ORIGINAL RESEARCH ARTICLES

Evaluation of Radiation Dosing Utilizing Coronary Dual-Source Computed Tomography Angiography in a Community Clinical Setting
A 20- to 40-Year Follow-Up of Asymptomatic Microhematuria Patients
A Comparison of Predicted Creatinine Clearance With Measured Creatinine Clearance in Morbidly Obese Patients Undergoing Laparoscopic Gastric Bypass Surgery

REVIEW

A Position Paper Concerning the Surgical Treatment of Refractory Gastroesophageal Reflux Disease in the Obese Patient

CASE REPORT

Compression Fractures as the Presenting Symptom in a Patient with End-Stage Renal Disease from IgA Nephropathy

HISTORY OF MEDICINE

Norse Transatlantic Trade and the Spread of Typhus from North America to Eurasia

SUPPLEMENT

Abstracts of Presentations Made by Gundersen Lutheran Staff in 2009
## Contents

### Editor's Message
David E. Hartman, PhD, BC-ANCDS(A)

### Original Research Articles

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>Evaluation of Radiation Dosing Utilizing Coronary Dual-Source Computed Tomography Angiography in a Community Clinical Setting</td>
<td>Vicki L. McHugh, MS; Mary Ellen Jafari, MS; Kara J. Kallies, BA; Jacob D. Gundrum, MS; Raju G. Ailiani, MD; Umang M. Patel, MD, FACC</td>
</tr>
<tr>
<td>44</td>
<td>A 20- to 40-Year Follow-Up of Asymptomatic Microhematuria Patients</td>
<td>Marvin J. Van Every, MD; Richard S. Howard, MD, Ret.; Jacob D. Gundrum, MS; Wendy L. Berth, BS</td>
</tr>
<tr>
<td>46</td>
<td>A Comparison of Predicted Creatinine Clearance With Measured Creatinine Clearance in Morbidly Obese Patients Undergoing Laparoscopic Gastric Bypass Surgery</td>
<td>Martha Tran, PharmD; Vanessa Freitag, PharmD, BCPS; Shanu N. Kothari, MD, FACS</td>
</tr>
</tbody>
</table>

### Review

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>A Position Paper Concerning the Surgical Treatment of Refractory Gastroesophageal Reflux Disease in the Obese Patient</td>
<td>Brandon T. Grover, DO; Shanu N. Kothari, MD, FACS</td>
</tr>
</tbody>
</table>

### Case Report

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>Compression Fractures as the Presenting Symptom in a Patient with End-Stage Renal Disease from IgA Nephropathy</td>
<td>Tracy C. Blichfeldt, MD; Balaji Srinivasan, MD; Steven B. Pearson, MD, FACP</td>
</tr>
</tbody>
</table>

### History of Medicine

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>Norse Transatlantic Trade and the Spread of Typhus from North America to Eurasia</td>
<td>William A. Agger, MD, FACP; Herbert DG Maschner, MS, PhD</td>
</tr>
</tbody>
</table>

### Supplement

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>Abstracts of Presentations Made by Gundersen Lutheran Staff in 2009</td>
</tr>
</tbody>
</table>
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EDITOR’S MESSAGE

“Idea not coupled with action will not get bigger than the brain cell it occupies…” A.H. Glasow

Food for thought as I welcome you to this issue of the GLMJ. Thanks as always to our contributors, reviewers, and the Journal Board members for taking time out of their busy schedules to see this project to fruition. I want to personally thank Board members Drs Sartin and Udermann for their thoughtful and timely contributions to the Board. Dr Sartin will be leaving Gundersen Lutheran to marry his fiancé in Omaha, Nebraska, and will join a practice there. Dr Udermann has assumed the role of Director of Online Education at the University of Wisconsin-La Crosse; given the workload and responsibility with this position he felt it necessary to resign from the Board. I wish them well in their new endeavors. To fill the void, I’ve invited Dr Anne Galbraith and Dr John Porcari from the University of Wisconsin-La Crosse to join us. Both have track records in research and scholarly writing; I look forward to their participation on the Board.

As a Board, we continue to examine ways to encourage contributions both within and outside of Gundersen Lutheran and to expand distribution of the Journal itself. Ms Fischer, Dr Go, and I have met to devise a strategy and timeline for meeting the requirements for having the Journal indexed in MEDLINE. As always, we encourage submission of scholarly papers, including original research, case reports, review articles, historical reports, and letters to the editor. The current issue includes abstracts of presentations made by Gundersen Lutheran staff in 2009.

In the Original Research section of this issue, Vicki McHugh, MS, and colleagues from the departments of Research, Diagnostic Physics, and Cardiology found that image quality is maintained using dual-source computed tomography-angiography at lesser radiation dosages for assessing heart disease. Their findings have implications for reducing the amount of radiation to which patients are exposed during diagnostic testing.

Marvin VanEvery, MD, and colleagues from Urology examined the records of 246 patients seen for unexplained asymptomatic microhematuria. Of the 103 patients who had follow-up information at least 20 years from initial evaluation, only 1 developed genitourinary cancer. This finding suggests that the majority of patients with asymptomatic microhematuria will not go on to develop significant disease, and that further diagnostic workup should be guided by urinary symptoms.

Martha Tran, PharmD, and colleagues from Pharmacy and General Surgery compared measured creatinine clearance with creatinine clearance as estimated by 2 common methods in obese patients undergoing laparoscopic gastric bypass surgery. They found that the Cockcroft-Gault equation modified with the patient’s adjusted body weight is the best predictor of creatinine clearance in the morbidly obese patient undergoing laparoscopic gastric bypass surgery.

In the Review section, Drs Grover and Kothari from General Surgery discuss treatment options for gastroesophageal reflux disease in the obese patient, with emphasis on surgical management for those patients whose symptoms are recalcitrant to more conservative therapies.
Drs Blichfeldt, Srinivasan, and Pearson describe an interesting case of a patient with compression fractures as the presenting symptom of end-stage renal failure from IgA nephropathy in the Case Reports section of this issue.

In the History of Medicine, Drs Agger and Maschner offer a thought-provoking rationale and proposal for the transmission of typhus from North America to Europe and Asia after AD 1000.

Finally, as a supplement in this issue and to keep the readership updated, abstracts of presentations made at professional meetings by Gundersen Lutheran staff in 2009 are provided.

I hope that you find this issue of the GLMJ stimulating and worthwhile. Your comments and contributions to the Journal are always welcome. We also encourage submission of interesting images and relevant text from any discipline. Without your contributions, the Journal would cease to exist!

David E. Hartman, PhD, BC-ANCDS(A)
Editor
Gundersen Lutheran Medical Journal
Evaluation of Radiation Dosing Utilizing Coronary Dual-Source Computed Tomography Angiography in a Community Clinical Setting

ABSTRACT

Background: Our objective was to compare volume-computed tomography dose index (CTDIvol), dose-length product (DLP), and effective dose of dual-source multi-detector computed tomography (DS MDCT) coronary angiography received—for both entire scan and for DS MDCT coronary angiography alone—under a manufacturer-suggested protocol with that received under a revised protocol intended to reduce radiation dose.

Methods: The medical records of 59 consecutive patients (group 1, 54% women, 46% men, mean age 54.9 ± 12.5 years) undergoing DS MDCT coronary angiography (120 kVp, 380-418 mAs, electrocardiographically gated pulsing window 30%-70% of R-R interval, 50% mAs used in non-pulsing window) were retrospectively reviewed. The medical records of 67 additional consecutive patients (group 2, 58% women, 42% men, mean age 54.7 ± 10.3 years) undergoing DS MDCT coronary angiography under a revised protocol (120 kVp, mAs calculated from measured chest size/breast-to-breast size ratio, electrocardiographically gated pulsing window based on heart rate, 25% mAs used in non-pulsing window) were retrospectively reviewed.

Results: Protocol changes reduced CTDIvol by 22% (74 vs 58 mGy, P < .0001). Scan and DS MDCT coronary angiography effective dose were reduced by 25% and 29% (23 vs 17 mSv, P < .0001; 21 vs 15 mSv, P < .0001). Heart rate had a significant impact on scan effective dose in group 1 comparing ≥70 beats/min (bpm) with ≤59 bpm (22 vs 26 mSv, P = .010) and DS MDCT coronary angiography effective dose comparing ≥70 bpm with 60 to 69 bpm (19 vs 23 mSv, P = .18), and on DS MDCT coronary angiography effective dose in group 2 comparing ≥70 bpm with 60 to 69 bpm (13 vs 16 mSv, P = .044). There was no significant deterioration of diagnostic quality of scans after protocol changes were implemented.

Conclusion: Implementing patient-specific DS MDCT coronary angiography protocols can reduce radiation dose while maintaining image quality. The use of chest size/breast-to-breast size ratio to set mAs is unique to this study.
coronary angiography rather than actual patient radiation dose. Those that do report actual patient radiation dose generally have a relatively small patient population and often exclude patients who are unstable, those with arrhythmia, and those with acute chest pain. Few studies address the issues of age, sex, and body mass index (BMI) within patient populations. Finally, cardiology studies tend to report the effective dose of only the coronary angiography portion of the DS MDCT procedure, not of the entire scan, hereafter referred to as scan effective dose.

DS MDCT coronary angiography effective dose and scan effective dose can differ significantly (up to a factor of 3) due to differences in local scanning techniques and parameters. Furthermore, radiation doses suggested by manufacturers’ literature reportedly due to technological improvement may be based on a selected patient population.

Our primary objective was to determine the radiation dose from a DS MDCT coronary angiography procedure (DS MDCT coronary angiography and entire scan) in a community clinical setting by determining CTDIvol, DLP, and effective dose. Secondary objectives were to evaluate the relationships of DS MDCT coronary angiography effective dose and the scan effective dose with age, sex, heart rate, and BMI.

**MATERIALS AND METHODS**

**Patient Population**

From December 1, 2006, to June 15, 2007, DS MDCT coronary angiography was performed using a manufacturer-suggested protocol, while from September 14, 2007, to December 3, 2007, it was performed using a protocol developed at our institution and intended to reduce radiation dose. Following Institutional Review Board approval, consecutive patients referred for clinically indicated DS MDCT coronary angiography during these 2 time intervals were identified and their medical records retrospectively reviewed.

Patients without calcification scores or complete scan data were excluded. If significant calcification was observed (calcification score greater than 1000 Agatston units), the scan was terminated because DS MDCT coronary angiography was not considered to be the most appropriate test in this population; consequently, these patients were excluded from the study because scan data were incomplete. The presence of arrhythmia was not considered a criterion for exclusion.

**Dual-source MDCT Coronary Angiography Protocol**

All patients underwent DS MDCT examination using a multidetector dual-source scanner (Somatom Definition, Siemens Medical Solutions, Forchheim, Germany). Intravenous access was obtained in all patients. Four electrocardiogram (ECG) leads were attached to the chest in standard position for continuous ECG recording throughout the scan. Patients were placed under the scanner, and lateral and anterior-posterior (AP) topogram (scout) scans were performed to determine the appropriate scan length for each patient. Calcium scoring was then performed using the TeraRecon 4D package (TeraRecon Inc., San Mateo, California). To determine the circulation time of the contrast media, a test bolus was performed with 20 cc of contrast (Visipaque, GE Healthcare, Buckinghamshire, UK) and 30 cc of saline at the flow rate of 4 to 5 mL/s. Full contrast media dosing was employed based on determined window size, heart rate, and flow rate. Data acquisition was performed in the craniocaudal direction. Measurements from the DS MDCT coronary angiography were recorded on the computer’s hard drive and individually calculated.

**Group 1.** Scan parameters used were as follows: tube voltage 120 kVp for both tubes; maximum tube current time (mAs) product based on physician preference (380-418 mAs) for both tubes; ECG pulsing window 30% to 70% of the R-R interval (interval of time from the R wave of 1 heart beat to the R wave of the next heart beat) for all patients. Sixty-four overlapping 0.6-mm slices were acquired with gantry rotation time of 0.33 seconds. A temporal resolution of 0.083 seconds was achieved. Pitch was automatically adjusted by the scanner based on patient heart rate. Care Dose 4D was turned off. ECG-based modulation of tube current was used to lower the radiation exposure in all patients, with 50% of maximum tube current (mAs) used in the non-pulsing window.

**Group 2.** Scan parameters used were as follows: tube voltage 120 kVp for both tubes; maximum tube current time (mAs) product based on measured chest size/breast-to-breast size as calculated by the physician (the distance between the most lateral structure on the left side and the most lateral structure on the right—either chest or breast tissue—measured from the topogram taken with the patient in the supine position); and ECG pulsing window was based on patient heart rate. For patients with heart rates of

- ≤ 59 beats/min (bpm), 60% to 70% of the R-R interval was applied
- 60-69 bpm, 50% to 70% of the R-R interval was applied
- ≥ 70 bpm, 30% to 70% of the R-R interval was applied

The pulse window incorporated the top of the T wave to the beginning of the P wave. Sixty-four overlapping 0.6-mm slices were acquired with gantry rotation time of 0.33 seconds. A temporal resolution of 0.083 seconds was achieved. Pitch was automatically adjusted by the scanner based on patient heart rate. Care Dose 4D was turned off. ECG-based modulation of tube current was used to lower the radiation exposure in all patients, with 25% of maximum tube current (mAs) employed in the non-pulsing window.

**DS MDCT Coronary Angiography Data Post-Processing and Analysis**

**Image reconstruction.** Retrospective ECG-gating pulsing was used to synchronize data with the ECG. A monosegment reconstruction algorithm was employed. Images were reconstructed with a slice thickness of 0.75 mm and an increment of 0.4 mm using a soft-tissue convolution kernel (B26f), and in some cases filter images were additionally constructed. Images were reconstructed in 10% steps of the R-R interval within the window of full tube current. All data were transferred to an offline evaluation workstation.

**Readers.** Three specialty-trained cardiologists read DS MDCT coronary angiography scans. At minimum, physician readers met the Level 2 requirements for training in Cardiac CT based on the ACC/AHA Clinical Competency Statement on Cardiac Imaging with Computed Tomography and Magnetic Resonance. Readers were not blinded, as this was a retrospective study. Scans were graded for diagnostic quality as follows:
• Good: entire coronary artery (left main, left anterior descending, left circumflex, right coronary artery) and its major branches could be viewed without artifacts
• Fair: motion artifacts were noted, but the study was still considered diagnostic
• Poor: some segments could not be accurately evaluated, and the study was not completely diagnostic

**Estimation of radiation dose.** Post-procedure scanner-indicated values for CTDI<sub>vol</sub> and DLP were obtained. CTDI<sub>vol</sub> and DLP values were used to calculate effective dose from the DS MDCT coronary angiography alone. CTDI<sub>vol</sub> and DLP values from the topogram, calcium score evaluation, test bolus, as well as that of the DS MDCT coronary angiography were all included to calculate the scan effective dose. Effective dose was estimated by multiplying DLP values (mGy cm) by the appropriate region-specific normalized effective dose (mSv mGy<sup>-1</sup> cm<sup>-1</sup>) coefficient. The normalized effective dose coefficient used for the chest was 0.017 mSv mGy<sup>-1</sup> cm<sup>-1</sup> and was obtained from Table 2, Appendix I, Chapter 1, of the European Guidelines on Quality Criteria for Computed Tomography. Indicated CTDI<sub>vol</sub> accuracy was determined to be -5% to +10% for the DS MDCT unit used for this study when compared with CTDI measurements obtained by our institution physicist using an ionization chamber.

**Statistical Analysis**
Statistical analysis was performed using SAS software (version 9.1, Cary, North Carolina). Continuous variables were expressed as mean ± standard deviation (SD) including 95% confidence intervals (CI) or range when appropriate, and t tests were used to test for significant differences between groups. Categorical data were expressed as frequencies or percentages. A χ<sup>2</sup> analysis was used to test for a proportion difference in sex between the groups. Within each group, a Pearson correlation test compared continuous variables of scan effective dose and DS MDCT coronary angiography effective dose with heart rate, BMI, age, chest diameter, chest depth, scan DLP, and DS MDCT coronary angiography DLP. Spearman correlation test replaced the Pearson test when assumptions of the Pearson test were not met. A general linear model was used to determine DS MDCT coronary angiography effective dose and scan effective dose across heart rate categories, followed by Tukey post-hoc analysis for pairwise comparisons. A P value of < .05 was considered significant.

**Table 1. Group Demographics<sup>a</sup>**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Group 1</th>
<th>Group 2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men, n (%)</td>
<td>27 (46)</td>
<td>28 (42)</td>
<td>.654</td>
</tr>
<tr>
<td>Age, y</td>
<td>55 (13)</td>
<td>55 (10)</td>
<td>.928</td>
</tr>
<tr>
<td>Heart rate, bpm</td>
<td>70 (14)</td>
<td>67 (13)</td>
<td>.223</td>
</tr>
<tr>
<td>BMI, kg/m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>31.6 (7)</td>
<td>29.2 (5)</td>
<td>.034</td>
</tr>
<tr>
<td>Chest diameter, cm</td>
<td>40.6 (5.6)</td>
<td>40.4 (5.2)</td>
<td>.837</td>
</tr>
<tr>
<td>Chest depth, cm</td>
<td>25.2 (3.5)</td>
<td>24.5 (3.3)</td>
<td>.246</td>
</tr>
<tr>
<td>Chest circumference, cm</td>
<td>104.8 (12.9)</td>
<td>103.5 (12.0)</td>
<td>.556</td>
</tr>
</tbody>
</table>

Abbreviations: bpm, beats/minute; BMI, body mass index.
<sup>a</sup> Unless otherwise indicated, values are presented as mean (SD).

**RESULTS**
We identified 59 patients (54% women, 46% men, mean age 54.9 ± 12.5 years, age range 29.8-82.1 years) who underwent DS MDCT coronary angiography under a manufacturer-suggested protocol between December 1, 2006, and June 15, 2007, (group 1) and 67 patients (58% women, 42% men, mean age 54.7 ± 10.3 years, age range 30.2-77.4 years) who underwent DS MDCT coronary angiography between September 14, 2007, and December 3, 2007, under the revised institutional protocol designed to reduce radiation dose (group 2).

CTDI<sub>vol</sub> and DLP values were available for all 126 patients. A majority of patients had some form of arrhythmia, with only 39% being in isolated normal sinus rhythm (49% in group 1 and 30% in group 2). Although a significant difference existed between groups for BMI, analysis of demographic variables revealed no clinically significant differences between groups (Table 1).

Significant differences were found between groups for scan DLP, scan effective dose, DS MDCT coronary angiography CTDI<sub>vol</sub>, DS MDCT coronary angiography DLP, and DS MDCT coronary angiography effective dose (as described earlier in the Estimation of Radiation Dose section) in favor of group 2 (Table 2). Implementing the previously described protocol changes reduced CTDI<sub>vol</sub> by 22% (74 vs 58 mGy, P < .0001). Further, the scan effective dose and the DS MDCT coronary angiography effective dose were reduced by 25% and 29%, respectively (23 vs 17 mSv, P < .0001; 21 vs 15 mSv, P < .0001).

Pearson correlation coefficients revealed that heart rate had a significant impact on scan effective dose for both groups (group 1: r = -0.47, P < .001; group 2: r = -0.26, P = .033), and on DS MDCT coronary angiography effective dose for both groups (group 1: r = -0.37, P = .005; group 2: r = -0.36, P = .003). The only other variable that demonstrated a trend toward significance was chest depth on scan effective dose in group 1 (r = 0.22, P = .087). However, the Pearson assumption of normality was questionable, so a Spearman correlation test was performed, which found this relationship to be significant (r = 0.26, P = .048).

We also used t tests to evaluate the relationships of scan effective dose and DS MDCT coronary angiography effective dose.

**Table 2. Group-to-group Dose Comparisons<sup>a</sup>**

<table>
<thead>
<tr>
<th>Dose compared</th>
<th>Group 1</th>
<th>Group 2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTDI&lt;sub&gt;vol&lt;/sub&gt;, mGy</td>
<td>74 (17)</td>
<td>58 (14)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Scan DLP, mGy-cm</td>
<td>1366 (264)</td>
<td>1022 (222)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Scan effective dose, mSv</td>
<td>23 (5)</td>
<td>17 (4)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>DS MDCT coronary angiography DLP, mGy-cm</td>
<td>1228 (288)</td>
<td>873 (226)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>DS MDCT coronary angiography effective dose, mSv</td>
<td>21 (5)</td>
<td>15 (4)</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Abbreviations: CTDI<sub>vol</sub>, computed tomography dose index volume; DLP, dose-length product; and DS MDCT, dual-source multi-detector computed tomography.
<sup>a</sup> Unless otherwise indicated, values are presented as mean (SD).
with age, sex, BMI, and heart rate (Tables 3a and 3b). Age was evaluated using the American Heart Association cutpoint for risk of developing coronary heart disease (men ≥ 45 years and women ≥ 55 years). No age-related differences were found for either group. In fact, the mean difference in radiation dose for any of the age variables in either group was <1 mSv. The only significant difference in radiation dose by sex was found for the entire scan effective dose in group 1 (men: 25 ± 4 mSv vs women: 22 ± 5 mSv, P = .045), a difference possibly due to greater physical size in men (27 men vs 32 women).

BMI was assessed as a continuous variable, and differences were found between groups (31.6 vs 29.2 kg/m², P = .034). The effect of BMI on radiation dose also was analyzed by 3 categories: obese (BMI ≥ 30), overweight (BMI = 25-29), and normal (BMI < 25) within each group. Comparisons of the categories within groups revealed no significant differences for obese versus overweight, obese versus normal, or overweight versus normal. The effect of heart rate on radiation dose was assessed by 3 categories: ≤ 59 bpm, 60 to 69 bpm, and ≥ 70 bpm. Significant differences were found for group 1 for the scan effective dose when comparing ≥ 70 bpm with ≤ 59 bpm (22 vs 26 mSv, P = .010) and for DS MDCT coronary angiography effective dose comparing ≥ 70 bpm with 60 to 69 bpm (19 vs 23 mSv, P = .018). For group 2, the only significant difference found was for DS MDCT coronary angiography effective dose when comparing ≥ 70 bpm with 60 to 69 bpm (13 vs 16 mSv, P = .044). However, there was a strong trend associated with differences between heart rates of ≥ 70 bpm and 60 to 69 bpm for the scan effective dose (16 vs 19 mSv, P = .054). It was also noted that the greatest radiation dose for DS MDCT coronary angiography effective dose in group 1 (23 mSv), and both scan and DS MDCT coronary angiography effective dose for group 2 (19 and 16 mSv, respectively) occurred in the 60 to 69 bpm heart rate category.

As defined in the methods section, image quality was subjectively assessed by the reading cardiologist as good (n = 95), fair (n = 29), and poor (n = 2). Only 2 DS MDCT coronary angiography scans were assessed poor quality (1 in each group), the fair and poor categories were grouped together for analysis. No image quality differences were found between groups; however, significant differences were found when image quality was assessed by heart rate categories of ≤ 59 bpm, 60 to 69 bpm, and ≥ 70 bpm (P = .018). Further analysis revealed differences in mean heart rate between patients with fair to poor quality scans compared with those with good quality scans (75 ± 14 bpm vs 67 ± 13 bpm; P = .003).

**DISCUSSION**

A continual goal in imaging is to achieve the best balance between radiation exposure and image quality for test accuracy. With differences in radiation exposure resulting from scanning techniques and parameters, protocol development is challenging. Further, assumed amounts of radiation exposure in manufacturers’ reports may differ from what is occurring in community-based settings. Moreover, public awareness and concern regarding

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<table>
<thead>
<tr>
<th>Effective dose and demographic variable compared</th>
<th>Group 1 n = 59</th>
<th>Group 2 n = 67</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS MDCT coronary angiography and age&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>increased risk versus low risk</td>
<td>21 vs 21</td>
<td>.806</td>
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<tr>
<td>Entire scan and age</td>
<td></td>
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<tr>
<td>increased risk versus low risk</td>
<td>23 vs 24</td>
<td>.538</td>
</tr>
<tr>
<td>DS MDCT coronary angiography and sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>men versus women</td>
<td>21 vs 21</td>
<td>.698</td>
</tr>
<tr>
<td>Entire scan and sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>men versus women</td>
<td>25 vs 22</td>
<td>.045</td>
</tr>
<tr>
<td>DS MDCT coronary angiography and BMI&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obese versus overweight</td>
<td>22 vs 21</td>
<td>.514</td>
</tr>
<tr>
<td>normal versus normal</td>
<td>22 vs 19</td>
<td>.192</td>
</tr>
<tr>
<td>overweight versus normal</td>
<td>21 vs 19</td>
<td>.348</td>
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<tr>
<td>Entire scan and BMI</td>
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<tr>
<td>Obese versus overweight</td>
<td>24 vs 24</td>
<td>.844</td>
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<tr>
<td>normal versus normal</td>
<td>24 vs 21</td>
<td>.165</td>
</tr>
<tr>
<td>overweight versus normal</td>
<td>24 vs 21</td>
<td>.105</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index; DS MDCT, dual-source multi-detector computed tomography.

<sup>a</sup> Using the American Heart Association cutpoint for age-related risk of developing coronary heart disease, we compared the effective dose of patients at increased risk (men ≥ 45 years and women ≥ 55 years) with that of patients at low risk (men < 45 years and women < 55 years).

<sup>b</sup> Obese was defined as having a BMI ≥ 30 kg/m², overweight as 26-29 kg/m², and normal as ≤ 25 kg/m².
radiation exposure is on the rise, with this issue highlighted not only in scientific journals,\textsuperscript{13-15} but in popular publications, as well.\textsuperscript{16,17}

The current study demonstrated that tailoring protocols to the patient population significantly reduced CTDI\textsubscript{vol} (22%), scan effective dose (25%), and DS MDCT coronary angiography effective dose (29%). These techniques included basing maximum tube current time (mAs) on measured chest size/breast-to-breast size from the topogram, setting the ECG pulsing window according to patient heart rate, individually narrowing pulse window to include only the peak of the T wave to onset of the P wave, and using 25% of maximum tube current (mAs) in the non-pulsing window.

Although no clinically relevant differences were found between groups for radiation dose with regard to sex, age, BMI, or chest dimensions (diameter, depth, and circumference), women in group 1 received significantly lower scan effective doses than did men. While group 1 had more women than men (32 vs 27), we believe this difference may reflect the larger body and organ dimensions typically found in men.

Even though image quality at higher heart rates and robustness of the method have significantly improved with DS MDCT systems, concerns regarding motion artifacts persist. The continued concern regarding the influence of heart rate on diagnostic accuracy of CT coronary angiography is well studied in single-source systems, but less information is available for DS MDCT systems, as well.\textsuperscript{16}

Recent publications have addressed radiation dose issues in DS MDCT coronary angiography. DS MDCT systems allow for adjusted pitch values based on heart rate. This increases table travel velocity and reduces radiation dose. Use of ECG-based tube current modulation with lowering of the tube current outside the normal tube output window (reduced to 25% in group 2 of the current study) also reduces dose, despite continuously wider ECG pulsing windows of the R-R interval with increased heart rates. Specifically for cardiac applications, a bowtie filter can be used to reduce x-ray intensity toward the margins of the field of view.\textsuperscript{2,21}

As in the previous studies, heart rate had a significant impact on radiation dose in both groups in the current study. Not surprisingly, differences were seen in both groups for DS MDCT coronary angiography effective dose when comparing heart rates of ≥ 70 bpm and 60 to 69 bpm, and for scan effective dose when comparing heart rates of ≥ 70 bpm and 60 to 69 bpm in group 2; however, a surprising finding was that this relationship was not linear. Patients with heart rates of 60 to 69 bpm had the greatest radiation dose for DS MDCT coronary angiography effective dose in group 1, as well as the greatest exposure for DS MDCT coronary angiography effective dose and scan effective dose in group 2.

Table 3b. Relationships between Effective Dose and Heart Rate\textsuperscript{a}

<table>
<thead>
<tr>
<th>Effective dose by heart rate category</th>
<th>Group 1 n = 59</th>
<th>Group 2 n = 67</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effective dose, mSv</td>
<td>P</td>
</tr>
<tr>
<td>DS MDCT coronary angiography</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 70 versus ≤ 59</td>
<td>19 vs 21</td>
<td>.263</td>
</tr>
<tr>
<td>≥ 70 versus 60-69</td>
<td>19 vs 23</td>
<td>.018</td>
</tr>
<tr>
<td>60-69 versus ≤ 59</td>
<td>23 vs 21</td>
<td>.741</td>
</tr>
<tr>
<td>Entire scan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 70 versus ≤ 59</td>
<td>22 vs 26</td>
<td>.010</td>
</tr>
<tr>
<td>≥ 70 versus 60-69</td>
<td>22 vs 24</td>
<td>.243</td>
</tr>
<tr>
<td>60-69 versus ≤ 59</td>
<td>24 vs 26</td>
<td>.223</td>
</tr>
</tbody>
</table>

Abbreviation: DS MDCT, dual-source multi-detector.

\textsuperscript{a} Heart rate values are presented as mean beats/minute.

detect valvular disease, to accurately assess regional wall motion abnormalities, and to establish the presence and extent of disease in the coronary arteries and major branches.

A recent phantom study comparing image quality of 64-row dual-source with single-source CT coronary angiography found that as heart rate and pitch increased, CTDI\textsubscript{vol} decreased with the dual-source system, as was also found in our study. Further, a doubling of heart rate was matched by an even greater pitch increase, reducing CTDI\textsubscript{vol} to less than half its value for the dual-source system.\textsuperscript{19} Another phantom study by McCollough et al\textsuperscript{20} evaluated radiation dose in a 64-channel DS MDCT system. The authors found that as heart rate increased, pitch value could be increased, which corresponded to a linear decrease in patient radiation dose—exactly opposite of the effect observed in a 64-channel single-source MDCT system.

The authors reported similar mean effective dose of 15 ± 4 mSv for patients with heart rates < 65 bpm and 16 ± 3 mSv for those with heart rates ≥ 65 bpm. No differences were found in the detection of coronary stenosis with per-patient analyses based on heart rate, indicating no motion artifact detriment. We found that motion artifacts minimally interfered with the diagnostic quality of our scans, despite including patients with various forms of arrhythmia. Even with a 25% reduction of the non-pulsing window, the image quality of 98% of scans was good enough to ascertain systolic function, to
patients developed heart rate variability (defined as varying a minimum of every fourth beat) in the beginning of the scan and often received the full dose radiation throughout the cardiac cycle, despite initially planning ECG-based dose modulation as per the protocol.

The strengths of this study are multi-faceted. First, the patients studied were from a community-based setting and, as such, are representative of the typical individual referred for further cardiac evaluation. In contrast, most published studies are phantom studies or they recruit patients from university hospital and/or academic settings where multiple exclusion criteria render results ungeneralizable. Second, our study includes radiation dose data for the entire scan, not only the dose that occurs with DS MDCT coronary angiography. By measuring only the DS MDCT coronary angiography dose, many studies ignore a component of the procedure contributing to the total dose where additional reductions in dose can be realized. Third, our study includes patient demographic data not typically present in previous publications. Variables such as age, sex, BMI, and chest dimensions may need to be considered when individualizing protocols. And last, our staff tailored the maximum tube current time product (mAs) to each patient’s chest size/breast-to-breast size as measured by the physician in order to further reduce radiation dose. We are unaware of this technique being described elsewhere.

We acknowledge the following limitations to our study. First, not all patients referred to DS MDCT coronary angiography were included in our study. All patients were screened for a calcium score prior to the DS MDCT coronary angiography, and patients found to have calcium scores greater than 1000 Agatston units had the full study aborted because DS MDCT coronary angiography was not considered to be the most appropriate test in this population. Consequently, these patients were excluded because complete study data were not available. Second, because image quality was not a primary objective of the study, readers were not blinded. As a result, image quality scoring might have been influenced by reader subjectivity bias. Third, patients were included regardless of baseline heart rate or rhythm and were referred for a variety of reasons, including evaluation of acute and subacute chest pain. Therefore, some patients received higher radiation doses based on heart rate variability during the procedure, most significantly those patients for whom ECG pulsing could not be used. However, we believe our study population accurately represents patients seen in a typical practice in a community-based setting. Finally, the effective dose values were calculated using a specific normalized effective dose (mSv mGy⁻¹ cm⁻²) coefficient for a patient weighing 70 kg. Since absorbed dose is inversely dependent on mass, the actual effective dose for patients who weighed more than 70 kg was less than we calculated; likewise, for patients who weighed less than 70 kg, the actual effective dose was higher than we calculated. This difference is notable because of the substantial number of obese and overweight patients in this study.

Further studies are needed to determine acceptable radiation dose while maintaining diagnostic image quality for DS MDCT coronary angiography. Efforts to reduce radiation dose with the DS MDCT unit at our facility are ongoing. Dose-reduction strategies currently being pursued include reducing the ECG pulse window even more aggressively, forgoing the calcium score component of the scan, reducing the dose in the non-pulsing window for selected patients (at the cost of loss of functional information), and exploring the effectiveness of β-blocker use in dose reduction.

CONCLUSIONS

Employing relatively simple dose-reduction techniques reduced CTDIvol by 22%. This translated into a reduction of entire scan effective dose of 25%, as well as a reduction of the DS MDCT coronary angiography effective dose of 29%. Therefore, assessing patient population and tailoring DS MDCT coronary angiography protocols can significantly reduce radiation dose. A one-size-fits-all protocol does not achieve a balance between radiation dose and image quality for patients. The computed tomography technologists and cardiologists at our institution have not found tailoring of protocols to be difficult or burdensome.

ACKNOWLEDGMENTS

The authors sincerely thank Professor W.A. Kalender, PhD, Director, Institute of Medical Physics, Friedrich-Alexander-University Erlangen-Nürnberg, for his technical assistance and guidance in the preparation of this manuscript.

REFERENCES


It is uncontested that patients with asymptomatic microscopic hematuria should undergo urologic evaluation. In 1980, we first reported our experience with 246 patients whose microhematuria had been evaluated by urine cytology, cystoscopy, and intravenous pyelogram (IVP). Urologic neoplasm was discovered in 10% of patients, and an additional 12% were found to have significant lesions. A protocol of periodic follow-up testing was established, but a combination of cost, inconvenience, and the failure of follow-up testing to identify malignancies likely contributed to poor compliance on the part of patients and physicians alike. In 1991, the results of a 10- to 20-year follow-up of 155 of the patients in the original study, none of whom developed a genitourinary cancer or urinary lesion, were reported (Figure 1).

Therefore, we revised our follow-up protocol to reflect the findings negative for cancer and recommended further evaluation only in the presence of urinary tract symptoms. In the present article, we report a 20- to 40-year follow-up.

**ABSTRACT**

**Objectives:** The purpose of this study was to determine whether patients evaluated for asymptomatic microhematuria with unremarkable findings require periodic follow-up testing.

**Methods:** The medical records of patients evaluated for asymptomatic microhematuria between 1967 and 1976 were retrospectively reviewed. All patients whose records contained a follow-up contact at least 20 years from the date of initial evaluation were included in the study.

**Results:** Of the 246 patients evaluated for unexplained asymptomatic microhematuria, the medical records of 103 contained a follow-up contact at least 20 years from the initial evaluation. Only 1 (0.97%; 95% confidence interval, 0.02%-5.29%) asymptomatic patient with persistent microhematuria developed a genitourinary cancer.

**Conclusions:** Further diagnostic studies for patients whose initial evaluation findings were unremarkable should be guided by the presence or absence of urinary tract symptoms.

**METHODS**

Following Institutional Review Board approval, we conducted a retrospective review of the medical records of patients who had a diagnosis of unexplained asymptomatic microhematuria between 1967 and 1976. Our patient population is not highly mobile, and most patients receive their healthcare within our multispecialty group practice, factors that enabled us to follow a substantial number of our original study patients over a period of 20 to 40 years. Of our initial 246 patients, those whose medical records contained documented follow-up of at least 20 years were included in the study. Records were examined to identify whether any of the patients developed genitourinary cancer or significant lesions. Data were not analyzed separately for men and women. Exact 95% confidence interval (CI) for the binomial proportion was calculated using the Clopper-Pearson method. Data were analyzed using SAS 9.2 (Cary, North Carolina).
The medical records of 103 patients (71 alive and 32 dead) contained a follow-up visit or contact at least 20 years from the date of their initial microhematuria evaluation (Figure 2). The age at the initial microhematuria investigation for these patients ranged from 17 to 72 years, median 47 years. For the 32 patients who died, the age at death ranged from 68 to 97 years, with a median of 84 years. The interval between the initial microhematuria studies and this review of the medical records ranged from 20 to 40 years, with a median of 31 years.

Six patients developed genitourinary cancer: 3 within 2 years of their initial evaluation, and 3 after 2 years. Of the 3 patients who developed genitourinary cancer at least 2 years after their initial evaluation, 2 had distinct urinary symptoms that prompted referral to urology. One of these patients, referred 32 years after an initial evaluation for microhematuria, had marked bladder irritability. Cystoscopy revealed scattered in situ transitional cell carcinoma of the bladder. This patient died at age 82 years. The other symptomatic patient, whose initial evaluation for microhematuria had also been completed 32 years earlier, was referred to urology for gross hematuria. Testing revealed transitional cell carcinoma of the bladder wall. This patient was alive during the study period.

The third patient was the only patient in our study who was diagnosed with genitourinary cancer but had no urinary tract symptoms (95% CI, 0.02%–5.29%). The patient was referred back to urology with persistent microhematuria 12 years after an initial evaluation, the findings of which had been unremarkable. Cystoscopy identified papillary transitional cell carcinoma of the bladder, which was managed surgically. Fifteen years after the bladder tumor resection—and 27 years after initial evaluation for microhematuria—sarcoma inside a bladder diverticulum was surgically managed. This patient died at age 90 years.

Without question, an initial evaluation of asymptomatic microhematuria is warranted, although life-threatening lesions are found in fewer than 15% of patients. The value of long-term evaluation, however, is questionable. To our knowledge, ours is the longest microhematuria patient series available, with follow-up ranging from 20 to 40 years. From our results, it is apparent that in the vast majority of cases asymptomatic microscopic hematuria is a benign condition. Unless the patient develops symptoms, such as gross hematuria or irritative bladder, the risk of developing genitourinary cancer is less than 1%. We therefore conclude that unless these patients develop symptoms, no follow-up is required after the initial evaluation.

The question of what the initial evaluation should include remains unsettled. The initial evaluations of the patients reported here all included cystoscopy, IVP, and, beginning in 1975, urine cytology. However, technical advances in sonography, flexible cystoscopy, and computerized tomography have changed the approach to initial assessment of microscopic hematuria. Bilateral renal sonography is the most cost-effective means of evaluating patients with asymptomatic microhematuria. Abnormal renal sonographic findings would trigger additional studies. While sonography may miss a small ureteral lesion, these cancers are very rare. Only in patients with gross hematuria or an abnormal renal sonographic study do the added cost and potential for complications (contrast reactions, nephrotoxicity, and increased cancer risk) associated with 3-phase CT studies appear justified.

**CONCLUSION**

The 20- to 40-year follow-up review supports an initial evaluation of asymptomatic microhematuria by bilateral renal sonography and flexible cystoscopy. If findings from these tests are unremarkable, no further studies are necessary unless urinary tract symptoms develop.

**REFERENCES**

A Comparison of Predicted Creatinine Clearance With Measured Creatinine Clearance in Morbidly Obese Patients Undergoing Laparoscopic Gastric Bypass Surgery

ABSTRACT

Background: Creatinine clearance is measured to determine appropriate dosing of renally excreted medications. An actual measurement of creatinine clearance from 24-hour urine collection is often impractical to obtain. Calculations have been developed to estimate a patient’s creatinine clearance. Our goal was to determine if a difference exists between common estimations of creatinine clearance and measured (actual) creatinine clearance in morbidly obese patients undergoing laparoscopic gastric bypass surgery.

Methods: The primary outcome was the difference between the measured creatinine clearance and the estimated creatinine clearance by means of the Cockcroft-Gault equation using actual body weight, ideal body weight, and adjusted dosing weights, and the Salazar-Corcoran equation. All patients undergoing laparoscopic gastric bypass surgery at Gundersen Lutheran Medical Center between October 15, 2004, and March 15, 2005, were prospectively screened for inclusion in this study. The study included men and women who were at least 18 years of age and had a body mass index > 35 with a preoperative serum creatinine ≤ 2.5 mg/dL (221 μmol/L).

Results: Significant differences between measured and estimated creatinine clearance were found for both men and women with 3 of the 4 calculations. Only levels calculated by the Cockcroft-Gault equation using adjusted dosing weight showed no significant difference when compared with measured creatinine clearance.

Conclusions: Data analysis indicates that using the Cockcroft-Gault equation modified with the patient’s adjusted body weight is the best predictor of creatinine clearance in the morbidly obese patient undergoing laparoscopic gastric bypass surgery.

Methods

Following Institutional Review Board approval of our study, all patients undergoing laparoscopic gastric bypass surgery at Gundersen Lutheran Medical Center between October 15, 2004, and March 15, 2005, were prospectively screened to determine eligibility. The study included men and women who were at least 18 years of age and had a body mass index (BMI = weight [kg]/height [m²]) greater than 35 with a preoperative serum creatinine ≤ 2.5 mg/dL (221 μmol/L). Patients were excluded from the study if they were younger than 18 years, had a BMI ≤ 35, or had a preoperative serum creatinine > 2.5 mg/dL (221 μmol/L). Informed consent was obtained prior to participation in the study. Preoperative serum creatinine was drawn on all patients. Patients were catheterized for 24 hours postprocedure. After the urine collection was complete, a urine creatinine was measured and a second serum creatinine was drawn. If the preoperative and postoperative serum creatinine levels differed by greater than 20%, the patient was considered to have unstable renal function and was excluded from the study. The primary outcome was the difference between the measured creatinine clearance and the estimated creatinine clearance by means of the Cockcroft-Gault equation using actual body weight, ideal body weight, and adjusted dosing weights, and the Salazar-Corcoran equation. The data were analyzed using analysis of variance with Bonferroni corrections. A P value of <.05 was considered significant.
**RESULTS**

Twenty-nine patients (23 women, 6 men) were enrolled in the study. The study population averaged 42.5 years of age (mean 40.3, range 24-60). Eighty-five percent of the patients were women. The equations used to estimate the creatinine clearance for patients enrolled in this study are provided in Table 1. Creatinine clearance was estimated using all 4 methods and compared with a measured clearance for all 29 patients. Each patient's creatinine clearance was determined using each of the 4 calculations, and the resulting values were compared with a measured 24-hour creatinine clearance. Significant differences between measured and estimated creatinine clearance were found for both men and women with 3 of the 4 calculations. Variance between measured creatinine clearance and the 4 calculated clearance values are shown in Table 2 (page 48). For both men and women, only the values calculated by the Cockcroft-Gault equation using adjusted dosing weight showed no significant difference from the measured values.

One woman's measured creatinine clearance was significantly different from the average for all other women in the study, so a second analysis was done excluding this patient's data. This did not change the outcome, as shown in Table 2.

**DISCUSSION**

The small sample size and population included in this study may overestimate or underestimate the difference found between measured and calculated creatinine clearance. The study population included only obese patients undergoing laparoscopic gastric bypass surgery. We cannot conclude that our findings are applicable to the general obese population.

The study did not account for potential or actual urine sample loss over a 24-hour collection period. We are unable to determine the extent to which this may have occurred.

One method commonly used in clinical practice to calculate creatinine clearance is the Cockcroft-Gault equation. The study used to derive this formula included few obese patients. The original form of the equation utilizes a patient's actual body weight. However, many clinicians manipulate the original form and substitute a patient's ideal body weight or adjusted dosing weight. There is little evidence to support what is the most appropriate form when assessing obese patients' renal function. Some studies have assessed using actual body weight, ideal body weight, or adjusted dosing weight. Leader et al. compared the Cockcroft-Gault equation—substituting actual body weight, ideal body weight, and adjusted dosing weight—with the Salazar-Corcoran equation with respect to predicting pharmacokinetic values for gentamicin dosing in the obese patient. They found that applying the adjusted dosing weight to the Cockcroft-Gault equation was not significantly biased in the obese patient population when determining pharmacokinetic parameters for gentamicin dosing. Another study assessed the Cockcroft-Gault equation using actual body weight and ideal body weight in morbidly obese patients. These investigators found that using ideal body weight underestimates creatinine clearance in morbidly obese patients, while using actual body weight overestimates creatinine clearance in this population. Unfortunately, they did not apply adjusted dosing weight to the equation.

The Salazar-Corcoran method is not frequently used in clinical practice due to its more complex application. However, it was derived to give a more accurate prediction of creatinine clearance in obese patients by using their fat-free body mass value. The formula originated from an overfed rat model. The method was then evaluated by analyzing data from previous studies. Unfortunately, there was no prospective study designed to evaluate the method. Spinler et al. evaluated 10 methods for predicting creatinine clearance in cardiac patients and found the Salazar-Corcoran method to be the least biased and most precise method for the obese subgroup. However, as stated earlier, Leader and colleagues also evaluated this method but found the Cockcroft-Gault method using a patient's dosing weight to be the only method that was not significantly biased.

Very few studies compare the methods used to predict creatinine clearance with measured creatinine clearance in obese patients, and among the studies that do make this comparison, discrepancies are found. Further, because these studies were all designed differently, it is difficult to compare their results. This inconclusive body of evidence supports the need to examine this matter further. Our study design was guided by information obtained from these previous studies.
Table 2. Comparison of Mean Measured Creatinine Clearance and Mean Calculated Creatinine Clearance

<table>
<thead>
<tr>
<th>Equation</th>
<th>All Women n = 23</th>
<th>Women, Adjusted* n = 22</th>
<th>Men n = 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cockcroft and Gault (ABW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>210 mL/min/1.73 m² (3.50 mL/s/m²)</td>
<td>212 mL/min/1.73 m² (3.53 mL/s/m²)</td>
<td>257 mL/min/1.73 m² (4.28 mL/s/m²)</td>
<td></td>
</tr>
<tr>
<td>Range 105-332 (1.75-5.53)</td>
<td>Range 105-332 (1.75-5.53)</td>
<td>Range 172-359 (2.87-5.99)</td>
<td></td>
</tr>
<tr>
<td>P &lt; .001</td>
<td>P &lt; .001</td>
<td>P = .002</td>
<td></td>
</tr>
<tr>
<td>Cockcroft and Gault (IBW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90 mL/min/1.73 m² (1.50 mL/s/m²)</td>
<td>89 mL/min/1.73 m² (1.48 mL/s/m²)</td>
<td>120 mL/min/1.73 m² (2.00 mL/s/m²)</td>
<td></td>
</tr>
<tr>
<td>Range 53-136 (0.88-2.27)</td>
<td>Range 53-136 (0.88-2.27)</td>
<td>Range 85-161 (1.42-2.68)</td>
<td></td>
</tr>
<tr>
<td>P &lt; .001</td>
<td>P &lt; .001</td>
<td>P = .033</td>
<td></td>
</tr>
<tr>
<td>Cockcroft and Gault (DW)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>138 mL/min/1.73 m² (2.30 mL/s/m²)</td>
<td>138 mL/min/1.73 m² (2.30 mL/s/m²)</td>
<td>175 mL/min/1.73 m² (2.92 mL/s/m²)</td>
<td></td>
</tr>
<tr>
<td>Range 85-214 (1.42-3.57)</td>
<td>Range 85-214 (1.42-3.57)</td>
<td>Range 120-240 (2.00-4.00)</td>
<td></td>
</tr>
<tr>
<td>P = .354</td>
<td>P = .622</td>
<td>P = .158</td>
<td></td>
</tr>
<tr>
<td>Salazar-Corcoran</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>91 mL/min/1.73 m² (1.52 mL/s/m²)</td>
<td>92 mL/min/1.73 m² (1.53 mL/s/m²)</td>
<td>101 mL/min/1.73 m² (1.68 mL/s/m²)</td>
<td></td>
</tr>
<tr>
<td>Range 46-142 (0.77-2.37)</td>
<td>Range 46-142 (0.77-2.37)</td>
<td>Range 68-142 (1.13-2.37)</td>
<td></td>
</tr>
<tr>
<td>P &lt; .001</td>
<td>P &lt; .001</td>
<td>P = .007</td>
<td></td>
</tr>
<tr>
<td>Reference Value (measured 24-hour creatinine clearance)</td>
<td>147 mL/min/1.73 m² (2.45 mL/s/m²)</td>
<td>92 mL/min/1.73 m² (1.53 mL/s/m²)</td>
<td>145 mL/min/1.73 m² (2.42 mL/s/m²)</td>
</tr>
<tr>
<td>Range 73-262 (1.22-4.37)</td>
<td>Range 73-219 (1.22-3.65)</td>
<td>Range 83-213 (1.38-3.55)</td>
<td></td>
</tr>
</tbody>
</table>

*One woman with measured creatinine clearance significantly different from the average value for all other women in the study was excluded in this analysis.

The t test P value of ≤ .05 indicates that the clearance as calculated by the equation is significantly different from the measured clearance.

CONCLUSION

Data analysis indicates that using the Cockcroft-Gault equation modified with the patient’s adjusted body weight is the best predictor of creatinine clearance in the morbidly obese patient undergoing laparoscopic gastric bypass surgery.

REFERENCES

A Position Paper Concerning the Surgical Treatment of Refractory Gastroesophageal Reflux Disease in the Obese Patient

ABSTRACT

Background: Gastroesophageal reflux disease (GERD) is a common medical condition. One of the major risk factors for developing reflux symptoms is obesity (body mass index [BMI] > 30 kg/m²). The initial treatment of GERD is lifestyle modification followed by medical management, but for patients who continue to have symptoms not alleviated by medical therapy, surgery is an option. Surgical treatment of GERD includes the Nissen fundoplication; however, obesity is a risk factor for postoperative failure. Currently, bariatric surgery is the only long-term effective treatment for morbid obesity. With gastric bypass surgery, GERD is typically resolved postoperatively as a side effect of the operation.

Methods: A review of the existing literature on treatment options for GERD was completed. We propose an algorithm for surgical treatment options for GERD based on patient BMI.

Results: In the non-obese patient (BMI < 30 kg/m²), performing a laparoscopic Nissen fundoplication remains the surgical treatment of choice. Obese patients with GERD who qualify for bariatric surgery are best treated with a gastric bypass. Patients who are obese but do not satisfy the criteria for gastric bypass (BMI of < 35 kg/m² or between 35 and 40 kg/m² with no comorbidities) would likely best be served with non-surgical weight loss followed by a Nissen fundoplication.

Conclusion: Obese patients who are appropriate candidates should be considered for gastric bypass surgery as a treatment option for refractory GERD. This will result in long-term management of reflux disease and potential treatment of other obesity-related disease processes.

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Gastroesophageal reflux disease (GERD) is a common medical condition that affects between 10% and 20% of the population. Obesity is a major risk factor for developing reflux symptoms, and in this population the incidence has been reported to be as high as 72%. Various degrees of obesity are stratified based on body mass index (BMI), which is a function of a person’s height and weight (Table 1). As the obesity epidemic worsens, the percentage of the population that suffers from GERD will increase.

The initial treatment of GERD is lifestyle modification, followed by medical management. Multiple classes of medications act to suppress acid production in the stomach, including antacids, H2 blockers, and proton pump inhibitors (PPIs). These medications are frequently initially effective at treating the symptoms of GERD, but they do not correct the root cause of the problem. One of the main pathophysiological problems in individuals with GERD is a nonfunctioning or poorly functioning lower esophageal sphincter. Medical treatment with acid suppression does not address this sphincter problem. For those patients who continue to have symptoms despite maximal and optimized medical therapy—or for those with bile (nonacid) reflux—surgery becomes an option.

The preferred surgical treatment of GERD is the Nissen fundoplication. The procedure is named after Rudolph Nissen, who serendipitously discovered the beneficial effect of wrapping the stomach around itself at the gastroesophageal junction. He performed the maneuver to patch an anastomosis of the gastric cardia, and on follow-up, the patient reported resolution of his severe reflux disease. The first laparoscopic Nissen fundoplication was performed in 1991 and is now the standard approach. The surgery is performed by mobilizing the fundus of the stomach, then using this to create a 360° wrap around the gastroesophageal junction to augment the lower esophageal sphincter (Figure 1). This corrects the underlying dysfunction and acts to prevent gastric contents from refluxing into the esophagus. The minimally invasive approach has allowed for a shorter hospital stay and a quicker postoperative recovery. Overall, the surgical treatment of GERD has a high success rate. In long-term follow-up studies, around 90% of patients continue to have significant relief from heartburn symptoms.

One of the risk factors for failure of the Nissen fundoplication is obesity. Being significantly overweight increases intraabdominal

### Table 1. Body Weight Classifications

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5-24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0-29.9</td>
</tr>
<tr>
<td>Obese class I</td>
<td>30.0-34.9</td>
</tr>
<tr>
<td>Obese class II</td>
<td>35.0-39.9</td>
</tr>
<tr>
<td>Obese class III</td>
<td>&gt; 40.0</td>
</tr>
</tbody>
</table>
pressure, which has a deleterious effect on the fundoplication and crural repair. Failure rates in patients who have a BMI > 35 kg/m² have been shown to be higher than those in patients who are not morbidly obese. The question arises: Is the obese population better served with a different surgical approach?

Gastric bypass surgery is the most common surgery performed in the United States for the treatment of morbid obesity. According to the National Institutes of Health (NIH) Consensus Conference, bariatric surgery is the only long-term effective treatment for obesity. NIH guidelines for gastric bypass surgery require that patients have a BMI > 40 kg/m² or a BMI > 35 kg/m² with obesity-related major comorbidities; they also must have a history of failed supervised weight loss attempts. In addition to treating morbid obesity, gastric bypass surgery improves major medical comorbidities. GERD is typically eliminated because, as part of the surgery, a majority of the acid-producing parietal cells of the stomach are excluded from the small gastric pouch (Figure 2).

Gastric bypass surgery and Nissen fundoplication cost about the same, and the risk of in-hospital complications related to surgery is actually lower after laparoscopic gastric bypass surgery than it is after laparoscopic fundoplication in the obese population. Laparoscopic fundoplication is more technically challenging in morbidly obese patients than gastric bypass. Varela et al analyzed data from a university-based administrative database to compare the outcomes of morbidly obese patients who underwent laparoscopic gastric bypass versus laparoscopic fundoplication and observed a higher rate of perforation/laceration in the fundoplication cohort. The overall complication rate was lower in the gastric bypass cohort compared to the fundoplication cohort (7% vs 10%). Patterson et al studied a small cohort of morbidly obese patients who had undergone either laparoscopic gastric bypass or laparoscopic Nissen fundoplication with pre- and postoperative esophageal manometry and 24-hour pH studies. Both procedures resulted in improved esophageal motility and symptom control. Interestingly, half of the gastric bypass patients also experienced a high increase in lower esophageal sphincter pressure, possibly due to the reduction of acid exposure after division of the stomach. Ultimately, gastric bypass outcomes are as good, if not better, than those of fundoplication in the treatment of GERD. Kendrick et al suggested that surgical treatment options for the obese patient with GERD should consider the severity of existing obesity related comorbidities and the potential to develop additional obesity-related comorbidities. They also recommended evaluation of the patient’s need for future bariatric surgery, particularly in patients with a BMI 30–34.9 kg/m², as they have observed a high perioperative complication rate in patients undergoing gastric bypass who had previously undergone fundoplication. Indications for surgical treatment of GERD are provided in Table 2.

We propose an algorithm for surgical treatment options for GERD (Figure 3). Obese patients with GERD who qualify for bariatric surgery are best treated with a gastric bypass, and nonobese patients are best treated with a laparoscopic Nissen fundoplication. But patients who are obese but do not meet the NIH minimum criteria for gastric bypass pose a difficult dilemma. These patients are at increased risk of Nissen fundoplication failure due to increased intraabdominal pressure, but while gastric bypass may provide better reflux control, they do not qualify for it. These patients would likely best be served with nonsurgical weight loss followed by a Nissen fundoplication.

Significant weight loss in the morbidly obese population has been associated with improvement, resolution, and prevention of obesity-related diseases. The list of obesity-related comorbidities is extensive and includes such conditions as hypertension, type II diabetes, obstructive sleep apnea, gastroesophageal reflux disease, coronary artery disease, cancer, hyperlipidemia, infertility, deep vein thrombosis, pulmonary embolism, arthritis, cholelithiasis, and hernias. By treating the severely obese patient who has reflux disease with a laparoscopic gastric bypass, it is likely that not only...
the patient’s reflux symptoms will resolve, but also that many of the obesity-associated comorbidities will improve or resolve.

The future may hold a different treatment algorithm for these patients as research continues on improved treatment options for GERD. Several endoscopic methods have been attempted, such as polymer injection (Enteryx), radiofrequency ablation (Stretta), and endoscopic plication (EndoCinch). These modalities were intended to work by augmenting the lower esophageal sphincter, but results have been disappointing. A multicenter trial (www.toraxmedical.com/clinicalstudies/) is currently being conducted to assess the safety and efficacy of laparoscopic placement of a magnetic ring (LINXTM System, Torax Medical Inc. Shoreview, MN) around the gastroesophageal junction, also aimed at augmenting the lower esophageal sphincter. The results of this trial have not yet been reported. As we await further advances in this field, surgery remains the treatment option of choice.

Gastric bypass surgery should be considered as a treatment option for obese patients with refractory GERD and a BMI > 35 kg/m². This procedure would afford them the best long-term management of reflux disease, and it carries the added benefit of treating other obesity-related disease processes.

Table 2. Indications for Surgical Treatment of GERD

<table>
<thead>
<tr>
<th>Indication</th>
<th>Refractory GERD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent or recurrent symptoms despite medical therapy</td>
<td>BMI &lt; 30 kg/m²</td>
</tr>
<tr>
<td>Severe esophagitis by endoscopy</td>
<td>BMI 30-36.9 kg/m² or 35-40 kg/m² with no comorbidities</td>
</tr>
<tr>
<td>Benign stricture</td>
<td>BMI &gt; 40 kg/m² or &gt; 35 kg/m² with comorbidities</td>
</tr>
<tr>
<td>Barrett columnar-lined epithelium (without severe dysplasia or carcinoma)</td>
<td>Encourage weight loss by conventional measures</td>
</tr>
<tr>
<td>Recurrent pulmonary symptoms (e.g., aspiration, pneumonia) in association with GERD</td>
<td>Laparoscopic Nissen fundoplication</td>
</tr>
<tr>
<td>Patient desire to be off life-long medications</td>
<td>Laparoscopic gastric bypass</td>
</tr>
</tbody>
</table>

Abbreviation: GERD, gastroesophageal reflux disease.

Figure 3. Algorithm for the surgical management of GERD in the obese patient.
Compression Fractures as the Presenting Symptom in a Patient with End-Stage Renal Disease from IgA Nephropathy

ABSTRACT

We present the case of a 39-year-old white man with compression fractures secondary to previously undiagnosed kidney disease due to immunoglobulin A nephropathy. While fracture risk is increased in patients with chronic kidney disease, this case is unusual because this patient’s presenting symptom was severe thoracic back pain caused by spontaneous vertebral compression fractures.

CASE REPORT

A 39-year-old white man experienced severe thoracic back pain after twisting in bed to turn off his alarm clock. He denied any other recent history of trauma. His past medical history was significant only for injuries sustained in a motor vehicle collision when he was 22 years old; he had a splenectomy and rod placement in his right femur. A full-spine radiographic series at that time showed no damage to his spine. He was on no medications other than occasional Excedrin. He denied alcohol use or smoking. His initial physical examination revealed a blood pressure of 159/93 mm Hg. He had tenderness to palpation over the thoracic spine. The remainder of his physical examination findings, including neurological examination, were normal.

Laboratory test results demonstrated advanced kidney disease, with elevated concentrations of creatinine (5.98 mg/dL) and serum urea nitrogen (48 mg/dL). Serum sodium, potassium, chloride, and bicarbonate concentrations were in reference range. He was anemic, with a hemoglobin concentration of 12 g/dL. Urinalysis revealed 3+ albumin and 3+ blood, with 17 red blood cells per high power field. A computed tomography scan revealed a blood pressure of 159/93 mm Hg. He had tenderness to palpation over the thoracic spine. The remainder of his physical examination findings, including neurological examination, were normal.

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A urine protein-to-creatinine ratio was 5.59, suggestive of nephrotic-range proteinuria. Results of tests for secondary causes of glomerulopathy showed C3 and C4 complement component levels within reference range. Tests for anti-nuclear, anti-neutrophilic cytoplasmic, and anti-glomerular basement membrane antibodies were negative. Results from cryoglobulin and antistreptolysin-O testing, as well as human immunodeficiency virus serology and full hepatitis panel, were unremarkable. Serum protein electrophoresis revealed a small abnormality in the β region, but a follow-up immunofixation showed no monoclonal protein. His serum calcium concentration was 9.4 mg/dL. The patient had hyperphosphatemia and significant secondary hyperparathyroidism, with concentrations of serum phosphorus of 4.9 mg/dL and parathyroid hormone (PTH) of 265 pg/mL.

Alanine aminotransferase, aspartate aminotransferase, and alkaline phosphatase levels were within reference range. He was vitamin D–deficient, with a 25-hydroxyvitamin D level of 16 ng/mL and 1,25 dihydroxyvitamin D level of 13 pg/mL. Renal ultrasonography revealed a 9-cm right kidney and a 9.3-cm left kidney, with bilateral diffuse increase in echogenicity but no hydronephrosis, stones, or masses. A renal biopsy showed sclerotic glomeruli with cellular crescents due to immunoglobulin A nephropathy (IgAN).

Magnetic resonance imaging (MRI) revealed the same thoracic vertebral fractures with edema surrounding the area, suggesting...
acute to subacute fractures. Kyphoplasty was initially considered but was not done because the patient’s pain improved with conservative management and because a repeat MRI showed that the patient was not losing any vertebral height. Two recent randomized trials have shown no beneficial effect of vertebroplasty when compared with a sham procedure in patients with painful osteoporotic vertebral fractures. Further testing for other causes of osteoporosis revealed thyroid-stimulating hormone (TSH), total testosterone, and free testosterone concentrations were within reference range. A dual-energy x-ray absorptiometry (DXA) scan showed T scores of -3.5 in the lumbar spine, -2.9 in the left femoral neck, and -2.5 in the distal left radius — scores consistent with osteoporosis.

The patient was begun on dialysis during his hospitalization and has been dialysis-dependent since that time. Trials of high-dose steroids and cyclophosphamide infusions were attempted, but these failed to improve his kidney function. He is now awaiting a kidney transplant.

**DISCUSSION**

Osteoporosis is characterized by a deficiency in bone mass or volume that results in increased bone fragility. It is defined by a decrease in the volume of bone more than 2.5 standard deviations below the young adult mean. Bone loss is diagnosed by bone mineral density (BMD) and is assessed most commonly by DXA scan. In the general population, the risk for fractures increases progressively with decrease in bone mass. Fracture risk usually reflects compromised bone strength. Bone strength is determined not only by BMD as measured by DXA, but also by bone quality, which is compromised in patients with chronic kidney disease (CKD) because they can develop renal osteodystrophy, a bone pathology associated with CKD. Renal osteodystrophy increases fracture risk in this patient population. Phosphate retention occurs early in CKD. It can inhibit bone resorption by mature osteoclasts and arrests the generation of new osteoclasts. Patients with advanced CKD also have deficiency of calcitriol (1,25 dihydroxyvitamin D3), and this has a suppressive effect on both bone formation and resorption. Phosphate retention and 1,25 dihydroxyvitamin D3 deficiency stimulate the secretion of PTH. Persistent PTH elevation stimulates bone resorption, and if untreated, can cause a high bone turnover state with increased rates of bone formation and fibrosis. At the other end of the spectrum, patients with CKD can have low bone turnover lesions, which include adynamic bone disease and osteomalacia. Adynamic bone disease is characterized by scarcity of bone cells, reduced osteoid thickness, and a low bone formation rate. This occurs when there is oversuppression of PTH due to excessive use of calcium-containing phosphate binders and vitamin D analogues. Osteomalacia is characterized by low bone turnover in combination with an increased volume of unmineralized bone (osteoid). This problem, which is now uncommon, was due primarily to aluminum deposition in bone at a time when aluminum-containing antacids were used as phosphate binders. Patients with CKD can also have mixed osteodystrophy, in which elements of both high and low bone turnover may be observed.

Diagnosis of bone disease in patients with CKD can be made by biochemical profiling, which includes measuring serum levels of calcium, phosphate, PTH, 25 hydroxy vitamin D3, and alkaline phosphatase. The other option is to do a bone biopsy with tetracycline-labeled bone histomorphometry. This is usually cumbersome and not routinely done in clinical practice.

The interpretation of DXA in CKD patients is still a subject of controversy. In this patient population it is recommended to use measurements of bone mass at cortical bone sites (distal radius) to determine bone loss. However, it should be noted that DXA measurements do not accurately predict fracture risk in CKD patients, and they do not distinguish between different forms of renal osteodystrophy.

A cross-sectional study revealed that patients with CKD had a higher prevalence of osteoporosis when compared with the control group. Bone mineral density decreased with more advanced stages of CKD, emphasizing the observation that disorders in bone metabolism occur very early and are progressive during the course of CKD. This study also showed that the BMD was much lower in patients with an onset of kidney disease before the age of 30 years (age of peak bone mass) than in patients in whom the kidney disease developed later in life. Our patient is unique in that he appears to be the only patient reported in the literature with the initial presentation of his end-stage renal disease (ESRD) being symptomatic compression fractures. It seems likely that he had subclinical IgAN for years prior to presentation, which resulted in a slow decline in kidney function that remained asymptomatic until he reached the point of ESRD. This is not necessarily surprising because IgAN, although classically presenting as hematuria following a viral illness, can be more insidious. When IgAN is diagnosed at an older age, patients may present with proteinuria, renal impairment, and hypertension due to longstanding subclinical disease. Given our patient’s relatively young age during the development of CKD, it is likely the CKD affected his bone metabolism during the time of life when he should have been building maximum bone density, thus leading to his untimely spontaneous vertebral fractures and low BMD.

**REFERENCES**


The spread of epidemic diseases in the context of the imperial expansions of the 15th through 19th centuries is well documented and well known. While millions of indigenous peoples died in the face of these new diseases, little is understood about diseases that originated in newly colonized regions and were subsequently introduced to the European landscape by early explorers. For example, there are data to support the paradigm that the spirochetal disease yaws was originally endemic in primates of Africa, which spread with humans into Eurasia, and was later carried across the Bering Sea into the Americas, circa 15,000 BC. In the Americas, its strains diverged: one Treponema, T. pallidum, became sexually transmitted syphilis, which was carried back to Europe in AD 1492-1493, rapidly disseminating with devastating consequences in Old World populations with poor natural resistance to this New World pathogen.4

Prior to Columbus and the period of major European colonization, there were other events that may have led to the global spread of some diseases. Certainly contacts were continuous between Asia and North America across the Bering Strait for thousands of years.5,6 There is a growing body of evidence, such as the discovery of bones of Asian jungle fowl (chickens) in pre-Columbian Peruvian sites, that there must have been early Polynesian encounters with South and Mesoamerica. The presence of the distinctive fungal skin infection tinea imbricate (Trichophyton concentricum) in Southeast Asia, across the Pacific, and into Central and South America perhaps represents a distant ripple of that contact. Later contacts, in the 12th century in western North America and in the 13th century in the North Atlantic, appear to have occurred by the Chinese and Basque, respectively.

One recently described clear example of pre-Columbian spread of epidemic diseases occurred with the arrival of the Norse in Greenland, Labrador, and the Canadian Maritimes between AD 800 and 1000, the first major exchange of epidemic diseases between Europe and North America.7

We hypothesize that the Medieval Norse trade system and attempts at colonizing North America resulted in the spread of epidemic typhus caused by R. prowazekii as a contagious disease carried from North America to Europe after AD 1000.

**History and Ecology of Typhus**

Vectored human-to-human by lice (Pediculus humanus), typhus often occurs in epidemics during times of strife and wars, and has a 10% to 40% mortality rate in populations without medical care. Epidemic typhus, similar to tick-borne spotted fevers such as Mediterranean tick fever, is characterized by a petechial rash, persistent headache, and if severe, gangrene of the distal extremities due to a Rickettsia-induced vasculitis.8

Until recently, epidemic typhus has been considered a Eurasian disease that was disseminated throughout the world after AD 1492 via European pelagic expansion and armies on the march. But controversy exists regarding possible descriptions of epidemic typhus in early Eurasian history. Perhaps the best known is MacArthur’s proposal that the Plague of Thucydides (431 BC) was epidemic typhus.9 However, Thucydides described a disease that was very unlike typhus—with prominent upper respiratory components, inflammations of the eyes, pustular and ulcerative skin lesions, and, later, diarrhea. Multiple illnesses have been proposed for this ambiguously described epidemic, including measles, smallpox, and even influenza with toxic shock from Staphylococcus aureus bronchitis. Recently, Salmonella typhi DNA has been detected in the dentition from an Athenian mass grave of more than 150 bodies from circa 430 BC, suggesting typhoid fever as a component of the Thucydidian plague.9

**Norse Transatlantic Trade and the Spread of Typhus from North America to Eurasia**

**ABSTRACT**

The late first millennium AD witnessed the expansion of Norse culture across the North Atlantic—first to Iceland, and then to Greenland and on to North America by AD 1000. We hypothesize that the Norse brought endemic typhus from North America to Eurasia. This hypothesis is founded on two lines of inquiry. First, the earliest recorded epidemics in Europe that can be attributed to typhus occur after the Norse colonization of North America and in the Mediterranean urban trade routes of the Norse. Second, the only natural vector for Rickettsia prowazekii is the flying squirrel (Glaucomys sp.), which traditionally inhabited the thatched roofs of eastern North America, including the Canadian Maritimes first colonized by the Norse.
In *Rats, Lice and History*, Zinsser places the first accurate historical description of a typhus-like epidemic illness with associated rash in Salerno, Italy, in AD 1083. Zinsser believed that the monastery of La Cava outbreak in the month of August or September probably had originated from trades with the Middle East during the First Crusades. However, the First Crusades began in AD 1095, making these dates inconsistent with explaining the rise of typhus.

However, Salerno was on a Norwegian trade route to Byzantium. According to Harold’s Saga, Norwegians were involved as Byzantium mercenaries in North Africa and Sicily some time between AD 1034 and 1041. By AD 1150, Nordic knowledge allowed the Arab geographer al-Idrisi to write from Sicily an excellent description of the North Atlantic “inner island” inhabitants (Eskimo) use of large sea animal (whale) bones “instead of wood to construct houses, clubs, darts, lances, knives, seats and ladders.”

Therefore, rather than accept the Middle East as a source of typhus after many millennia of trade had occurred in the Mediterranean basin, we propose that recently Christianized Norse traders carried typhus as a new disease from North America along their sailing routes to the Mediterranean area. Apropos to this proposal, we know that the Norse were infested with lice by the archaeological findings of parts of *P. humonus* in sites in Greenland.

Furthermore, Zinsser quoted Bernal Diaz and Nicolas Leofi as recording an Aztec legend that described a typhus-like epidemic in the city of Tolan in AD 1116, which led to the destruction of that Toltec city, the Mesoamerican state that directly preceded the Aztec. Zinsser also pointed out that lice were plentiful at the time of the Spanish Conquest and have been found on the scalps of mumified southwestern American and Peruvian burials antedating the Spanish Conquest. This historical note has recent DNA support with the molecular studies of lice from pre-Columbian mummies. Thus, the second historic outbreak of typhus in the Italian peninsula in AD 1489 (pre-Columbus) cannot be assumed to have arisen from the Middle East; rather, this occurrence fits better as a product of contact along Viking-Byzantine trade routes.

Until recently, epidemic typhus was considered somewhat unusual for a rickettsiosis because no nonhuman mammalian reservoir was known (eg, the rat for endemic typhus, *R. typhi*). And, unlike other rickettsioses, the human-to-human arthropod vector, the body louse, always dies from the infection it transmits, supporting a recent acquisition of *R. prowazeki* passed among humans from their lice.

Microbiological discoveries for a North American origin for epidemic typhus comes from the studies by McDade and others, who studied a winter seasonal, sporadic rickettsial illness, first mistakenly considered to be Rocky Mountain Spotted Fever, found in the southeastern United States. These investigators showed this winter illness to be due to *R. prowazeki*. The genetics of the American strain were found by protein structure analysis to be only a few genes different from European epidemic typhus strains. This “endemic-epidemic” typhus was found by the Centers for Disease Control and Prevention investigators to be associated with flying squirrels, *Glaucomys volans*, that had nested in the victims’ attics during the cold months.

Further support of a New World origin of *R. prowazeki* comes from its phylogenetic relationships to other *Rickettsia* species. *R. prowazeki* is closely related by DNA analysis only to *R. typhi* (a pan-world species) and is otherwise more distally related to other *Rickettsia* that have Old World genetic interrelationships.

The rate of transmission of endemic-epidemic typhus to humans is unclear, as the lice (Neohaematopinus sciuropteri) of flying squirrels are capable of carrying large numbers of *R. prowazeki* but do not readily bite humans, and the fleas (Orchopeas howardi) of *G. volans* will bite humans but are poor vectors of *R. prowazeki*. Both *G. volans*, with a natural range that includes eastern North America, south along the Gulf Coast into Mexico and parts of Guatemala, and *G. sabrinus*, a species of flying squirrel found in the Canadian boreal forests, are natural reservoirs of *R. prowazeki*. Noteworthy for our discussion is that the natural range of *G. sabrinus* extends north to include the boreal areas of the Labrador coast. In that location *G. sabrinus* would have found Norse sod houses with grass thatch roofs to be ideal for overwintering—perhaps much better than modern attics. Thus, the Norse in North America could have been infected by epidemic typhus directly from its natural reservoir, the flying squirrel, or by the more usual transmission of human lice carried by native North Americans. Sustained in Europe by Brill-Zinsser disease, recrudescence typhus seems to have survived between European epidemics without a natural rodent reservoir in Europe. Further support for this hypothesis might be sought by polymerase chain reaction (PCR) identification of *R. prowazeki* DNA from the teeth of pre-Columbian graves and, indirectly, by the absence of typhus from Eurasian flying squirrels.

**REFERENCES**


Supplement
2009 Presentation Abstracts
Gundersen Lutheran Health System


**Background:** Morbidity and mortality rates are higher in obese patients due to a multitude of obesity-related comorbidities such as hypertension (HTN), diabetes mellitus, obstructive sleep apnea (OSA), gastroesophageal reflux disease (GERD), and hyperlipidemia. Surgical treatment of obesity has been shown to be an effective long-term solution. A study completed at Gundersen Lutheran in 2005 found that the most common reason patients evaluated for bariatric surgery do not undergo surgery was because of insurance denials or unattainable coverage prerequisites. Our objective was to track the development of new obesity-related comorbidities in patients denied laparoscopic gastric bypass at our institution.

**Methods:** Following IRB approval, a retrospective review of the medical records of patients whose insurance denied coverage for gastric bypass surgery at Gundersen Lutheran Medical Center from 2001-2007 was completed. Patients’ baseline comorbidities (those present at the initial evaluation) and development of new comorbidities (those diagnosed within 2.5 years following the initial evaluation) were identified by querying our institution’s electronic medical record system.

**Results:** Two hundred twenty-one patients were denied coverage. 32 were excluded due to lack of follow-up after the initial evaluation. 155 (82%) were women. Mean age and BMI was 40.9 years and 47.8 kg/m², respectively. Follow-up BMI was 46.8 kg/m². Percentages of patients’ baseline and follow-up comorbidities are reported in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Diabetes</th>
<th>OSA</th>
<th>HTN</th>
<th>GERD</th>
<th>Hyperlipidemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline, %</td>
<td>20</td>
<td>20</td>
<td>51</td>
<td>62</td>
<td>34</td>
</tr>
<tr>
<td>Follow-up, %</td>
<td>27</td>
<td>48</td>
<td>72</td>
<td>69</td>
<td>41</td>
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</table>

**Conclusion:** Although patients’ BMIs did not significantly worsen or improve, there was a significant increase in the development of new co-morbidities. Patients who are appropriate candidates for bariatric surgery but ultimately denied by insurance develop a high incidence of new obesity-related co-morbidities over a short follow-up period.


A 55-year-old man reportedly rolled out of bed and fell onto the temple of his eyeglasses, which impaled him in the anterior chest. He experienced no associated hemodynamic or respiratory compromise, and he had a sinus rhythm without ectopy. He was alert and oriented, GCS 15. A thin metallic object was protruding from his anterior chest just left of midline and cephalad to the xiphoid. Breath sounds were clear bilaterally, and cardiovascular examination findings were normal. No JVD was appreciated. There was no external hemorrhage. Lateral chest radiograph demonstrated a linear metallic structure through the sternum and into the cardiac silhouette.

CT scan confirmed penetration of the right ventricle to a depth of 15-16 mm, with associated moderate pericardial effusion. He was taken to the operating room, where a subxiphoid pericardial window was performed with evacuation of approximately 100 cc of bloody fluid. The penetrating object was removed under direct vision with no resultant hemorrhage, and a 24-French Blake drain was placed into the pericardial cavity. The patient’s postoperative course was unremarkable. The drain was removed and the patient discharged on POD#2.


**Background:** Within shared governance, nursing councils help define quality and excellence of practice.

**Purpose:** The project’s purpose was to obtain a baseline measurement of the council process effectiveness. A survey was distributed to all staff nurses (N=1,218) measuring their knowledge of council operations, beliefs about council importance and perceptions of nurse autonomy.

**Results:** Of the 643 (53%) respondents, 54% work in inpatient settings. Overall, 90% believe councils are important and provide opportunities for nurses to participate in practice decisions. However, 61% of the respondents did not
have enough knowledge about councils to participate. Nurses working less than 10 years were the least likely to know council structure and roles.

**Implications for Practice:** Council design needs to be simplified and centered on the unit-committee structure to engage staff nurses in shared decision making to enhance patient care and good patient outcomes.


In 2008, the Oncology Nursing Society (ONS) Research Priorities Survey determined cancer screening and early detection as number twelve in their list of 20 evidenced-based priorities. Colorectal cancer is the second leading cause of cancer mortality and is largely a preventable disease. The removal of pre-cancerous polyps through the use of colonoscopy can reduce the incidence of colorectal cancer by 75-90%, yet colorectal cancer (CRC) screening rates, particularly colonoscopy, remain low nationally. Motivational interviewing (MI), incorporating the Transtheoretical Model (TTM) of behavior change is a patient centered directive method of communication for enhancing intrinsic motivation to change by exploring and resolving ambivalence, anger and fear. Research has demonstrated that MI can increase mammography screening and smoking cessation rates. To document the process and outcomes of a telephone intervention utilizing MI communication strategies on colonoscopy rates. Two nurses trained in MI conducted telephone interviews using MI with patients who had been referred for colonoscopy but failed to schedule within six months. Data were collected on: patient’s TTM stage of change, overall health, scheduling issues, MI skills used, and outcomes.

Of the 163 patients telephoned, 57% were female, 52% rated their health as very good/excellent, and 53% presented in either pre-contemplation or contemplation stage of change. Reasons for not scheduling: too busy/forgot (27%), not ready (19%), other health problems (19%), preparation and/or pain concerns (16%), and no insurance (9%). Interventions included: education (n=51) and/or MI strategies (n=42). Outcomes included: 114 (69%) patients scheduled colonoscopy, 85 (75%) tests completed, 45 (53%) patients with polyps, 29 (64%) patients with pre-cancerous polyps, and one patient presented with a carcinoid polyp. Patients rating their health as fair or poor were the least likely to schedule. Colonoscopy screening rates improved following a telephone interview using MI in addition to education. Skills in MI allow oncology nurses to individualize care plans and to assist patients to progress from pre contemplation to action. Nurses, who utilize MI skills, can play a vital role in reducing CRC and in promoting CRC screening.


**Background:** The optimal method of bowel preparation before colorectal surgery has been a topic of debate since the mid 1970s. Mechanical bowel preparation (MBP) has traditionally been thought to have greater benefits compared to no MBP. Despite patient inconvenience, discomfort and expense associated with MBP, surgeons have favored MBP secondary to the perceived benefits including reduction in stool quantity, infectious complications, fecal contamination and leaks. Recent studies suggest that patients who undergo MBP have morbidity and mortality rates comparable to patients with no MBP. Our objective was to assess 30-day outcomes, including morbidity and mortality after right hemicolecotomy with and without MBP at our community-based teaching hospital.

**Methods:** An IRB approved, retrospective review of the medical records of all patients who underwent a right hemicolecotomy from 1/1/2004-3/31/2009 was completed. Patients were identified by querying our institution’s electronic medical record system. Emergent cases were excluded. Type of MBP was at the surgeons’ discretion. Patients were grouped into the MBP group or the no bowel preparation (no-MBP) group and endpoints observed included anastomotic leak, wound infection, abdominal abscess, and 30-day mortality. Statistical analysis included t-tests, chi square, fisher exact tests and multivariate logistic regression.

**Results:** 302 patients underwent a right hemicolecotomy during the study period. 72 patients had emergent right hemicolecotomies and were excluded. 230 patients met inclusion criteria, 35 in the no-MBP group and 195 in the MBP group. All patients received preoperative antibiotics. Mean age, length of stay, ASA class, and operative time was similar between the two groups. 66% were completed laparoscopically. Complication rates are reported in the table. After adjusting for age, sex, ASA class, and open approach, there still was no difference (p=0.063).
### Complication Rates by Bowel Preparation Group

<table>
<thead>
<tr>
<th></th>
<th>No-MBP</th>
<th>MBP</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anastomotic leak</td>
<td>0 (0)</td>
<td>5 (3)</td>
<td>0.999</td>
</tr>
<tr>
<td>Wound infection</td>
<td>6 (17)</td>
<td>18 (9)</td>
<td>0.224</td>
</tr>
<tr>
<td>Abdominal abscess</td>
<td>1 (3)</td>
<td>7 (4)</td>
<td>0.999</td>
</tr>
<tr>
<td>Combined complication rate per patient (anastomotic leak, wound infection, abdominal abscess)</td>
<td>7 (20)</td>
<td>23 (12)</td>
<td>0.182</td>
</tr>
<tr>
<td>Mortality (30-day)</td>
<td>1 (3)</td>
<td>4 (2)</td>
<td>0.763</td>
</tr>
</tbody>
</table>

**Conclusion:** Our results support those of larger studies establishing no advantage to MBP. As we move towards more evidence-based, cost-effective and patient-centered care, we must reconsider our current practice of MBP for elective colon resections.


**Background:** The differential diagnosis of a red breast is large and includes both benign and malignant disease. The literature documents patients presenting with a red breast that have delays in the diagnosis of inflammatory cancer. We prospectively recorded our institutional experience in the evaluation, diagnosis, and treatment of a red breast. We are unaware of previous similar reports.

**Methods:** Data on patient history, examination and imaging were collected prospectively on patients who presented to our breast center over a 14 month period ending in February 2009 with the chief complaint of a “red breast.” A retrospective review of final diagnosis and outcome was then conducted.

**Results:** Twenty-two patients presented or were referred with the chief complaint of a red breast. This accounted for only 0.6% (22/3762) of patients evaluated in our breast center during this time period. Examination findings included skin thickening in 59% (13/22) and breast tenderness in 50% (11/22). Ninety-one percent (20/22) underwent ultrasound examination and 50% (11/22) underwent mammography. Breast biopsy was performed in 41% (9/22). Final diagnoses were mastitis in 31.8% (7/22), breast abscess in 13.6% (3/22), erythematous changes secondary to radiation therapy in 13.6% (3/22), cellulitis in 9.1% (2/22), and venous hypertension in 9.1% (2/22). Other diagnoses included post radiation morphea, benign dermatologic inflammation, Paget’s disease of the breast, Inflammatory Breast Cancer, and psoriasis (one patient each). After treatment, 68.2% (15/22) patients had resolution of their symptoms and 22.7% (5/22) were improved. One patient died of inflammatory breast cancer during follow-up. Only one (4.5%) of 22 patients had a change in diagnosis in a median follow-up of 8.8 months.

**Conclusion:** A “red breast” is an uncommon chief complaint in patients evaluated at a breast center. The differential diagnosis of a red breast is large. A thorough history, physical examination, imaging, and often biopsy will identify an accurate diagnosis to guide appropriate treatment. With appropriate treatment, the majority of patients will have improvement or resolution of their symptoms. The NCCN compliant algorithm utilized by our breast center can serve as a guide to evaluate patients with a red breast. This algorithm correctly identified the cause of the red breast in more than 95% of patients at the time of their presentation.


**Background:** After the discovery of JAK2V617F, concomitant cases of myeloproliferative neoplasm (MPN) and chronic myelogenous leukemia (CML) are increasingly being reported. We reviewed the literature for patients having both MPN and CML in order to define the clinical features and explore the potential association between the two conditions.

**Methods:** Previous reports of concomitant MPN and CML up to November 2008 were identified using PubMed and Google search. This was supplemented by direct search of the references. We calculated the expected incidence of concomitant MPN and CML using data from the Surveillance Epidemiology and End Results program.

**Results:** We found 29 cases of concomitant MPN and CML, 16 of which were reported after the discovery of JAK2V617F. Most of the reports came from Europe (15 cases) and the North America (8). Majority were males (69.0%). In most patients, MPN preceded CML (67.9%). Overall, polycythemia vera (PV) was the most common MPN associated with CML (51.7%) followed by primary myelofibrosis (PMF, 37.9%). This was true even if one considered only the cases reported before the
JAK2V617Fera. When MPN preceded CML, PV was the most commonly associated (65.0%). Most of these patients did not receive chemotherapy or 131P prior to CML diagnosis. On the other hand, when MPN followed CML, PMF was most common (83.3%). Among those cases in which MPN was diagnosed after CML, JAK2V617F was found retrospectively to be present at the time of CML diagnosis in all cases. The median time from diagnosis of MPN after CML is much longer compared with that of diagnosis of MPN after CML (7 [range, 2-17] versus 2 [0.5-9] years). This is true regardless of the timing of the case reports, pre- or post-JAK2V617Fera. A common finding was the spontaneous improvement of MPN clinical features at the time of CML diagnosis. Among CML patients treated with imatinib, MPN clinical features often reemerged at the time of CML cytogenetic remission. JAK2V617F and BCR-ABL had been reported to exist in the same or separate clones of myeloid progenitor cells. Epidemiologic analysis of MPN and CML suggests a higher than expected co-incidence in the U.S. The annual age-adjusted incidence rate of MPN is 1.8 cases per 100,000 population, while that of CML is 1.5 per 100,000. Assuming that the two conditions are independent of each other, we calculated that one would expect to see only 1.7 concomitant cases over a 25-year period. Yet, since 1975, at least 6 cases have been reported in the U.S., and many more cases could have gone unreported.

**Conclusion:** CML may develop subsequent to or at the same time as MPN even among those who never had exposure to chemotherapy or 131P. We also found a higher than expected co-incidence of MPN and CML based on known epidemiologic data for each specific condition. We hypothesize that MPN, and therefore potentially JAK2 mutations or molecular events that are responsible for or associated with them, may be risk factors for the development of CML. Because of therapeutic implications, clinicians should be aware that MPN and CML may co-occur more frequently than once thought.


**Background:** Many programs admit patients with obstructive sleep apnea (OSA) to the ICU following laparoscopic Roux-en-Y gastric bypass (LRYGB), fearing pulmonary complications. Our practice is to admit these patients to the surgical ward. Our aim was to evaluate the perioperative course and outcomes in morbidly obese patients with OSA undergoing LRYGB compared to those without OSA (non-OSA).

**Methods:** We performed a retrospective review of our prospective database on 650 consecutive LRYGB patients between September 2001 and March 2008. Following LGB all patients were transferred to the surgical ward. Patients with polysomnography confirmed diagnosis of OSA were compared to similar patients without evidence of OSA. Statistical analysis included t-tests and chi-square analysis.

**Results:** There were 217 patients who met inclusion criteria for the OSA cohort and 368 for the non-OSA cohort. 65 were excluded from the analysis due to insufficient medical documentation of sleep apnea diagnosis. Demographics were similar between groups. Based on the respiratory disturbance index, 74% of the OSA patients had severe sleep apnea. See table below for outcomes.

<table>
<thead>
<tr>
<th>Perioperative data</th>
<th>OSA</th>
<th>Non-OSA</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of PACU stay (min)</td>
<td>105.4 ± 37.5</td>
<td>106.3 ± 34.3</td>
<td>0.754</td>
</tr>
<tr>
<td>Length of hospital stay (days)</td>
<td>2.2 ± 0.7</td>
<td>2.2 ± 1.1</td>
<td>0.792</td>
</tr>
<tr>
<td>30 day major complications rate (%)</td>
<td>4.1</td>
<td>5.4</td>
<td>0.488</td>
</tr>
<tr>
<td>ICU admissions for pulmonary complications</td>
<td>0</td>
<td>0</td>
<td>NS</td>
</tr>
<tr>
<td>Mortality</td>
<td>0</td>
<td>0</td>
<td>NS</td>
</tr>
</tbody>
</table>

**Conclusion:** Morbidly obese patients with OSA undergoing LGB have a similar perioperative course as those without this co-morbidity. These patients had no increase in postoperative pulmonary complications. Routine admission of patients with OSA to the ICU after LRYGB is not indicated.


Also presented as Gundrum JD, Go RS. Cancer in the oldest old population in the United States: current statistics and projections. Oral presentation at the Eastern Cooperative Oncology Group (ECOG) Fall Meeting, Baltimore, Maryland, November 6-8, 2009. (Mr. Gundrum won ECOG's 2009 Young Investigator Award for Clinical Research for this study.)
Background: The oldest old, defined as people age > 85 years, in the U.S. is projected to double from 4.3 million in 2000 to 9.6 million in 2030. Since cancer is the number one cause of death, it is critical to assess the current and projected cancer burden in this population.

Methods: We obtained data from the Surveillance, Epidemiology and End Results (SEER) program. We included patients who had a previous cancer before age 85, but excluded benign tumors, myeloproliferative, and myelodysplastic neoplasms. Incidence was reported per 100,000 person years and age-adjusted to the 2000 U.S. standard population. For current statistics, we included years 2001-2005. Trend analyses were based on 1973-2005 data.

Results: The oldest old represents 7.2% of annual new cancers cases diagnosed and 10.5% of cancer deaths in the U.S. The 10 leading cancers by incidence (both sexes and decreasing order) are colorectal (388.9), lung (287.7), breast (250), prostate (211.5), urinary bladder (162.5), non-Hodgkin lymphoma (110.9), leukemia (85.1), melanoma (65), renal (46.4), and uterine (40.2). The incidences of melanoma, non-Hodgkin lymphoma, renal, and lung cancers are increasing, while those of leukemia, prostate, breast, and colorectal cancers are decreasing. The top 5 causes of cancer deaths are lung and bronchus (21%), colorectal (15%), pancreatic (7.1%), prostate (5.9%), and breast cancers (5.3%). Cancer specific survival (CSS) has been increasing continuously since 1973 for melanoma, non-Hodgkin lymphoma, breast, colorectal, prostate, and urinary bladder cancers but decreasing in recent years for colorectal, breast, prostate, and uterine cancers. CSS for leukemia, lung, renal, and uterine cancers showed no change over time. If the current incidence trends for each cancer continue in a linear fashion, it is projected, using 1973-2005 data, that in 2030, the oldest old will represent 8.8% of annual new cancers cases diagnosed and 13.6% of cancer deaths.

Conclusions: Cancer incidence and mortality trends in the oldest old differ from the general population. Because the oldest old are likely to have multiple co-morbid conditions, there is a need to find better ways to diagnose and treat cancers in this unique segment of the population.


Background Summary: Few studies have focused on the impact of a myocardial infarction (MI) on the lives and roles of middle aged women who are committed to family, jobs and community.

Objective: As part of a pilot study designed to help women manage fatigue following a MI, women were interviewed to gain insights into their fatigue experience and self-care needs.

Methods: Ten women (age 48 to 59) were interviewed at 1, 6 and 12 weeks after their MI. The same series of open-ended questions focusing on the experience of angina and fatigue were asked at each interview. Interviews were transcribed verbatim. Life Transition Theory was used to guide the qualitative analysis.

Results: Women's stories centered on the need to maintain their sense of self as defined by previous family roles. Women highlighted stress as the reason for having the MI at this time in their lives. In the first interviews, women verbalized the importance of lifestyle changes and need for stress reduction. In addition, they expected to be back to their usual roles at 3 months. At 3 months, women changed their diets, stopped smoking, but were struggling to manage stress and find time for exercise.

Conclusion: Maintaining a productive self-image was a defining feature of women's experiences. Women wanted to quickly return to their family roles, defined as stressful in their first interviews. Women did not recognize how this goal conflicted with the self-care need for stress reduction and exercise. As prevention strategies, nurses can explore this conflict with women, provide options for reframing self-care as productive activity, teach fatigue management, and partner with women to fit stress reduction and exercise into what the woman normally does in her daily life.


Background/Purpose: Life Transition Theory (LTT) identifies the processes a person uses to reduce uncertainty following a critical event. Nurses can use LTT to assess what strategies patients are using to cope with life changes. Because old coping strategies often do not work during a life transition experience, the nurse can assist patients in implementing new skills and strategies supporting a successful transition. The applicability of LTT to women following myocardial infarction (MI) has not been tested. As part of a pilot study designed to help women manage fatigue following MI, women were interviewed to explore their recovery experiences and assess the utility of LTT in defining this experience.

Method: Ten women (age 48 to 59) were interviewed at 1, 6 and 12 weeks after their MI. Interviews, using open-ended questions, were conducted at the women's home and audio-taped. Interviews were transcribed verbatim.
without identifying information. LTT was used to guide the analysis.

**Result:** Women's stories centered on the need to maintain their view of self as active, productive women. Women sorted out the cause of their MI recognizing the role of traditional risk factors, but highlighting stress. In the first interview, women verbalized importance of lifestyle changes and expected to be back to normal at three months. At three months, women changed their diets, stopped smoking, but were struggling to manage stress and find time for exercise.

**Conclusion:** Understanding life transitions can give nurses a framework to counsel women. Maintaining a productive self-image was a defining feature of women's experiences. Women's need for productivity existed in conflict with their goals of self-care. Nurses can explore this conflict with women, provide options for reframing self-care as productive activity, and teach strategies to integrate stress management and exercise into daily life activities.


**Background:** A 1998 study evaluated the efficacy of an advance care planning program for 540 adult decedents through a retrospective chart review. (Hammes/Rooney. Arch of Intern. 1998;158:383-390.). Efforts to promote advance care planning have continued in this community and were expanded to include the Physician Orders for Life-Sustaining Treatment (POLST) Program. The POLST program converts treatment preferences into actionable medical orders.

**Research Objectives:** Assess advance care planning in the same community using a similar methodology in 2008.

**Methods:** The medical records of 404 adult decedents were reviewed from all settings of care in La Crosse County, Wisconsin over six months.

**Results:** The demographics of the two study populations were statistically the same. Findings indicate that rates of advance directive (AD) use remains high (85% in 1998 versus 90% in 2008). ADs are still widely available in medical records at the place of death (95% in 1998 vs 100% in 2008). POLST forms were present in the charts of 66% of decedents. In the 1998 study it was determined that 37 decedents (37/540 or 7%) had requested no hospitalization in their AD, but in 2008, that number had increased by more than five-fold (164/404 or 41%) when looking at POLST forms alone. In 1998 the request not to be hospitalized was overridden 16 times, 8 times with no clear explanation of why this preference was not honored (8/37 or 22%). In 2008, we found 16 cases where a patient was hospitalized despite the plan not to do so, 3 times with no clear explanation of why this preference was not honored (3/164 or 2%).

**Conclusions:** The POLST program is better than advance directives alone at clarifying this issue of hospitalization and assuring it is honored.

**Implications for research, policy, or practice:** Advance care planning with a POLST program can help create plans that are honored.


For localizationists, it is generally accepted that the left cerebral hemisphere in most individuals is responsible for speech and language, whereas the right cerebral hemisphere is responsible for attributes such as spatial relationship skills and orientation in time and space. In this case report we describe the communicative, cognitive, neurologic, electrophysiologic and neuroimaging findings for a left handed patient who had right cerebral hemiatrophy following a protracted seizure, but whose findings were more characteristic of focal left cerebral hemisphere involvement.

Speech, language, neuropsychological evaluations, sodium and functional magnetic resonance imaging studies subsequent to acquired brain injury suggest that in most cases the left cerebral hemisphere is dominant for speech and language, while the right hemisphere is responsible for visual-spatial skills, awareness of body scheme, and orientation in time and space. However, in some individuals, particularly developmental left handers (sinistrals), the right cerebral hemisphere might be “in reserve” or to a lesser extent dominant for speech and language (Goodglass & Quadfasel, 1954; Hecaen & Sauguet, 1971; Hecaen, De Agostini & Monzon-Montes 1981); thus the potential for better outcome following brain damage. This bears some analogy to, but should not be confused with crossed aphasia (CA), a rare condition characterized by communicative impairment in a developmental right hander (dextral) following right cerebral hemisphere brain damage, e.g., stroke (Bramwell, 1899; Dronkers, 1987; Coppens & Roby, 1992; Hartman & Goodsett, 2003). Herein we report an unusual case of aphasia and apraxia of speech in a developmental left hander who experienced protracted status epilepticus and hemiatrophy of the right cerebral hemisphere.

Both oral (PO) and intravenous (IV) proton-pump inhibitors (PPIs) have been shown to be beneficial in management of acute peptic ulcer bleeding. They have not, however, been directly compared. We retrospectively compared outcomes in 85 patients hospitalized with acute peptic ulcer bleeding and high-risk endoscopic stigmata treated with high-dose PO PPI therapy (omeprazole, 40 mg BID; pantoprazole, 80 mg BID or lansoprazole, 60 mg BID) vs. those of 85 similar patients treated with IV therapy (pantoprazole or esomeprazole [1], 80 mg bolus followed by 8 mg/hour by continuous infusion). Eligible patients had endoscopic findings of benign gastric or duodenal ulcers with active bleeding (49%), nonbleeding visible vessel (28%), adherent clot (15%) or blood, eschar or black particulate matter in the base which could not be washed away with vigorous irrigation (8%). Patients in the PO group had a mean admission pulse of 96, vs. 85 in the IV group (p, .003). There were no other significant differences in baseline characteristics between the two groups. There were no significant differences in duration of hospitalization (3.8 days, 3.8 days), units of blood transfused after initial endoscopy (1.7, 1.3; p, .19), number of endoscopies (1.1, 1.2; p, .85), rebreeding (11%, 14%; p, .48), need for surgery (4%, 5%; p, .7), readmission within 30 days of discharge for peptic ulcer bleeding (5%, 1%; p, .2) or mortality (9%, 4%; p, .12) in the PO and IV groups, respectively.

Conclusion: We found no significant difference in outcomes in patients with bleeding peptic ulcers and high-risk endoscopic stigmata treated with high-dose oral PPI therapy vs. those treated with IV bolus PPI injections followed by continuous infusion.


Converting Treatment Wishes into Orders at the End-of-Life: A Multi-State Study of the POLST (Physician Orders for Life-Sustaining Treatment) in Nursing Facilities

Background: The POLST (Physicians Orders for Life-Sustaining Treatment) is a medical order form containing orders that reflect treatment preferences for resuscitation, medical interventions, antibiotics, and artificial nutrition/hydration.

Research Objectives: An NIH funded study was to assess the effectiveness of the POLST in the nursing facility setting in comparison to traditional advance directives.

Methods: A total of 1,792 chart reviews were conducted at 90 nursing facilities in Oregon, Wisconsin, and West Virginia. Charts were selected using a stratified, random sampling approach that accounted for POLST use, resident ethnicity, and rural/urban location. Residents aged 65 and older who resided at the facility for a minimum of 60 days prior to the date of study review or death were included in the sample; 43% were deceased at the time of the chart review.

Results: Deceased residents with POLST forms were more likely to have orders reflecting treatment limitations that living residents (p < .001). POLST use and the treatment options selected also differed significantly across the three states. A binomial test indicated that nursing facility residents with traditional advance directives had fewer specific and immediately actionable medical orders for life-sustaining treatments than residents with POLST forms (87% versus 100%, p < .001). Multilevel modeling was conducted to adjust for nesting within facilities and state as well as to control for age, race, life status, and hospice use. Residents with POLST forms received fewer life-sustaining treatments than residents without POLST forms (16% versus 26%, p < .001) and the amount of life-sustaining treatments provided was consistent with POLST orders. However, there were no differences between residents with and without POLST forms on symptom management indicators including shortness of breath and pain.

Conclusions: The POLST is effective at limiting unwanted life-sustaining treatment without negatively affecting symptom management. Implications for research, policy, and practice: The POLST is an effective tool to ensure preferences for treatment limitations are honored.


Purpose: To identify and resolve issues with medication events associated with smart pump technology that were reported via safety huddles, medication event reports, personal reports, and practice audits.

Design: Evidence-based pilot study to investigate medication delivery system issues.

Setting: Midwest Medical Center

Method: After finding a paucity of information in the literature, the smart pump technology support team was questioned as to how their other clients worked out the identified issues. No specific recommendations were provided by the support team. Medication event reports and staff requests were reviewed to identify the top high risk issues. The study incorporated two types of infusion bags used at the institution. Data collected included: primary and secondary color-coded fluid set ups, primary and secondary volumes, secondary rates, occurrence of concurrent flow, head height measurements, volume to flush the secondary fluid through primary line, the time for the flush to occur, and additional observations documented during the pilot. Care was taken to have the eight pumps set up by one clinician to avoid human variation.

Results: Inconsistency in technique to establish needleless port connections was the primary reason for failure to deliver the intermittent medication. Not accounting for overfill and flushing volume was the second reason for intermittent medication events. The volume required to flush the medication through the primary tubing is not accounted for in the current practice. Head height distance had no impact on concurrent flow except at extremely high rates (600 cc/l/hour and higher).

Implications: Smart pump technology does not eliminate the need for thoughtful clinicians. Review of old practices and their incorporation into new technology is mandatory. New technology demands thoughtful inquiry of all elements of practice and will unveil areas not previously addressed.


PUrpose/ Framework
Patient falls are a complex problem and a successful reduction plan requires a multidisciplinary, multifaceted approach. To maintain patient safety, nurses implement fall prevention interventions as a standard of care. Despite these efforts the patient fall rate has been gradually increasing in many hospitals across the country.

Design
At this 325-bed teaching hospital, safe patient care is a high priority. In 2007, a nursing-led multidisciplinary team convened to identify the issues and develop a successful plan to reverse this trend. In 2008 a system-wide goal was set to reduce actual patient falls by 30 percent.

After reviewing research and evaluating best practices from other organizations, the Multidisciplinary Falls Advisory Group and unit-based teams designed a falls “bundle” which includes: caution signs, hourly rounding, patient/family education and safe room set-up.

The “bundle” was piloted on two medical-surgical units for two months and two additional medical-surgical units implemented the “bundle” after the pilot period.

Method
The effectiveness of the “bundle” was analyzed as follows:

Patient/ Family Education – A patient education sheet was provided to the patient. During this introductory period, a survey was created to gather data on the effectiveness of this patient education.

Caution signs – Information was gathered from staff and patients regarding the efficacy of the signs.

Targeted hourly rounding – Hourly rounding sheets are placed inside patients rooms and are replaced every 24 hours. Data was evaluated on a daily basis with monthly trending for staff compliance with rounding.

Results
The four medical-surgical “pilot” units had a 29% reduction in the number of falls and 51% decrease in injuries related to those falls in 2008. This successful strategy is now system-wide. The rate of patient fall rate continues to decrease.

Implications
The incorporation of this “bundle” into patient care is an effective strategy in reducing patient falls.


Purpose
Nurses can use music as a caring-healing modality to reduce anxiety, to establish “caring moments” and to improve satisfaction with care. Will music listening practiced within the context of a human caring relationship influence patient and nurse outcomes?
Framework: Jean Watson’s Theory of Human Caring and the Rosswurm and Larrabee evidence-based practice (EBP) model
Setting/Sample: Adult oncology outpatient center. Convenience samples of patients receiving chemotherapy treatment and nurses who monitored patients.
Project Design: Pilot evidence-based practice project with a dual focus (patient-nurse) implementation strategy using a pre- posttest one-group design.
Methods: Patients self-selected music for listening using an MP3 or compact disc player. Nurses were encouraged to engage in “caring moments” with the patient participants focusing on music as caring-healing modality. Patients completed a distress scale using the Distress Thermometer and Caring Factor Survey (CFS) pre- and post music listening. Nurses completed the Caring Factor Survey-Care Provider Version (CFS-CPV) and participated in a focus group to share insights and experiences from the pilot.
Results: Patient pre- and post-music scores demonstrated a decrease in distress. Overall, patient (n=14) and nurse (n=9) scores on the CFS and CFS-CPV indicated a high level of effectiveness in caring. Patients’ and nurses’ rated the effectiveness in delivering spiritual care as challenging. Nurses were uncomfortable talking to patients about their spiritual needs. Spirituality assessment tools and music were identified as key factors in promoting spiritual care.
Implications: Integrating Watson’s Human Caring Theory and music at the clinical practice setting includes view Watson’s DVD, start educational sessions with “caring moments,” develop music device guidelines, market music listening, incorporate a Standard Operating Procedure, include information in nurses’ orientation materials and patients’ information folders, continue use of CFS and CFS-CPV to assess outcomes, and maintain infrastructure support.

Purpose: Clinical opportunities in underserved countries can provide invaluable experiences for general surgery residents. Challenges involving access to health care, working with limited resources, increased reliance on history and physical examination skills, understanding cultural differences, and determining the appropriate level of care or intervention are inherent to these experiences.
Methods: We designed a 2- to 4-week international elective (IE) to provide these opportunities and to instill a sense of volunteerism and service in our residents.
Results: To date, two residents have participated on this rotation and gained significant insight into global health issues, exposure to a broad spectrum of surgical pathology, and a strong operative experience.
Conclusions: Participation on an IE can provide invaluable experiences for general surgery residents. Challenges inherent in the development of the elective including adequate supervision and evaluation, resident safety, funding, and attention to American Board of Surgery requirements were not insurmountable. Institutional involvement with either domestic or international medically underserved areas has the potential to provide our residents with valuable opportunities for cross-cultural exchange of knowledge and experience.

We report a traumatic disruption of a polytetrafluoroethylene (PTFE) axillofemoral bypass (AFB) graft due to a fall. We also review the literature concerning reported blunt traumatic PTFE graft disruptions. A 75-year-old male with previous bilateral AFB grafting presented with a painful left chest wall mass after a fall from standing height. Chest computed tomography (CT) revealed a large chest wall hematoma. The patient underwent evacuation of the hematoma, resection of the fractured graft, and placement of an interposition PTFE graft. Two prior case reports have documented mid portion PTFE graft disruption from blunt trauma. Our case report demonstrates the potential for disruption of the mid portion of PTFE AFB grafts with direct blunt trauma. The diagnosis was confirmed by CT scan and the graft was successfully repaired with an interposition graft.

Introduction: Large splenic artery aneurysms are rare, but comprise 60% of all visceral artery aneurysms. Most are found incidentally and rupture in the non-pregnant patient carries an approximate 25% mortality rate. Historically these have been managed with an open surgical approach for resection.
Methods: We present the case of a 45 year old male with a recent episode of bacterial endocarditis with an incidental finding of a large 6 cm splenic artery aneurysm. There was noted to be splenic vein occlusion and multiple splenic infarcts versus abscesses on pre-operative imaging. There were concerns this represented a mycotic aneurysm. He underwent a laparoscopic en bloc splenic artery aneurysm resection with splenectomy and distal pancreatectomy with the use of pre-operative prophylactic balloon catheter aneurysm occlusion.

Results: His large splenic artery aneurysm was adjacent to the splenic hilum. Due to the splenic vein occlusion there were large collateral vessels complicating the dissection. Additionally, the aneurysm had dense adhesions to the tail of the pancreas from a desmoplastic reaction. To safely remove the aneurysm a distal pancreatectomy was included with resection of the spleen. The specimen was successfully removed intact using the laparoscopic approach. The patient had an uneventful recovery and was discharged home on post-operative day two. Final pathology revealed no evidence of bacterial etiology.

Conclusion: Laparoscopic distal pancreatectomy with splenectomy is an appropriate minimally invasive option for the treatment of splenic artery aneurysms. This video demonstrates the technical challenges and management options for successfully completing a distal pancreatectomy and splenectomy in the face of a splenic artery aneurysm.


The appropriate antibiotic treatment of surgically resected diabetic foot osteomyelitis is controversial. We conducted a retrospective cohort study to evaluate the prognostic impact of residual osteomyelitis at the surgical margin of surgically resected diabetic foot osteomyelitis. Of the 111 patients included in the study, 39 had pathologically confirmed margins positive for residual osteomyelitis. Median total duration of antibiotic treatment was greater in patients with positive margins than in those with negative margins (19 days vs 14 days, \( P = .01 \)). The primary outcome of pathologically or microbiologically confirmed infection relapse at the proximal amputation site developed in 3 of 39 patients (8%) with positive margins and 4 of 72 patients (6%) with negative margins (\( P = .695 \)). Seventeen of 39 patients (44%) with positive margins developed the secondary composite outcome of definite treatment failure or the need for more proximal amputation (\( P = .001 \)), compared with 11 of 72 patients (15%) with negative margins. Residual osteomyelitis at the pathologic margin was associated with increased treatment failure rates despite receiving more antibiotic therapy.


http://www.wisurgicalsociety.com/conferences.html

Background: Pre-operative identification of breast malignancy by image guided percutaneous needle biopsy is optimal for patient care, reserving surgery for definitive tumor resection for treatment. Likewise, percutaneous biopsy is optimal for minimizing surgery for benign lesions, increasing patient satisfaction, obviating the need for repeat surgical interventions, and reducing the cost of diagnosis and treatment. Despite the endorsement of these techniques by many professional organizations, the literature documents underutilization. In a database collected from 11 NCCN institutions from 1997-2002, 2805/6500 patients (43%) had their breast cancer diagnosed by surgical biopsy. The use of open biopsy has become increasingly discouraged and core needle biopsy rate is now suggested as a marker for quality of breast cancer care. The purpose of this study is to evaluate the success rate of minimally invasive biopsy for diagnosis of breast cancer at an interdisciplinary breast center.

Methods: IRB approval was obtained. An audit of a single institution’s prospectively maintained cancer registry was performed for all breast cancers diagnosed in 2007 and 2008. Methods of diagnosis included core needle biopsy, vacuum assisted needle biopsy, punch biopsy, and open surgical biopsy. Patients diagnosed with breast cancer elsewhere, but treated at our institution, were excluded. Image guided needle biopsies were performed by clinical breast radiologists, accredited in this procedure.

Results: Three hundred sixty-five new and recurrent breast cancers were diagnosed in 2007 and 2008. Age ranged from 26 to 91 years (mean 63). Minimally invasive techniques successfully diagnosed breast cancer in 363 (99.5%) out of 365 patients.

Conclusion: A very high rate of tissue diagnosis of breast cancer by minimally invasive techniques is achievable by commitment of all care providers to attempt needle biopsy and by a high level of performance to successfully target non-palpable image detected lesions.

25. Linebarger JH, Mathiason MA, Kallies KJ, Shapiro SB. Does increased body mass index affect lymph node retrieval in colon resection for adenocarcinoma? Presented at the Wisconsin Surgical Society, Kohler, Wisconsin, November

**Background:** Adequate lymphadenectomy is fundamental in staging and treating colon adenocarcinoma. Evaluation of ≥12 lymph nodes is recommended. Few studies have assessed whether lymph node harvest is compromised by obesity.

**Hypothesis:** Lymph node retrieval in colon resection for adenocarcinoma decreases with an increasing BMI.

**Methods:** Our institution’s prospective cancer registry was retrospectively reviewed for patients undergoing resection for colon cancer diagnosed from 8/1/2000 to 7/31/2007. Patients were stratified by BMI and lymph node harvest was evaluated. Statistical analysis included ANOVA and t-test. A p-value <0.05 was considered significant.

**Results:** 401 patients met inclusion criteria. Mean age was 72.7 years, 44.4% were male. Mean BMI was 28.3 kg/m² (range 15.6–54.6). Node harvest, specimen length, and operative time per BMI group are summarized in the table as mean ± SD.

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>N</th>
<th># Nodes Recovered</th>
<th>Specimen Length (cm)</th>
<th>Operative Time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;18.5</td>
<td>10</td>
<td>20.6 ± 12.1</td>
<td>22.3 ± 9.9</td>
<td>122.8 ± 39.5</td>
</tr>
<tr>
<td>18.5 - 24.9</td>
<td>113</td>
<td>25.1 ± 13.7</td>
<td>23.8 ± 16.2</td>
<td>142.6 ± 61.4</td>
</tr>
<tr>
<td>25 – 29.9</td>
<td>122</td>
<td>23.3 ± 14.3</td>
<td>30.0 ± 26.4</td>
<td>156.1 ± 62.3</td>
</tr>
<tr>
<td>30 – 34.9</td>
<td>101</td>
<td>22.4 ± 13.2</td>
<td>26.0 ± 20.0</td>
<td>165.2 ± 61.1</td>
</tr>
<tr>
<td>35 – 39.9</td>
<td>29</td>
<td>19.0 ± 14.1</td>
<td>28.0 ± 16.3</td>
<td>185.3 ± 81.4</td>
</tr>
<tr>
<td>≥40</td>
<td>17</td>
<td>21.1 ± 14.2</td>
<td>25.2 ± 10.3</td>
<td>184.1 ± 126.6</td>
</tr>
</tbody>
</table>

All attending surgeons retrieved an average >12 nodes per resection. There was no difference in node harvest rates among BMI groups. Further analysis showed no difference between laparoscopic versus open procedures, primary versus recurrent resections, or attending pathologist. Differences in node recovery were observed when comparing pathology assistants (range 11.0 to 28.3, p=0.001), and right versus left sided resections (24.4 ± 11.8 and 18.1 ± 10.6 nodes, respectively, p=0.001).

**Conclusion:** Lymphadenectomy in colon resection for adenocarcinoma was not affected by BMI.


**Background:** Concerns about introducing emotional distress have impeded families from initiating conversations regarding advance care planning for teens with HIV/AIDS. However, studies suggest talking about death and dying with youth with a life-threatening illness can be beneficial.

**Objective:** To compare 3-month outcomes of the Family Centered (FACE) Advance Care planning intervention vs. controls regarding advance directives, psychological adjustment, quality of life, spirituality and medication adherence.

**Design/Methods:** A 2-group, randomized, controlled trial in two hospital-based clinics from 2006-2008 with teens with HIV aged 14 to 21 years and their surrogates (N=38 dyads). Three 60-90 minute sessions were conducted one week apart. 3-month outcome measures were: complete advance directive; Beck Depression and Anxiety Inventories; Pediatric Quality of Life & General Health Assessment; Spiritual Well Being Scale of Functional Assessment of Chronic Illness Therapy; and Medication Adherence Self-Report Inventory.

**Results:** Advance Directives were completed at a significantly higher rate in the FACE intervention than control group (p<0.001). Psychological Adjustment (anxiety, depression) and Quality of Life did not significantly differ from baseline to 3-month follow-up, or by intervention vs. control for teens. But intervention surrogates perceived their teen as getting worse at 3 months compared with baseline, emotionally (p=0.0162) and at school (p=0.0192). At 3-month follow-up intervention teens reported significantly lower spirituality than controls (p=0.0216) with a significant decrease over time compared to controls (p=0.0146). Teens with behaviorally-acquired HIV increased adherence to Highly Active Antiretroviral Treatment (HAART) from 79% to 90% at 3-month follow-up (p=0.0361).
Conclusions: The FACE intervention did not unduly distress teens, as psychological adjustment and quality of life were maintained. The secular approach of FACE may have decreased spirituality for teens. Family involvement may have increased HAART adherence for teens with behaviorally-acquired HIV. The FACE intervention appears to have increased surrogates' awareness of their teens' emotional and school difficulties.


Background: To improve adolescent health, the Institute of Medicine identifies family involvement as critical. Despite evidence-based recommendations, interventions designed to increase adherence to Highly Active Antiretroviral Therapy (HAART) among youth living with HIV/AIDS (YLWHA) rarely include families. A study was conducted to evaluate whether family/surrogate involvement in a Family-Centered (FACE) Advance Care Planning intervention for YLWHA increased adherence to HAART.

Methods: A 2-group, randomized, controlled trial was conducted in two hospital-based outpatient clinics from 2006-2008. Participants (N=38 adolescent-surrogate dyads) included medically stable YLWHA aged 14-21 years and surrogates over age 21. Three 60-90 minute sessions were conducted via semi-structured family interview. Intervention included (1) Lyon Advance Care Planning Survey; (2) Respecting Choices interview; and (3) Five Wishes. Outcome measures included Medication Adherence Self-Report Inventory (Walsh, Mandalia, & Gazzard, 2001); Threat Appraisal Scale (Program for Prevention Research, 1999), adolescent self-report of family income.

Results: Participants of mean age 16 years were 61% female, 94% Black, and 17% below poverty level; 77% were perinatally infected and 82% were on HAART. In analysis of baseline data, behaviorally and perinatally YLWHA were similar in adherence. However, adherence was inversely related to family income (p=0.003) and the Threat Appraisal subscale Negative Evaluation (p=0.036). At 3-month follow-up behaviorally infected YLWHA significantly increased adherence to HAART from Baseline from 79% to 90%, respectively, and this was statistically significantly higher than for perinatally infected YLWHA (p=0.0361). At 3-month follow-up Negative Evaluation was no longer associated with adherence (p=0.593), while the Threat Appraisal subscale Rejection by Others was borderline associated with decreased adherence (p=0.084).

Conclusion: Behaviorally infected YLWHA in a family-centered intervention increased adherence to HAART to clinically therapeutic levels. Negative Appraisal and Rejection by Others, because of HIV status, may be barriers to adherence. Facing the threat of a foreshortened future with family in a caring context may be a powerful method for increasing adherence for behaviorally infected adolescents. Decreased adherence to HAART for those with increased family income suggests possible problems with insurance coverage for those not eligible for Medicaid.


Objective: Patient centered care is one of six goals recommended by the Institute of Medicine in “Crossing the Quality Chasm: Building a Better Healthcare System in the 21st Century”. Patient centered performance measures include the success rate of one step surgery and patient self-assessment of post-operative pain and cosmesis. The aim of this study was to identify and audit patient centered quality indicators to create a breast center report card that could be provided to patients, third party payors and other care providers for comparison. We hypothesize that the processes of care and the performance that result in successful one step surgery, adequate pain control and good cosmesis are measurable and therefore could be used for economic and quality comparisons between institutions.

Methods: An IRB approved retrospective review of consecutive patients undergoing sentinel lymph node biopsy (SLNB) for breast cancer at a single institution from April 1998 to December 2006 was conducted. Males and neoadjuvant chemotherapy patients were excluded. Sentinel lymph node (SLN) performance metrics and re-excision lumpectomy rates were determined. Immediate intraoperative assessment of SLN’s was performed by frozen section analysis of multiple sections stained with H&E. The identification of a positive SLN resulted in immediate axillary...
lymphadenectomy. A postal survey was also mailed to patients in 2006-2007 to query patients about post-operative cosmetic satisfaction and pain control.

Results:

Components of One Step Surgery (1998-2006 unless otherwise indicated by *)

| Percentage eligible patients offered SLNB* | 348/374 (93%) |
| SLN identification rate | 682/697 (98%) |
| Immediate intraoperative assessment of SLN performed | 609/682 (89%) |
| Sensitivity of intraoperative identification of positive SLN | 86/131 (66%) |
| Re-excision lumpectomy rate for SLNB patients* | 40/232 (17%) |
| % Patients (lumpectomy or mastectomy) with single step surgery* | 320/367 (87%) |
| % Patients (lumpectomy) with single step surgery* | 189/232 (81%) |

*Years 2004-2006

Patient Self-Assessment of Cosmesis and Pain Control

| 2006-2007 Cosmesis (5 point scale): Excellent to very good | 103/134 (77%) |
| 2007 Pain Control (3 point scale): | |
| Intraop “definitely good” | 69/72 (96%) |
| First week “definitely good” | 60/72 (83%) |

Conclusion: The components of care that contribute to a patient centered assessment of breast cancer surgery are measurable. Intraoperative identification of positive SLN’s, immediate completion lymphadenectomy for node positive patients and low re-excision lumpectomy rates allow most patients to undergo one step surgery. Cosmetic results and analgesic efficacy are additional patient centered quality indicators. Both can be measured by survey. Institutional comparisons of these metrics have the potential to indentify performance outliers. The study of outliers may help design quality initiatives to improve patient centered care. Transparency of metrics could potentially be utilized by patients, payors and policy makers for patient steerage. Further study of patient centered quality indicators (conducted by care providers and their professional societies) are necessary for refinement of definitions, consensus development and risk adjustment to aid policy makers.


Introduction: Left ventricle ejection fraction (LVEF) is the most commonly used marker of LV function. It generally does not change over a short period of time in the absence of a major cardiovascular event or medication change. Cardiac magnetic resonance imaging (CMRI) is considered gold standard for LVEF assessment, however echocardiography is more widely available and most commonly used tool to assess LVEF.

Purpose: To evaluate the differences in clinically relevant LVEF ranges as measured by echocardiography and CMRI and to assess the reproducibility of CMRI LVEF calculations of experienced CMRI physicians compared to minimally-trained medical residents.

Methods: One hundred consecutive patients who underwent both echocardiography and CMRI from 9/01/05 to 6/18/07 at a community hospital were retrospectively reviewed. Echocardiography LVEF was derived by standard
techniques. CMRI LVEF measurements were derived by standard techniques, utilizing short axis stack of TRUFISP cine images over the entire LV volume with volumetric analysis on the ARGUS work station. LVEF cutoffs for major clinical decision making were defined as <30% (prophylactic ICD implantation) and <50% (diagnosis of cardiomyopathy and discontinuation of cardiotoxic chemotherapy agents), and were the basis for comparisons. Mean time frame between the echocardiogram and CMRI was 15.8 days (range 14–49 days). CMRI LVEF calculated by two internal medicine residents blinded to patient information and original CMRI was compared with experienced CMRI physician calculated LVEF. Residents received limited training in selecting appropriate CMRI images and working with ARGUS workstation. We compared physician read echocardiography and CMRI LVEF, as well as physician read and resident read CMRI derived LVEF.

**Results:** Physician read echocardiography and CMRI LVEF comparisons divided subjects into 4 groups. Group 1 had LVEF <30% on echocardiography (n = 16). Of these, 8 (50%) had corresponding LVEF by CMRI as ≥30% with differences of 5–10% in 1 subject (6%) and >10% in 7 subjects (44%). Group 2 had LVEF <30% on CMRI (n = 9). Of these, 1 subject (5%) had corresponding LVEF by echocardiography ≥30%, with a difference of >10%. Group 3 had LVEF ≥30 to <50% on echocardiography (n = 22). Of these, 10 (45%) had corresponding LVEF by CMRI as ≥50% with differences of 5–10% in 4 subjects (18%) and >10% in 6 subjects (27%). Group 4 had LVEF ≥30 to <50% on CMRI (n = 27). Of these, 5 subjects (18%) had corresponding LVEF by echocardiography as ≥50% with differences of 0–10% in 2 subjects (7%) and >10% in 3 subjects (11%). When LVEF was assessed as <30% by either tool, the discordance was 36%; when assessed as ≥30 to <50% by either tool, the discordance was 35%. Physician read and resident read CMRI LVEF comparisons divided subjects into 2 groups. Group A had physician calculated CMRI LVEF <30% (n = 9). Of these, 8 (89%) had corresponding LVEF by resident calculated CMRI as <30%. The one subject with a divergent LVEF was over read by the resident by 10.4%. Group B had LVEF ≥30 to <50% on CMRI (n = 27). Of these, 17 (63%) had corresponding LVEF by resident read CMRI as ≥30% to <50% with differences of <5% in 6 subjects (22%) and >5% in 4 subjects (15%). Overall discordance between physician and resident calculated CMRI LVEF for <30% was 11%. When LVEF was assessed as ≥30 to <50%, the discordance was 37% (22% with a difference of <5%; 15% with a difference of >5%).

**Conclusion:** Prior to making major management decisions based on echocardiography derived LVEF in clinically relevant ranges, CMRI confirmation is strongly suggested, particularly in patients with suboptimal images. These results also suggest that the analysis of CMRI data to derive accurate LVEF can be performed without extensive training and is reproducible.


**Background:** Lenalidomide has shown activity in a wide range of hematological malignancies. We conducted a phase II trial of single-agent lenalidomide in indolent non-Hodgkin's lymphoma (NHL). Methods: Patients with relapsed or refractory indolent NHL were eligible, with no limit on the number of previous therapies. Oral lenalidomide 25 mg was self-administered once-daily on days 1-21 of every 28-day cycle for up to 52 weeks as tolerated, or until disease progression. The primary endpoint was overall response rate (ORR), with secondary endpoints of response duration, progression-free survival (PFS), and safety.

**Results:** Forty-three patients were enrolled and were evaluable for response and safety. Patients had received a median of 3 prior systemic therapies (1-17) and half of all patients were refractory to their last therapy. The ORR was 23% (10/43), including a complete response (CR) or unconfirmed CR (CRu) rate of 7%. The median time to first response was 3.6 months (1.7-4.2) and the median time to CR or CRu was 4.2 months (1.9-11.1). Twenty-seven percent (6/22) of patients with follicular lymphoma grade 1 or 2, and 22% (4/18) of patients with small lymphocytic lymphoma responded to therapy. The median duration of response has not reached, but is longer than 16.5 months with 7 of 10 responses ongoing at 15-28 months. Median PFS was 4.4 months (2.5-10.4). Adverse events were consistent with the known safety profile of lenalidomide and manageable; the most common grade 3 or 4 adverse events were neutropenia (30% and 16%, respectively) and thrombocytopenia (14% and 5%, respectively).

**Conclusions:** Oral lenalidomide monotherapy produces durable responses with manageable side effects in relapsed or refractory indolent NHL and warrants further investigation in the treatment of indolent NH.
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