Carolina. Charleston, SC
2017-2018 Ralph H Johnson VA Hospital. Charleston, SC
2017-2018 McLeod Regional Medical Center. Florence, SC
2017-2018 Carolinas Hospital. Florence, SC
2018-Present Bon Secour Roper St Francis, Greenville, SC
2018-Present University of Virginia

Principal Clinical and Hospital Service Responsibilities

None

Major Committee Assignments

2017-present AOSNA Strategic Initiative Task Force on Knowledge Translation

Professional Societies

2005-present American Medical Association
2011-2017 Congress of Neurological Surgeons, Resident Member
2011-2017 American Association of Neurological Surgeons, Resident Member
2016-present AO Spine North America
2017-present Congress of Neurological Surgeons
2017-present American Association of Neurological Surgeons
2017-present North American Spine Society
2017-present Society of Lateral Access Surgery
2017-present Scoliosis Research Society (Candidate Member)
2017-present AANS/CNS Joint Section Spine and Peripheral Nerve

Editorial Boards and Reviewer

Ad-Hoc- Global Spine Journal
Ad-Hoc- The Spine Journal

Select Awards and Honors

2002 Departmental Honors, Department of Chemistry, University of California
2001 Vance E Hightower Scholarship (service)
2002 Citadel Foundation Scholarship (academics)
2002 Phi Kappa Phi National Honor Society
2002 Tri Beta Biological Honor Society
2003 Dr. Francis Eugene Zemp Biology Award
2003 Metcalf Biology Scholarship (academics)
2006 Shapiro Summer Research Grant Recipient
2010 Max S Rittenbury MD Intern of the Year Award: MUSC

2013 Best Presentation 2013 North Carolina Spine Society Meeting
2014 Resident Research Day Most Promising New Research. Neurosurgery
2015 Cleveland Spine Review Poker Run 1st Place
2016 MUSC Resident Neurosurgery Teaching Award
2017 AO Spine Best Clinical Research Award. AOSNA Banff Fellows Forum.
2017 Global Spine Journal Top Reviewer 2017

Funded Grants

None

Major Research Interests

1. Adult deformity surgery and outcomes.
2. Spine surgery outcomes.
3. Work flow and efficiency
4. OR design and management

Teaching Experience

2001-2003 Teaching Assistant, Department of Chemistry and Biology, The Citadel
2014-2016 Teaching Assistant, Department of Neurological Surgery, Medical University of South Carolina School of Medicine.

Lectures and Presentations

2005 **Buchholz AL**, Valppu L, Xu L. Unbalanced Expression of Antagonistic Splicing Factors in Cardiac Hypertrophy. 2nd Annual Symposium of AHA Council on Basic Cardiovascular Sciences, Keystone, CO

2006 **Buchholz AL** (Co-Moderator). From Battlefield to Home Front: Caring for the Combat Wounded. National Military Medical Conference. Hyatt Regency Milwaukee, WI.

2006 **Buchholz AL**, Niesen MC, Wisniewski MG, Kaplan MG. Age and Gender Differences in the Metabolic Activity of Osteoarthritic Knee Articular Cartilage. 5th Annual Medical Student Research Fall Forum, Madison, WI

2007 **Buchholz AL**, Niesen MC, Gausden E, Hetzel S, Squire MW, Kaplan LD. Metabolic Activity of Osteoarthritic Knees Correlates with Body Mass Index. OARSI World Congress on Osteoarthritis. Ft. Lauderdale, FL Dec 6-7, 2007.

2008 **Buchholz AL**, Niesen MC, Gausden E, Hetzel S, Squire MW, Kaplan LD. Metabolic Activity of Osteoarthritic Knees Correlates with Body Mass Index. 54th Orthopedic Research Society Conference. San Francisco, CA March 2-5, 2008.

2008 **Buchholz AL**, Niesen MC, Gausden E, Hetzel S, Squire MW, Kaplan LD. Metabolic Activity of Osteoarthritic Knees Correlates with Body Mass Index. 13th ESSKA 2008 Congress. Porto, Portugal May 21-24, 2008.

2008 **Buchholz AL**, McGuine T. The Epidemiology of Female High School Volleyball Injuries. Public Health Symposium Madison, WI May 9, 2008.

2009 **Buchholz AL**, Niesen MC, Gausden E, Hetzel S, Squire MW, Kaplan LD. Metabolic Activity in Osteoarthritic Knee Explants Correlates with Body Mass Index. ICRS. Miami, FL May 23-26 2009.

2009 Chapman E, Linzer M, Baranski B, **Buchholz A**, Manwell L, Crnich C. The More You Look the More You Morula... Society of General Internal Medicine. Miami, FL May 13-16, 2009.

- 2012 **Buchholz AL**, Krishna V, Frankel BM. Posterior Less Invasive Decompression and Stabilization for the Treatment of Malignant Neoplasms of the Thoraco-Lumbar Spine. Medical University of South Carolina Neurosciences Research Day. March 23, 2012.
- 2012 Krishna V, Blaker B, **Buchholz AL**, Morgan SL, Frankel B. Posterior Minimally Invasive Decompression and Stabilization for the Management of Benign, Intradural, Extramedullary Neoplasms of the Thoraco-Lumbar Spine. AANS/CNS Section on Disorders of the Spine and Peripheral Nerves. 2012 Annual Meeting.
- 2012 **Buchholz AL**, Krishna V, Blaker B, Morgan SL, Frankel B. Posterior Less Invasive Decompression and Stabilization for the Treatment of Malignant Neoplasms of the Thoraco-Lumbar Spine: Perioperative Results and Risk of Hardware Failure. AANS/CNS Section on Disorders of the Spine and Peripheral Nerves. 2012 Annual Meeting.
- 2013 **Buchholz AL**, Morgan S, Frankel BM. Minimally Invasive Percutaneous Screw Fixation of Traumatic Spondylolisthesis of the Axis. SMISS. Las Vegas, NV Oct 2013.
- 2013 **Buchholz AL**, Krishna V, Frankel BM. Posterior Less Invasive Decompression and Stabilization for the Treatment of Malignant Neoplasms of the Thoraco-Lumbar Spine. South Carolina Spine Society. Charleston, SC September 28 2013.
- 2013 **Buchholz AL**, Morgan S, Frankel BM. Minimally Invasive Percutaneous Screw Fixation of Traumatic Spondylolisthesis of the Axis. North Carolina Spine Society. Kiawah Island, SC August 24 2013.
- 2013 **Buchholz AL**, Krishna V, Frankel BM. Posterior Less Invasive Decompression and Stabilization for the Treatment of Malignant Neoplasms of the Thoraco-Lumbar Spine. North Carolina Spine Society. Kiawah Island, SC August 25 2013.
- 2015 Adult Spine Deformity: Importance of Pelvic Parameters. **Avery L Buchholz MD MPH**. Medical University of South Carolina Neurosurgery Grand Rounds October 23, 2016.
- 2016 **Buchholz AL**, Morgan S, Frankel BM. Minimally Invasive Percutaneous Screw Fixation of Traumatic Spondylolisthesis of the Axis. MUSC Resident Research Day. Charleston, SC 2016.
- 2016 Current Concepts in adult spine deformity correction: Importance of alignment in decision making. **Avery L Buchholz MD MPH**. Medical College of Georgia Neurosurgery Grand Rounds November 3 2017.
- 2017 **Buchholz AL**, Buell TJ, Quinn, JC, Shaffrey CI, Smith JS. Long Segment Fusion and the Use of a Tether for Proximal Junctional Kyphosis Reduction. 15th Annual AO Spine North America Fellows Forum. Banff Springs, Alberta Canada March 2017.
- 2017 Quinn JC, **Buchholz AL**, Buell TJ, Shaffrey CI, Smith JS. Alignment Risk Factors for PJK and the Effect of Posterior Polyester Tethers in Multilevel Posterior Instrumentation for Adult Spinal Deformity. 15th Annual AO Spine North America Fellows Forum. Banff Springs, Alberta Canada. March 2017.
- 2017 Eriksson EA, **Buchholz AL**, Matar M, Kalhorn S. Thoracic Spine Exposure: A New Indication for Rib Surgical Fixation. Platform Presentation at Chest Wall Summit. Park City, Utah. March 2017.
- 2017 Shaffrey CI, **Buchholz AL**. Three Column Osteotomy for Sagittal Correction. IMAST. Cape Town, South Africa. July 12-15, 2017.

- 2017 Buell D, **Buchholz AL**, Quinn JC, Nguyen J, Mazur MD, Bess S, Line BG, Ames CP, Schwab F, Lafage V, Shaffrey CI, Smith JS. A Pilot Study on Posterior Polyethylene Tether to Prevent Proximal Junctional Kyphosis After Multilevel Spinal Instrumentation For Adult Spinal Deformity. CNS Annual Meeting 2017
- 2017 **Buchholz AL**. Importance of Lumbar Lordosis in Reduction of Adjacent Segment Disease. SCANS. Kiawah, SC. Dec 1-3, 2017.
- 2018 Garces J, Buell TJ, Mullin JP, Mazur MD, Nguyen JH, Taylor DG, **Buchholz AL**, Yen Chun-Po, Shaffrey CI, Smith JS. The Effect of Junctional Tethers on Proximal Junctional Kyphosis in Multilevel Posterior Spinal Instrumentation for Adult Spinal Deformity. 16th Annual AO Spine North America Fellows Forum. Banff Springs, Alberta Canada March 22-24, 2018.
- 2018 **Buchholz AL**. Surgeons as High Performance Athletes. 16th Annual AO Spine North America Fellows Forum. Banff Springs, Alberta Canada. March 22-24, 2018.
- 2018 Buell D, Quinn JC, **Buchholz AL**, Nguyen J, Mazur MD, Bess S, Line BG, Ames CP, Schwab F, Lafage V, Shaffrey CI, Smith JS. Alignment Risk Factors For Proximal Junctional Kyphosis and the Effect of Lower Thoracic Junctional Tethers for Adult Spinal Deformity. AANS/CNS Section on Disorders of the Spine and Peripheral Nerves Spine Summit 2018.
- 2018 Buell D, **Buchholz AL**, Quinn JC, Nguyen J, Mazur MD, Bess S, Line BG, Ames CP, Schwab F, Lafage V, Shaffrey CI, Smith JS. A Pilot Study on Posterior Polyethylene Tether to Prevent Proximal Junctional Kyphosis After Multilevel Spinal Instrumentation For Adult Spinal Deformity. AANS/CNS Section on Disorders of the Spine and Peripheral Nerves Spine Summit 2018.
- 2018 **Buchholz AL**. Transforaminal Endoscopic vs. Microscopic Discectomy. 2018 MUSC Health Spine Conference – Controversies in Spine Care. April 14, 2018. Kiawah Island, SC
- 2018 **Buchholz AL**. ALIF vs TLIF/PLIF vs LLIF Indications. 2018 MUSC Health Spine Conference – Controversies in Spine Care. April 14, 2018. Kiawah Island, SC
- 2018 **Buchholz AL**. Treatment of Adult Deformity: Whenever and When Never to Perform. 2018 MUSC Health Spine Conference – Controversies in Spine Care. April 14, 2018. Kiawah Island, SC
- 2018 Gross RH, **Buchholz AL**, Webb S, Bonthius, D. The Rib Construct – a Safe and Effective Method for Correction of Severe Pediatric Deformity. 3rd Annual Safety in Spine Surgery Summit. New York, NY. April 20, 2018.
- 2018 **Buchholz AL**, Buell TJ, Quinn JC, Bess S, Line B, Ames C, Schwab F, Lafage V, Shaffrey CI, Smith JS. Long Segment Fusion and the Use of a Tether for Proximal Junction Kyphosis Reduction. AO Global Spine Congress. May 2-5, 2018. Singapore.
- 2018 **Buchholz AL**. Primary Infections. Patient Care – Discitis. AO Global Spine Congress. May 2-5, 2018. Singapore.
- 2018 Gross RH, **Buchholz AL**, Webb SA, Walton Z, Bonthius D, Yao H. Fixation Costale Haute – Une Methode Sure Et Efficace Pour Traitant La Difformite Pediatrique Severe. Societe Francais de Chrugie du Rachis. Nantes France. June 7-9 2018.

Inventions and Patents

None

Bibliography

1. Kappler CS, **Buchholz AL**, Xu L, Menick DR. Interaction of the Na⁺/Ca²⁺ Exchanger with Signaling Cofactors in the Cardiomyocyte. *Biophysical Journal*. 2005 88: 5928.
2. **Buchholz AL**, Valppu L, Xu L. Expression of Alternative Splicing Factors Are Changed in Pressure-Overloaded Cardiac Hypertrophy. *Circulation Research*. 2005 97 (2): e35.
3. Menick DR, Renaud L, **Buchholz A**, Muller JG, Zhou H, Kappler CS, Kubalak SW, Conway SJ, Xu L. Regulation of Ncx1 Gene Expression in the Normal and Hypertrophic Heart. *Ann N Y Acad Sci*. 2007 Mar;1099:195-203.
4. Chandrasekaran S, Peterson RE, Mani SK, Renaud L, **Buchholz AL**, Addy B, Xu L, Thiyagarajan T, Kern CB, Menick DR. Histone Deacetylases Facilitate Ncx1 Upregulation in Adult Cardiocytes. *FASEB* 2009 Nov 23(11): 3851-64.
5. **Buchholz AL**, Niesen MC, Gausden E, Hetzel S, Squire MW, Kaplan LD. Metabolic Activity in Osteoarthritic Knees Correlates with Body Mass Index. *The Knee* 2010 Mar;17(2) 161-6.
6. Schreiber JJ, Anderson PA, Humberto RG, **Buchholz AL**, Au AG. Hounsfield Units for Assessing Bone Mineral Density and Strength – A Tool For Osteoporosis Management. *JBJS* 2011 June: 93(11):1057-1063.
7. **Buchholz AL**, Morgan SL, Robinson L, Frankel BM. Minimally Invasive Percutaneous Screw Fixation of Traumatic Spondylolisthesis of the Axis. *Journal of Neurosurgery Spine* 2015 May: 22 (5) 459-465.
8. **Buchholz AL**, Frankel BM. Response. Alternative Approach in Type II Hangman Fractures. *Journal of Neurosurgery Spine*. 2016 Apr;24(4):672.
9. Buell TJ, **Buchholz AL**, Quinn JC, Bess S, Line BG, Ames CP, Schwab FJ, Lafage V, Shaffrey CI, Smith JS. A Pilot Study on Posterior Polyester Tethers as an Anti-PJK Device for Multilevel Spinal Instrumentation for Adult Spinal Deformity. *Operative Neurosurgery*. 2018 April 24.
10. **Buchholz AL**, Quinn JC, Buell TJ, Shaffrey CI, Smith JS. Transforaminal Lumbar Interbody Fusion: A Review of Techniques and Advances. Submitted to *Contemporary Neurosurgery* 2017
11. Quinn JC, **Buchholz AL**, Buell TJ, Smith JS, Shaffrey CI. Adjacent Segment Disease and Proximal Junctional Kyphosis: Prevention and Treatment Strategies. Submitted to *Contemporary Neurosurgery* 2017
12. Buell TJ, **Buchholz AL**, Quinn JC, Smith JS, Shaffrey CI. Adjacent Segment Disease and Proximal Junctional Kyphosis: Etiology and Classification. Submitted to *Contemporary Neurosurgery* 2017
13. Howie B.A., Davidson I.U., Tanenbaum J.E., Pahuta M.A., **Buchholz A.L.**, Steinmetz M.P., Mroz T.E. Thoracic epidural abscess: A systematic review. *Global Spine Journal*. In Press. Accepted 24 January 2018.
14. Buell TJ, Mullin JP, Nguyen JH, Taylor DG, Garces J, Mazur MD, **Buchholz AL**, Shaffrey ME, Yen CP, Shaffrey CI, Smith JS. A Novel Junctional Tether Weave Technique for Adult Spinal Deformity: 2-Deminesional Operative Video. *Operative Neurosurgery*. 2018 June 05. <https://doi.org/10.1093/ons/opy148>
15. Lowe S, Buchholz AL, Spiotta A. Perspectives from a Residency Training Program Following the Implementation of a Wellness Initiative. *World Neurosurgery*. Accepted for Publication 2018.
16. Spiotta, Mocco, Buchholz AL. The High Performance Athlete. *World Neurosurgery*. Accepted for Publication.

17. Buell TJ, Buchholz AL, Alignment Risk Factors for Proximal Junctional Kyphosis and the Effect of Lower Thoracic Junctional Tethers for Adult Spinal Deformity. Accepted. World Neurosurgery 2018.

Books and Monographs

None

Book Chapters

1. Vandergrift WA, Kalhorn SP, **Buchholz AL**. Common Postoperative Complications in Neurosurgery. Principles and Practices of Hospital Medicine. 2e. Edited by McKean SC, Ross JJ, Dressler DD, Scheurer DB. McGraw Hill Medicine 2016.
2. Quinn, JC, **Buchholz AL**, Shaffrey CI, Smith JS. Sagittal Plane Deformity Surgery (VCR) Complication. Spinal Deformity: A Case-Based Approach to Managing and Avoiding Complications: Springer Science 2016.
3. **Buchholz AL**, Quinn JC, Shaffrey CI, Berven SH, Polly MD, Smith JS. Kyphotic Deformity in the Pediatric Spine. AO Spine Masters Series Volume 9 Pediatric Spine Deformity. Edited by Luiz Roberto Vialle MD. Thieme Publishing 2016.
4. Quinn, JC, **Buchholz AL**, Shaffrey CI, Smith JS. Surgical Considerations in Non-Osteoarthritic Spondylopathies. Degenerative Cervical Myelopathy and Radiculopathy: Treatment Approaches and Options. Edited by Fehlings MG, Kaiser MG, Haid RW, Shaffrey CI. Springer Science and Business Media 2017.
5. **Buchholz AL**, Quinn JC, Shaffrey CI, Smith, JS. Atlantoaxial Stabilization. Degenerative Cervical Myelopathy and Radiculopathy: Treatment Approaches and Options. Edited by Fehlings MG, Kaiser MG, Haid RW, Shaffrey CI. Springer Science and Business Media 2017.
6. **Buchholz AL**, Quinn JC, Shaffrey CI. Post-op Spinal Deformities: Kyphosis, Non-union, and Loss of Motion Segment. Nanda Complications in Neurosurgery, 1st edition. Elsevier Clinical Solutions 2017.
7. Buell TJ, Quinn JC, **Buchholz AL**, Shaffrey CI, Smith JS. Importance of Sagittal Alignment of the Cervical Spine in the Management of Degenerative Cervical Myelopathy. Neurosurgery Clinics of North America. Edited by Michael G Fehlings and Junich Mizuno. Elsevier Publishing 2017.

Course Faculty

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| 2018 | 16 th Annual AO Spine North America Fellows Forum. Banff Springs, Alberta Canada. March 22-24, 2018 |
| 2018 | NuVasive Intro to XLIF lab. Charlottesville, VA June 16, 2018 |
| 2018 | SNS Intern Bootcamp. Atlanta, GA. July |
| 2018 | Cleveland Clinic Spine Review, Cleveland OH. July 2018 |
| 2018 | 2018 SNS Intern Boot Camp Course, Fundamentals of Neurosurgery. Atlanta, July 20-21. |

Online Content

1. <http://abcnews4.com/archive/new-concussions-bill-aims-to-make-high-school-football-safer>
2. <http://www.muschealth.org/health-blog/high-school-concussion-policy-and-management>

3. <http://academicdepartments.musc.edu/newscenter/2017/back-pain/index.html>

4. <https://youtu.be/SgLYCwYqHpk>

Clinical References

Christopher I Shaffrey MD, Director of Spine, University of Virginia Department of Neurosurgery

Justin S Smith, MD, Director of Spine, University of Virginia Department of Neurosurgery

Sunil J Patel MD, Chairman, Medical University of South Carolina Department of Neurosurgery

Scientific References

Lee D Kaplan MD, Chief of Sports Medicine, University of Miami Department of Orthopedics