Quantification of Vertebral Bone Density with Computed Tomography Predicts Non-Home Discharge After Severe Blunt Chest Wall Injury

Connor Wakefield, MD[1], Matthew Baucom, MD, Stephanie Sisak, MD, Christopher W. Seder, MD, Christopher F. Janowak, MD

Capt, USAF, MCM

Internal Medicine PGY3

Brooke Army Medical Center

Disclaimer

- I do not have any relevant financial relationships with ineligible companies pertaining to this topic

- The view(s) expressed herein are those of the author(s) and do not reflect the official policy or position of Uniformed Services University of the Health Sciences, Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc., National Institutes of Health or the Department of Health and Human Services, Brooke Army Medical Center, Defense Health Agency, the Departments of the Air Force, Navy, or Army, the Department of Defense, or the U.S. Government.

Introduction

Osteoporosis in Trauma

- portends worse outcomes
- future increased risk of fractures
- intuitively plays a role in rehabilitation
- Attempts to measure bone density inpatient for chest wall injury has not been studied

ORIGINAL ARTICLES

Screening for osteoporosis after trauma

A new approach using quantitative computed tomography of the skull

Taylor, Amber MD; Waxman, Kenneth MD; Izfar, Seema MD; Grotts, Jonathan MA; Yim, Samantha RN

Author Information

Journal of Trauma and Acute Care Surgery 77(4):p 635-639, October 2014. | *DOI:* 10.1097/TA.0000000000000411

Journal of *Personalized Medicine*

MDPI

Article

Computed Tomography-Based L1 Bone Mineral Density in 624 Dutch Trauma Patients—Are North American Reference Values Valid in Europe?

Tim Kobes [1,2,*,†], Arthur Sweet [1,2,†], Sophie Verstegen [1], Marijn Houwert [1], Wouter Veldhuis [2], Luke Leenen [1], Pim de Jong [2,*] and Mark van Baal [1]

METHODS

- Retrospective Cohort Study (2014 – 2019)
- Single Institution – Urban Level 1 Trauma Center

- Inclusion Criteria;
    - Blunt chest wall injury
    - Intensive Care Unit admission
    - Computed tomography (CT) imaging available

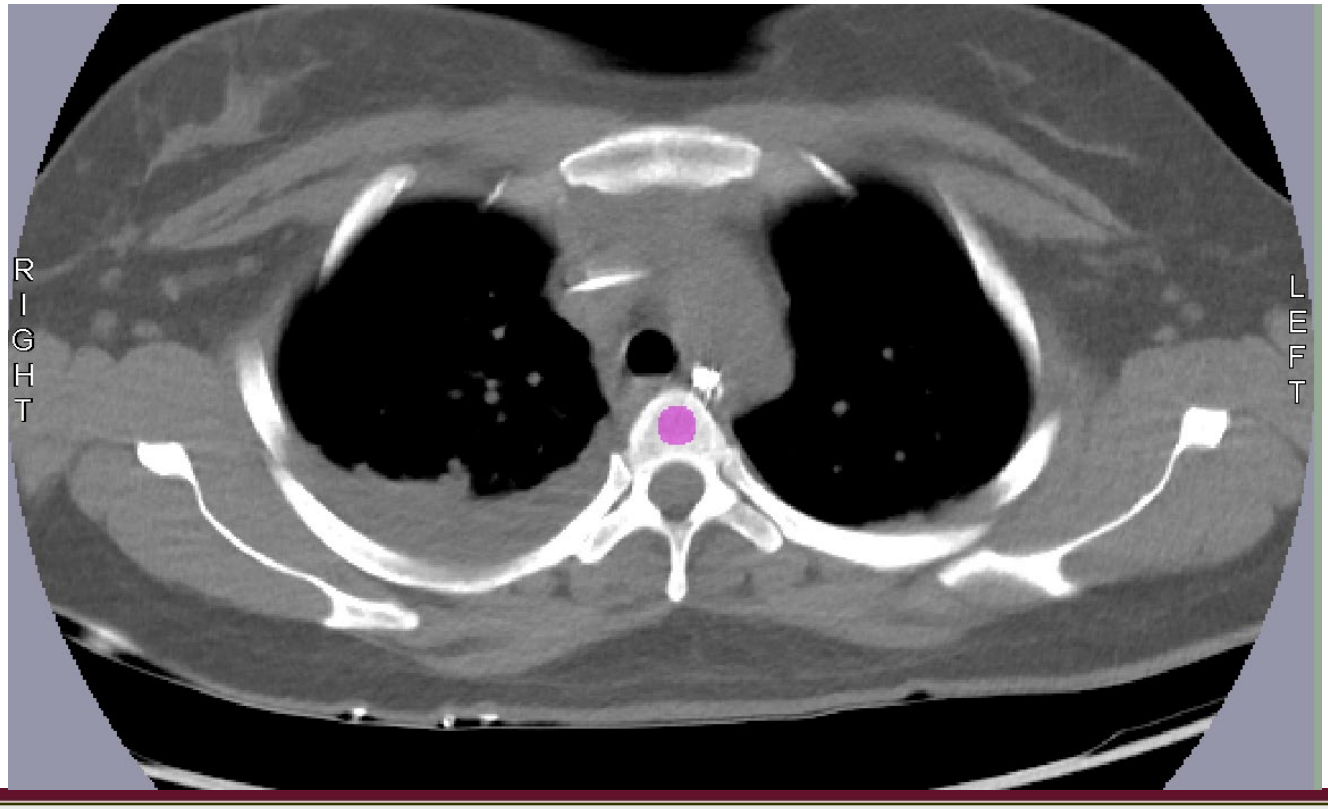
- Exclusion Criteria;
    - Penetrating injury
    - < 18 years of age
    - Pregnant
    - Death within 72 hours
    - Catastrophic neurologic injury

METHODS Continued

Bone Density Analysis

- Vertebral bone was analyzed at T4 level on CT chest scans

- The average Houndsfield Units (HU) of cancellous bone (Figure) was determined with SliceOmatic Software (Tomovision, Canada)



METHODS Continued

Primary Outcome Measures

- Hospital Disposition

Secondary Outcome Measures

- In patient mortality, 90-day outcomes, duration of mechanical ventilation, rates pulmonary infections, rates of tracheostomy, length of stay (LOS)

Statistical Analysis

- Patients were groups based on home vs non-home hospital disposition

- Baseline demographics and variables were compared between groups

-STATA software (StataCorp, College Station, TX) was utilized for all analysis

Results

Demographics	Discharged Home (n = 19)	Non-Home Discharge (n= 131)	p value
Age, years mean (±SD)	**36.8 years (±11.1)**	**48.4 years (±17.2)**	**p = 0.000**
Gender (male, n [%])	15 (79%)	98 (75%)	p = 0.565
Obesity (yes, n[%])	6 (32%)	26 (20%)	p = 0.245
Rib Score, median (±IQR)	3.0 (2.0-4.0)	3.0 (1.5-4.0)	p = 0.891
BMI, kg/m^2 (±SD)	29.1 kg/m^2 (± 6.7)	30.8 kg/m^2 (± 7.8)	p = 0.455
Bone HU, mean (±SD)	**232.6 (± 62.2)**	**194.7 (± 57.2)**	**p = 0.000**

Results Continued

Outcomes	Discharged Home (n = 19)	Non-Home Discharge (n= 131)	p value
Tracheostomy (yes, n[%])	2 (11%)	71 (54%)	p = 0.000
Hospital Length of Stay, mean (±SD)	16.9 days (±6.9)	24.6 days (±12.8)	p = 0.000
Intensive Care Unit Length of Stay, mean (±SD)	11.6 days (± 6.3)	20.3 days (±10.2)	p = 0.000
In-patient Mortality	0 (0%)	10 (76%)	p = 0.000

Results Continued

Multivariate Linear Regression Model for Hospital Disposition

Variable	Regression Coefficient (*B*)	Z score	p value	95% Confidence interval
Bone Density HU	**-0.01**	**-2.58**	**p = 0.010**	**[-0.02, -0.03]**
Gender	-0.38	-0.59	p = 0.557	[-1.63 0.88]
Rib Score	-0.30	-1.55	p = 0.120	[-0.68, 0.08]

Conclusion:

Reduced bone density measured with CT imaging PMI in patients with blunt chest trauma is associated with non-home discharge disposition.

Limitations:

-Single center retrospective study

-Mechanically vented patients

-Elderly patients

Future Directions:

-Applying similar analysis in surgical cohorts to assess rates of surgical complications, poor bone healing, or need for revision surgery.

QUESTIONS?

Connor Wakefield

Connor.J.Wakefield.mil@health.mil

Christopher Janowak

Christopher.janowak@uc.edu