



DARTMOUTH



The Diabetic Foot – Pain – Depression Cycle:

A Retrospective Cohort Study

Brandon M. Brooks, DPM, MPH¹; Chia-Ding Shih, DPM, MPH, MA²; Bradley M. Brooks, DO³; Dyane E. Tower, DPM, MPH, MS⁴; Tiffany T. Tran, BS²; Vilayvanh Saysoukha, DPM, MS²; Janet Simon, DPM⁶; David G. Armstrong, DPM, MD, PHD⁷

1. The Dartmouth Institute for Health Policy and Clinical Practice, Hanover, NH; 2. California School of Podiatric Medicine at Samuel Merritt University, Oakland, CA; 3. The University of South Alabama Health, Mobile, AL; 4. American Podiatric Medical Association, Bethesda, MD; 5. Premier Foot and Ankle Centers of Tennessee, Murfreesboro, TN; 6. New Mexico Foot & Ankle Institute, Albuquerque, NM; 7. University of Southern California - Keck School of Medicine, Los Angeles, CA



DARTMOUTH



Purpose

The purpose of this study is to identify associations between the characteristics of patients with type 2 diabetes mellitus with ABIs greater than 0.8 and A1cs below 8.0% who underwent diabetic forefoot amputations (i.e toe, ray, transmetatarsal [TMA]) using postoperative opioids beyond 7 days. We hypothesized that patients who utilize antidepressant medication would have reduced odds of using postoperative medication. Secondly, we aimed to determine if any underlying mechanism can explain such a phenomenon given that this patient population commonly presents with altered sensation.

Background

Lower Extremity Amputations & The Diabetes Pandemic

- Over 100,000 Americans undergo some form of lower extremity amputation annually.¹
- Approximately 86% of these amputations are attributed to diabetes mellitus.^{1,2}
- Many patients with type 2 diabetes mellitus have altered epicritic and protopathic sensation, which may suggest that these same patient require less analgesics following surgery.³

Depression among US Adults

- Approximately 13% of US adults used antidepressant medication within the last 30 days; however, depression remains underdiagnosed.⁴
- US adults with depression are more likely to use opioids.⁵
- Many patients with type 2 diabetes mellitus have altered epicritic and protopathic sensation, which may suggest that these same patient require less analgesics following surgery.³

The United States Opioid Epidemic during the COVID-19 Pandemic

- The COVID-19 Pandemic has caused the United States Opioid Epidemic to worsen.⁶
- An estimated 5,000 to 6,000 Americans die every month from opioid overdoses in the United States, which is up from the 3,800-3,900 pre-pandemic levels.⁶⁻⁸

Methods: Research Design

Study Design

- We obtained institutional review board approval for a retrospective cohort study design. Charts from 2017 to 2021 at a large podiatry clinic in the Southeast were reviewed via CPT codes for forefoot amputations (i.e. partial and total toe, ray, TMA).

Inclusion Criteria

- All patients were prescribed opioids for 7 days or less at the time of surgery. All patients were seen 1 week after surgery for a post-op visit. All patients had a past medical history of type 2 diabetes mellitus and underwent forefoot amputations. Patients needed to have an A1c below 8.0% and an ABI above 0.8. Patients also needed to have no postoperative dehiscence and needed to remain healed at 2 months after the surgery.

Outcome of Interest

- Our outcome of interest was dichotomous: postoperative opioid use (1) 7 days or less and (2) beyond 7 days.
- The CDC recommends prescribing no more than 7 days of opioids for acute pain; several states have adopted restrictive opioid prescribing laws at 7 days or less.

Methods: Statistical Analyses

- Explanatory variables were patient demographics/history (age, BMI race, gender, marital status), use of antidepressants, and level of the amputation.
- Simple logistic regression was used for univariate analysis.
- We developed multiple logistic regression was used to adjust for confounding, as well as determine the direction and strength of the association.
- All explanatory variables with a p-value <0.1 in the univariate analysis were included in the multiple logistic regression model.
- We analyzed the data using Stata, v.15.1 (StataCorp, College Station, TX). We assessed statistical significance at p<0.05.

Results

Sample

- 50 patients met the inclusion criteria.

Univariate Analysis

- Only two explanatory variables met the criteria to be included in the multiple logistic regression model; these variables were marital status and use of an anti-depression. Age, BMI, race, level of the amputation, and gender were excluded from the adjusted model.

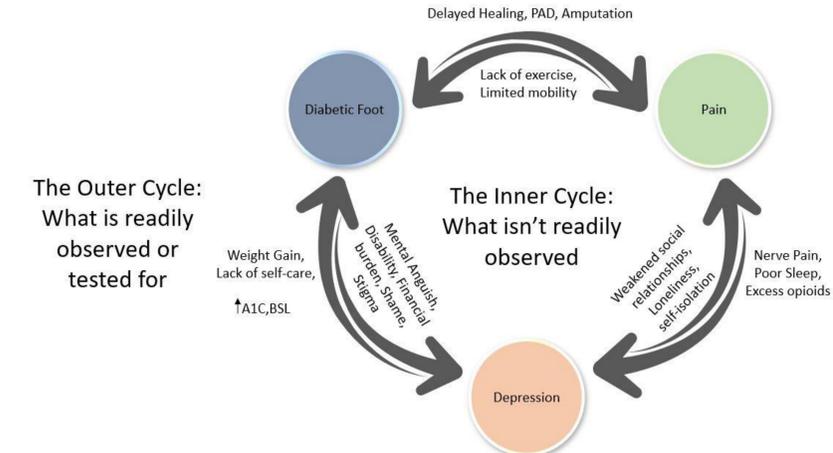
Multiple Logistic Regression Model

- Adjusting for marital status, patients that used antidepressant medication had decreased odds (OR 0.52; 95%CI 0.005,0.526; p=0.012) of utilizing postoperative opioids beyond 7 days following any diabetic forefoot amputation.

Discussion

- In this single-practice retrospective cohort study of 50 patients with type 2 diabetes mellitus that utilized antidepressants had significantly reduced odds of utilizing opioids beyond one week following forefoot amputations compared to those without antidepressants.
- The loss of part of the human body can be a traumatic event that is often associated with shame and stigma and may lead to depression. As podiatric physicians we must recognize that depression is associated with increased use of opioids.
- In order to further combat the United States Opioid Epidemic, it is imperative for Podiatric Physicians to screen for depression via the PHQ-2 and PHQ-9, which as their names suggest are two and nine questions each. We submit that all patients with type 2 diabetes mellitus that are undergoing a forefoot amputation should be screened with PHQ-2 pre-operatively. Those with a score of 3 or more, should receive the additional PHQ-9. If the PHQ-9 yields a score of 6 or more, then a psychiatry or mental health referral is warranted.
- Postoperatively, if a patient with type 2 diabetes mellitus who underwent a forefoot amputation uses opioids, beyond 7 days, we recommended screening for depression again after ruling out other explanations.
- We proposed the Diabetic Foot – Pain – Depression Cycle as an explanation based on this phenomenon that we observed and extensive review of the literature.

The Diabetic Foot – Pain – Depression Cycle



How to Screen your patients for Depression: The PHQ-2 and PHQ-9

Over the **last 2 weeks**, how often have you been bothered by the following problems?

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	<input type="radio"/> 0	<input type="radio"/> +1	<input type="radio"/> +2	<input type="radio"/> +3
2. Feeling down, depressed or hopeless	<input type="radio"/> 0	<input type="radio"/> +1	<input type="radio"/> +2	<input type="radio"/> +3

PHQ-2 score obtained by adding score for each question (total points)

Score: 0-6

3 or More = Also Screen with PHQ-9

Over the last 2 weeks, how often have you been bothered by any of the following problems? (use "*" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself...or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite—being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

Score of 3 or More means use the PHQ-9

Figure 1: The PHQ-2 Scored 0-6 "3 or More = Also Screen with PHQ-9"

Figure 2: The PHQ-9 – Scored 0 to 27 Depression Scores: 5 = Mild, 10 = Moderate, 15 = Mod-Severe, 20 = Severe

Conclusions

- Patients with type 2 diabetes mellitus that utilized antidepressants had significantly reduced odds of utilizing opioids beyond one week following any forefoot (i.e. toe, ray, TMA) amputation compared to those without antidepressants.
- We proposed an underlying *Diabetic Foot – Pain – Depression Cycle*.
- To break the cycle, podiatric physicians should not hesitate to screen for depression and make a mental health referral if warranted.
- Psychiatrists and other mental health providers should be considered members of limb salvage teams. care and prescribing non-opioid analgesics when warranted.

References

- LEA - Burden Toolkit. <https://nccd.cdc.gov/Toolkit/DiabetesBurden/Hospitalization/Lea>. Accessed September 1, 2021.
- Armstrong DG, Boulton AJM, Bus SA. Diabetic Foot Ulcers and Their Recurrence. *New England Journal of Medicine*. 2017;376(24):2367-2375. doi:10.1056/NEJMRA1615439
- Brooks BM, Brooks BM, Brooks BM, Fleischer AE, Smith RG, Albright RH. Postoperative Opioid Prescribing Practice in Foot and Ankle Surgery. *Journal of the American Podiatric Medical Association*. March 2021. doi:10.7547/20-223
- Brody DJ, Gu Q. Antidepressant Use Among Adults: United States, 2015-2018. *NCHS Data Brief*. 2020 Sep;(377):1-8. PMID: 33054926.
- Sullivan MD. Depression Effects on Long-term Prescription Opioid Use, Abuse, and Addiction. *Clin J Pain*. 2018 Sep;34(9):878-884. doi: 10.1097/AJP.0000000000000603. PMID: 29505419.
- Cantor J, Laurito A. The new services that opioid treatment programs have adopted in response to COVID-19. *J Subst Abuse Treat*. 2021 Nov;130:108393. doi: 10.1016/j.jsat.2021.108393. Epub 2021 Apr PMID: 34118694; PMCID: PMC8032476.
- Drug Overdose Deaths | Drug Overdose | CDC Injury Center. <https://www.cdc.gov/drugoverdose/data/statedeaths.html>. Accessed November 10, 2019.
- Opioid Overdose Crisis | National Institute on Drug Abuse (NIDA). <https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis>. Accessed November 8, 2019.