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Suicidal Ideation Among Individuals With Dysvascular Lower Extremity Amputation

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Abstract

Objective: To examine the estimated prevalence and correlates of suicidal ideation (SI) among individuals 1 year after a first lower extremity amputation (LEA).

Design: Cohort survey.

Setting: Four medical centers.

Participants: A referred sample of patients (N=239), primarily men, undergoing their first LEA because of complications of diabetes mellitus or peripheral arterial disease, were screened for participation between 2005 and 2008. Of these patients, 136 (57%) met study criteria and 87 (64%) enrolled; 70 (80.5%) of the enrolled patients had complete data regarding SI at 12-month follow-up.

Interventions: Not applicable.

Main Outcome Measures: SI, demographic/health information, depressive symptoms, mobility, independence in activities of daily living (ADL), satisfaction with mobility and ADL, medical comorbidities, social support, self-efficacy.

Results: At 12 months postamputation, 11 subjects (15.71%) reported SI; of these, 3 (27.3%) screened negative for depression. Lower mobility, lower satisfaction with mobility, greater impairment in ADL, lower satisfaction with ADL, lower self-efficacy, and depressive symptoms were all correlated with the presence of SI at a univariate level; of these, only depressive symptoms remained significantly associated with SI in a multivariable model.

Conclusions: SI was common among those with recent LEA. Several aspects of an amputee's clinical presentation, such as physical functioning, satisfaction with functioning, and self-efficacy, were associated with SI, although depression severity was the best risk marker. A subset of the

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sample endorsed SI in the absence of a positive depression screen. Brief screening for depression that includes assessment of SI is recommended.

Keywords

Amputation; Depression; Rehabilitation; Suicidal ideation

Amputation is a relatively common procedure. An estimated 185,000 individuals in the United States undergo an upper or lower limb amputation each year.[1] Recent studies suggest that 1.6 million individuals in the United States are living with an amputation, an estimate that is expected to double in the next 50 years.[2]

Although prevalence estimates vary, research suggests that individuals with an amputation are at increased risk of developing clinically significant depressive symptoms. Although there is some variability in how depressive symptoms are measured and how depression is defined, prevalence rates typically range from 25% to upwards of 50%,[3–6] which are comparable to the rates of depression reported among individuals with chronic illness or disability.[7–9] Rates of depression appear highest during the first 2 years after amputation, declining thereafter to approximately those seen in the general population,[5] which is estimated to be roughly 5% to 6%.[10,11]

Suicidal ideation (SI) is a symptom of major depressive disorder (MDD) as well as other depressive disorders (eg, dysthymia, minor depression).[12,13] A community cohort study[14] observed that 16.9% of individuals diagnosed with clinically significant depressive symptoms (ie, endorsing at least 2 symptoms of MDD, 1 of which was anhedonia or depressed mood) reported experiencing SI over a 2-year period. Estimates indicate that among individuals with MDD, 15.9% will attempt suicide at least once in their lifetime.[15] Because depressive disorders occur at an elevated rate among individuals with amputation (particularly in the first 2 years after amputation), this may be a population at higher risk for SI. Individuals with amputation related to diabetes mellitus (DM) may be at particular risk because the presence of comorbid depression and DM has been linked with an increased risk of SI compared with that associated with DM alone,[16] and because the link between depression, SI, and suicide attempts is well established.[17–19] Thus, an individual with a recent dysvascular lower extremity amputation (LEA) may be at a greater risk for SI, and consequently, suicide attempts or death by suicide.

Although less frequently discussed, some individuals report SI in the absence of depressive symptoms. In a study[20] of 11,015 primary care patients, 5.4% reported SI without depressive symptoms. In a sample of adults older than 75 years who endorsed SI in the past 2 weeks, only 50% met the criteria for a major depressive episode; among those who endorsed SI without depressive symptoms, impairments in activities of daily living (ADL) were significantly associated with SI.[21] There is even less information on individuals who attempt suicide in the absence of depressive symptoms or other psychiatric disorders, although 1 study[22] did note that approximately 11% of participants who attempted suicide did not meet *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* criteria for a psychiatric disorder.

Although psychiatric comorbidities have well-established associations with SI,[23,24] there is some evidence that physical comorbidity also leads to both increased depressive symptoms[3] and increased SI.[25,26] Research shows that individuals with chronic health conditions have an elevated risk for SI,[8,27,28] but comparatively little is known about SI in individuals with dysvascular LEA. Several studies[29,30] have reported that 20% to 29% of amputees experienced SI in the first few weeks after amputation. Another study[31] found that 36% of respondents who sustained amputations as a result of motor vehicle collisions endorsed SI. While amputation appears to be associated with an increased likelihood of SI, research has not explored the potential relation between known associates of SI (eg, depressive symptoms, self-efficacy) and amputation-specific experiences (eg, mobility and mobility satisfaction, impairment in ADL).

The present study sought to examine the estimated prevalence of SI 1 year after LEA secondary to complications from peripheral arterial disease (PAD) and DM. It was expected that individuals undergoing LEA would report increased levels of SI relative to the general population. The study also examined correlations with variables thought to be risk factors for SI in this population, including variables that have previously demonstrated correlations with depressive symptoms or SI in other populations (ie, age,[12,13] alcohol misuse,[32,33] smoking status,[34,35] mobility and satisfaction with mobility,[36–39] ADL and satisfaction with ADL,[21,40–42] pain,[43,44] social support,[45–47] self-rated health,[48–51] self-efficacy[52]). Additionally, this study's secondary aim was to evaluate the ability of a brief screening for depression to identify patients with recent SI.

Methods

Study design

This cross-sectional secondary analysis is part of a larger multisite prospective cohort study of individuals undergoing LEA because of PAD or DM at 2 Veterans Affairs medical centers, a university hospital, and a level I trauma center. Participants were assessed via in-person or telephone interview at 12 months postamputation. Additional details of the study design are described elsewhere.[36,53] This study was conducted in accordance with the procedures approved by the human subjects review boards at each study site.

Participants

Participants were considered eligible if (1) they were aged ≥18 years; (2) they were awaiting (or underwent in the last 6wk) a first major LEA, defined as transmetatarsal level or higher; and (3) the primary cause of amputation was DM or PAD. Subjects were excluded if they had any of the following: (1) cognitive or language impairment that would preclude consent or participation, defined by >4 errors on the Short Portable Mental Status Questionnaire[54]; (2) prior amputations; (3) nonambulatory before admission to the hospital for reasons unrelated to impairment of the extremity awaiting amputation; or (4) planned bilateral amputation. Of 239 individuals screened between 2005 and 2008, 136 (57%) met study criteria and 87 (64%) enrolled. Of these, 70 (80.5%) had complete data regarding SI at 12-month follow-up.

Measures: potential correlates of SI

Demographic information—For data analyses, covariates were dichotomously coded as follows: sex, male (0) or female (1); race, white (0) or nonwhite (1); and amputation level, below knee (transtibial or transmetatarsal, 0) or above knee (transfemoral, 1). Age and education were reported in years.

Depressive symptoms—The Patient Health Questionnaire-9 (PHQ-9),[55] a commonly used inventory of depressive symptoms,[56–58] was used to assess both the level of depressive symptoms and the presence of SI in the past 2 weeks at 12 months. A sum score of the first 8 items (ie, all symptoms except for SI) was computed. Possible scores range from 0 to 24, with higher scores representing greater depressive symptoms.

Depression screen—As proposed by the United States Preventive Services Task Force, a minimal screen for depression was included.[59] Individuals who endorsed experiencing anhedonia or depressed mood on more than half of the days in the past 2 weeks (items 1 and 2 from the PHQ-9) were considered screening positive for depression and coded as 1, and those who screened negative were coded as 0.

Medical comorbidities—The presence of comorbid conditions was assessed by modifying the Seattle Index of Comorbidity.[60] The Seattle Index of Comorbidity provides a score of comorbidity using a weighted sum. We removed the “current smoker” factor from the calculation since it was assessed separately. Additionally, pneumonia was excluded from the calculation because our study did not specifically ask participants whether they had received a diagnosis of pneumonia.

Alcohol misuse—Alcohol use was assessed at 12 months postamputation with the Alcohol Use Disorders Identification Test.[61] For data analyses, we recoded Alcohol Use Disorders Identification Test scores into a dichotomous variable reflecting alcohol misuse (1) or no misuse (0) according to standard guidelines, where scores ≥4 (≥3 for women) were considered indicative of misuse, and scores <4 (<3 for women) were considered to indicate “no misuse.”

Smoking status—Smoking status was assessed by a standard question from the Veterans Affairs Large Health Survey. Subjects were considered smokers (1) if they endorsed smoking “every day” or “some days” at 12-month follow-up; nonsmokers were coded as 0.

Self-rated health—Self-rated health was assessed via a single item with response options ranging from 1 (very poor) to 5 (very good) at 12-month follow-up.[62–64]

Mobility and satisfaction with mobility—Mobility was assessed at 12 months using the Locomotor Capability Index-5.[65] Possible scores range from 0 to 56, with higher scores representing higher functional mobility. To assess satisfaction with mobility, participants were asked, “How satisfied are you with your current walking ability?” Possible values ranged from 0 to 10, where 0 indicated “not at all satisfied” and 10, “extremely satisfied.”

ADL impairment and satisfaction with ADL—ADL impairment at 12 months was assessed using the Groningen Activity Restriction Scale.[66] Total possible scores range from 18 to 72, with higher scores indicating greater levels of impairment.[66] To assess satisfaction with ADL, participants were asked, "How satisfied are you with your current ability to perform activities of daily living?" Possible values ranged from 0 to 10, where 0 indicated "not at all satisfied" and 10, "extremely satisfied."

Pain—To assess pain at 12 months postamputation, participants were asked, "Do you currently experience any persistent and bothersome pain?"[67] and given "yes" (1) or "no" (0) response options.

Social support—We assessed the degree of social support at 12 months postamputation using the brief version of the Modified Social Support Survey, a measure of perceived social support developed initially as part of the Medical Outcomes Study[68] and subsequently shortened (to 5 items from 18) as part of the Multiple Sclerosis Quality of Life Inventory.[69] Possible total scores range from 0 to 100, with higher scores indicating greater perceived social support.

Self-efficacy—A widely used chronic illness self-efficacy scale[70] was adapted to assess perceived self-efficacy in coping with amputation-specific concerns (ie, preventing amputation from interfering with relationships, dealing with difficult emotions related to amputation). Possible scores range from 0 to 40, with higher scores indicating greater self-efficacy.

Outcome variable: SI—SI was assessed using the final item from the PHQ-9: "Thoughts that you would be better off dead or hurting yourself in some way" over the past 2 weeks. Any positive response to this item (ie, "several days," "more than half the days," or "nearly every day") was coded as 1 to reflect the presence of SI.

Data analysis

Univariate logistic regression analyses were used to identify potential correlates (noted above) of SI. Variables significantly correlated with SI at $P \leq .05$ were then entered simultaneously into a multivariable logistic regression model to determine the unique variance accounted for by each predictor. To determine the utility of the brief depression screening to detect SI, sensitivity and specificity were calculated.

Results

At 12 months postamputation, 15.71% (n=11) endorsed experiencing some degree of SI in the past 2 weeks. Among those endorsing SI, 3 individuals (27.3%) screened negative for depressive symptoms (see table 1 for other participant characteristics).

In univariate analyses, SI at 12 months postamputation was statistically significantly correlated with concurrent lower levels of mobility and ADL independence, as well as lower levels of satisfaction with both mobility and ADL (see table 2 for mean scores and frequencies of variables of interest). Additionally, 12-month SI was statistically significantly

associated with lower levels of self-efficacy and higher levels of depressive symptoms (table 3). When the variables statistically significantly associated with 12-month SI were entered into a multivariable model, only depressive symptoms were statistically significantly associated with SI.

With the use of the brief 2-item depression screen, 14 (20.0%) of the participants screened positive, endorsing either anhedonia or depressed mood on more than half the days in the past 2 weeks. The brief screen demonstrated a sensitivity of 72.7% and a specificity of 89.8% to detect SI.

Discussion

The present secondary analysis sought to explore the estimated prevalence and the correlates of SI in individuals after initial amputation of a lower extremity as a result of PAD or DM. Notably, findings from the present study suggest that individuals who undergo amputation have increased rates of SI in the first year after amputation compared with the general population. Compared with 2 prior studies[29,30] estimating the prevalence of SI after amputation, lower rates of SI were observed in the present study. This may partly reflect the amputation etiology of our sample, since studies with higher rates of SI have included individuals with traumatic amputations; some evidence suggests that individuals with traumatic amputations may experience increased rates of depression relative to individuals with amputations from other causes.[3] However, our SI estimates are consistent with those previously observed in individuals with diabetes (15%),[71] and are higher than reported prevalence rates in community-dwelling elderly men (1%)[72] and 1-year prevalence rates from a U.S. National Comorbidity Survey (3.3%).[73] This suggests that the present rates may be specific to individuals with amputations as a result of dysvascular disease, particularly associated with DM.

Several factors were identified in the present study that may impact the development of SI in individuals with LEA. Consistent with previous research in both medical and psychiatric samples, higher levels of depressive symptoms were correlated with SI at 12 months after amputation. Functional abilities, including both mobility and ADL, were correlated with SI. Individuals who reported more difficulties with ambulation and with ADL were more likely to report SI 1 year postamputation. Interestingly, at the univariate level, participants' satisfaction with mobility and ADL was also associated with SI 12 months after amputation. While assessing patient perceptions and satisfaction is not new to medicine,[74,75] there are far fewer studies exploring whether patient perceptions may have an equal or a greater influence on outcome than an objective evaluation of function.[76,77] However, this finding highlights both the importance of a patient's subjective appraisal of rehabilitation and the restoration of function and independence postamputation. Helping individuals establish reasonable expectations (or encouraging adjustment of unrealistic expectations) about mobility and independent functioning postamputation may increase patient satisfaction, which may, in turn, contribute to a reduction in SI.

Additionally, those endorsing SI also reported lower self-efficacy. As it relates to amputation, perceived self-efficacy was conceptualized as confidence in the ability to

ambulate effectively and carry out tasks of daily living. Individuals who report low self-efficacy may experience difficulties not only in completing tasks but also in evaluating perceived success of future tasks. Should individuals experience less recovery of function than expected, complications with recovery (eg, chronic pain), or increased difficulty adjusting to changes after amputation, they may experience decreased confidence in their ability to complete tasks and to cope with the effects of amputation. Both of these factors may confer an increased risk for developing depression and SI. As such, the present findings suggest that screening for depressed mood and SI is warranted for individuals who struggle with mobility and ADL, as well as for individuals who express frustration and dissatisfaction with their physical recovery. Screening may also be warranted if individuals report low levels of self-confidence or report difficulty meeting the demands of their environment. Recognition of these risk factors is particularly important for rehabilitation providers, who are likely to observe these challenges during the course of the clinical care they provide.

In the multivariable model, only depression remained significantly correlated with SI, perhaps unsurprising given that depressive symptoms are a risk factor for SI. However, more than one quarter of our sample reported SI in the absence of endorsing depression in the 2-item screen, suggesting that attention to the other variables associated with SI is warranted. Our small sample size of individuals reporting SI and a negative depression screen (n=3) precluded additional exploration of potential associations within this specific group. However, it may be that the variables significant at the univariate level are particularly important risk factors for those not endorsing depression. Thus, among the nondepressed, assessing satisfaction with function and self-efficacy may be even more important. Also of note, only 72.7% of those endorsing SI screened positive on the 2-item screen. The addition of a single item identifying SI provides minimal additional burden for care providers, particularly among higher-risk individuals.

Study limitations

Although the present study identified several factors potentially involved in the development of SI after amputation, several limitations precluded further investigation of these relationships. A relatively small number of participants endorsed SI, limiting the power to detect relationships between key variables, particularly in multivariable models. For instance, although social support has previously been associated with improved coping and adjustment to lower limb amputation,[78] no association was observed in the present study. Our sample of predominantly white older men provided limited variability and may preclude generalizability to more diverse populations. Future research should include larger samples and focus on identifying risk factors along the entire continuum of self-directed violence, as well as improving the precision in estimating the prevalence of SI. Given that other correlates of depressive symptoms (eg, hopelessness)[79] were not assessed, future research should consider assessing such constructs when evaluating contributing factors to the development of SI. Further, several of the constructs assessed relied on single-item measurement, limiting the reliability of measurement and factors that may comprise each construct. Of note, our outcome (SI) was also a single item, although using item 9 from the PHQ-9 as a single item to assess SI has been well established.[80–83]

Conclusions

The present study highlights the importance of screening for SI in individuals after amputation. With nearly 15% of the present sample reporting SI at 12 months postamputation, individuals with recent amputation appear to be a population with a heightened risk for developing SI. Additional screening appears warranted for individuals with a history of amputation, particularly those reporting dissatisfaction with recovery or lower self-efficacy. Given that this population may be more susceptible to both depression and SI, screening all individuals with recent LEA for SI would ensure that no patient's concerns would be lost in the midst of a variety of other health concerns and rehabilitation goals (eg, pain management, wound healing, gait training); this may be particularly important because some individuals in the present study reported SI in the absence of a positive depression screen. Depression screening should include assessment for SI, which can be as brief as a single item. Routine screening of individuals with amputations may result in increased identification of individuals with difficulty coping with their disability and serve as an important tool to help connect them with needed psychological services.

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List of abbreviations:

ADL	activities of daily living
DM	diabetes mellitus
LEA	lower extremity amputation
MDD	major depressive disorder
PAD	peripheral arterial disease
PHQ	9 Patient Health Questionnaire-9
SI	suicidal ideation

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Table 1

Baseline sociodemographic data among study participants with complete PHQ-9 data at 12 months (N=70)

Sociodemographic Data (Assessed at Baseline)	Values
Age (y)	61.64±8.79 (47–83)
Years of education	13.5±1.92 (10–18)
Male	65 (92.9)
Veteran	56 (82.4)
Race	
White	58 (82.9)
Other	12 (17.1)
Amputation level	
Below knee (transmetatarsal and transtibial)	63 (90.0)
Above knee (transfemoral)	7 (10.0)
Comorbidity score (SIC)	3.49±2.71 (0–11)
DM diagnosis	62 (88.6)

NOTE. Values are mean ± SD (range) or n (%).

Abbreviation: SIC, Seattle Index of Comorbidity.

Table 2

Variables assessed for associations with 12-month SI (N=70)

Variables (Assessed at 12mo)	Endorse SI (n = 11)	Do Not Endorse SI (n = 59)
Self-rated health	2.91±0.83 (2–4)	3.22±0.83 (1–5)
Mobility	32.27±17.11 (0–56)	43.33±13.43 (2–56)
Satisfaction with mobility	3.18±3.25 (0–8)	6.03±2.70 (0–10)
ADL impairment	35.64±12.84 (18–51)	27.14±12.17 (18–72)
Satisfaction with ADL	5.64±2.67 (2–9)	7.20±2.07 (2–10)
Social support	61.36±20.14 (35–100)	70.34±29.00 (5–100)
Self-efficacy	25.91±13.92 (0–40)	33.67±7.26 (12–40)
Depressive symptoms	13.09±6.47 (3–24)	4.05±3.68 (0–13)
Report persistent, bothersome pain	10 (90.9)	36 (61.0)
Alcohol misuse	1 (9.1)	8 (13.6)
Current smoker	5 (45.5)	15 (25.4)

NOTE. Values are mean ± SD (range) or n (%).

Table 3

Factors associated with SI at 12 months postamputation

	Unadjusted Univariate Analyses		Adjusted Analyses*	
Factors	**OR**	**95% CI**	**OR**	**95% CI**
Age	0.96	0.88–1.04	NT	NT
Race	0.09	0.07–4.91	NT	NT
Veteran	0.71	0.13–3.96	NT	NT
Sex	4.15	0.61–28.37	NT	NT
Years education	1.35	0.97–1.89†	NT	NT
Amputation level	0.88	0.10–8.15	NT	NT
DM	0.30	0.15–12.17	NT	NT
Comorbidities (SIC)	0.90	0.70–1.17	NT	NT
Alcohol misuse	0.64	0.07–5.68	NT	NT
Smoker	2.44	0.65–9.18	NT	NT
Self-rated health	0.64	0.29–1.39	NT	NT
Mobility	0.96	0.92–0.99‡	0.95	0.88–1.02
Mobility satisfaction	0.72	0.57–0.91§	0.91	0.57–1.44
ADL impairment	1.05	1.00–1.09‡	1.01	0.93–1.10
ADL satisfaction	0.74	0.55–0.99‡	1.22	0.73–2.05
Pain	1.86	0.77–53.29	NT	NT
Social support	0.99	0.97–1.01	NT	NT
Self-efficacy	0.92	0.87–0.99‡	0.97	0.86–1.10
Depressive symptoms	1.40	1.17–1.67‖	1.43	1.16–1.77‖

NOTE. Significance based on Wald statistic.

Abbreviations: CI, confidence interval; NT, not tested; OR, odds ratio; SIC, Seattle Index of Comorbidity.

*Fully adjusted model including univariate predictors significant at $P \leq .05$.

†$P \leq .10$.

‡$P \leq .05$.

§$P \leq .01$.

‖$P \leq .001$.