Complications Following Total Versus Partial Digital Amputation

UPMC LIFE CHANGING MEDICINE

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STATEMENT OF PURPOSE

Partial and complete toe amputations are often performed secondary to infection, ischemia, and pain. However, these procedures are overwhelmingly performed due to infection among diabetic patients. Although the affected area is removed, the change in foot architecture alters the biomechanics and may subsequently result in adjacent soft tissue break down. **The purpose of this study was to assess outcomes following partial and complete toe amputation.**

METHODOLOGY & PROCEDURES

SUBJECTS

- **Inclusion Criteria**: Index procedure of a single complete toe amputation (CTA) or single partial toe amputation (PTA) and a minimum of 12-month follow-up in the electronic medical record.
- **Exclusion Criteria**: Any elective foot or ankle procedure performed prior to or after the index amputation or who had a lower extremity amputation done at an outside medical facility.
- 62 patients (44 M, 18 F, age = 59.7 ± 12.7 years, 31 CTA, 31 PTA)
- 45 (72%) with Diabetes Mellitus
- 51 (82%) with Sensory Neuropathy (SN)
  - SN was defined as the loss of foot sensation to a 5.07 Semmes Weinstein Monofilament.
- Patients were identified using CPT codes

INDEPENDENT VARIABLES

- Index Procedure (CTA / PTA)
- Diagnosis of Diabetes Mellitus
- Diagnosis of Sensory Neuropathy

OUTCOME MEASURES

- Number of Subsequent Procedures
- Number of New Post-Operative Wounds
- Location of New Post-Operative Wounds
- Time Frame from When a Patient was Released from Care and Voluntary Return Visit

STATISTICAL ANALYSIS

- Independent samples T-tests, Mann-Whitney U and Fisher's Exact Tests were used to identify differences between CTA and PTA, and between a sub-cohort of patients with and without SN

LITERATURE REVIEW

Diabetes mellitus is the most common underlying cause of lower extremity amputations in the United States and Europe, half of which are performed at the level of the foot.[1] Among patients requiring foot amputations at any level, the hallux or first ray is most commonly affected.[1] In 1996, Dillingham et al. estimated the average 12-month service use and medical care cost associated with an isolated toe amputation in diabetic patients to be $45,513; a figure that has most certainly increased over the last twelve years. In light of this prevalence and economic burden, there is debate about the optimal level of digital amputation, specifically when the malady does not involve the entire toe.

Previous literature has demonstrated acquired digital deformities[2] and abnormal pressure distributions after a complete hallux amputation[3,4] leading to the assumption that it is beneficial to preserve length. However, as seen with infection, the desire to restore optimal biomechanics must be reconciled with the likelihood of leaving diseased tissue intact. Despite thorough resection, as many as 41% of foot amputations retain osteomyelitis resulting in dehiscence, re-ulceration, re-amputation, and even death.[5] Furthermore, as high as 23% of index toe amputations require a higher level re-amputation after one year,[6] leading to significant morbidity and mortality. [7,8 9-11]

To our knowledge, no study has investigated the effect of amputation at the inter-phalangeal joint compared to the metatarsal-phalangeal joint secondary to any pathology.

RESULTS

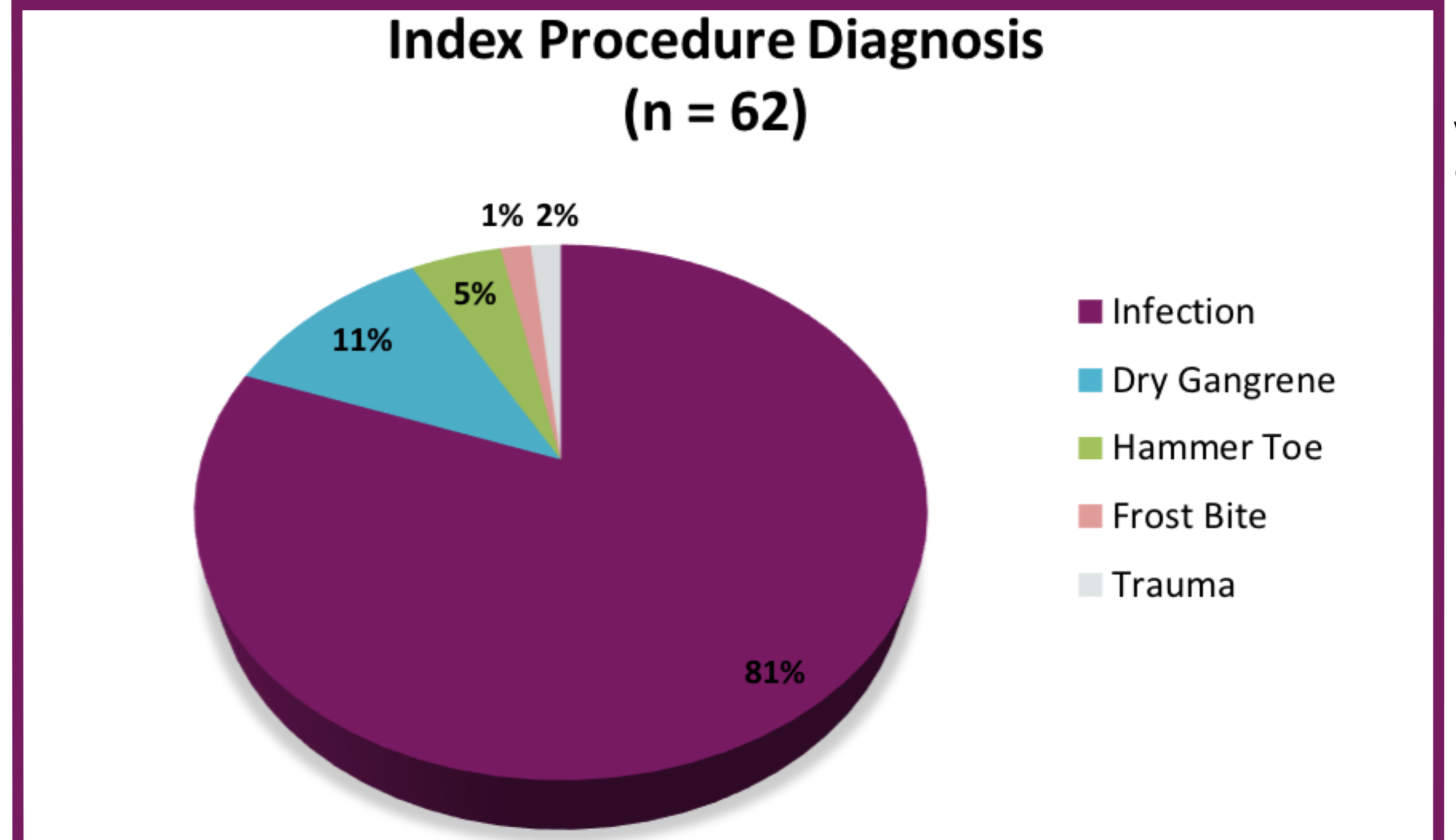

Figure 1. Frequency distribution of the index procedure diagnosis among all patients.

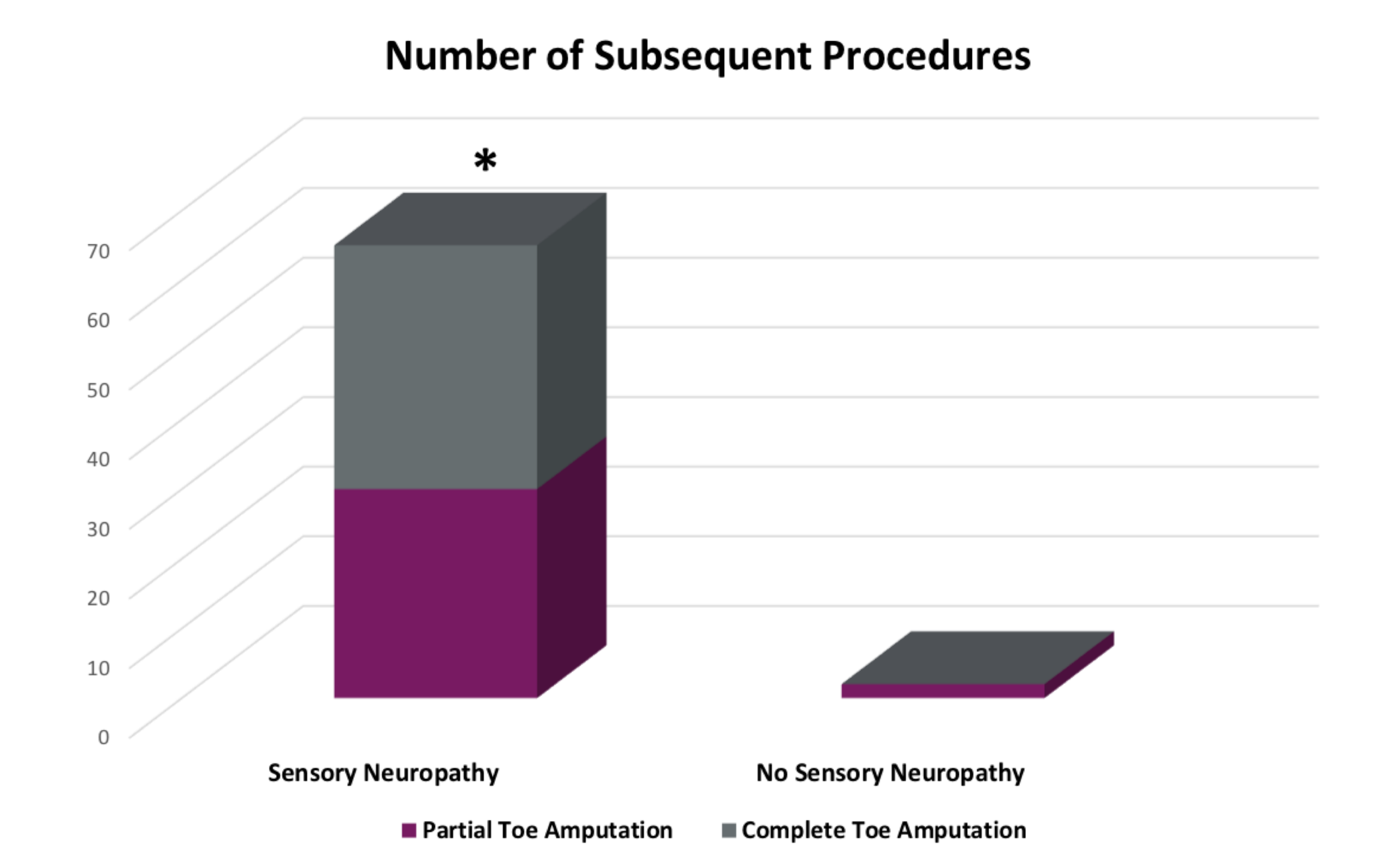

Figure 2. Number of subsequent procedures among patients with a CTA and PTA index procedure with and without SN. **Patients with SN had significantly more subsequent procedures (*U* = 120.0, *p* = .002).**

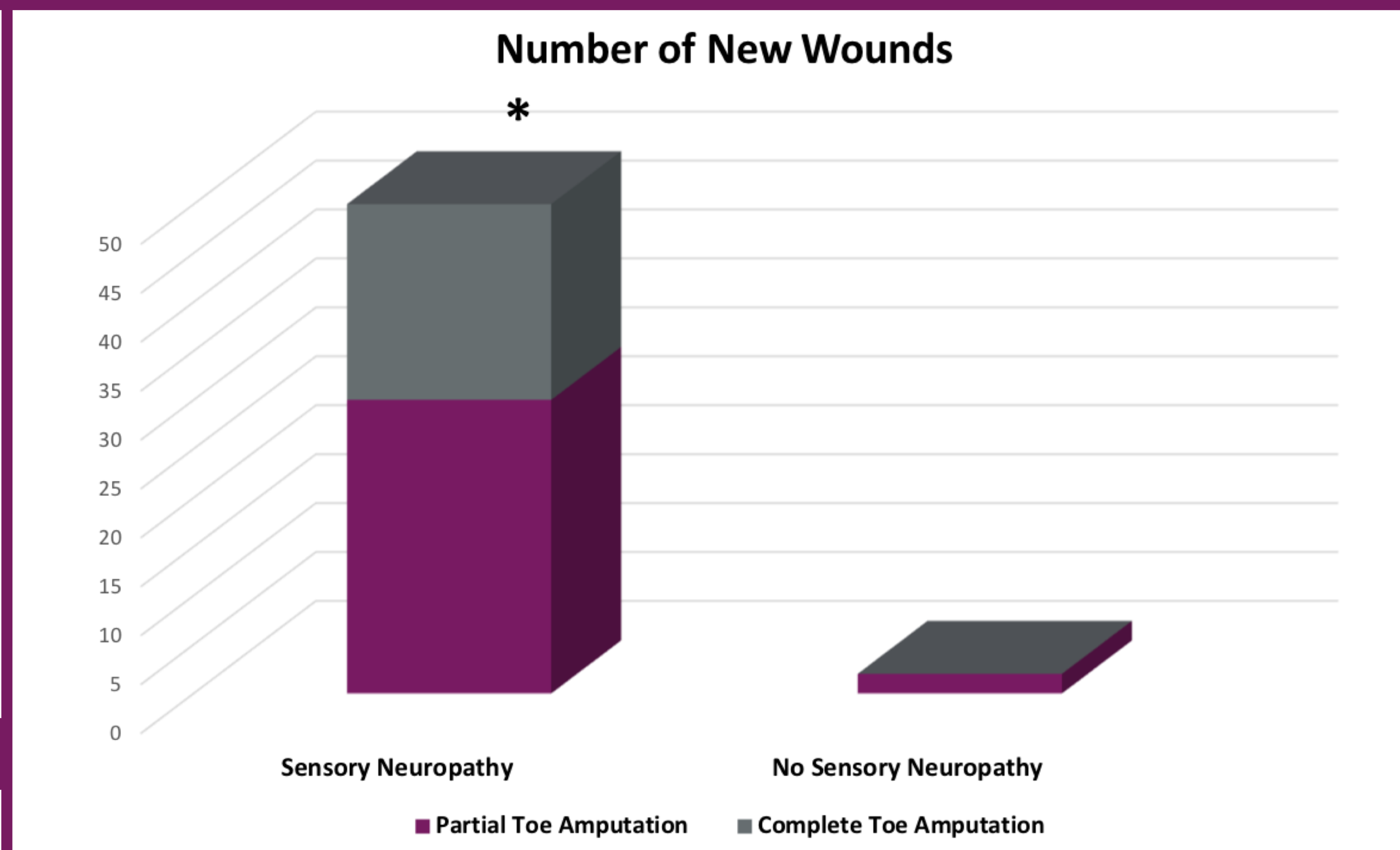

Figure 3. Number of new wounds among patients with a CTA and PTA index procedure with and without SN. **Patients with SN had significantly more new wound development (*U* = 138.0, *p* = .005).**

NEW WOUND LOCATION

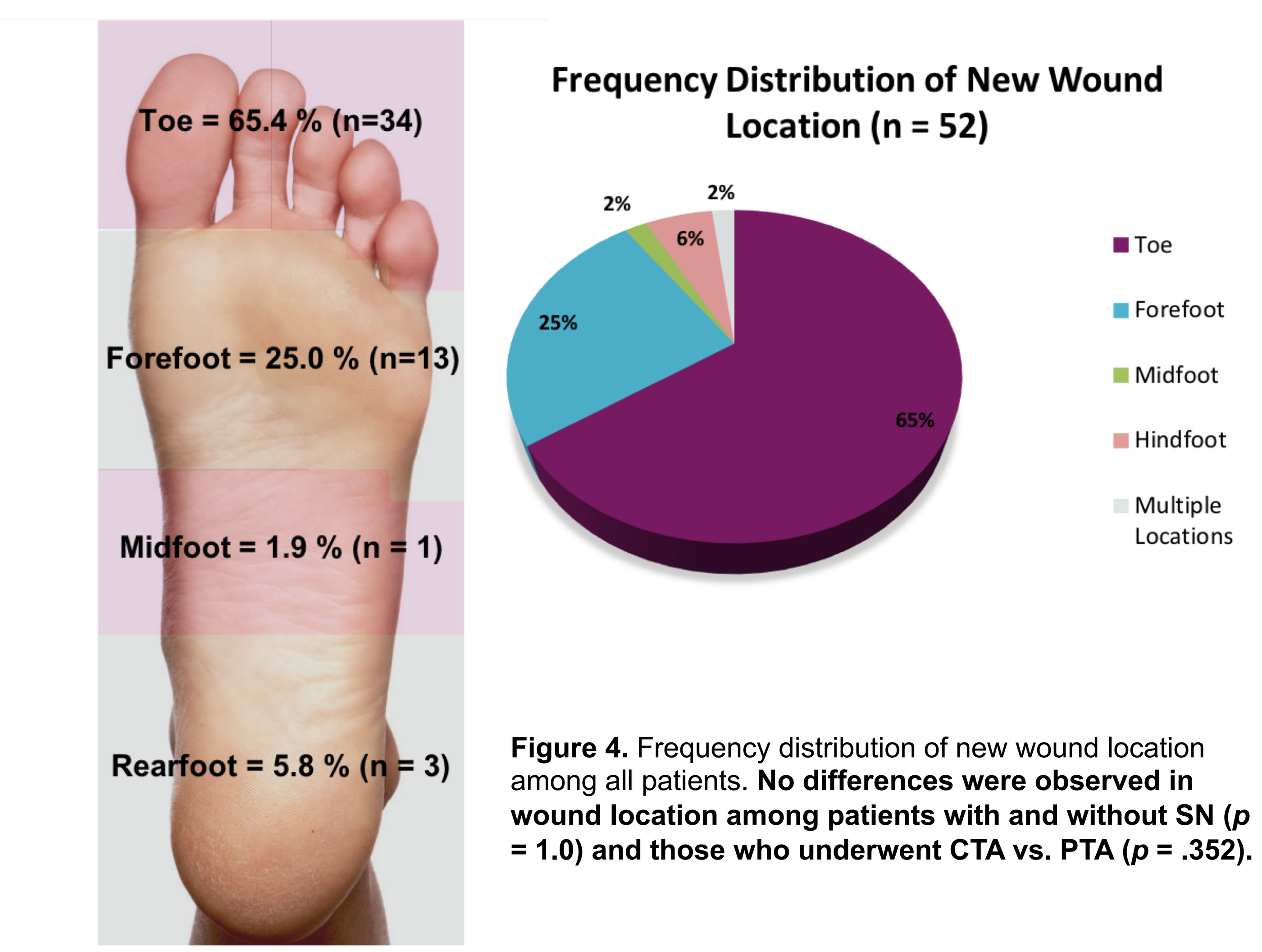

Figure 4. Frequency distribution of new wound location among all patients. **No differences were observed in wound location among patients with and without SN (*p* = 1.0) and those who underwent CTA vs. PTA (*p* = .352).**

Multiple Locations = 1.9 % (n = 1)

ADDITIONAL RESULTS

- No difference among patients with CTA and PTA (T = .436, *p* = .672) from the time the patient was released from care (PRN) and voluntary return visit
- No difference among patients with and without SN (*p* = .102) from the time the patient was released from care (PRN) and voluntary return visit

ANALYSIS & DISCUSSION

- Patients with SN had significantly more subsequent procedures and increased incidence of new wound development compared to those without SN.
- There were no differences among outcome measures in patients with CTA and PTA.
- 58% of patients required a subsequent procedure and 53% developed a new wound after the index procedure, similar to the incidence rate of new wound development following hallux amputation reported as 48%.[2]
- An average of 280 days passed between the index procedure and the first subsequent procedure.
- 65% of new wounds developed in the toes. As demonstrated after hallux amputation, any level of digital amputation likely alters biomechanics, causing abnormal pressure distribution and putting the most adjacent soft tissue structures at risk of breakdown and deformity. [2-4]
- If one assumes preserving length is biomechanically advantageous, removing the least amount of affected toe may protect against the cascading events of wound development, infection, and amputation. Unfortunately, this protective effect was not seen in those with SN.
- While prior literature has shown promising results with conservative treatment of digital amputation, these have been limited by small sample size and short follow-up.[12-13]
- Further investigation is needed to ascertain causes of complications following digital amputation.

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