WOUND HEALING CLTI WITHOUT AMPUTATION USING TIME ORIGINAL: A CASE STUDY

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Abstract

Chronic limb-threatening ischemia (CLTI) is clinical syndrome defined by presence PAD in the combination rest pain, gangrene, or lower limb ulceration more than 2 weeks. Arterial ulcers as complication ischemia ulcers risk limb loss, the lesion are generally refractory to healing unless tissue perfusion can be improved prone to progress infection or gangrene. With or without surgery arterial ulcer cause of chronic limb ischemia need wound care treatment. The method is using case study, there are present female 61 years old complain necrotic right & left leg after CABG surgery 1 month ago. Glucose uncontrolled, angiography hard occlusion artery popliteal sinistra and tibi-alis anterior. Wound management using moist concept with TIME original Framework; tissue management with sharp and safe debridement continue using autolytic debridement using hydrogel base, infection control with iodosorb powder & nano colloidal silver spray alternate every 2 weeks, moisture imbalance using calcium alginate and hydro foam, Migration cell epithelial need the support with collagen lotion to prevent break down periwound skin. This case in wound care management necrotic tissue causes of CLTI failed healing after surgery CABG, using TIME original framework have significant result and wound healing at four months without amputation. Case of wound in critical limb-threatening ischemia need appropriate wound care management to heal the wound. Occlusion artery as problem because cannot heal the wound, but the moist condition granulate tissue will grow with helping vascular endothelium growth factor as angiogenesis process. Using moist concept TIME original framework to create and promote healing without amputation and saving feet to saving lives.

Keywords: TIME original Framework, wound healing, CLTI, without amputation

1. Introduction

Prevalence in United States 2015 estimated 504.000 individual (total 295.5 million) living with major amputation due to Peripheral Arterial Disease (PAD), double by 2050. Meta-analysis United States prevalence PAD ranged 6.5% man and 5.3% woman 60-69 years (Conte MS et al, 2019). The incidence of injuries in PAD due to pressure injuries reaches 65%. Risk factor Smoker, Diabetes mellitus (DM), Hypertension, dyslipidemia, obesity. Chronic limb-threatening ischemia (CLTI) is clinical syndrome defined by presence PAD in the combination rest pain with or without tissue loss, gangrene, or lower limb ulceration more than 2
weeks (Conte MS et al 2019). Chronic wound are considered to be the latest global health care challenge (Treadwell T, 2010). CLTI proposed to include a broader and more heterogeneous group of patients with variety degree of ischemia that can often delay healing and increase amputation risk. Arterial ulcers as complication ischemia ulcers risk limb loss, the lesion are generally refractory to healing unless tissue perfusion can be improved prone to progress infection or gangrene (Laurie MN, 2008; 2016). With or without surgery arterial ulcer cause of chronic limb-threatening ischemia need wound care treatment (Abayan V. et al, 2017). Regarding the limb risk at 5 years 21% progress to CLTI, 4% - 27% have amputation. Survive 2 years post amputation on average 7 months and free survive 6 months (Abayan V. et al, 2017). Need multidisciplinary team for solving problem of limb ischemia complication in artery ulcers (Moore Z. et al, 2014; Ousey K. et al, 2018). The purpose is demonstrating TIME Original framework to promote healing case of ulcers CLTI.

This concept was introduced by experts in wound care known as moist wound healing (Schultz, 1993; Laurie MN, 2014, 2016) or the process of wound healing with the moist concept. Theory which was first introduced by George D. Winter of 1962 was done with a closed technique to achieve moist levels. This concept was first published in the journal Nature, that is “conditions that are closed, the healing rate is two times faster than the open conditions”. The normal stages in the wound healing process are hemostasis or the coagulation process, inflammation, proliferation or regeneration and maturation or remodeling. Refer to the above that wound care will follow the phase and process of healing so it must be done in the right procedure. Wound bed preparation (WBP) is a structure and systemic approach to eliminate any barrier for disturbed wound healing (Prasetyono, 2018), nonviable tissue provides focus on infection and impedes wound healing included foreign material (debris, exudate, biofilm and slough) on the wound bed (Swanson T. et al, 2016). Practice guide to wound management that related clinical observation and intervention to the underlying wound pathology in the each of four areas called framework. The framework is a TIME original (Schultz G, 2003).

TIME Framework acronym define by T (tissue management) are removing dead tissue (necrotic or scar and slough yellowish tissue) and disruption biofilm, include foreign material (exudate, debris and wound dressing remnant). The method tissue management using debridement technique such as autolytic debridement, surgical debridement, sharp debridement, mechanical, enzymatic and biological debridement. I (infection or inflammation control) are remove infection from systemic or topical bioburden, focusing cleansing wound bed using antimicrobial topical such as polyhexamethylene biguanide, octenidine, povidone iodine, silver and honey. Inflammation control are reducing inflammatory phase focusing on periwound skin like erythema and edema. Inflammation is a complex defensive vascular response to harmful stimuli, cause of irritant, cell damage and pathogen. M (moisture imbalance) are keep stable condition in moist environment wound bed to support granulation, collagen synthesis and epithelialization using dressing focused to absorb exudates. The wet condition using absorbent dressing choice management to keep moist environment. E (edge of wound and non-advancing) are focus to migration epithelial cell in remodeling phases and focusing epidermal margin.

2. Materials and Methods

Peripheral Arterial Disease (PAD) is a disease of blockage of arterial blood vessels, PAD is the result of an atherosclerotic process, which causes stenosis and occlusion in non-cerebral and non-coronary extremity vessels which often lead to amputation.
PAD Categories:
1. Acute Limb Ischemia
   - Decreased perfusion of members of gestures that threatens the continuity of gestures (Creager MA et al, 2012)
   - Is a condition where there is a sudden decrease in perfusion towards the extremities that causes disturbances and signs of severe ischemia for less than 2 weeks (Obara H. et al, 2018)

2. Chronic Limb-Threatening Ischemia
   - A clinical syndrome defined by presence PAD in the combination rest pain, gangrene, or lower limb ulceration more than 2 weeks (Aboyan V. et al, 2017)

Etiology:
1. Embolism occurs at the branching point of the bifurcation or trifurcation extremity artery. 90% occurs due to complications of atrial fibrillation that cause the blood clot then releases towards the peripheral collar.
2. Thrombosis occurs in atherosclerosis lesions with malignant predisposition, post-installation of graft bypass, hypotension and dehydration.
3. Trauma is an effects of Accidental and iatrogenic events (effects of installing IABP devices or cardiac catheterization)

Risk Factors:
1. Primary: atherosclerotic vessels because of high cholesterol elevate level of total cholesterol and low density lipoprotein cholesterol (LDL) are widely accepted as risk factor of PAD, reduce high density lipoprotein (HDL) also appear to be associated with increased mortality in PAD patient. Increasing blood glucose intolerance body namely diabetes mellitus, in patients with DM 26% increased risk of PAD every 1% increase in HbA1c levels and insulin resistance increased by 30%-50%.

2. Secondary:
   - Age: all geriatric problem decreasing function of human body, happen in contractility arterial vessel.
   - Smoking: smoking is a bad habit that must be abandoned, the blood vessel in smoker is non elastic arterial vessel, micro albumin, obesity.

PAD has experienced symptoms of rest pain and frequently worse at night, PAD patients will be lazy to mobilize or moving. When the condition continues, for example someone experiences occlusion / blockage in the lower extremity area and complains of pain to a severe scale, the patient will position his legs without movement, because does not experience a change in position from hours to days and even weeks, there will be pressure injury and then become ulcers either due to suppression or because of lesions. If this has happened, it will worsen the condition, so it is mentioned that the wound in the patient with PAD is called arterial ulcers.

Under normal conditions PAD is not the main cause of a person experiencing injuries, it often occurs due to a condition of aggravation to an advanced phase called critical limb-threatening ischemia (CLTI) which results in complete occlusion of the arteries of the extremities so that necrosis occurs in peripheral areas more often in the toes and forefoot areas. The other area may be affected by diabetic neuropathy, altered biomechanics, or foot deformity. If present ischemic rest pain for more than 2 weeks and combined with hemodynamic evidence of severely impaired perfusion (such as absolute AP <50 mmHg, absolute TP <30 mmHg), it is diagnostic as CLTI. There is important to documenting patient history and record details of cardiovascular risk,
drug history, previous vascular and endovascular revascularization procedures, assessment of frailty, functional status and health related quality of life.

Physical examination:
Some cases with the arterial disease have a common features of examination likes palpation of lower limb pulses. The other features to determine PAD such as coolness, dry skin, muscle atrophy, hair loss and dystrophic toenails. See also buerger sign, pallor of the foot and special characteristic of rubor. CLTI patient with DM have tingling, numbness, weakness and burning pain in the feet and ankles.

Detect PAD through the vascular system:
1. Visual
   Check for color changes in both extremities, more of case showed pale skin in area lower extremities cause of blood supply not enough to peripheral occlusion vessel domination.

2. Palpation of pulses
   Perform palpation of the second pulse area of the same extremity both the upper extremities (brachialis, ulnar and radial pulses) and the lower extremities (femoral, popliteal, dorsalis pedis, posterior and anterior tibialis). Palpation can also determine the part that experiences occlusion towards the peripheral direction when it is cold compared to the next door, it is strongly suspected to have PAD, pulseless is a dominant sign in CLTI.

3. Doppler Ultrasound
   Which is a device to detect whether the flow from the artery is progressing properly towards the periphery without any obstacles, by providing a pulse sound affixed to the prop or guide. Ideally in conducting an ultrasound doppler examination not only the sound is in mode in the device but there should be a graphic screen display. The function of the sound is to detect the presence of whether there is a turbulence or a bruit-like sound on the carotid artery, meaning that it signals the presences of occlusion then from the graphic or wave can determine and confirm the form of triphasic, biphasic or monophasic. Normally the flow in the arteries can be seen triphasic wave.
4. Ankle Brachial Pressure Index (ABPI) or Ankle Brachial Index (ABI)

Is a form of examination using a sphygmomanometer to obtain systolic pressure on the ankle divided by systolic pressure on brachial. The need for this examination for wound care science helps in determining the process of bandaging management if the assessment is included in the arterial ulcer then counter indications for bandaging. Meanwhile, vascular science is useful for detecting whether it enters the chronic limb threatening ischemia so that it is useful for determining the next step towards intervention or vascular reperfusion actions. Contraindicated examination of the acute condition of limb ischemia. Normal ABI value is 1.0 – 1.4, reperfusion intervention vascular when the ABI value more than 1.4.
5. Toe Brachial Index (TBI)

Is an examination to determine the pressure of the systolic artery at the end or peripheral toe. TBI represent an alternative diagnosis tools in CLTI patients. Microvascular of the small vessel to peripheral. Normal value of TBI is between 0.65 – 0.7. When the TBI value is less than 0.65 it is indicated to CLTI then TBI more than 1 classified as arteries.

6. Transcutaneous Pressure Oxygen (TCPO2)

It is an examination to find out and ensure sensory oxygen towards the distal, if the value is less than 40 mmHg, it is difficult for the wound to heal. When the result of pressure is more than 40 mmHg measure good oxygen condition and healing wound is occur (Menberg, 2013).

7. Skin Perfusion Pressure

An examination using laser doppler skin perfusion pressure, if the value is more than 30 mmHg the wound will quickly heal wound.

8. CT scan and MRI

Computerized tomography scan (CT scan) is a procedure that uses a combination of x-ray technology and computer system to view conditions in the body from various angles. Uses in wound healing to di-gnose and know the direction of blood vessel, available or not.
9. Angiography

It is an act of checking the status of arterial blood vessels by invasive means using contrast to see the location and extent of arterial occlusion, if you need further conditions, you can install a stent on the arterial vessel or known as PTA (Percutaneous Transluminal Angiography) action.

A condition was found by a person with an arterial ulcer wound which is suspected to be the main problem because CLTI requires a fairly serious, fast and appropriate treatment. It is said to be fast because the process continues to run if it late in handling, it will be a worse condition towards the chronic because if it continues to worsen due to necrosis, it will be difficult to build tissue repair, it is said that it must be appropriate because if in the assessment does not pay attention to the vascular system, it will be wrong in handling, especially the condition is aggravated with diabetes problems, so that vascular problems seem to be closed, an example when problems of infection and necrosis are found in DFU sufferers if they are not observant in conducting an assessment, then when they have to be amputated and the problem of arterial vessel occlusion in the proximal direction is still there, then necrosis will continue and amputation is not solving the problem in the wound. When it is said that it must be serious because it requires the role of multidisciplinary science in solving wound problems in CLTI so that the wound can heal and the cause can be overcome and complications can be avoided.

Plays role in PAD patients
1. Wound Care Clinician who is competent and legal, because with the role of being able to complete and be able to solve wounds with the right concept, which focuses on tissue management, infection & inflammation control, moisture balance, epithelial edge and offloading system, all oriented towards tissue repair.
2. Vascular intervention, namely PTA (Percutaneous Transluminal Angiography) as well as installing stenting and lysing occlusion of arterial vessels.
3. Vascular surgery, if a surgical procedure is needed because vascular intervention is not successful, surgery will be carried out, for example with arterial vessel bypass.
4. Endocrinology, in connection with PAD problems as the cause due to diabetes, the role of an endocrinologist is needed and solving uncontrolled glucose.
5. Diabetes nursing also needs its role because as an educator so that sufferers are more obedient in managing life with diabetes.
6. Nephrology has a role in the condition of patients with PAD and DM when pre and post PTA related to the kidneys because these actions require a lot of substance and using contras for make sure problem occlusion arteries vessel during diagnostic in catheterization laboratory unit, showed using contras increasing creatinine serum in kidney.
7. Nutritionists as caregivers of diet problems and daily eating needs, such as manage of nutrient, vitamins, carbohydrate, fat and protein source consumption for support healing wounds.

Wound Assessment
Assessment wound along with consideration of history, etiology and other clinical finding.

- Pain leg (moderate to severe)
- Wound location, shape, size
- Wound bed (necrotic, slough, granulation, epithelialization)
- Wound edge (smooth, undermining, tunnelling)
- Periwound skin (erythema, local oedema, increase warmth)
- Exudate (colour, odour, consistency)
- Complication (infection, gangrene, osteomyelitis, deformity)

Wound Care Management
- Basic principles wound care management serve as a guide for management wound ischemia: identification localize lower limb, treatment of infection, remove necrotic tissue (devitalize), exudate control, periskin and periwound protection, dead space, close wound edge.
- Topical dressing therapy
- Oxygen support: hyperbaric oxygen therapy, oxygen topical treatment, haemoglobin spray
- Offloading system: the purpose is to decreasing pressure cause of immobilize, no pressure no tape (Baath et al, 2016)
- Multidisciplinary team (Moore Z. et al, 2014; Ousey K. et al, 2018; Aboyan V. et al, 2017; Conte MS et al, 2019)

![Chronic Limb-Threatening Ischaemia (CLTI) Algorithm](image)

**Figure 4: Chronic Limb-Threatening Ischemia Algorithm (Aboyan V. et al, 2017)**
Nursing Intervention
- Assess physical 6P’s (pain, pulseless, polar, pallor, paraesthesia, paralysis), symptom and claudication history
- Education changed lifestyle (smoking, alcohol, nutrition)
- Hydration 2.5 L to reduce symptom claudication and rest pain
- Glucose and lipid controlled, hypertension controlled
- Exercise to promote collateral vessel
- No elevation legs
- No pressure, shear, friction legs and no tape
- Keep moist the skin with lotion
- Supplement nutrition: zinc, vitamin E, Vitamin C, Vitamin B, Albumin
- Warning effect of bleeding from coagulation drugs
- Actual CLTI, referral to revascularization intervention
- Multidiscipline team for wound cases (cardiology intervention, vascular surgeon, diabetic nurse, wound care clinician, orthopaedic and endocrine)

3. Method: Case Study

Present case study female 61 years old, complain necrotic right & left leg after CABG surgery 1 month ago with inflammation periwound, pale periskin and pain. Glucose uncontrolled, duplex ultrasound lower extremity diagnostic find diffuse sclerotic and thrombus in artery tibialis anterior left leg and sclerotic right tibialis posterior. Not find deep vein thrombosis and chronic venous insufficiency. ABI diagnostic right pressure is 97/148 with the result 0.66 and left pressure is 63/148 with the result 0.43, normal ABI range is 1.0-1.4. Find TBI diagnostic right pressure is 89/148 with the result 0.6 and left pressure is 52/148 with the result 0.35, normal TBI range is 0.65-0.7. Angiography result hard occlusion artery popliteal sinistra & tibi-alis anterior success intervention ballooning and stenting to revascularization. Wound care management using moist concept with TIME original Framework: Tissue management with sharp and safe debridement continue using autolytic debridement using hydrogel base one times apply and result lysis necrotic tissue, infection control with iodosorb powder & nano colloidal silver spray alternated every 2 weeks, inflammation reduce using transparent film dressing, moisture imbalance using calcium alginate and hydro foam, migration cell epithelial need the support with collagen lotion to prevent break down periwound skin. Wound care process and changing dressing every 3 days.

4. Results

This case in wound care management with necrotic tissue causes of CLTI failed healing after surgery CABG and using TIME original framework. The wound care management with moist concept are strategy for method of wound healing process, in this case using TIME original framework. Tissue management, Infection or inflammation control, Moisture imbalance, and Epithelial edge. Tissue management using technic sharp debridement to removes dead tissue and eliminate biofilm in wound bed, the result after technic debridement show more than 70% granulation in wound bed and tendon exposes. Sharp debridement is first choice to remove necrotic tissue for wound bed preparation and cleansing using soap gentle is recommendation for eliminate biofilm and bioburden. Next step in wound care process after debridement and cleansing need assessment for the apply appropriate dressing choice. Because finding infection with purulence exudate and
inflammation periwound need dressing for release inflammation and infection control. Infection control using antimicrobial topical dressing with iodosorb powder and altered nano colloidal silver spray after two weeks for kill bacteria, reduce inflammation a focused periwound and periskin using transparent film dressing for evaporating inflammation. Moisture imbalance are keep stable condition in moist environment wound bed using hydro foam and calcium alginate for absorb exudate and support granulation then create neo angiogenesis process.

During this phase of proliferation, doing by cardiology intervention vascular angiography result success ballooning and stenting to revascularization, this conditions are gold standard for CLTI management. After epithelial show in 5 weeks, the migration of epithelial cell support using collagen lotion to prevent break down periwound skin in remodeling phases. In 6 weeks wound care process, granulation cells show good grow granulation and migrate epithelial cell but still showing tendon exposed in left leg. Then after three months (12 weeks) tendon exposed covered by granulation. Right leg healed after one month, then after four months (16 weeks) the wound care management have significant result and wound healing left leg without amputation.

Figure 5a: Present necrotic tissue before first debridement

Figure 5b: Result after CSWD and mechanical first debridement June 11th

Figure 5c: There is slough and granulation in wound bed June 06th

Figure 5d: Right leg healing within 1 month in July 12th
5. Conclusion

Case of wound in critical limb-threatening ischemia need appropriate wound care management to heal the wound, arterial ulcers are hard to heal wounds, occlusion artery as problem because cannot heal the wound, but the moist condition granulate tissue will grow with helping vascular endothelium growth factor as angiogenesis process. Using moist concept TIME original framework to create and promote healing without amputation and saving feet to saving lives. Multidisciplinary team with cardiologist vascular intervention to reperfusion artery using PTA (percutaneous transluminal angiography) ballooning and continue to stenting artery popliteal sinistra & tibialis anterior during wound care treatment help good blood flow to distal or peripheral leg and promote wound healing process.

References


