Reducing Hospital Admissions:

A Diabetic Foot Program that can Effectively Prevent Amputations, Improve Clinical Outcomes, and Decrease Hospitalizations

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Learning Objectives:

- Detailed approach to an innovative program with proven clinical excellence, leading to financial rewards.
- Link between the foot exam and the cardiovascular health of the patient.
- Immediate incision and drainage of the infected diabetic foot improves chances of limb preservation.

The Urgency:

From the CA Governor's PAD Task Force Meeting, Feb 3, 2009:

- Two thirds of U.S. adults 20-74 yrs are either overweight or obese.
- Former Surgeon General Richard Carmona calls obesity "a threat to our national security."
- Obesity has led to Diabetes in 6.3% of the American population.
- There is a strong correlation between obesity, diabetes, heart disease, and PAD.
- Over 16 million Americans will have PAD by 2030 (12 million now).

*Ogden et al JAMA 2006 1/3 are obese.
CDC Estimated diabetes costs in the United States in 2007

- **Total (direct and indirect):** $174 billion
- **Direct medical costs:** $116 billion
- **Indirect costs:** $58 billion (disability, work loss, premature mortality)
- 2.3 times higher cost than for non-diabetics.
- 33% of this care cost is linked to the treatment of foot ulcers.

cdc.gov 2010.

Cost of Amputations

- $740 to $1140 for a leg amputation.
- $30,000 to $60,000 in hospital costs.
- between $43,000 and $60,000 over the next 3 years in follow-up care.

1. Cheryl Clark, for Health Leaders Media, August 14, 2009

Lower Extremity Crude Amputation Rate in 2005 was 4.3 per 1000 persons with diabetes.

Males are twice as likely to have an amputation as a female.
In 2005 the age-adjusted LEA rate per 1000 person with diabetes was 5.7 among blacks and 2.5 among whites.

Limb Preservation. The Impossible Dream?
Are we just chasing windmills?

- Too many patients
- Not enough providers interested to see feet
- Not enough people trained specifically in treating foot ulcers and vascular complications
- Too hard, as patients too sick and non-compliant

Our Kaiser Baldwin Park Story

- In 1997 the Baldwin Park (BPK) hospital opened to service a primarily Hispanic (88%) community with Kaiser membership of 230,000 patients and 12,000 diabetics.
- 3 general podiatrists.
- No vascular surgeon.

Diabetic Foot Care Services:

- Moved this service from Podiatry/Orthopedics to Primary care offices in 1998-2000. Training and certification of providers by Podiatrist.
- MDs, RNPs, PAs perform the High risk DM foot care with diabetes management at primary care level. Educated on nuances of vascular and foot issues.
What became clear: Lots of Gangrene!

- Vascular intervention was desperately needed.
- One place to send foot ulcers and gangrene patients where there was an interest and expertise present.
- Communication between multiple specialties.

Change Reaction From....

....To Confidence!

The Limb Preservation Team

Vascular Surgeons:
Vascular Surgeon:

- The 1st vascular surgeon is inundated with work: Carotids, AAA’s, gangrenous feet, claudicators, etc.
- Major Amputations in 2000: 55
- One podiatrist assigned to work exclusively with foot ulcers and gangrene.

A Comprehensive Treatment Plan Was Initiated

- Primary Care education to detect problems early; order screenings.
- Diabetic foot-at-risk care to be provided at primary care offices all over our service area.
- Vascular surgery team: Vascular surgeon, PA, Podiatrist, RVT, RN, etc.
- Work with other specialists: Nephrology, IR, Vascular Lab, cardiology, hospitalists, Internal and FP, etc.

Need to Change Methods of Vascular Disease Management

- Continue Acute Disease Therapy
  - Crisis Management Life or Limb threat
  - Gangrene, leaking AAA, Stroke in Evolution
- Optimize Chronic Disease Management
  - Optimal Medical Therapy of Risk factors
    - DM, HTN, Cholesterol, Smoking Cessation, Obesity
  - Pharmacologic Therapy
    - Statins, Beta Blockers, Rheologic Agents, Antiplatelet
  - Exercise and Vascular Rehab Therapy
  - Disease Detection: PVD Screenings
    - Carotids, AAA, ABI
- Need Comprehensive Vascular Data Base to Track Patients
- Vascular Disease is Systemic, Chronic and lifelong
- Improving Chronic Disease Management will Ultimately Impact on Acute Disease Therapy

What is Required for Vascular Intervention and Limb Preservation?

- Multidisciplinary Vascular Therapy Clinic
  - Vascular Surgery, Vascular Podiatry, Vascular PA, Vascular RN, Vascular Internist (still on the wish list)
  - ICAVL Accredited Non Invasive Vascular Lab—RVT
  - Main Operating Room
    - Major open or combined open/endo cases
  - Interventional Radiology Suite
    - Minor IR Cases w/Conscious Sedation
  - Minor Operating Room
    - Minor Vein Surgery, Tunneled Catheter Removal, Synthetic Skin Grafts, Wound Debridement, minor amputations, advanced wound care, etc.
What is Role of Vascular Lab?

- **Vascular Specialists**
  - Lab Integral to:
    - Diagnose
    - Plan Operations
    - Document and Follow Results
    - Detect Disease Progression
    - Plan Revision Procedures
    - Follow Outcome Data
- **Other Specialists and Primary Care**
  - Screening for Carotid Disease, PAD, Aneurysms, DVT, etc.


- Early Vascular intervention (RVT)
- Correct deformities
- Biomechanics
- Incision and Drainage
- Debridement
- Wound care
- Infection
- Reconstruct Charcot
- Shoes/ Inserts

Coordinated Care: Vascular and Podiatric Surgeons

- 31% lower amputation rate for Diabetics with foot ulcers who are treated with coordinated care which included a podiatrist.

Ref: Sloan, Frank, PhD. 2010 Journal of Health Services Research. Review of 6 years of Medicare claims, on 190,000 diabetic patients with foot ulcers.
Key Turning Point

Foot Ulcers and Amputations:
- All major limb amputations performed by the vascular surgeon.
- All foot ulcers treated by vascular podiatrist.
- All foot ulcers and gangrene get referred to the vascular surgery department and are seen by a podiatrist and vascular surgeon at one location.
- Sharing of plans of action.

Primary Care Screenings:

- Foot exams: Movie, EMR reminders.
- Vascular lab screenings: PAD, Carotid and AAA.

Liaison with Primary Care in the Form of a Multidisciplinary Conference:

Topics:
- LE vascularity,
- Carotid disease,
- Surgical innovations for limb salvaging,
- Nephropathy,
- MIBI,
- Renal transplants,
- Diet, Nutrition, Obesity & Bariatrics
- Smoking cessation,
- Dyslipidemia,
- DM control: Treat to Target,
- Foot ulcers, etc.

Diabetic and Non-diabetic Foot Exam: Why it must be done...

- 66% of diabetics with PAD are asymptomatic.
- Death rate for people with untreated P.A.D. is 28% after 5 years (higher than for breast cancer or Hodgkins disease)
- Having a history of a foot ulcer is associated with a 2-fold hazard risk for mortality compared to a non-diabetic. There was also a 47% increase in mortality between a diabetic with a history of a foot ulcer compared to a diabetic without a foot ulcer history.

If you don’t look…

Not only will the foot go away…
but the patient will also.

Foot Exams:
Three Steps to Risk Identification

<table>
<thead>
<tr>
<th>Step 1: Look</th>
<th>Skin</th>
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<tbody>
<tr>
<td>Nails:</td>
<td>Nails</td>
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<tr>
<td></td>
<td>Arches</td>
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<tr>
<td>Skin:</td>
<td>Temperature</td>
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<td></td>
<td>Texture</td>
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<td></td>
<td>Pulses</td>
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</table>

<table>
<thead>
<tr>
<th>Step 2: Feel</th>
<th>Vascular: Pulse of DP and PT</th>
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<td>Neurological: Monofilament exam</td>
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<tr>
<td>Musculoskeletal: Bunion or hammertoe deformities that are significant (i.e., unshoeable in a normal shoe)? Arches flat or high (Charcot deformity)</td>
<td></td>
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</table>

Step 1: Look
- Nails:
  - Thick (fungal nails)
  - Thin (normal)
- Skin:
  - Normal texture, or thin & shiny
  - Temperature
  - Scaling (athlete's foot)
  - Hair (growth)
  - Wounds, Ulcers, Calluses, Warts

Step 2: Feel
- Vascular: Pulse of DP and PT
- Neurological: Monofilament exam
- Musculoskeletal: Bunion or hammertoe deformities that are significant (i.e., unshoeable in a normal shoe)? Arches flat or high (Charcot deformity)
Monofilament Exam

2 or more areas on both feet of loss of sensation as tested with the Semmes-Weinstein 10 gram monofilament.

Step 3: Risk Stratification

<table>
<thead>
<tr>
<th>Risk Categories</th>
<th>Evaluation Frequency</th>
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<tbody>
<tr>
<td>0</td>
<td>Diabetes, but no loss of protective sensation in feet</td>
</tr>
<tr>
<td>1</td>
<td>Diabetes, loss of protective sensation in feet</td>
</tr>
<tr>
<td>2</td>
<td>Diabetes, loss of protective sensation in feet with high pressure (callus/deformity) or poor circulation</td>
</tr>
<tr>
<td>3</td>
<td>Diabetes, history of plantar ulceration or neuropathic fracture</td>
</tr>
</tbody>
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PAD is closely related to heart disease and stroke:

- Risk factors, disease processes, and early treatments are similar (exercise, diet, lipid-controlling drugs)
- Signs of P.A.D. can appear long before coronary symptoms and can be a strong predictor of heart disease.
- Recent studies show PAD is most significant in Hispanic and African-Americans (highest of all in women).
Be Aware Other Areas for PAD

*30% incidence of MI in next month in patient who presents with an ischemic foot.

(CVA July 2006)

This is a non-diabetic with gangrene from smoking.

Cost Savings:

- Earlier detection and effective treatment prevents many costly consequences:
  - Amputations (average $40,000 per patient)
  - Chronic non-healing wounds (average $15,000 per patient per year)
  - Blockage requiring athrectomies, angioplasties, or stent placement surgery (average $12,000)

Vascular Screening for PAD
AAA Screen
- Males 65 - 75 yrs old with prior smoking hx
- Family history of AAA

Carotid Screen
- Asymptomatic Pts over the age of 60 with any/all of the following:
  - HTN
  - Smoking
  - DM
  - Hypercholesterolemia
- Asymptomatic Pts < 60 rarely indicated

Morbidity & Mortality of Diabetic Foot Infections
- >1 million Pts in Toronto
- 50% DM w/infxn; 38% non-DM w/infxn
- 80% increased risk of cellulitis
- >4-fold increased risk of osteomyelitis
- 2-fold risk for sepsis
- Death due to any infxn more prevalent w/DM (risk ratio 1.84).

Ucers and Gangrene:
- Referrals for foot ulcers and gangrene all go to vascular surgery department.
- Access in vascular department is fluid: It can be immediate for stat problems such as gangrene or foot infections, but definitely no longer than 7 days for a stable foot ulcer.

In multiple studies 59-68% of LEA had Diabetic Foot Infections (DFI) as the reason why the procedure was performed.

Limb Threatening DFI
- Fever, malaise, leukocytosis and hyperglycemia.
- Fever not always reliable
- Cellulitis > 2 cm, lymphangitis, edema, bacteremia.
- Deep space infxn, bone, joint, facial.
Sharp Debridement

- Helps improve systemic symptoms.
- Chose site, look for sinuses, eval for further procedures.
- Culture the tissue, not the pus.
- Aggressive flushing and packing.
- Infection deep in foot, always requires admission.

American College of Foot and Ankle Surgeons. J Foot Ankle Surg 2000; 39:S1-60

“Early Surgical Debridement Of Diabetics with Deep Foot Space Abscess and Revascularization”

- I&D vs. just IV antibiotics?
- Risk for Chopart or Above the Ankle Amputations increased 1.6 fold for every day elapsed without debridement.
- No difference with presence or severity of PAD.

Severe Foot Infection:
Incision, drainage and debridement of infected foot is essential for limb salvage

Gangrene
Lots of Tools for Wound Care... But you need to know how to use them!

2010 Ulcer Treatments

• Enzymatic debriders
• Growth Factors
• Silver dressings
• Collagen Matrix
• Manufactured Skin
• Maggot therapy
• Split thickness skin grafts
• Arterial Pumps
• Vacuum assisted therapy
• Hyperbaric Oxygen
• Debridement
• Surgery to rebalance the foot
• Distal bypasses and amputations
• Pads/shoes/casts
• Compression dressings

Molecular Biology of Wounds:

<table>
<thead>
<tr>
<th></th>
<th>Healing</th>
<th>Chronic</th>
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<tbody>
<tr>
<td>Cell Mitosis</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Inflammatory Cytokines</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Proteases (MMP)</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Growth Factors</td>
<td>Increased</td>
<td>Decrease</td>
</tr>
<tr>
<td>Cell Response</td>
<td>Rapid</td>
<td>Senescent</td>
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Case 1:

- 50 year old Hispanic male
- Ran barefoot at Lake Havasu to get wife a cold soda and developed 3rd degree burns to bone, b/l feet.
- Transferred to Kaiser when insurance went into effect after 3 months at county hospital.
- DVT, Low Alb, DM poor control, anemic, low GFR, etc.
- Right leg BKA as part of foot was already amputated.
Case 2:
- 52 year old School teacher with severe nausea, vomiting, chills and fever presents to ER feeling VERY ill. No open wounds.
- ER doctor asks me to just check out a “blister” on her foot...states it is nothing.
- Blister is flesh-eating bacteria which balloons over next hour as we try to get to patient to OR for urgent I&D.
- Over next few days infection is moving up leg requiring daily serial debridement.

Necrotizing Fasciitis-Skin Grafting
2009 Amputation Statistics Comparison per 1000 diabetics:

- 18,089 diabetics
- 2009 BPK:
  - 13 toes,
  - 3 transmets,
  - 3 BKA,
  - 0 AKA

Cost Savings?

- $40,000 per amputation
- 18,089 diabetics at Baldwin Park Kaiser today.
- 54 diabetic persons who did not need an amputation compared to the national average.

Imagine the possibilities....

2007 Age-Adjusted Estimates of the Percentage of Adults with Diagnosed Diabetes (CDC 2010)

...$2.16 million per year savings at BPK.
Kaiser South has 13 centers...$28 million
Kaiser North has 19 centers...$41 million
Kaiser in California could potentially save
$69 million per year

...$$3.5 billion
Thank You!