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MEDICAL JOURNAL

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Contents–Volume 7, Issue 1

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EDITOR'S MESSAGE

"The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' ('I found it!') but rather 'hmm…that's funny…'." --Isaac Asimov

And speaking of science and research, I'm particularly proud of this issue of the *Gundersen Lutheran Medical Journal* in that it contains more original research than any other issue of the *Journal* published to date!

In the first article Dr Porcari and colleagues report in a 2-part investigation the effects of "toning shoes" on exercise, calorie expenditure during walking, and muscle activation in the lower extremities. This study is particularly timely, given the plethora of ads on television, the internet, and in magazines and stores concerning tools to enhance one's health.

In the second study, Dr Alliani and colleagues from the Department of Cardiology examined the records of 100 consecutive patients who underwent transthoracic echocardiography (TTE) and cardiac magnetic resonance imaging (CMRI) for assessment of left ventricular ejection fraction (LVEF). Results showed differences in LVEF as measured by TTE and CMRI in many patients, even when the quality of the TTE was good. CMRI was recommended for evaluation of LVEF for major cardiac decision making.

Summer Research Fellow Luke Zurbriggen, with assistance from Vicki McHugh, MS, and Jacob Gundrum, MS, from the Department of Medical Research, and direction from Ronald Go, MD, FACP, Hematology-Oncology, examined the types and prevalence of self-reported financial conflicts of interest (FCOIs) among researchers at a major cancer meeting. Results showed that most FCOIs were unrelated to research funding or employment. However, substantially fewer abstract presenters reported FCOIs in comparison to planners and speakers.

In the fourth study, Todd Kowalski, MD, and colleagues from Infectious Disease, Department of Internal Medicine, retrospectively studied the medical records of 28 patients with methicillin-sensitive *Staphylococcus aureus* (MSSA) and their response to ertapenem. Results suggested that a daily dosage of ertapenem may be useful for MSSA bone and joint infections.

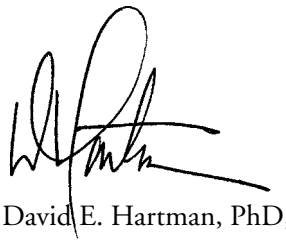
In the fifth study, Catherine Inman, MD, from Occupational Health Medicine, and colleagues compared digital images with analog film chest radiographs from individuals undergoing pre-employment physicals or surveillance examinations for pneumoconiosis. The results supported the use of soft-copy digital images for this purpose.

In the REVIEW section, Dr Villarreal provides a thoughtful discussion of the role of cannabinoids for treating intractable neuropathic pain. Drs Hartman and Edwin Overholt present an interesting and rare CASE REPORT of laryngeal hemangioma in an 82-year-old man with progressive voice and swallowing difficulties.

Finally, in the SUPPLEMENT section, we reprint abstracts from presentations made by staff at professional meetings in 2010. It is encouraging to know that so many Gundersen Lutheran employees carve time from their busy schedules to report the results of their research projects, to share best practices, or to document unusual cases with others in their fields.

I hope that you find this issue of the *Journal* both stimulating and rewarding! I again want to thank the *Journal* Board, and Cathy Mikkelson Fischer, MA, Managing Editor, for their guidance and insights regarding the content and design of this publication.

Along with the Editorial Board, I'd like to remind readers that this publication is an interdisciplinary and archival journal. To this end, manuscripts are sought from any medical or surgical specialty or sub-specialty, and from any health-related field. Manuscripts can be based upon (1) original, data-driven, high quality randomized or nonrandomized controlled studies, (2) systematic reviews or meta-analyses, (3) clinical outcome studies, (4) tutorials, (5) case reports, and (6) letters to the editor. "Vignettes" and "how I do it" submissions that can potentially enhance patient care or stimulate research are encouraged, as well.



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Gundersen Lutheran Medical Journal

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The Physiologic and Electromyographic Responses to Walking in Regular Athletic Shoes versus "Toning Shoes"

ABSTRACT

Background: *This 2-part study evaluated the claims that wearing "toning" shoes can (1) increase the relative exercise intensity and caloric expenditure of walking, and (2) increase muscle activation in the lower extremities compared to walking in regular athletic shoes.*

Methods: *Toning shoes evaluated in the current study were Skechers Shape-Ups, Masai Barefoot Technology (MBT), and Reebok EasyTones. Results were compared to walking in a New Balance running shoe. In Study 1, 12 women walked on a motorized treadmill at 3 speed/grade combinations. Participants wore each shoe for 5 minutes under each condition. In Study 2, 12 other women walked at the same speed/grade combinations as Study 1 while wearing each of the shoes. Muscle activity in the calf, thigh, buttocks, abdomen, and low back were assessed via electromyography (EMG).*

Results: *There were no significant differences in heart rate, oxygen consumption, or caloric expenditure between walking in toning shoes compared with walking in the control shoe. Likewise, muscle activity as measured via EMG was similar between shoe conditions for all of the muscles tested.*

Conclusion: *Based upon these results, the claims that walking in toning shoes will result in any greater weight loss or muscle strengthening/toning benefits than walking in a conventional running shoe are not supported by the evidence.*

One of the hottest trends in the footwear industry is "toning" or "rocker" shoes. Most major manufacturers have entered into the toning shoe arena, including New Balance, Avia, Reebok, Skechers, and MBT (Masai Barefoot Technology). The common denominator of all of these shoes is that they have an unstable sole design, which forces the wearer's body to constantly struggle to find equilibrium or balance point. Manufacturers of these shoes claim that this instability helps wearers to burn more calories, tone muscles, improve posture, improve circulation, relieve back and joint pain, and improve overall health. The clinical studies supporting the benefits of these shoes have generally been non–peer reviewed and funded by the manufacturers. Additionally, a review of these studies finds that they generally had small sample sizes,[1,2] lacked adequate research control,[3] or came to unfounded conclusions based upon non–statistically significant results or no apparent statistical analyses.[2,4-6]

Several training studies reported reductions in body weight and percent body fat following 6- and 8-week training periods, respectively.[3,4] These results seem to be at odds with a study by Hoppeler et al,[7] who found no increase in caloric expenditure when walking on a treadmill or a 400-meter track while wearing rocker-type shoes (MBTs). Studies have also reported higher muscle activation in the lower leg, thigh, and buttocks when wearing toning shoes.[2,6,8] This greater muscle activity purportedly results in increased glutei, hamstring, and gastrocnemius strength, and improved low back endurance in subjects who wear these shoes; however, the limited training data do not seem to support these claims.[4]

Because claims about the benefits of walking in toning shoes seems to be unsubstantiated, the purpose of this study was 2-fold: first, to evaluate the exercise responses (heart rate, oxygen consumption, caloric expenditure, and ratings of perceived exertion) to walking in regular athletic shoes compared with toning shoes; and second, to evaluate muscle activation when walking in regular athletic shoes compared with toning shoes. This investigation was conducted as 2 separate studies using 2 separate groups of women.

Women were used as subjects in both studies because they are the primary target market for these shoes. The shoes tested in this study were Skechers Shape-ups, MBT, and Reebok's EasyTone Reeinspire. They were compared with a neutral New Balance running shoe (Model 415 WPP). This investigation was approved

by the University of Wisconsin-La Crosse Institutional Review Board for the Protection of Human Subjects. Participants provided written informed consent before any tests were completed.

STUDY 1

Subjects: Participants were 12 physically active women between 19 and 24 years of age. Descriptive characteristics of the subjects are presented in Table 1.

Procedures: Participants completed a total of twelve 5-minute exercise trials. They walked for 5 minutes at 3.0 mph/0% grade while wearing each type of shoe. Participants had 5 minutes of rest between each shoe condition in order to change shoes. This sequence was repeated at 3.5 mph/0% grade and at 3.5 mph/5.0% grade. Shoe order within each of the workloads was randomized.

Throughout each trial, oxygen consumption was measured continuously with a MOXUS metabolic system (AEI Technologies, Pittsburg, PA). Heart rate (HR) was recorded each minute with a Polar heart rate monitor, and ratings of perceived exertion (RPE) were assessed during the final 30 seconds of each 5-minute trial using the 6-20 Borg Scale. Caloric expenditure during each 5-minute walking condition was calculated from the oxygen consumption data.

Statistical Analysis: Repeated measures analysis of variance (ANOVA) were used to compare the physiological and subjective responses to walking under the 4 different shoe conditions. If the *F* ratio was significant, Tukey post-hoc procedures were used to detect differences between shoe conditions. Alpha was set at $P < .05$ to achieve statistical significance for all analyses.

Table 1. Descriptive Characteristics of Study 1 Participants

Characteristic	Mean ± SEM	Range
Age, y	22.2 ± .47	19-24
Height, cm	168.6 ± 1.31	160.0-175.2
Weight, kg	64.1 ± 1.67	56.8-75.7

Abbreviation: SEM, standard error of the mean.

RESULTS

The physiological and subjective responses to each of the shoe conditions are presented in Table 2. Significant increases in volume of oxygen (VO_2, ml/kg/min), HR (beats/min), kcal/min, and RPE were observed from 3.0 mph/0% grade to 3.5 mph/0% grade and from 3.5 mph/0% grade to 3.5 mph/5.0% grade. These differences were expected since the workloads differed in intensity. No significant differences were observed in VO_2, HR, or kcal/min between each of the 4 shoe conditions within each workload. Overall, RPE was significantly higher for the MBT shoes compared to the New Balance and EasyTone shoes; however, the difference reached statistical significance only at 3.5 mph/5% grade.

STUDY 2

Subjects: Subjects were 12 physically active females between 21 and 27 years of age. Descriptive characteristics of the subjects for this portion of the study are presented in Table 3.

Table 2. Exercise Responses to Walking in New Balance, Skechers, MBT, and EasyTone Shoes

Measured responses at each mph/grade combination	Shoe			
	New Balance	Skechers	MBT	EasyTone
3.0 mph/0% grade				
HR, beats/min	94 ± 4.3	94 ± 4.0	93 ± 3.8	95 ± 4.3
VO_2, ml/kg/min	14.3 ± .34	14.1 ± .31	14.2 ± .28	14.3 ± .34
Kcal/min	4.6 ± .14	4.5 ± .15	4.6 ± .12	4.6 ± .15
RPE	8.0 ± .41	8.2 ± .46	8.4 ± .47	7.9 ± .42
3.5 mph/0% grade				
HR, beats/min	98 ± 3.8	100 ± 3.9	100 ± 4.1	99 ± 3.8
VO_2, ml/kg/min	15.7 ± .33	15.9 ± .35	16.2 ± .42	15.8 ± .35
Kcal/min	5.1 ± .18	5.1 ± .18	5.2 ± .20	5.1 ± .18
RPE	9.8 ± .41	10.0 ± .37	9.9 ± .45	9.8 ± .41
3.5 mph/5.0% grade				
HR, beats/min	122 ± 5.9	123 ± 5.7	123 ± 5.1	122 ± 5.7
VO_2, ml/kg/min	22.8 ± .40	22.9 ± .45	23.1 ± .42	22.9 ± .42
Kcal/min	7.4 ± .28	7.4 ± .29	7.5 ± .29	7.4 ± .29
RPE	11.3 ± .45[a]	11.7 ± .50	11.9 ± .50	11.2 ± .47[b]

Abbreviations: MBT, Masai Barefoot Technology; mph, miles per hour; HR, heart rate; VO_2, volume of oxygen; RPE, rating of perceived exertion.

Values are presented as mean ± standard error of the mean.

[a]Significantly lower than MBT ($P < .05$).

[b]Significantly lower than MBT ($P < .05$).

Procedures: As in the energy cost portion of the study, each subject completed a total of twelve 5-minute exercise trials. Subjects walked for 5 minutes at 3.0 mph/0% grade while wearing each type of shoe. There was 5 minutes of rest between each shoe condition so that subjects could change shoes. This sequence was repeated at 3.5 mph/0% grade and at 3.5 mph/5.0% grade. Shoe order within each of the workloads was randomized.

Muscle activation in the rectus abdominus, erector spinae, gluteus maximus, rectus femoris, biceps femoris, and gastrocnemius under each condition was measured via electromyography (EMG) using Deluca surface electrodes placed on the respective muscle bellies on the right side of the body. Data from these electrodes were amplified and digitally sampled at 1000 Hz. Post-processing of the data included use of the root mean square technique with a 10 ms window and a 60 Hz notch filter. Maximum voluntary isometric contractions (MVIC) on all muscles were performed using manual muscle techniques prior to testing. EMG recordings from 3 representative strides while at steady state (approximately 4th minute) for each condition were represented as a percentage of the EMG obtained during the MVIC condition for that muscle.

Statistical Analysis: Repeated measures analysis of variance (ANOVA) were used to compare EMG activity between shoes for each muscle at each speed/grade. Alpha was set at $P < .05$ to achieve statistical significance.

Table 3. Descriptive Characteristics of Study 2 Participants

Characteristic	Mean ± SEM	Range
Age, y	23.3 ± .43	21-27
Height, cm	170.1 ± 1.77	160-183
Weight, kg	66.7 ± 3.78	56.8-102.4

Abbreviation: SEM, standard error of the mean.

RESULTS

Muscle activation in the 6 muscles examined in the study is presented in Table 4. There were no significant differences in EMG levels in the gastrocnemius, rectus femoris, biceps femoris, gluteus maximus, erector spinae, or rectus abdominus among the 4 types of shoes. As expected, EMG activity was generally higher at the higher workloads (ie, 3.0/0% grade vs 3.5 mph/0% grade vs 3.5 mph/5% grade).

DISCUSSION

One of the selling points of wearing shoes with an unstable sole construction is that they supposedly provide a more intense workout than regular walking shoes. The results of this study found no evidence that walking in toning shoes had any positive effect on exercise heart rate, oxygen consumption, or caloric expenditure compared with walking in a regular running shoe. A study by Hoppeler et al[7] found results similar to the current study. They

Table 4. Maximum Muslce Activation[a] Responses to Walking in New Balance, Skechers, MBT, and EasyTone Shoes

Muscle measured at each mph/grade combination (n)	Shoe			
	New Balance	Skechers	MBT	EasyTone
3.0 mph/0% grade				
Gastrocnemius (12)	47 ± 6.9	43 ± 6.4	46 ± 6.7	43 ± 6.4
Rectus femoris (11)	24 ± 4.3	22 ± 5.1	22 ± 4.5	21 ± 4.2
Biceps femoris (11)	28 ± 3.7	31 ± 5.0	30 ± 4.5	30 ± 4.8
Gluteus maximus (12)	22 ± 2.5	20 ± 2.0	22 ± 2.1	24 ± 2.5
Erector spinae (12)	37 ± 5.1	42 ± 7.0	42 ± 5.6	41 ± 6.4
Rectus abdominis (12)	13 ± 2.7	13 ± 2.9	13 ± 2.9	13 ± 3.0
3.5 mph/0% grade				
Gastrocnemius (12)	51 ± 7.7	48 ± 7.0	48 ± 6.7	46 ± 6.5
Rectus femoris (11)	26 ± 4.1	26 ± 4.4	28 ± 5.8	24 ± 4.5
Biceps femoris (10)	30 ± 4.2	32 ± 5.3	34 ± 6.0	33 ± 5.8
Gluteus maximus (12)	23 ± 2.6	23 ± 2.6	22 ± 1.8	23 ± 3.0
Erector spinae (11)	41 ± 5.8	38 ± 6.6	42 ± 5.8	41 ± 5.2
Rectus abdominis (12)	18 ± 4.7	15 ± 3.5	16 ± 4.1	17 ± 4.7
3.5 mph/5.0% grade				
Gastrocnemius (8)	49 ± 10.9	51 ± 10.9	53 ± 11.3	49 ± 11.3
Rectus femoris (11)	29 ± 4.2	30 ± 5.8	31 ± 5.1	29 ± 5.1
Biceps femoris (10)	36 ± 5.6	37 ± 6.4	35 ± 5.7	38 ± 6.1
Gluteus maximus (12)	26 ± 2.7	24 ± 2.7	26 ± 2.5	28 ± 2.8
Erector spinae (11)	51 ± 5.7	50 ± 5.6	50 ± 5.6	48 ± 5.1
Rectus abdominis (12)	15 ± 3.7	14 ± 3.8	16 ± 3.9	14 ± 3.7

Abbreviations: MBT, Masai Barefoot Technology; mph, miles per hour; SEM, standard error of the mean.

[a]Reported as percentage of maximum voluntary isometric contraction (%MVIC), mean ± SEM.

saw no differences in energy cost or heart rate when participants walked on a treadmill at speeds ranging from 4 to 7 km/hr at varying grades or when they walked on a 400-meter outdoor track. A curious finding in their study was that oxygen uptake was 9.3% higher when subjects stood in MBT shoes compared with conventional running shoes.

These results are in apparent disagreement with several training studies that found that training in toning shoes resulted in significant weight and fat loss.[3,4] Subjects who wore Skechers Shape-Ups during 6- or 8-week training periods lost 3.25 lbs (1.125% fat) and 2.54 lbs (1.81% fat), respectively. The initial study, however, included only 8 subjects and did not include a control group. The latter study included 80 subjects and reported that the overall loss of body weight and body fat for the Skechers group was significantly greater than that of the control group; however, participants who wore Shape-Ups walked an average of 241 minutes per week, compared with 164 minutes per week for the group who walked in their own shoes. When the weight loss and percent fat data are corrected for the discrepancy in weekly walking time using appropriate statistical techniques (ie, analysis of covariance), the reported differences between groups become non-significant.

In the current study we believed that there might be a difference in relative exercise intensity due to the greater weight of the toning shoes compared with the New Balance running shoes, especially since the control shoe was the lightest. The weights of the shoes (individual shoe) used in the current study were as follows: New Balance, 9.75 oz; EasyTone, 13.375 oz; Skechers, 15.125 oz; and MBT, 16.875 oz. Despite these differences in shoe weight, we found no differences in exercise intensity or caloric expenditure.

A study by Nigg et al[9] did find a 2.5% greater increase in oxygen cost when walking in MBTs compared with regular walking shoes; however, because there were no differences in muscle activation of the tibialis anterior, medial gastrocnemius, biceps femoris, vastus medialis, or gluteus medius, the authors attributed the difference in oxygen cost to the 292-gram difference in the weight of the shoes used in their study.

The only difference between shoe conditions in the present study was for RPE at 3.5 mph and 5% grade. It is possible that the greater weight of the MBT shoes compared with the other shoes attributed to this difference in perceived effort. Again, this perceived difference in effort was not accompanied by an increase in physiological cost.

Manufacturers also claim that walking in shoes with unstable sole construction increases muscle activity in the abdomen, low back, buttocks, and legs when compared with regular walking or running shoes. In the current study, muscle activation levels for the muscles tested were not significantly different between any of the shoe conditions. In fact, the largest difference between any of the conditions for any muscle was only 4% MVIC. As illustrated in Table 4, for some of the conditions the %MVIC values for the reference shoe (ie, New Balance) were actually higher than those of any of the toning shoes.

Only 2 published, peer-reviewed articles could be found that investigated the effect of wearing toning shoes on muscle activation while walking, and these studies came to conflicting conclusions. Nigg et al[5] found no significant differences in EMG activity of the tibialis anterior, medial gastrocnemius, biceps femoris, vastus medialis, and gluteus medius when subjects walked in the MBT shoes compared with a running shoe. In fact, only the medial gastrocnemius showed an increase in muscle activation, and all other muscles showed non-significant decreases. Conversely, Romkes et al[8] found that wearing MBT shoes resulted in significant increases in tibialis anterior, gastrocnemius, vastus medialis and lateralis, and rectus femoris activation during various phases of the gait cycle. There was no increase in semitendinosus activation. A possible explanation as to why Romkes et al saw significant differences was that they divided the gait cycle into 16 equally spaced intervals and compared EMG values at each point in the cycle. Most other studies, including the current study, compared only maximal muscle activation (represented as %MVIC), which occurred at any point in the gait cycle.

All other studies that investigated muscle usage while wearing toning shoes were company-sponsored internet reports and reported similarly inconsistent conclusions. For instance, Vernon et al[6] found that wearing MBT shoes resulted in increased gastrocnemius, biceps femoris, and gluteus maximus muscle activity compared with walking in a control shoe; however, no significance levels were provided, and the authors concluded that the results "suggest" increased motor unit recruitment when wearing MBT shoes. Similarly, Yanagiya and Koyama[2] reported higher EMG levels when subjects walked in Skechers Shape-Ups compared with a control shoe, but the study was small (n = 6), and there was no apparent statistical analysis. Wren[10] did find a significant reduction in tibialis anterior activation and a significant increase in gastrocnemius muscle activity when subjects walked in Skechers compared with conventional walking shoes; however, there were no differences in quadriceps, hamstring, abdominal, or low back EMG recordings. Finally, Reebok reported that wearing their EasyTone shoes results in a 28% increase in gluteus maximus activation and 11% increases in hamstring and calf muscle activation, compared with walking in a Reebok walking shoe.[1] Yet, the only information available about the study is that it was conducted at the University of Delaware and involved 5 subjects who walked on a treadmill for 500 steps.

Possible limitations to the current study were that subjects did not have a chance to practice in each shoe prior to being tested. It is possible that with more practice, as well as a longer walking time, differences may have occurred. Additionally, the study was not blinded, so subjects could see which shoes they were wearing for each condition. This could have affected the perceived exertion values.

CONCLUSION

Companies claim that by wearing toning shoes, individuals can achieve significantly greater weight loss, strength, and toning benefits than they can by walking in regular athletic shoes. The results of this study cast doubt upon that claim. Based upon the results of this study, wearing so-called toning shoes in place of a regular running shoe will have no beneficial effect on exercise intensity or caloric expenditure. Additionally, there is no evidence that wearing shoes with an unstable sole design will increase muscle activation (suggesting greater muscle strength and tone in the low back, abdomen, or legs) more than wearing a regular running shoe.

REFERENCES

1. Parker-Pope T. New athletic shoes offer a workout in just the wearing. December 7, 2009. http://www.nytimes.com/2009/12/08/health/08well.html?_r=1. Accessed June 27, 2011.
2. Yanagiya T, Koyama K. The effect of shoe sole shapes on muscle activity amount and patterns. September 2009. http://www.toningshoestudies.com/storage/Juntendo%20University%20Study.pdf. Accessed July 12, 2011.
3. Gautreau S. Skechers Shape Ups clinical case study. 2009. http://www.fitnessfootwear.com/t-skechers-shape-ups-clinical-case-study.aspx. Accessed June 27, 2011.
4. Gautreau S, Petalus J, Rodriquez V, Edwards G. An expanded clinical trial measuring the benefits of wearing Skechers Shape-Ups shoes while participating in a walking program on weight loss, body toning and specific muscle strengthening as they relate to improved posture. 2009. http://www.toningshoestudies.com/storage/Gautreau.pdf. Accessed June 27, 2011.
5. Nigg B, Hintzen S, Ferber R. Effect of an unstable shoe construction on lower extremity gait characteristics. *Clin Biomech (Bristol, Avon).* 2006;21(1):82-88.
6. Naik R, Vernon T, Wheat J, Pettit G. Changes in gait characteristic or a normal, healthy population due to an unstable shoe construction. August 2004. us.mbt.com/Home/Benefits/Studies.aspx. Accessed July 13, 2011.
7. Hoppeler HH, Gasser BA, Stäuber AM. Increased metabolism while standing with unstable shoe construction. September 2008. http://us.mbt.com/Home/Benefits/Studies.aspx. Accessed June 27, 2011.
8. Romkes J, Rudmann C, Brunner R. Changes in gait and EMG when walking with the Masai Barefoot Technique. *Clin Biomech (Bristol, Avon).* 2006;21(1):75-81.
9. Nigg BM, Ferber R, Gormley T. Effect of an unstable shoe construction on lower extremity gait characteristics. June 30, 2004. http://www.avidorhc.co.il/pdf/halicha-4.PDF. Accessed June 27, 2011.
10. Wren T. Testing of Skechers Shape-Ups shoes. 2009. http://www.toningshoestudies.com/storage/Hospital%20Study%20Combined.pdf. Accessed July 12, 2011.

No Visible Means of Support
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All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

Comparison of Left Ventricular Ejection Fraction by Transthoracic Echocardiography and Cardiac Magnetic Resonance Imaging in Day-to-Day Clinical Practice

ABSTRACT

Background: *Left ventricular ejection fraction (LVEF) is often used in isolation for clinical decision making but lacks a gold standard. Transthoracic echocardiography (TTE) is the most used modality to assess LVEF; however, cardiac magnetic resonance imaging (CMRI) can accurately measure LVEF without geometric assumptions. Therefore, we aimed to compare LVEF by TTE and CMRI for clinical decision making in daily practice.*

Methods: *The medical records of 100 consecutive patients who underwent both TTE and CMRI were retrospectively evaluated. Patients with LVEF ‹50% by at least 1 modality were included in the study (n = 30). LVEF data were divided into groups by modality and cutpoints defined as ‹30% and ≥30% to ‹50%. In each group, LVEF was compared with the nonreference modality for concordance/discordance with respect to the reference LVEF cutpoint.*

Results: *In the TTE ‹30% group, 6 of 12 patients (50%) had discordant LVEF by CMRI as ≥30%. In the CMRI ‹30% group, 1 of 7 patients (14%) had discordant LVEF by TTE as ≥30%. In the TTE ≥30% to ‹50% group, 6 of 13 patients (46%) had discordant LVEF by CMRI as ≥50%. In CMRI ≥30% to‹50% group, 5 of 17 patients (29%) had discordant LVEF by TTE as ≥50%. Mean CMRI LVEF was 3.8 ± 10.9 higher than mean TTE LVEF (*P = .068); r_c = 0.69; *Bland-Altman limits, 18% to 26%; Bland-Altman range 44%.*

Conclusion: *Differences in LVEF as measured by TTE and CMRI were found in many patients, even when TTE quality was graded as good. CMRI confirmation of LVEF is recommended prior to making major clinical decisions.*

Left ventricular ejection fraction (LVEF) is the most commonly used cardiac function parameter in clinical practice. It is often used in isolation for making major clinical decisions, such as whether to recommend implantable cardioverter defibrillators (ICDs) for primary prophylaxis of sudden cardiac death (SCD) in ischemic cardiomyopathy patients,[1,2] to make a diagnosis of systolic cardiomyopathy,[3] or to withhold cardiotoxic chemotherapy for treatable cancers.[4] Despite ongoing extensive research regarding factors of size, extent, location, and transmurality of infarct, presence or absence of myocardial edema, presence or absence of "at risk" peri-infarction ischemic myocardium, QRS duration, signal-averaged electrocardiogram, QTc, QT dispersion, heart rate variability, and functional class, no other unequivocal factor has been studied as extensively as LVEF.[5-8] Yet LVEF assessment alone remains an inadequate method of risk stratification for SCD.

Traditional LVEF cutpoints used in clinically relevant situations have been <30% for prophylactic ICD implantation[1] and <50% for initial diagnosis of cardiomyopathy or withholding cardiotoxic chemotherapy.[9,10] Other less commonly used LVEF cutpoints are 35% for primary prophylactic implantation of ICDs in nonischemic cardiomyopathy patients[2] and implantation of biventricular pacemakers for cardiac resynchronization therapy in patients with refractory heart failure[11,12]; 40% for use of angiotensin converting enzyme inhibitors[13]; <60% for asymptomatic severe mitral insufficiency as referral for surgery[14]; and <50% for asymptomatic severe aortic insufficiency as referral for surgery.[15] However, these cutpoints are typically used in conjunction with other clinical parameters and/or are used for relatively minor therapeutic decision making.

Cardiac magnetic resonance imaging (CMRI) is the gold standard for measurement of LVEF without geometric assumptions in relation to LV shape and has superb temporal resolution.[5] Other true 3-dimensional (3D) modalities that employ no geometrical assumptions include real-time 3D transthoracic echocardiography (TTE) and multiphase, retrospectively gated volume cardiac computed tomography (CT); however, these modalities have their own limitations[16-18]: real-time 3D TTE is not widely available, and poor temporal resolution and significant radiation exposure are ongoing issues with cardiac CT.

Multiple therapeutic clinical trials have employed TTE, but as these trials typically have been therapeutic in nature, they have not addressed the diagnostic aspects of decision making, which involves the accuracy and reproducibility of LVEF assessment. In clinical practice, it is not uncommon to use LVEF data obtained from another modality, such as multi-gated resting radionuclide ventriculogram or CMRI, to support decision making, especially if the accuracy of the LVEF obtained from TTE is questionable. However, extrapolating evidence available from therapeutic clinical trials to apply to imaging modalities other than TTE in a clinical setting has been contentious. Therefore, we aimed to compare the

LVEF obtained by TTE with that obtained by CMRI in clinically relevant ranges upon which major clinical decisions are made based on LVEF alone in our community hospital-based setting.

METHODS

Patients

One hundred consecutive patients underwent both TTE and CMRI from September 1, 2005, to June 18, 2007, for cardiac evaluation as clinically indicated. Patients were excluded from the study if the length of time between the imaging studies was greater than 45 days, if a myocardial infarction (MI) occurred ≤6 months prior of initial imaging, if an MI occurred between the TTE and CMRI, or if clinically significant therapeutic changes were made between the imaging studies.

A retrospective analysis included TTE and CMRI variables, demographics, and clinical data. Major cardiovascular events and medication changes that occurred between imaging tests that may have affected LVEF measurement were also collected. LVEF cutpoints 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. The study sample consisted of patients with LVEF <50% on at least 1 of the 2 tests. TTE and CMRI LVEF values were compared. There was no requirement for the order of tests. Because this was a retrospective analysis, physicians were not blinded to patient history or previous test results. Gundersen Lutheran Institutional Review Board approved this study.

TTE

All patients underwent 2-dimensional TTE with color and spectral Doppler, and intravenous (IV) contrast, if required. Five standard views were obtained (parasternal long-axis, parasternal short-axis, apical long-axis, apical 4-chamber, and apical 2-chamber) and were captured with an Acuson Sequoia 512C (Siemens, Mountain View, California). Images were recorded on the computer's hard drive and measured digitally. LV systolic function was determined by LVEF as calculated by modified Simpson rule from the apical views. One of the staff cardiologists reviewed the echocardiograms as part of the patient's standard medical care.

CMRI

All patients underwent retrospectively gated true FISP cine images of the LV with a Siemens 1.5 T Symphony MR system (Siemens, Erlangen, Germany). Tests were obtained with expiratory breath-hold in order to minimize the artefacts resulting from respiratory movements. Acquisition was obtained in the standard vertical long-axis, horizontal long-axis, and left ventricular outflow tract. LV short-axis views were acquired in a series of 8 to 10 slices to cover the entire LV. The LVEF analysis was performed using the ARGUS Siemens package. CMRI LVEF measurements were derived by standard techniques, using short-axis stack of true FISP cine images over the entire LV volume with volumetric analysis on the ARGUS work station. The rest of the CMRI study was tailored to the patients' specific conditions. One of the CMRI specially trained cardiologists reviewed the CMRI scans as part of the patient's standard medical care.

Statistical Analysis

The statistical analysis was conducted using SAS software (version 9.2, SAS Institute Inc., Cary, North Carolina). Continuous data were expressed as mean ± standard deviation (SD) or median (range), and categorical variables were described in frequencies and proportions. Overall discordance was defined as a range disagreement between the LVEF as measured by TTE and the CMRI per case. LVEF ranges were defined as <30%, ≥30 to <50%, and ≥50%. The overall discordance rate for patients meeting inclusion criteria was calculated as the number of cases from the selected population where there was discordance, divided by the total cases in the selected population. The discordance rate between the CMRI as compared with the TTE for an individual CMRI or TTE range was defined as the percentage of cases in which the comparison method reading was above the given range for the reference method. Bi-level categorical comparisons on continuous metric means were assessed by 2-sided *t* tests; a 2-sided Wilcoxon rank-sum test with *t* adjustment (due to small sample size) for a comparison of distributions was used if the normality assumption of the *t* test was in question. Clopper-Pearson exact confidence intervals (CIs) were calculated for binomial proportions. A Bland-Altman plot was used to illustrate systematic trends in the differences between the TTE and CMRI. With this plot, the mean value of the differences obtained between LVEFs as determined by TTE and CMRI are shown in the abscissa axis. Lin concordance correlation coefficient with macro implementation was used to compare ejection fraction agreement between the TTE and CMRI.[19] A paired *t* test was used to compare the LVEFs as determined by TTE and CMRI. Categorical variables were assessed using χ^2 tests; a Fisher exact test was used if the expected cell count was less than 5 for at least 25% of cells. A *P* value of <.05 was considered significant.

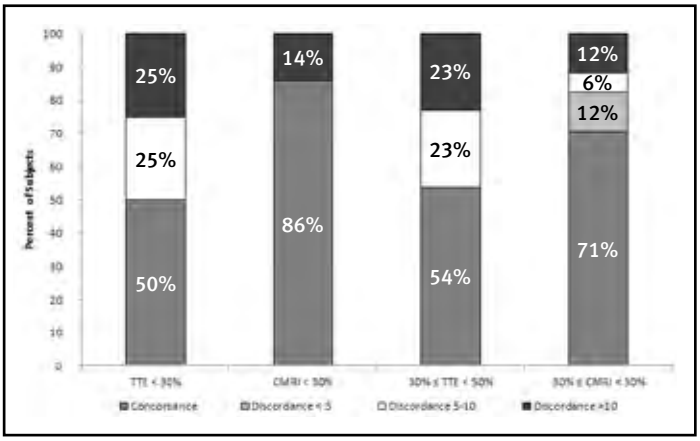


Figure 1. LVEF agreement between TTE and CMRI. Discordance is measured in percentage points. Illustration of CMRI as the reference modality having much lower discordance rates than TTE for each clinically relevant cutpoint.

Abbreviations: LVEF, left ventricular ejection fraction; TTE, transthoracic echocardiography; CMRI, cardiac magnetic resonance imaging.

RESULTS

General

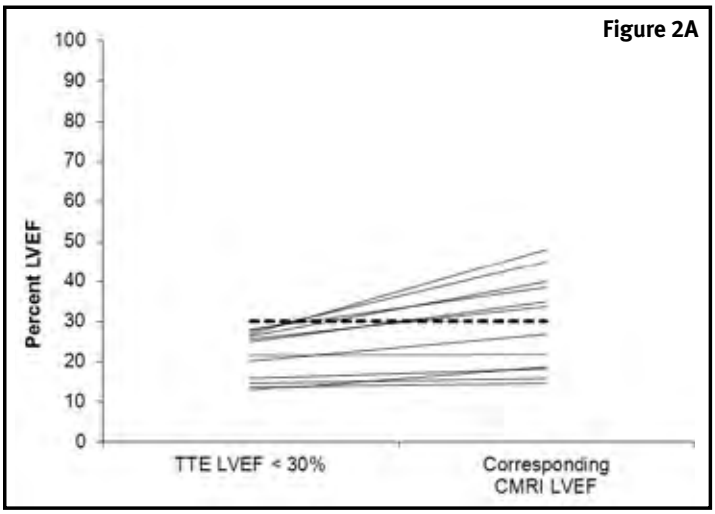
Of the initial 100 patients, 12 patients were excluded for having had an MI within 6 months preceding initial imaging, 10 were excluded for missing TTE or CMRI variables, 2 were excluded for clinically significant therapeutic changes between the imaging studies, and 46 did not have an LVEF <50% by at least 1 modality. The remaining 30 patients compose the study group. Comparison of demographic profiles between the study group and the 70 patients in the excluded group revealed higher rates of heart failure and current smokers in the study group. This was expected because patients in the excluded group were excluded for either study criteria or LVEF >50% by both modalities and, thus, represented a healthier population. Further analysis was confined to the medical records of the 30 patients in the study group. The median interval between the TTE and CMRI studies for the study group was 16 days (range 0 to 42 days). In 90% of patients, TTE preceded the CMRI.

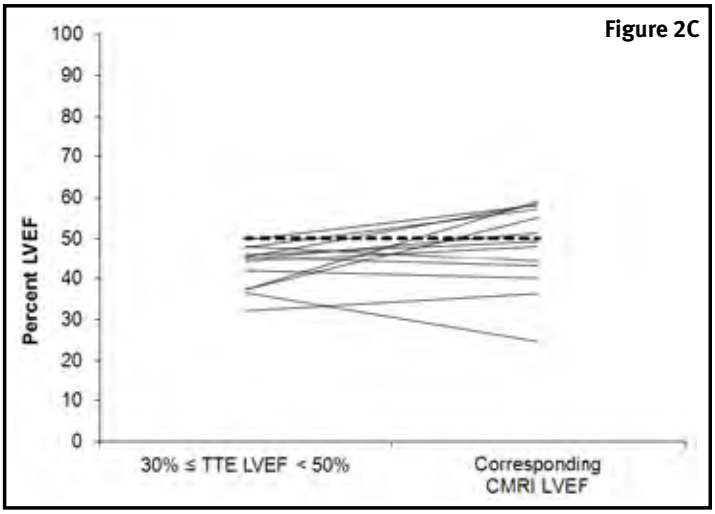
Comparison of LVEF as measured by TTE and CMRI

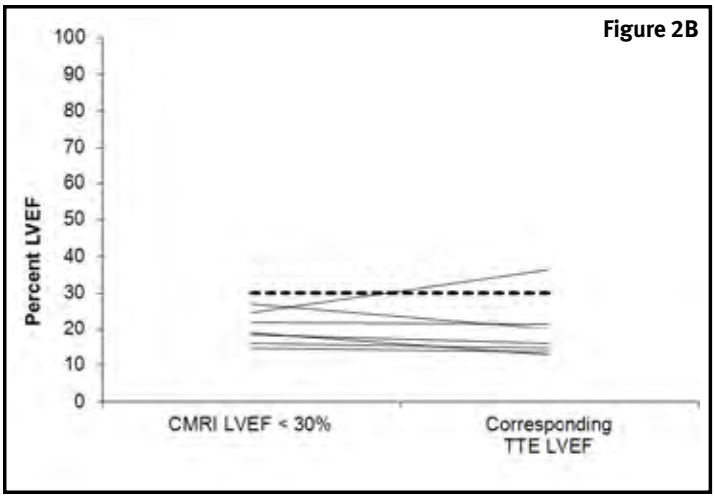
The study patients' LVEF values were broken into 4 groups based on LVEF ranges for TTE and CMRI:

- TTE <30% (n = 12)
- CMRI <30% (n = 7)
- TTE ≥30% to <50% (n = 13)
- CMRI ≥30% to <50% (n = 17)

In the TTE <30% group, 6 patients (50%) had discordant LVEF by CMRI as ≥30% with differences in LVEF of 5% to 10% in 3 patients (25%) and >10% in 3 patients (25%). In the CMRI <30% group, 1 patient (14%) had discordant LVEF by TTE as ≥30% with a difference in LVEF of >10%. In the TTE ≥30% to <50% group, 6 patients (46%) had discordant LVEF by CMRI as ≥50%, with differences in LVEF of 5% to 10% in 3 patients (23%) and >10% in 3 patients (23%). In the CMRI ≥30% to <50% group, 5 patients (30%) had discordant LVEF by TTE as ≥50%, with differences in LVEF of 0% to 5% in 2 patients (12%), 5% to 10% in 1 patient (6%), and >10% in 2 patients (12%) (Figure 1). The analysis illustrates that the CMRI groups







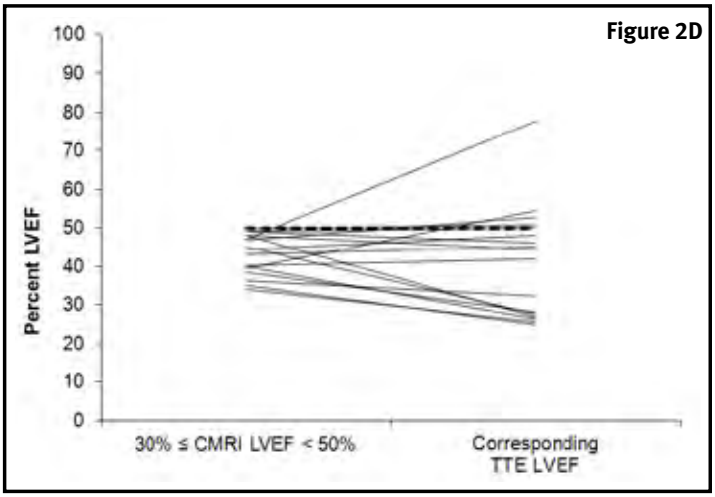


Figure 2. Differences in LVEF values by modality and cutpoint. The dot-and-line diagrams for TTE as the reference modality (A) LVEF ‹30% and (C) LVEF 30% to ‹50%; and CMRI as the reference modality (B) LVEF ‹30% and (D) LVEF 30% to ‹50% showing the differences in LVEF values for the corresponding modality for each clinically relevant LVEF cutpoint. Abbreviations as in Figure 1.

Table 1. Comparison of Demographic Characteristics from Discordant and Concordant LVEF Patients

Characteristic	Discordant LVEF n=18	Concordant LVEF n=12	*P* Value
Age, y	54 ± 21	55 ± 16	.894
BMI, kg/m^2	27 ± 8	29 ± 7	.453
Men	8 (44)	7 (58)	.456
TTE to CMRI, median days (range)	20.5 (2-42)	5 (0-38)	.064
TTE as first-line study	17 (94)	10 (83)	.548
IV contrast use	2 (11)	0 (0)	.503
TTE good quality[a]	16 (89)	10 (91)	›.999
CMRI good quality	18 (100)	12 (100)	NA
Arrythmia	6 (33)	7 (58)	.176
Anxiety	4 (22)	4 (33)	.678
Asthma	4 (22)	2 (17)	.999
CAD	6 (33)	5 (42)	.712
COPD	1 (6)	2 (17)	.548
Depression	5 (28)	6 (50)	.266
Diabetes mellitus	5 (28)	3 (25)	›.999
Heart failure	7 (39)	9 (75)	.052
Hypertension	10 (56)	7 (58)	.880
Hypothyroid	4 (22)	3 (25)	›.999
Renal failure	1 (6)	2 (17)	.548
History of smoking	2 (11)	4 (33)	.184
Current smoker	6 (33)	5 (42)	.712

Abbreviations: BMI, body mass index; IV, intravenous; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease. All others as in Figure 1.

Values are presented as n (%) or mean ± standard deviation unless otherwise noted.

[a]TTE quality assessment missing for 1 subject in each group.

had lower discordance rates (14% and 29%, respectively) than the TTE groups (50% and 46%, respectively), although small sample size produced large confidence intervals. This is also illustrated in the dot-and-line diagrams in Figures 2A through D, which show the reference modality (TTE or CMRI) with the clinically relevant LVEF range (<30% or ≥30% to ≤50%) compared with the corresponding modality LVEF value on a case-by-case basis.

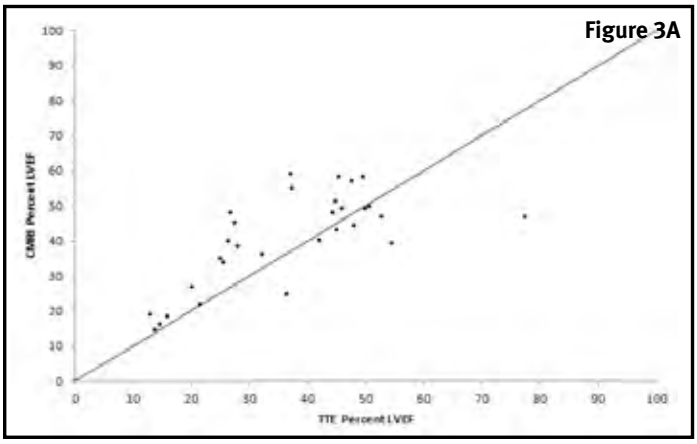
Overall pooled analysis, which had a 60% overall discordance rate, found no significant differences between the discordant and concordant groups. However, median days between scans for the discordant and concordant groups (20.5 days [range 2 to 42] vs 5 days [range 0 to 38]; $P = .064$) neared significance. We do not believe this finding is clinically relevant because major changes in LVEF typically do not occur in the absence of major therapeutic changes or event occurrence within the median 20.5 days for the discordant group in this study. The TTE preceded the CMRI in 94% of the discordant cases and 83% of the concordant cases ($P = .548$). Of note, IV contrast was used in 11% of the discordant group (Definity, n = 2; both scans were graded as good quality) compared with none in the concordant group ($P = .503$). The 2 discordant studies used Definity IV contrast for LV opacification and endocardial edge detection (Table 1).

To verify that there were no major differences in concordant versus discordant patients, 2-sided *t* tests and 2-sided Wilcoxon rank-sum tests were performed per group when possible. No significant differences within groups were found for any group

for any characteristic assessed, with the exception of a greater proportion of heart failure patients in the concordant patients of the TTE ≥30% to <50% group, that is, patients with LVEF of ≥30% to <50% by both TTE and CMRI; more specifically, statistical differences in sex, age, body mass index (BMI), image quality, arrhythmia, and days between TTE and CMRI, which were expected to affect the discordance analysis, were not found. However, when evaluating the median LVEF in the concordant and discordant subgroups within the TTE <30% group, the median LVEF was significantly lower in the concordant subgroup (15.4%, range 13% to 21.6%) compared with the median LVEF in the discordant subgroup (26.6%, range 25% to 48.1%; P = .017). Similar analysis failed to show difference in median LVEF between the concordant and discordant subgroups within the TTE ≥30% to <50% and CMRI ≥30% to <50% groups. The CMRI <30% group did not meet criteria for analysis due to small sample size.

Assessing agreement of LVEF by TTE and CMRI using Lin's concordance correlation coefficient (CCC) for data from all groups yielded a mean marginally satisfactory result of r_c = 0.689 (95% CI, 0.45 to 0.83). Results of the Bland-Altman analysis demonstrated a possible trend for TTE to underestimate LVEF compared with CMRI and are depicted in Figures 3A and 3B, encompassing ±2 SD from the mean. Although not significant, this was validated by a paired t test that shows on average the CMRI LVEF was 3.8% ± 10.9% higher than the TTE LVEF (P = .068).

The impact of image quality on discordance for the study cohort was specifically addressed. When imaging studies were reviewed as part of standard care, as a whole, 90% of TTE studies and 100% of CMRI studies were graded as good quality. Nonetheless, 60% of patients' LVEF measurements by TTE and CMRI were discordant.



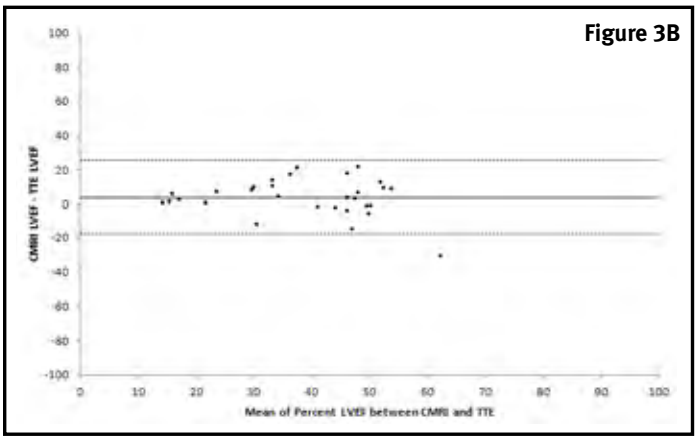


Figure 3. Bland-Altman comparison between TTE- and CMRI-obtained LVEF.

Concordance correlation coefficient (CCC) and Bland-Altman results between measurements of LVEF obtained by TTE and CMRI (A, B). Mean difference ± standard deviation (%), 3.8 ± 10.9; CCC, r_c = 0.689; paired t test, P = .068; Bland-Altman limits (%), -18 to 26; Bland-Altman range (%), 44. Abbreviations: CCC, concordance correlation coefficient; other abbreviations as in Figure 1.

DISCUSSION

This study was not designed to prove the superiority or inferiority of TTE or CMRI for the measurement of LVEF; rather, the intent was to demonstrate that a considerable difference in TTE- and CMRI-obtained LVEF values is possible. This difference can translate into differences in therapeutic decision making and prognostication. Due to the increasing use of CMRI, it is important to understand the degree to which these LVEF assessments are interchangeable with the more common assessment by TTE. In this study, we sought to compare the LVEF obtained from TTE versus CMRI in clinically relevant ranges that could influence major clinical decisions made based on LVEF alone. Our study was performed in a community hospital–based setting, which many clinicians will find representative of a real-world clinical setting.

It is well established that TTE as a diagnostic modality has superb capabilities with the components of 2-dimensional (2D), M-mode, and color and spectral Doppler imaging.[17,18,20] Arguments have been raised that most outcome-based studies assessing LVEF have been performed using TTE data; however, when the methods of outcome studies are carefully reviewed, baseline LVEF values have been assessed by several different modalities and not by TTE alone. For example, in the Multicenter Automatic Defibrillator Implantation Trial II (MADIT II), LVEF was assessed by angiography, multi-gated resting radionuclide ventriculogram, or echocardiography,[1] and in the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT), LVEF values obtained by nuclear imaging or echocardiography were accepted.[2] In fact, the 2008 American College of Cardiology/American Heart Association/Heart Rhythm Society guidelines for the use of device-based therapy for the treatment of cardiac rhythm abnormalities acknowledge "that the determination of LVEF lacks a 'gold standard' and that there may be variation among the commonly used clinical techniques of LVEF determination. All clinical methods of LVEF determination lack precision and the accuracy of techniques vary among laboratories and institutions." At present, the writing committee recommends that clinicians use the LVEF determination that is believed to be the most clinically accurate and appropriate in their respective institutions.[5]

We found it interesting to note that in a clinically relevant range, there was less discordance when the CMRI was used as the reference modality than when TTE was used for the same clinically relevant range. This was not unexpected because the CMRI-obtained LVEFs in our study were typically higher on average when compared with the TTE-obtained LVEF. Gardner et al [21] recently

reported that when compared with CMRI, TTE underestimated LVEF by 4 percentage points, which is similar to our finding of a 3.8% ± 10.9% difference. This difference between modalities is further corroborated by the results from Hoffmann and colleagues in 2006 and those reported from the Carvedilol Hibernation Reversible ISchaemia Trial; MArker of Success (CHRISTMAS) trial in 2000, which concluded that LVEF values determined by 1 modality cannot be assumed to be interchangeable with those obtained by other modalities.[22,23]

It would be unethical and impractical to perform an outcome-based study in this population with a nonintervention control group. But due to the amount of discordance in LVEF between modalities found in this study, we suggest that prior to making any major clinical decisions based on LVEF obtained by TTE, another modality, particularly CMRI, should be used to corroborate the information.

Our study demonstrated that even though the quality of the TTE study was graded as good, the LVEF measurement was discordant compared with CMRI-measured LVEF in 60% of cases. This may be explained by errors introduced by gain-dependent edge identification, the 2D nature of TTE as a modality, and transducer position during TTE imaging foreshortening the views, which may contribute to differences between TTE and CMRI reported previously. Additionally, even with good-quality images that encompass different subjective reader thresholds in evaluation of LVEF, reader differences exist. By comparison, CMRI acquires high-resolution tomographic images that are free of geometric assumptions, accurate, and reproducible.[24,25]

Limitations

This was a retrospective study, which has inherent limitations. However, the TTE and CMRI images were interpreted in the course of routine day-to-day work flow in a real-world clinical setting, thus eliminating the intrinsic bias that occurs in a prospective blinded study in which the reader is quite cautious and spends a longer time on interpretation. While TTE and CMRI were not performed on the same day for the majority of patients, situations that arose in the interval between scans that may have caused changes in LVEF measurements were identified and those individuals excluded from the analysis. Finally, small sample size within each group may not provide sufficient power to detect differences; however, extreme differences likely would have been detected by the pooled analysis of the groups.

Clinical Implications

Differences in TTE- and CMRI-obtained LVEF were found in a number of patients. CMRI had lesser rates of discordance for established LVEF ranges (<30%, ≥30% to ≤50%) when used as the reference modality than TTE when it was used as the reference modality. These findings suggest that CMRI confirmation of LVEF be obtained prior to making major management decisions because the results may influence individual patient treatment plans. Based on these findings, we believe our data have several clinical implications.

Primary Prophylaxis with ICD

When TTE- and CMRI-derived LVEF values are within 5% of each other, some would argue that using a CMRI-derived LVEF that is marginally greater than 30% can deprive high-risk individuals of life-saving ICD placement. This is especially true if the TTE-derived LVEF is less than 30% because we know that LVEF values across different modalities are not interchangeable. However, when the difference between TTE- and CMRI-derived LVEF is considerable (>10%), the decision to implant ICD for primary prophylaxis may need to be re-evaluated. On the other hand, if the TTE-derived LVEF is <20%, the CMRI-derived LVEF is not likely to be >30%. Recommendations from future ICD trials should be modality-specific for assessment of LVEF.

Diagnosis of Cardiomyopathy

Before making a diagnosis of cardiomyopathy based on TTE-derived LVEF marginally less than 50%, especially if a patient's clinical profile does not fit the diagnosis, a practitioner should strongly consider corroborating the findings with CMRI. Myocardial tissue characterization by CMRI may offer additional diagnostic and prognostic pieces of information.

Withholding Cardiotoxic Chemotherapy

Likewise, a decision to withhold potentially cardiotoxic chemotherapy for otherwise treatable cancer based on a TTE-derived LVEF marginally less than 50% should be re-evaluated if the patient's clinical profile conflicts with that finding. CMRI should again be considered for corroboration of TTE-derived LVEF. In this clinical presentation, myocardial tissue characterization by CMRI may add additional diagnostic and prognostic information, as well. CMRI may be the appropriate first-line test for the monitoring of LVEF in these patients.

CONCLUSION

In conclusion, this study contributes to the body of evidence that suggests that LVEF assessment by 1 modality cannot be assumed to be interchangeable with that by other modalities. Further research in this area is needed to confirm our findings. We suggest that future research establish modality-specific cutpoint ranges for LVEF as the basis for clinical decision making.

REFERENCES

1. Moss AJ, Cannom DS, Daubert JP, et al. for the MADIT II Investigators. Multicenter Automatic Defibrillator Implantation Trial II (MADIT II): Design and clinical protocol. *Ann Noninvasive Electrocardiol*.1999;4(1):83-91.
2. Bardy GH, Lee KL, Mark DB, et al. for the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT) Investigators. Amiodarone or an implantable cardioverter-defibrillator for congestive heart failure. *New Eng J Med*. 2005;352(3):225-237.
3. Patrianakos AP, Parthenakis FI, Mavrakis HE, Zacharis EA, Vardas PE. Late left ventricular color M-mode Doppler in the assessment of diastolic dysfunction in patients with dilated cardiomyopathy. *J Am Soc Echocardiogr*.2006;18(9):979. e1-e2.
4. Bloom KR, Bini RM, Williams CM, Sonley MJ, Gribbin MA. Echocardiography in adriamycin cardiotoxicity. *Cancer*. 1978;41(4):1265-1269.
5. Budoff MJ, Cohen MC, Garcia MJ, et al, for the American College of Cardiology Foundation, American Heart Association, American College of Physicians Task Force on Clinical Competence and Training, American Society of Echocardiography, American Society of Nuclear Cardiology, Society of Atherosclerosis Imaging, Society for Cardiovascular Angiography & Interventions. ACCF/AHA clinical competence statement on cardiac imaging with computed tomography and magnetic resonance: a report of the American

College of Cardiology Foundation/American Heart Association/ American College of Physicians Task Force on Clinical Competence and Training. *J Am Coll Cardiol*. 2005;46(2):383-402.

6. Barkhausen J, Ruehm SG, Goyen M, Buck T, Laub G, Debatin JF. MR evaluation of ventricular function: true fast imaging with steady-state precession versus fast low-angle shot cine MR imaging: feasibility study. *Radiology* 2001; 219(1):264-269.
7. Mitchell SC, Lelieveldt BP, van der Geest RJ, Bosch HG, Reiber JH, Sonka M. Multistage hybrid active appearance model matching: segmentation of left and right ventricles in cardiac MR images. *IEEE Trans Med Imaging*. 2001;20(5):415-423.
8. Spotnitz HM. Macro design, structure, and mechanics of the left ventricle. *J Thorac Cardiovasc Surg*. 2000;119(5):1053-1077.
9. Hershman DL, Shao T. Anthracycline cardiotoxicity after breast cancer treatment. *Oncology (Williston Park).* 2009;23(3):227-234.
10. Meinardi MT, van der Graaf WTA, van Veldhuisen DJ, Gietema JA, de Vries EGE, Sleijfer DT. Detection of anthracycline-induced cardiotoxicity. *Cancer Trea Rev*. 1999;25(4):237-247.
11. St John Sutton MG, Plappert T, Abraham WT, et al, for the Multicenter InSync Randomized Clinical Evaluation (MIRACLE) Study Group. Effect of cardiac resynchronization therapy on left ventricular size and function in chronic heart failure. *Circulation*. 2003;107(15):985-990.
12. Cleland JG, Daubert JC, Erdmann E, et al, for the Cardiac Resynchronization-Heart Failure (CARE-HF) Study Investigators. The effect of cardiac resynchronization on morbidity and mortality in heart failure. *N Engl J Med*. 2005;352(15):1539-1549.
13. Yusuf S, Sleight P, Pogue J, Bosch J, Davies R, Dagenais G, for the Heart Outcomes Prevention Evaluation Study Investigators. Effects of an angiotensin-converting–enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. *N Engl J Med*. 2000;342(3):145-153.
14. Hoffmann R, Lethen H, Marwick T, et al. Analysis of interinstitutional observer agreement in interpretation of dobutamine stress echocardiograms. *J Am Coll Cardiol*. 1996;27(2):330-336.
15. Nagel E, Lehmkuhl HB, Bocksch W, et al. Noninvasive diagnosis of ischemia-induced wall motion abnormalities with the use of high-dose dobutamine stress MRI: comparison with dobutamine stress echocardiography. *Circulation*. 1999;99(6):763-770.
16. Hoffmann R, Marwick TH, Poldermans D, et al. Refinements in stress echocardiographic techniques improve inter-institutional agreement in interpretation of dobutamine stress echocardiograms. *Eur Heart J*. 2002;23(1):821-829.
17. Cho GY, Marwick TH, Kim HS, Kim MK, Hong KS, Oh DJ. Global 2-dimensional strain as a new prognosticator in patients with heart failure. *J Am Coll Cardiol*. 2009;54(7):618-624.
18. Ghali JK, Liao Y, Cooper RS. Influence of left ventricular geometric patterns on prognosis in patients with or without coronary artery disease. *J Am Coll Cardiol*. 1998;31(7):1635-1640.
19. Dierkhising R. SAS Macro computes Lin's concordance correlation coefficient (CCC) for any number of raters. Rochester, MN: Mayo Clinic, Division of Biomedical Statistics and Informatics. http://mayoresearch.mayo.edu/biostat/upload/. Published 2006. Accessed September 29, 2010.
20. Quinones MA, Waggoner AD, Reduto LA, et al. A new, simplified and accurate method for determining ejection fraction with two-dimensional echocardiography. *Circulation*. 1981;64(4);744-753.
21. Gardner BI, Bingham SE, Allen RM, Blatter DD, Anderson JL. Cardiac magnetic resonance versus transthoracic echocardiography for the assessment of cardiac volumes and regional function after myocardial infarction: an intrasubject comparison using simultaneous intrasubject recordings [abstract]. *Cardiovasc Ultrasound*. 2009;7(1):38.
22. Hoffmann R, von Bardeleben S, Kasprzak JD, et al. Analysis of regional left ventricular function by cineventriculography, cardiac magnetic resonance imaging, and unenhanced and contrast-enhanced echocardiography: a multicenter comparison of methods. *J Am Coll Cardiol*. 2006;47(1):121-128.
23. Bellenger NG, Burgess MI, Ray SG, et al. Comparison of left ventricular ejection fraction and volumes in heart failure by echocardiography, radionuclide ventriculography and cardiovascular magnetic resonance; are they interchangeable? *Eur Heart J*. 2000; 21(16):1387-1396.
24. Semelka RC, Tomei E, Wagner S, et al. Interstudy reproducibility of dimensional and functional measurements between cine magnetic resonance imaging studies in the morphologically abnormal left ventricle. *Am Heart J*. 1990;119(6):1367-1373.
25. Bellenger NG, Gatehouse PD, Rajappan K, Keegan J, Firmin DN, Pennell DJ. Left ventricular quantification in heart failure by cardiovascular MR using prospective respiratory navigator gating: comparison with breath-hold acquisition. *J Cardiovasc Magn Reson*. 2000;11(4):411-417.

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Nature and Extent of Financial Conflicts of Interest among Planning Committee Members, Speakers, and Abstract Presenters at the American Association for Cancer Research Annual Meetings

ABSTRACT

Purpose: *We examined the types and prevalence of self-reported financial conflicts of interest (FCOIs) among researchers at a basic science–oriented cancer research meeting.*

Design: *Using the 2006, 2007, and 2008 American Association for Cancer Research (AACR) meeting program books, we tallied the types and number of FCOIs reported by planning committee (program and education) members, speakers for education sessions, and abstract presenters. FCOI data were available for abstract presenters only in 2006.*

Results: *A total of 644 planners, 1371 speakers, and 6120 abstract presenters were listed in the 3 AACR meeting program books examined. FCOIs were reported by 40.5%, 40.3%, and 13.8% of planners, speakers, and abstract presenters, respectively. Overall, the types of FCOI were distributed as follows: employment (27.7%), grants (17.3%), consulting (16.8%), stocks (13.0%), advisory board (12.4%), honoraria (4.5%), speakers bureau (2.0%), and other remunerations (6.4%), but the distribution varied between groups, with abstract presenters more likely than planners and speakers (57.7% vs 33.0%) to have employment or grants as their FCOI type. Among those with disclosures, 54.6% of planners and speakers and 42.0% of abstract presenters reported more than 1 FCOI. Over time, the percentage of those reporting FCOIs increased among planners (*$P = .009$*) and speakers (*$P < .001$*).*

Conclusion: *At a major basic science–oriented cancer meeting, FCOIs were commonly reported by planning committee members and speakers, and reported FCOIs increased over time. Substantially fewer FCOIs were reported by abstract presenters than by planners and speakers. Most FCOIs were unrelated to research funding or employment.*

According to the Merriam-Webster dictionary, a conflict of interest is a conflict between the private interests and the official responsibilities of a person in a position of trust. Financial conflicts of interest (FCOIs) between academia and industry are widespread and on the increase.[1,2] The competing interests of academia and industry may introduce bias or call into question the objectivity of scientific reporting, leading some professional groups and physician leaders to call for extensive change in way industry and physicians interact. The 2008 report of the Association of American Medical Colleges strongly encouraged the profession to manage all real or perceived FCOIs through effective self-regulation, particularly industry support of medical education.[3]

In 2009, the Institute of Medicine issued a report on primary (financial) and secondary (professional advancement, recognition for personal achievement, and favors to friends, family, students, or colleagues) conflicts of interest. The report contained a comprehensive set of recommendations intended to further restrict and oversee different types of conflicts of interest in various settings, including research, education, and practice.[4]

Studies of human psychology suggest that biases in research are generally unintentional. Therefore, despite training and professionalism, researchers are not immune from external influences, especially when FCOIs exist.[5] While reporting FCOIs does not eliminate the conflict, it allows the public to judge the credibility of the information presented in light of the conflict. Disclosure of FCOIs is now mandatory in most types of research reporting, and the first report of national data on department-level institutional academic-industry relations in academic medical

centers in the United States was published in 2007.[2]

Nonetheless, obstacles to full transparency remain. A large proportion of biomedical journals still do not require FCOI disclosure, and even when they do, many authors do not consistently disclose their FCOIs.[6] Further, no standard criteria or definitions for FCOI reporting exist. Recently, the International Committee of Medical Journal Editors (ICMJE) developed an electronic uniform disclosure form that was piloted among ICMJE member journals and placed it in the public domain for feedback.[7] This is a huge step in the right direction, but the extent to which the form will be adopted by other journals remains to be seen.

We previously reported that FCOIs were common among researchers at a prominent clinical cancer research meeting.[8] A substantial proportion of committee members (67%) and speakers (47%) reported at least 1 FCOI. Many abstract presenters (27%) had at least 1 FCOI, and most FCOIs (63%) were unrelated to the research presented or to employment status. Similar data among basic science cancer researchers are lacking. The purpose of the current study was to examine the nature and extent of self-reported FCOIs among researchers presenting at the American Association for Cancer Research (AACR) annual meeting. AACR is the largest and oldest scientific organization in the world focused on cancer research. Its annual meeting is generally oriented toward basic science and attracts almost 20 000 attendees from around the world.

MATERIALS AND METHODS

Data on the FCOIs of planning committee members, educational session speakers, discussants, and abstract session presenters were gathered from the AACR meeting program books from years 2006, 2007, and 2008. Beginning in 2007, AACR discontinued publishing FCOI information on abstracts, so data for abstract presenters were available for only 2006. The AACR requires that all commercial and/or financial relationships within the past 3 years that might be perceived as a real or potential conflict be disclosed. FCOIs were further disclosed as *relevant* (defined as same or similar subject matter; same, similar or competing drug or device, product or service, intellectual property or asset; or with the potential to result in financial, professional, or other personal gain or loss for themselves or an immediate family member), and as *major* or *minor* (*major* defined as personally receiving $10 000 or more during any 12-month period, or owning the equivalent in voting stock or share of the entity; and *minor* defined as personally receiving an amount less than $10 000 during any 12-month period, or owning the equivalent in voting stock or share of the entity).[9]

The monetary values of individual FCOIs reported were not made available to us by the AACR. The types of FCOI were divided as follows: research grants, employment, advisory board, consulting, honoraria, speakers bureau, stockholder, and other remunerations. The number and type of FCOI were tallied for each planning committee member, speaker, discussant, and abstract presenter. Data for speakers and discussants were combined for the analyses.

Descriptive statistics were used to describe the results. The proportion of FCOIs across the years was analyzed using the Cochran-Armitage trend test. A χ^2 test was used to compare the distributions of FCOI types among planning committee members, speakers, and abstract presenters. The Spearman correlation test was used to assess FCOIs per member and year. A P value of $< .05$ was considered significant. We calculated annual per-individual mean number of FCOIs by dividing the number of FCOIs reported by the total number of committee members and speakers. Because we did not have access to detailed individual-level information, we cannot report ranges, medians, or standard deviations.

RESULTS

The annual AACR meetings from 2006 through 2008 involved a total of 644 planning committee members and 1371 speakers. In 2006, 6120 abstracts were accepted for presentation. Overall, almost half of the planning committee members and speakers reported a FCOI, compared with less than a fifth of the abstract presenters. The percentage of planning committee members and speakers reporting FCOIs trended upward over time (P = .009 and P = .001, respectively) (Figure 1). Of those 1657 individuals reporting FCOIs, approximately 859 (52%) reported having 1 FCOI, 482 (29%) having 2 FCOIs, and 316 (19%) having 3 or more FCOIs. Of planning committee members reporting FCOIs,

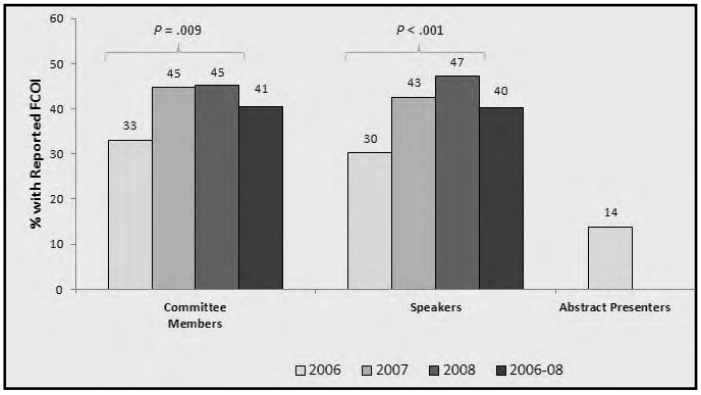

Figure 1. Proportion of planning/education committee members, speakers, and abstract presenters with reported financial conflicts of interest (FCOIs) over time.

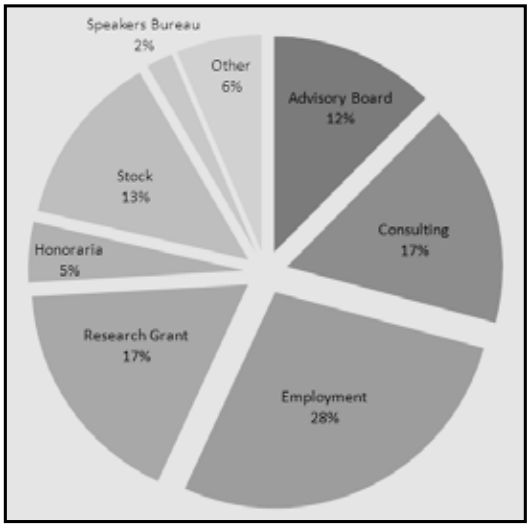

Figure 2. Distribution of types of financial conflicts of interest (FCOIs), 2006-2008.

the percentage who reported 3 or more trended up over time (13 of 77 [17%] in 2006; 28 of 113 [25%] in 2007; and 22 of 71 [31%] in 2008; $P = .045$).

Collectively, 2918 FCOIs were reported by planning committee members, speakers, and abstract presenters. Employment, research grant, and consulting were the most common types of FCOIs, comprising over half of all disclosures (Figure 2). The mean number of FCOIs per individual committee member or speaker increased over time (.56 in 2006, .80 in 2007, .88 in 2008; $P < .001$). Further analysis revealed that FCOI distribution varied among groups. For abstract presenters, over half of FCOIs were research grants and employment. Conversely, two-thirds of FCOIs for planning committee members and speakers were consulting, advisory board, and stock ownership. Comparison of FCOI types across planning committee members, speakers, and abstract presenters revealed significant differences between the groups ($P < .001$; Table).

DISCUSSION

For more than 3 decades, FCOI in medical research has been the subject of debate.[10] Without question, biases occur and have occurred in medical research, but their frequency and magnitude have been difficult to quantify. Furthermore, the complex relationships between government, academia, and industry help move research discovery to standard practice, but these relationships also have the potential to render the integrity of research vulnerable to external influences.

Several studies have been published describing the nature, extent, and implications of FCOIs in research and educational activities presented at various medical meetings.[6,11-16] For example, in a study of the 2001 and 2002 annual meetings of the American Academy of Orthopedic Surgeons, FCOIs were reported in 41% of abstracts presented. Only 40% of the FCOIs involved research funding. Positive study findings were significantly more common in studies authored by investigators with FCOIs related to royalties, stock options, and consulting than by those with FCOIs related to employment and research funding. FCOIs were also widespread among other types of presentations, including symposia (74%), instructional course lectures (60%), and scientific exhibits (60%).[11]

Another study involving the Radiological Society of North America 2003 Annual Meeting showed that FCOIs were reported in only 17% of abstracts presented; however, abstracts with FCOIs were twice as likely as those without such disclosures to discuss off-label use—that is, use of a commercial product for a purpose not approved by the US Food and Drug Administration.[12]

A more recent study that investigated the 2006 Annual Scoliosis Research Society found that FCOIs were reported in only 28% of abstracts. Slightly over half of the reported FCOIs (51%) were research grants. Favorable findings were more frequently reported among abstracts with FCOI categories of consulting and employment.[16]

Our study showed that FCOIs were widespread, with an increasing trend over the 3-year study period among the leading basic science oncology researchers. Approximately 40% of the planning committee members and speakers reported at least 1 FCOI. Interestingly, over two-thirds (67%) of all FCOIs were unrelated to the research being presented or to employment. In contrast, FCOIs were much less frequent among abstract presenters (14%) and were more likely to be related to either employment or research grant (57%). These findings are similar to what we previously found among researchers at a major clinical cancer research meeting.[8] To some degree, these similarities are expected because a part of the AACR annual meeting is devoted to clinical research presentations. Many researchers perform both laboratory and clinical research and, thus, present findings at both meetings.

Based on our data and other recent studies, we have several observations. Financial relationships between oncology researchers and industry are on the rise, despite heightened awareness regarding their potentially negative influence on research outcome and interpretation. This is disquieting because most of the FCOIs reported are not directly related to the research being presented or published. Possible explanations for this trend include the growing opportunities for collaborations between industry and researchers due to recent major advances in the molecular biology of cancers, researchers' and physicians' belief that their professional training and objectivity protect them from external influences,[17] and the irresistible enticement of monetary rewards. The monetary allure is exacerbated by the enormous disparity in compensation between academic and private oncologists, with the latter earning on average nearly double that of the former.[18,19]

Stakeholders in medical research generally agree that FCOIs may influence research outcome or its interpretation, and therefore, that declaration is important.[4] However, most agree that FCOI disclosure alone does not eliminate biases. Therefore, in addition to reporting FCOIs, researchers must make every effort to reduce unintentional biases. This should not stifle research progress because our study and others generally show that research grants and employment FCOIs comprised a minority of

Table. Distributions of Financial Conflicts of Interest (FCOIs) for Planning/Educating Committee Members, Speakers, and Abstract Presenters across FCOI Types[a]

FCOI Type	Committee Members n = 644 FCOIs = 497	Speakers n = 1371 FCOIs = 1003	Abstract Presenters n = 6120 FCOIs = 1418
Advisory Board	85 (17.1)	170 (17.0)	108 (7.6)
Consulting	108 (21.7)	213 (21.2)	168 (11.9)
Employment	41 (8.3)	135 (13.5)	633 (44.6)
Research Grant	124 (25.0)	195 (19.4)	186 (13.1)
Honoraria	37 (7.4)	68 (6.8)	25 (1.8)
Stock	62 (12.5)	157 (15.7)	59 (11.2)
Speakers Bureau	16 (3.2)	29 (2.9)	13 (0.9)
Other	24 (4.8)	36 (3.6)	126 (8.9)

All values presented as number of FCOIs (%).

[a]Distribution of FCOIs across subgroups was significantly different (P <.001).

the disclosures.[8,11,12] While it is not unethical to accept money for activities like consulting and public speaking, forgoing monetary rewards or diverting them to their institution or charity of choice would greatly reduce the appearance of bias. In fact, the new ICMJE disclosure form distinguishes money paid to the authors from that paid to their respective institutions.[7] Narrowing the compensation gap between academic and private practices could also minimize FCOIs.

Our study has limitations. While the reporting of FCOIs at the AACR meetings during the data collection period for this study was mandatory, the accuracy and completeness of disclosure information could not be verified. Self-reports can underestimate FCOIs if disclosures are incomplete, or overestimate FCOIs if disclosures unrelated to the specific research study are listed. A recent study suggests that FCOIs are reported inconsistently by authors publishing several articles on the same topic.[6] In order to address these shortcomings, medical organizations and journals could set uniform criteria and thresholds for FCOI reporting. In fact, in an editorial published simultaneously in 2010 in all ICMJE journals, the editors urged non-ICMJE journals to adopt the format of the new FCOI form they had developed in order to make disclosure easier for authors to use and less confusing for readers to interpret.[7]

In our study, the monetary values of FCOIs reported were unavailable. Therefore, we did not perform value-based analysis. It is human nature to harbor biases in favor of desirable, or against undesirable, influences.[5] A corollary to this is that the degree of bias can be influenced by the degree of incentive or disincentive. Moreover, even when research grant and employment are excluded, the value of financial incentives varies widely—from less than $10 000 to more than $100 000.[13] Thus, value-based reporting of FCOIs may be important and should be made available to the public. Unfortunately, to our knowledge, no journal in the English literature requires this level of transparency. Another recent study reported that of the 41 physicians receiving in excess of $1 million in 2007 from companies manufacturing orthopedic devices, FCOIs with the specific orthopedic device manufacturers were disclosed in only 46% of their publications. Among the subgroup of authors who published more than 1 article, only 15% consistently mentioned the company name. It is likely that both journals and authors contribute to this inconsistency by not soliciting or publishing complete FCOIs, as well as by believing that the support is irrelevant to the reported research.[19] And lastly, the effect of multiple FCOIs per individual was unknown for the analysis of FCOI distributions across categories of planning committee members, speakers, and abstract presenters, but it was reasonable to expect there was some correlation between FCOIs for an individual.

At a major basic science cancer research meeting, FCOIs were common among abstract presenters, but even more so among planning committee members and speakers. FCOI reporting appears to be increasing over time among planning committee members and speakers. The majority of FCOIs reported were unrelated to research funding or employment and, therefore, could be avoided without stifling research progress. While the influence of FCOIs on the way oncologists and researchers conduct, interpret, and present the results of their research cannot be determined from this study, the potential for such influence is considerable.

REFERENCES

1. Bekelman JE, Li Y, Gross CP. Scope and impact of financial conflicts of interest in biomedical research: a systematic review. *JAMA*. 2003;289(4):454-465.
2. Campbell EG, Weissman JS, Ehringhaus S, et al. Institutional academic industry relationships. *JAMA*. 2007;298(15):1779-1786.
3. Association of American Medical Colleges (AAMC). Industry Funding of Medical Education: Report of an AAMC Task Force. https://services.aamc.org/publications/showfile.cfm?file=version114.pdf&prd_id=232&prv_id=281&pdf_id=114. Updated 2008. Accessed March 23, 2011.
4. Lo B, Field MJ, eds. *Conflict of Interest in Medical Research, Education, and Practice*. Washington, DC: National Academies Press; 2009
5. Cain DM, Detsky AS. Everyone's a little bit biased (even physicians). *JAMA*. 2008;299(24):2893-2895.
6. Weinfurt KP, Seils DM, Tzeng JP, Lin L, Schulman KA, Califf RM. Consistency of financial interest disclosures in the Bbomedical literature: the case of coronary stents. *PLoS ONE*. 2008;3(5):e2128. http://dx.plos.org/10.1371%2Fjournal.pone.0002128. Accessed June 13, 2011.
7. Drazen JM, Van Der Weyden MB, Sahni P, et al. Uniform format for disclosure of competing interests in ICMJE journals. *Ann Intern Med*. 2010;152(2):125-126.
8. Johnston KL, Go RS. Financial conflicts of interest among ASCO annual meeting abstract authors, speakers, and planners. *J Natl Cancer Inst*. 2007;99(18):1415-1416.
9. American Association for Cancer Research. American Association for Cancer Research: Conflict of Interest Disclosure. http://www.aacr.org/Uploads/DocumentRepository/Journals/AACRSmartSubmit/coi_corresponding_auth.pdf. Accessed March 23, 2011.
10. Blumenthal D, Gluck M, Louis KS, Wise D. Industrial support of university research in biotechnology. *Science*. 1986;231(4735):242-246.
11. Okike K, Kocher MS, Mehlman CT, Bhandari M. Conflict of interest in orthopaedic research. An association between findings and funding in scientific presentations. *J Bone Joint Surg Am*. 2007;89(3):608-613.
12. Brown SD, Daly JC, Kalish LA, McDaniel SA. Financial disclosures of scientific papers presented at the 2003 RSNA Annual Meeting: association with reporting of non-Food and Drug Administration–approved uses of industry products. *Radiology*. 2006;239(3):849-855.
13. Hampson LA, Joffe S, Fowler R, Verter J, Emanuel EJ. Frequency, type, and monetary value of financial conflicts of interest in cancer clinical research. *J Clin Oncol*. 2007;25(24):3609-3614.
14. Bhattacharyya N, Lin HW. Prevalence and reliability of self-reported authorship disclosures in *Otolaryngology-Head and Neck Surgery*. *Otolaryngol Head Neck Surg*. 2009;141(3):311-315.
15. Kubiak EN, Park SS, Egol K, Zuckerman JD, Koval KJ. Increasingly conflicted: an analysis of conflicts of interest reported at the annual meetings of the Orthopaedic Trauma Association. *Bull Hosp Jt Dis*. 2006;63(3-4):83-87.
16. Roach JW, Skaggs DL, Sponseller PD, Macleod LM. Is research presented at the Scoliosis Research Society annual meeting influenced by industry funding? *Spine (Phila Pa 1976).* 2008;33(20):2208-2212.
17. Smith TJ, Girtman J, Riggins J. Why academic divisions of hematology/oncology are in trouble and some suggestions for resolution. *J Clin Oncol*. 2001;19(1):260-264.
18. Todd RF,3rd. A guide to planning careers in hematology and oncology. *Hematology Am Soc Hematol Educ Program*. 2001:499-506.
19. Chimonas S, Frosch Z, Rothman DJ. From disclosure to transparency: the use of company payment data. *Arch Intern Med*. 2011;171(1):81-86.

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Ertapenem in the Treatment of *Staphylococcus aureus* Bone and Joint Infections: A Retrospective Double Cohort Study

ABSTRACT

Background: *The safety and efficacy of ertapenem in the treatment of methicillin-sensitive* Staphylococcus aureus *(MSSA) bone and joint infections is unknown. The purpose of our study was to compare the outcomes of patients with MSSA bone and joint infections who were treated with ertapenem with those of patients treated with other antimicrobials.*

Methods: *We retrospectively studied the medical records of 28 adult patients with MSSA bone and joint infections treated with ertapenem (ertapenem group) or other comparator antimicrobial (comparator group) at our institution from 2002 through 2006. Comparisons between categorical and continuous data were performed using the Fisher exact and Wilcoxon rank sum tests, as appropriate.*

Results: *None of the 10 patients in the ertapenem group experienced definite treatment failure, while 2 of the 18 patients in the comparator group did.*

Conclusion: *Once-daily dosed ertapenem shows promise for MSSA bone and joint infection.*

Pyogenic bone and joint infections typically require prolonged, usually parenteral, antimicrobial therapy and surgical debridement to achieve cure.[1] Therefore, once-daily outpatient parenteral antimicrobial therapy (OPAT) to treat bone and joint infections is attractive to both patients and providers. *Staphylococcus aureus* (*S. aureus*) is the most common causative pathogen in bone and joint infections. Currently recommended first-line therapies for *S. aureus* bone and joint infections typically require multiple daily doses.[1]

Ertapenem, a carbapenem antimicrobial, is dosed once daily and has been shown to have clinical and *in vitro* activity against methicillin-sensitive *S. aureus* (MSSA).[2,3] It is approved for the treatment of complicated skin and skin structure infections, including diabetic foot infections *without* osteomyelitis, among other indications.[4] There are scant published data available concerning the use of ertapenem in the treatment of bone and joint infections,[5,6] and none to our knowledge concerning staphylococcal bone and joint infections.

We present our experience with ertapenem in the treatment of MSSA bone and joint infections compared with comparator antimicrobials.

METHODS

Following Institutional Review Board approval, we conducted a retrospective double cohort study at our institution, a tertiary teaching hospital and multispecialty clinic located in the Midwest. The study population consisted of adult patients with bone and joint infection, as defined below, who were evaluated and treated at our institution from 2002 through 2006. Inclusion criteria were as follows: age >17 years, bone and joint infection as defined below, receipt of at least 2 weeks of either parenteral or highly bioavailable oral antimicrobial therapy, and MSSA as the causative pathogen.

Cases were identified by searching for ICD-9 codes used for bone and joint infections in hospitalized and outpatient subjects seen in our health system during the study period. The following ICD-9 codes were used to identify potential cases: osteomyelitis, 730.00-730.99, 731.8, 376.03, 526.4, 383.20-383.22; septic arthritis 711.0; prosthetic joint infection: 996.66; and epidural abscess 324.0, 324.1, 324.9. Patients thus identified were then screened to determine whether they met inclusion criteria.

Data were collected by retrospective review of the inpatient and outpatient medical record and were recorded into a predetermined data collection form. Definitions were developed prior to data collection as follows: (1) prosthetic joint infection = clinical

diagnosis of prosthetic joint infection and isolation of MSSA from either joint aspirate, intra-operative cultures, or 2 or more blood cultures; (2) osteomyelitis = clinical diagnosis of osteomyelitis and isolation of MSSA from bone cultures or histopathologic evidence of osteomyelitis and 2 or more blood cultures positive for MSSA; (3) septic arthritis (in the absence of prosthetic material) = clinical diagnosis of septic arthritis and isolation of MSSA from either joint aspirate, intraoperative culture, or 2 or more blood cultures. Treatment failure was defined as clinician-diagnosed infection relapse supported by either histopathologic or microbiologic evidence.

Descriptive statistics were used to summarize the demographic, clinical, and treatment details. Comparisons between categorical and continuous data were performed using the Fisher exact and Wilcoxon rank sum tests, as appropriate.

RESULTS

Twenty-eight patients met study inclusion criteria. Of these, 10 patients received ertapenem as their primary medical therapy (ertapenem group), and the remaining 18 were treated with other antimicrobials (comparator group). Two additional patients were started on ertapenem therapy for bone and joint infections, but it was discontinued prior to completing 2 weeks of therapy because of possible adverse reactions: 1 patient developed a rash, while the other patient was felt to have drug-induced fever. Thus, these patients did not meet predetermined inclusion criteria and their data were not included in the baseline and follow-up data for the ertapenem group. The remaining 10 patients who received ertapenem had no significant adverse events noted.

Table 1. Demographic, Clinical, and Treatment Characteristics of 28 Patients with Bone and Joint Infection

Characteristic	Ertapenem Group n = 10	Comparator Group n = 18	*P*
Men age, y (range)	70 (25-89)	72 (47-92)	.508
Sex, Men/Women	8/2	10/8	.247
Diabetes mellitus	3 (30)	3 (17)	.635
Immunocompromised[a]	0 (0)	6 (33)	.062
Rheumatoid arthritis	0 (0)	2 (11)	.524
Infection type Upper extremity prosthetic joint infection Lower extremity prosthetic joint infection Lower extremity osteomyelitis Vertebral osteomyelitis	 0 (0) 7 (70) 2 (20) 1 (10)	 1 (6) 10 (56) 2 (11) 5 (28)	
WBC at diagnosis, 10^9/ml (range)	12.5 (8.2-8.3)	9.3 (5.5-124)	.187
ESR at diagnosis, mm/hr (range)	83.5 (8-150)	105 (25-150)	.436
CRP at diagnosis, mg/dL (range)	5.8 (0-27.6)	7.9 (0-31.5)	.775
Debridement surgery performed	10 (100)	14 (64)	.265
Number of debridement surgeries	1 (1-6)	2 (1-4)	.10
Implant retained	2 (20)	7 (32)	.417
Parental therapy agent Ertapenem Ampicillin/Sulbactam Cefazolin Ceftriaxone Daptomycin Oxacillin Vancomycin	 10 (100) 0 (0) 0 (0) 0 (0) 0 (0) 0 (0) 0 (0)	 0 (0) 1 (5) 5 (23) 2 (9) 2 (9) 3 (14) 5 (23)	
Duration parenteral antimicrobial, mean days (range)	32 (14-52)	39.5 (10-56)	.521
Adjunctive oral antimicrobial used	8 (80)	15 (83)	.999
Duration adjunctive oral antimicrobial, mean days (range)	47.5 (14-828)	91.0 (7-1411)	.505

Abbreviations: WBC, white blood cell count; ESR, eryrthrocyte sedimentation rate; CRP, C-reactive protein.

All values are presented as number (%), unless otherwise indicated

[a]Defined as being an immunosuppressive medications such as prednisone, azathioprine, etc.

The Table shows the baseline demographic, clinical, and treatment characteristics of the ertapenem and comparator groups. No significant differences between groups were noted. All patients in the ertapenem group underwent surgical debridement compared with 14 of 18 (78%) in the comparator group. The most commonly used antibiotics in the comparator group were vancomycin (n = 5, 27%) and cefazolin (n = 5, 27%). Most patients in both groups received adjunctive oral antimicrobial therapy following the initial course of parenteral antimicrobial. The median follow-up time for patients who did not develop treatment failure was 22 months (range 6-51 months) in the ertapenem group and 21 months (range 6-49 months) in the comparator group.

No patient in the ertapenem group developed definite treatment failure as defined in the methods. However, 1 patient with vertebral osteomyelitis and epidural abscess

received 16 days of ertapenem therapy and was then changed to parenteral oxacillin because of apparent radiographic worsening of the abscess. This patient died 5 weeks later of multiple organ failure despite surgical debridement, initial ertapenem therapy, and subsequent prolonged therapy with oxacillin.

In the comparator group, 2 of 18 patients (11%) developed definite treatment failure. The first patient had MSSA total knee arthroplasty infection initially treated with surgical debridement, retention of the implant, and 6 weeks of parenteral oxacillin therapy; she was maintained on chronic oral doxycycline therapy. However, 6 months following initial debridement, she had recurrent pain in the knee, and intraoperative cultures once again grew MSSA. The second patient had MSSA total hip arthroplasty infection initially treated with surgical debridement, retention of the implant, and 4 weeks of parenteral cefazolin therapy; the patient then was maintained on chronic oral cefadroxil therapy. However, 2 years later the patient developed a purulent draining sinus tract from the hip.

DISCUSSION

To our knowledge, this is the first reported series of patients with *S. aureus* bone and joint infection treated with ertapenem. Elbaz et al[6] reported the use of ertapenem, among other antimicrobials, in the apparent successful treatment of *Enterobacter* spp. sacral osteomyelitis. Chuang et al[5] reported a case of *Citrobacter freundii* necrotizing fasciitis and osteomyelitis successfully treated with ertapenem for 42 days. We are aware of no other published reports describing ertapenem in the treatment of osteomyelitis. Overall, our results using prolonged ertapenem therapy for bone and joint infection have been favorable both in terms of efficacy outcomes and long-term tolerability.

Ertapenem demonstrates good *in vitro* activity against MSSA. The MIC (90) for ertapenem is 0.25 to 0.5 mg/L.[7,8] Similar to other once-daily dosed anti-staphylococcal agents, it is highly protein-bound. The penetration of ertapenem into bone and synovial tissue was recently reported.[9] The concentrations achieved in cancellous and cortical bone tissue and in synovial tissue were greater than the MIC(90)s for most aerobic organisms, including MSSA for 24 hours following a single 1-gram dose of ertapenem.

Other once-daily dosed antimicrobials that have been used for OPAT in patients with *S. aureus* bone and joint infections include ceftriaxone[10-12] and daptomycin.[13] Vancomycin can sometimes be appropriately dosed once daily, depending on patient factors and drug levels achieved. Outcomes of *S. aureus* bone and joint infections treated with ceftriaxone have been favorable in the published literature.[10-12] Even so, clinicians often remain reluctant to use ceftriaxone because of reduced *in vitro* potency against *S. aureus*. Daptomycin has been recently approved to treat complicated skin and skin structure infections and *S. aureus* bacteremia, including infective endocarditis. There are limited published data available regarding its efficacy in the treatment of bone and joint infections,[13] and concerns have been raised regarding its high protein binding and possible resistance developing when used to treat bone and joint infections.

Our results are limited by the relatively small sample size, the retrospective study design, and the use of adjunctive oral antimicrobial therapy following parenteral therapy in some patients in both the ertapenem and comparator groups. Furthermore, similar to ceftriaxone, ertapenem exhibits a broader spectrum of antimicrobial activity than is needed for monomicrobial *S. aureus* infection, potentially leading to unnecessary selection for antimicrobial resistance.

CONCLUSION

Recent data regarding bone penetration in conjunction with this series suggest prolonged ertapenem therapy may be useful and safe in the treatment of MSSA bone and joint infections. Ertapenem represents an attractive agent for OPAT because of its once-daily dosing schedule and relatively favorable cost profile.

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REFERENCES

1. Sia IG, Berbari EF, Karchmer AW. Prosthetic joint infections. *Infect Dis Clin North Am*. 2005;19(4):885-914.
2. Gesser RM, McCarroll KA, Woods GL. Efficacy of ertapenem against methicillin-susceptible *Staphylococcus aureus* in complicated skin/skin structure infections: results of a double-blind clinical trial versus piperacillin-tazobactam. *Int J Antimicrob Agents*. 2004;23(3):235-239.
3. Lemaire S, Van Bambeke F, Mingeot-Leclercq MP, Tulkens PM. Activity of three β-lactams (ertapenem, meropenem and ampicillin) against intraphagocytic *Listeria monocytogenes and Staphylococcus aureus. J Antimicrob Chemother*. 2005;55(6):897-904.
4. Lipsky BA, Armstrong DG, Citron DM, Tice AD, Morgenstern DE, Abramson MA. Ertapenem versus piperacillin/tazobactam for diabetic foot infections (SIDESTEP): prospective, randomised, controlled, double-blinded, multicentre trial. *Lancet*. 2005;366(9498):1695-1703.
5. Chuang YM, Tseng SP, Teng LJ, Ho YC, Hsueh PR. Emergence of cefotaxime resistance in *Citrobacter freundii* causing necrotizing fasciitis and osteomyelitis. *J Infect*. 2006;53(3):e161-3.
6. Elbaz W, Donnelly A, Eames N, Hedderwick S. Enterobacter osteomyelitis treated with outpatient intravenous ertapenem [Federation of Infection Societies abstract P41]. Abstracts of the Tenth Conference of the Federation of Infection Societies, 2003. *J Infect*. 2004;49(1):52-53.
7. Friedland I, Mixson LA, Majumdar A, Motyl M, Woods GL. *In vitro* activity of ertapenem against common clinical isolates in relation to human pharmacokinetics. *J Chemother*. 2002;14(5):483-491.
8. Wexler HM. In vitro activity of ertapenem: review of recent studies. J Antimicrob Chemother. 2004;53 Suppl 2:ii11-21.
9. Boselli E, Breilh D, Djabarouti S, Bel JC, Saux MC, Allaouchiche B. Diffusion of ertapenem into bone and synovial tissues. *J Antimicrob Chemother*. 2007;60(4):893-896.
10. Guglielmo BJ, Luber AD, Paletta D,Jr, Jacobs RA. Ceftriaxone therapy for staphylococcal osteomyelitis: a review. *Clin Infect Dis*. 2000;30(1):205-207.
11. Tice AD, Hoaglund PA, Shoultz DA. Outcomes of osteomyelitis among patients treated with outpatient parenteral antimicrobial therapy. *Am J Med*. 2003;114(9):723-728.
12. Wynn M, Dalovisio JR, Tice AD, Jiang X. Evaluation of the efficacy and safety of outpatient parenteral antimicrobial therapy for infections with methicillin-sensitive *Staphylococcus aureus*. *South Med J*. 2005;98(6):590-595.
13. Falagas ME, Giannopoulou KP, Ntziora F, Papagelopoulos PJ. Daptomycin for treatment of patients with bone and joint infections: a systematic review of the clinical evidence. *Int J Antimicrob Agents*. 2007;30(3):202-209.

B Reader Interpretation of Digital Images Compared with Analog Films: A Study of Image Quality

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ABSTRACT

Background: *With the advent of digital radiography in the last decade, B readers have been challenged with the optimal method to interpret digital images for the presence of pneumoconioses. International Labor Organization (ILO) standards are based on analog films, yet many facilities are now exclusively digital and no longer have radiographic capability. The purpose of this study is to compare interpretation of analog films with both soft- and hard-copy digital images using ILO analog standards, as well as digital versions of the ILO standard films kindly provided by NIOSH with permission granted from the ILO.*

Methods: *Individuals visiting the clinic for pre-employment or pneumoconiosis surveillance examinations as required by their employers from October 2008 to October 2009 were asked to participate in the study. Those who agreed to participate then completed a brief questionnaire containing questions about their occupation, exposure to coal dust, silica, and asbestos, smoking status, and any breathing-related diagnoses or symptoms. Their analog and digital images were compared in terms of quality, presence of parenchymal or pleural abnormalities, costophrenic angle obliteration, and other abnormalities. Demographic data were collected and assessed as well.*

Results: *The study population was composed of young men, with only 10% of study participants older than 60 years. Thus, participants' occupational exposure to any harmful dust was generally brief, resulting in a decreased likelihood of abnormal findings on chest radiograph. Image quality consistency was the lowest when comparing the analog film interpretation with the hard-copy digital image interpretation (41%; 95% Confidence Interval [CI]: 24% to 61%; Cronbach α <0), higher when comparing digital read interpretation using either the ILO analog standards (59%; 95% CI: 39% to 76%; Cronbach $\alpha = 0.216$) or the digital version of the ILO standards (62%; 95% CI: 42% to 79%; 0.346), and highest (83%: 95% CI: 64% to 94%; Cronbach $\alpha = 0.782$) when comparing digital reads.*

Conclusion: *The current study results support the use of soft-copy digital images with the ILO analog standards until ILO digital standards become available and discourage the use of hard-copy digital images due to inconsistent quality.*

The classification of pneumoconioses is standardized through the International Labor Organization (ILO).[1] Guidelines for the use of the ILO international classification of radiographs of pneumoconioses have undergone numerous revisions (1930,1950,1958,1968,1971,1980, 2000).[1,2] Briefly, a subject's film is matched with the standard film that most closely corresponds to it in appearance. The purpose of the guidelines is to afford consistency in international comparisons, research, and epidemiological investigations,[1] because interreader variability was unacceptably high with earlier classification systems.[3] Therefore, the B reader program was initiated by the National Institute for Occupational Safety and Health (NIOSH). The B reader program was first developed as a research tool to add consistency to the radiographic evaluation of pneumoconiosis. The program is actually codified in the Code of Federal Regulations 42 CFR part 37.[4] The NIOSH B reader program trains physicians in the use of the ILO system for evaluating chest films for the presence of pnemoconioses. A physician must pass a certification examination to become a B reader and subsequently pass recertification examinations every 4 years to maintain the certification.[5]

The original program was developed using analog film standards to compare with the subject's posterior-anterior (PA) chest film. Based on the comparison, the B reader interpreted the film using the B reader interpretation form. What was intended as a research tool soon evolved into a clinical tool, with B readers now asked to evaluate chest radiographs for evidence of pneumoconioses—a group of dust-related lung diseases that includes silicosis, coal workers' pneumoconiosis (CWP), and asbestosis. These diseases result from the inhalation of inorganic dusts and typically have long latency periods.[6]

In spite of measures to decrease pneumoconiosis in coal miners via the Federal Coal Mine Health and Safety Act of 1969, advanced cases of pneumoconiosis continue to be identified.[7] Therefore, screening of large populations at risk for pneumoconioses needs to continue and can be accomplished by interpretation of radiographs by a certified B reader.

With the advent of digital radiography (DR) in the last decade, B readers have been challenged as to how to interpret digital images for the presence of pneumoconioses. Comparison is with ILO analog standards, yet many facilities are totally digital and no longer have analog capability. The purpose of this study is to compare the interpretation of analog films with digital images, both soft (ie, on a computer monitor) and hard (printed) copies, in order to establish a more uniform approach to the interpretation of films by B readers until such time as the ILO adopts digital standards.

Over the last decade, radiology has undergone an explosion of technological advances, including the use of digital radiography (DR), with many hospitals no longer offering analog films.[8] Data from Michigan indicate that 16% of facilities used digital imaging for chest radiography from 2002-2006,[9] with an expectation that more facilities will use digital equipment in the future.[10] A benchmark report conducted by market research and consulting firm IMV revealed that by the end of 2005, "about one-third of the hospitals in the United States had at least one DR system in their radiology department. Over half of U.S. hospitals have adopted CR (computed radiography)."[11] Unfortunately, the B reader program and the ILO have not kept abreast of these changes, and the program continues to require the interpretation of plain film radiographs. This problem is addressed on the NIOSH Website, and the use of digital images should be acceptable in the near future.[12]

Although the trend of radiology departments is to adopt digital systems, few publications to date have addressed the comparison of the interpretation of analog films versus digital images. Franzblau et al[13] demonstrated that analog films and soft-copy digital images appear to yield equivalent results for small and large opacities. The hard-copy digital images (ie, printed) appeared to result in a greater prevalence of small and large opacities compared with analog film and soft-copy digital images. All 3 image formats appeared to differ for prevalence of pleural findings.[13] NIOSH is currently conducting research comparing analog films with digital images (both soft and hard copies). A review of the literature revealed only 1 additional published paper to date addressing the problem.[14]

In clinical practice, a scheme must be developed that will allow accurate and consistent classification of radiographic images—both digital and analog. Therefore, the purpose of this research is to compare the use of the ILO classification standards using digital images versus analog films. The current study, albeit small, is intended to help answer the question of whether digital images can be correctly interpreted using the existing ILO analog standard films in a clinical setting. The findings in this study could be useful to other B readers who no longer have analog systems available.

MATERIALS AND METHODS

Population and Setting

After receiving approval from the Gundersen Clinic, Ltd. Human Subjects Committee/Institutional Review Board, we enrolled study participants as they presented for their scheduled pre-employment or pneumoconiosis surveillance examination as required by their employer from October 2008 – October 2009. After agreeing to participate in the study and signing the informed consent form, they completed a brief questionnaire concerning their occupation, smoking status, exposure to silica, coal dust, or asbestos, and any breathing-related diagnosis or symptom. All analog films were taken on the same equipment using a diagnostic radiology room/GE Proteus # 08482, followed by a digital image taken on a Fuji computed radiography (CR) system using a phosphorus plate. The resulting images were reviewed and interpreted using 4 methods, and the investigator completed the B reader interpretation form for each reading.

In Method 1, the analog films were reviewed and interpreted on a view box in the investigator's office, comparing the patient films to ILO analog standards. The investigator was not blinded from patient identity or exposure history during this initial reading, since the results were part of the patient's required clinical examination.

All digital images (hard and soft copy) were randomized by the biostatistician. The investigator was blinded to the previous interpretations. The investigator was also blinded to patient identifiers to avoid potential recall bias. To further reduce the potential for recall bias, the digital image readings were performed upon completion of all analog films. To avoid diagnostic bias based on exposure history, the investigator was not given access to the completed questionnaires. Four weeks after all analog films were read, images were reviewed and interpreted using Method 2; 4 weeks later, using Method 3; and 4 weeks later, using Method 4.

In Method 2, the digital image "display as acquired" was printed for reading the digital hard copy. Parameters contrast 512 and density 1024 were used for all hard-copy digital images. The hard-copy images were interpreted using ILO analog standards.

The investigator read the soft-copy digital images on the picture archiving communication system (PACS) (TOTOKU 2 Megapixel Monitor Workstation) compared with the analog ILO standards (Method 3) and with a digital version of the ILO standard films kindly provided by NIOSH with permission granted from the ILO (Method 4).

Images were graded for quality as *good* (defined as having no technical defect), *acceptable* (defined as having no technical defect likely to impair pneumoconiosis classification), or *unacceptable* (defined as having a defect likely to impair pneumoconiosis classification). Images that contained artifacts, had poor contrast, or were underinflated, improperly positioned, or over- or under-exposed but were nonetheless diagnostic for pneumoconiosis were rated as acceptable.

Statistical Analysis

Simple descriptive statistics for demographic data were analyzed using median and range for age at initial scan date and using frequencies and proportions for categorical variables. For analysis of occupation, we combined carpenters, contractors, and roofers with construction workers.

Primary analysis was the assessment of consistency via Cronbach α between combinations of the 4 methods. We analyzed

(1) image quality, (2) parenchymal abnormalities, (3) pleural abnormalities, (4) costophrenic angle obliteration, and (5) presence of other abnormalities. For this study we consider a Cronbach $\alpha < 0.5$ as low, 0.5 to .75 as moderate, and > 0.75 as high. For each combination of methods, we also report the frequency and proportion of consistent image quality ratings along with 95% confidence intervals (CI).

For the percent of good quality images the frequency and the 95% confidence intervals are reported per method, as well. To compare the proportion of those with *completely consistent* image quality ratings between categorical variables, we used Fisher exact tests; completely consistent means all 4 images had good quality or all 4 had adequate quality; one patient did not have a body mass index (BMI) measure and was considered to be non-obese for analysis; those who noted they were a current smoker or a former smoker were grouped as those who had smoking history. To compare age between those with completely consistent image quality ratings and those without, a Wilcoxon rank-sum test was used.

To compare age and BMI between image quality categories, the Wilcoxon rank-sum test was used. For testing categorical variable associations with image quality categories we used Fisher exact tests.

RESULTS

Twenty-nine participants completed the study. All were men, with a median age of 35 years (range 19 to 71). Most participants (n = 19; 66%) worked in construction. One participant worked directly with asbestos. The study population was composed primarily of young men, with only 10% of study participants older than 60 years, resulting in a shorter exposure history with decreased likelihood of findings on chest radiograph. Pneumoconiosis has a latency of 10 to 30 years before signs of exposure manifest on the radiograph. However, 83% of subjects did report some exposure to asbestos. Five participants had dust exposure for longer than 20 years, with 1 of those subjects reporting severe exposure. Most (22 of 29; 76%) participants were current or former smokers, with 52% (12 of 23) smoking between .5 and 1.0 packs per day. Thirty-one percent of participants had BMIs in the normal range. Four participants had asthma and/or bronchitis, and none had chronic obstructive pulmonary disease. Occupational, demographic, and clinical data are provided in Table 1.

Sixty-two percent (n = 18; 95% CI, 42% to 79%) of analog films were of good quality, and 38% (n = 11; 95% CI, 21% to 58%) of hard-copy digital images were of good quality. Sixty-two percent (n = 18; 95% CI, 42% to 79%) of soft-copy images interpreted using Method 3 were of good quality, while 59% (n = 17; 95% CI, 39% to 77%) of those interpreted using Method 4 were of good quality. The technical defects that rendered images of acceptable quality rather than good quality are provided in Table 2. No images were of unacceptable quality.

Comparisons of image quality consistency among the methods used are presented in Table 3. Image quality consistency was lowest when comparing the analog film and the hard-copy digital image. Image quality consistency was highest when comparing the 2 soft-copy digital interpretations (Methods 3 and 4), which is expected, given that the only variable between these methods was the ILO standard used. Image quality consistency between the soft-copy digital images (Methods 3 and 4) and the hard-copy digital images (Method 2) was 52%.

No costophrenic abnormalities were found. Four images from 3 individuals yielded parenchymal abnormalities. Consistency was low when comparing these abnormalities among the methods (Cronbach $\alpha = 0.405$); however, all 3 subjects' parenchymal findings were interpreted as 0/1, which is considered a normal image with a boundary level of profusion. Therefore, from a clinical standpoint, consistency for normal images was 100%. All 3 individuals were smokers, 1 was obese, and 1 indicated mild and moderate exposure

Table 1. Participant Demographics

Characteristic	n	%
Men	29	100
Occupation		
Construction	19	66
Asbestos supervisor	1	3
Crane operator	1	3
Facilities repair	1	3
Laborer	2	7
Maintenance	1	3
Marine mechanic	1	3
Retired	2	7
Waterproofer	1	3
Smoking status		
Current	15	52
Former	7	24
Never	7	24
Body mass index[a], kg/m^2		
Normal	9	31
Overweight	10	35
Obese	9	31
Unknown	1	3
Coal exposure		
None	19	65
Some	7	24
Unknown	3	10
Silica exposure		
None	16	55
Some	12	41
Unknown	1	4
Asbestos exposure	24	83
Breathing-related diagnosis or symptom		
Asthma	3	10
Bronchitis	1	3
Chronic obstructive pulmonary disease	0	0
Wheezing	3	10
Dry cough	4	14
Sputum	2	7
Shortness of breath	1	3

[a]Normal body mass index was defined as 18.5 to 24.9 kg/m^2; overweight, as 25 to 29.9 kg/m^2; and obese, as ≥30 kg/m^2.

Table 2. Acceptable Image Quality Technical Defects by Interpretation Method[a,b]

Technical Defect	Method 1	Method 2	Method 3	Method 4
Artifacts	0 (0)	1 (6)	0 (0)	0 (0)
Improper position	2 (18)	0 (0)	5 (45)	5 (42)
Reason not given	1 (9)	1 (6)	0 (0)	0 (0)
Overexposed	1 (9)	9 (50)	3 (27)	2 (17)
Overexposed and artifacts	0 (0)	7 (39)	3 (27)	0 (0)
Poor contrast	1 (9)	0 (0)	0 (0)	3 (25)
Underexposed	6 (55)	0 (0)	0 (0)	0 (0)
Underinflated	0 (0)	0 (0)	0 (0)	2 (17)

[a]Values are presented as number of images (%)
[b]Method 1 = Analog film interpreted using ILO analog standards.
Method 2 = Hard-copy digital image interpreted using ILO analog standards.
Method 3 = Soft-copy digital image interpreted using ILO analog standards.
Method 4 = Soft-copy digital image interpreted using digital versions of ILO analog standards.

Table 3. Image Quality Comparisons by Method[a]

Methods Compared	Consistent Scores			Cronbach α[b]	
	n	(%)	95% CI	Overall (n = 29)	Non-Obese (n = 20)
4, 3	24	(83)	64-94	0.782	0.946
2, 3, 4	15	(52)	33-71	0.662	0.822
3, 2	20	(69)	49-85	0.634	0.637
1, 3, 4	15	(52)	33-71	0.591	0.843
1, 2, 3, 4	8	(28)	13-47	0.549	0.799
1, 2, 3	10	(35)	18-54	0.355	0.667
4, 1	18	(62)	42-79	0.346	0.606
3, 1	17	(59)	39-76	0.216	0.732
1, 2, 4	8	(28)	13-47	0.153	0.599
4, 2	15	(52)	33-71	0.147	0.593
2, 1	12	(41)	24-61	-0.276	0.223

[a]Methods as in Table 2.
[b]Cronbach α values ‹ .5 are considered low, .5 to .75, moderate, and › .75 high.

to silica and asbestos, respectively, but for ≤ 5 years. Image quality was good for all 4 images.

One individual had pleural plaques using 3 of the 4 methods. Consistency was high (Cronbach α = 0.889) when comparing pleural changes across all methods. On the analog film these changes were interpreted as pleural fat, whereas on the digital images, the interpretation was "consistent with pleural plaque."

Fourteen images (11 individuals) exhibited other abnormal findings. Findings were moderately consistent (Cronbach α = 0.616) when comparing the various methods.

There were no statistical differences found in the proportion of those with completely consistent image quality ratings between (1) those noted to have at least some exposure to either silica, asbestos, or coal dust versus those with none (P > .999); (2) those having at least 1 of the 3 conditions (asthma, bronchitis, COPD) versus those with none (P > .999); (3) those having at least 1 symptom (wheezing, dry cough, sputum, or shortness of breath) versus those with none (P = .382); (4) those who noted a smoking history versus those without (P = .635); nor (5) those who worked construction versus those who did not (P = .390). No statistical difference in age was detected between those with all consistent ratings as compared with those with some inconsistent image rating across the 4 methods (P = .845). However, no obese patients (0 of 9) had completely consistent image quality ratings, while 40% (8 of 20) of non-obese patients had complete consistency (P = .033).

In the soft-copy digital image interpreted using the ILO analog standard method, a higher percentage of participants with acceptable image quality had a history of smoking compared with those with good quality (50% vs 0%; P = .026). Using the hard-copy digital method, median BMI was lower in participants with images of acceptable quality compared with those of good quality (26 [18-38] kg/m^2 vs 32 [24-47] kg/m^2; P < .01). No other statistically significant results were found when comparing smoking history, BMI, age, exposure (any), conditions (any), or symptoms (any) with image quality for any method.

DISCUSSION

Since this was a screening of a minimally exposed population, comparison of image quality yielded results allowing for the most analysis compared with the other parameters: parenchymal/pleural changes; costophrenic angle obliteration, and presence of other abnormalities. In spite of results focusing on differences in image quality, image quality can have an impact on interpretation and is, therefore, a valuable variable.[15] Older studies have shown that film quality can affect the classification of the presence or absence of pneumoconiosis.[16] Poor film quality increased

inter- and intra-reader disagreement in a study of tuberculosis films by Garland et al.[17] Felson et al[3] suggested that disagreement among B readers was due to poor film quality. Historically, researchers have disagreed about the effect of film quality on disease classification.[15,18-20] Reger[18] found that there were differences among 4 readers determining classification of film quality but believed that it had only a trivial effect on consistency of pneumonconiosis categorization. Liddel[19] also agreed that film quality "introduced only slight biases into the reading of pneumoconiosis." In contrast, Musch and colleagues[20] found that film quality does affect the classification of films for pneumoconiosis. Lawson et al[21] agreed with previous studies that good quality films lead to better overall agreement between readings.

Several authors have found that obesity affects film quality.[15,19-20] Though we found an association between BMI and image quality only for the hard-copy digital method, the obesity effect may be reflected in the current study insofar as no obese subjects had completely consistent image quality ratings over the 4 methods, whereas 40% of the non-obese did, and that difference was statistically significant; moreover, consistency (as measured by Cronbach α) is considerably improved when considering only non-obese patients (Table 3). Overall, age did not seem to correlate with image quality, which was the experience of Liddel et al.[19] Pearson et al[15] did, however, find an improvement in image quality in their older age groups. More smokers than non-smokers had images of acceptable quality in the soft-copy digital image interpreted using the ILO analog standard method (50% vs 0%, $P = .026$) and using the digital standard (50% vs 14%, $P = .18$), respectively. Although the difference was statistically insignificant when using the soft-copy image with the digital version of the standard, the difference was in 1 record. Thus, considering the results of the 2 methods together, 1 being statistically significant and the other not, along with a small sample size, it may be an indication that digital images are more sensitive to the effects of smoking, causing the appearance of overexposure.

Although parenchymal abnormalities were found in only 4 images (from 3 individuals), they were categorized only as 0/1. Guidelines for the use of radiographs of pneumoconioses[1] describe subcategory 0/1 as "used for radiographs classified as category 0 after having seriously considered category 1 as an alternative." This represents 1 of the most difficult categories to interpret. Felson et al[3] commented on the difficulty of distinguishing category 1 images from normal images. The experts in their study would more frequently record a chest image as normal, while the A or B readers would classify it as positive for pneumoconioses. No conclusion can be drawn from 3 individuals. All of the 4 images were of good quality, so quality was not a factor in the inconsistent reads. The abnormalities were found using the analog, hard-copy digital, and in the soft-copy digital interpreted using the digital version of the ILO standards. All 3 individuals were current or past smokers. Smoking is known to affect the prevalence of small opacities on the chest radiographs.[22,23] This was also found to be true in populations considered to be free from dust exposure[23,24] and may be seen in other pathological conditions—for example, in individuals with repeated pulmonary infections, early congestive heart failure, and sarcoidosis.

One participant had evidence of a pleural plaque on both the soft- and hard-copy digital images, which can indicate previous exposure to asbestos; however, the pleural plaque was interpreted as pleural fat on the analog film. The participant, a smoker, self-reported severe asbestos exposure for 7 to 8 hours per day for 15 to 20 years. Lawson et al[21] reported that "pleural abnormalities can be confused with fat deposition, bone shadows, and extrathoracic muscle" on the PA chest radiograph. In addition, pleural reaction can also be seen in other conditions, eg, viral or pyogenic inflammations, trauma, embolism, and following irradiation.[25] Franzblau's study yielded differing numbers of pleural abnormalities, depending on the film format.[15] Autopsy studies have shown poor correlation between radiographic findings and actual pleural plaques.[26] Again, no conclusion can be made on findings from a single subject, but it is reassuring that the abnormality was detected by all 4 methods, albeit interpreted slightly differently on the analog method.

Limitations of this study include the small number of participants, low exposure histories, and the low prevalence of abnormal chest radiographic findings. In addition, though blinded to patient data, the reader was aware of which method was being used—that is, whether it was analog film, a printed digital image, or 1 of the 2 soft-copy digital methods.

Exposure data were by self-report. Another limitation was the use of only 1 B reader for interpretation. Results would likely have differed with multiple readers, since inter-reader variability remains high.[27] Agreement of classification of pneumoconiosis among readers has remained low, despite the requirement that readers become certified through an examination process. When reading normal films, reader agreement has been reported as fairly high.[28] Yet Felson et al[3] demonstrated only 10.1% to 68.9% agreement among pairs of readers when interpreting normal radiographs. Garland et al[17] reported 30% inter-reader disagreement and 21.5% intra-reader disagreement in their imaging study of tuberculosis. In the current study, image quality consistency was highest between the 2 soft-copy digital image methods, which is expected because the only difference between the methods was the comparison standard format. Image quality consistency was good (59% and 62%) in comparing analog film quality interpretations with digital soft-copy interpretations. Takishima et al[14] demonstrated that no significant differences were shown for quality between analog films and flat-panel detector radiography; however, there were significant differences between analog films and storage phosphor computed radiography, which was the system used in the present study. It was believed that there was improved contrast resolution in the digital images that may have explained the differences between the 2 modalities in terms of quality reproducibility.

CONCLUSION

Pneumoconiosis persists in spite of prevention efforts. In a recent *Morbidity and Mortality Weekly Report* article,[7] the authors concluded that the resurgence of the disease might be from lack of participation in the voluntary screening program. In spite of the controversy and variability surrounding the B reader interpretation of chest films, it remains a viable screening tool. Overall, when compared to the interpretation of analog films, soft-copy digital image interpreted using ILO analog standards resulted in the highest consistency in terms of quality; image quality consistency was significantly improved when considering only non-obese

patients. Although image quality was the only variable in this study that differed enough for statistical analysis, as discussed previously, consistency in quality has been shown to affect B reader interpretations. Based on prior studies[13,14] comparing digital and analog images in diseased populations, digital images are an alternative format for screening populations for pneumoconiosis via B reader interpretation. When analog capabilities are unavailable—and until ILO digital standards are established—soft-copy digital images interpreted using ILO analog standards appear to be the best alternative to analog film, while hard-copy digital images offer the lowest consistency of image quality.

REFERENCES

1. International Labour Office. *Guidelines for the Use of the ILO International Classification of Radiographs of Pneumoconioses, Revised Edition 2000*. Occupational Safety and Health Series 22. Geneva: ILO, 2002.
2. Henry DA. International Labor Office Classification System in the age of imaging: relevant or redundant. *J Thorac Imaging*. 2002;17(3):179-188.
3. Felson B, Morgan WK, Bristol LJ, et al. Observations on the results of multiple readings of chest films in coal miners' pneumoconiosis. *Radiology*. 1973;109(1):19-23.
4. United States Code of Federal Regulations. Title 42. Chapter I. Part 37.
5. Attfield MD, Wagner GR. A report on a workshop on the National Institute for Occupational Safety and Health B reader certification program. *J Occup Med*. 1992;34(9):875-878.
6. Merchant JA, Boehlecke BA, Taylor G, National Institute for Occupational Safety and Health. *Occupational Respiratory Diseases*. Washington, DC: US Dept. of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health; 1986. US Department of Health and Human Services (NIOSH) Publication NO. 86-102.
7. Centers for Disease Control and Prevention (CDC). Advanced pneumoconiosis among working underground coal miners--Eastern Kentucky and Southwestern Virginia, 2006. *MMWR Morb Mortal Wkly Rep.* 2007;56(26):652-655.
8. Schwerha JJ. Occupational medicine forum. *J Occup Environ Med*. 2008;50(3):373-374.
9. Michigan Department of Community Health (MDCH). Dental intraoral patient exposures. 2008. http://www.michigan.gov/mdch/0,1607,7-132-27417_35791_35798-46657--,00.html. Accessed June 10, 2011.
10. National Council on Radiation Protection and Measurements. *Ionizing Radiation Exposure of the Population of the United States*. Bethesda, MD: National Council on Radiation and Measurements, 2009. NCRP Report No. 60, pp. 105-106.
11. IMV Commerce Store for Benchmark and Summary Reports for Market Research. http://www.imvinfo.com/index.asp?sec=mkt&sub=omkt&pag=def&pid=36214. Accessed September 22, 2010.
12. NIOSH. Chest radiography: B reader information for medical professionals. http://www.cdc.gov/niosh/topics/chestradiography/breader-info.html. Accessed June 10, 2011.
13. Franzblau A, Kazerooni EA, Sen A, et al. Comparison of digital radiographs with film radiographs for the classification of pneumoconiosis. *Acad Radiol*. 2009;16(6):669-677.
14. Takashima Y, Suganuma N, Sakurazawa H, et al. A flat-panel detector digital radiography and a storage phosphor computed radiography: screening for pneumoconioses. *J Occup Health*. 2007;49(1):39-45.
15. Pearson NG, Ashford JR, Morgan DC, Pasqual RS, Rae S. Effect of quality of chest radiographs on the categorization of coalworkers' pneumoconiosis. *Br J Ind Med*. 1965;22:81-92.
16. Fletcher CM, Oldham PD. The problem of consistent radiological diagnosis in coalminers' pneumoconiosis; an experimental study. *Br J Ind Med*. 1949;6(3):168-183.
17. Garland LH, Miller ER, Zwerling HB, et al. Studies on the value of serial films in estimating the progress of pulmonary disease. *Radiology*. 1952;58(2):161-177.
18. Reger RB, Morgan WK. On the factors influencing consistency in the radiologic diagnosis of pneumoconiosis. *Am Rev Respir Dis*. 1970;102(6):905-915.
19. Liddell FD. The effect of film quality on reading radiographs of simple pneumonconiosis in a trial of x-ray sets. *Br J Ind Med*. 1961;18:165-174.
20. Musch DC, Higgins IT, Landis JR. Some factors influencing interobserver variation in classifying simple pneumoconiosis. *Br J Ind Med*. 1985;42(5):346-349.
21. Lawson CC, LeMasters MK, Kawas Lemasters G, Simpson Reutman S, Rice CH, Lockey JE. Reliability and validity of chest radiograph surveillance programs. *Chest*. 2001;120(1):64-68.
22. Dick JA, Morgan WK, Muir DF, Reger RB, Sargent N. The significance of irregular opacities on the chest roentgenogram. *Chest*. 1992;102(1):251-260.
23. Weiss W. Cigarette smoking and small irregular opacities. *Br J Ind Med*. 1991;48(12):841-844.
24. Meyer JD, Islam SS, Ducatman AM, McCunney RJ. Prevalence of small lung opacities in populations unexposed to dusts. A literature analysis. *Chest*. 1997;111(2):404-410.
25. Solomon A, Kreel L. *Radiology of Occupational Chest Disease*. New York: Springer-Verlag; 1989.
26. Frumkin H, Pransky G, Cosmatos I. Radiologic detection of pleural thickening. *Am Rev Respir Dis*. 1990;142(6 Pt 1):1325-1330.
27. Muller JG, Lieske JM, Hernandez JE, Kubiak G, Rudolph WG, Jan MH. Variability in interpretation among B-readers in the U.S. Navy Asbestos Medical Surveillance Program. *Mil Med*. 2008;173(4):375-380.
28. Attfield MD, Althouse RB, Reger RB. An investigation of inter-reader variability among x-ray readers employed in the underground coal miner surveillance program. *Ann Am Conf Gov Ind Hyg*. 1986;14:401-409.

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A Case of Adult Laryngeal Hemangioma

ABSTRACT

Laryngeal hemangiomas in adults are rare and are best diagnosed by direct observation of the larynx. Herein we report a case of a pyriform sinus hemangioma manifested by progressive dysphonia and dysphagia in an 82-year-old man.

INTRODUCTION

Laryngeal hemangiomas are rare, benign, highly vascular lesions of the larynx that can occur in either the supra- or infraglottis, but are most common in the supraglottis in adults.[1-3] They are diagnosed by direct observation—generally laryngeal endoscopy and, if deemed necessary, biopsy. Hemangiomas in children usually resolve within the first 2 years of life and, thus, rarely require surgical intervention.[4] For adults who have symptomatic stridorous respiration, dysphonia, and/or dysphagia, surgical intervention is usually indicated. Laryngeal hemangiomas are twice as common in men than in women.[4] In this report we describe the history and course for a man with a symptomatic laryngeal hemangioma of the pyriform sinus.

CASE REPORT

Our patient was an 82-year-old gentleman, a retired carpenter, with a 2-year history of progressive voice change, globus sensation, and oropharyngeal swallowing complaints, primarily for solids. Of potential relevance and concern for his current complaints was a history of colon carcinoma for which he underwent hemicolectomy 11 years ago and for which there had been no recurrence or signs of metastasis to date. He had not smoked for 25 years and rarely used alcohol. He denied instances of hematemasis, nasopharyngeal reflux of either liquid or solid foods, or frank shortness of breath. As of late, he had experienced slight hemoptysis. He had undergone maxilla-dental surgery 1 year prior to being seen and posited whether his altered chewing patterns could somehow be contributing to his swallowing difficulties. He described a 20-pound weight loss within the past 2 months, which he attributed to his swallowing difficulty and altered dentition. His appetite was good. The results of a recent colonoscopy were unremarkable. He had no symptoms of gastroesophageal reflux disease and, other than his voice, had no concerns regarding components of his speech. There was no history of neck or recent throat trauma; he had been intubated for the hemicolectomy 11 years ago. He was compliant with his medications (low-dose aspirin, citalopram, gabapentin, lisinopril, metrogel, extra strength Tylenol), and was allergic to fentanyl, metaxalone, and tramadol.

Examination showed normal function for cranial nerves V, VII, XI, X, XI, and XII. There were no pathologic reflexes, and the structural integrity of the oral speech mechanism was adequate. His voice was characterized by moderate-severe dysphonia perceptually, while transoral laryngeal videoendostroboscopy revealed a large exophytic lesion involving the pyriform sinus on the left and prominent secretions within the pyriform sinuses, particularly on the right. Vocal fold movement was preserved bilaterally, although somewhat irregular. Figure 1 is an image obtained from laryngeal endoscopic examination showing the lesion within the pyriform sinus on the left.

Subsequent videofluorgraphic study of swallow (VFSS) showed very mild oropharyngeal dysphagia characterized by stasis within the hypopharynx and pyriform sinuses. There were no signs of laryngeal penetration, aspiration, discoordination, or delay in swallowing. Figure 2 shows an image from a VFSS depicting hypopharyngeal-pyriform stasis after completion of the pharyngeal

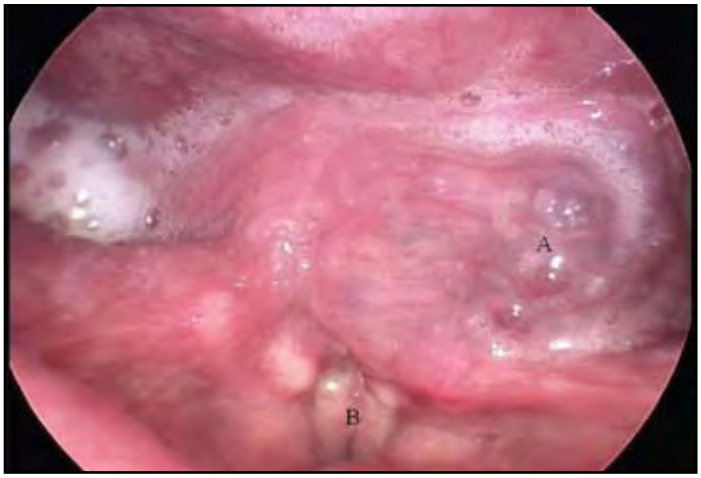

Figure 1. Laryngeal endoscopic image showing the highly vascular hemangioma within the pyriform sinus (A). The true vocal folds are identified for reference (B).

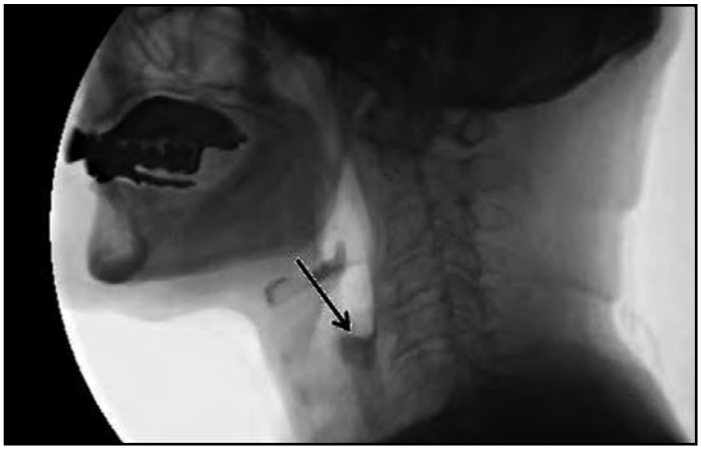

Figure 2. Image from lateral videofluorographic swallowing study showing hypopharyngeal stasis (arrow) after pharyngeal swallow due to mass effect from hemangioma.

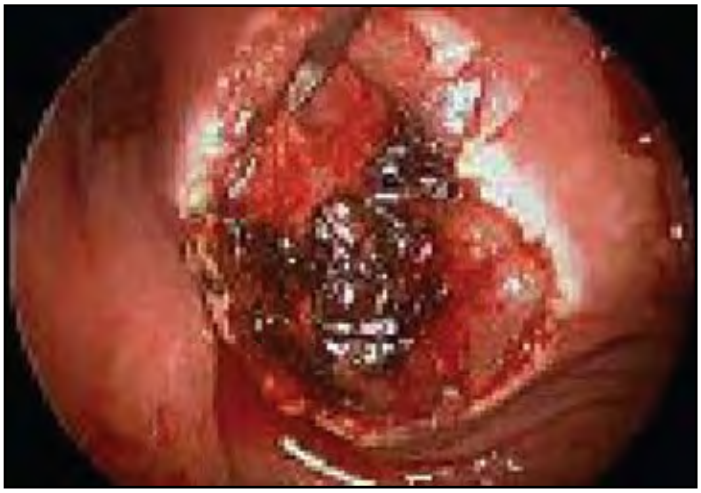

Figure 3. Intraoperative image showing the marked vascularity of the hemangioma.

stage of swallow.

Direct laryngoscopy revealed a large, soft, mobile mass extending from the medial wall of the pyriform sinus on the left to the level or aryepiglottic fold and then down to the posterior aspect of the arytenoids on the left. Submuscosal biopsy resulted in aggressive bleeding that was controlled with cautery hemostasis. Pathology showed benign squamous hyperplasia and dilated vessels consistent with hemangioma. Figure 3 is an intraoperative image of the lesion showing the marked hypervascularity.

DISCUSSION

MacKenzie provided the earliest report of laryngeal hemangioma in 1864.[5] Like hemangiomas in other parts of the body, laryngeal hemangiomas are highly vascular and have a purple-bluish appearance. Although there is no uniform, standardized treatment for laryngeal hemangiomas, intralesional steroid injections, laser ablation, interferon, microdebridement, cryosurgery, and open excision have been used.[1] Neck irradiation and implantation of radioactive seeds have been attempted, but these treatments increase the patient's risk of developing malignancy later in life.[1,4] Currently, surgeons favor laser ablation as the treatment of choice.[1,2,4]

For our patient's dysphagia and weight loss, which were judged to be secondary to the hemangioma, a soft solid diet and high caloric liquid supplement were recommended. His oral intake and weight gradually improved with this regimen. The slight hemoptysis that he had experienced was believed to be due to petechial hemangiogenic hemorrhages, while the dysphonia and irregular vocal fold movement were thought to be the result of lesion mass effect.

Because of the surgical risks, particularly for bleeding, and because the lesion was benign, our patient elected to not have the hemangioma removed. He was actively followed by the authors until his death from complications from a bowel obstruction 2 years after being seen for his voice and swallowing problems. In the interim, his condition related to his laryngeal hemangioma had remained stable.

REFERENCES

1. Prasad SC, Prasad KC, Bhat J. Vocal cord hemangioma. *Med J Malaysia*. 2008;63(5):419-420.
2. Lucioni M, Marioni G, Della Libera D, Rizzotto G. Adult laryngeal hemangioma CO_2 laser excision. A single institution 3-year experience (Vittorio Veneto 2001-2003). *Acta Otolaryngol*. 2006;126(6):621-626.
3. Martins RH, Lima Neto AC, Semenzate G, Lapate R. Laryngeal hemangioma. *Braz J Otorhinolaryngol*. 2006;72(4):574.
4. Lomeo P, McDonald J, Finneman J. Adult laryngeal hemangioma: report of four cases. *Ear Nose Throat J*. 2000;79(8):594, 597-598.
5. Mackenzie M, Stanton A, Friedberg MD. *Essay on Growths in the Larynx; with Reports, and an Analysis of One Hundred Consecutive Cases Treated by the Author, and a Tabular Statement of all Published Cases Treated by other Practitioners Since the Invention of the Laryngoscope*. Philadelphia: Lindsay & Blakiston; 1871:263.

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Role of Cannabinoids in the Management of Chronic Pain: A Review of the Clinical Literature

ABSTRACT

Neuropathic pain is difficult to treat, and current therapies do not reduce symptoms consistently. Treatments that have been investigated include the use of cannabinoids. The current article explores the pharmacology of these compounds, as well as the clinical evidence behind the rationale for their use in the treatment of neuropathic pain. Based on the current evidence, the use of cannabinoids may provide for further improvement of symptoms in patients with intractable neuropathic pain; more studies are needed, however, especially regarding specific indications for use, preparations, and toxicity.

Neuropathic pain is defined as "all pains initiated or caused by a primary lesion or dysfunction of the nervous system" (International Association for the Study of Pain –IASP-). This condition is quite disabling and very difficult to treat. It is a well-known fact that our current armamentariums of pharmacological treatments have shown only minimal effectiveness.[1-6] Multiple animal studies, on the other hand, have shown that cannabinoids (compounds derived from the plant Cannabis sativa), do have antinociceptive properties that are worth exploring.[7,8]

Based on the above, a Medline search was conducted regarding the use of these compounds for the treatment of neuropathic pain. Keywords used on the search included *cannabinoids, marijuana*, and *neuropathic pain*.

Cannabis sativa, has been used for thousands of years for the treatment of multiple illnesses.[1,7,8] Its main ingredients include tetrahydrocannabinol (THC), cannabidiol (CBD), cannabichromene (CBC), and cannabigerol (CBG).[9] In addition, studies have demonstrated the presence of an endogenous cannabinoid system in the brain, that includes cannabinoid receptors (CB_1 and CB_2), their endogenous ligands (anamdamide and 2-arachidonoylglycerol), and the synthetic and hydrolytic enzymes that control the bioavailability of the endocannabinoids.[1]

CB_1 receptors are found in sites associated with pain processing, including the periaqueductal gray, rostral ventromedial medulla, thalamus, dorsal root ganglia, amygdale, and cortex. When activated, CB_1 suppresses calcium conductance and inhibits inward rectifying potassium conductance, thereby suppressing neuronal excitability and transmitter release.[1] This receptor represents the main target for the effects of THC.

Under normal circumstances, CB_2 receptors are mainly found in immune cells; however, in painful conditions, CB_2 seems to express itself into the microglia and dorsal root ganglion cells.

Another compound of *Cannabis sativa*, CBD appears to have limited affinity for either cannabinoid receptor, but in higher doses it may potentiate the effects of THC and mediate non-cannabinoid effects by activating the transient receptor potential vanilloid 1 (TRPV1) receptor.[5,8] These receptors are mainly expressed on unmyelinated C-fibers, known as *polymodal nociceptors*, responding to mechanical, thermal, and chemical stimuli.[8] Activation of these receptors causes depolarization of the primary neuron.

Currently, in addition to the herbal form of *Cannabis sativa*, commonly known as *marijuana*, THC derivatives, dronabinol and nabilone are used clinically for chemotherapy- and cancer-related nausea and vomiting, and for the stimulation of appetite in acquired immunodeficiency syndrome (AIDS) patients.[7] More recently, Sativex, a product combining THC and CBD in a 1:1 ratio, has been developed for neuropathic pain. The rationale for this combination was derived from the belief that CBD could modulate the unwanted psychotropic effects produced by THC.[7,10]

Evidence to date from clinical studies suggests that these compounds show therapeutic efficacy in suppressing neuropathic pain as presented below.

CLINICAL EVIDENCE

Human immunodeficiency virus (HIV) neuropathy: This condition is common in all stages of the disease and produces a symmetrical sensory polyneuropathy. Phillips and associates recently published a review, concluding that currently there are no good pharmacological therapies for treatment of HIV neuropathy.[3]

Abrams and associates performed a randomized placebo-controlled trial using cannabis for the treatment of this condition. Patients were randomized to smoke cannabis or "identical placebo cigarettes" 3 times daily for 5 days. In order to do the

study, the National Institute on Drug Abuse provided identically appearing pre-rolled cannabis and placebo cigarettes weighing on average 0.9 g. Active cannabis cigarettes contained 3.56% delta-9-tetrahydrocannabinol (delta-9-THC), and identical-appearing placebo cannabis cigarettes from which the active components had been extracted contained 0% delta-9-THC. No patient withdrew from the study because of adverse events. Mean recorded side effects were low in both study groups. Cannabis was well tolerated and effectively relieved chronic neuropathic pain from HIV-associated sensory neuropathy.[2] In 2009, Ellis et al performed a phase II, double-blind, placebo-controlled, crossover trial of analgesia with smoked cannabis in HIV-associated distal sensory predominant polyneuropathy (DSPN). Eligible patients were randomized to placebo or active cannabis ranging in potency between 1% and 8% delta-9-THC, 4 times daily for 5 consecutive days during each of 2 treatment weeks, separated by a 2-week washout. All cannabis and placebo cigarettes were provided by the National Institute on Drug Abuse and were constructed of the same base material. Placebo cigarettes were made from whole plant material with cannabinoids removed and were identical in appearance to active cigarettes. Those patients smoking cannabis were able to titrate to the dose affording the best achievable pain relief without unacceptable adverse effects. The proportion of patients achieving at least 30% pain relief with cannabis versus placebo were 0.46 (95% confidence interval [CI] 0.28-0.65) and 0.18 (95% CI, 0.03-0.32), respectively. The authors concluded that "smoke cannabis was generally well tolerated and effective when added to concomitant analgesic therapy in patients with medically refractory pain due to HIV DSPN."[6]

Multiple sclerosis (MS)-induced neuropathy: Central pain—that is, pain initiated or caused by a primary lesion or dysfunction of the central nervous system—is estimated to occur in between 17% and 52% of patients. Rog and associates conducted a 5-week, randomized, placebo-controlled, parallel-group trial for 66 patients with MS and central pain. Patients were provided with an oromucosal spray of a preparation containing THC and CBD (Sativex). Results showed effective reduction of pain and sleep disturbances with minimal side effects.[11]

In a more ambitious study, Wade et al selected 160 outpatients from 3 centers in a double-blind, randomized, placebo-controlled study to determine whether a cannabis-based medicinal extract (CBME) benefits a range of symptoms due to MS. The symptoms included spasticity, spasms, bladder problems, tremor, and pain. Each eligible patient chose the most troublesome of these symptoms as his or her primary symptom and rated it using a Visual Analog Scale (VAS). In order to participate in the study, the patient had to rate the troublesome symptom as at least 50% of maximal severity. This particular study did not demonstrate a significant difference between placebo and active medication for pain; however, spasticity and bladder control both showed improvement. Patients also had better quality of sleep and no significant changes in cognition or mood.[4] Conversely, an older study showed impairment in mood and cognition in MS patients who smoked herbal cannabis, suggesting that this form of the compound may be associated with more side effects than the refined product.[12]

Other clinical neuropathic conditions: Berman et al conducted a randomized, double-blind, placebo-controlled study using 2 extracts of *Cannabis sativa* for the treatment of brachial plexus avulsion. One contains THC:CBD and the other, THC alone. The study showed a significant reduction in pain from the beginning of the study to the end, as well as improvement in sleep for both treatment groups. Both groups tolerated the medications well, with the majority of adverse events, including intoxication, being mild to moderate in severity and resolving spontaneously.[10]

Using Sativex for the treatment of neuropathic pain of various etiologies showed a statistically significant reduction in the pain with only minimal side effects.[5,13] It is important to mention that the study was conducted in 5 weeks, but at the end of the study, each patient was offered the opportunity to enter an open-label extension study. The duration of participation in the extension trial ranged from 1 to 871 days. By study closure, 63% of patients had been withdrawn. An analysis performed at 52 weeks showed continued pain reduction with minimal side effects.

Wilsey et al conducted a double-blinded, placebo-controlled, crossover study for the analgesic effects of smoking cannabis for neuropathic pain. Thirty-eight patients with central and peripheral neuropathic pain underwent a standardized procedure for smoking either high-dose (7%) or low-dose (3.5%) cannabis, or a placebo. Secondary outcomes of the study included psychoactive side effects and neuropsychological performance. The study showed "a ceiling effect" as there was no difference in antinocipception between the 2 dosages of cannabis (they were both equally effective compared with placebo). Cognition was also equally affected by the 2 cannabis groups, showing moderate to severe impairment for verbal learning and recall compared with placebo. "Feeling stoned" and "feeling high" were more common among patients using the higher dose of cannabis. The authors concluded that cannabis may be effective for ameliorating neuropathic pain and, thus, an alternative for patients who do not respond to, or cannot tolerate, other drugs. They do, however, emphasize the fact that "administration of cannabis may be deleterious in that it impairs cognition. Further vigilance is warranted in young patients because cannabis use in adolescence increases the risk of later schizophrenia-like psychoses, especially in genetically susceptible individuals."[13]

DISCUSSION

Endogenous and herbal cannabinoids can play a role in pain management through stimulating CB_1 and possible CB_2 receptors. Currently, neuropathic pain is difficult to treat; our current pharmacologic treatments are not as desired. Current research suggests that cannabis may have a role in neuropathic pain management; however, we still need to be careful not to reach conclusions too quickly. Moreover, the studies examined in this report have certain commonalities. First, the populations treated are highly selective. People with drug addiction problems, psychiatric problems, and so forth, were excluded from study. Second, in that most were of short duration, it could not be determined if the effects were sustainable or if side effects were an issue for either the natural or endogenous form of the drug. Most of the studies reviewed concluded that further investigation is needed before we can add these compounds to our regular arsenal of drugs to be used in the treatment of neuropathic pain.

REFERENCES

1. Rahn EJ, Hohmann AG. Cannabinoids as pharmacotherapies for neuropathic pain: from the bench to the bedside. *Neurotherapeutics*. 2009;6(4):713-737.
2. Abrams DI, Jay CA, Shade SB, et al. Cannabis in painful HIV-associated sensory neuropathy: a randomized placebo-controlled trial. *Neurology*. 2007;68(7):515-521.
3. Phillips TJC, Cherry CL, Moss PJ, Rice ASC. Painful HIV-associated sensory neuropathy. *Pain: Clinical Updates*. 2010;18(3):1-8. http://www.iasp-pain.org/AM/TemplateRedirect.cfm?template=/CM/ContentDisplay.cfm&ContentID=11067. Accessed June 27, 2011.
4. Wade DT, Makela P, Robson P, House H, Bateman C. Do cannabis-based medicinal extracts have general or specific effects on symptoms in multiple sclerosis? A double-blind, randomized, placebo-controlled study on 160 patients. *Mult Scler*. 2004;10(4):434-441.
5. Nurmikko TJ, Serpell MG, Hoggart B, Toomey PJ, Morlion BJ, Haines D. Sativex successfully treats neuropathic pain characterised by allodynia: a randomised, double-blind, placebo-controlled clinical trial. *Pain*. 2007;133(1-3):210-220.
6. Ellis RJ, Toperoff W, Vaida F, et al. Smoked medicinal cannabis for neuropathic pain in HIV: a randomized, crossover clinical trial. *Neuropsychopharmacology*. 2009;34(3):672-680.
7. Moreira FA, Grieb M, Lutz B. Central side-effects of therapies based on CB_1 cannabinoid receptor agonists and antagonists: focus on anxiety and depression. *Best Pract Res Clin Endocrinol Metab*. 2009;23(1):133-144.
8. Comelli F, Giagnoni G, Bettoni I, Colleoni M, Costa B. Antihyperalgesic effect of a *Cannabis sativa* extract in a rat model of neuropathic pain: mechanisms involved. *Phytother Res*. 2008;22(8):1017-1024.
9. Grotenhermen F. Pharmacokinetics and pharmacodynamics of cannabinoids. *Clin Pharmacokinet*. 2003;42(4):327-360.
10. Berman JS, Symonds C, Birch R. Efficacy of two cannabis based medicinal extracts for relief of central neuropathic pain from brachial plexus avulsion: results of a randomised controlled trial. *Pain*. 2004;112(3):299-306.
11. Rog DJ, Nurmikko TJ, Friede T, Young CA. Randomized, controlled trial of cannabis-based medicine in central pain in multiple sclerosis. *Neurology*. 2005;65(6):812-819.
12. Greenberg HS, Werness SA, Pugh JE, Andrus RO, Anderson DJ, Domino EF. Short-term effects of smoking marijuana on balance in patients with multiple sclerosis and normal volunteers. *Clin Pharmacol Ther*. 1994;55(3):324-328.
13. Wilsey B, Marcotte T, Tsodikov A, et al. A randomized, placebo-controlled, crossover trial of cannabis cigarettes in neuropathic pain. *J Pain*. 2008;9(6):506-521.

Supplement

2010 Presentation Abstracts
Gundersen Lutheran Health System

1. Benden DM. **An unusual case of dyspareunia: case report and review of primary vaginal lymphoma.** Presented at the Central Association of Obstetricians and Gynecologists Annual Meeting, Las Vegas, Nevada, October 27-30, 2010.

   Purpose: Primary lymphoma of the female genital tract is rare, with primary vaginal lymphoma accounting for fewer than 1% of all cases of lymphoma. To increase awareness of this rare disease, we describe presentation and evaluation of a postmenopausal woman with a vaginal mass ultimately diagnosed as primary lymphoma of the vagina.

   Case Report: A 53-year-old white woman presented to her primary nurse practitioner for routine examination. She reported persistent dyspareunia and intermittent vasomotor symptoms. Recto-vaginal examination revealed a palpable mass that seemed to be located in the posterior uterine wall or within the colon. A computed tomographic (CT) scan of the abdomen and pelvis revealed a 6×4-cm mass that appeared to originate from the lower uterine segment. The patient was referred to the department of gynecology. The CT scan was reviewed and an ultrasonographic examination performed. On pelvic examination, the patient was noted to have a large mass in the recto-vaginal septum. The mass was visualized 3 cm from the vaginal introitus and bulged from the posterior vaginal wall. The mass was firm and nonmobile. A punch biopsy was performed. The specimen showed a chronic inflammatory reaction of the vaginal mucosa but no cellular atypia or evidence of carcinoma. Due to the appearance of the mass, a repeat biopsy was performed. The vaginal mucosa was thickened and confluent with the mass and could not be separated from it. Therefore, a 1-cm wedge biopsy specimen was taken from the mass in the office under local anesthesia.

   On histological examination, this biopsy specimen showed an ulcerated squamous vaginal mucosa with extensive mixed B cells, T cells, and histiocytes. These three cell types appeared equal in quantity based on immunohistochemistry performed for CD3, CD20, PAX-5, and CD163. The B cells were slightly atypical. The large number of B cells with slight atypia, together with the presence of a large mass, was suggestive of diffuse large B-cell lymphoma (DLBCL), a diagnosis confirmed by an outside laboratory.

   The patient was referred to the department of hematology. A bone marrow biopsy was performed, the results of which were normal. A positron emission tomographic (PET)/CT scan revealed increased fluorodeoxyglucose uptake in the posterior vaginal wall and minimal uptake along the peripheral uterine margins. The patient was determined to have stage IE (extranodal) primary lymphoma of the vagina. She received 6 cycles of R-CHOP (rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisone) and has had complete clinical remission of her lymphoma.

   Discussion: The incidence of lymphoma has been increasing by approximately 2% to 4% per year in the United States, with DLBCL being the most common aggressive non-Hodgkin lymphoma.[1] Extranodal lymphoma accounts for approximately 33% of non-Hodgkin lymphoma, although fewer than 1% of extranodal lymphomas originate in the female reproductive tract. The most common gynecological sites are the cervix and ovaries, followed by the uterine corpus and vagina.[2-4]

   Most women with primary vaginal lymphoma present with vaginal bleeding, urinary symptoms, or an introital mass. Mean age at presentation is 52 years.[3] Generally, vaginal walls appear thickened, and a mass protrudes toward the rectum, bladder, or pelvic sidewall. Contiguous structures may be involved. Only 25% of vaginal lymphomas are primary or low-stage, and the majority of these cases are DLBCLs. Standard treatment for localized DLBCL is 6 to 8 cycles of R-CHOP or 3 cycles of R-CHOP followed by local radiation therapy.[1] Overall survival is approximately 70% at 3 years and 58% at 5 years.[5] Primary genital lymphomas are rare and can present a diagnostic challenge. Knowledge of lymphoma affecting the female reproductive tract is of utmost importance in the consideration for appropriate diagnosis.

   References:

   1. Friedberg JW, Fisher RI. Diffuse large B-cell lymphoma. *Hematol Oncol Clin North Am*. 2008;22(5):941-52, ix.
   2. Harris NL, Scully RE. Malignant lymphoma and granulocytic sarcoma of the uterus and vagina. A clinicopathologic analysis of 27 cases. *Cancer*. 1984;53(11):2530-2545.
   3. Lagoo AS, Robboy SJ. Lymphoma of the female genital tract: Current status. *Int J Gynecol Pathol*. 2006;25(1):1-21.
   4. Hariprasad R, Kumar L, Bhatla DM, Kukreja M, Papaiah S. Primary uterine lymphoma: Report of 2 cases and review of literature. *Am J Obstet Gynecol*. 2006;195(1):308-313.
   5. Coiffier B, Lepage E, Briere J, et al. CHOP chemotherapy plus rituximab compared with CHOP alone in elderly patients with diffuse large-B-cell lymphoma. *N Engl J Med*. 2002;346(4):235-242.

2. Bird JJ, Endrizzi JM, Mathiason MA, Kallies KJ, Kothari SN. **Retropubic versus transobturator approach for suburethral sling placement in the treatment of stress urinary incontinence: the general surgeon's perspective.** Presented at the 62nd Southwestern Surgical Congress, Tucson, Arizona, March 21, 2010.

   Background: Two well established surgical approaches exist for placement of a suburethral sling to treat female stress urinary incontinence: retropubic and transobturator. The transvaginal retropubic approach requires a vaginal incision with blind passage of trocars to a suprapubic location while attempting to maintain proximity to the back of the pubic bone. The transobturator approach requires passage of mesh through the medial compartment of the obturator fossa to avoid pelvic viscera and vessels. The FDA has issued a notification of serious complications associated with these procedures to include bowel and vascular injuries. It has been reported that over 1.5 million of these procedures have been performed in the U.S. to date; therefore, it is important for general surgeons to be aware of the potential risks of these procedures. Presentation of complications may be delayed and require operative repair. Initial evaluation of these patients should take this into consideration in the differential diagnosis.

   Methods: A literature search of all publications from 1996-2008 was completed using the following search terms: "tension free vaginal tape," "complications," and "suburethral sling." The literature search was limited to English language publications with human subjects. Publications were reviewed and excluded if the number of subjects was <10, or if complication rates were not reported by approach. A follow-up of >= 7 days was required. Data were grouped by operative approach (retropubic vs. transobturator). Statistical analysis included Chi square for comparison of reported complications.

   Results: Fourteen publications met inclusion criteria. 6256 subjects were included in the retropubic group, and 3260 in the transobturator group. The reported success/cure rates were 89.4% in the retropubic group and 93.7% in the transobturator group. Complication rates of bladder injury in the retropubic vs. transobturator group were 3.9% vs. 0.5% (P=.001). Bowel injuries occurred in 0.3% of those in the retropubic group, and 0% in the transobturator group (P=.999). Urethral and vascular injuries in the retropubic vs. transobturator group were 5.9% vs. 0.3% (P=.001) and 0.3% vs. 0% (P=.999), respectively. Incidences of bleed and hematoma for the retropubic group vs. the transobturator group were 2.2% vs.3.0% (P=.017) and 2.1% vs. 0% (P=.004), respectively.

   Conclusion: Suburethral slings offer a successful treatment for female stress urinary incontinence. While both the retropubic and transobturator approach result in high success/cure rates, the retropubic approach has a higher rate of bladder, bowel, urethral, and vascular injury as well as a higher rate of hematoma. The volume of these procedures performed to date coupled with a significant inherent complication rate supports the need for general surgeons to be familiar with the risks. Surgeons should have a heightened awareness to avoid missing injuries associated with this common surgical treatment.

3. Blichfeldt TC, Pearson SB, Srinivasan **B. Ouch! My back isn't worth beans!** *WMJ*. 2010;109(1):34-35. http://viewer.zmags.com/publication/cd0185ae#/cd0185ae/36. Presented at the American College of Physicians, Wisconsin Chapter, Annual Meeting, Wisconsin Dells, Wisconsin, September 11, 2010.

   A 39-year-old Caucasian male presented with acute onset thoracic back pain after turning in bed. He denied recent trauma. His past medical history was significant only for injuries sustained in a motor vehicle collision at age 22. His medications included occasional Excedrin. On physical exam, his blood pressure was 159/93 and vertebral thoracic tenderness to palpation. The remainder of the exam was normal. Laboratory results demonstrated kidney disease (creatinine of 5.98 mg/dL and BUN 48 mg/dL). His electro-lytes were normal. He was anemic (hemoglobin 12 g/dL). Urinalysis showed 3+ albumin, 3+ blood, with 17 RBC/hpf. A CT scan of his thorax revealed new thoracic compression fractures of T 4, 5, and 6. Further work-up of his kidney disease revealed nephrotic range proteinuria; normal complement levels; negative ANA, ANCA, anti-GBM antibody, cryoglobulins, anti-streptolysin O-antibody, HIV serology, and hepatitis panel. Immunofixation showed no monoclonal protein. He had normal calcium, hyperphosphatemia, and secondary hyperparathyroidism (PTH of 265 pg/mL). He had a slight vitamin D deficiency. Renal ultrasound revealed small kidneys. Renal biopsy showed sclerotic glomeruli with cellular crescents due to IgA nephropathy. He was started on dialysis and has been dialysis dependent since. Further work-up of his osteoporosis included a normal TSH and free testosterone levels. A Dual X-ray absorptiometry (DEXA) scan showed a T-score of -3.5 in the lumbar spine consistent with osteoporosis. Fracture risk is increased in patients with chronic kidney disease (CKD) as they can develop renal osteodystrophy. This is a term that traditionally has been used to describe the abnormalities in bone morphology that develop in CKD. Phosphate retention in CKD inhibits bone resorption by osteoclasts and arrests generation of osteoclasts. CKD causes a deficiency of calcitriol, which has a suppressive effect on bone formation and resorption. These both stimulate PTH secretion that, in turn, stimulates bone resorption and high turnover rates (e.g. osteitis fibrosa cystica). There can also be low turn over lesions (adynamic bone disease and osteomalacia).A DEXA scan, used to diagnose osteoporosis, cannot accurately predict fracture risk in CKD as it cannot distinguish between the types of renal osteodystrophy, as it is a disease of bone quality and not only bone density. Instead, the gold standard for diagnosing the type of renal osteodystrophy

is tetracycline-labeled quantitative bone histomorphometry.

4. Cole CE, McHugh VL, Mathiason MA, Schroeder JE, Bottner WA, Farnen JP, Ettinger R, Peters A, Dawson J, Johnston KL. **Comparative assessment of significant psychological distress in patients with malignant and non-malignant hematologic disorders.** Presented at the American Society of Hematology (ASH) 52nd Annual Meeting and Exposition, Orlando, Florida, December 4-7, 2010.

   Background: Several measurement tools for distress have been extensively evaluated in patients with solid tumor malignancies and are useful in various stages of treatment, but none have been consistently incorporated into clinical care for hematology patients. The degree of distress in patients with hematologic disease, both malignant and non-malignant is under-investigated, and comparisons of stress levels of patients with malignant and non-malignant blood disorders are infrequent.

   Aim: To asses and compare distress in patients with malignant and non-malignant hematological disorders at a multidisciplinary community-based hematology/oncology clinic.

   Methods: Consecutive adult malignant and non-malignant hematology patients (n=617) seen at the Gundersen Lutheran Center for Cancer and Blood Disorders were prospectively enrolled over a 6 month period. Patients were excluded for incomplete surveys. Study patients completed a prospective survey that included the National Comprehensive Cancer Network (NCCN) Distress Thermometer (DT; scale of 0-10) and the modified NCCN problem list at the first clinic visit and all subsequent visits throughout the study period. All prospective surveys were completed prior to each clinic appointment. Additional demographics including diagnosis and disease related information were collected by chart review. A distress score ≥ 5 was used an indicator of distress.

   Results: A total of 572 patients met study criteria (mean age 62.4±17.4 yrs; 49% men; 56% non-malignant hematologic disorders). The mean DT stress number for the cohort was 3.4±2.7, with 36% rating distress ≥5. Univariate logistic regression analysis revealed younger age (OR:1.33, CI:1.20-1.47;p=0.001, per 10 year decrease in age), history of depression and/or anxiety (OR:3.14, CI:2.20-4.48;p=0.001), female gender (OR:2.23, CI:1.62-3.27;p=0.001), non-malignant disease state (OR:1.51, CI:1.06-2.14;p=0.022) and unmarried (OR:1.70, CI:1.18-2.46;p=0.005) were all associated with a distress score ≥5. The timing of patients' first visit to hematology clinic was also associated with a distress score ≥5, with patients filling out the DT and problems list within 30 days of their first hematology visit more likely to rate distress ≥5 (OR:1.92, CI:1.21-3.04; p=0.008 compared to patients more than 1 year). All but non-malignant disease state remained associated with a distress score ≥5 in a multivariate analysis (Table 1). Further analysis for the subgroup of disease state (non-malignant vs malignant) revealed that subjects with non-malignant diagnoses were younger (61.1 vs 64.1 yrs; p=0.040), largely female (60% vs 40%; p=0.001), had greater history of depression and/or anxiety (47% vs 38%; p=0.035) and less likely to be married (66% vs 75%; p=0.013).

   Conclusion: Distress levels of >5 on the DT were significantly more likely to occur in patients who were seen within the first 30 day of presentation, women, younger patients, those with previous depression/anxiety, and those who are unmarried. On multivariate analysis the diagnosis of malignant or non-malignant hematologic disorder did not predict DT levels >5. Based on these results, patients with malignant as well as non-malignant hematologic disorders with these risk factors should be considered for distress screening and management.

   Multivariate Logistic Regression model for patients rating distress ≥5

Variable	Odd Ratio	CI	*P*-value
Age (per 10 yr decrease)	1.27	1.14-1.42	0.001
Sex, Female	1.64	1.11-2.41	0.013
Hx Depression/Anxiety	2.96	2.02-4.33	0.001
Not Married	1.62	1.08-2.44	0.020
Visit Day 1-30 days 31 days › 1 year	 0.80 1.91 1.00	 0.50-1.27 1.17-3.31	0.008
Non-Malignant	1.08	0.72-1061	0.717

   Hx indicates history of.

5. Conrad AL, McHugh VL, Gundrum JD, Go RS. **Utility of routine cardiac ejection fraction (EF) measurement prior to anthracycline-based chemotherapy (ABC) in patients with diffuse large b-cell lymphoma (DLBCL).** In: 2010 ASCO Annual Meeting Proceedings Part I. *Journal of Clinical Oncology*. 2010;28(15s):Abstract 6101. http://www.asco.org/ASCOv2/Meetings/Abstracts?& vmview=abst_detail_view&confID=74&abstractID=41982. Presented at the American Society of Clinical Oncology Annual Meeting (2010), Chicago, Illinois, June 4-8, 2010.

   Background: Routine EF measurement in DLBCL patients prior to ABC is recommended by the National Comprehensive Cancer Network and an eligibility criterion for most DLBCL trials sponsored by US cancer cooperative groups. The utility of this practice is unknown. Objectives: We determined the frequency of the following events in newly diagnosed DLBCL patients: a) EF measurement prior to ABC; b) finding of asymptomatic LV dysfunction; and c) modification in treatment strategy as a result of EF measurement.

   Methods: A list of DLBCL patients seen and treated at our institution from January 2000-September 2009 was obtained from our Cancer Registry. EF of < 50% was considered low. Congestive heart failure (CHF) risk factors were collected.

   Results: We identified 197 eligible patients. The median age was 71 years (range, 29-97) and 54% were men. EF was measured in 128 (65%) patients before treatment, including 15 with prior CHF. The reasons why EF was not measured in the remaining patients included: clinician assessed patient as low risk to develop CHF (n = 32), patient opted palliative care (n = 3), ABC not recommended due to poor performance status (n = 15), ABC not standard therapy (n = 12) or prior CHF (n = 7). The group considered to be low risk was younger (median 47 vs. 72 years; $p < 0.001$) and had fewer CHF risk factors (median 1 vs. 2; $p < 0.001$).Among patients without prior CHF and had EF assessed (n = 113), asymptomatic LV dysfunction was detected in 4 (4%) with EF ranging from 41%-48%. Four patients were not treated despite normal EF due to severe aortic stenosis, older age, and anticipated toxicities of ABC. On the contrary, all of the 4 patients with asymptomatic LV dysfunction received ABC. No patient in this group (0 of 113) had a modification of treatment strategy as a result of EF measurement. CHF developed in 19% and 6% of patients who did and did not have EF measured before ABC, respectively ($p = 0.085$).

   Conclusions: At our institution, EF measurement before ABC is a common though not uniform practice. Rarely, mild asymptomatic LV dysfunction was detected but did not affect treatment decision. Our findings challenge the utility of routine EF measurement on DLBCL patients prior to ABC.

6. Go RS, Meyer CM, Mathiason MA, Emmel AE, Frisby KA, Meyer LA, Schroeder JE, Sieber DL, Crampton KL, Pingali SR. **Nature and outcome of clinical trials conducted by the Eastern Cooperative Group (ECOG) from 1977 to 2006.** In: 2010 ASCO Annual Meeting Proceedings Part I. *Journal of Clinical Oncology*. 2010;28(15s):Abstract 6069. http://www.asco.org/ASCOv2/ Meetings/Abstracts?&vmview=abst_detail_view&confID=74&abstractID=42058. Presented at the American Society of Clinical Oncology Annual Meeting (2010), Chicago, Illinois, June 4-8, 2010.

   Background: Systematic analysis of trials conducted by ECOG is unavailable.

   Methods: From the National Cancer Institute and ECOG websites, we obtained a list of therapeutic trials conducted by ECOG between 1977 and 2006 that were terminated before September 1, 2007. A trial was considered positive if the treatment was recommended to be safe for further study (phase I), had a response rate of ≥ 20% (phase II), or if the primary endpoint was reached (phase III). We searched for abstract presentation and subsequent publication until September 1, 2008.

   Results: A total of 495 trials were included. Phase II trials predominated (65%) followed by phase III (31%) and I (4%). The top 5 disease sites were hematologic (24%), gastrointestinal (17%), genitourinary (15%), thoracic (14%), and breast (11%). Most trials (73%) completed accrual. The median times that the trials were open to accrual were 42, 25, and 39 months for phase I, II, and III trials, respectively. Characteristics of trial development, accrual, and data dissemination are shown in the Table. In terms of outcome, 33% were positive, while 45% were negative and 22% were unavailable or not applicable. To date, 68% of all trials had been published. The median follow-up time for unpublished trials was 95 months. For trials that completed accrual, 27% and 56% were published within 3 and 5 years, respectively. Independent predictors of trial accrual completion were nonhematologic studies, positive result, and activation prior to 1987. Independent predictors of full publication were achievement of accrual goal and activation prior to 1987.

   Conclusions: Over the last 30 years, ECOG conducted mostly phase II and III trials targeting a variety of malignancies. The process from trial development to publication was generally slow and could take up to a decade to complete. Over a quarter of the trials failed to achieve accrual goal and almost a third never got published. Equal efforts must be directed towards streamlining trial activation, promotion of accrual, and timely publication of results.

7. Gorski JA, Corey PR, Newberry SM, Schaper AM. **Improving colorectal screening rates in a family practice setting.** Presented at Nursing Research on the Green, La Crosse, Wisconsin, April 27, 2010.

   Background: A preliminary survey of Primary Care Physicians indicated a need for nurses to participate in collaborative practice efforts to increase colorectal screening. Communication skills, such as Motivational Interviewing (MI), can help patients work through the ambivalent feelings when referred for a colonoscopy. Purpose: The purpose of this project is to evaluate use of face-to-face MI to promote scheduling colonoscopy immediately following a patient's wellness check up. Design: This is an evidence-based practice pilot project Methods: Training in MI was completed by Family Practice nursing staff. Patients were referred to the RNs by the physician following patient's wellness exam. Registered nurses documented education and MI strategies/skills used during their interaction. Data were collected for a 4 month period. Results/Outcomes/Findings: Sample consisted of an n = 94, with 61% being male. Ages ranged from 50-78. Most frequently used MI strategies: elicit-provide-elicit (60%), summarization (51%), open ended questions (34%), and affirmation (27%). Primary patient concern was prep issues (61%). Completed colonoscopies totaled 76 (83%). Of those 39 (51%) had polyps, 102 polyps were removed, 18 were hyperplastic and 41 adenomatous. Clinical Implications: Face-to-face nurse-patient interactions using MI is an effective and feasible intervention for increasing colonoscopy screenings in ambulatory settings.

8. Gowda A, Hawker R. **Young man with acute campylobacter myocarditis.** *WMJ*. 2010;109(1):36. http://viewer.zmags.com/publication/cd0185ae#/cd0185ae/38. Presented at the American College of Physicians, Wisconsin Chapter, Annual Meeting, Wisconsin Dells, Wisconsin, September 11, 2010.

   Case: A 20-year-old Caucasian male was transferred from an outside facility where he presented with sudden onset retro-sternal pleuritic chest pain. The pain lasted for 2 hours and had resolved by the time he arrived to the hospital. His associated symptoms included epigastric discomfort, diarrhea, vomiting, mild diffuse headache, myalgia and intermittent profuse sweating over the last 6 days. He had a history of sick contacts with his family members who had a mild form of gastroenteritis. He is a dairy farmer where he has been in contact with cows and dogs. His 12 lead Electrocardiogram showed J-point elevation in the inferior leads. Troponin T, Creatinine Phospho Kinase (CPK) and C-reactive protein (CRP) were significantly elevated. Stool cultures grew Campylobacter Jejuni on day 2. Cardiac Magnetic Resonance Imaging (MRI) showed a pattern typical of myocarditis with Left Ventricle Ejection Fraction of 50%. The patient was initiated on metoprolol, captopril and erythromycin. His CRP and CPK trended down reaching near normal levels by day 5. He was discharged in a stable clinical condition after a 6 day hospital stay. Discussion: In developed countries, viral infection is the most common cause of myocarditis, with the most frequently identified viruses being adenovirus and enterovirus (including coxsackievirus). Campylobacter jejuni is one of the most common causes of human gastroenteritis in the world, but there has been no accurate estimate of the incidence of Campylobacter jejuni myocarditis with less than 20 reported cases worldwide. The diagnosis of myocarditis is difficult to establish because the clinical presentation is highly variable. Although endomyocardial biopsy is the gold standard technique, due to the complicated nature of this procedure, contrast-enhanced MRI is increasingly popular. It cannot only definitively diagnose myocardial involvement but can also detect the extent and degree of inflammation. Management of myocarditis includes treatment of the underlying cause, minimization of hemodynamic load of the heart, and management of associated complications.

9. Haas JM, Gundrum JD, Rathgaber SW. P269. **Comparison of time to endoscopy and outcome between weekend and weekday admissions to a community hospital in patients with upper gastrointestinal hemorrhage.** Presented at the American College of Gastroenterology Annual Scientific Meeting, San Antonio, Texas, October 17, 2010.

   Purpose: Recent findings suggest that time to endoscopy is prolonged in patients admitted on the weekend with upper gastrointestinal hemorrhage (UGIH) which may result in increased adverse outcomes. This study was designed to determine if these findings hold true for a single community gastroenterology practice. Methods: This retrospective cohort study reviewed patients admitted to a community hospital from 1/1/08 through 10/31/08 with the primary diagnosis of UGIH. UGIH patients were further defined as acute variceal hemorrhage (AVH) or non-variceal hemorrhage (NVUGIH). Weekend admission was defined as Friday at 1700 through Sunday at midnight. Adverse outcomes were defined as death within 30 days of admission attributable to UGIH, emergent surgical intervention, blood transfusion, or repeat inpatient EGD. Presenting symptom (acute blood loss anemia (ABLA), hematemesis, or melena), endoscopic intervention, and INR reversal were analyzed as well. Results: 174 UGIH patients were included (50 weekend, 124 weekday); 16 patients had AVH; 158 patients had NVUGIH. There was no difference in presenting symptom, hemoglobin, heart rate, presenting systolic blood pressure, gender, age, need for INR reversal, or proportion of AVH between weekend and weekday admissions (all $p>0.05$). Most patients (94.25%) received an EGD within 24 hours of admission. Mean time to endoscopy was shorter for weekend

admission (7.52 hours vs. 10.82 hours, p=0.012) for the entire group; no difference was noted for AVH patients (6.37 hours vs. 4.37 hours, p=0.09); a difference was observed in the NVUGIH group (7.65 hours vs. 11.45 hours, p=0.015). Adverse outcomes were not associated with weekend admission (p=0.583). Mean length of stay (LOS) was not different (3.08 days vs. 3.85 days, p=0.131) and mean units of blood transfused per patient were not different between admission groups (2.44 vs. 2.07, p=0.417). Within the entire group, patients presenting with hematemesis averaged EGD sooner than patients presenting with melena or ABLA (6.03 hours vs. 11.50 hours, p<0.001). On average, EGD was completed sooner in all patients with AVH than NVUGIH (4.99 hours vs. 10.36 hours, p=0.011).Conclusion: Patients admitted to this community hospital with UGIH on the weekend did not experience delayed endoscopy, increased adverse outcomes, or longer LOS. The previously reported 'weekend effect' was not observed. In fact, patients admitted with NVUGIH on the weekend had endoscopy sooner than patients admitted during the week. Patients presenting with hematemesis received EGD sooner than patients with other presenting symptoms independent of the day of admission.

10. Haedtke CA, Schaper AM. **A pilot qualitative study to explore middle-aged women's perceptions of recovery following chest pain syndrome.** Presented at Nursing Research on the Green, La Crosse, Wisconsin, April 27, 2010.

    Background Summary • Chest pain is often a manifestation of heart disease • However, it is non-specific and occurs for a variety of other causes. • Little is known about the recovery of women experiencing chest pain symptoms who undergo an angiogram, but do not have significant coronary disease. Objective As part of a pilot study designed to help women (age < 65 years) manage fatigue after a hospital admission for chest pain, 10 women were interviewed to gain insights into their fatigue experience and self-care needs. Methodology: Triangulated Design ♣ Data collection occurred at 1-week, 6 weeks and 3 months. In addition, women completed the VAS-F three days a week for six weeks. ♣ Interview using semi-structured questions ♣ Quality of life as measured by the SF-36 ♣ Fatigue as measured by the Visual Analog Scale-Fatigue Summary and Conclusions • Women hospitalized for chest pain experience high levels of fatigue after discharge even when a heart attack is ruled out. • LTT is helpful in framing women's recovery experiences and to assess a woman's progression through a major life change. • Women viewed the event as a wake-up call with a renewed appreciation for life, family and self-care. • Women expected to quickly return to their family roles, but now were committed to making life style changes which reduced stress. • Fatigue management strategies used by these women focused on stress reduction, good life style changes, and getting more sleep/relaxation. • The fatigue did not improve over the six week time period, and their vitality had not improved by 3 months. • Supporting women's recovery: What we learned from the women • Follow up care using fatigue interventions was helpful to these women in making improvement in reducing their stress. • In order to prevent future cardiac events in women, • Nurses need to: • Foster the importance of self care • Plan with women options for implementing good self care practices

11. Harris L. **Acute bilateral swelling, pain, and stiffness in the hands of an elderly women: a case of RS3PE syndrome.** *WMJ*. 2010;109(1):48. http://viewer.zmags.com/publication/cd0185ae#/ cd0185ae/48. Presented at the American College of Physicians, Wisconsin Chapter, Annual Meeting, Wisconsin Dells, Wisconsin, September 11, 2010.

    Remitting Seronegative Symmetrical Synovitis with Pitting Edema (RS3PE) Syndrome is a rare inflammatory arthritis seen in older adults that occurs acutely and is resolved by a short course of low dose oral steroids. The diagnostic criteria for RS3PE syndrome include bilateral pitting edema of the hands, abrupt onset of polyarthritis, age greater than 50 years, and seronegative rheumatoid factor. Not uncommonly, it represents a paraneoplastic process. This case is of an 82-year-old white female who presented with sudden onset of bilateral swelling, pain, and stiffness in her hands. Prior to presentation, she had tried over-the-counter naproxen 220 mg orally twice daily for two weeks but had minimal improvement of her complaints. A complete review of symptoms was otherwise negative. Besides the symmetrical synovitis and pitting edema in the hands, there were no other abnormal findings on physical exam. C-reactive protein and erythrocyte sedimentation rate were checked and were moderately elevated. Rheumatoid factor and anti-nuclear antibodies were negative. She was treated with prednisone 5 mg orally twice daily for four weeks, and the bilateral hand swelling, pain, and stiffness resolved. She completed a prednisone taper over two more weeks. At a follow-up appointment, eight weeks after completion of the prednisone taper, she had no reoccurrence of her hand symptoms. Due to the association of RS3PE syndrome with cancer, she underwent an extensive malignancy workup, including mammogram and colonoscopy. All screenings were negative, and thus no systemic cause for RS3EP syndrome was found.

12. Hauser AL. **Nursing news STAT: nursing news you need to know now!** Presented at the National Nursing Staff Development Organization Convention (2010), San Diego, California, July 8-11, 2010.

    In January 2009, the first edition of Nursing News Stat, a weekly e-newsletter hit nurses' inboxes and has continued to do so every Thursday since that time. To date, there have been 63 issues of these "need-to-know-only" newsletters published. This poses the question: how did nurses get this information before the time of this innovative newsletter? Either they didn't, or it wasn't timely enough to impact patient care. Before the time of Nursing News Stat, many of our communication vehicles were monthly (i.e. all-nursing staff meetings, monthly education, Unit Practice Education Quality committee meetings), yet change does not seem to come on a scheduled monthly basis. When urgent information was needed to be communicated, leadership scrambled to send the message, leading staff to be inundated with messages coming at different times, from different people, in many different ways, or not coming at all. Staff felt overwhelmed, leadership felt no control. Nursing News Stat is a one-stop approach to receiving need-to-know information that literally solved this gap in communication. The purpose of this poster will be to describe the background leading to the development of Nursing News Stat, how it was developed, how it is maintained and share our great success.

13. Hegde P, Dolan MJ. **Was that really small?** *WMJ*. 2010;109(1):48. http://viewer.zmags.com/ publication/ cd0185ae#/ cd0185ae/48. Presented at the American College of Physicians, Wisconsin Chapter, Annual Meeting, Wisconsin Dells, Wisconsin, September 11, 2010.

    Case Information: A 77-year-old Caucasian male presented with a 4 week history of unsteadiness. On examination he had positive cerebellar signs. An MRI of the brain and cerebral spinal fluid analysis were normal. Chest X-ray showed a scar at the left lung base which was attributed to previous trauma. A CT scan of the chest and abdomen revealed a bladder mass which was found to be a poorly differentiated small cell carcinoma. A paraneoplastic panel was positive for Anti-Hu antibody. These features suggested paraneoplastic cerebellar degeneration secondary to a small cell bladder cancer. PET scan was negative for metastatic disease. He was initiated on steroids and chemotherapy. Unfortunately his symptoms neither improved nor progressed after 3 cycles of chemotherapy. Discussion: This is a case of subacute cerebellar degeneration occurring with systemic cancer, present with diffuse cerebellar dysfunction, The etiology is believed to be an autoimmune response against "onconeural" antigens. Specifically anti-Yo, anti-Tr and anti-Mglu1 are associated with pure cerebellar syndrome. The common associated malignancies are Hodgkin's lymphoma, breast cancer and lung cancer. This is a rare presentation of bladder tumor. The striking histological finding is diffuse loss of purkinje fibers. CSF evaluation may show nonspecific elevation of protein, oligoclonal bands and elevated IgG index. CT / MRI are generally normal. Antineuronal antibodies are useful for diagnostic purposes although a negative assay does not rule out the diagnosis. Treatment consists of plasmapheresis, IV Ig, corticosteroids or cyclophosphamide given alone or in combination. Unfortunately less than 10% of patients respond to treatment.

14. Heiderscheit C, Broten K, Arndt S, Craig L, Larson C. **Day surgery discharge redesign.** Presented at Nursing Research on the Green, La Crosse, Wisconsin, April 27, 2010.

    With implementation of the EMR staff in Day Surgery found it took longer to document post op patient assessments with it becoming increasingly difficult to perform and document assessments within organizational policy. A team of nurses looked at the current process and identified three areas for improvement: amount of time spent traveling between patients, frequency of post op vital signs, and lack of consistent caregiver. A review of the literature and policies of other health care organizations regarding the frequency of post op assessments showed we were performing these assessments more often than needed. This resulted in the elimination of an unnecessary post op assessment per patient which resulted in about 520 nursing hours per year being directed to other patient care activities such as pain control, patient education and emotional support. In addition, we began assigning post op patients to rooms in three adjacent pods to decrease travel time from patient to patient between post op assessments. We also started assigning patients to a specific nurse for the duration of their post op course. This decreased the number of different staff the patient/family came in contact with and allowed for more consistent use of AIDET. These changes were piloted for a 2 month period of time with no change in admission rate or patient outcomes. We also feel that there has been a decrease in length of stay but no data was collected prior to the change to verify this.

15. Inglis RL, Hamson-Kalis KM, Mathis KC, Zibrowski KM, Zick ML. **Identify and resolve recurring medication events when using smart pump technology.** Presented at Nursing Research on the Green, La Crosse, Wisconsin, April 27, 2010.

    Background: 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. Significance: National Patient Safety Goal of Medication Safety. 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. Method: 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/hour and higher). Clinical 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.

16. Linebarger JH, Landercasper J, Ellis RL, Marcou KA, De Maiffe BM, Hudak J, Gundrum JD. **Core needle biopsy rate for new cancer diagnosis in an interdisciplinary breast center: evaluation of care 2007-2008.** Presented at the Interdisciplinary Breast Center Meeting (20th), Las Vegas, Nevada, March 20-24, 2010.

    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 2007and 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.

17. Lombard K, Patel NY, D'Huyvetter C, Mathiason MA, Cogbill TH. **The impact of low level falls in the elderly.** Presented at the American Association for the Surgery of Trauma Annual Meeting, Boston, Massachusetts, September 22, 2010.

    Background: One third of Americans over age 65 fall each year; 10% of these result in injuries requiring hospitalization. Outcomes for low level (<5ft) falls are poorly defined. Our objective was to determine the morbidity and mortality of these injuries in the elderly.

    Methods: Our prospective trauma registry was queried for all patients > 70 years of age hospitalized after falls from <5 ft. The following variables were retrospectively reviewed: demographics, Injury severity score (ISS), fall mechanism, length of stay (LOS), discharge disposition, mortality, Functional Impairment Measure (FIM), at discharge and independence status at 1-year. Statistical analysis included chi square and t-tests.

    Results: From January 2005 through December 2008, 379 patients met inclusion criteria. Mean age was 83.1 years (range, 70–101), 70% were female. Median ISS was 9.5 (range, 1–34). Falls occurred indoors in 65% and

were caused by slip, trip, or loss of balance in 92%. Median LOS was 4.4 days (range, 1–26). 14.5% required ICU admission. Overall 30-day and 1-year mortality rates were 11.1% and 23%, respectively. Of those who survived past 30 days, 74.5% were discharged to a skilled nursing facility and 25.5% to home. Median FIM at discharge was 10. Of the 323 patients who lived independently before their fall, 180 (55.7%) did so at 1-year. Data for patients aged ≥ 85 years were compared to those aged 70 –84 (Table).

	70-84 years	≥ 85 years	p-value
30-day mortality	7.5%	16.3%	0.007
1-year mortality	20%	33.8%	0.005
Independent living at 1 year	64.9%	44.4%	0.001

Conclusions: Low level falls result in significant mortality and loss of independence in patients >70 years old. Outcomes are markedly worse among patients aged ≥ 85 years. Effective strategies for reducing the impact of this frequent injury in the elderly population must focus on well designed fall prevention measures.

18. Main L. **Too little...but not too late!** *WMJ*. 2010;109(1):41-42. http://viewer.zmags.com/publication/cd0185ae#/cd0185ae/42. Presented at the American College of Physicians, Wisconsin Chapter, Annual Meeting, Wisconsin Dells, Wisconsin, September 11, 2010.

    A 30-year-old female with known HIV for 8 years presented to the infectious disease clinic with fatigue, weakness, and shortness of breath. Symptoms had progressed over the previous 3 days. Review of systems was positive for chills and night sweats. She was up to date on immunizations and had no animal or outdoor exposures. She was an immigrant from Honduras, but had no recent travel outside of the United States. The patient was found to be markedly anemic and thrombocytopenic, with a hemoglobin of 4.5 and a platelet count of 52. Review of her peripheral smear demonstrated microspherocytes without a significant number of schistocytes, as well as giant platelet forms. This was consistent with autoimmune hemolytic anemia and thrombocytopenia, thus indicating Evans Syndrome. Treatment with high dose intravenous methylprednisone and intravenous immunoglobulin was initiated and the patient was supported with transfusions of packed red blood cells and platelets once cross match was obtained. This resulted in stabilization of hemoglobin and platelet counts and steroids were transitioned to prednisone. The inciting factor was not determined, but thought to be an unidentified infection, despite negative blood and sputum cultures and tropical infectious disease work up.

    Evan's Syndrome is an autoimmune disease defined by the combination, either simultaneously or sequentially, of immune thrombocytopenia and autoimmune hemolytic anemia. No specific underlying immune defect has been identified, but evidence suggests abnormalities in both cellular and humoral immunity. Researchers have speculated abnormalities of lymphocyte subsets and immunoglobulin synthesis, supporting the concept of aberrant immunoregulation in this condition. Infection is considered to be the most likely precipitating cause in susceptible individuals. Diagnosis is confirmed by the presence of autoimmune hemolytic anemia and thrombocytopenia with a positive direct antiglobulin test and absence of known underlying etiology. The clinical course is often chronic and relapsing. Treatment is often ineffective but typically consists of high dose steroids; some patients may also require IVIG. In refractory cases, immunosuppressive medications, including Rituxan, and splenectomy have been used. The cause of death is generally bleeding, especially intracranial hemorrhage, or sepsis.

19. Oettel KR, Ruther NR, Mathiason MA, Keller JK, Schroeder JE, Go RS. **Analysis of cancer clinical trials in the United States with comparison of National Institute of Health (NIH) and pharmaceutical industry (PHARMA)-sponsored studies.** In: 2010 ASCO Annual Meeting Proceedings Part I. *Journal of Clinical Oncology*. 2010;28(15s):Abstract 6084. http://www.asco.org/ ASCOv2/Meetings/Abstracts?&vmview=abst_detail_view&confID=74&abstractID=42026. Presented at the American Society of Clinical Oncology Annual Meeting (2010), Chicago, Illinois, June 4-8, 2010.

    Background: We performed this study in order to describe the nature of current cancer trials in the US.

    Methods: From the National Cancer Institute website, we obtained a list of 2,262 therapeutic trials open to accrual on January 14, 2008. We included trials solely sponsored by NIH (62%) or PHARMA (38%) and excluded those with joint sponsorship or not stated (n = 42).

    Results: Majority of the trials were treatment studies (90%) with only a minority aimed at supportive care (7%) or prevention (3%). Over half were phase II trials (59%) while the rest were phase I (26%), III (15%), and IV (0.4%). Most were open only in the US (75%) with the rest being multinational. Adult trials predominated (88%). Most frequent cancers studied were breast (10%), lung (8%), leukemia (7%), lymphoma (7%), and prostate (6%).

Multiple types of cancers were allowed in 26% of the trials. Distribution according to the type of therapeutic modality was systemic treatment (84%), radiation (9%), transplant (7%), and surgery (0.7%). The following exclusion criteria were commonly observed: ECOG performance status of > 1 (36%) or > 2 (97%), brain metastases (50%), and HIV positivity (35%). Only 7% of adult trials had an upper age limit. Among the NIH trials, 80% were investigator initiated trials, while the rest were cooperative group studies. Of the trials initiated by cooperative groups, the major sponsors were COG (22%), ECOG (21%), SWOG (21%), CALGB (19%), NCCTG (14%), and RTOG (10%). The top PHARMA sponsors were Pfizer (9%), GlaxoSmithKline (6%), Novartis (5%), Amgen (4%), and Bristol-Myers Squibb (4%). Compared to NIH, PHARMA trials were more likely to be treatment (92% vs. 88%), phase III/IV (20% vs. 12%), lung cancer (10% vs. 6%), and exclude patients with performance status of > 1 (46% vs. 31%).

Conclusions: There is a plethora of cancer therapeutic trials in the United States, mostly focused on treatment with less emphasis on prevention and supportive care. Lung, colorectal, pancreatic, and liver cancers are relatively underrepresented when burden of mortality is taken into account. Compared to NIH, PHARMA trials are generally more treatment oriented, later phase studies, and more restrictive in eligibility criteria.

20. Poonacha TK, Go RS. **Scientific evidence underlying National Comprehensive Cancer Network Clinical Practice Guidelines.** In: 2010 ASCO Annual Meeting Proceedings Part I. *Journal of Clinical Oncology*. 2010;28(15s):Abstract 6020. http://www.asco.org/ASCOv2/Meetings/Abstracts? &vmview=abst_detail_view&confID=74&abstractID=43593. Presented at the American Society of Clinical Oncology Annual Meeting (2010), Chicago, Illinois, June 4-8, 2010.

    (NOTE: Dr. Poonacha won ECOG's 2010 Young Investigator Award for Clinical Research for this study.)

    Background: The National Comprehensive Cancer Network (NCCN) guidelines are the most comprehensive, recognized, and widely used standard for clinical policy in oncology by clinicians and payors in the United States. However, the level of scientific evidence on which these guidelines are based, has not been systematically investigated. Objectives: We performed this study to describe the distribution of categories of evidence and consensus (EC) among the 10 most common cancers in the US with regards to recommendations for staging, initial and salvage therapy, and surveillance practice.

    Methods: We obtained the latest versions (September 1, 2009) of relevant guidelines from the NCCN. The definitions for various categories of EC used by NCCN panel members were as follows: Category 1 (high level evidence such as randomized controlled trials with uniform consensus), Category 2A (lower level of evidence with uniform consensus), Category 2B (lower level of evidence without a uniform consensus but with no major disagreement) and Category 3 (any level of evidence but with major disagreement).

    Results: Of the 983 recommendations found in the 10 sets of guidelines, the proportions of Category 1, 2A, 2B and 3 EC were 5%, 85%, 9% and 1%, respectively. Recommendations with any Category 1 EC were found in breast (19%), non-Hodgkin lymphoma (8%), kidney (7%), melanoma (6%), and lung (6%) guidelines. Colorectal, pancreatic, urinary bladder, and uterine guidelines did not have any recommendations with category 1 EC. 8% of all therapeutic recommendations were derived from category 1 EC with the majority (83%) of these pertaining to initial therapy. Guidelines with the highest proportions of therapeutic recommendations based on category 1 EC were breast (30%), lung (10%), and kidney (10%) cancers. No category 1 EC formed basis for any recommendations on screening or surveillance.

    Conclusions: Recommendations issued in the current NCCN guidelines are largely developed from lower levels of evidence but with uniform expert opinion. Our study underscores both the urgent need and available opportunities to expand evidence base in oncology which forms the platform for clinical practice guidelines.

21. Riess KP, Kallies KJ, Mathiason MA, Manske BR, Kothari SN. P-81: **Effect of laparoscopic gastric bypass on bone mineral density and markers of bone turnover.** *Surgery for Obesity and Related Diseases*. 2010;6(3, Supplement 1):S55-S56. Presented at the 27th Annual Meeting of the American Society for Metabolic & Bariatric Surgery (ASMBS), Las Vegas, Nevada, June 21-26, 2010. http://www.sciencedirect.com/science?_ob=PublicationURL&_method=list&_tockey=%23toc%2323219%232010%23999939996.8998%232119753%23FLA23&_auth=y&_version=1&refSource=toc&_pubType=J&PDF_DDM_MAX=20&_cdi=23219&md5=91adb4be1b6b4fd051fcb93ac56b4e4a&chunk=0&view=c&go=next&count=271&pdfDownload=&count=271&NEXT_LIST=Y

    Background: Despite multiple beneficial effects of weight loss following laparoscopic gastric bypass (LGB), the influence on bone mineral density (BMD) remains largely unknown. Our objective was to evaluate the short-term changes in BMD and serum/urine bone markers after LGB.

Methods: Thirty-four female patients undergoing LGB were prospectively enrolled and underwent bone densitometry (DXA) and serum/urine analysis preoperatively and 1-year postoperatively. Postoperative supplementation consisted of calcium (500-600mg TID) and vitamin D (approximately 1000 IU QD). Changes≥0.025 g/cm^2 in hip, femoral neck and spine BMD and decreases -2% in total BMD were considered significant. Statistical analysis included paired t-tests and McNemar's test.

Results: Mean age was 44.6 years. Preoperative and 1-year postoperative BMIs were 46.7 and 29.6 kg/m2, respectively. Changes were observed in BMD, T-scores, and bone markers (Tables).

Conclusion: BMD and bone markers changed significantly after LGB. Current recommendations for supplementation in post-LGB women may need to be re-evaluated.

DXA Results

DXA variable (mean ± SD)	Preoprative	1-Year Postoperative	% Decrease
BMD, g/cm^2			
Hip	1.191 ± 0.136	1.087* ± 0.134	5.8
Femoral neck	1.105 ± 0.131	1.032* ± 0.119	6.5
Spine (L1-L4)	1.323 ± 0.146	1.227* ± 0.158	3.5
Total	1.328 ± 0.132	1.251 ± 0.127	8.8
T-Score			
Hip	1.45 ± 1.08	0.62 ± 1.06	
Femoral neck	1.50 ± 0.94	-0.05 ± 0.85	
Spine (L1-L4)	1.19 ± 1.22	0.79 ± 1.31	

*P<0.001

Serum and Urine Analysis

Serum/urine bone marker (% of patients)	Preoprative	1-Year Postoperative	*P*-value
Calcium, abnormal	0%	0%	NA
Vitamin D, low	54%	21%	0.007
PTH, high	21%	17%	0.655
Osteocalcin, high	4%	62%	0.001
Bone alkaline phosphatase, high	14%	43%	0.011
24-hr urine Calcium, low	17%	30%	0.170
24-hr X-linked N- telopeptide, high	0%	19%	NA

22. Schaper AM, Jones KM, Voves HC, Kuisle M. **Medical home model: communication of a child's medical care plan.** Presented at Nursing Research on the Green, La Crosse, Wisconsin, April 27, 2010.

Background: The Medical Home is a new model using a team approach to deliver primary care for children that is accessible, continuous, coordinated, compassionate and culturally-competent. A key element of the Medical Home model is a documented plan of care developed with input from and then shared with the family and community resources, including school systems. Need for the Study: Little research focuses on communication between health care providers and teachers of children with special health care needs (CSHCN). Purpose: The purpose of this study is two-fold: a) to determine the perceived benefits and detriments of communication between members of the Medical Home pediatric team and teachers, and b) to determine the methods of and barriers to communication. Research Design: This is a cross-sectional qualitative study consisting of focus groups and/or individual interviews. The sample includes two cohorts of participants: members of the Medical Home pediatric team and parents of elementary school CSHCN. Focus groups and interviews were audio-taped and transcribed verbatim. Data were

analyzed through directed concept analysis.Results: Participants included 25 members of the Medical Home team and 7 parent members of a parent advisory group. Themes present in the data from both cohorts include: parents as communication intermediaries, health care confidentiality concerns, the need for open communication, providing advocacy for parents, and keeping everyone on the "same page" through a shared plan of care. Implications for the Nursing Role in a Medical Home: The nursing role needs to be explicitly defined within team practice. Nurses can partner with parents to identify relevant health information to be shared with teachers and help parents become skilled communicators about their child's health needs with support of the shared care plan. Guided Participation is a process through which nurses can share their knowledge and skill in communication with parents.

23. Tilson ML, Vollenweider CM. **Enterocutaneous fistula management: achieving patient-centered goals with innovative pouching techniques.** Presented at the Wound, Ostomy, and Continence Nurses Society Conference (41st), St. Louis, Missouri, June 6-10, 2010.

    Introduction: Perhaps one of the most challenging patient care situations that a wound, ostomy, and continence (WOC) nurse can encounter is the management and treatment of an enterocutaneous fistula. Treatment of this catastrophic complication usually involves multifaceted medical and nursing care. Nursing management of fistulas includes: a) protection of perifistular skin integrity, b) containment of effluent, c) control odor, d) allow accurate measurement of effluent, e) allow mobility and comfort for the patient, and f) decrease cost and time spent in care.

    Achieving predictable and effective containment of the fistula effluent often proves to be essential for patients to effectively cope with this rare and frustrating complication. Because each individual patient situation has its own complexities, management requires developing creative and individual plans of care. Utilization of basic pouching concepts, previously reported customized techniques, and networking with WOC nurses are invaluable tools to achieving the goals for management of enterocutaneous fistulas.

    Patient History: The patient is a 66-year-old Caucasian female with a past medical history of chronic abdominal pain and recurrent small bowel obstructions. Her medical history includes diabetes, anemia, hypertension, hypothyroidism, osteoporosis, Raynaud's phenomenon, recurrent pancreatitis, renal lithiasis, mild renal insufficiency and renal tubular acidosis.

    Surgical history includes numerous abdominal surgeries, including multiple laparotomies and lysis of adhesions, as well as sigmoidectomy with loop colostomy and subsequent colostomy takedown, total abdominal hysterectomy with left salpingo-oophorectomy, open cholecystectomy, and small bowel resection. With the last small bowel obstruction she underwent exploratory laparotomy and four-hour lysis of adhesions. She experienced complications including a deep vein thrombosis, and postoperative wound infection with methacillin-resistant staph aureus, and an enterocutaneous fistula at the most proximal aspect of her incision.

    Uneven abdominal contour with thick scar tissue related to multiple surgeries, wound infection, and closure by secondary intention with an enterocutaneous fistula matured into a well-formed stoma. After a CT scan, the fistula was determined to be mid-jejunal. The output was a thin yellow-green liquid with faint fecal odour, rich in digestive enzymes. With the assistance of negative pressure wound therapy, the incision distal to the fistula eventually healed, and the fistula matured into a well formed stoma. A Yaunker suction catheter was used to collect effluent during dressing changes to keep perifistular skin dry. Stomahesive powder was applied to the denuded areas of skin with the excess blown off, and a protective skin barrier wipe was dabbed over the powder. Four-inch hydrocolloid seals were cut in five wedge shaped pieces and molded together with a tongue blade around the distal aspect of the stoma. A two-inch hydrocolloid seal, divided in half and layered to create a double thickness, was placed above the stoma, so the peristomal plane was then even. A convex skin barrier and drainable pouch were applied as a unit, an ostomy belt was secured, and additional pieces of soft cloth tape were placed around the tape collar to further enhance the seal. The patient rested for 15 to 20 minutes to allow her body heat to enhance product adherence.

    Conclusions: This new application technique was able to provide a comfortable pouching system with a wear time of five to seven days. The products used were comparable in cost, accessible, and easily customized for the patient. The application time was reduced by minutes compared with other pouching techniques performed. Patient return visits required for applications were reduced to twice week in an outpatient clinic setting. The patient was able to regain a productive and active lifestyle including resumption of her exercise routine of walking up to two miles a day.

    The products used with this technique have been further utilized to customize other pouching systems for patients with enterocutaneous fistula(s) as well as less than ideal ostomy stomas to achieve adequate wear time. WOC nurses can contribute to providing efficient and effective patient care by sharing their experiences using the properties and functions of common products and/or equipment to customize treatments and achieve patient-centered goals.

Footnotes
Stomahesive powder & Allkare protective barrier wipes (ConvaTec)
Eakin cohesive seals, four-inch & two-inch (ConvaTec)
SUR-FIT Natura Durahesive Convex skin barrier with flange (ConvaTec)
Nu-Hope skin cement
Medipore soft cloth surgical tape (3M Health Care)

24. Weinberg HA. Coordinating ADHD care between school and doctor: an unique opportunity. Presented at the International Conference on ADHD (22nd) - "Pathways to Wellness, Healthy Minds and Resilience," Atlanta, Georgia, November 11, 2010.

    Program Description: Classroom teachers are contacted electronically twice a year and asked to complete updated rating forms on children in their classroom who are being treated and medicated for ADHD. Completed forms are sent directly to the child's doctor for review.

    Program Abstract: It is widely accepted that medicated children with ADHD require careful monitoring of their medication response and side effects in order to ensure the best possible care and outcome. Typically, children and their parents will visit with their prescribing provider periodically to review the child's response to medication, the presence of adverse events and make any necessary adjustments in dosage or medication. The frequency of these follow up visits vary from provider to provider, but can range any where from one month to several months. During these follow up visits, the prescribing provider requires accurate and current information about the child's medication response, and very often the classroom teacher is in the best position to offer this information. Although many parents observe their children while they are using medications, this may occur after school when medications are wearing off or on weekends when the child is not in the classroom environment. However, during these follow up visits, many parents have not received current information from the classroom teacher about the youngster's response to medications or other behavioral/academic issues. Consequently, many parents are forced to speculate about the youngster's current classroom functioning which may or may not be accurate appraisal of true functioning. This places the prescribing provider at a disadvantage when trying to make an informed assessment of the youngster's medication response, especially in the classroom setting where improved focusing and behavior is critical to the youngster's success.

    At the Gundersen Lutheran Medical Center in La Crosse, WI we have an ADHD Specialty Clinic that initiated an electronic communication and feedback system between the classroom teacher and the prescribing provider. We maintain an updated registry of youngsters who are being treated in our system for ADHD. Approximately 1200 primary and middle school youngsters are included in the registry. At the beginning of each school year letters are sent to their parents or guardians describing this project and asking their consent to participate. If they elect to participate, they then forward the information to their respective schools and the classroom teacher. Each school in our catchment area has an ADHD Coordinator who tracks the names of youngsters who are participating in this project. Twice during the school year, our ADHD Specialty Clinic sends out a group email to Directors of Special Education in the various school districts that encompass our catchment area. In this email, there is an attachment that includes a short Rating Form with additional space for narrative comments. The Special Education Directors then forward this email to the ADHD Coordinators at their respective schools who then forward the email to the identified classroom teachers.

    The teachers then complete the Rating Form and return it electronically, or by fax or physical mail. These Rating Forms are then distributed to the youngster's prescribing provider for further review.

    Although the prescribing providers do not always receive these Rating Forms at the exact time of scheduled follow up appointments, they universally find this information helpful. It better informs them about the youngster's medication response and any other behavioral or learning concerns, and often allows them to make more timely adjustments in the youngster's medication and dosage.

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