Ankle Pressure (mmHg)

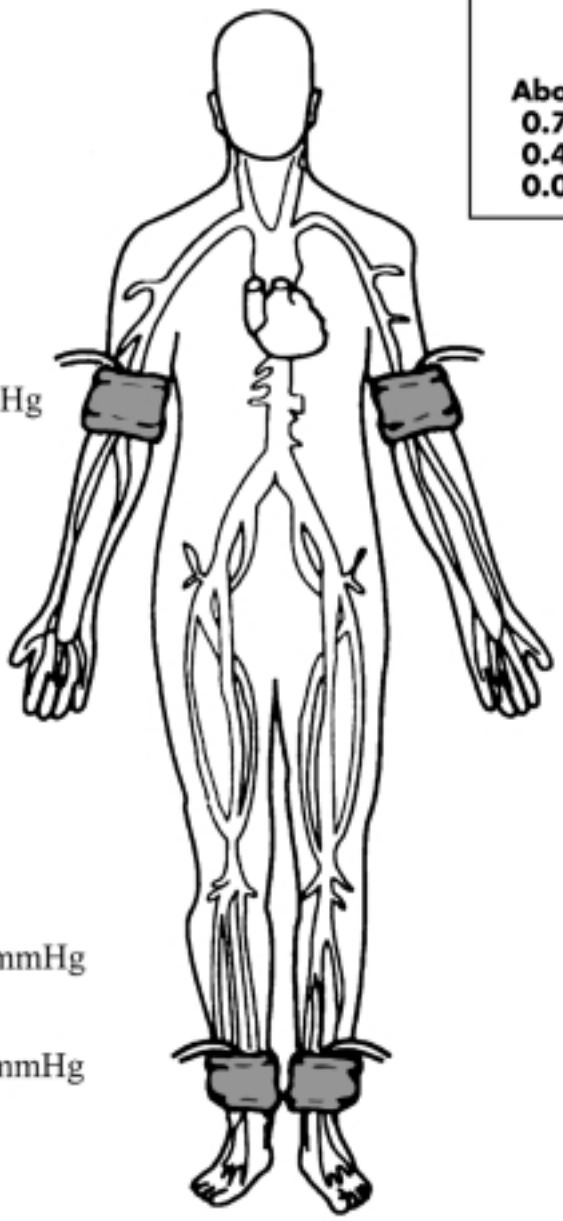
Brachial Pressure (mmHg)

	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	
230	.17	.20	.22	.24	.26	.28	.30	.33	.35	.37	.39	.41	.43	.46	.48	.50	.52	.54	.57	.59	.61	.63	.65	.67	.70	.72	.74	.76	.78	.80	.83	.85	.87	230
225	.18	.20	.22	.24	.27	.29	.31	.33	.36	.38	.40	.42	.44	.47	.49	.51	.53	.56	.58	.60	.62	.64	.67	.69	.71	.73	.76	.78	.80	.82	.84	.87	.89	225
220	.18	.20	.23	.25	.27	.30	.32	.34	.36	.39	.41	.43	.45	.48	.50	.52	.55	.57	.59	.61	.64	.66	.68	.70	.73	.75	.77	.80	.82	.84	.86	.89	.91	220
215	.19	.21	.23	.26	.28	.30	.33	.35	.37	.40	.42	.44	.47	.49	.51	.53	.56	.58	.60	.63	.65	.67	.70	.72	.74	.77	.79	.81	.84	.86	.88	.91	.93	215
210	.19	.21	.24	.26	.29	.31	.33	.36	.38	.40	.43	.45	.48	.50	.52	.55	.57	.60	.62	.64	.67	.69	.71	.74	.76	.79	.81	.83	.86	.88	.90	.93	.95	210
205	.20	.22	.24	.27	.29	.32	.34	.37	.39	.41	.44	.46	.49	.51	.54	.56	.59	.61	.63	.66	.68	.71	.73	.76	.78	.80	.83	.85	.88	.90	.93	.95	.98	205
200	.20	.23	.25	.28	.30	.33	.35	.38	.40	.43	.45	.48	.50	.53	.55	.58	.60	.63	.65	.68	.70	.73	.75	.78	.80	.83	.85	.88	.90	.93	.95	.98	1.00	200
195	.21	.23	.26	.28	.31	.33	.36	.38	.41	.44	.46	.49	.51	.54	.56	.59	.62	.64	.67	.69	.72	.74	.77	.79	.82	.85	.87	.90	.92	.95	.97	1.00	1.03	195
190	.21	.24	.26	.29	.32	.34	.37	.39	.42	.45	.47	.50	.53	.55	.58	.61	.63	.66	.68	.71	.74	.76	.79	.82	.84	.87	.89	.92	.95	.97	1.00	1.03	1.05	190
185	.22	.24	.27	.30	.32	.35	.38	.41	.43	.46	.49	.51	.54	.57	.59	.62	.65	.68	.70	.73	.76	.78	.81	.84	.86	.89	.92	.95	.97	1.00	1.03	1.05	1.08	185
180	.22	.25	.28	.31	.33	.36	.39	.42	.44	.47	.50	.53	.56	.58	.61	.64	.67	.69	.72	.75	.78	.81	.83	.86	.89	.92	.94	.97	1.00	1.03	1.06	1.08	1.11	180
175	.23	.26	.29	.31	.34	.37	.40	.43	.46	.49	.51	.54	.57	.60	.63	.66	.69	.71	.74	.77	.80	.83	.86	.89	.91	.94	.97	1.00	1.03	1.06	1.09	1.11	1.14	175
170	.24	.26	.29	.32	.35	.38	.41	.44	.47	.50	.53	.56	.59	.62	.65	.68	.71	.74	.76	.79	.82	.85	.88	.91	.94	.97	1.00	1.03	1.06	1.09	1.12	1.15	1.18	170
165	.24	.27	.30	.33	.36	.39	.42	.45	.48	.52	.55	.58	.61	.64	.67	.70	.73	.76	.79	.82	.85	.88	.91	.94	.97	1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.21	165
160	.25	.28	.31	.34	.38	.41	.44	.47	.50	.53	.56	.59	.63	.66	.69	.72	.75	.78	.81	.84	.88	.91	.94	.97	1.00	1.03	1.06	1.09	1.13	1.16	1.19	1.22	1.25	160
155	.26	.29	.32	.35	.39	.42	.45	.48	.52	.55	.58	.61	.65	.68	.71	.74	.77	.81	.84	.87	.90	.94	.97	1.00	1.03	1.06	1.10	1.13	1.16	1.19	1.23	1.26	1.29	155
150	.27	.30	.33	.37	.40	.43	.47	.50	.53	.57	.60	.63	.67	.70	.73	.77	.80	.83	.87	.90	.93	.97	1.00	1.03	1.07	1.10	1.13	1.17	1.20	1.23	1.27	1.30	1.33	150
145	.28	.31	.34	.38	.41	.45	.48	.52	.55	.59	.62	.66	.69	.72	.76	.79	.83	.86	.90	.93	.97	1.00	1.03	1.07	1.10	1.14	1.17	1.21	1.24	1.28	1.31	1.34	1.38	145
140	.29	.32	.36	.39	.43	.46	.50	.54	.57	.61	.64	.68	.71	.75	.79	.82	.86	.89	.93	.96	1.00	1.04	1.07	1.11	1.14	1.18	1.21	1.25	1.29	1.32	1.36	1.39	1.43	140
135	.30	.33	.37	.41	.44	.48	.52	.56	.59	.63	.67	.70	.74	.78	.81	.85	.89	.93	.96	1.00	1.04	1.07	1.11	1.15	1.19	1.22	1.26	1.30	1.33	1.37	1.41	1.44	1.48	135
130	.31	.35	.38	.42	.46	.50	.54	.58	.62	.65	.69	.73	.77	.81	.85	.88	.92	.96	1.00	1.04	1.08	1.12	1.15	1.19	1.23	1.27	1.31	1.35	1.38	1.42	1.46	1.50	1.54	130
125	.32	.36	.40	.44	.48	.52	.56	.60	.64	.68	.72	.76	.80	.84	.88	.92	.96	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.28	1.32	1.36	1.40	1.44	1.48	1.52	1.56	1.60	125
120	.33	.38	.42	.46	.50	.54	.58	.63	.67	.71	.75	.79	.83	.88	.92	.96	1.00	1.04	1.08	1.13	1.17	1.21	1.25	1.29	1.33	1.38	1.42	1.46	1.50	1.54	1.58	1.63	1.67	120
115	.35	.39	.43	.48	.52	.57	.61	.65	.70	.74	.78	.83	.87	.91	.96	1.00	1.04	1.09	1.13	1.17	1.22	1.26	1.30	1.35	1.39	1.43	1.48	1.52	1.57	1.61	1.65	1.70	1.74	115
110	.36	.41	.45	.50	.55	.59	.64	.68	.73	.77	.82	.86	.91	.95	1.00	1.05	1.09	1.14	1.18	1.23	1.27	1.32	1.36	1.41	1.45	1.50	1.55	1.59	1.64	1.68	1.73	1.77	1.82	110
105	.38	.43	.48	.52	.57	.62	.67	.71	.76	.81	.86	.90	.95	1.00	1.05	1.10	1.14	1.19	1.24	1.29	1.33	1.38	1.43	1.48	1.52	1.57	1.62	1.67	1.71	1.76	1.81	1.86	1.90	105
100	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95	1.00	1.05	1.10	1.15	1.20	1.25	1.30	1.35	1.40	1.45	1.50	1.55	1.60	1.65	1.70	1.75	1.80	1.85	1.90	1.95	2.00	100
95	.42	.47	.53	.58	.63	.68	.74	.79	.84	.89	.95	1.00	1.05	1.11	1.16	1.21	1.26	1.32	1.37	1.42	1.47	1.53	1.58	1.63	1.68	1.74	1.79	1.84	1.89	1.95	2.00	2.05	2.11	95
90	.44	.50	.56	.61	.67	.72	.78	.83	.89	.94	1.00	1.06	1.11	1.17	1.22	1.28	1.33	1.39	1.44	1.50	1.56	1.61	1.67	1.72	1.78	1.83	1.89	1.94	2.00	2.06	2.11	2.17	2.22	90

ABI WORKSHEET

Ankle-Brachial Index Interpretation

Above 0.90: Normal
0.71 - 0.90: Mild Obstruction
0.41 - 0.70: Moderate Obstruction
0.00 - 0.40: Severe Obstruction



Right Arm:
Systolic Pressure ☐☐☐ mmHg

Left Arm:
Systolic Pressure ☐☐☐ mmHg

Right Ankle:
Systolic Pressure
Posterior Tibial (PT) ☐☐☐ mmHg
Dorsalis Pedis (DP) ☐☐☐ mmHg

Left Ankle:
Systolic Pressure
Posterior Tibial (PT) ☐☐☐ mmHg
Dorsalis Pedis (DP) ☐☐☐ mmHg

Right ABI equals Ratio of:
Higher of the Right Ankle Pressures (PT or DP) ☐☐☐ mmHg
Higher Arm Pressure (right or left arm) ☐☐☐ mmHg
= ☐.☐☐ *

Left ABI equals Ratio of:
Higher of the Left Ankle Pressures (PT or DP) ☐☐☐ mmHg
Higher Arm Pressure (right or left arm) ☐☐☐ mmHg
= ☐.☐☐ *

* The lower of these numbers is the patient's overall ABI.
Overall ABI (lower ABI) = _____

PERFORMING THE ABI TEST

The ABI measurement is performed with the patient resting in a supine position. The examiner should make all arm and leg blood pressure measurements with an appropriately sized blood pressure cuff and the Doppler device. The systolic blood pressure is determined in both arms, and the ankle systolic blood pressure is determined for the right and left posterior tibial (PT) and dorsalis pedis (DP) arteries. The ABI for each leg is determined by using the higher of the two readings from either the PT or DP arteries, and the higher of the two brachial readings. The lower ABI of the two is used for diagnostic purposes. An ABI measurement can usually be performed in less than 10 minutes. (See sample ABI worksheet.)

ABI PROCEDURE

Step 1. Have the patient lie in a supine position with shoes and stockings removed for at least 10 minutes prior to obtaining blood pressure measurements.

Step 2. Apply the blood pressure cuff snugly on the upper arm with the lower edge of the cuff 1 inch above the antecubital fossa. Usually the cuff that is the appropriate size for the patient's arm will also be suitable for the ankle pressure measurement. In the rare instance that upper arm and ankle pressures are markedly different, choose cuff sizes that are appropriate for each site.

Step 3. Apply a 1–2 centimeter ribbon of Doppler gel to the antecubital area. Be sure to use enough gel.

Step 4. Turn the Doppler probe on and place it at the antecubital area at approximately a 60-degree angle to the surface of the skin. Move the probe around until the clearest arterial pulse sounds are heard and keep the probe at that position.

Step 5. Inflate the blood pressure cuff to approximately 20 mm Hg above the numerical reading where the pulse sounds cease.

Step 6. Deflate the cuff at a rate of 2 mm Hg per second until the first arterial pulse sound is heard. When this number is determined, deflate the cuff completely and record this systolic reading. Remove the gel from the patient's skin with a tissue.

Step 7. Apply the same blood pressure cuff snugly to the ankle on the same side of the body.

Step 8. Palpate the area around the medial malleolus to find the posterior tibial (PT) arterial pulse.

Step 9. If this pulse is palpable, apply a 1–2 centimeter ribbon of Doppler gel to the area. If there is no palpable pulse, apply gel to the general area, turn on the Doppler probe, and move the probe around until the clearest arterial sound is heard. Keep the probe in that position. Continue inflating the blood pressure cuff as before, followed by deflation and reading (Steps 5–6).

Step 10. Palpate the dorsal arch of the same foot for the dorsalis pedis (DP) arterial pulse. Apply the Doppler gel and use the Doppler probe as before (Step 9).

Step 11. Apply the blood pressure cuff to the opposite ankle and record the PT and DP pressures as before (Steps 8–10).

Step 12. Then repeat Steps 2–6 on the other arm.

Use the ABI worksheet page to figure the patient's ABI. Measurements should be noted in the patient's medical record.

Both the DP and PT arterial pressures are measured to provide a complete assessment of the extent of PAD in each limb. Additionally, some patients may have a congenitally absent dorsalis pedis pulse.

Other patients, particularly some elderly and diabetic individuals, have calcification in their arteries that prevents occlusion of flow by the pressure cuff. This will cause an abnormally high reading. Typically any reading greater than 1.50 is considered abnormal. Such patients should be referred for additional testing in a vascular laboratory.

HELPFUL HINTS

- Follow the instructions specific to the Doppler probe you are using.
- Be sure to use enough gel.
- Use a cuff size that is right for both the arm and ankle of the patient.
- Be sure you're centered on the pulse when you take the reading; if you're off to the side, the reading will be low.
- Be aware of known diabetics with calcified vessels and abnormally high ABI.
- In a small percentage of patients, one of the ankle pressures will be nondetectable; use the detectable pressure for calculating the ABI.

Patients with an ABI value of 0.90 or less are diagnosed as having PAD and considered at increased risk for cardiovascular ischemic events. Prompt investigation and risk-reducing treatments are then warranted.

Don't be discouraged if measuring the ABI seems slow or clumsy at first. Like any procedure, the ABI becomes easier to do with practice.

Diabetes foot examination

TOOL KIT

Name: _____ Age: _____ Date: _____

I. Medical history (per patient)

☐ Diabetes (_____ Insulin) (_____ Oral) (_____ Diet)
☐ Hypertension
☐ Cardiovascular disease
☐ Peripheral vascular disease
☐ Other _____
_____
Blood pressure _____

II. Current history (per patient)

Yes No
☐ ☐ History of foot exam? When? _____
☐ ☐ Current foot ulcer?
☐ ☐ History of foot ulcer? When? _____
☐ ☐ Intermittent claudication –
Frequency _____
_____ Blood glucose level (normal 80-110 mg/dL)

Clinician assessment

III. Vascular Findings

	(+) Present Left	(–) Absent Right
Dorsalis pedis pulse	_____	_____
Posterior tibial pulse	_____	_____
Foot hair	_____	_____
Capillary refill	_____	_____
Edema	_____	_____

IV. Structural

	Left	Right
Corn	☐	☐
Callus	☐	☐
Bunion	☐	☐
Charcot joint	☐	☐
Hammer toe	☐	☐

V. Nails

	Yes	No
Thick	☐	☐
Need trim	☐	☐
Ingrown	☐	☐
Ingrown	☐	☐
Discolored	☐	☐

VI. Sensory exam

Indicate the level of sensation in the circles on the foot diagram:
+ = Can feel the 10-gram nylon filament
- = Cannot feel the 10-gram nylon filament



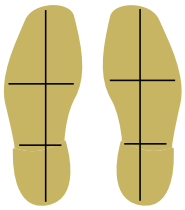
VII. Skin condition – foot and between the toes

1. Label skin condition with:
   R – Redness **S** – Swelling **W** – Warmth
   D – Dryness **M** – Maceration **F** – Fissure
2. Draw pattern where there is:
   Callus  Pre-ulcer  Ulcer 
3. Ulcer description: See wound assessment form.

VIII. Footwear

	Yes	No
Loose	☐	☐
Rubbing	☐	☐
Tight	☐	☐
Worn lining	☐	☐
Bulges	☐	☐
Orthotics	☐	☐

Wear patterns



IX. Risk categorization

Low-risk
All of the following:
☐ Intact protective sensation
☐ No severe deformity
☐ No prior foot ulcer
☐ Pedal pulses present
☐ No severe deformity
☐ No amputation

High-risk
All of the following:
☐ Loss of protective sensation
☐ Absent pedal pulses
☐ Severe foot deformity
☐ History of foot ulcer

X. Education

Prior foot education? ☐ Yes ☐ No Able to demonstrate appropriate self-care? ☐ Yes ☐ No

XI. Recommendations

☐ Schedule visit with personal physician or podiatrist
☐ Preventative foot care education
☐ Wound clinic
☐ Orthotics/new shoes

Completed by: _____ Date: _____

DIABETES FOOT SCREEN

Patient's Name (Last, First, MI) _____ **Date:**_____
Physician's Name _____ **Sex:** ☐ M ☐ F
ID No:_____
D.O.B._____

Check (✓) the appropriate boxes below to indicate findings on the right or left foot:	**No findings**	**Yes Left**	**Yes Right**
Is there a foot ulcer now?	☐	☐	☐
Is there a history of foot ulcer?	☐	☐	☐
Is there an abnormal shape of the foot?	☐	☐	☐
Is there toe deformity? (bunions, hammertoes)	☐	☐	☐
Are the toenails thick or ingrown? (fungal)	☐	☐	☐
Is there a callus buildup?	☐	☐	☐
Is there swelling?	☐	☐	☐
Is there elevated skin temperature?	☐	☐	☐
Is there muscle weakness?	☐	☐	☐
Is there lower extremity pain?	☐	☐	☐
Has there been a previous amputation?	☐	☐	☐
Is there a blister or laceration?	☐	☐	☐
Can the patient see the bottom of his/her feet?	☐	☐	☐
Does the patient use footwear appropriate for his/her category?	☐	☐	☐

Other _____

Vascular Findings: (+) Present (-) Absent

	Left	Right
Dorsalis Pedis Pulse	_____	_____
Post Tibial Pulse	_____	_____
Foot Hair	_____	_____
Capillary Refill	_____	_____
Edema	_____	_____



Indicate the level of sensation in the circles on the foot diagram

+ = Can feel the 10 gram nylon filament

- = Cannot feel the 10 gram nylon filament

Skin conditions on the foot and between the toes:

1. Label: Skin condition with:
   R - Redness, **S** - Swelling, **W** - Warmth, **D** - Dryness, and/or **M** - Maceration
2. Draw pattern where there is:

Callus  Pre-Ulcer  Ulcer  (note ulcer size in cm.)

Risk Category:

- 0 = No loss of protective sensation
- 1 = Loss of protective sensation with no weakness, deformity, callus, ore-ulcer or history of ulceration
- 2 = Loss of protective sensation with weakness, deformity, pre-ulcer or callus but no history of ulceration or poor circulation
- 3 = History of plantar ulceration or neuropathic fracture

Refer to:

_____Primary Care Provider _____Endocrinologist _____Certified Diabetes Educator _____Vascular surgeon
_____Podiatrist _____Orthotist _____Other_____

Follow-up Care: Schedule follow-up visit. Date: _____
Signature:_____

Lanarkshire Oximetry Index



ByDonna Sardina, RN, MHA, WCC, CWCMS, DWC

Purpose

The Lanarkshire oximetry index (LOI) is a noninvasive procedure using a pulse oximeter for assessment of peripheral arterial perfusion to determine if it is safe to apply venous compression bandaging.

Indications

Assess peripheral arterial perfusion when:

- there is evidence of calcified vessels (ankle brachial pressure index [ABPI] > 1.3)
- you have difficulty locating arteries with Doppler
- the patient has diabetes or lymphedema
- you work in a facility where you only need to perform one to two vascular assessments a month.

Precautions

The pulse oximetry signal may be difficult to detect if the patient has grossly dystrophic toenails, extreme cyanosis, or a condition in which there is peripheral vasoconstriction (such as Raynaud's disease). Additionally, LOI will not detect localized arterial disease in which there is adequate collateral circulation. If it is necessary to assess blood flow to individual arteries, Doppler ABPI should be used.

Frequency

Perform LOI per facility or agency policy. Arterial perfusion may deteriorate over relatively short periods; reassess every 3 months or more frequently if the clinical situation indicates a change.

Equipment

Equipment needed for LOI includes:

- sphygmomanometer with appropriately sized cuff. Cuff sizes suggested below are guidelines for arm circumference but may also be applied to leg circumference.
  - limb circumference 22-26 cm: small adult cuff (12 x 22 cm)
  - limb circumference 27-34 cm: adult cuff (16 x 30 cm)
  - limb circumference 35-44 cm: large adult cuff (16 x 36 cm)
  - limb circumference 45-52 cm: adult thigh cuff (16 x 42 cm)
- fingertip pulse oximeter with Spo_2 and pulse rate
- writing instrument and paper.

Steps

1. Explain the procedure to the patient.
2. Ensure the patient is comfortable with both feet elevated in a semirecumbent position.
3. Place an appropriately sized blood pressure cuff around the upper arm.
4. Place the pulse oximeter sensor on the index or middle finger. The pulse oximeter unit will display two numbers: The first represents the patient's heart rate; the second is the percentage of circulating oxygenated hemoglobin. Pulsatile blood flow is also displayed, either by a waveform or by a column of lights.
5. Record a baseline reading. Inflate the sphygmomanometer cuff to 60 mm Hg, then in 10-mm Hg increments, allowing approximately 10 seconds between increments. Once 100 mm Hg is reached, the incremental changes can be increased to 20 mm Hg.
6. Record the pressure reading that is one below the point where the audible signal is lost on the pulse oximeter; for example, if the signal is lost at 180 mm Hg, record a pressure of 160 mm Hg.
7. Don't inflate the cuff further if 180 mm Hg is reached before the loss of the audible signal; record a maximum pressure of 180 mm Hg.
8. Repeat the measurement on the other arm; when calculating the LOI (see step 13), use the higher of the two readings.
9. Place an appropriately sized cuff around the ankle immediately above the malleolus. It's important to protect fragile skin or ulcers beforehand (for example, with a sterile towel or cling film).
10. Place the oximetry sensor on one of the first three toes.
11. Inflate the cuff in the same way as described above and record the pressure at which the signal is lost (or 180 mm Hg if this is reached before the loss of the signal).
12. Repeat the measurement on the other leg; when calculating the LOI, use the higher of the two readings.
13. The LOI for each leg is calculated by dividing the toe pressure by finger pressure and expressing the figure gained as a decimal. For example, if the toe pressure = 140 mm Hg and finger pressure = 120 mm Hg, the LOI is equal to toe pressure/finger pressure (140/120) = 1.17.
14. The readings are similar to ABPI readings:
    - Normal: LOI = 0.8
    - Moderate arterial disease: LOI = 0.5-0.8
    - Severe arterial disease: LOI = 0.5
15. Reassess after the application of compression:
    - Once the patient is deemed suitable for compression, apply an appropriate graduated stocking to the leg; then place the sensor on one of the first three toes.
    - Check the signal with the leg horizontal; then elevate the leg slightly for 30 seconds and check the signal again. This will ensure that the blood flow is still present and not adversely affected by the compression or the position of the leg.
    - A loss of signal is indicated by flattening of a waveform on the oximeter, loss of Spo_2, or greater than a 10% drop in Spo_2 from baseline. If there is a loss of signal, arrange for further assessment before proceeding with full compression.

continued...

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Distinguishing Arterial, Diabetic, & Vascular Ulcers

Arterial Ulcers	Diabetic Ulcers	Venous Ulcers
Predisposing Factors		
• Peripheral vascular disease (PVD) • Diabetes mellitus • Advanced Age	• Diabetic patient with peripheral neuropathy	• Valve incompetence in perforating veins • History of deep vein thrombophlebitis and thrombosis • Previous history of ulcers • Obesity • Advanced age
Anatomic Location		
• Between toes or tips of toes • Over phalangeal heads • Around lateral malleolus • At sites subjected to trauma or rubbing of footwear	• On plantar aspect of foot • Over metatarsal heads • Under heel	• On medial lower led and ankle • On malleolar area
Wound Characteristics		
• Even wound margins • Gangrene or necrosis • Deep, pale wound bed • Blanched or purpuric periwound tissue • Severe pain • Cellulitis • Minimal exudate	• Even wound margins • Deep wound bed • Cellulitis or underlying osteomyelitis • Granular tissue present unless PVD is present • Low to moderate drainage	• Irregular wound margins • Superficial wound • Ruddy, granular tissue • Usually no pain • Frequently moderate to heavy exudate
Patient Assessment		
• Thin, shinny, dry skin • Hair loss on ankle & foot • Thickened toenails • Pallor on elevation and dependent rubor • Cyanosis • Decreased temperature • Absent or diminished pulses	• Diminished or absent sensation in foot • Foot deformities • Palpable pulses • Warm foot • Subcutaneous fat atrophy	• Firm edema • Dilated superficial veins • Dry, thin skin • Evidence of healed ulcers • Periwound and leg hyperpigmintation • Possible dermatitis

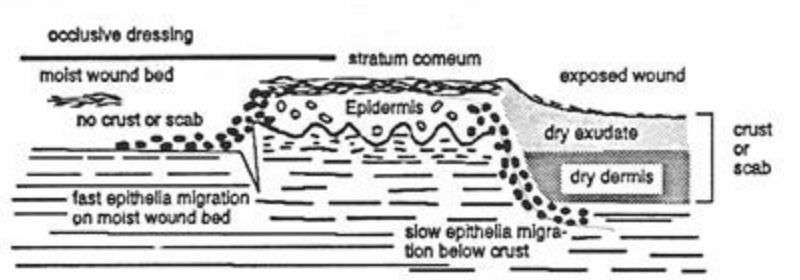
Moist Wound Healing

George Winter, PhD, University of London questioned if allowing wound to dry out was the best method of healing.

- 1962 conducted study by creating multiple small partial thickness wounds on the backs of pigs. Portion of the wounds were allowed to dry out and form scabs, while others were covered with a polymer film.
- Results: Wounds that had been covered by polymer film, epithelialized twice as quickly as the wounds exposed to air.

Winter postulated that epithelial cells in dry wounds have to negotiate the scab, consuming energy and time, whereas in moist wounds they migrate freely across a moist, vascular wound surface. Winter's theory has been supported by other studies in addition other studies provided evidence that a moist environment can accelerate the inflammatory response, leading to faster cell proliferation and wound healing in deeper dermal wounds.

The principle of moist wound healing mimics the function of the epidermis. Our body is mainly composed of water, and the natural environment of a cell is moist; therefore, a dry cell is a dead cell. The diagram below demonstrates the benefits of moist wound healing from use of an occlusive dressing.



Epidermal cells migrate only over viable tissues as they require a blood and nutritional supply that is adequate to meet their energy needs. Because the migration tongue of epithelium must burrow between eschar, crust, or a scab and the underlying living tissue,

Advantages of moist wound healing

- Decreased dehydration and cell death (Neutrophils, macrophages, & fibroblast necessary for wound healing cannot thrive in a dry environment)
- Increased angiogenesis
- Enhanced autolytic debridement
- Increased re-epithelialization (Dry crusted wounds decrease supply of blood and nutrients which thus results in a barrier to cell migration and slowing of epithelialization.)
- Decreased pain (Moist wound bed insulates and protects nerve endings thereby reducing pain.)

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Hanging Wet-to-Dry Dressings Out to Dry

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Liza G. Ovington, PhD, CWS

There's More to Dressings Than Gauze

Healthcare professionals caring for patients with chronic or complex wounds in the 21st century have a wide and exciting variety of treatment options and adjunctive therapies from which to choose. The list of products that have shown positive benefits for wound healing includes a recombinant protein drug for diabetic foot ulcers, bioengineered tissue products for venous and diabetic ulcers, negative pressure therapy, normothermic therapy, constant tension approximation, electrical stimulation, hyperbaric oxygen, and hundreds of types of topical wound dressings.

Wound dressings in particular have undergone an extensive diversification over the past quarter century. In the 1960s it was documented in both animal and human studies that wounds in which the tissues remained moist healed twice a rapidly as those in which the tissues dried out (Hinman & Maibach, 1963; Winter, 1962; Winter & Scales, 1963). Soon manufacturers embraced this new "moist wound healing" concept and began to develop dressings from materials that could prevent wound tissues from desiccating.

Gauze dressings have been joined (but not displaced) by polymeric materials such as polyurethane films, foams, hydrogels, and hydrocolloids as well as calcium alginates, collagens, and other materials. These dressings are often collectively referred to as "moisture-retentive" or "semi-occlusive." Today over 50 manufacturers produce more than 350 types of moisture retentive wound dressings.

With so many choices for topical wound management, one might expect to find a wide variety of dressing products in use among wound patients at any one facility or in any particular care setting. However, this is not the norm. Despite the benefits of the newer dressing products, gauze is still the most widely used wound care dressing and may be erroneously considered a standard of care.

Prevalent Types of Dressings Used in Home Care

In an illustrative study, a group of 13 home care agencies in one geographic area gathered data regarding the topical dressings being used during 1 week for 1,029 patients with 1,638 classified wounds (Pieper, Templin, Dobal, & Jacox, 1999). Wound types included chronic wounds such as pressure ulcers, venous leg ulcers, and diabetic foot ulcers as well as surgical wounds and other skin tears. Their survey found that the most commonly used dressing for all types of wounds was gauze —dry gauze. The majority of cases (n = 406) were treated with dry gauze. Saline moistened gauze was the third most used dressing (n = 145) with the second most common being no dressing at all (n = 252). Advanced, moisture-retentive dressings such as alginates, collagens, films, foams, hydrogels, and hydrocolloids accounted for less than 25% of all dressings used.

One could argue that dry gauze dressings have little value for optimal wound management in today's healthcare environment. Even saline-moistened gauze dressings have little value when compared to the more advanced dressing categories. Gauze dressings (whether dry or

moistened with saline) are substandard for optimal wound care for several reasons:

1. They may actually add to the patient's discomfort, impede healing, and increase the risk of infection;
2. they may incur more labor for the clinician or caregiver; and
3. they may incur more costs for the healthcare system.

This article examines each of these allegations in detail.

Wet-to-Dry and Wet-to-Moist—What's the Difference?

Wet-to-dry and wet-to-moist are terms used in conjunction with gauze dressings and technically they are two distinctly different ways of using saline (the most common wetting agent). However, in actual use, there may be little difference between the two.

Wet-to-Dry Gauze Dressings

Wet-to-dry gauze dressings are typically intended for use in the debridement of devitalized tissues from the wound bed. Gauze is moistened with normal saline and placed into or onto the wound. This moistened layer is then covered with dry layers of gauze or other dry dressings (abdominal pads, etc.). The moistened gauze then dries out; while drying it adheres to surface tissues, which are removed when the dried dressing is removed.

Wet-to-dry debridement is not selective and often also removes healthy tissues, causing reinjury. The patient may also suffer significant pain upon removal of a wet-to-dry dressing. Alternative forms of debridement such as surgical, sharp, enzymatic, and autolytic offer a higher degree of selectivity and less pain in most cases.

Wet-to-Moist Gauze Dressing

A wet-to-moist dressing is generally prepared in the same manner as a wet-to-dry dressing; however, it is *intended* to remain continuously moist until removal. Nevertheless, it may become a wet-to-dry dressing in practice. A recent study of the mechanism of action of saline dressings suggests that they function as an osmotic dressing (Kim, Saliba, & Smith, 2000). Normal saline is isotonic. As water evaporates from the saline dressing, it becomes hypertonic and fluid from the wound tissues is drawn into the dressing in attempt to reestablish isotonicity.

However, wound fluid is not merely water, it contains blood and proteins that may begin to form an impermeable layer on the dressing's surface. At this point, fluid from the wound is unable to replace the fluid lost from the dressing by evaporation and the dressing dries out completely. Therefore, unless careful attention is paid to the moisture levels in a wet-to-moist gauze dressing—either through frequent changing of the dressing or through remoistening of the gauze with additional saline—it becomes wet-to-dry.

Removal of the dried dressing may then cause reinjury of the wound resulting in pain and delayed wound healing. Semiocclusive dressings that maintain a moist wound environment have been associated with less pain at dressing change than gauze dressings as well as less pain in general (Hedman, 1988; Nemeth, Eaglstein, Taylor, Peerson, & Falanga, 1991). The diminution of pain is based on the fact that nerve endings in the wound tissue are protected from exposure and dehydration.

Gauze Dressings: Patient Issues

Impeded Healing—Local Tissue Cooling

Another effect of the drying-out of a gauze dressing is that of local tissue cooling. It is known in general that the evaporation of water from a surface results in a reduction of temperature at that surface due to water's high heat of vaporization (540 cal per gm). In an open wound with

nothing to impede fluid evaporation, the tissue temperature has been measured at 218C. A gauze dressing placed in the wound does little to impede fluid evaporation and tissue temperature measures 258C to 278C—still approximately 108 below normal tissue temperature (Thomas, 1990).

The use of a semiocclusive dressing, which impedes moisture loss from the wound, will diminish the local cooling and wounds dressed with transparent films or foams have tissue temperatures measuring 338C to 358C. Reductions in tissue temperature have multiple physiological effects including local reflex vasoconstriction and hypoxia, impairment of leukocyte mobility and phagocytic efficiency, and increased affinity of hemoglobin for oxygen—all of which not only impede healing but increase susceptibility to infection. Therefore, a gauze dressing does not support healing whereas a dressing that reduces loss of the wound temperature facilitates healing.

Increased Risk of Infection

Gauze dressings present no physical barrier to the entry of exogenous bacteria. In one dramatic in vitro study it was shown that bacteria were capable of penetrating up to 64 layers of dry gauze (Lawrence, 1994). Moistened gauze presents even less of a barrier to bacterial penetration. This is a significant issue as more wounds are managed in the home environment where infection control practices are not rigorously practiced. This lack of infection control is further complicated by reports from the Centers for Disease Control that 40% of the population sheds Staphylococcus aureus from the nares (Mangram, Horan, Pearson, Silver, & Jarvis, 1999).

Therefore, patients whose wounds are dressed with gauze dressings would appear to be more susceptible to wound infection than those whose wounds are dressed with a moisture retentive dressing. Indeed, both retrospective and prospective clinical studies have shown that infection rates in wounds dressed with gauze are actually higher than that of wounds dressed with transparent films or hydrocolloids (Hutchinson, 1989, 1993). For example, in a literature review of 3,047 wounds, it was found that the overall infection rate for wounds dressed with moisture-retentive dressings was 2.6% whereas the infection rate for gauze-dressed wounds was 7.1% (Hutchinson & McGuckin, 1990).

The rationale for this difference is thought to be due to the barrier effects of the moisture-retentive dressings as well as their ability to preserve the viability and function of endogenous phagocytes by maintaining a moist environment (Mertz, 1985). While moisture-retentive dressings allow the passage of moisture vapor through their surfaces, they are impervious to liquids. Therefore, a moisture-retentive dressing with an adhesive border or secondary dressing will allow the patient to bathe or shower without disturbing the wound.

Gauze Dressings: Clinician and Caregiver Issues

Labor Intensive

As explained previously, in order for gauze to remain continuously moist to support optimal healing, it must either be changed frequently or remoistened with additional saline. This requires additional labor on the part of the clinician or the lay caregiver. BID or TID dressing changes used to be common in home care. In today's PPS environment this practice is no longer feasible not only from a reimbursement perspective but as a way to reach the best patient outcomes.

In the acute care setting, where clinician attention to a dressing change does not require the extra home care expenses of travel, in home and postvisit time, frequent dressing changes require time that could be used in other patient care tasks. It has also been shown that frequent dressing changes have been associated with evaporative cooling of the wound as it is exposed to the air.

Distribution of Airborne Bacteria Leading to Cross Contamination

The removal of a dried dressing from a wound disperses significant amounts of bacteria into the

air. One study used hand-held air samplers to quantify the number of bacteria released from colonized wounds upon removal of gauze dressings from burns compared to the removal of hydrocolloid dressings (Lawrence, Lilly, & Kidson; 1992). It was found that the airborne dispersal of bacteria was greatest when removing dry gauze dressings; however, even removing moist gauze dressings released bacteria. Removal of a moisture-retentive hydrocolloid dressing released almost no bacteria. It was further shown that the decline of these airborne bacteria was slow, taking up to 30 min.

Most chronic wounds have polymicrobial colonization (Brook & Frazier, 1998; Bowler & Davies, 1999). Implications for potential cross-infection are considerable especially if the patient has multiple wounds or if multiple patients are seen in the same area (simultaneously or consecutively). If the wound is colonized with antibiotic resistant bacteria, the implications may be even more serious.

Gauze Dressings: Healthcare System Issues

Because prospective payment has become the reality in most healthcare facilities and systems, everyone is looking for ways to decrease costs. Supply costs are a tangible and attractive target for cost savings and it may be tempting to think that a product that costs less will decrease costs of care. Those still using gauze dressings may feel financially impeded to move toward using advanced dressings, and even enlightened clinicians may feel that they can no longer afford to purchase advanced dressings. This is wrong.

Now more than ever, advanced dressings are financially sensible in wound care. Although dressings such as films, foams, hydrocolloids, hydrogels, collagen, alginates, etc., may be more expensive per dressing to acquire than gauze dressings, they are less expensive to use. It is important not to confuse price of product with cost of care.

The *real* cost of wound care can be considered as:

- the price of the dressing *plus*
- the labor cost of having a healthcare professional change the dressing *plus*
- the indirect costs of ancillary supplies and services used in changing the dressing (e.g., gloves, biohazardous waste disposal, etc.) p*lus*
- the cost of the duration of care (e.g., facility charges, travel costs for home care nurse, etc).

Why Gauze Dressings Should NOT Be Used

A gauze dressing placed in the wound does little to impede fluid evaporation and allows a loss of tissue temperature resulting in impaired healing.

Wet-to-dry debridement is not selective and often also removes healthy tissues, causing reinjury and significant pain.

Both retrospective and prospective clinical studies have shown that infection rates in wounds dressed with gauze are actually higher than that of wounds dressed with transparent films or hydrocolloids.

In today's PPS environment BID and TID dressings are not feasible not just from a reimbursement perspective but as an ineffective way to reach the most positive outcomes.

Removing a dried dressing from a wound disperses significant amounts of bacteria into the air. Research has determined that airborne dispersal of bacteria was greatest from dry gauze dressings; however, even removing moist gauze dressings released bacteria.

Semiocclusive dressings are more financially feasible from a total cost perspective.

Several studies have been done to establish that advanced wound dressings can be cost effective simply by taking into account the cost of labor. A more expensive dressing that requires less frequent dressing changes and results in shorter healing times has been found to be much less expensive to use (Alterescu, 1989; Colwell, 1993).

Colwell, Foreman, and Trotter (1993) demonstrated that the even when the cost of the semiocclusive dressing and ancillary supplies was $6.15 per dressing change versus $0.47 for wet-to-moist gauze; the daily cost of care for the semiocclusive dressing was only $3.55 versus $12.26 for the gauze because the former required less frequent changes than the latter.

Xakellis and Chrischilles (1992) demonstrated that while the materials cost of a semiocclusive dressing was over three times higher than saline gauze, the nursing time required for use was one-eighth that of the saline gauze. The cost in use of the semiocclusive dressing using national nursing wages at the time was $15.90 versus $25.31 for the gauze dressing.

Bolton (1997) proposed that a true, total cost of care should include yet another variable: the quality of the healing outcome in terms of clinical effect. Adding this variable underscores the idea that an inexpensive product is not really inexpensive if it does not produce the desired results, i.e. timely healing and improved quality of life for the patient.

These researchers found moisture-retentive dressings actually decrease the costs of care relative to gauze, primarily through their impact on clinician labor, but also due to improved healing. Add to this the implications for decreased costs related to a lower incidence of infections and pain and semiocclusive dressings are a more logical alternative during prospective payment than ever before.

Illustrative Case Study

Table 1 is an example of the financial costs of using gauze and saline for wound management versus more expensive advanced dressings that maintain a moist wound environment and better facilitate healing.

Table 1. Comparison of Cost and Effectiveness of Twice Daily or BID Wet-to-Dry Versus 3x/Wk Using Advanced Product

	Saline and Gauze	Advanced Dressing
Dressing change frequency	**BID**	**3 x/wk**
Price of dressing	$0.75	$10.00
Price of gloves	$0.10	$0.10
Price of irrigation syringe	$0.86	$0.86
Price of saline	$1.12	$0.56
Price of tape	$0.08	$—
Cost per dressing change	**$2.91**	**$11.52**
Materials cost/wk	**$40.74**	**$34.56**
Cost of 1 nursing visit	$100.00	$100.00
Costs of 1 wk of visits	$1,400.00	$300.00
Weekly labor costs	**$1,400.00**	**$300.00**
Weekly costs: labor + materials	**$1,440.74**	**$334.56**
Amount of progress after 4 wks **% Wound size reduction in 4 wks** **Costs for 4 wks of care**	 **50** **$5,762.96**	 **100** **$1,338.24**
Cost per 1% reduction*	**$115.26**	**$13.38**
Supply cost per 1% healing with pt doing self-care*	$3.26	$1.38
*4-wk costs/% healing.		

Approximate costs for the supplies in this example were taken from the online catalog of a national medical product distributor. We assume a BID dressing change for the saline and gauze dressing and a three times per week dressing change for the alternative—an adhesive bordered foam dressing such as Tielle (Johnson & Johnson Advanced Wound Care). Note that even for a dressing that is more than 10 times the price of gauze ($10 versus $0.75), the weekly materials cost is actually less than gauze due to the frequency of dressing changes! The table further shows that if the patient is occasionally doing dressing changes independently, the supply cost of gauze dressings the agency would assume is over *twice as much* as the supply cost of an advanced dressing.

Factor in the cost of the nursing labor at $100 per visit to perform the dressing change—the labor costs for the advanced dressing are approximately 20% of the labor required for the gauze dressing changes. The weekly labor and materials costs for caring for the wound with gauze dressings is almost five times the costs of using the more expensive foam dressing.

Patient Outcome

Consider the cost-effectiveness of the two dressing modalities. Assume, based on the literature, the advanced dressing results in more expedient healing of the wound. Assume that the wound is healed within 4 weeks of treatment with the advanced dressing and only 50% healed in the same amount of time with the gauze dressing. To determine cost-effectiveness, compute the cost of the effect of the treatment (i.e, what did it cost in terms of labor and materials to attain a 1% reduction in the size of the wound?).

To obtain this cost figure, multiply weekly cost per treatment by 4 (for 4 weeks of treatments) and divide the total cost by the percent of healing achieved (either 50 or 100). In this example, using gauze and saline to achieve healing costs over $115 per 1% reduction in wound size, whereas the semiocclusive foam dressing costs approximately $13 for the same reduction. As this typical example shows, far from saving money, *gauze actually may be more expensive to use than a more effective dressing that costs 10 times its price.*

In Table 2, although numbers changed when the procedure changed from BID to daily, there was still a significant cost difference in total care and rate of healing. As you analyze the cost of caring for wound care patients, put this table in a spread sheet format to better anticipate the costs of wound care. As you initially develop the plan of care, discuss plans with the physician and patient and look prospectively and retrospectively at your practices and costs.

Table 2. Comparison of Cost and Effectiveness of Daily Wet-to-Dry Dressings Versus 3x/wk Frequency Using Advanced Product

	Saline and Gauze	Advanced Dressing
Dressing change frequency	**Daily**	**3 x/wk**
Price of dressing	$0.75	$10.00
Price of gloves	$0.10	$0.10
Price of irrigation syringe	$0.86	$0.86
Price of saline	$1.12	$0.56
Price of tape	$0.08	0
	$2.91	**$11.52**
Materials cost/wk	**$20.37**	**$34.56**
Cost of 1 nursing visit	$100.00	$100.00
Costs of 1 wk of visits	$700.00	$300.00
Weekly labor costs	**$700.00**	**$300.00**
Weekly costs: labor + materials	**$720.37**	**$334.56**
Amount of progress after 4 wks **% Wound size reduction in 4 wks** **Costs for 4 wks of care**	 **50** **$2,881.48**	 **100** **$1,338.24**
Cost per 1% reduction*	**$57.63**	**$13.38**
Supply cost per 1% healing with pt doing self-care*	$1.63	$1.38
*4-wk costs/% healing.		

Knowing All This—Now What?

Gauze dressings are not an optimal wound care modality for the patient, the clinician, or the healthcare system. They do not effectively support optimal healing and are more labor intensive to use than advanced dressings such as films, foams, hydrocolloids, and hydrogels. Reasons for the persistence of gauze as a wound management material may be related to several factors.

- Gauze and saline are essentially a "one size fits all" modality, are readily available and familiar, are perceived as inexpensive, and are the dressings of long tradition.
- Not all physicians, nurses, and therapists have knowledge of the broad array of products available and understand the way they work.
- Most advanced dressings are of discrete dimensions and cannot always be adjusted for wounds of different sizes—requiring that the healthcare facility stock multiple sizes.
- There are many brands and variations of advanced dressings that have variable appearances and performance, which may initially confuse the healthcare provider.
- Advanced dressings may also incorrectly be perceived as more expensive than gauze due to their individual purchase price.

Properly used, advanced dressings have significant benefits and should become the standard of care for wound management. Due to their diversity, the effective and efficient use of moisture retentive dressings will require that home care clinicians familiarize themselves with the range of dressing types and functions. Manufacturers provide specific information in product package inserts, instructions for use, and material safety data sheets. There are also multiple reviews of these dressings in the literature.

Editor's Note

Dr. Ovington has raised critically important points in this article that should be used as the basis for a total review of an agency's wound care procedures, cost evaluation, and Plan of Care coordination with the patient's physician. I strongly urge you to use the material in this article, along with Dr. Ovington's previous HHN article in the April, 2001 issue, "Wound Care Dressings—How to Choose" to evaluate your practice and the agency's approach to wound care under PPS. Look for more articles from Dr. Ovington in future issues of the journal as well as "Payment Pointers" by Kathleen Schaum. These pointers give you specific information about how the wound care article subject relates to your PPS reimbursement.

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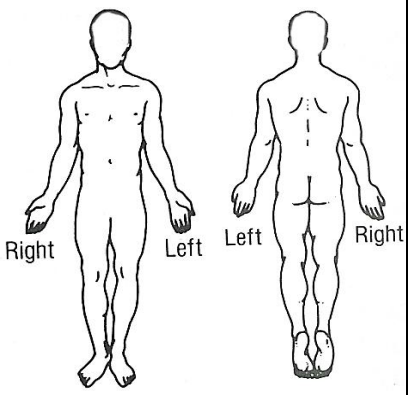
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Instructions: To be completed upon initial identification of wound and weekly thereafter. Initially, Mark wound location on figure, number each site and complete Identification box's. Weekly follow up in rows below.

Wound Assessment Progress Report

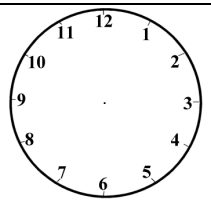
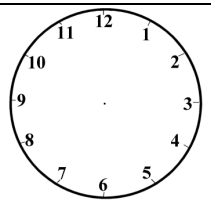
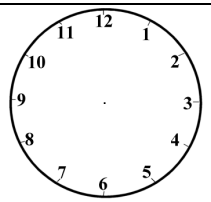


Locate Skin Impairment(s) with an **X**.

INITIAL IDENTIFICATION Site # 1			
Date	Present on admission: ☐ Yes ☐ No		
Location	Stage		
Wound Type:			
Size (cm) Length:	Width:	Depth:	
Color	Drainage	Odor	Tunneling
MD notified?	Dietary consult?		
Pain – Type - Amount			

INITIAL IDENTIFICATION Site # 2			
Date	Present on admission: ☐ Yes ☐ No		
Location	Stage		
Wound Type:			
Size (cm) Length:	Width:	Depth:	
Color	Drainage	Odor	Tunneling
MD notified?	Dietary consult?		
Pain – Type - Amount			

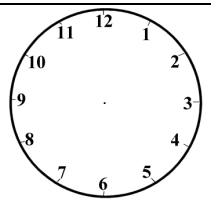
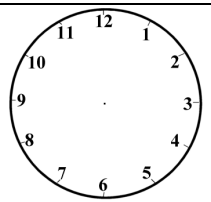
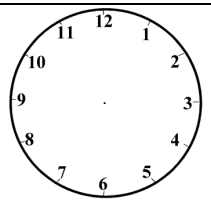
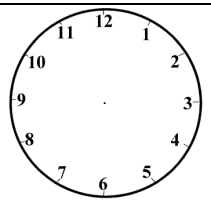
INITIAL IDENTIFICATION Site # 3			
Date	Present on admission: ☐ Yes ☐ No		
Location	Stage		
Wound Type:			
Size (cm) Length:	Width:	Depth:	
Color	Drainage	Odor	Tunneling
MD notified?	Dietary consult?		
Pain – Type - Amount			

	Measurements	Wound Bed	Peri -Wound	Drainage	Comments
Date	L_____ X W_____X D_____	Color:	Wound Margins:	Color:	Treatment:
Site #	Tunneling/ Undermining 	Necrotic Tissue %:		Amount:	Pressure Relief Interventions:
Stage/Type		Granulation Tissue %:	Surrounding Tissue:		Nutritional Interventions:
Initials		Pain:		Odor:	Wound Status: ☐ Improving ☐ Decline ☐ Same
Date	L_____ X W_____X D_____	Color:	Wound Margins:	Color:	Treatment:
Site #	Tunneling/ Undermining 	Necrotic Tissue %:		Amount:	Pressure Relief Interventions:
Stage/Type		Granulation Tissue %:	Surrounding Tissue:		Nutritional Interventions:
Initials		Pain:		Odor:	Wound Status: ☐ Improving ☐ Decline ☐ Same
Date	L_____ X W_____X D_____	Color:	Wound Margins:	Color:	Treatment:
Site #	Tunneling/ Undermining 	Necrotic Tissue %:		Amount:	Pressure Relief Interventions:
Stage/Type		Granulation Tissue %:	Surrounding Tissue:		Nutritional Interventions:
Initials		Pain:		Odor:	Wound Status: ☐ Improving ☐ Decline ☐ Same

Resident Name	ID #	Room #	Physician

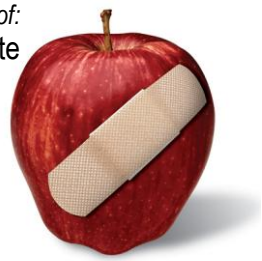
Instructions: To be completed upon initial identification of wound and weekly thereafter. Initially, Mark wound location on figure, number each site and complete Identification box's. Weekly follow up in rows below.

Wound Assessment Progress Report

	Measurements	Wound Bed	Peri -Wound	Drainage	Comments
Date	L_____ X W_____X D_____	Color:	Wound Margins:	Color:	Treatment:
Site #	Tunneling/ Undermining 	Necrotic Tissue %:		Amount:	Pressure Relief Interventions:
Stage/Type		Granulation Tissue %:	Surrounding Tissue:		Nutritional Interventions:
Initials		Pain:		Odor:	Wound Status: ☐ Improving ☐ Decline ☐ Same
Date	L_____ X W_____X D_____	Color:	Wound Margins:	Color:	Treatment:
Site #	Tunneling/ Undermining 	Necrotic Tissue %:		Amount:	Pressure Relief Interventions:
Stage/Type		Granulation Tissue %:	Surrounding Tissue:		Nutritional Interventions:
Initials		Pain:		Odor:	Wound Status: ☐ Improving ☐ Decline ☐ Same
Date	L_____ X W_____X D_____	Color:	Wound Margins:	Color:	Treatment:
Site #	Tunneling/ Undermining 	Necrotic Tissue %:		Amount:	Pressure Relief Interventions:
Stage		Granulation Tissue %:	Surrounding Tissue:		Nutritional Interventions:
Initials		Pain:		Odor:	Wound Status: ☐ Improving ☐ Decline ☐ Same
Date	L_____ X W_____X D_____	Color:	Wound Margins:	Color:	Treatment:
Site #	Tunneling/ Undermining 	Necrotic Tissue %:		Amount:	Pressure Relief Interventions:
Stage/Type		Granulation Tissue %:	Surrounding Tissue:		Nutritional Interventions:
Initials		Pain:		Odor:	Wound Status: ☐ Improving ☐ Decline ☐ Same

Resident Name	ID #	Room #	Physician

Compliments of:
Wound Care Education Institute



Wound Documentation Tips

1. Document the type of wound and location.
2. Describe if the wound is a partial or full thickness wound
   - Partial Thickness - tissue destruction through the epidermis extending into but not thru the dermis.
   - Full Thickness- tissue destruction extending thru the dermis to involve subcutaneous tissue and possibly bone and muscle.
3. Describe the stage (if wound is pressure ulcer) **National Pressure Ulcer Advisory Panel Staging Guidelines 2/2007**
   - Suspected Deep Tissue Injury: Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue. Further description: Deep tissue injury may be difficult to detect in individuals with dark skin tones. Evolution may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar. Evolution may be rapid exposing additional layers of tissue even with optimal treatment.
   - Stage I: Intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding areas. Further description: The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Stage I may be difficult to detect in individuals with dark skin tones. May indicate "at risk" persons (a heralding sign of risk)
   - Stage II: Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister. Further description: Presents as a shiny or dry shallow ulcer without slough or bruising.* This stage should not be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation. *Bruising indicated suspected deep tissue injury
   - Stage III: Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling. Further description: The depth of a stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage III pressure ulcers. Bone/tendon is not visible or directly palpable.
   - Stage IV: Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling. Further description: The depth of a stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and these ulcers can be shallow. Stage IV ulcers can extend into muscle and/or supporting structures (e.g., fascia, tendon or joint capsule) making osteomyelitis possible. Exposed bone/tendon is visible or directly palpable.
   - Unstageable: Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed. Further description: Until enough slough and/or eschar is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined. Stable (dry, adherent, intact without erythema or fluctuance) eschar on the heels serves as "the body's natural (biological) cover" and should not be removed.

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4. Document Size. Measure in centimeters – ALWAYS Document Length x Width X Depth
   - Length = head to toe direction
   - Width = hip to hip direction
   - Depth = measure deepest part of visible wound bed
5. Document any undermining/tunneling/sinus tracts. Document using the "Clock System" with head = 12:00 (example: 2cm undermining at 3 o'clock)
   - Tunneling- course or pathway that can extend in any direction from the wound, results in dead space
   - Undermining – tissue destruction underlying intact skin along wound margins
   - Sinus Tract – A drainage pathway from a deep focus of acute infection through tissue and/or bone to an opening on the surface
6. Describe any drainage (exudate) – type, amount, or odor using descriptions below:
   - Type
     - Sanguineous – thin, bright red
     - Serosanguineous – thin, watery, pale red to pink
     - Serous – thin, watery, clear
     - Purulent – thick or thin, opaque tan to yellow
     - Foul Purulent – thick opaque yellow to green with offensive odor
   - Amount –
     - None – wound tissues dry
     - Scant – wound tissues moist, no measurable drainage

- Small – wound tissues very moist, drainage <25% dressing
- Moderate – wound tissues wet, drainage involves 25 – 75% dressing
- Large – wound tissues filled with fluid – involves > 75% dressing

7. Odor – Describe presence or absence of odor- strong, foul, pungent, fecal, musty, sweet
8. Describe the various types/characteristics of tissue in wound bed including:
   - Adherence of the tissue
     - Nonadherent – easily separated from wound base
     - Loosely adherent – pulls away from wound, but attached to wound base
     - Firmly adherent – Does not pull away from wound
   - Amount – Describe in % (example: 50% wound bed covered with soft yellow slough, 50% beefy red granulation tissue) May also use "clock system" in describing location of necrotic tissue in wound bed.
   - Tissue Types
     - Slough – usually lighter in color, thinner and stringy in consistency; Color – Can be yellow, gray, white, green, brown
     - Eschar – usually darker in color, thicker and hard consistency black or brown in color.
     - Granulation Tissue – it is usually beefy red, granular, bubbly in appearance; should be differentiated from a smooth red wound bed; color of tissue – red, pink, pale pink or full dusky red
     - Epithelialization – can appear as deep pink, then progress to pearly pink/ light purple from the edges in full thickness wound or may form islands in the wound base with superficial wounds
     - Foreign Bodies
9. Describe wound edges:
   - Definition – Defined or undefined edges
   - Attachment – Attached or unattached edges –
   - Rolled Under (Epibole) – Macerated – Fibrotic – Callused
   - Border shape
10. Describe surrounding tissue: Color, edema, firmness, intact, induration, pallor, lesions, texture, scar, rash, staining, moisture
11. Describe any indicators of infection: fever, streaking, redness, increased drainage, odor, warmth, elevated WBC, induration, malaise, edema, weeping, increased pain, discolorations
12. Document any pain – location, causative factors, intensity, quality, duration, alleviating factors, patterns, variations, interventions
13. Document interventions for healing: dietary supplements, vitamins, lab tests, turning repositioning schedules, support surface, cushion, padding, pillows, elevation, heel protection, incontinence management, skin protection(barrier ointments)
14. Document any conditions which would affect healing: Mobility/Turning Surface and Positioning Limitations, Nutritional Status, continence, abnormal labs, infections, deterioration of medical condition, non-compliance.
15. Document current topical treatment plan, response to treatment , modifications to plan, implementation of new orders, reason for not changing treatment plan, referrals.
16. Patient and caregiver education.

Anatomical Directions

Lateral – toward side
Distal – away from center
Medial – toward middle
Dorsal – located near
Posterior – back, underside
Superior – Top, up
Anterior – Front, top
Inferior – below, down
Proximal – toward center, nearest

Specialized directions for limbs
Proximal - Towards body
Distal - Away from body

Specialized directions for Hand
Palmar - towards palm, also volar
Dorsal - opposite of palmar

Specialized directions for Foot
Plantar - towards bottom of foot, also volar
Dorsal - opposite of plantar

