Amputation Outcomes

Gary M. Rothenberg, DPM, CDE, CWS
Clinical Assistant Professor
Department of Internal Medicine - Podiatry
University of Michigan School of Medicine
Ann Arbor, Michigan

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New Cardiovascular Horizons
Disclosures

No relevant disclosures related to this presentation
Objectives

- Amputation outcome measures
  - Rates
- Amputation outcomes by level
- Amputation predictors
  - Smoking
  - ESRD
- Future directions for outcomes research
Introduction – Amputation Outcomes

- Despite advancements in limb salvage treatments, lower-extremity amputations continue to pose a significant health care challenge.
- In the US, there are more than 1.6 million amputees, and that number is projected to double to 3.6 million by the year 2050.
- Amputation outcomes are multifactorial and predicting outcomes is difficult.
- Reoperation, ulcer recurrence, major amputations and mortality are common failure outcome measures.
- Amputation rates have not increased in several decades.
Amputation Rates


**Medical Daily**

January 24, 2012 Tuesday - 05:32 pm EST

**Diabetes Amputations Drop Dramatically**

By Christine Hsu

The rate of foot and leg amputations as a result of diabetes have fallen by more than half since the mid-1990s, according to a new government research released on Tuesday.

Amputations were once a common fate for diabetics, but health officials said that the rate of foot and leg amputations among diabetes patients aged 40 and older fell by 60 percent between 1996 and 2008, according to a data analysis by the U.S. Centers for Disease Control and Prevention.
Amputation Rates


“The rate of foot and leg amputations among diabetes patients age 40 and older fell by 65% between 1996 and 2008.”

- Improvements in blood glucose control
- Improvements in foot care and diabetes treatments
- Decline in cardiovascular disease
- Medicare coverage for blood sugar monitoring and protective shoes
- Number of people diagnosed with diabetes has tripled in the past 20 years
- Advances in Vascular Surgery
- Multidisciplinary Approach and integrated centers
- EBM algorithms including advanced modalities
- Diabetes Education

<table>
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<th>Year</th>
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<table>
<thead>
<tr>
<th>Group</th>
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<tr>
<td>Men</td>
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<tr>
<td>Age &gt;75</td>
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The probability of major amputation depends on who you are and where you live. Amputation rates vary by race, age, socioeconomic status, hospital volume and geographic location.

- Medicare and Medicaid patients are more likely to have major amputations
- 2012 Total direct inpatient and outpatient costs:
  - **Major** amputations $11.1 billion
  - **Minor** amputations $13.6 billion
- Other significant costs associated with amputations include:
  - inability for patient and / or caregivers to earn wages,
  - long term facility costs
  - modifications for living including handrails, wheelchair ramps, etc.
Distal Amputation Value
Major vs. Minor

- Lower rate of mortality
  - 5% vs. 21% 1 year
- Higher rehabilitation potential
  - 70% vs. 19% walk 1km
  - 93% vs. 61% return home
  - 40% regular use of prosthesis

Despite a longer healing time (29 vs. 8 weeks) and high re-amputation rates, long term results are more favorable with minor vs. major amputations.

Aim of the study is to determine the predictors for reulceration, reamputation, and mortality in patients with diabetes following toe amputations and the impact on activities of daily living.

- Prospective cohort of 245 patients who had a toe amputation followed for 5 years.
- Wound Healing 82.4%.
- Incidence of new foot ulcer: 27.3% / 57.2% / 76.4%.
- Reamputation rates: 12.5% / 22.3% / 47.1%.
- Cumulative mortality: 5.8% / 15.1% / 32.7%.
- HbA1C >9% independent predictor of impaired wound healing, reulceration and reamputation.
- Age >70 independent predictor of reamputation, mortality, and impairment of ADLs.

Conclusion: Long term outcomes of toe amputations are not optimistic. Taking measures to prevent reulceration and reamputation is very important in patients with diabetic foot minor amputations.
First Ray Amputation

5 studies -- 435 Patients underwent 1st ray amputations

- Mean f/u 26 months
- Mean Age 59
- 19.8% re-amputation rate
  - 37.2% Additional digit
  - 32.6% TMA
  - 29.1% BKA
  - 1.2% Lisfranc

Conclusion: One out of every 5 patients undergoing a partial first ray amputation subsequently require a more proximal amputation to achieve a durable, weight bearing residual extremity.
Transmetatarsal Amputation


TMA healing success

- Hunter 1975 46%
- Young 1977 73%
- Durham 1989 53%
- Pomposelli 1993 93%
- Hosch 1997 68%
- LaFontaine 2001 74%
- Pollard 2006 57%
- Landry 2011 53%

Meta-analysis of 24 studies

- 1453 TMAs
- 19% readmission rates within 60 days
- 26.9% reoperation
- 35.8% reamputation (any level)
- 33.2% major amputation

Conclusion: Reoperation, reamputation, and major amputation occur frequently after TMA. Direct comparison amputation level studies are needed in patients with similar preoperative health.

Non healing TMA’s result in increased hospitalizations and increased amputations
Chopart Amputation

Retrospective study on outcomes (ulcer recurrence, major amputation and death) in diabetic patients undergoing Chopart amputation because of deep infection or midfoot gangrene.

83 patients Chopart amputation between 2009-2011
Mean age 71.4 years
Mean follow-up 2.8 years
47/83 (56.6%) healed mean 164.7 days
31.9% ulcer recurrence
27.7% major amputation
45.8% died (advanced age, history of stroke, urgent surgery)

Conclusion: Chopart amputation represents a last chance to avoid major amputation for diabetic patients with deep infections or midfoot gangrene. Success rate is high enough to consider this level as a viable option for limb salvage.
**Syme’s Amputation**


Potential benefits of the Syme’s level include the ability to end weightbearing, relatively easy prosthesis fitting, less extensive rehab or placement in skilled nursing or rehab facilities.

33 patients underwent Syme’s amputation for diabetic foot infections

- Average f/u 6.8 years
- Average Age 62.1 years
- 17/33 (51.5%) patients died
- 4/33 (12.1%) converted to BKA
- Average Mobility Index 34.7
- Functional Index 29.9
- Bothersome Index 30.6

Conclusion: Patients having a Syme’s amputation seem to fare better than patients with BKA in terms of less rehab and more functional independence.
Meta-analysis of smoking, as a single risk factor, was analyzed and used to compare adverse outcomes in the postoperative setting of foot and ankle surgery.

**Toe amputation** – Smoking has no influence on the rate of subsequent major amputation after amputation of ≥1 toes as a result of PAD.

**Palpable pulses or functioning arterial reconstruction** found to be predictors of success.

**Transmetatarsal amputation** – No significant difference in healing rates between patients with and without a smoking history (retrospective). Smoking habits did not have any predictive value in terms of wound healing (prospective).

**Blood glucose control (HbA1C)** found to be a predictor of success and the need for debridement after amputation was a predictor of failure.

**Syme’s amputation** – Smoking did not appear to affect wound healing rates however, the overall infection rate was 3 times greater in smokers.
Are Outcomes Affected by ESRD?

Purpose: Compare outcomes of transtibial amputation patients with ESRD to patients without, and identify risk factors for mortality after TTA.

- Retrospective review TTA for chronic infections, nonreconstructable lower extremity PAD, Charcot deformity
- 102 patients April 2006 – Jan 2016
  - 81 (79.4%) no ESRD
  - 21 (20.6%) ESRD
- Median age 56
- Median follow-up 109 weeks

- Patients with ESRD were less likely to ambulate
  - 42.9% vs 67.9%
- Patients with ESRD were more likely to die
  - 52.4% vs 23.5%

Conclusion: TTA in patients with diabetes was associated with significant morbidity and mortality. Risk factors significantly associated with increased rate of mortality include ESRD, age ≥56 and inability to ambulate postoperatively.
The Patient Perspective

Reed, AB et al. Major Lower Extremity Amputation after Multiple Revascularizations: Was it Worth It?  

**Purpose:** To investigate the patients’ perspectives of multiple procedures for limb salvage that culminated in major lower extremity amputation

- **Jan 2000- Dec 2005**
  - 78 patients BKA/AKA
  - 46 alive at 5 years (59%)
  - 13 lost to follow-up

- **33 patients**
  - 142 revasc procedures (median 4/patient)
    - 94 open procedures
    - 48 percutaneous

Eight-five percent (28/33) of amputees surveyed would do everything to save the leg if faced with a similar scenario, regardless of the number of procedures

- **18/33** actively used a prosthesis (54%)
- **30/33** resided at home (91%)
Multidisciplinary Approach and Evidence Based Algorithms

Previous studies have demonstrated a reduction of major amputations by up to 80% simply in centers that function as a multidisciplinary group:

- Centers of Excellence
- Mid-level providers
- Surveillance
- Strong focus on prevention
- Appropriate and timely consultations
- Expedited management of complicated patients

The cost of curative care is 5-30 times greater than cost of preventive care.
Amputation Outcomes and Future Directions

Delivery and outcomes for lower extremity amputations will vary according to the region and type of surgeon performing the operation.

Future work should not only focus on predictors of outcomes but also explore the variability in outcomes and develop initiatives to improve the quality of health care delivery to this vulnerable patient population.
Amputation Outcomes

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