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was born in Winfield, Illinois. She received her BS in biology from Northern Illinois University in DeKalb and her DPM from the Dr. William M. Scholl School of Podiatric Medicine in Chicago. She presented a poster, *Fibular Stress Fractures Associated with Hindfoot Valgus* at the College of Foot and Ankle Surgeons Annual Meeting, earlier this year. Following graduation, Alissa will enter private practice in Florida. She and her husband, Bryan Zdancewicz, were married on December 5, 2003.

FIBULAR STRESS FRACTURES ASSOCIATED WITH HINDFOOT VALGUS DEFORMITY

ALISSA BERNER, DPM RONALD SAGE, DPM

INTRODUCTION

A stress fracture results from cumulative repetitive forces insufficient to cause an acute fracture, but which eventually lead to stress failure of the involved bone. Risk factors for stress fractures in the general population include osteoporosis, rheumatoid arthritis, osteomalacia, diabetes mellitus, and other metabolic diseases affecting bone formation.[1] The role of the fibula in weight-bearing has been studied previously.[2, 3] One study showed that with the ankle joint in neutral the fibula accepted 6.4% of the weight distribution.[3] The same study also showed that with lateral loading of the ankle joint the weight on the fibula increased by 62%. Studies on stress fractures of the lower extremity in patients with inflammatory arthritides have commented on valgus deformities of the knee, ankle, and subtalar joints.[4, 5,6] The purpose of the following study is to document a distinctive pattern of stress fractures of the fibula in patients exhibiting a hindfoot valgus deformity along with long term conservative and surgical management of the deformity.

MATERIALS AND METHODS

A retrospective investigation was performed on patients diagnosed with stress fractures of the fibula at our institution from 1991-2004. The diagnosis of stress fracture of the fibula was based on complaints of lateral ankle or leg pain without a history of obvious inversion or eversion injury, tenderness to palpation along the fibula and radiographic evidence of fibula fracture. Patients under the age of 18 and athletes were excluded from the study. The study was limited by chart and radiograph availability. Nine patients with fibular stress fractures met the criteria. All patients were female with an average age of 61. The clinical charts were reviewed for co-morbidities, subjective complaints and physical exams. Plain film radiographs and reports were reviewed for evaluation of fracture site and pattern, along with radiographic measurements of the ankle and lateral column alignments. Ankle alignment was measured on the AP view of the ankle as the relationship between the tibia and the talus.[7] The lateral column alignment was assessed on the lateral view as the relationship between the calcaneus and the talus.[8]

RESULTS

Nine female patients were studied with an average age of 61 years. Seven plain film radiographs were evaluated. Two radiology reports were reviewed. According to the charts, all except one of the patients related pain and swelling to the lateral malleolus of the affected limb at the time of initial presentation. Six of the nine patients denied known trauma to the affected limb. The remaining three patients either could not recall or related questionable trauma. On physical exam, eight patients experienced pain on palpation to the distal fibula. For one patient (Subject 8) the stress fracture of the left fibula was an incidental finding in a series of routine radiographs. She denied pain, swelling or known trauma to the left limb. Acutely, patients were treated with a removable cast boot, with or without a soft compressive wrap, an ankle stirrup brace or a below knee fiberglass cast. All patients

FIGURE 1A: Six months prior to stress fracture, flatfoot structure noted.

FIGURE 1B: Radiograph taken at the time of initial pain to distal fibula.

FIGURE 1C: Spiral oblique fracture of distal fibula, two months after Figure 1B.

FIGURE 2A: One month prior to symptoms.

FIGURE 2B: Films taken at the time of initial symptoms. Arrow indicates area of pain.

FIGURE 2C: Two weeks later. Note early periosteal reaction.

FIGURE 2D: Two more weeks later. Proliferation of periosteal reaction.

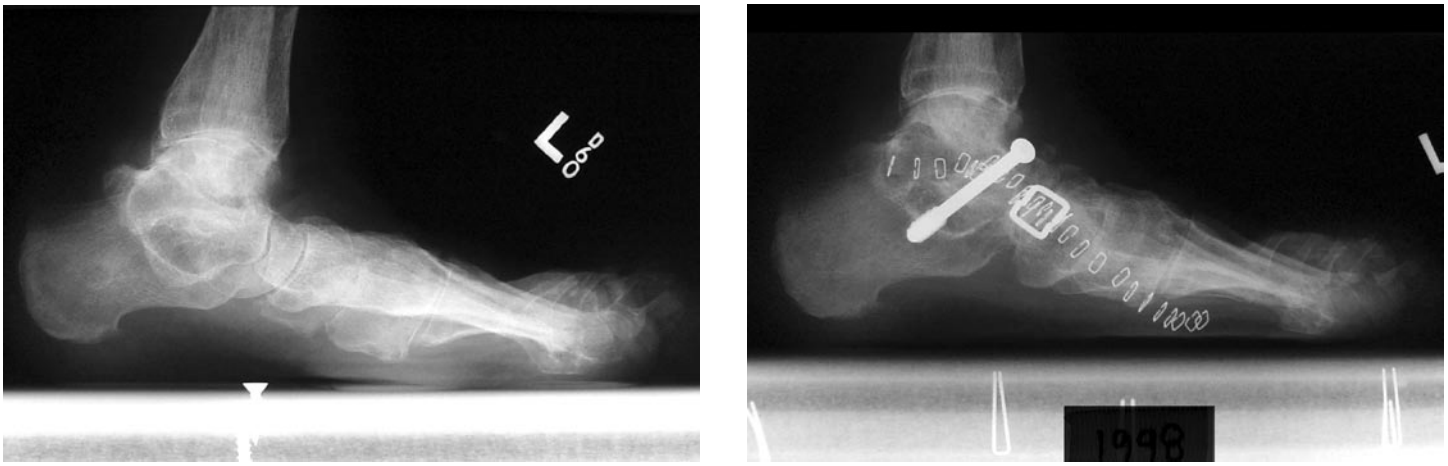

FIGURE 3A&B: In two patients, subtalar arthrodesis with tricortical iliac crest bone graft was performed once the fibular stress fracture had resolved. The bone was wedged into the lateral aspect of the subtalar joint in order to invert the position of the calcaneus and decrease the deforming force on the fibula.

Subject	Age	Limb	Calcaneal Inclination	Talocalcaneal Angle	Ankle Alignment	Fracture Pattern
1	57	Left	12	45	14	Spiral oblique fracture of the distal fibular diaphysis
2	65	Left	U.A.	U.A.	U.A.	Oblique fracture of distal fibular diaphysis*
3	59	Right	U.A.	U.A.	0	Transverse fracture of the fibular diaphysis proximal to ankle mortise
4	61	Left	24	34	5	Transverse fracture of the fibular diaphysis proximal to ankle mortise
5	87	Left	14	40	10	Distal lateral malleolus fracture
6	51	Right	10	48	14	Spiral oblique fracture of the distal fibular diaphysis
7	48	Right	U.A.	U.A.	U.A.	Oblique fracture of distal fibular diametaphysis*

TABLE 1: Data Evaluated
**As documented by radiology report of plain films, U.A. = Unavailable for measurement*

could weight-bear to their tolerance with a gait assistive device such as a walker or cane, if necessary.

Of the nine patients, four exhibited oblique or spiral oblique stress fractures of the fibula. Two of the four had a calcaneal inclination angle of 12 degrees or less, talocalcaneal angle of greater than 45 degrees and ankle alignment of 14 degrees of valgus as measured on the weight-bearing lateral views of the foot and AP views of the ankle of conventional radiographs. (Figure 1A-C) The remaining two patients had documented flatfoot deformity either in clinical charts or radiograph reports. Two of the patients with oblique fracture patterns of the fibula had a history of rheumatoid arthritis as documented in the clinical charts. Four patients exhibited transverse fractures of the fibula. Three fractures were proximal and one fracture distal to the ankle mortise. Of the patients with transverse fractures of the fibula, the ankle alignment was noted to be 12° or less in valgus. One patient with the transverse fracture of the fibula proximal to the ankle mortise demonstrated an increase in calcaneal inclination angle and decrease in talocalcaneal angle on the lateral view of the radiographs. (Figure 2A-D)

Long-term treatments for these patients included a variety of conservative and surgical means such as accommodative orthoses, thermoplastic ankle foot orthoses and subtalar joint arthrodeses with use of tricortical bone graft.

DISCUSSION

Malalignment of the lower extremity such as valgus deformity of the knee, ankle and subtalar joints contribute to excess stress on the tibia and fibula.[4, 5] This excessive force may result in a stress fracture. In the acute stage of a stress fracture, plain film radiographs are typically normal. The presence of periosteal reaction, cortical thickening, bone callous and a visible fracture line may take two to four weeks to appear.[5, 9] Solitary stress fractures of the fibula have been shown to occur just proximal to the lateral malleolus.[4] Our study supports this as seven of the nine fibular stress fractures presented as such. In our study, one half of the fibular stress fractures were oblique or spiral oblique in nature. The other half had a transverse pattern. The patients with the oblique or spiral oblique fractures exhibited valgus deformities of the ankle and/or subtalar joints.

In two patients, subtalar arthrodesis with tricortical iliac crest bone graft was performed once the fibular stress fracture had resolved. The bone was wedged into the lateral aspect of the subtalar joint in order to invert the position of the calcaneus and decrease the deforming force on the fibula. (Figure 3A-B) They were then fitted with in-lay, extra depth shoes and custom accommodative plastizote inserts with longitudinal arch supports.

Future research may focus on the forces the fibula experiences with excessive pronation or supination of the subtalar joint in the stance phase of gait. With an understanding of the biomechanics and deforming forces, appropriate conservative and surgical treatments can be implemented to treat hindfoot valgus deformity. Conservative options include UCB and AFO devices. Surgical interventions such as ankle, triple or subtalar arthrodesis with use of tricortical bone graft may be necessary to improve subtalar and/or ankle position.

REFERENCES

1. Roebuck, D.L., Finger, D.R., Irvin, T.L. Evaluation of suspected stress fractures. Orthopedics. 24: 771-773, 2001.
2. Lambert, K. L. The weight-bearing function of the fibula, a strain gauge study. J. Bone and Joint Surg. 53A: 507-513, 1971.
3. Takebe, K., Nakagawa, A., Minami, H., Kanazawa, H., Hirohata, K. Role of the fibula in weight-bearing. Clin Orthop. 184: 289-292, 1984.
4. Young, A., Kinsella, P., Boland, P. Stress fractures of the lower limb in patients with rheumatoid arthritis. J Bone and Joint Surg. 63B: 239-243, 1981.
5. Maenpaa, H., Lehto, M.U.K., Belt, E.A. Stress fractures of the ankle and forefoot in patients with inflammatory arthritides. Foot Ankle Int. 23: 833-837, 2002.
6. Schneider, R., Kaye, J.J. Insufficiency and stress fractures of the long bones occurring in patients with rheumatoid arthritis. Radiology. 116: 595-599, 1975.
7. Duckworth, T. The hindfoot and its relation to rotational deformities of the forefoot. Clin Orthop. 177: 39-48, 1983.
8. Schon, L.C., Weinfeld, S. B., Horton, G.A., Resch, S. Radiographic and clinical classification of acquired mid tarsus deformities. Foot Ankle Int. 19: 394-404, 1998.
9. Haverstock, B. Stress fractures of the foot and ankle. Clin Podiatr Med Surg. 18: 273-284, 2001.

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HEALTH-RELATED QUALITY OF LIFE, COGNITIVE FUNCTION, AND DEPRESSION IN DIABETIC PATIENTS WITH FOOT ULCER OR AMPUTATION: A PRELIMINARY STUDY

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LAWRENCE LAVERY, DPM, MPH

ABSTRACT

Diabetic foot ulcers, foot infection, Charcot foot arthropathy, and lower extremity amputation impart a severe negative impact on the health related quality of life in individuals with diabetes. The purpose of this study was to determine if there is a relationship between these negative impacts on health related quality of life and the presence of cognitive impairment or clinical depression.

Sixty adult diabetic individuals completed the Short Form 36 (SF-36) health related quality of life questionnaire, two screening examinations for cognitive function (Mini Mental Exam and Clock Drawing Test), and a screening examination for depression (Zung depression assessment). The two focus groups were comprised of twenty subjects each, and were undergoing treatment for: 1) diabetic foot ulcers or active Charcot foot arthropathy or 2) lower extremity amputation. A control group was comprised of twenty diabetic individuals without foot-related morbidity, but with evidence of peripheral neuropathy, as measured by insensitivity to the Semmes-Weinstein 5.07 (10gm) monofilament.

SF-36 (health-related quality of life) scoring was significantly impaired in both the diabetic foot ulcer/Charcot arthropathy ($p<0.001$) and amputee ($p<0.000$) groups. There was no evidence for the presence of cognitive impairment or depression in either group. The negative impact on health related quality of life was similar in both focus groups. ($p<0.314$)

The results of this preliminary study suggest that the negative impact on health related quality of life in diabetic patients with foot ulcer or Charcot foot arthropathy may be as severe as similar patients following lower extremity amputation. Cognitive impairment or clinical depression did not appear to play a role in the negative impact on health related quality of life in either focus group, nor did it appear to differ from a similar control population with no evidence of diabetic foot-related morbidity.

INTRODUCTION

Diabetic foot ulcers precede 85% of diabetes-related lower extremity amputations. Preventive strategies of foot-specific patient education, prophylactic skin and nail care as well as therapeutic footwear are currently well-accepted modalities capable of decreasing the risk for the development of diabetic foot ulcers.[1] Once a diabetic patient undergoes a lower extremity amputation, he/she is at increased risk for undergoing amputation of the contralateral limb [2,3,4] and succumbing at an earlier age.[5,6]

Diabetes-related morbidity negatively affects patients' perceived quality of life, as well as substantially inhibiting the ability to perform daily activities.[7] Peters, et al report that diabetics, following transtibial amputation, demonstrated significantly higher impairment scores on the Sickness Impact Profile than both non-amputees and forefoot amputees.[8] There is substantial evidence demonstrating both cognitive dysfunction and clinical depression in individuals with diabetes.[9,10,11] Diabetics are twice as likely to demonstrate clinical depression as similar individuals without a diagnosis of diabetes.[12,13,14] While many experts feel that depression and impaired cognition play an important role in negatively perceived quality of life, we are not aware of any

Gender	Physical Function	Health Limitation	Emotional Limitation	Energy	Well Being	Social Function	Pain	GenHealth	Tota SF36	Mini Mental	Clock Draw	Zung
Female N=6	800.00	233.33	283.33	220.00	380.00	170.83	154.17	370.83	2612.50	29.00	3.67	32.83
Male N=14	828.57	285.71	242.86	242.86	424.29	173.21	145.71	350.00	2693.21	27.07	3.79	35.07
Total N=20	820.00	255.00	255.00	236.00	411.00	172.50	148.25	356.25	2669.00	27.65	3.75	34.40

TABLE 1: Average Survey Score Comparison - *No Complication Group*

Gender	Physical Function	Health Limitation	Emotional Limitation	Energy	Well Being	Social Function	Pain	GenHealth	Tota SF36	Mini Mental	Clock Draw	Zung
Female N=8	400.00	87.50	162.50	207.50	297.50	137.50	120.00	263.37	1675.88	27.13	3.75	35.50
Male N=12	629.17	208.33	216.67	228.33	423.33	158.33	172.08	333.33	2369.58	28.25	3.58	32.42
Total N=20	537.50	160.00	195.00	220.00	373.00	150.00	151.25	305.35	2092.10	27.80	3.65	33.65

TABLE 2: Average Survey Score Comparison - *Ulceration Group*

Gender	Physical Function	Health Limitation	Emotional Limitation	Energy	Well Being	Social Function	Pain	GenHealth	Tota SF36	Mini Mental	Clock Draw	Zung
Female N=11	377.27	45.45	236.36	167.27	365.45	138.64	110.00	247.73	1688.18	28.00	3.64	38.73
Male N=9	566.67	177.78	177.78	268.89	404.44	130.56	117.22	322.22	2165.56	27.67	3.44	34.44
Total N=20	462.50	105.00	210.00	213.00	383.00	135.00	113.25	281.25	1903.00	27.85	3.55	36.80

TABLE 3: Average Survey Score Comparison - *Amputation Group*

		SF-36									Cognitive Function		Depression
		Physical Function	Health Limits	Emotional Score	Energy Level	Well Being	Social Function	Pain	General Health	Total	Mini Mental	Clock Draw	Zung
No Complications	Mean	820.00	270.00	255.00	236.00	411.00	172.50	148.25	356.25	2669.00	27.65	3.75	34.40
	Median	875.00	300.00	300.00	260.00	420.00	200.00	160.00	375.00	2782.50	29.50	4.00	34.00
	Std. Dev.	235.30	130.18	75.92	70.07	72.97	38.81	48.27	100.29	547.32	3.77	.44	6.70
Ulceration	Mean	537.50	160.00	195.00	220.00	373.00	150.00	151.25	305.35	2092.10	27.80	3.65	33.65
	Median	625.00	100.00	250.00	230.00	380.00	150.00	160.00	300.00	2090.00	29.00	4.00	32.50
	Std. Dev.	257.45	139.17	123.44	73.70	108.83	50.00	45.51	115.99	587.51	2.65	.49	7.11
Amputation	Mean	462.50	105.00	210.00	213.00	383.00	135.00	113.25	281.25	1903.00	27.85	3.55	36.80
	Median	350.00	.00	300.00	230.00	420.00	162.50	135.00	275.00	1877.50	29.00	4.00	35.50
	Std. Dev.	307.31	153.81	116.53	98.89	100.16	65.09	61.97	122.71	636.81	3.20	.94	7.10

TABLE 4: Statistical Data

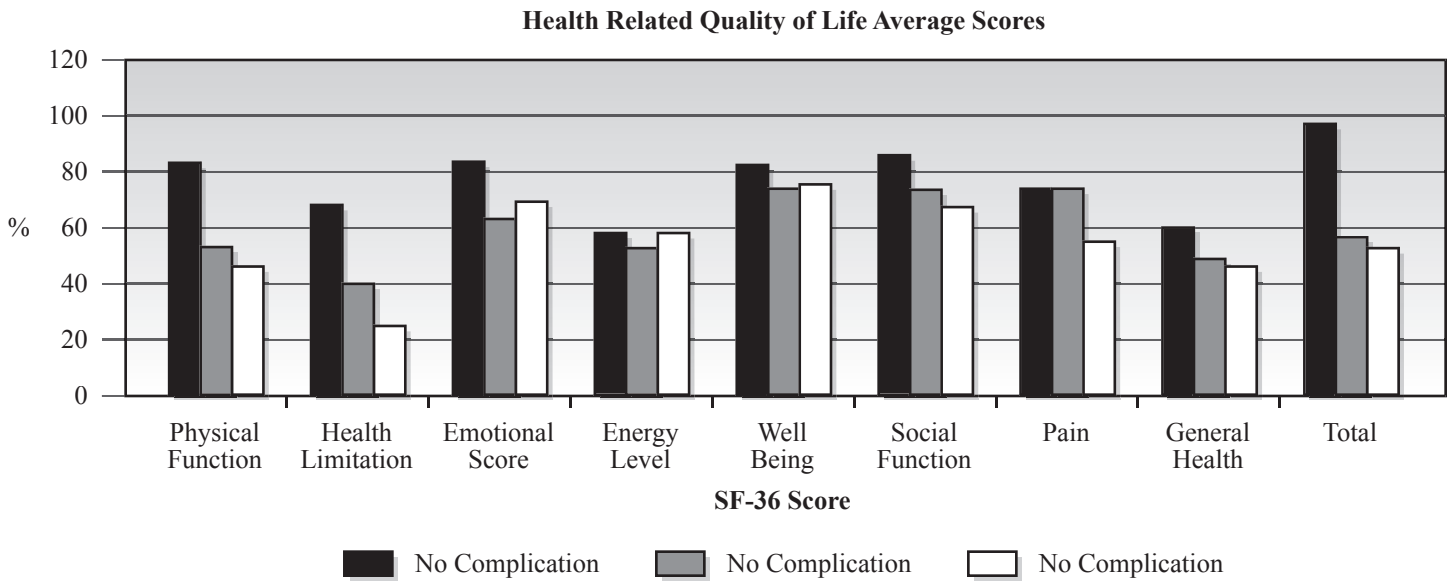

TABLE 5: Average Survey Score Comparison

	SF-36									Cognitive Function		Depression
	Physical Function	Health Limits	Emotional Score	Energy Level	Well Being	Social Function	Pain	General Health	Total	Mini Mental	Clock Draw	Zung
No Complication vs. Ulceration	.000	.017	.165	.565	.301	.157	.862	.127	.001	.565	.602	.659
No Complication vs. Amputation	.000	.001	.301	.265	.512	.046	.056	.060	.000	.841	1.000	.383
Ulceration vs. Amputation	.429	.127	.738	.640	.841	.512	.063	.512	.314	.698	.678	.242

TABLE 6: Statistical Data

attempts to correlate cognitive or psychological impairment in diabetic individuals with diabetic foot morbidity. The primary purpose of this project was to compare and contrast health related quality of life in individuals with diabetes and no foot-associated morbidity, those with diabetic foot ulcers and those who have undergone lower extremity amputation.

METHODS

Study focus groups consisted of twenty randomly selected adult individuals with diabetes who were undergoing clinical treatment for active diabetic foot ulcers or Charcot arthropathy of the foot, and twenty undergoing follow-up care at least six months following lower extremity amputation. A control group consisted of twenty diabetic individuals with no evidence of foot-specific morbidity, who had evidence of peripheral neuropathy, as determined by insensitivity to the Semmes-Weinstein 5.07 (10 gm) monofilament. Amputation level ranged from digital amputation to transtibial. The amputee group was not divided based on level of amputation.

Upon obtaining informed consent, each person completed four surveys and underwent a lower extremity examination. The SF-36 questionnaire was used to evaluate perceived functional status and health related quality of life. This survey consists of thirty-six questions divided into eight categories consisting of physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well being, social functioning, physical pain and general health. All questions are scored on a descending scale with a value of 100 representing the highest level of functioning possible. Scoring was performed based on standardized methods.[15,16,17] The level of cognitive functioning was determined by completing a clock drawing test and a Mini Mental examination.[18,19,20] The clock-

drawing test specifically evaluated frontal lobe function.[21,22] The Zung depression assessment was used to evaluate individuals for the presence of clinical depression.[23,24]

Statistical analysis was performed using SPSS v.10 software (SPSS Inc., Chicago, Il). Medians, means and standard deviations were computed for each group of interest. (Tables 1-5) Differences among groups were tested for statistical significance using Mann-Whitney test. Significance was noted at $p<=0.05$.

RESULTS

In this preliminary study, patients in both the diabetic foot ulcer/Charcot and lower extremity amputation groups displayed a decrease in perceived functional status and quality of life as evaluated by the SF-36 survey. Health related quality of life scores were significantly impaired in both the diabetic foot ulcer/Charcot ($p<0.001$) and amputee ($p<0.000$) groups in comparison to control subjects. (Table 6) The negative impact on health related quality of life was not statistically different in the two focus groups ($p<0.314$). This data indicates that there is an equal contribution to a decrease in health related quality of life in both focus groups. A statistically significant difference regarding both physical functioning and limitations due to health was present in both the foot ulcer/Charcot and amputee groups. There was no statistical difference between the two focus groups in these specific categories, nor was there any evidence for the presence of cognitive impairment or depression in either focus group.

DISCUSSION

The results of this preliminary study suggest that diabetic individuals who develop foot ulcers or Charcot arthropathy, or undergo a lower extremity amputation, may perceive their quality of life to be equally impaired by their health conditions. This data supports earlier studies which have indicated that lower extremity amputation may be correlated with decreased physical and psychosocial functioning.[8] We found that impairment in cognitive function was no worse in the two focus groups than in a similar control population with no foot morbidity, but who did have evidence of peripheral neuropathy. Clinical depression did not appear to play a substantial role. This was surprising due to the evidence indicating that individuals with diabetes are predisposed to both depression and cognitive impairment.

The limitations of this study include population size, lack of knowledge concerning length and control of diabetes, and lack of segregation regarding level of amputation or length of ulceration. Future endeavors will act to address the limitations. Obtaining the knowledge that diabetic foot ulcerations may be equally psychologically detrimental as lower extremity amputations should provide the practitioner with an added perspective to the disease process and associated complications.

REFERENCES

1. Pinzur, MS, Slovenkai, MP, and Trepman, E: Guidelines for Diabetic Foot Care. *Foot and Ank Int.* 20: 695-702, 1999.
2. Lavery LA, Armstrong DG, Vela SA, Quebedeaux TL, Fleischli JG: Practical criteria for screening patients at high risk for diabetic foot ulceration. *Arch Intern Med* 158: 158-162, 1998.
3. Lavery LA, Lavery DC, Quebedeaux TL: Increased foot pressures after great toe amputation in diabetes. *Diabetes Care* 18: 1460-1462, 1995.
4. Lavery LA, Vela SA, Fleischli JG, Armstrong DG, Lavery DC: Reducing plantar pressure in the neuropathic foot: a comparison of footwear. *Diabetes Care* 20: 1706-1710, 1997.
5. Lavery LA, VanHoutum WH, Harkless LB: In-hospital mortality and disposition of diabetic amputees in the Netherlands. *Diabet Med* 13: 192-197, 1996.
6. Pinzur MS, Gottschalf F, Smith D, Shanfield S, Shanfield S, deAndrade R, et al: Functional outcome of below-knee amputation in peripheral vascular insufficiency: a multicenter review. *Clin Orthop* 286: 247-249, 1990.
7. Gregg EW, Beckles GL, Williamson DF, Leveille SG, Langlois JA, Engelgau MM, Narayan KM: Diabetes and physical disability among older U.S. adults. *Diabetes Care* 23: 1272-1277, 2000.
8. Peters E, Childs MR, Wunderlich RP, Harkless LB, Armstrong DG, Lavery LA: Functional Status of Persons With Diabetes-Related Lower Extremity Amputations. *Diabetes Care* 24: 1-6, 2001.
9. Gregg EW, Yaffe K, Cauley JA, Rolka DB, Blackwell TL, Narayan KM, Cummings SR: Is diabetes associated with cognitive impairment and cognitive decline among older women? Study of Osteoporotic Fractures Research Group. *Arch Intern Med* 160 (2): 174-180, 2000.
10. Grodstein F, Chen J, Wilson R, Manson J: Type 2 Diabetes and Cognitive Function in Community-Dwelling Elderly Women. *Diabetes Care* 24: 1060-1065, 2001.

11. Thomas J, Jones G, Scarinci I, Brantley P: A Descriptive and Comparative Study of the Prevalence of Depressive and Anxiety Disorders in Low-Income Adults with Type 2 Diabetes and Other Chronic Illnesses. *Diabetes Care* 26: 2311-2317, 2003.
12. Anderson RJ, Freedland KE, Clouse RE, Lustman PJ: The prevalence of comorbid depression in adults with diabetes: a meta-analysis. *Diabetes Care* 24 1069-1078, 2001.
13. Edge LE, Zheng D, Simpson K: Comorbid Depression is Associated with Increased Health Care Use and Expenditures in Individuals with Diabetes. *Diabetes Care* 25: 464-470, 2002.
14. Lustman PJ, Anderson RJ, Freedland KE, deGroot M, Carney RM, Clouse RE: Depression and poor glycemic control: a meta-analytic review of the literature. *Diabetes Care* 23: 934-942, 2000.
15. McHorney, CA, Ware, JE Jr., Lu, R, and Sherbourne, CD: The MOS 36-Item Short Form Health Survey (SF-36): III. Tests of Data Quality, Scaling Assumptions, and Reliability Across Diverse Patient Groups. *Medical Care*, 32:40-66, 1994.
16. McHorney, CA, Ware, JE Jr., and Raczek, A: The MOS 36-Item Short Form Health Survey (SF-36): II. Psychometric and Clinical Tests of Validity in Measuring Physical and Mental Health Constructs. *Medical Care*, 31:247-263, 1993.
17. Jenkinson C, Coulter A, Wright L: Short form 36 (SF36) health survey questionnaire: normative date for adults of working age. *BMJ* 306 (6890): 1437-40, 1993.
18. Crum RM, Anthony JC, Bassett SS, Folstein MF: Population-based norms for the mini-mental state examination by age and educational level. *Journal of the American Medical Association* 269 (18): 2386-2391, 1993.
19. Folstein MF, Folstein SE, McHugh Pr: Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 12: 196-198, 1975.
20. Tombaugh TN, McIntyre NJ: The mini-mental state examination: A comprehensive review. *JAGS* 15: 548-561, 2000.
21. Shulman KI: Clock-drawing: Is it the ideal cognitive screening test? *Int J Geriatr Psychiatry* 15(6): 548-561, 2000.
22. Shulman KI, Gold DP, Cohen Ca, Zucchero CA: Clock-drawing and dementia in the community: a longitudinal study. *Int J Geriatr Psychiatry* 8: 487-496, 1993.
23. Zung W: A self-rating depression scale. *Arch Gen Psychiatry* 12: 63-70, 1965.
24. Steuer J, Bank L, Olsen EJ, Jarvik LF: Depression, physical health and somatic complaints in the elderly: a study of the Zung Self-Rating Depression Scale. *J Gerontol* 35(5): 683-688, 1980.