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D+Wound Solution

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CELL & GENE BIOTECHNOLOGY

D+Wound Solution

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This guidebook is intended to provide healthcare professionals involved in wound care a standard care guideline using the wide variety of Daewoong·CGBio products. To correctly apply wound care products, an accurate diagnosis and an appropriate treatment plan must be preceded. This guidebook is meant to deliver the necessary information ranging from the diagnosis of wounds to the optimum treatment plans in a systematic and scientific way. Eleven specialists, including plastic surgeons and wound, ostomy, and continence nurses (WOCN), participated in the writing and editing of this guidebook at the request of Daewoong · CGBio.

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D+Wound Solution

Chapter I This chapter introduces the concept of D+Wound Solution and provides a general definition of the DIRECT coding, which is a classification system of wounds.

Chapter II Wounds with different indications have their own causes and pathologic physiology upon which the focus and priority of treatment depend. Therefore, in this chapter, wounds are first classified into ten representative indications. Basic concepts by each indication, D+Wound Solution by DIRECT coding, treatment algorithm, examples of representative coding combinations, and expert opinion are presented. In this way, we have tried to contain comprehensive information that covers basic and expert levels. The purpose and scope of the information for each configuration are as follows:

▶ **Basic concepts**
Describes the definition of an indication, causes, pathologic physiology, diagnostics, a representative classification method, and basic principles and precautions of treatment in order to help users of this guidebook understand the characteristics of indications.

▶ **D+Wound Solution by DIRECT coding**
Contains interpretations of each code and the customized solution specific to the circumstances by classifying the major points to be examined when diagnosing a wound using the DIRECT coding system.

▶ **Treatment algorithm**
Contains the sequence of diagnosis by indication and treatment method according to the diagnosis in a chart in order to intelligibly express a series of processes for accurate diagnosis.

▶ **Examples of representative coding combinations**
Presents the coding combinations for several clinical examples that occur frequently by indication and a treatment method associated with it in order to help users of this guidebook understand comprehensive diagnoses by each case and its treatment.

▶ **Expert opinion**
Summarizes the discussion of clinical issues that we would like to emphasize from an expert's point of view, although we do not deal with them in generalities.

Chapter III An introduction to the D+Wound Solution product and the areas applicable in the DIRECT coding system are presented.

Chapter IV Cases utilizing the D+Wound Solution at all stages of wound healing are introduced.

Chapter V Appendices

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Chapter

I

Introduction and overview of the D+Wound Solution

01.

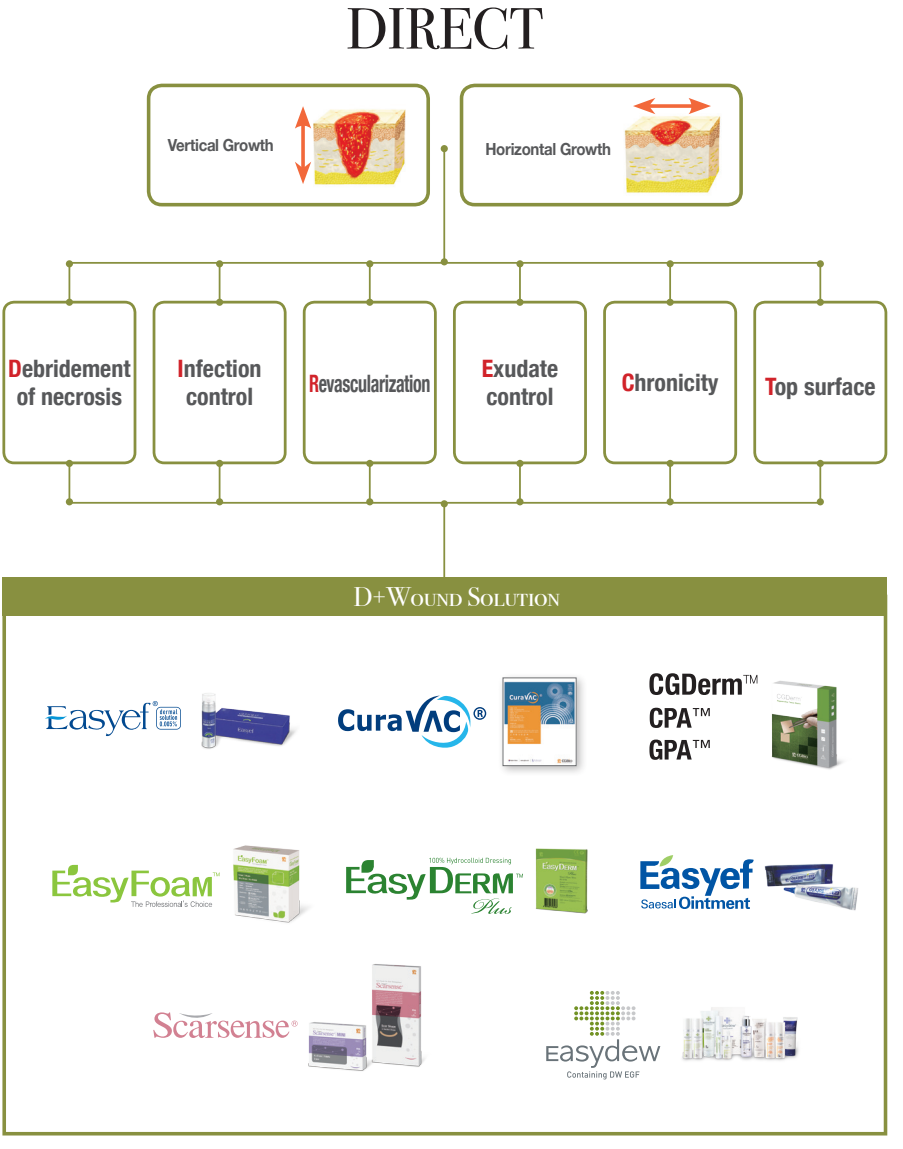
What is the D+Wound Solution?

The D+Wound Solution represents a group of Daewoong·CG Bio's wound care products that provides ideal healing solutions for all types of wounds classified on the basis of the Debridement of necrosis, Infection control, Revascularization, Exudate control, Chronicity, and Top surface (DIRECT) coding system.

The D in the D+Wound Solution stands for "Dressing", "Daewoong", and "DIRECT".

01.

What is the D+Wound Solution?



02.

Wound classification using DIRECT coding

DIRECT

Debridement of necrosis	▶	Debridement of necrosis is classified according to the wound's degree of necrosis.
Infection control	▶	Infection control is classified according to the presence of wound infections.
Revascularization	▶	Revascularization is classified according to the vascular status of the wound.
Exudate control	▶	Exudate control is classified according to the exudate amount of the wound.
Chronicity	▶	Chronicity is classified according to the time taken to heal the wound or its response to therapy.
Top surface	▶	Top surface is classified according to the surface condition of the wound.

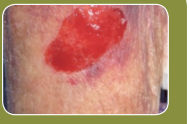
02.

Wound classification using DIRECT coding

Debridement of necrosis

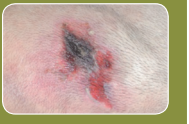
Debridement of necrosis is classified according to the wound's degree of necrosis.

None D.0



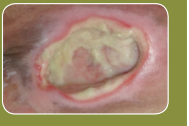
- No necrotic tissue.

Dry D.1



- Black, dry, and hard dead tissue caused by topical pressure or peripheral ischemia.

Wet D.2



- White or yellow, sticky, and sloughy tissues

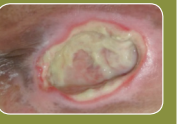
Infection control

Infection control is classified according to the presence of wound infections.

None I.0

- No sign of infection.

Infection I.1

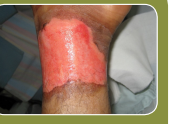


- Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor.

Revascularization

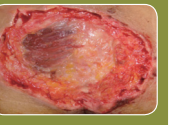
Revascularization is classified according to the vascular status of the wound.

None R.0



- No abnormality in blood flow.

Ischemic R.1

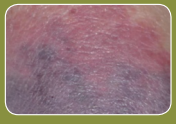


- Arterial or venous insufficiency exists in the extremity vessel or there is topical poor blood flow around the wound.

Exudate control

Exudate control is classified according to the exudate amount of the wound.

None E.0

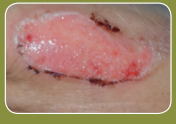


■ The state that the wound site is dry, and moisturization is required.

Light E.1

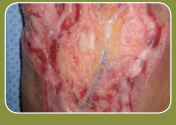
■ Exudate does not ooze when applying EasyDERM™ Plus, or once-daily replacement is required based on EasyFoam™ 2 mm.

Intermediate E.2



■ Once-daily replacement is required based on EasyFoam™ 5 mm.

Heavy E.3

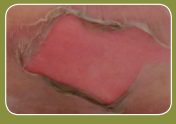


■ Twice or more frequent daily replacement is required based on EasyFoam™ 5 mm.

Chronicity

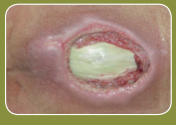
Chronicity is classified according to the time taken to heal the wound or its response to therapy.

Acute C.0



■ The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment.

Chronic C.1

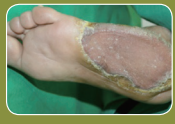


■ The wound shows no visible healing progress even after 3~6 weeks of treatment.
Or the wound has no response to the current wound treatment or is getting worse.
It may be caused by the pressure ulcer, diabetes, severe burns, autoimmune diseases, chemicals, anticancer or radiation therapy, severe infection, or peripheral vascular diseases.

Top surface

Top surface is classified according to the surface condition of the wound.

Closed T.0



■ The skin is open only a little or not open at all, and there may be problems such as bruising, hematoma, crushing injury, pressure ulcer, seroma, or pus pockets under the subcutaneous layer that are not revealed directly.

Open T.1

■ The skin is dehisced, and the inside of the skin is exposed.

Chapter

II

Indications and the D+Wound Solution

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01. Diabetic Foot Ulcer
02. Pressure Ulcer
03. Traumatic Wound
04. Venous Ulcer
05. Arterial Ulcer
06. Burn
07. Surgical Suture Wound
08. Wound Dehiscence
09. Cancerous Wound
10. Scar

01.

Diabetic Foot Ulcer

01. Diabetic Foot Ulcer

Definition

Infection, ulcer, or necrosis of the deep tissues of the foot that occurs in the lower extremity in patients with diabetes and its accompanying neuropathy and peripheral arterial diseases.

Causes and pathologic physiology

The causes of the healing disorder of diabetic foot ulcers are peripheral neuropathy and peripheral vascular damage. Neuropathy damages the protective senses of the foot, which produces deformation of the shape of the foot and insensitivity to the wound, gradually worsening the wound. In addition, the vascular disorder causes healing to be delayed due to an insufficient supply of oxygen and nutrients.[1]

Diagnosis

Proper management of diabetes is essential. First, the presence of infection should be assessed empirically, and then the depth and scope of the wound should be identified through probing. In particular, if the bone is affected, a bone infection must be suspected. A bone scan or magnetic resonance imaging (MRI) should be scheduled to identify osteomyelitis. In addition, the vascular status of the lower extremities must be precisely evaluated.

Classification

There are three types of classifications commonly used: the UT grading system*, the Wagner classification system*, and the PEDIS grading classification system*.[2-4]

Basic principles/precautions of treatment

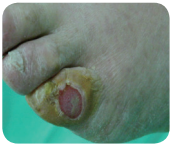
Thorough sugar and electrolyte controls as well as a comprehensive examination of the cardiovascular system and renal function are required. For wound management, tissues must be collected and cultured to ensure the choice of appropriate antibiotics. Immediate debridement should be performed and the proper dressing needs to be selected. Continuous wound management is required until the wound is completely healed.
To correct limb ischemia, endovascular angioplasty or bypass surgery may be necessary depending on the patient's vascular status.

※ See Appendix I

01. Diabetic Foot Ulcer | DIRECT coding

D Debridement of necrosis

D.0 No necrosis

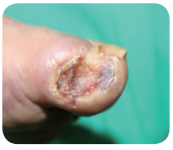


No necrotic tissue

D+Solution

- See Category E (Exudate Control)
- Easyef®, Easyef Ointment
- EasyFoam™(5mm, 2mm)
- EasyDERM™ Plus

D.1 Dry

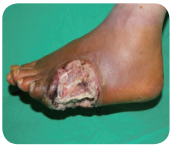


Black, dry, and hard dead tissue

D+Solution

- No debridement
- Moisturizing with Easydew
- Revascularization
- Cushioning with EasyFoam™

D.2 Wet



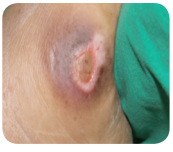
White or yellow, sticky, and sloughy tissues

D+Solution

- Complete debridement
- CuraVAC® Silver
- basic fibroblast growth factor (bFGF)
- CGDerm™, CGCRYODERM®, CGDerm™ powder

I Infection control

I.0 No infection

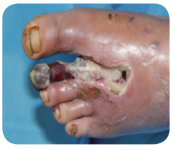


No sign of infection

D+Solution

- See Category E (Exudate Control)
- Easyef®, Easyef Ointment
- EasyFoam™ (5 mm, 2 mm)
- EasyDERM™ Plus

I.1 Infection present



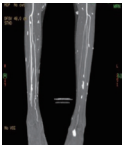
Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor.

D+Solution

- Complete debridement
- Systemic antibiotics
- CuraVAC® Silver
- bFGF
- CGDerm™, CGCRYODERM®, CGDerm™ powder

R Revascularization

R.0 Non-ischemic

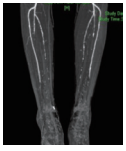


No abnormality in blood flow

D+Solution

- See Category E (Exudate Control)

R.1 Ischemic



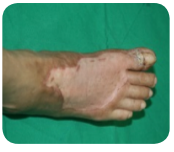
Arterial insufficiency exists in the extremity vessel or there is topical poor blood flow around the wound.

D+Solution

- Angioplasty or bypass surgery

E Exudate control

E.0 None

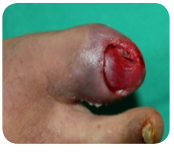


The state that the wound site is dry, and moisturization is required.

D+Solution

- Easyef Ointment or Easydew

E.1 Light

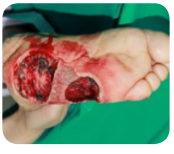


Exudate does not ooze when applying EasyDERM™ Plus, or once–daily replacement is required based on EasyFoam™ 2 mm.

D+Solution

- EasyDERM™ Plus or EasyFoam™ (2 mm)

E.2 Intermediate

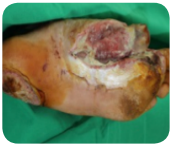


Once–daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm)

E.3 Heavy



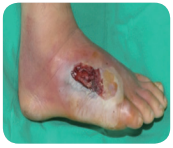
Twice or more frequent daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm) or CuraVAC®

C Chronicity evaluation

C.0 Acute

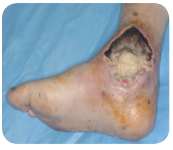


The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment

D+Solution

- EasyDERM™ Plus or EasyFoam™
- Easyef Ointment

C.1 Chronic



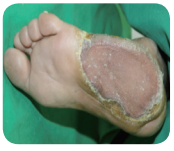
The wound shows no visible healing progress even after 3~6 weeks of treatment. Or the wound has no response to the current wound treatment or is getting worse.

D+Solution

- Confirm blood flow
- Complete debridement
- CuraVAC® Silver
- CGDerm™, CGCRYODERM®
- CGDerm™ powder
- bFGF, Easyef®, Easyef Ointment

T Top surface

T.0 Closed

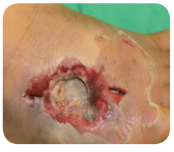


The status of phlegmon or the status before or after the ulcer.

D+Solution

- Systemic antibiotics
- Easydew

T.1 Open

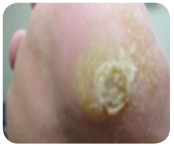


The skin is dehisced, and the inside of the skin is exposed.

D+Solution

- Evaluation of vascular status
- Complete debridement
- CuraVAC® Silver
- CGDerm™, CGCRYODERM®
- CGDerm™ powder
- bFGF, Easyef®, Easyef Ointment

T.c Callus formation

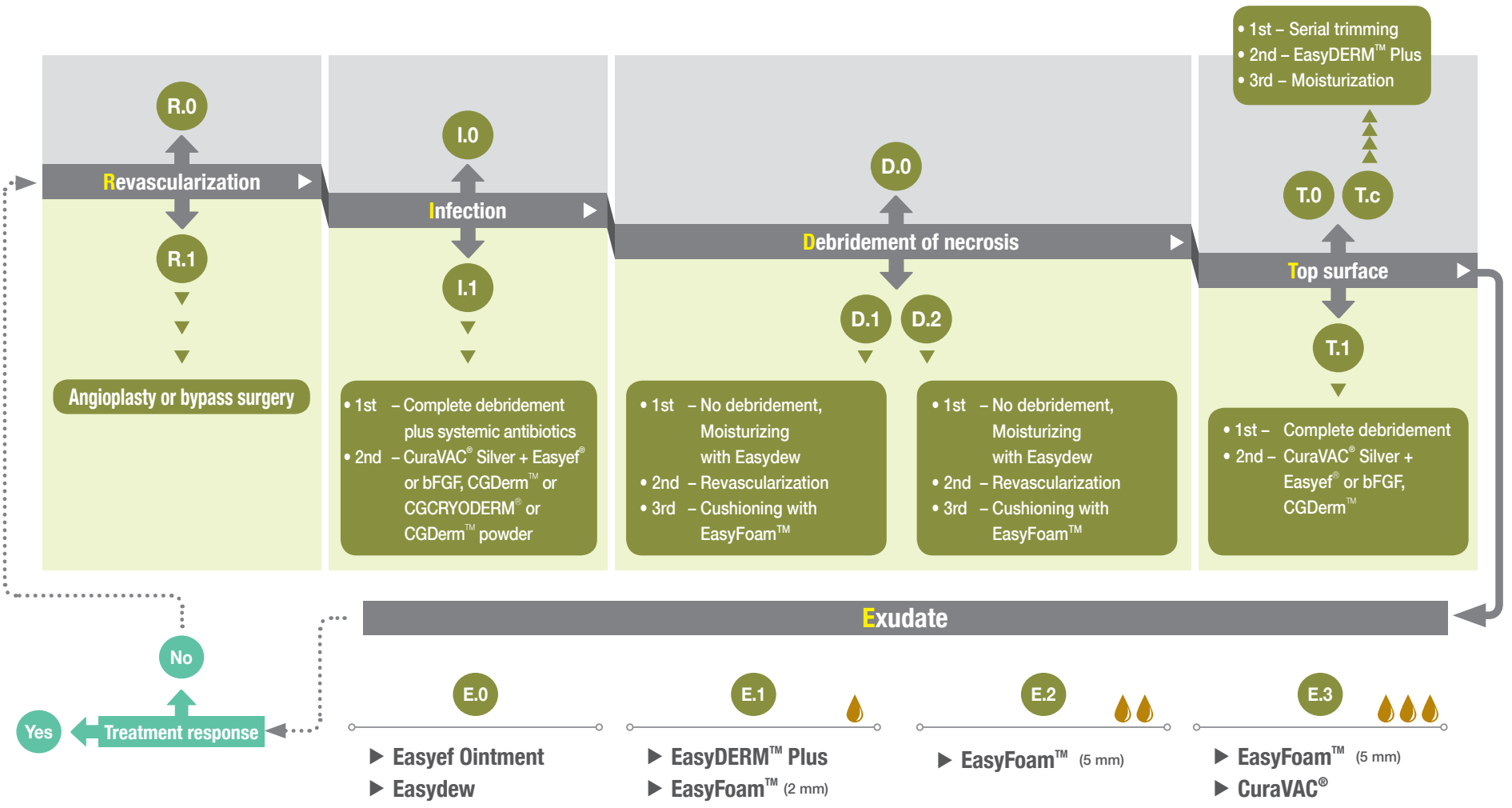


Keratin components are abnormally thickened due to excessive proliferation of keratinocytes.

D+Solution

- Serial trimming
- EasyDERM™ Plus
- Moisturization

01. Diabetic Foot Ulcer | ALGORITHM

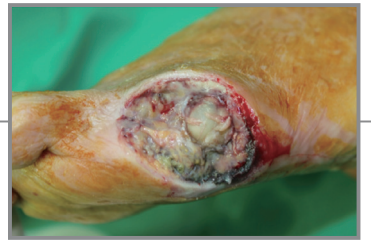


Diabetic Foot Ulcer

ALGORITHM

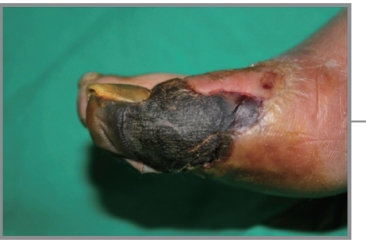
OI. Diabetic Foot Ulcer | Examples of representative coding combinations

D.2 Wet | I.1 Infection | R.1 Ischemic | E.3 Heavy | C.1 Chronic | T.1 Open



Severe soft tissue infection and osteomyelitis are strongly suspected because the wound is covered with sloughy dead tissues and accompanied by a heavy odor, and the cartilage of the fifth metatarsal is exposed. Initial debridement is very important. Any tissue in which infection is suspected should be sufficiently removed until there is enough bleeding. Later, the status and the scope of any bone infection should be assessed using a bone scan or MRI; if a bone infection is present, a treatment plan should be developed. In addition, if the vascular status of the lower extremities is poor, it is more important than anything to improve the vascular status. For wound treatment, adequate debridement and proper materials that can regulate the infection (e.g., silver, hydrophobic material) should be used primarily, and EasyFoam™ (5 mm) should be the second dressing, which is recommended to be changed more often than twice a day. The wound should be evaluated repeatedly, and the contents of the treatment should be changed based on the evaluation results. Debridement also should be performed repeatedly to ensure complete removal of the infected tissues. After that, the remaining dead space must be filled. It is very effective to use basic fibroblast growth factor (bFGF), CGDerm™ paste, or CuraVAC® alone or in combination, depending on the situation. If the wound is converted to a superficial wound, Easyef® can be used to complete treatment.[5–6]

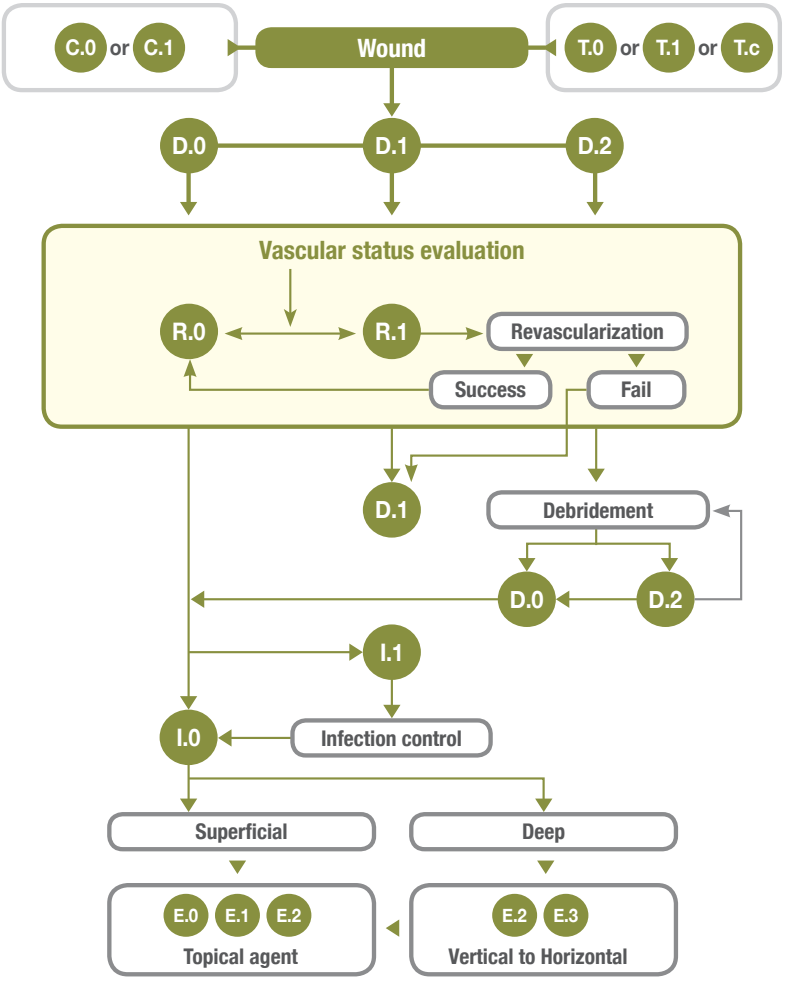
D.1	I.0	R.1	E.0	C.1	T.0
Dry	No infection	Ischemic	No exudate	Chronic	Closed



The wound has been kept covered with hard black eschar for more than two weeks. Infection is not suspected, since the exudate amount is very small and there is no smell. It is not desirable to remove the eschar immediately. Instead, ensure that any external pressure is no longer being applied. In case the eschar is hard and dry, it should not be touched if you cannot ensure sufficient blood flow. Unless there is suspected symptom of secondary infection, EasyFoam™ of 5 mm in thickness is useful for protection of the wound and a cushioning effect.

01. Diabetic Foot Ulcer | Expert Opinion

Flow Chart for DF according to DIRECT



D.I.R.E.C.T.

D.0 The wound is often not accompanied by infection, and the dressing is determined according to the exudate amount.

D.1 In general, the wound is accompanied by peripheral artery disease, so it is important to check the patient's vascular status. A hard and dry eschar should not be removed. A cushioning effect using EasyFoam™ may be effective. Pay attention to moisturization with Easydew.

D.2 In most cases, the ulcer accompanies infection, and the topical inflammation reaction is severe. It is vital to completely remove the dead and infected tissues with repetitive debridement. After sufficient debridement, soft tissue defects are revealed. Therefore, it is important to achieve the status of D.0 by treating these defects.

I.0 With a status of no infection, the dressing should match that of D.0. The wound may be accompanied by deep soft tissue defects. In this case, treat in the same manner as D.2 after sufficient debridement.

I.1 Adequate debridement is essential if the wound has the same aspect as D.2 in the initial stage. A culture examination should be performed for the deep tissues, and proper systemic antibiotics should be selected for administration. However, the infection cannot be removed completely with systemic antibiotics administration alone and thus repetitive debridement is also required.

Topical agent of D+Wound Soulution

Easyef®	Recombinant epithelial growth factor (EGF)
bFGF	Recombinant bFGF
Easyef Ointment	Ointment containing recombinant EGF
CGDerm™ paste	Acellular dermal matrix paste

01. Diabetic Foot Ulcer | Expert Opinion

D.I.R.E.C.T.

R.0 As there is no vascular disorder, evaluate only the wound itself and choose a treatment based on the D+Wound Solution.

R.1 If obstructive peripheral arterial disease is present, endovascular angioplasty or bypass surgery is necessary. If the revascularization procedure is successful, reevaluate it as R.0, and design the treatment based on the D+Wound Solution. However, if this surgery fails, it will be very difficult for the wound to heal successfully. In addition, using CuraVAC® when the ischemia is not improved may actually make the wound worse. Therefore, special attention is required.

E.0
E.1
E.2
E.3

The status should be converted from E.3 to E.1, inducing wound healing. E.3 is likely to be accompanied by severe infections or deep infections. Therefore, the wound can be treated corresponding to D.2. That is, E.3 often requires proper debridement. After sufficient debridement, it is recommended to apply vertical to horizontal treatment.

How to convert vertical wound to horizontal by D+Wound Solution

CuraVAC®	Negative Pressure Wound Therapy (NPWT)
bFGF	Recombinant bFGF
CGDerm™	Acellular dermal matrix
CGDerm™ paste	Acellular dermal matrix paste

D.I.R.E.C.T.

C.0

The wound appears in various types clinically. It varies widely from a wound upon which blisters form lightly and are removed to a wound accompanied by an infection, which penetrates into the deep tissues within a few days. Accordingly, the initial evaluation is very important. However, it is hard to identify a case of D.1. In D.0 cases, treatment can be based on the D+Wound Solution. The wound may be at the D.2 state indefinitely in some cases, but in this case, it is quite usual for considerable deep tissues to have already been destroyed and for pus to be present. Therefore, if suspicious, it is very important to prevent the diffusion of the infection to surrounding tissues by immediate drainage and repetitive debridement. At this C.0 stage, it is essential to achieve D.0 and I.0 status in a short period of time.

C.1

Although it is usually a deep D.0 wound beyond the acute stage, some wounds are untended in the state of D.2 even for two weeks. It is imperative to treat a case of untended D.2 according to the D.2 solution as soon as possible in order to prevent infection and minimize tissue necrosis. In diabetic patients, the inflammation stage is not completed in the wound healing process for various reasons. The causes should be determined through an in–depth evaluation and resolved. Evaluate the wound based on the DIRECT coding system, and treat it based on each solution.

T.0

For pre–ulcer status or a status where the ulcer is healed, sufficient moisturization using Easydew is crucial. At the status of phlegmon before abscess, antiinflammation drug therapy to reduce inflammation and empirical systemic antibiotics therapy should be employed. Sometimes abscesses of different degrees occur under the skin without changes to the skin surface. In this case, the skin should be incised for drainage and debridement and treated it according to T.1.

T.1

T.1 varies from a light superficial wound to a wound accompanied by infection of the deep tissues. Therefore, it should be treated according to the D+Wound Solution.

T.c

Calluses occur at sites where weight is applied to the soles. Although a callus is not considered as an open wound, if the callus is left untreat, an ulcer may occur. Therefore, it should be trimmed on a regular basis. At this stage, it does not matter if you trim the callus until slight bleeding is seen. Trimming is usually done with a knife, but it is much easier if you soften the tissue with EasyDERM™ Plus beforehand.

01. Diabetic Foot Ulcer | References

1. Jeffcoate WJ, Harding KG. Diabetic foot ulcers. Lancet 2003; 361(9368): 1545-51.
2. Wagner FW, Jr. The dysvascular foot: a system for diagnosis and treatment. Foot Ankle 1981; 2(2): 64-122.
3. Lavery LA, Armstrong DG, Harkless LB. Classification of diabetic foot wounds. J Foot Ankle Surg 1996; 35(6): 528-31.
4. Schaper NC. Diabetic foot ulcer classification system for research purposes: a progress report on criteria for including patients in research studies. Diabetes Metab Res Rev 2004; 20 Suppl 1: S90-5.
5. Hong JP, Jung HD, Kim YW. Recombinant human epidermal growth factor (EGF) to enhance healing for diabetic foot ulcers. Ann Plast Surg 2006; 56(4): 394-8.
6. Lee HB HJ. Using recombinant human epidermal growth factor with standard of good care for diabetic foot ulcers in inoperable patients. Korean wound care soc 2008; 4(1): 16-9.

02.

Pressure Ulcer

02. Pressure Ulcer

Definition

An ulcer caused by necrosis of dermal tissues due to a blood flow disorder or stimulus that results from the application of continuous pressure onto projected sites of a bone or region to which the weight is applied.

Causes and pathologic physiology

The main factor influencing the occurrence of a pressure ulcer is topical ischemia, which means a shortage of blood supply to a tissue. When continuous pressure is applied to a certain site of the body, circulatory disturbances of blood vessels can result. If the blood cannot reach the tissues, the supply of oxygen and nutrients to cells is blocked, and metabolic waste products accumulate within the cells, which leads to tissue necrosis.
Pressure ulcers appear when soft tissues in a bone projection site have been under compression for too long. In addition to the pressure, various complex factors, such as immobile posture, neural damage, skin aging, humidity of the affected site (due to incontinence, etc.), existence of paralysis, chronic diseases, or a decreased level of consciousness increase the likelihood of a pressure ulcer.[1]

Diagnosis

As pressure ulcers are an uncommon type of skin ulcer, they should be distinguished from other causes of skin ulcers that are unassociated with pressure.
For example, the differential diagnosis of a foot ulcer must include similar conditions, such as ischemic ulcer, venous stasis ulcer, diabetic ulcer, phlegmon, and necrotizing fasciitis. The medical history of the patient should also be reviewed. In general, a pressure ulcer often occurs at a site where pressure is applied.[2]

Classification

There are several methods to classify a pressure ulcer, but the most common is that of the National Pressure Ulcer Advisory Panel (NPUAP)*.[3]

Basic principles/precautions of treatment

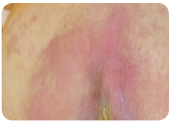
First, in addition to removing the causal factors of a pressure ulcer, it is also important to improve the patient's systemic condition so the wound can heal. Topically, removal of necrotic tissues is vital, and if there is infection, proper treatment must be performed concurrently.[4] Absorbing excessive exudate and keeping the pressure ulcer site moist will promote an optimum healing environment.[5–6]

※ See Appendix Ⅱ

02. Pressure Ulcer | DIRECT coding

D Debridement of necrosis

D.0 No necrosis

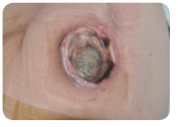


No necrotic tissue.

D+Solution

- See Category E (Exudate Control)
- EasyDERM™ Plus or EasyFoam™

D.1 Dry

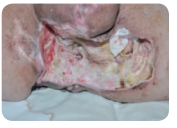


Black, dry, and hard dead tissue caused by topical pressure or peripheral ischemia.

D+Solution

- Surgical or Autolytic or Enzymatic debridement
- CuraVAC®+Easyef® or bFGF

D.2 Wet



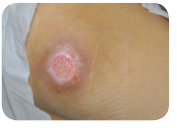
White or yellow, sticky, and sloughy tissues

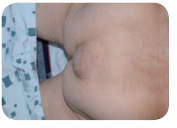
D+Solution

- Surgical or Autolytic or Enzymatic debridement
- CuraVAC®+Easyef® or bFGF

I Infection control

I.0 No infection



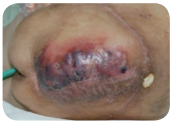


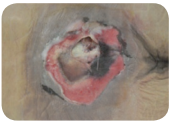
No sign of infection.

D+Solution

- See Category E (Exudate Control)
- EasyDERM™ Plus or EasyFoam™

I.1 Infection present





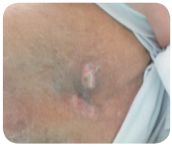
Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor.

D+Solution

- Adequate Incision and Drainage plus systemic antibiotics
- Surgical or Autolytic or Enzymatic debridement
- CuraVAC® + Easyef® or bFGF

R Revascularization

R.0 Non-ischemic

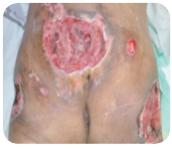


No abnormality in blood flow.

D+Solution

- See Category E (Exudate Control)
- EasyDERM™ Plus or EasyFoam™

R.1 Ischemic



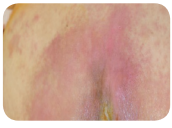
Arterial or venous insufficiency exists in the extremity vessel or there is topical poor blood flow around the wound.

D+Solution

- Surgical or Autolytic or Enzymatic debridement
- CuraVAC® + Easyef® or bFGF
- Skin graft or Flap surgery

E Exudate control

E.0 None

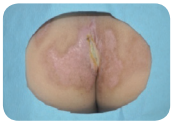


The state that the wound site is dry, and moisturization is required.

D+Solution

- See Category E (Exudate Control)
- EasyDERM™ Plus or EasyFoam™

E.1 Light

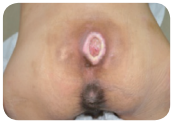


Exudate does not ooze when applying EasyDERM™ Plus, or once–daily replacement is required based on EasyFoam™ 2 mm.

D+Solution

- EasyDERM™ Plus or EasyFoam™ (2 mm)

E.2 Intermediate

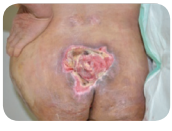


Once–daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm)

E.3 Heavy



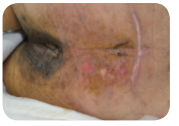
Twice or more frequent daily replacement is required based on EasyFoam™ 5 mm.

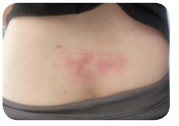
D+Solution

- EasyFoam™ (5 mm) or CuraVAC®

C Chronicity evaluation

C.0 Acute



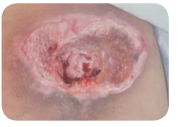


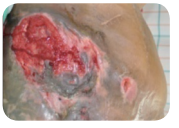
The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment.

D+Solution

- See Category E (Exudate Control) → EasyDERM™ Plus or EasyFoam™, or CuraVAC®
- Topical wound → Easyef Ointment

C.1 Chronic





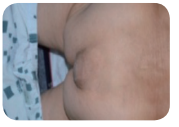
The wound shows no visible healing progress even after 3~6 weeks of treatment. Or the wound has no response to the current wound treatment or is getting worse.

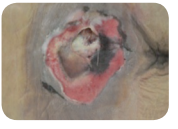
D+Solution

- Surgical or Autolytic or Enzymatic debridement
- CuraVAC® + Easyef® or bFGF

T Top surface

T.0 Closed



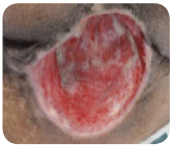


The skin is open only a little or not open at all, and there may be problems such as bruising, hematoma, crushing injury, pressure ulcer, seroma, or pus pockets under the subcutaneous layer that are not revealed directly.

D+Solution

- Adequate Incision and Drainage and/or systemic antibiotics
- Surgical or Autolytic or Enzymatic debridement
- CuraVAC® + Easyef® or bFGF

T.1 Open

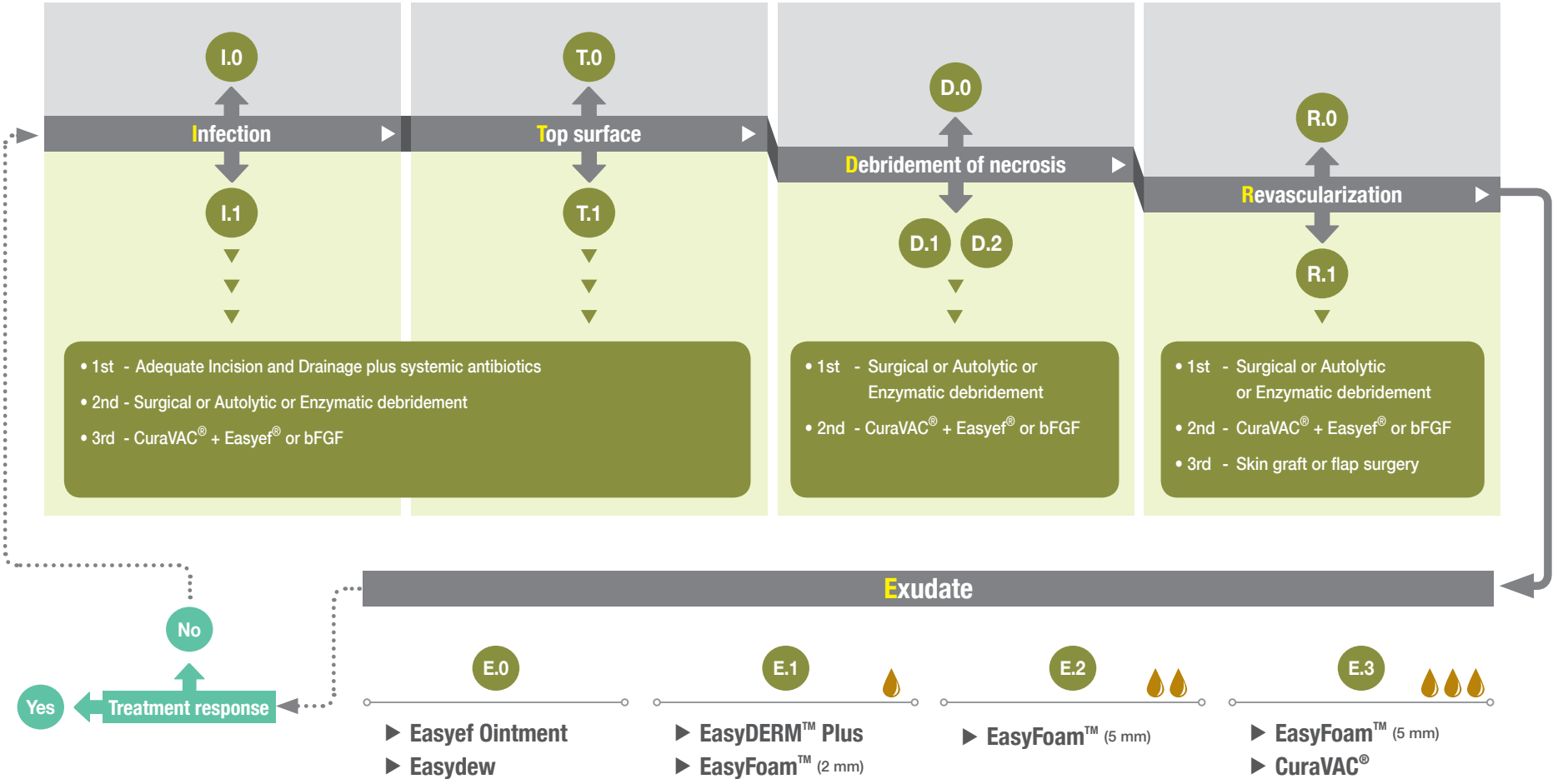


The skin is dehisced, and the inside of the skin is exposed.

D+Solution

- See Category E (Exudate Control)
- Surgical or Autolytic or Enzymatic debridement
- CuraVAC® + Easyef® or bFGF

02. Pressure Ulcer | ALGORITHM



02. Pressure Ulcer | Examples of representative coding combinations

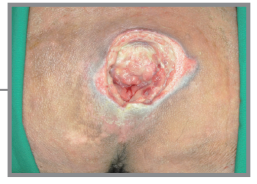
D.2 Wet | I.1 Infection | R.1 Ischemic | E.3 Heavy | C.1 Chronic | T.1 Open

Pressure Ulcer

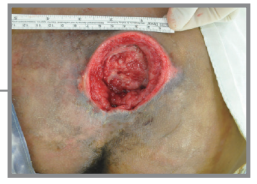
ALGORITHM

1st — Adequate incision and drainage plus systemic antibiotics

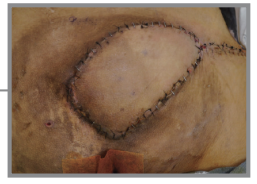
2st — Surgical debridement



3rd — CuraVAC® + bFGF



4th — Flap surgery



D.1 Dry

I.0 No infection

R.1 Ischemic

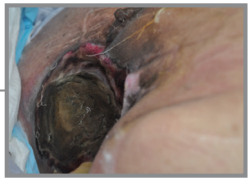
E.1 Light

C.1 Chronic

T.1 Open

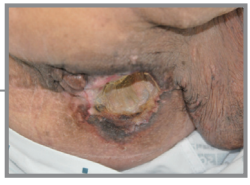
1st

Surgical debridement



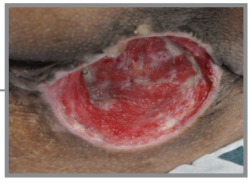
2st

Enzymatic debridement (EasyDERM™ Plus)



3rd

CuraVAC® + bFGF



4th

Flap surgery

D.0	I.1	R.0	E.0	C.0	T.0
No necrosis	Infection	Non-Ischemic	No exudate	Acute	Closed

This is a case with a bursa due to repetitive stimulation, which results in the symptom of systemic infection.

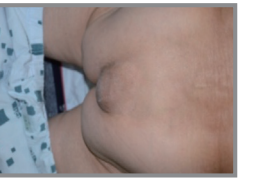
1st

Adequate incision and drainage plus systemic antibiotics.

▼

2st

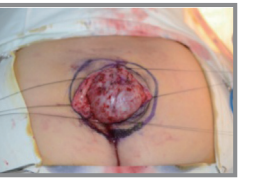
If the symptom of the infection is primarily improved, apply Easyef Ointment and Easydew for topical wound protection.



▼

3rd

Perform the surgical flap procedure if repetitive infection appears or the patient's condition is available.



02. Pressure Ulcer | Expert Opinion

D+Wound Solution according to NPUAP classification

Stage 1

Description: Skin intact but reddened for more than 1 hour after relief of pressure

D+Wound Solution: **Easyef Ointment / EasyDERM™ Plus / EasyFoam™**

Stage 2

Description: Blister or other break in dermis and/or infection

D+Wound Solution

1) No infection or infection control - EasyDERM™ Plus or EasyFoam™
2) Infection
- **Assess clinical sign and symptoms of infection**
  (purulent exudate and/or elevated temperature and/or peripheral induration or edema)
- **Adequate incision and drainage plus systemic antibiotics**

Stage 3

Description: Subcutaneous destruction into muscle and/or infection

D+Wound Solution

Stage2 management Plus
1) No infection or infection control
- **EasyDERM™ Plus or EasyFoam™**
- **Surgical or Autolytic or Enzymatic debridement and CuraVAC® + Easyef® or bFGF**

2) Wound Volume
- **Small – EasyDERM™ Plus or EasyFoam™**
- **Large – Skin graft or Flap surgery**

Stage 4

Description: Involvement of bone or joint and/or infection

D+Wound Solution

Stage3 management Plus
Surrounding skin condition
1) Non-ischemic - EasyDERM™ Plus or EasyFoam™
2) Ischemic
- **Surgical or Autolytic or Enzymatic debridement & CuraVAC® + Easyef® or bFGF**
- **Flap surgery**

02. Pressure Ulcer | References

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2. Shai A, Maibach HI. Wound healing and ulcers of the skin : diagnosis and therapy : the practical approach. Berlin ; New York: Springer; 2005.
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4. Livesley NJ, Chow AW. Infected pressure ulcers in elderly individuals. Clin Infect Dis 2002; 35(11): 1390-6.
5. de Laat EH, Scholte op Reimer WJ, van Achterberg T. Pressure ulcers: diagnostics and interventions aimed at wound-related complaints: a review of the literature. J Clin Nurs 2005; 14(4): 464-72.
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03.

Traumatic Wound

03. Traumatic Wound

Definition

A wound that appears in the form of a cut, laceration, or puncture wound when the skin or its underlying tissues are damaged due to external factors.

Cause

A traumatic wound is generated by a variety of causes, such as the following.[1]

- Incision : In general, it is created by a knife. In most cases, the incisional site is clear.
- Abrasion : This occurs when the skin is scratched or peeled off. Debris, such as gravel, sand, and glass, often remains in the wound.
- Wound by an external force such as an accident : This is mostly the wound by a car accident. This is the wound that a part of the body is suddenly torn or cut by being hit.

Diagnosis

First of all, check the systemic surface, and identify whether the muscular, skeletal, and nervous systems react properly. According to how the patient is wounded, examine if bleeding or other wounds have occurred inside the body through x-ray, computed tomography (CT) scan, or ultrasonography.

Classification

Classify a traumatic wound according to the severity, wound site, or wound generating factor.

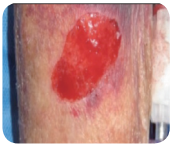
Basic principles/precautions of treatment

Determine whether life-threatening factors exist first, and then if bleeding has occurred, hemostasis should be achieved. Wound treatment should be carried out as soon as possible in emergencies to increase the success rate.

03. Traumatic Wound | DIRECT coding

D Debridement of necrosis

D.0 No necrosis

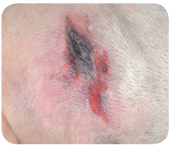


No necrotic tissue.

D+Solution

- See Category E (Exudate Control)

D.1 Dry

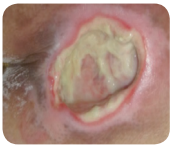


Black, dry, and hard dead tissue.
It is often generated by scab formation. If scabs are present, it is likely that scars will form later.

D+Solution

- Surgical or Autolytic debridement

D.2 Wet



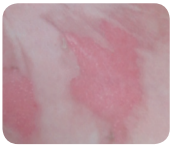
White or yellow, sticky, and sloughy tissues

D+Solution

- Surgical or Autolytic debridement
- Surgical treatment
  (Primary suturing, Flap, Skin graft)
- If surgical treatment is not possible, see category E (Exudate Control)

I Infection control

I.0 No infection

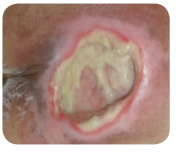


No sign of infection.

D+Solution

- See Category E (Exudate Control)

I.1 Infection present



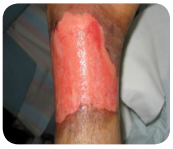
Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor.

D+Solution

- Removal of foreign materials – Careful observation is required because the infection may be caused by foreign materials that have not yet been removed.
- Incision and Drainage
- Administration of local or systemic antibiotics.

R Revascularization

R.0 Non-ischemic

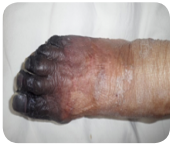


Confirm that it is not an ischemic ulcer due to arterial insufficiency.

D+Solution

- See Category E (Exudate Control)

R.1 Ischemic



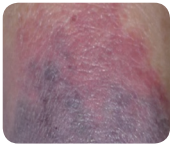
Sometimes, these ulcers result from acute vascular damage, but they can also be chronic.

D+Solution

- Acute – Immediate surgical treatment (vascularization or vascular anastomosis)
- Chronic – Surgical or Autolytic debridement
- See Category E (Exudate Control)

E Exudate control

E.0 None

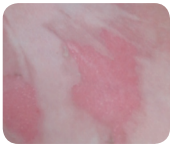


A state where a traumatic wound has been received, but there is only erythema.

D+Solution

- Easyef Ointment or Easydew

E.1 Light

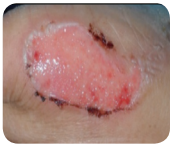


The area is small or the secretions are light : a little scratched wound. The wound is not deep and is usually a thin abrasion.

D+Solution

- EasyDERM™ Plus
- If exudate leaks out of the EasyDERM™ Plus, apply EasyFoam™ (2 mm).

E.2 Intermediate

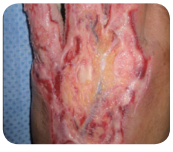


When the area is large or small or the secretion is intermediate, it corresponds to a laceration or a deep abrasion.

D+Solution

- EasyFoam™ (2 mm)
- In the case of a laceration, surgical treatment is a priority. On the day of suture, there may be a lot of exudate, so apply EasyFoam™. From the next day after the suture and afterwards, EasyDERM™ Plus may be applied after judging the degree of secretion.

E.3 Heavy



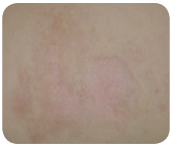
The area is large or small or the secretions are heavy. It corresponds to a deep laceration or a skin and soft tissue defect.

D+Solution

- EasyFoam™ (5mm)
- Perform surgical treatment (e.g., primary suture, skin graft, or flap surgery).
- In case the wound is wide and deep beyond the surgical treatment → Enforce CuraVAC® to reduce the width of the wound and lower the depth.
- If the wound is deep, bFGF is recommended, while if the wound is wide, Easyef® is suggested.
- If major structures (ligaments, etc.) are exposed because the wound is very deep beyond the surgical treatment area → Cover and protect the major structures by applying CGDerm™, and then apply CuraVAC®.

C Chronicity evaluation

C.0 Acute

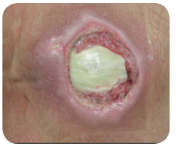


The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment.

D+Solution

- See Category E (Exudate Control)
- EasyDERM™ Plus or EasyFoam™

C.1 Chronic



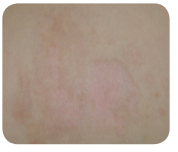
The wound shows no visible healing progress even after 3~6 weeks of treatment. Or the wound has no response to the current wound treatment or is getting worse. It may be caused by the pressure ulcer, diabetes, severe burns, autoimmune diseases, chemicals, anti-cancer or radiation therapy, severe infection, or peripheral vascular diseases.

D+Solution

- Surgical debridement
- Split thickness skin graft & CGDerm™ → CuraVAC® + Easyef® or bFGF

T Top surface

T.0 Closed

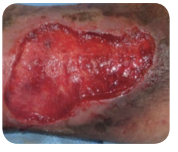


A state where a traumatic wound has been received, but there is only erythema.

D+Solution

- Moisturization effect : Easyef Oinment, Easydew
- Protection of skin from external stimuli : EasyDERM™ Plus
- Distribute the pressure with EasyFoam™ at the first sign of a pressure ulcer.

T.1 Open

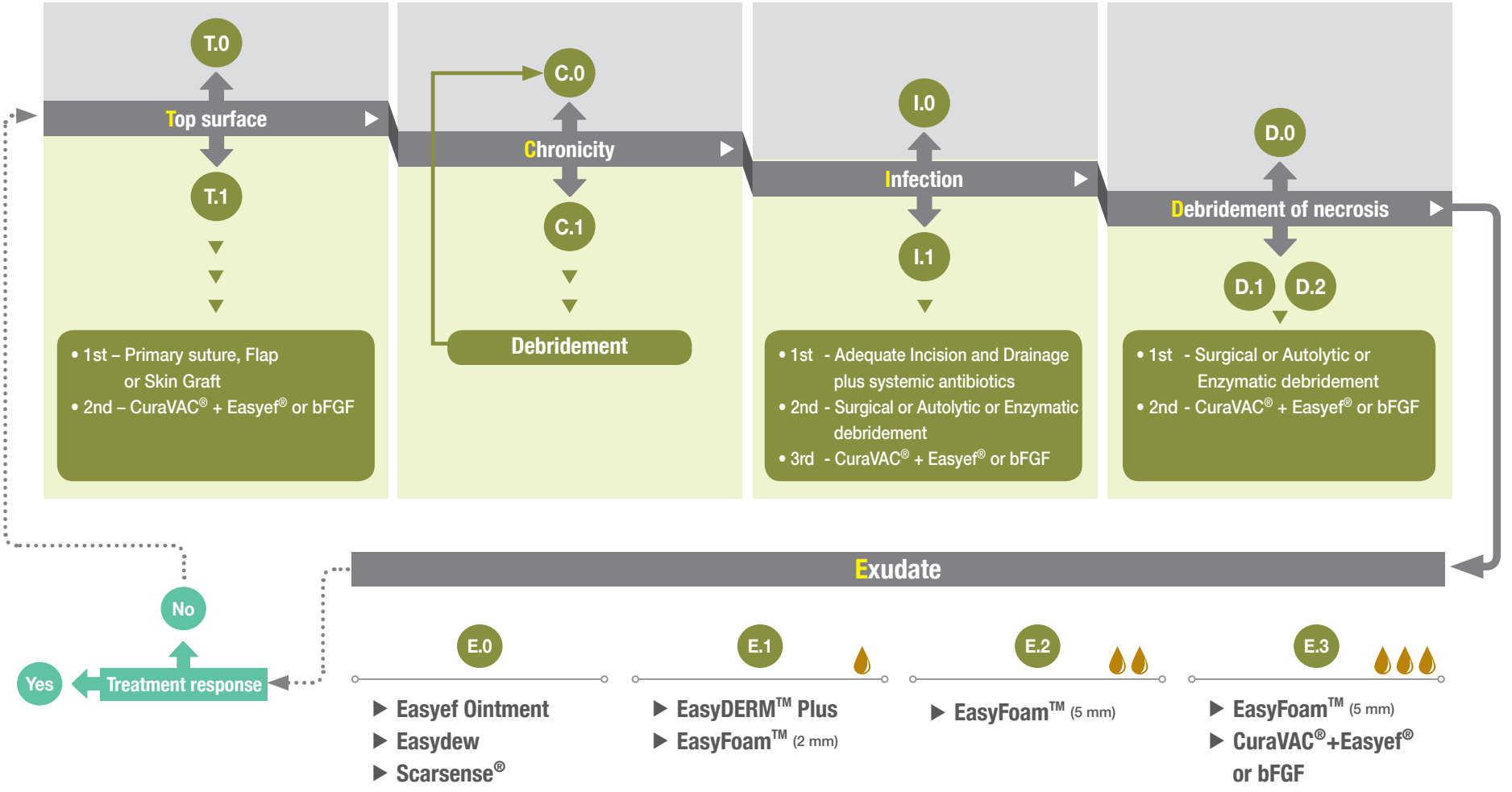


The skin is dehisced, and the inside of the skin is exposed.

D+Solution

- If surgical treatment (primary suture, flap surgery, skin graft surgery) is possible, it should be recommended. However, if surgical treatment is unnecessary or impossible, determine the dressing solution according to the exudate amount.

03. Traumatic Wound | ALGORITHM

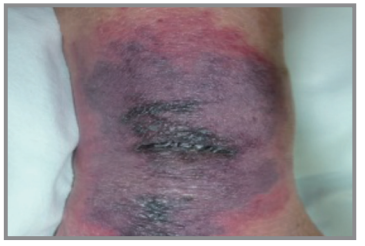


Traumatic Wound

ALGORITHM

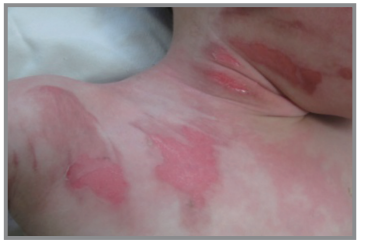
03. Traumatic Wound | Examples of representative coding combinations

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.0 No exudate | C.0 Acute | T.0 Closed



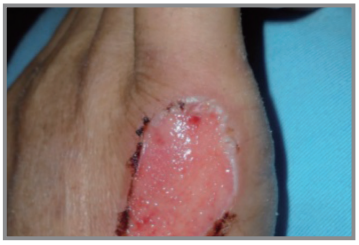
This is a state where there is only erythema although a traumatic wound has been occurred (E.0). Easyef Ointment and Easydew may be applied for moisturization effect.

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.1 Light | C.0 Acute | T.1 Open



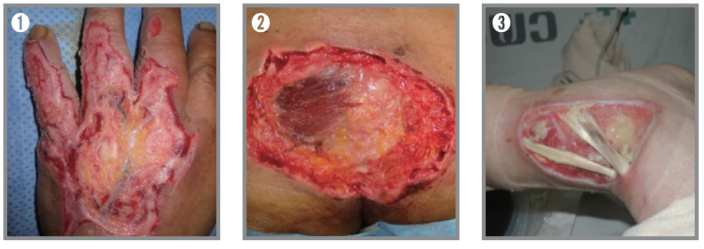
The wound has a slight scratch and is not that deep. If EasyDERM™ Plus is applied and the secretions still leak out, EasyFoam™ 2 mm may be applied.

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.2 Intermediate | C.0 Acute | T.1 Open



In the case of a laceration, surgical treatment (e.g., primary suture, flap surgery, skin graft surgery) is a priority. On the day of suture, there may be a lot of exudate, so EasyFoam™ is recommended. From the next day of the suture onward, EasyDERM™ Plus may be applied after judging the degree of secretion.

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.3 Heavy | C.0 Acute | T.1 Open



Apply EasyFoam™ 5 mm.

❶ When surgical treatment (e.g., primary suture, skin graft, flap surgery) is possible, it should be performed.

❷ The wound is wide or deep beyond the surgical treatment (e.g., primary suture, skin graft, flap surgery). Perform a negative pressure treatment with CuraVAC® to reduce the width of the wound and lower the depth. In particular, it is recommended to use bFGF if the wound is deep and to use Easyef® if the wound is wide.

❸ This is a state where the wound is very deep beyond the surgical treatment (e.g., primary suture, skin graft, flap surgery), so major structures (ligaments, etc.) are exposed. Cover the major structures (ligaments, etc.) with CGDerm™ for protection and enforce a negative pressure treatment with CuraVAC® together. The use of bFGF is recommended if the wound is deep, while Easyef® is suggested for wide wounds.

03. Traumatic Wound | Expert Opinion

Surgical treatment of traumatic wounds

For traumatic wounds, enforce surgical treatment first if surgery is possible, as shown in the algorithm.

❶ If there is no abnormality of major structures at the traumatic wound site, enforce it from the most simple method in the following sequence.
Direct closure ▶ Skin graft ▶ Local flap ▶ Distant flap

❷ The main goal of traumatic wound treatment is to cover the skin as soon as possible to prevent invasion of external bacteria and to promote optimal wound healing. If it is impossible to cover the skin, it is important to form an environment in which surgical treatment can be given as soon as possible by using dressing materials and negative pressure treatment.

❸ In the case of a traumatic wound, the skin must be restored quickly. As the wound healing time increases, it is more likely to turn into a non–healing wound (chronic wound). A chronic wound can be converted to an acute wound by performing curettage and debridement.

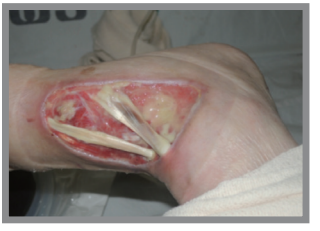
❹ **Direct closure (primary suture)** : In the case of a simple incision, suturing the skin is helpful in curing the wound and protecting the wound from the outside, which can also minimize scarring.

❺ **Skin graft** : A surgery is carried out to detach a piece of skin from another site and then suture it to a defect site when there are skin or soft tissue defects that cannot be covered with primary sutures. During detachment, the skin graft may be divided into a split thickness skin graft and a full thickness skin graft according to the thickness of the skin.

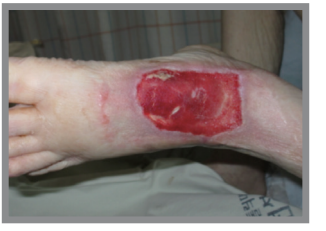
❻ **Flap** : Unlike a skin graft, flap surgery includes the attached blood vessels. Thus, the grafted flaps not only survive but also cover various structures of the defect site. The flap surgery is divided into either local flap or distant flap types according to the grafting method. It is also divided into skin flap, musculocutaneous flap, bone skin flap, and fascia skin flap according to the type of tissues to be grafted. In addition, there are random skin and axial pattern flaps according to the blood supply method. Random skin flaps do not have a particularly large blood vessel, while for the axial–pattern flap surgery, the surgeon should find a blood vessel. The axial pattern flap surgery includes a free flap surgery to connect the blood vessels under the microscopic operation.

Application of negative pressure for treatment of a traumatic wound[2–6]

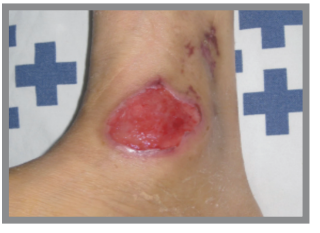
While most acute wounds result from trauma, the wounds that remain after surgical debridement of infected or necrotic tissues are also treated in a similar way to that of acute wounds. For treatment of infected or necrotic tissues, extensive and repeated surgical debridement is often necessary. The wound specialist may have difficulty in dressing due to anatomical position (e.g., Fournier's gangrene) after debridement, the size of the defect or the patient's habitual behavior. In this case, negative pressure treatment may be very useful. Negative pressure treatment can be applied after surgical debridement, and it helps to facilitate postoperative wound healing. It has the advantages that it can be applied regardless of the contour, shape, and size of the wound and it can be used after skin graft or flap surgery. In addition, negative pressure treatment is easy to apply and may reduce various complications followed by secondary infection or delayed wound healing through reducing the number of dressing changes and the time required for wound closure. This treatment is also good for the management of wounds for which general dressing is difficult, such as lower extremity fasciotomy, degloving injury, open amputation, and complex traumatic wounds with exposed tendons, bones, or orthopedic hardware. In addition, it facilitates wound healing by preventing the progression of a zone of stasis by increasing the blood flow when applied to a burn wound.



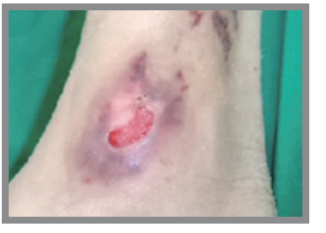
Before NPWT application



After the application



Before NPWT application



After the application

03. Traumatic Wound | References

1. Leaper DJ. Traumatic and surgical wounds. BMJ 2006; 332(7540): 532-5.
2. Scherer SS, Pietramaggiori G, Mathews JC, Prsa MJ, Huang S, Orgill DP. The mechanism of action of the vacuum-assisted closure device. Plast Reconstr Surg 2008; 122(3): 786-97.
3. Scherer SS, Pietramaggiori G, Mathews JC, Orgill DP. Short periodic applications of the vacuum-assisted closure device cause an extended tissue response in the diabetic mouse model. Plast Reconstr Surg 2009; 124(5): 1458-65.
4. Franczyk M, Lohman RF, Agarwal JP, Rupani G, Drum M, Gottlieb LJ. The impact of topical lidocaine on pain level assessment during and after vacuum-assisted closure dressing changes: a double-blind, prospective, randomized study. Plast Reconstr Surg 2009; 124(3): 854-61.
5. Neligan P, Warren RJ, Van Beek A. Plastic surgery. 3rd ed. London ; New York: Elsevier Saunders; 2013.
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04.

Venous Ulcer

04. Venous Ulcer

Definition

A leg ulcer generated by chronic venous insufficiency.

Pathologic physiology

Chronic venous reflux occurs due to the expansion of veins associated with venous hypertension and dysfunction of the venous valves. This causes structural changes of the venous walls and venous valves, which finally leads to a rise in the blood pressure of capillary vessels and lower extremity edema, causing chronic venous insufficiency. When the chronic venous insufficiency is accompanied by inflammation, a venous ulcer occurs.[1–4]

Diagnosis

Diagnose it clinically through a medical examination of the affected area, and confirm the diagnosis with color duplex ultrasonography.[5]

Classification

As a venous ulcer is a type of symptom expressed on the skin in the lower extremity among the clinical aspects of the chronic venous insufficiency, follow CEAP*, which is a classification of the chronic venous insufficiency, regarding the classification system.[5–9]

Basic principles/precautions of treatment

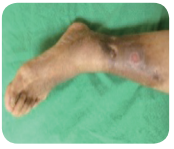
It is important to treat the wound with compression therapy after confirming that it is not an arterial ulcer through color duplex ultrasonography.[10–12] In addition, a dressing material that can maintain a wet environment will promote wound healing. Foam dressings with exudate control capability that are easy to remove are more appropriate than hydrocolloid materials.[13–15]

※ See Appendix Ⅲ

04. Venous Ulcer | DIRECT coding

D Debridement of necrosis

D.0 No necrosis

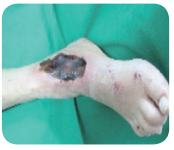


No necrotic tissue.

D+Solution

- See Category E (Exudate Control)
- Easyef Ointment or Easydew
- Compression therapy

D.1 Dry

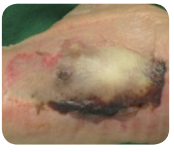


Black, dry, and hard dead tissues
Generated when chronic venous insufficiency is accompanied by inflammation.

D+Solution

- Surgical or Autolytic debridement
- EasyDERM™ Plus or EasyFoam™
- Compression therapy

D.2 Wet



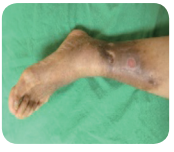
White or yellow, sticky, and sloughy tissues.

D+Solution

- Surgical or Autolytic debridement
- Split thickness skin graft & CGDerm™
- CuraVAC® or CuraVAC® Silver + Easyef® or bFGF
- EasyFoam™
- Compression therapy

I Infection control

I.0 No infection

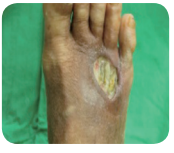


No sign of infection.

D+Solution

- See Category E (Exudate Control)
- Easyef Ointment or Easydew
- Compression therapy

I.1 Infection present



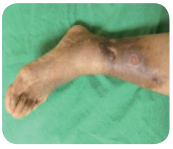
Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor

D+Solution

- Incision and Drainage
- Topical or Systemic antibiotics
- EasyFoam™
- Compression therapy

R Revascularization

R.0 Non-ischemic

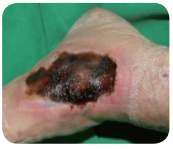


Confirm that it is not an ischemic ulcer due to arterial insufficiency.

D+Solution

- See Category E (Exudate Control)
- Easyef Ointment or Easydew
- Compression therapy

R.1 Ischemic



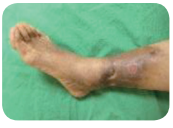
Chronic venous insufficiency may be accompanied by arterial insufficiency of the extremity vessel or topical blood flow decrease around the wound.

D+Solution

- Surgical or autolytic debridement
- Perform revascularization and flap surgery. Otherwise, skin graft surgery without revascularization is available
- EasyDERM™ Plus or EasyFoam™

E Exudate control

E.0 None

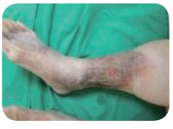


The state that the wound site is dry, and moisturization is required.

D+Solution

- Easyef Ointment or Easydew
- Compression therapy

E.1 Light

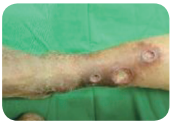


Exudate does not ooze when applying EasyDERM™ Plus, or once-daily replacement is required based on EasyFoam™ 2 mm.

D+Solution

- EasyDERM™ Plus or EasyFoam™ (2 mm)
- Compression therapy

E.2 Intermediate

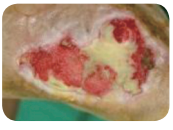


Once-daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm)
- Compression therapy

E.3 Heavy



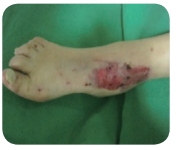
Twice or more frequent daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm) or CuraVAC®
- Compression therapy

C Chronicity evaluation

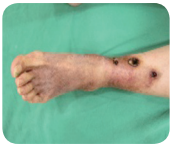
C.0 Acute



The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment.

D+Solution
- See Category E (Exudate Control)
- EasyDERM™ Plus or EasyFoam™
- Compression therapy

C.1 Chronic

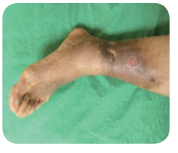


The wound shows no visible healing progress even after 3~6 weeks of treatment. Or the wound has no response to the current wound treatment or is getting worse. Most venous ulcers are chronic and are caused by underlying systemic diseases, such as diabetes, topical infections, venous hypertension, or varicose veins.

D+Solution
- Surgical debridement
- split thickeness skin graft & CGDerm™ → CuraVAC® + Easyef® or bFGF
- Compression therapy

T Top surface

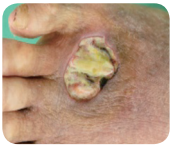
T.0 Closed



The skin is open only a little or not open at all, and there are problems such as bruising, hematoma, crushing injury, pressure ulcer, seroma, or pus pockets under the subcutaneous layer that are not revealed directly.

D+Solution
- See Category E (Exudate Control)
- Compression therapy

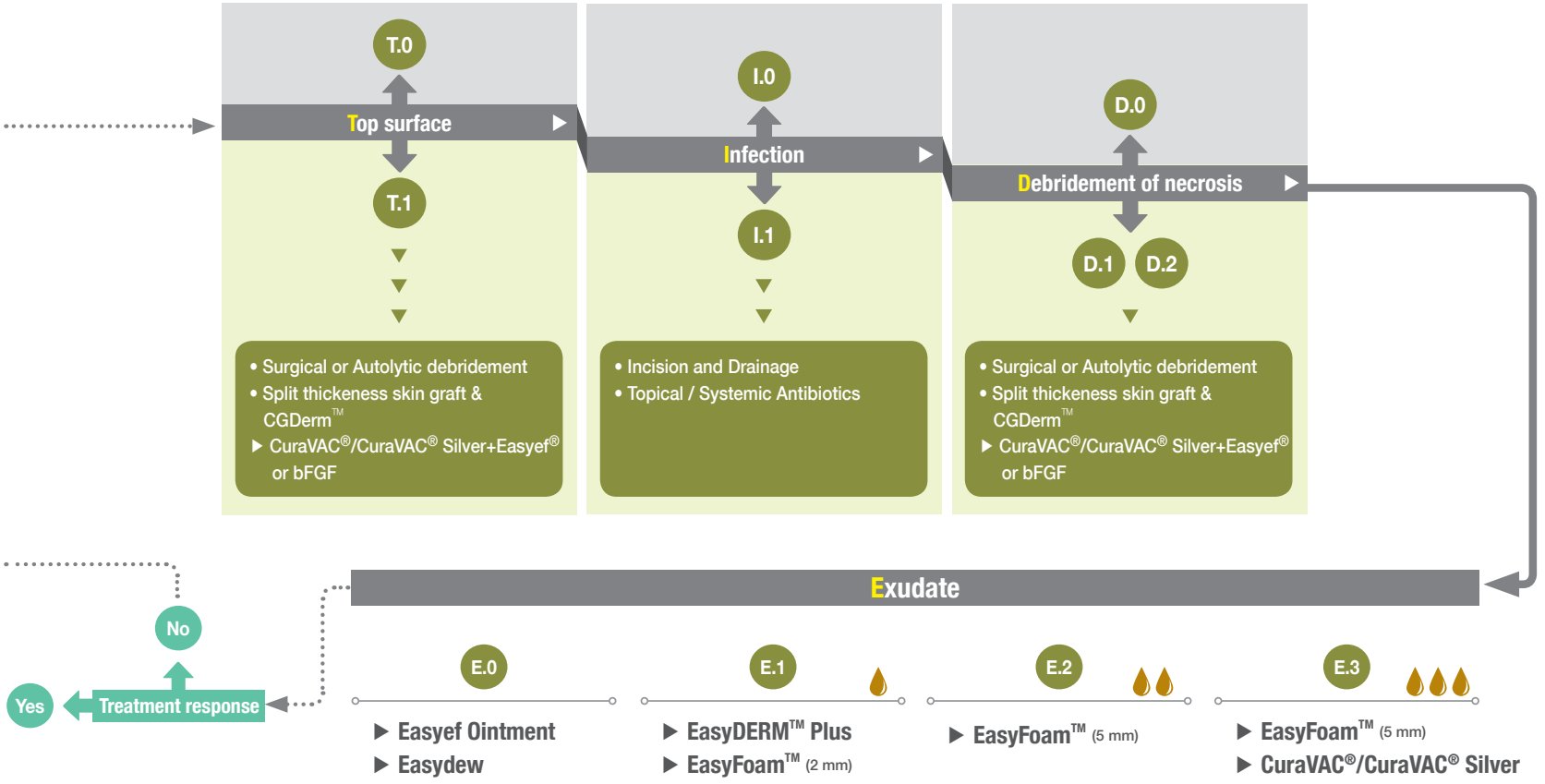
T.1 Open



The skin is dehisced, and the inside of the skin is exposed.

D+Solution
- Surgical or Autolytic debridement → EasyFoam™
- split thickeness skin graft & CGDerm™ → CuraVAC® or CuraVAC® Silver + Easyef® or bFGF

04. Venous Ulcer | ALGORITHM

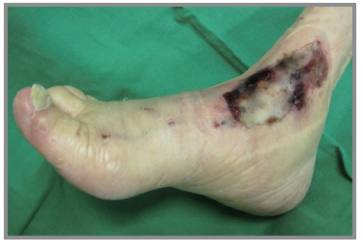


Venous Ulcer

ALGORITHM

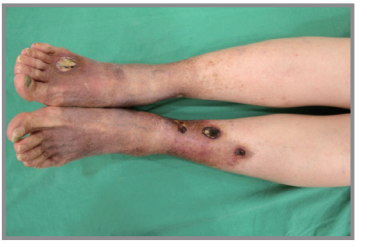
04. Venous Ulcer | Examples of representative coding combinations

D.2 Wet | I.0 No infection | R.0 Non-ischemic | E.1 Light | C.0 Acute | T.0 Closed



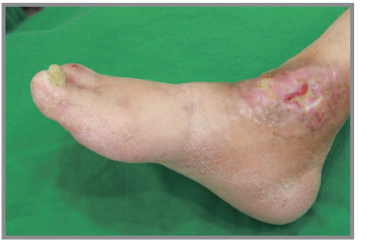
Ten days have passed since the occurrence of a venous ulcer.
The DIRECT category is the same as above. For treatment, EasyDERM™ Plus, EasyFoam™, or compression therapy can be used.

D.1	I.1	R.1	E.0	C.1	T.1
Dry	Infection	Ischemic	No exudate	Chronic	Open



A venous ulcer patient with arterial insufficiency developed chronic symptoms. Pseudomonas aeruginosa were detected. Use aggressive wound dressing, EasyDERM™ Plus or EasyFoam™, and topical or systemic antibiotics therapy. Compression therapy may also be used if care is taken not to inhibit the blood flow of the artery.

D.0	I.0	R.0	E.1	C.1	T.1
No necrosis	No infection	Non-ischemic	Light	Chronic	Open



Seven months have passed since the occurrence of a venous ulcer, so EasyFoam™ and Easyef Ointment may be applied.

04. Venous Ulcer | Expert Opinion

- In the case of wound infection, administer topical or systemic antibiotics in addition to a dressing based on the D+Wound Solution.
- When using CGDerm™, Easyef®, bFGF, CuraVAC® (D.0/I.0/R.0/E.0~E.1/ C.0~C.1/T.1), a split thickness skin graft may be carried out at the same time.
- When using CGDerm™, EasyDERM™ Plus / EasyFoam™ (D.2/I.0/R.0/E.0/C.0~C.1/T.1), CGDerm™ may be employed as a biologic dressing or wound bed preparation.
- A venous ulcer often is accompanied by arterial insufficiency clinically and corresponds to the severe grade of each category (D.2/I.1/R.0~R.1/E.3/C.1/T.1).
- The D+Wound Solution for a venous ulcer aims to downgrade the wound status of a patient from the severe grade of a D+Wound Solution category to a mild to normal grade (D.2/I.1/R.0~R.1/E.3/C.1/T.1 → D.0/I.0/R.0/E.0/C.0/T.0) by promoting the vertical and horizontal growth of granulation tissues.
- In cases where there is no necrosis or infection, the exudate amount is minimal, and the wound surface is closed (D.0/I.0/R.0~1/E.0~1/C.0~1/T.0). Easyef Ointment and Easydew can be applied, and then compression therapy may be performed.
- The D+Wound Solution may be applied differently depending on the general and wound conditions of a patient.

04. Venous Ulcer | References

1. O'Meara S, Martyn-St James M. Alginate dressings for venous leg ulcers. Cochrane Database Syst Rev 2013; 4: 1-74.
2. Meissner MH, Gloviczki P, Bergan J, et al. Primary chronic venous disorders. J Vasc Surg 2007; 46 Suppl S: 54S-67S.
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6. Porter JM, Moneta GL. Reporting standards in venous disease: an update. International consensus committee on chronic venous disease. J Vasc Surg 1995; 21(4): 635-45.
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12. Robson MC, Cooper DM, Aslam R, et al. Guidelines for the treatment of venous ulcers. Wound Repair Regen 2006; 14(6): 649-62.
13. O'Meara S, Martyn-St James M. Foam dressings for venous leg ulcers. Cochrane Database Syst Rev 2013; 5: 1-114.
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15. Tang JC, Marston WA, Kirsner RS. Wound healing society (WHS) venous ulcer treatment guidelines: what's new in five years? Wound Repair Regen 2012; 20(5): 619-37.

05.

Arterial Ulcer

05. Arterial Ulcer

Definition

A leg ulcer caused by acute and chronic arterial ischemia.

Causes

An arterial ulcer is caused by a shortage of oxygen and nutrients supplied to tissues due to peripheral vascular obstructive diseases (obstructive arteriosclerosis, obstructive thromboangiitis, etc.), acute circulatory failure (hypovolemic shock, arteriorrhexis, compartment syndrome, etc.), or peripheral blood circulatory disturbances due to the use of blood vessel constrictors.[1]

Diagnosis

For the patients with ischemic leg pains or ischemic leg necrosis, measure the blood flow and diagnose it with the Ankle Brachial Index (ABI), angiography, transcutaneous tissue oxygen pressure ($TcPO_2$), or arterial doppler test.[2]

Classification

As an arterial ulcer is one of the clinical aspects of peripheral artery disease expressed on the skin, follow the Fontaine and Rutherford classification system*, which is a peripheral arterial insufficiency classification, regarding the classification system.[3–4]

Basic principles/precautions of treatment

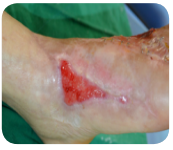
Smoking cessation is important for effective treatment of the wound and recovery of blood flow. Appropriate treatments for the infected and necrotized tissues are required, and blood flow must be ensured through revascularization.[5–6]

※ See Appendix Ⅳ

05. Arterial Ulcer | DIRECT coding

D Debridement of necrosis

D.0 No necrosis

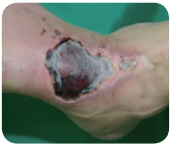


No necrotic tissue

D+Solution

- See Category E(Exudate Control)

D.1 Dry

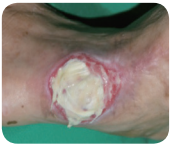


Black, dry, and hard dead tissue caused by topical pressure or peripheral ischemia.

D+Solution

- White–gray eschar
  - Chemical debridement
  - EasyDERM™ Plus for eschar softening
- Dark eschar
  - Surgical debridement
  - EasyDERM™ Plus for eschar softening

D.2 Wet



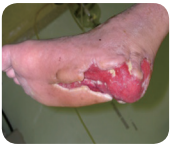
White or yellow, sticky, and sloughy tissues

D+Solution

- Surgical debridement

I Infection control

I.0 No infection

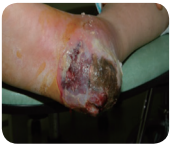


No sign of infection.

D+Solution

- See Category E(Exudate Control)

I.1 Infection present



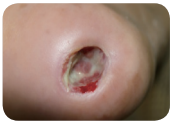
Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor.

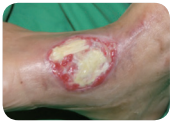
D+Solution

- Incision and Drainage
- Wound culture
- Topical/systemic antibiotics
- Debridement

R Revascularization

R.0 Non-ischemic



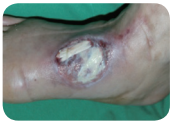


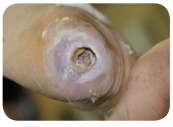
No abnormality in blood flow.

D+Solution

- Hyperbaric oxygen therapy
- See Category E(Exudate Control)
- Wound management

R.1 Ischemic





Arterial insufficiency exists in the extremity vessel or there is topical poor blood flow around the wound.

D+Solution

- Consider the revascularization
  - Bypass graft
  - Angioplasty
  - Wound management
- Hyperbaric oxygen therapy

E Exudate control

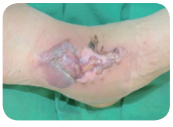
E.0 None

The state that the wound site is dry, and moisturization is required.

D+Solution

- Easyef Ointment or Easydew

E.1 Light

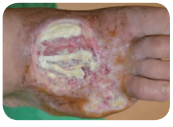


Exudate does not ooze when applying EasyDERM™ Plus, or once–daily replacement is required based on EasyFoam™ 2 mm.

D+Solution

- EasyDERM™ Plus or EasyFoam™ (2 mm)

E.2 Intermediate

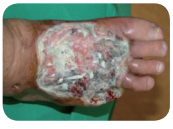


Once–daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm)

E.3 Heavy



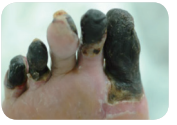
Twice or more frequent daily replacement is required based on EasyFoam™ 5 mm.

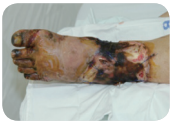
D+Solution

- EasyFoam™ (5 mm) or CuraVAC®

C Chronicity evaluation

C.0 Acute



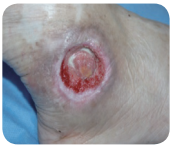


The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment.

D+Solution

- See Category E(Exudate Control)
- Hypovolemic shock → Fluid treatment
- Vascular rupture → vessel repair
- Compartment syndrome → fasciotomy

C.1 Chronic



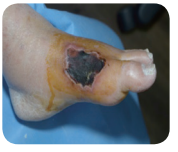
The wound shows no visible healing progress even after 3~6 weeks of treatment. Or the wound has no response to the current wound treatment or is getting worse.
Most arterial ulcers are chronic and are caused by underlying systemic diseases, such as diabetes and peripheral artery occlusive disease.

D+Solution

- Incision and Drainage
- Surgical debridement
- CuraVAC® + Easyef® or bFGF

T Top surface

T.0 Closed

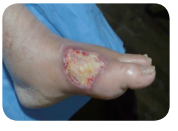


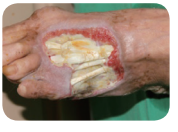
The skin is open only a little or not open at all, and there may be problems such as bruising, hematoma, crushing injury, pressure ulcer, seroma, or pus pockets under the subcutaneous layer that are not revealed directly.

D+Solution

- Moisturization with Easydew, Easydew repair
- EasyDERM™ Plus or EasyFoam™ as a preventive measure
- Erosion → Easyef Ointment, EasyDERM™ Plus, EasyFoam™

T.1 Open



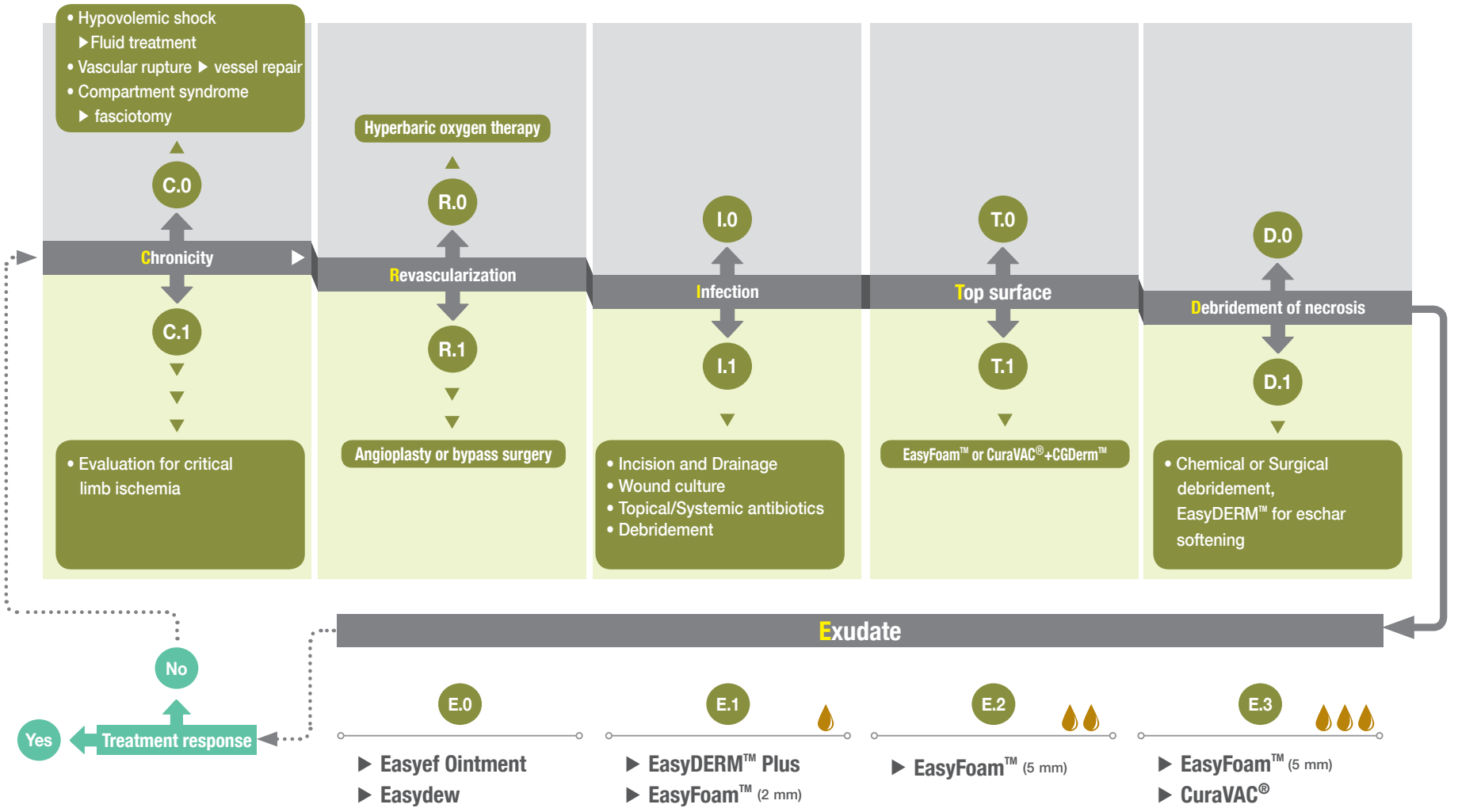


The skin is dehisced, and the inside of the skin is exposed.

D+Solution

- Deep wound → CuraVAC® + CGDerm™
- Shallow wound → EasyFoam™

05. Arterial Ulcer | ALGORITHM

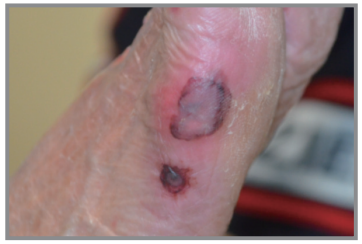


Arterial Ulcer

ALGORITHM

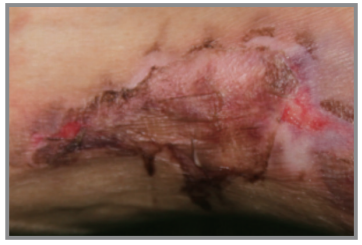
05. Arterial Ulcer | Examples of representative coding combinations

D.1 Dry | I.0 No infection | R.1 Ischemic | E.0 No exudate | C.1 Chronic | T.0 Closed



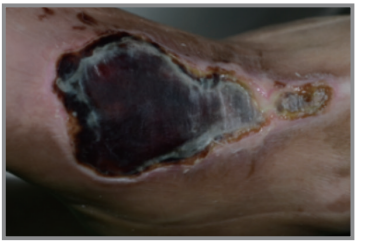
This is a chronic wound accompanied by dry necrosis and ischemia. Consider revascularization, such as angioplasty, through accurate diagnosis. Apply Easyef Ointment only or along with EasyDERM™ Plus and EasyFoam™ to protect the affected area.

D.1 Dry | I.0 No infection | R.0 Non-ischemic | E.1 Light | C.0 Acute | T.1 Open



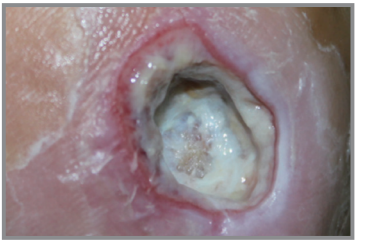
First, it is important to create an environment where the wound can heal quickly by removing the cause of the acute ischemia. Then, hyperbaric oxygen treatment may be considered for the supply of oxygen.
Apply Easyef Ointment only or along with EasyDERM™ Plus and EasyFoam™ to protect the affected area.

D.1 Dry | I.0 No infection | R.1 Ischemic | E.2 Intermediate | C.1 Chronic | T.1 Open



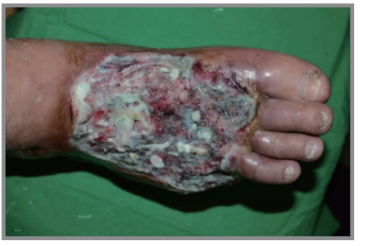
This is a chronic wound accompanied by dry necrosis and ischemia without any signs of infection. First, consider the revascularization, and apply EasyFoam™ 5 mm and Easyef Ointment depending on the exudate amount. EasyDERM™ Plus may be used to soften the eschar.

D.2 Wet | I.0 No infection | R.1 Ischemic | E.2 Intermediate | C.1 Chronic | T.1 Open



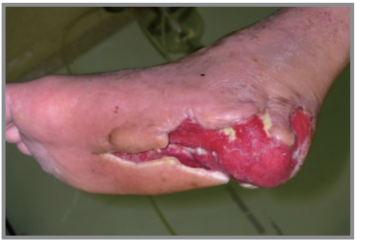
This is a chronic wound accompanied by wet necrosis and ischemia without any signs of infection. Consider the revascularization, and apply CuraVAC® or EasyFoam™ 5 mm.

D.2 Wet | I.1 Infection | R.1 Ischemic | E.3 Heavy | C.1 Chronic | T.1 Open



This is a chronic wound accompanied by wet necrosis and ischemia with signs of infection. Revascularization implementation is necessary, and systemic antibiotic treatment is required. Apply CuraVAC® Silver or EasyFoam™ 5 mm.

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.2 Intermediate | C.1 Chronic | T.1 Open



This is a chronic wound with no sign of infection or necrosis.
Apply CuraVAC®, CuraVAC® with CGDerm™, or EasyFoam™ 5 mm.
Growth factors such as Easyef® and bFGF may be applicable.

05. Arterial Ulcer | Expert Opinion

1. Features of critical limb ischemia

❶ Physical exam
- Dry skin, thickened nails, loss of hair, loss of subcutaneous fat or muscle atrophy
- Coolness to palpation
- Decreased or absent pulses
- Elevation pallor or dependent rubor
- Non-healing wound or ulcer, especially over bony prominences, distally, and on the plantar surface of the foot

❷ Non-invasive vascular exam
- Ankle-brachial index (ABI) ≤ 0.4
- Ankle systolic pressure ≤ 50 mmHg
- Toe systolic pressure ≤ 30 mmHg

Measures of skin microcirculation
(Capillary density ≤ 20 mm^2, Absent reactive hyperemia on capillary microscopy, $TcPO_2$ 〈 10 mmHg)

2. Reperfusion

After angioplasty or bypass surgery for the reperfusion of ischemic tissues, blood flow to the ischemic wound increases rapidly. Edema occurs in the tissue, which has been dried and contracted, and the exudate is increased. Such an increase of edema and exudate reactivates the wound infection bacteria embedded in the necrotic tissues, exacerbating infection and inflammation findings of the tissues temporarily. Therefore, after revascularization of the blood flow, evaluation of the infection of the tissues is required, and careful topical wound treatment and antibiotics treatment are necessary. In addition, in case there are many necrotic tissues, it is necessary to consider enforcing additional debridement.

3. Hyperbaric oxygen (HBO) therapy

❶ Mechanism
- In the case of $TcPO_2$ 〈 30 mmHg, normal metabolic activity and wound healing become difficult due to oxygen deficiency in the tissues. In such a case, the oxygen supplied to the tissues through HBO helps collagen accumulation and angiogenesis.

❷ Application
- 100% oxygen, 2–25 atmospheres, 90 minutes, 1~2/day
- The increase in oxygen concentration in the tissues is maintained for 1 hr in muscles and for 4 hr in skin and subcutaneous tissues.
- For a chronic wound, apply it once a day.
- For a serious wound, apply it twice a day.
- Necrotizing fasciitis, ischemic limb after release of compartment syndrome, Radiation burn, Failing flap, etc.

❸ Patient selection
- In case there is no improvement with conventional therapeutic methods.
- In case the wound is not decreased.
- In case the perfusion state is good and proper debridement is done.
- $TcPO_2$ 〈 40 mmHg

❹ Side effect
- Barotraumas

05. Arterial Ulcer | References

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2. Nelson EA, Bradley MD. Dressings and topical agents for arterial leg ulcers. The Cochrane database of systematic reviews 2007; (1): CD001836.
3. Fontaine R, Kim M, Kieny R. [Surgical treatment of peripheral circulation disorders]. Helv Chir Acta 1954; 21(5-6): 499-533.
4. Norgren L, Hiatt WR, Dormandy JA, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). Eur J Vasc Endovasc Surg 2007; 33 Suppl 1: S1-75.
5. Myers BA. Wound management : principles and practice. 2nd ed. Upper Saddle River, N.J.: Pearson/ Prentice Hall; 2008.
6. Shai A, Maibach HI. Wound healing and ulcers of the skin : diagnosis and therapy : the practical approach. Berlin ; New York: Springer; 2005.

06.

Burn

06. Burn

Definition

Skin damage due to heat, light, chemicals, friction, etc

Pathologic physiology

At an early stage of the skin burn, denaturation of skin proteins due to heat and skin blood flow disorders occur. Then, the aspects of erythema, blisters, and necrosis eschar appear depending on the extent of the damage.

Diagnosis

The temperature of the heat source, the contact time, and the percent of the body surface area burned are factors that determine the severity of the burn. Check the relevant items based on the classification criteria described below.

Classification

Depending on the burn depth, the spontaneous recovery availability, surgical treatment necessity, and generation of sequelae, such as scars, are determined. Therefore, classification by burn depth is very important. Classify the burn as follows based on the histological structure of the skin.

1st degree burn	Invading the outer skin layer, erythematous, no blisters.
Superficial 2nd degree burn	Invading the papillary dermis of the skin, many small blisters, normal capillary refill of the skin.
Deep 2nd degree burn	Invading the reticular dermis of the skin, large blisters, skin blood circulatory disorders (sluggish or no capillary refill).
3rd degree burn	The full thickness of the skin is damaged. Aspects resembling white leather with no blood flow or blackening due to being carbonized are observed.

Basic principles/precautions of treatment

At an early stage of a burn, it is important to chill the affected area with cool physiological saline quickly. Cooling the area within 30 minutes from the occurrence of the burn reduces the tissue damage and the tissue repair time and is also effective at reducing the pain. Foreign materials, hematomas, clots, and dead tissue should be removed before proper dressing is performed according to the burn state.

06. Burn | DIRECT coding

D Debridement of necrosis

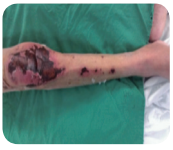
D.0 No necrosis

1st degree, 2nd degree burns with no necrotic tissues

D+Solution

- Dressing is selected according to the exudate amount.
- Small amount - Hydrocolloid (EasyDERM™ Plus)
- Moderate amount or more - foam dressing (EasyFoam™)

D.1 Dry

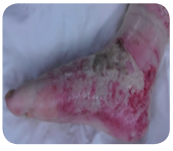


Dry necrosis
– 3rd degree burn

D+Solution

- Debridement or autolytic debridement through hydrocolloid dressing/hydrogel (intrasite gel)

D.2 Wet



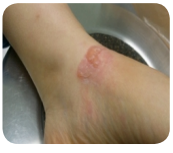
Wet necrosis
– 3rd degree burn

D+Solution

- Debridement is preferred
- After debridement, granulation tissue repair to the defects through CuraVAC® is induced.

I Infection control

I.0 No infection

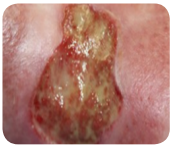


No sign of infection.
Appear as blister but flare or abscess is not observed

D+Solution

- Select a dressing based on the exudate amount.
- Small amount - hydrocolloid (EasyDERM™ Plus)
- Moderate amount or more - foam dressing (EasyFoam™)

I.1 Infection present



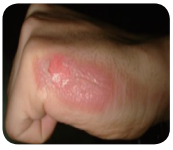
Accompany flare, pain, edema, and hot sensation and pus is observed. It often results in a foul odor

D+Solution

- Shortening the dressing replacement cycle (2 times/day ~3 times/day)
- Betadine–soaked dressings or silver antimicrobial dressings

R Revascularization

R.0 Non-ischemic

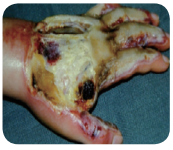


Normal blood flow in the burned area
(1st degree burn – superficial 2nd degree burn)

D+Solution

- Select a dressing based on the exudate amount.
- Small amount - hydrocolloid (EasyDERM™ Plus)
- Moderate amount or more - foam dressing (EasyFoam™)

R.1 Ischemic



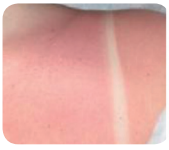
Ischemia status in the burned area (deep 2nd degree burn ~ 3rd degree burn)

D+Solution

- Debridement in case ischemic necrosis occurs
- Flap surgery
- Skin graft after applying CuraVAC®

E Exudate control

E.0 None

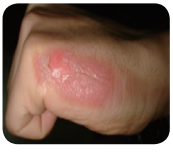


No exudate or an insignificant amount
(1st degree burn–superficial 2nd degree burn, dry necrosis 3rd degree burn

D+Solution

- Hydrocolloid dressing (EasyDERM™ Plus), Open and application of antibiotic ointment – dry necrosis – 3rd degree burn Up to the time before debridement
- 1st degree burn - moisturization ointment (Easyef Ointment, Easydew)

E.1 Light

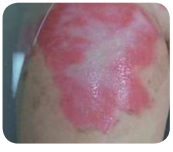


Small amount of exudate

D+Solution

- Hydrocolloid (EasyDERM™ Plus)

E.2 Intermediate

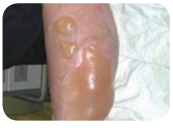


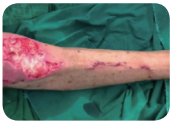
Moderate amount of exudate

D+Solution

- Foam dressing (EasyFoam™)

E.3 Heavy





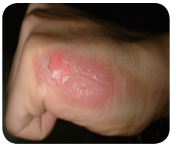
Large amount of exudate

D+Solution

- No necrosis or infected tissues
- Foam dressing(EasyFoam™), CuraVAC® application

C Chronicity evaluation

C.0 Acute

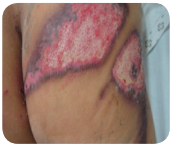


Mostly acute wound

D+Solution

- See Category E (Exudate control)

C.1 Chronic



If the burn is small → D+Solution: Dressing in which a wound recovery inducer is applied (Easyef®, bFGF)

If the burn is larger than 3 cm → D+Solution: Surgical therapy (e.g., skin graft)

T Top surface

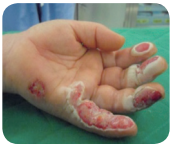
T.0 Closed

Closed (without open wound) 1st degree burn

D+Solution

- Moisturization ointment (Easyef Ointment, Easydew)

T.1 Open

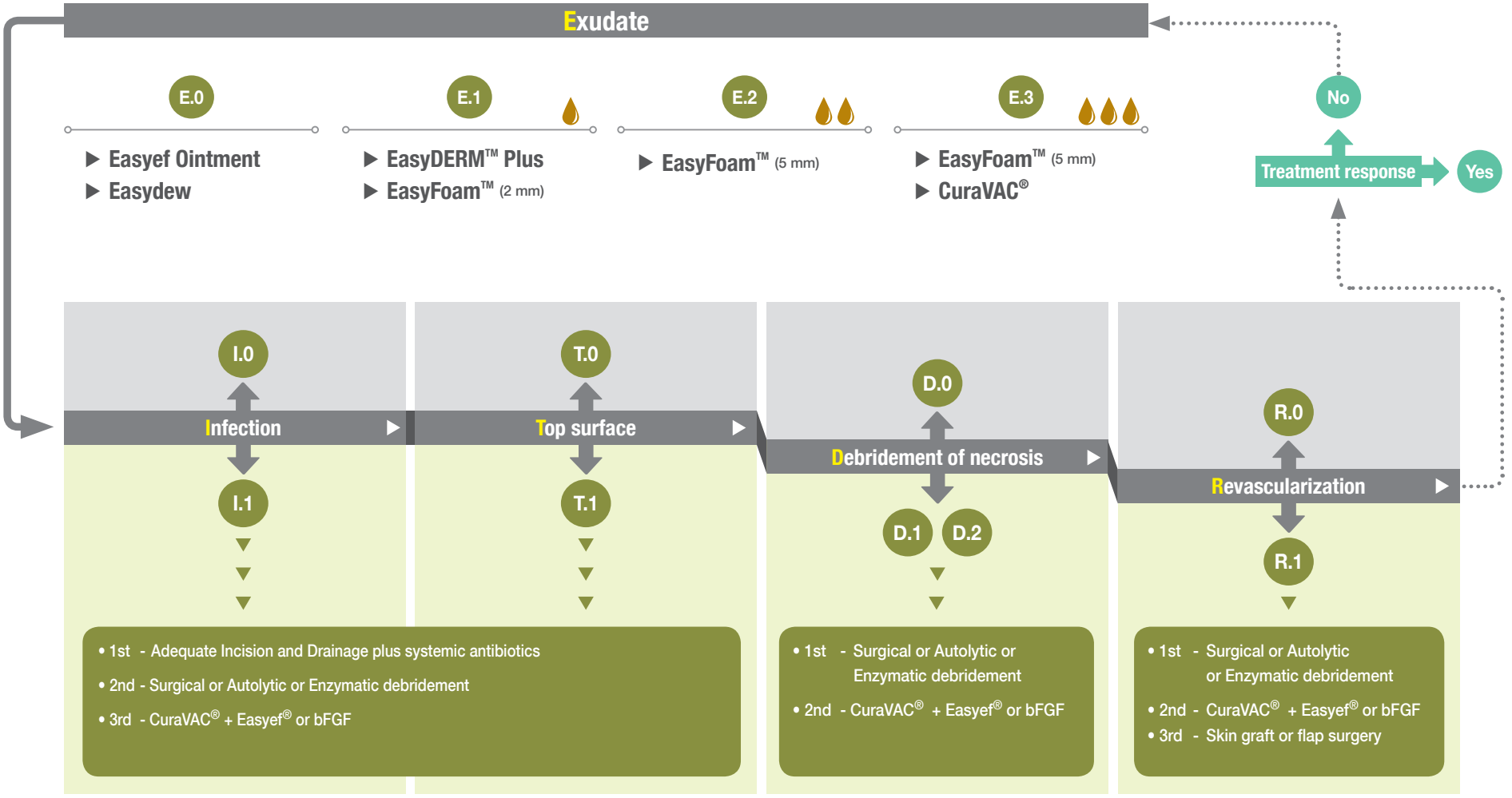


Open wound 2nd degree or 3rd degree burns

D+Solution

- Determine depending on the exudate amount and infection status. (See E. exudate/I. infection)

06. Burn | ALGORITHM



Burn

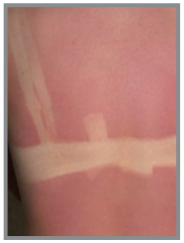
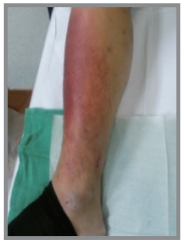
ALGORITHM

06. Burn | Examples of representative coding combinations

1st degree burn

First–degree burns affect only the epidermis, or the outer layer of the skin. The burned area is red, swollen and moderately painful. Generally, 1st–degree burns are cured spontaneously within a week, and no scar is left behind. However, they may leave light skin sequelae, such as skin discolorations.

D.0	I.0	R.0	E.0	C.0	T.0
No necrosis	No infection	Non-ischemic	No exudate	Acute	Closed

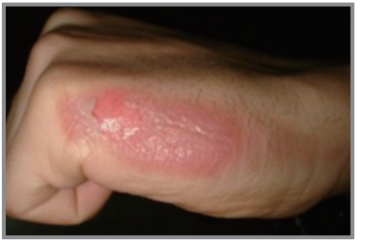




This wound shows erythema with a hot sensation. At the acute stage, it is important to perform cooling using ice packs. Apply Easydew and EasyDERM™ Plus to suppress the pain, alleviate the traction, and quicken the recovery. Sunburn or exposure to ultraviolet (UV) light after receiving a burn may cause discoloration, so precautions need to be taken.

Superficial 2nd degree burn

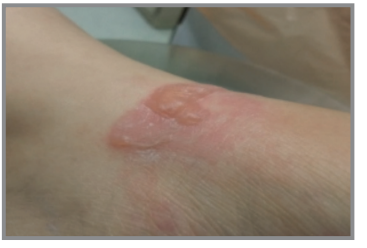
Superficial 2nd degree burns affect the papillary dermis of the skin and appear as blisters within one or two days. If the blisters are peeled off, a layer of dark pink dermis is exposed, and the sense remains keen. The skin will recover within 2–3 weeks if the formation of eschar is suppressed with wet dressings and precautions are taken to prevent infection. As a general treatment, it is important to cleanse the burned area with cold physiological saline during the acute stage. Although there is a controversy about the treatment of burn blisters, generally, large blisters more than 2–3 cm in diameter should be drained with a needle. It is advantageous not to peel off the epidermis of the blisters (non–deroofing) to reduce pain and the chances of infection. The thickness of the foam dressing must be determined depending on the size of the burned area and the exudate amount at the early dressing stage. When replacing the dressing, antibiotic ointment may be applied evenly, and a foam dressing may be used to cover the site to reduce pain and inhibit infection, especially in patients whose blisters have peeled off. In case the exudate is decreased and the affected area is small, it may be useful to apply Easyef Ointment. In most cases, the exudate is almost gone 7 to 10 days after the burn occurred, and then epithelization proceeds. In this case, EasyDERM™ Plus may be applied for the purposes of protecting the affected area and moisturization. Wound recovery is complete 2 weeks after the burn. However, continuous care is necessary by applying Easydew or sunblock for moisturization, suppression of traction, and suppression of skin pigmentation of the affected area. Although scars can occur, they are not severe, and they appear as changes in the texture and the color of the skin (pigmentation, decoloration). The scars may be severe in certain areas (e.g., ears, shoulders, breasts, and joints). Therefore, pay attention to the areas.

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.1 Light | C.0 Acute | T.1 Open



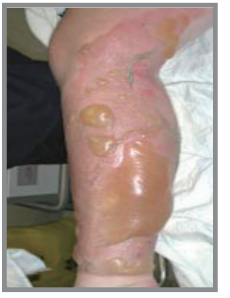
This is an acute burn whose affected area is relatively small and the blisters are peeled off and there is no infection. The exudate seems minimal, so apply EasyFoam™ (2 mm) after spreading the antibiotic ointment. Once–daily replacement is suitable.

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.2 Intermediate | C.0 Acute | T.1 Open



The affected area is relatively small, and it seems to be free of infection. Blisters should be drained with a medical needle, and the epidermis of the blisters should be left. Exudate may be moderate in the early stage of a burn. Apply EasyFoam™ (5 mm) dressing after spreading the antibiotic ointment. Once–daily replacement is desirable.

D.0	I.0	R.0	E.0	C.0	T.0
No necrosis	No infection	Non-ischemic	No exudate	Acute	Closed

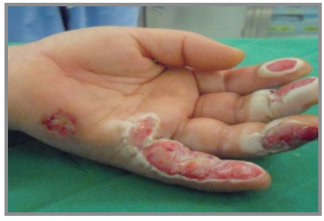


This is an acute burn with a relatively wide affected area, and it has a high risk of infection, although it currently shows no signs of infection. It is expected that there will be much exudate in the early stages of a burn. Drain the blisters with a medical needle, and apply EasyFoam™ (5 mm) after spreading the antibiotic ointment. A roll type of EasyFoam™ would be useful. A twice–daily dressing replacement cycle is recommended. If alginate dressing is used, the dressing replacement cycle may be extended. In case the blisters are peeled off, biologic dressing materials (CPA, GPA) may be used only when it is certain that there is no infection. These materials are useful for reduction in pain and exudates, and epithelialization.

Deep 2nd degree burn

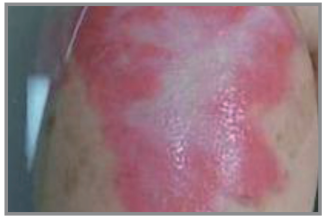
Deep 2nd degree burns involve the reticular dermis of the skin. Blisters appear within one day. A pale pink to white ischemia dermis is observed if the blisters are peeled off and the senses are blunted. If the burned area is small and there is no infection, it may recover within 2–3 weeks. However, if the burned area is large and accompanied by infection, it may require a longer recovery time. It may also proceed to a 3rd degree burn, which cannot be cured spontaneously and therefore may require surgical intervention. Also, it is likely to have sequelae, such as scars, hypertrophic scars, or scar contracture. In case the burned area is not improved after more than 3 weeks or the wound recovery is insignificant between 7 and 10 days for certain areas (e.g., face, neck, groin, joints, fingers), early skin graft surgery should be considered.[1] If a split thickness skin graft surgery is planned, CGDerm™ may be used for inhibiting contracture after surgery. In case the recovery is insignificant and the burned area is not relatively large, the use of Easyef® may be considered.[2–5]

D.2 Wet | I.0 No infection | R.0 Non-ischemic | E.2 Intermediate | C.1 Chronic | T.1 Open



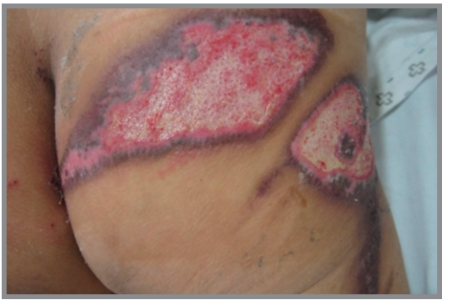
Small necrotic tissues are observed, and although 2 weeks have passed, the exudate is expected to be moderate. It seems that there is no infection. For the second finger, the third finger, and the fourth finger, which are small and relatively mild burn, the use of Easyef® may be considered. For the fifth finger, whose site is large and passes through the articular surface, skin graft surgery needs to be planned.

D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.3 Heavy | C.0 Acute | T.1 Open



This is an acute deep dermal burn with no necrotic tissue and no infection and it is considered to have a large quantity of exudate. Apply the antibiotic ointment, and replace EasyFoam™ (5 mm) twice a day. In case a decrease of exudate is apparent, replace it with EasyFoam™ (2 mm) or EasyDERM™ Plus. At this time, Easyef Ointment is applicable.

D.0	I.0	R.0	E.1	C.1	T.1
No necrosis	No infection	Non-ischemic	Light	Chronic	Open

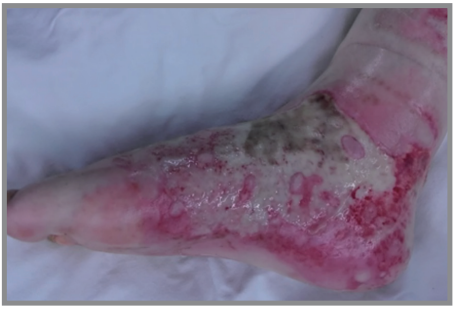


If exudate continues for more than 2 weeks, the burn is considered a deep 2nd degree burn, which is relatively small. Apply antibiotic ointment, replace EasyFoam™ once a day and plan a skin graft surgery. In case surgery is difficult, Easyef® may be used along with the dressing.

3rd degree burn

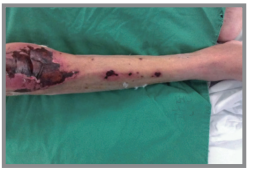
A 3rd degree burn is a serious burn on the full thickness of the skin. In this case, the skin appears light brown like beeswax or white leather, not in the shapes of blisters. Sensation is lost, so there is almost no pain even if the burned area is stimulated. If the burned area is larger than 3 cm in diameter, spontaneous healing is usually difficult, and surgical therapy (skin graft, flap, etc.) is required. Perform conservative dressing before the skin graft surgery depending on the exudate amount before and after debridement of the necrotic tissues. If there are tissue defects after debridement of the necrotic tissues, it is useful to apply CuraVAC® for facilitating blood flow to the wound site prior to skin graft surgery.

D.1	I.0	R.1	E.1	C.1	T.1
Dry	No infection	Ischemic	Light	Chronic	Open



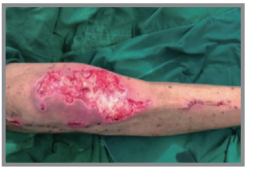
This is the aspect that 1st degree burn, superficial 2nd degree burn, deep 2nd degree burn, and 3rd degree burns are mixed. The exudate amount is moderate. Apply the antibiotic ointment, and replace EasyFoam™ (5 mm) twice a day. After debridement of the necrotic tissues, perform the negative pressure dressing therapy with CuraVAC® and skin graft surgery at the same time. When performing the spilt thickness skin graft surgery around the ankle joint, use CGDerm™ for preventing contracture.

D.1 Dry | I.0 No infection | R.1 Ischemic | E.0 No exudate | C.1 Chronic | T.1 Open



Dry necrosis eschar without exudate is observed. After debridement, it turned into a wound with heavy exudate. Dress it with EasyFoam™ (5 mm) and alginate dressing, and consider the skin graft surgery. When performing the spilt thickness skin graft surgery around the knee joint, use CGDerm™ for preventing contracture.

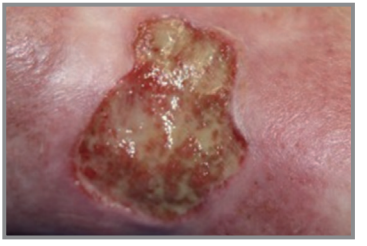
D.0 No necrosis | I.0 No infection | R.0 Non-ischemic | E.3 Heavy | C.0 Acute | T.1 Open



Burn complicated with infection

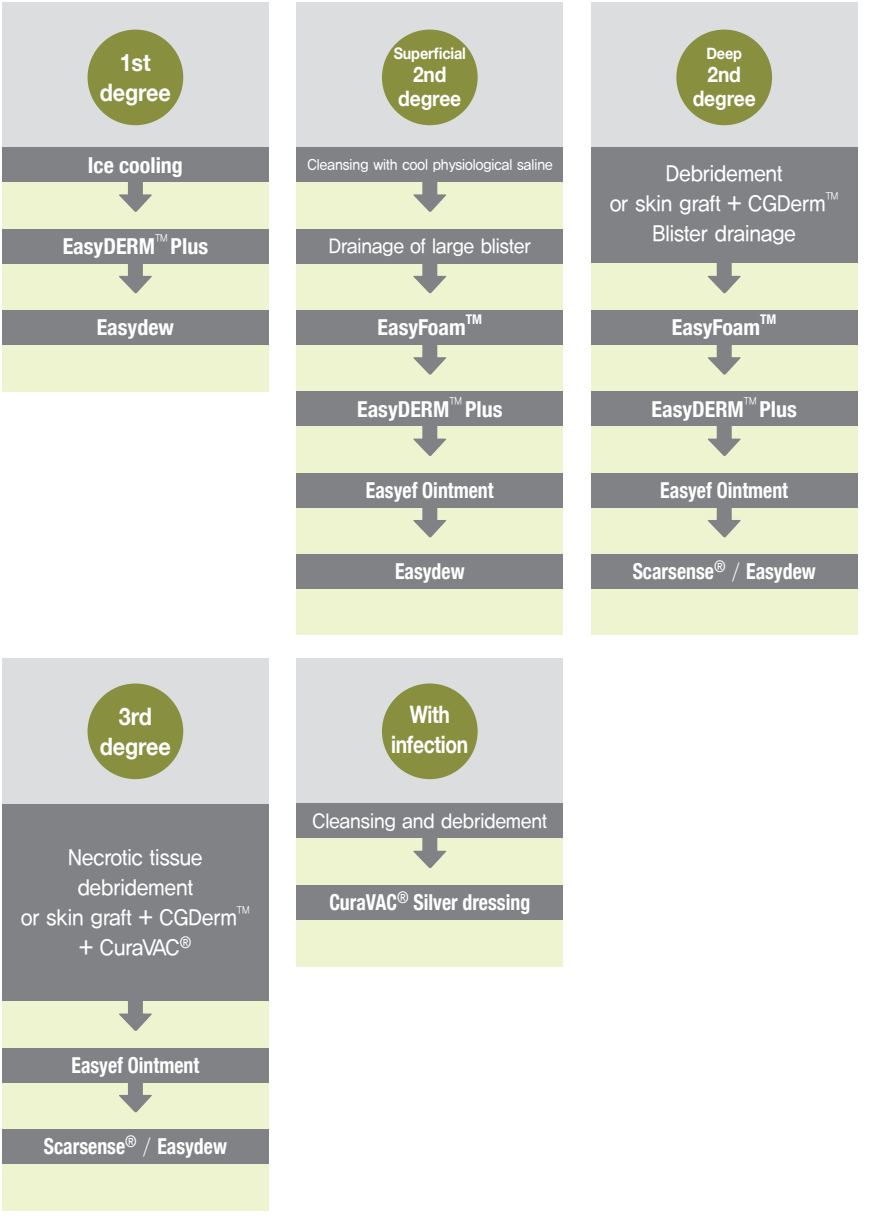
Burns often recover more slowly than expected due to delayed epithelization. Even after time has elapsed, the pain does not decrease or it gets worse. Flares and edema appear around the burned area, and unpleasant ordor is present due to a cloudy yellow or greenish yellow exudate. A dirty biofilm is also observed.

D.2	I.1	R.0	E.2	C.1	T.1
Wet	Infection	Non-ischemic	Intermediate	Chronic	Open



Yellow pus, biofilm, and periphery flares are noted. It is usually accompanied by a bad smell.
Clean washing, debridement, Betadine–soaked dressings, and silver agent dressings are required.
The dressing replacement cycle should be shortened to once or twice a day.
Administration of systemic antibiotics must be performed concurrently.

06. Burn | Expert Opinion



❶ For mild burns less than superficial 2nd degree burn, dressing therapy must be the main treatment.
❷ In the case of deep 2nd degree burns, administer dressing therapy for 2~3 weeks, and if the burn recovery is not significant, consider a skin graft. For extremities, joints, and the face, early skin graft surgery may be performed without waiting for 2 weeks to alleviate scar contractures.
❸ There is a report that parallel use of an artificial dermis agent (CGDerm™) may reduce the side effects, such as scar contracture, if there is no infection and the blood flow conditions are good at the recipient site when performing the skin graft surgery.[6-8]
❹ Although it is a burn requiring a surgical therapy, if there is no infection, the burn size is small (less than 3 cm), and surgery is difficult, the application of a growth factor such as Easyef® and bFGF may be considered. Such growth factor dressings may be used even in cases where epidermal repair was not progressing for more than 2 weeks during the burn dressing therapy.[2-5, 9]

Fourth-degree burn

The 4th degree burn represents a burn that extends deeply into the subcutaneous tissue.
The subcutaneous fat, underlying muscle, fascia, or bone is damaged and the surgical treatment such as tissue reconstruction is required.

Biologic dressing for burn patients

In case of large defects with burn (normally second degree or higher), the defect area may be covered with the biologic dressing such as amnion or xenograft to promote wound healing and epithelialization by pain reduction and moisturization effect. Recent advances in tissue engineering have generated various biologic dressings including cultured epithelial autograft, cryo preserved allograft (CPA), and glycerol preserved allograft (GPA).

06. Burn | References

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07.

Surgical Suture Wound

07. Surgical Suture Wound

Definition

The surgically closed site where a traumatic wound occurred or a wound generated by an incision for surgery.

Causes and symptoms

When there is no evidence of infection or skin and soft tissue defects in laceration, or if surgery is performed through the skin incision, the skin is sutured. The suture site should heal with an appropriate level of tension within 1-2 weeks. However, there are cases where the suture wound does not heal but instead becomes dehisced or requires another surgery due to inflammation depending on the health condition of the patient, the surgical technique, and the status of the surgery peripheral region. Therefore, attention is required.

Diagnosis

First, it is necessary to evaluate the systemic conditions of a patient or blood flow of the surgical site. These evaluations should be performed before the surgery or suture to predict the probability of the suture wound to dehisce and the method to prevent dehiscence must be applied right after the wound suture. Before surgery, the following points need to be examined; if the patient has diabetes, hypertension, blood circulatory disorders, obesity, or connective tissues diseases, if the patient is a smoker or has had a previous operation at the same site, if the skin condition of the incisional site is fine.

Classification

- A suture site in which the blood flow is very good and the probability of skin dehiscence is low.
- A suture site with a high probability of accumulation of blood or fluid due to a wide dead space (the inner space of the surgical site) within the incision line.
- A suture site with a high probability of wound dehiscence due to poor blood flow around the suture site.

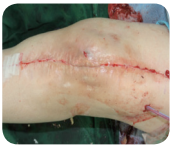
Basic principles/precautions of treatment

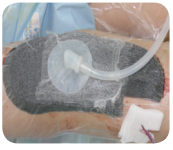
Keep the wound of the suture site clean, and minimize excessive compression. If a hematoma or fluid accumulates inside the suture site, the probability that bacteria may grow and cause inflammation or that the suture site will dehisce is increased. Therefore, it is necessary to confirm whether there are hematomas or fluids at every treatment. If there is bleeding or a blood clot in the skin of the suture site, it disturbs wound healing. Therefore, it is advisable to wipe it with saline solution at every treatment. If blood oozes between the skin layers, it is desirable to maintain a wet environment by covering it with EasyFoam™ to absorb the blood and fluid properly and to prevent scab formation along with proper compression. There are cases that surgery must be done in situations where blood flow is declined or the blood vessel of the surgical site is damaged due to repetitive incisions at the same site. To improve the blood flow of the wound, the use of CuraVAC® in a cyclic setting may be attempted.[1-2]

07. Surgical Suture Wound | DIRECT coding

R Revascularization

R.1 Ischemic





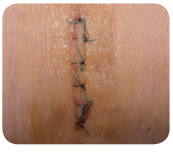
The status that surgical site or systemic blood flow decrease is suspected

D+Solution

- It is possible to attempt CuraVAC® in a cyclic mode for improving the blood flow of the wound.
- Apply CuraVAC® directly to the skin grafted site for 4~5 days. Apply −80 mmHg continuously or apply −80 ~ −30 mmHg in a cyclic mode in case the peripheral blood flow is declined. Do the first dressing on the 4th or 5th day after skin graft, and replace it twice or three times at intervals of 2~3 days.[3]

E Exudate control

E.0 None



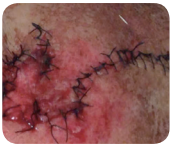
The status that the wound site is dry and that moisturization is required.

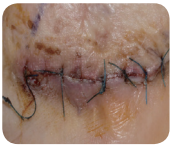
D+Solution

- Protect the wound with EasyDERM™ Plus and maintain an appropriate wet environment.

E.1 Light

E.2 Intermediate



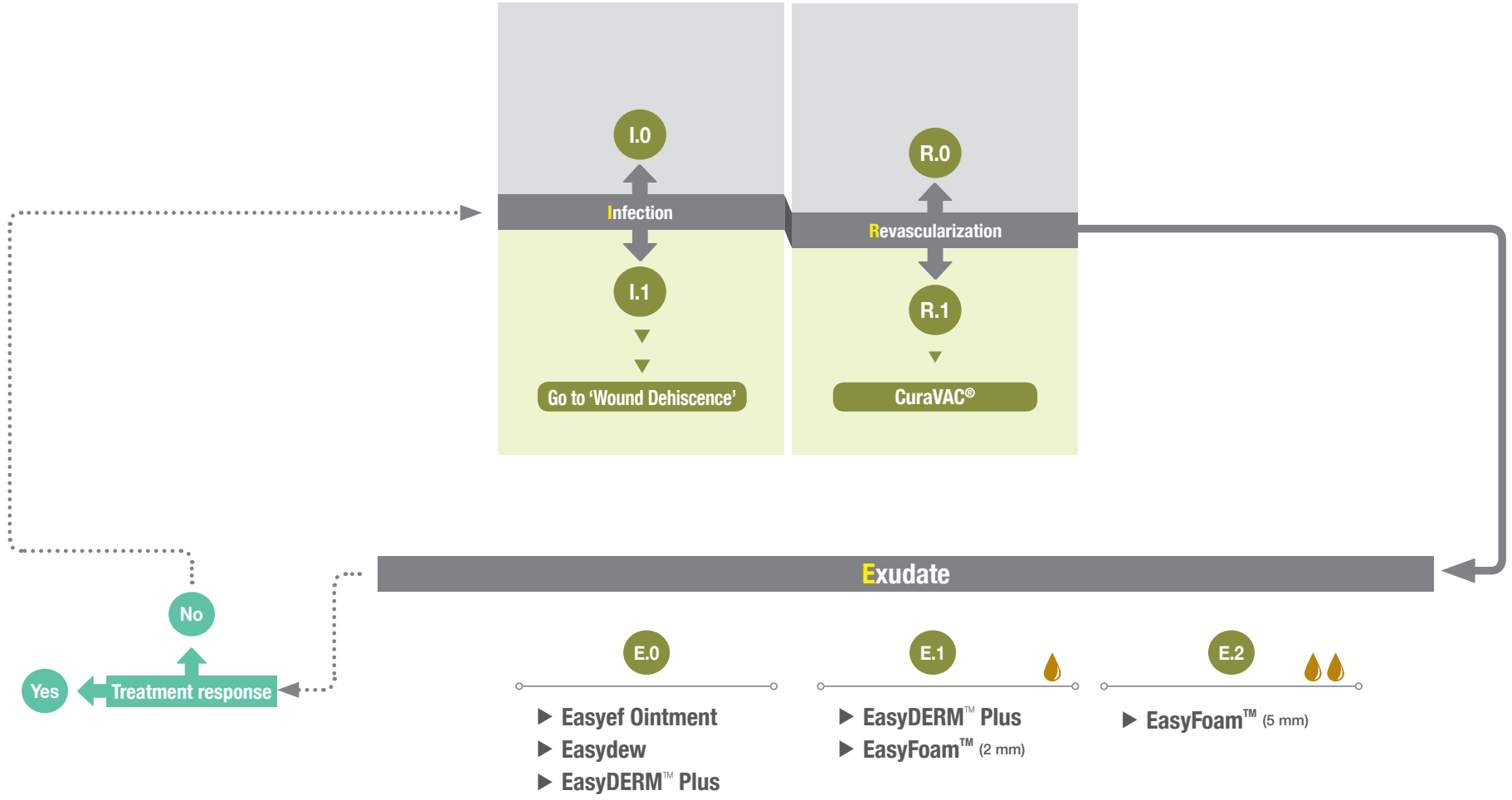


There is a little exudate or bleeding of the wound suture surface, or the exudate oozes from the peripheral region.

D+Solution

- If the primary dressing is smeared with exudate or blood, or blood remains on the skin suture site, wipe it with saline solution so that no exudate or blood is left on the skin suture site.
- In case the exudate is excessive at an early suture, use EasyFoam™. If the wound is dried or the exudate is decreased after using EasyFoam™, replace it with EasyDERM™ Plus.

07. Surgical Suture Wound | ALGORITHM



Surgical Suture Wound

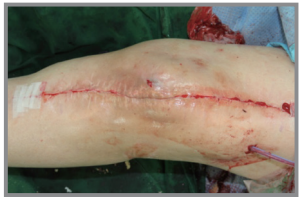
ALGORITHM

07. Surgical Suture Wound | Examples of representative coding combinations

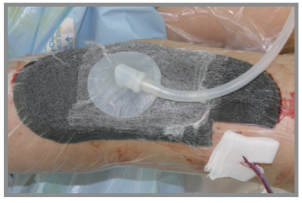
R.1 Ischemic | E.0 No exudate

R.1 Ischemic | E.1 Light

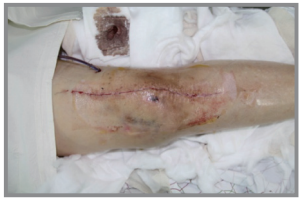
R.1 Ischemic | E.2 Intermediate



As a diabetic patient, the patient has a history of wound dehiscence due to surgical suture site necrosis caused by repetitive knee joint surgeries.



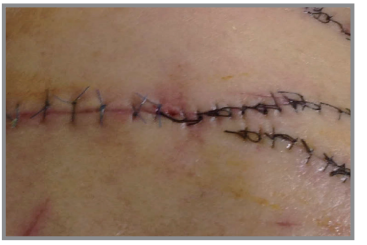
Right after the surgery, a negative pressure wound treatment with CuraVAC® was begun.



Two days after the surgery, the suture site condition was good. So, the negative pressure wound treatment was conducted for 4 days after the surgery and EasyFoam™ dressings were used from the fourth day after the treatment.

R.0 Non-ischemic E.0 No exudate

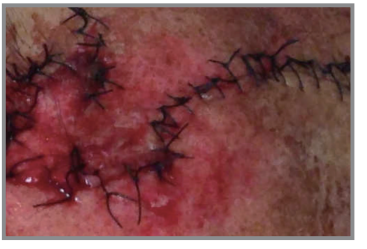
R.0 Non-ischemic E.1 Light



For clean wounds, apply EasyDERM™ Plus to protect the wound from the outside. Use Easyef Ointment if the affected area is eye rim. If the EasyDERM™ Plus turns white from absorbing the exudate, replace it once or twice a day. Otherwise, maintain the dressing for a few days.

R.0 Non-ischemic E.2 Intermediate

R.0 Non-ischemic E.3 Heavy



Wipe the blood with saline solution so that no blood is left on the skin suture site. In case the exudate is excessive at early stage, use EasyFoam™ once or twice a day. If the wound is dry or the exudate is decreased after using EasyFoam™, replace it with EasyDERM™ Plus. The replacement cycle of the dressing is determined depending on the exudate amount.

07. Surgical Suture Wound | Expert Opinion

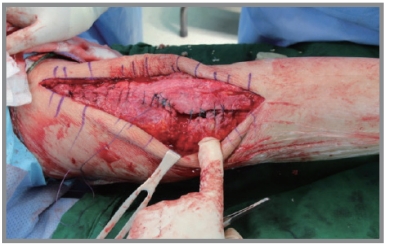
Examples of the application of CuraVAC® in a cyclic mode in the suture wound [4–6]

❶ When there is a high risk of wound dehiscence due to decreased blood flow or physical diseases
– There are cases that surgery must be done in situations where blood flow is declined or the blood vessel of the surgical site is damaged due to repetitive incisions at the same site. In particular, blood flow is often declined in the wound suture site after orthopedic joint surgery, thoracotomy, and repeated laparotomy. For the thoracotomy, the probability of wound dehiscence after surgery is as high as 1–10% according to the literature. Even for the laparotomy, the probability of wound dehiscence is 0.2~0.6%. If the wound is dehisced, those who receive treatment also experience pain, and treatment time and expenses are consumed. The application of CuraVAC® in a cyclic mode may be attempted in order to reduce this risk and to improve the blood flow of the wound.

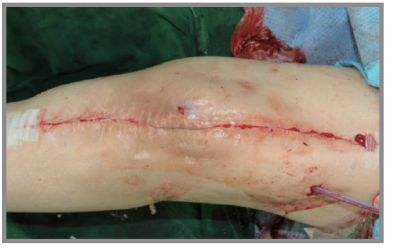
❷ When there is a high risk of hematomas or fluid accumulation in the large dead space under the skin
– In comparison with gauze dressings, the negative pressure therapy significantly reduced the exudate amount, improved the blood flow, and increased the tensile strength of the skin.

A. How to apply

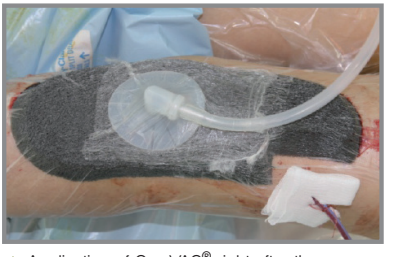
– The negative pressure wound treatment of a cyclic mode (–125~–10 mmHg) may be attempted twice or three times at intervals of 2 days right after the surgery in order to improve the blood flow after suturing the surgical site. In case the blood flow has substantially declined, the higher negative pressure of the cyclic mode can be reduced to –80~–60 mmHg, and a continuous mode should not be used.



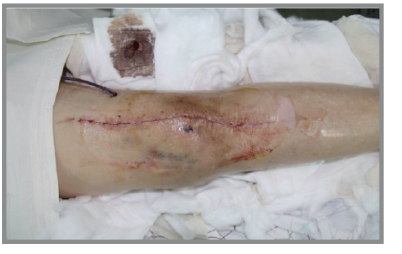
▲ During surgery



▲ Right after the surgery



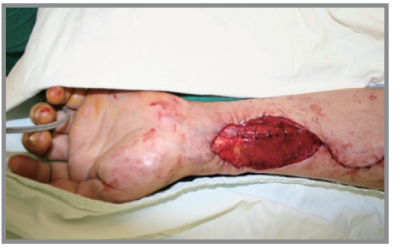
▲ Application of CuraVAC® right after the surgery



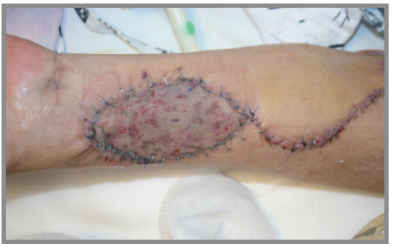
▲ 2 days after the surgery

An example of the application of CuraVAC® after skin grafting

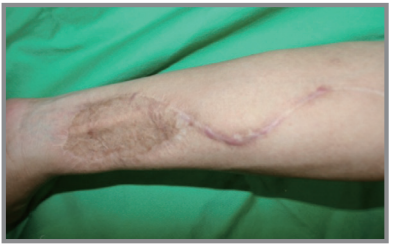
Apply the negative pressure wound treatment (CuraVAC®) directly to the skin grafted site. Maintain the continuous negative pressure as –125~–80 mmHg depending on the circulation status for 4~5 days. In case the blood flow of the skin graft site declines, apply a cyclic mode as –80~–30 mmHg. Do the first dressing on the 4th or 5th day after skin grafting, and replace the dressing twice or three times at intervals of 2 or 3 days.



Before skin graft



Five days of CuraVAC® application after STSG with CGDerm™



2 years after the surgery

07. Surgical Suture Wound | References

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08.

Wound Dehiscence

08. Wound Dehiscence

Definition

Complications after surgery resulting from the separation of the skin layer of the surgical wound.

Causes and symptoms

The cause of wound dehiscence include infection of wound sites or suture sites, pressure of the suture site, too tight suture, traumatic wound of the wound site, improper suture, use of steroids at high concentration, and severe vitamin C deficiency. The symptoms are exposure of exudate in the wound, pain, edema, flare, a heat sensation reported around the wound, dehisced postoperative wound, protrusion of fat, muscle, or organs out of the wound, and the separation of the surgery suture site edge.[1]

Diagnosis

Diagnosis is performed using wound tissue culture, blood testing, and image examination (x-ray, ultrasound, CT).

Classification

Partial dehiscence : Only a portion of the surface skin or incised tissue is dehisced.
Full dehiscence : The entire layer of the incised tissue is dehisced, and the underlying tissues or organs are exposed.[2]

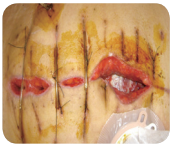
Basic principles/precautions of treatment

Replace dressings frequently if appropriate for prevention of infection, and expose the wound to the air at the proper time in order to improve the wound healing, prevent infection and make the granulation tissues grow well. If there are infected or necrotized tissues, remove them surgically and re-suture the wound at the time of regulation of the wound infection and decrease of the tension. If necessary, use an abdominal binder to help reduce tension.

08. Wound Dehiscence | DIRECT coding

D Debridement of necrosis

D.0 No necrosis

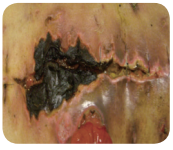


No necrotic tissue.

D+Solution

- See Category E (Exudate Control)

D.1 Dry

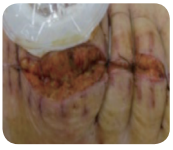


Black, dry, and hard dead tissue caused by topical pressure or peripheral ischemia.

D+Solution

- Surgical or Autolytic or Enzymatic debridement
- CuraVAC®+Easyef® or bFGF

D.2 Wet



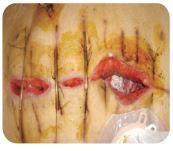
White or yellow, sticky, and sloughy tissues

D+Solution

- Surgical or Autolytic or Enzymatic debridement
- CuraVAC®+Easyef® or bFGF

I Infection control

I.0 No infection

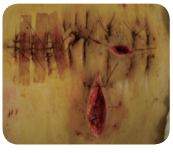


No sign of infection.

D+Solution

- See Category E (Exudate Control)

I.1 Infection present



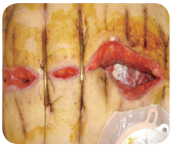
Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor.

D+Solution

- Adequate debridement, irrigation and drainage
- Systemic antibiotics

R Revascularization

R.0 Non-ischemic

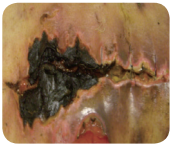


No abnormality in blood flow.

D+Solution

- See Category E (Exudate Control)

R.1 Ischemic



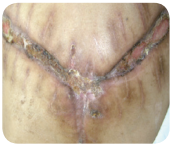
Arterial insufficiency exists in the extremity vessel or there is topical poor blood flow around the wound.

D+Solution

- Enforce the angioplasty and ensure the blood flow.
- Surgical or Autolytic debridement
- CuraVAC® + Easyef® or bFGF
- Skin graft or Flap surgery

E Exudate control

E.0 None

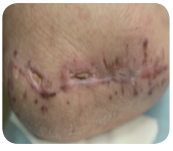


The state that the wound site is dry, and moisturization is required.

D+Solution

- Easyef Ointment or Easydew

E.1 Light

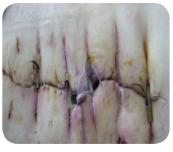


Exudate does not ooze when applying EasyDERM™ Plus, or once–daily replacement is required based on EasyFoam™ 2 mm.

D+Solution

- EasyDERM™ Plus or EasyFoam™ (2 mm)
- Easyef Ointment

E.2 Intermediate

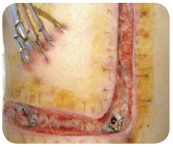


Once–daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm)
- Easyef Ointment

E.3 Heavy



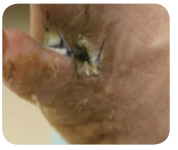
Twice or more frequent daily replacement is required based on EasyFoam™ 5 mm.

D+Solution

- EasyFoam™ (5 mm) or CuraVAC®

C Chronicity evaluation

C.0 Acute

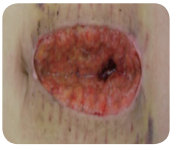


The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment.

D+Solution

- See Category E (Exudate Control) → EasyDERM™ Plus or EasyFoam™ or CuraVAC®
- Local wound → Easyef Ointment

C.1 Chronic



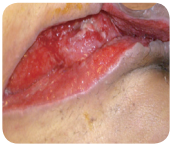
The wound shows no visible healing progress even after 3~6 weeks of treatment. Or the wound has no response to the current wound treatment or is getting worse. It may be caused by the pressure ulcer, diabetes, severe burns, autoimmune diseases, chemicals, anti–cancer or radiation therapy, severe infection, or peripheral vascular diseases.

D+Solution

- Surgical or Autolytic or Enzymatic debridement
- CuraVAC® + Easyef® or bFGF

T Top surface

T.1 Open

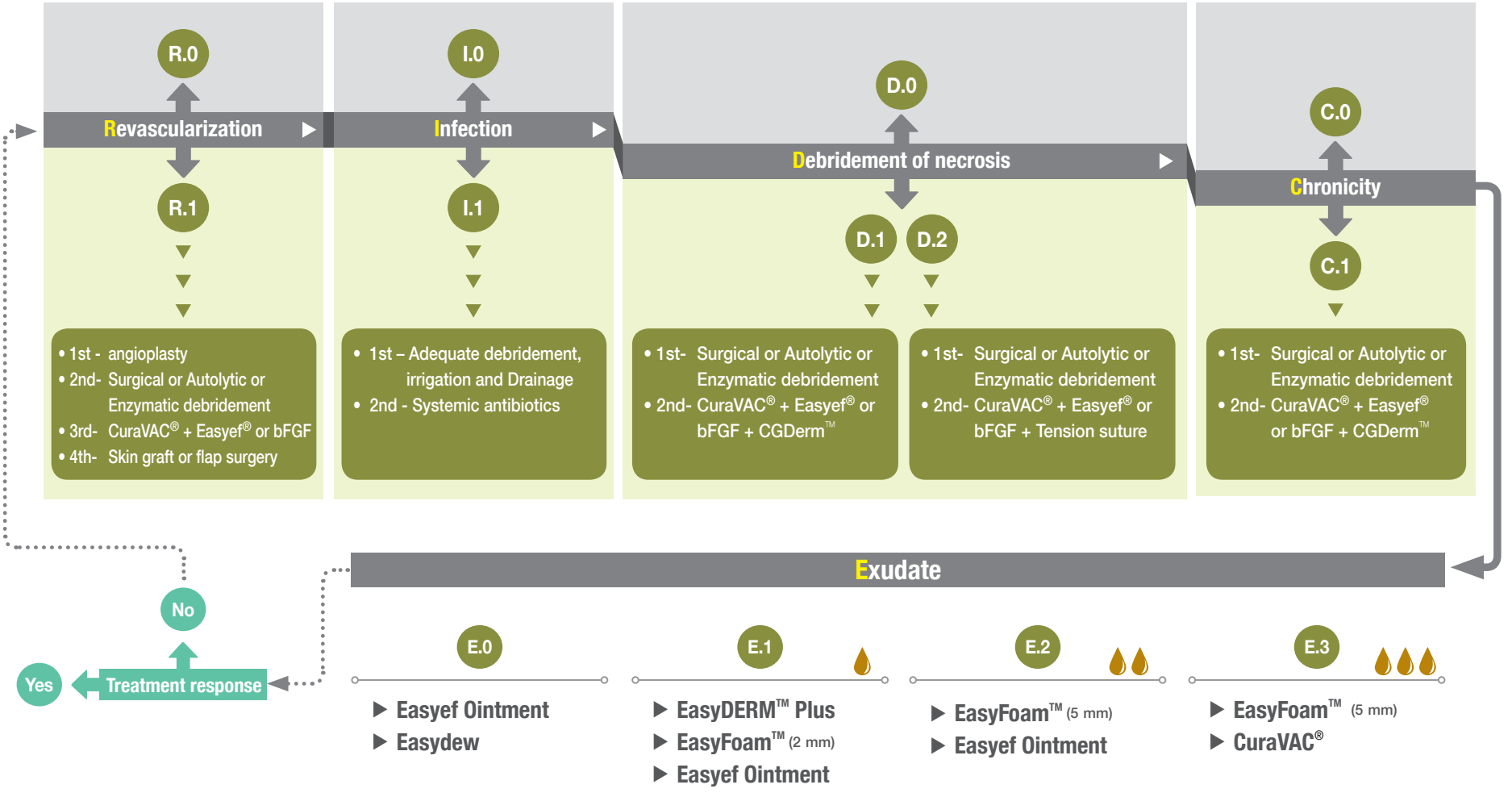


The skin is dehisced, and the inside of the skin is exposed.

D+Solution

- See Category E (Exudate Control)
- Surgical debridement
- CuraVAC® + Easye® or bFGF

08. Wound Dehiscence | ALGORITHM

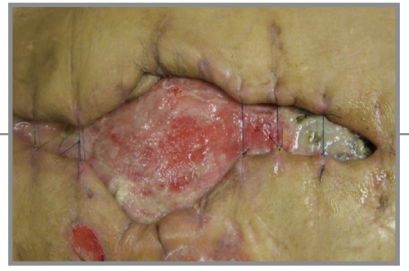


Wound Dehiscence

ALGORITHM

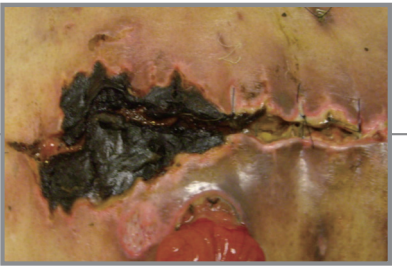
08. Wound Dehiscence | Examples of representative coding combinations

D.1 Dry | I.1 Infection | R.0 Non-ischemic | E.2 Intermediate | C.1 Chronic | T.1 Open



1. First, remove dead tissues using a gel or enzyme.
2. Regulate the infection using antibiotics.
3. Help absorb exudate by applying EasyFoam™ and protecting the affected area.
4. Perform suture.

D.1	I.0	R.1	E.1	C.1	T.0
Dry	No infection	Ischemic	Light	Chronic	Closed



1. Enforce the angioplasty and ensure the blood flow.
2. Carry out surgical or autolytic debridement.
3. Apply CuraVAC®.
4. Perform skin graft or flap surgery

08. Wound Dehiscence | Expert Opinion

1. Abdominal Wound Evisceration[3]

Exposure of serous blood from the closed abdominal wound is the initial symptom of abdominal wound dehiscence suspected as evisceration. If such a condition appears, a surgeon must check the wound directly by hand, wearing sterile gloves, after removing one or two sutures in the skin. If the separation of the rectus fascia is confirmed, primary suture must be enforced in the operating room. If it is discovered late, the mortality rate increases dramatically up to 30%. The basic principles of management of wound dehiscence and evisceration of the abdominal wall are initial diagnosis and surgical suture. The purpose of the surgery is to close the abdominal wall.

2. Surgical Site Infection (SSI)[4-9]

❶ Clinical symptoms and diagnosis

Symptoms include the topical rash, hardness, heat sensation, and pain of the incisional site. Leakage of pus secretion and wound dehiscence may occur. In some patients, infection accompanying high fever and leukocytosis occurs systemically. The most dangerous, necrotizing fasciitis, can be fatal, and it requires emergency surgery. Necrotizing fasciitis is characterized by a large quantity of dirty secretions, dark and soft subcutaneous tissues, and pale and lethargic fascia.

❷ Treatment

The infected wound should be opened, examined, drained, and washed. Dead tissues must be removed. It is a principle to use open dressing. If the fascia is ruptured, surgery should be enforced in the operating room. If the infection is treated and the granulation tissues grow, secondary wound suture is possible. For patients with active infections, systemic infection symptoms, immunosuppressant use, diabetes, or long–term steroid therapy, antibiotics treatment is necessary.

▷ Incision and drainage – Cleanse the sloughy dead tissues, secretions, and clots using a 18G syringe needle containing physiological saline in a 20 cc syringe in order to remove them. For removing necrotized tissues or foreign bodies, remove the dead tissues using surgical debridement and enzymes.
▷ Wound dressing - Maintain a wet dressing.
▷ Antibiotic treatment
▷ Delayed suture

❸ Classification

The SSI is classified into three groups according to the incision depth.
▷ Superficial incisional SSI - Including the skin and subcutaneous tissues
▷ Deep incisional SSI - Penetrating to deep soft tissues (fascia, muscle)
▷ Organ/space SSI - Including even the organs

❹ Inclusion criteria

▷ **Superficial incisional SSI**

When it is accompanied by at least one among the following symptoms along with the infection generated only in the skin or subcutaneous tissues of the incisional site within 30 days after surgery.

1. Purulent drainage
2. Detection of bacteria in the culture examination
3. If it is accompanied by at least one symptom, such as pain, tension, topical edema, flare, or heat sensation, the surgeon should open the superficial incisional site on purpose, even if bacteria are not detected in the culture examination.

– If the incision does not lead to endocarditis, the surgeon may implement the superficial incision slowly.

The cases not diagnosed as the superficial incisional SSI are as follows :

1. Abscess in the suture needle site
   (when it is limited to the minimal inflammation and secretion in the suture needle site)
2. Infection in the pubic incisional site and circumcision sites of newborn babies
3. Burn wound infection
4. Infection of the incision site that has penetrated to the fascia and muscle layers

Note : For differentiation among pubic incisional site infections, circumcision site infections, and burn wound infection, follow different criteria.

▷ **Deep incisional SSI**

Infection occurs within 30 days after the surgery unrelated to artificial grafts in the deep soft tissues, such as the fascia and muscle layers of the incisional site, or infection occurs within one year after the artificial graft surgery and is related to the surgery, and the infection is accompanied by at least one of the following symptoms :

1. Purulent drainage from deep tissue (fascia, muscle layer) incision, not the space between the organ and the mesentery of the surgical site.
2. Symptoms such as a high fever of 38 degrees or more, topical pain, and tension occur and the surgeon opens the postoperative wound site deliberately or the deep incisional site is dehisced naturally although bacteria are not detected in the culture examination.
3. If there is other evidence (pathologic or diagnostic imaging examination) that the infection has been generated in connection with an abscess or deep incision.

▷ **Organ/space SSI**

Infection occurs within 30 days after the surgery unrelated to artificial grafts in the space between the organ and mesentery, or infection occurs within one year after the artificial graft surgery and is related to the surgery, and the infection is accompanied by at least one of the following symptoms :

1. Purulent drainage from the stab wound drain. The infection around the stab wound is not a surgical site infection. This is a skin soft tissue infection that has occurred deep in the space between the organ and the mesentery.
2. Bacteria are detected in the culture examination in the space between the organ and the mesentery.
3. If there is other evidence (pathologic or diagnostic imaging examination) that an infection has been generated in connection with an abscess or the space between the organ and the mesentery, all SSIs must be diagnosed by a surgeon or a related doctor.

08. Wound Dehiscence | References

1. Haynes AB, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med 2009; 360(5): 491-9.
2. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control 2008; 36(5): 309-32.
3. Clifford R. Wheeless J, M.D., Marcella L. Roenneburg MD. Atlas of Pelvic Surgery ; on-line edition. http://www.atlasofpelvicsurgery.com/9AbdominalWall/5AbdominalWoundDehiscenceandEvisceration/cha9sec5.html.
4. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for prevention of surgical site infection, 1999. Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol 1999; 20(4): 250-78.
5. Casey AL, Elliott TS. Progress in the prevention of surgical site infection. Curr Opin Infect Dis 2009; 22(4): 370-5.
6. Chong T, Sawyer R. Update on the epidemiology and prevention of surgical site infections. Curr Infect Dis Rep 2002; 4(6): 484-90.
7. Fry DE. A systems approach to the prevention of surgical infections. Surg Clin North Am 2009; 89(2): 521-37.
8. McKibben L, Horan T, Tokars JI, et al. Guidance on public reporting of healthcare-associated infections: recommendations of the Healthcare Infection Control Practices Advisory Committee. Am J Infect Control 2005; 33(4): 217-26.
9. Services DoHaH. Action Plan to Prevent Healthcare-Associated Infections. http://www.hhs.gov/ophs/initiatives/hai/infection.html.

09.

Cancerous Wound

09. Cancerous Wound

Definition

An inoperable malignant lesion which is a wound caused when cancer cells present in the subcutaneous tissue have penetrated the skin.

Symptoms

The most common symptoms are heavy exudates and unpleasant odor accompanied by pain, bleeding, and itching.

Diagnosis

A histological examination is conducted to confirm the tumor, and the existence of anaerobic microbes, which are the cause of the bad smell, is examined through cell culture.

Occurrence rate

Breast (62%) / Head and neck (24%) / Groin, genitals, and back (3%) / All other regions (8%).[1]

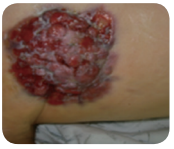
Basic principles/precautions of treatment

Therapeutic purposes may vary depending on the progression of cancer and the patient's condition. Treatments can be administered to stop the progression of the tumor or to alleviate the pain in the case of terminally ill patients. In either case, suffering due to pain, smells, and bleeding are as bothersome as the lesion itself in the cancerous wound. Accordingly, treatment should be performed in a direction to relieve these symptoms.[2–6]

09. Cancerous Wound | DIRECT coding

D Debridement of necrosis

D.0 No necrosis

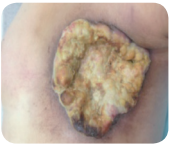


No necrotic tissue.

D+Solution

- See Category E (Exudate Control)
- None or EasyFoam™

D.1 Dry

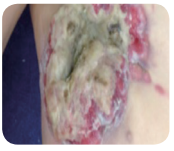


Black, dry, and hard dead tissue.

D+Solution

- Autolytic or Enzymatic debridement

D.2 Wet



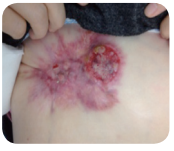
White or yellow, sticky, and sloughy tissues

D+Solution

- Autolytic or Enzymatic debridement

I Infection control

I.0 No infection

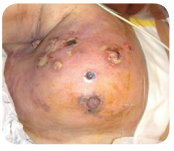


No sign of infection.

D+Solution

- None or EasyFoam™

I.1 Infection present



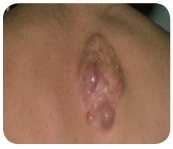
Infection is a state in which bacteria or fungi proliferate around the site of the wound. When an infection is present, there is evidence of erythema around the wound, fever, edema, tenderness, purulent discharge, or an unpleasant odor.

D+Solution

- Adequate Incision and Drainage
- Topical or Systemic antibiotics
- However, it is necessary to consider the systemic condition of a patient including bleeding at the time of incision and drainage.

E Exudate control

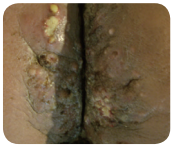
E.0 None



The state that the wound site is dry, and moisturization is required.

D+Solution
- Easyef Ointment
- Easydew
- EasyDERM™ Plus

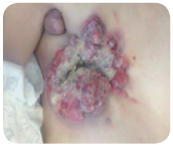
E.1 Light



Exudate does not ooze when applying EasyDERM™ Plus, or once–daily replacement is required based on EasyFoam™ 2 mm.

D+Solution
- EasyDERM™ Plus or EasyFoam™ (2 mm)

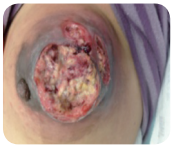
E.2 Intermediate



Once–daily replacement is required based on EasyFoam™ 5 mm.

D+Solution
- EasyFoam™ (5 mm)

E.3 Heavy

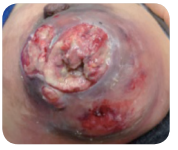


Twice or more frequent daily replacement is required based on EasyFoam™ 5 mm.

D+Solution
- EasyFoam™ (5 mm)

C Chronicity evaluation

C.0 Acute

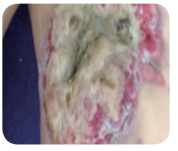


The wound is generally healed within two weeks, or the healing progress is shown by the wound treatment.

D+Solution

- See Category E (Exudate Control)
- EasyDERM™ Plus or EasyFoam™

C.1 Chronic



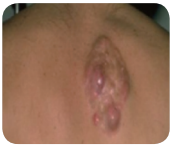
The wound shows no visible healing progress even after 3~6 weeks of treatment. Or the wound has no response to the current wound treatment or is getting worse.

D+Solution

- Surgical or Autolytic debridement
- Evaluate wound surface and exudates amount
  → EasyDERM™ Plus, EasyFoam™

T Top surface

T.0 Closed

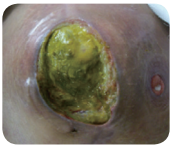


The state that the wound is closed so the bottom is not revealed.

D+Solution

- See Category E (Exudate Control)
- Easydew

T.1 Open

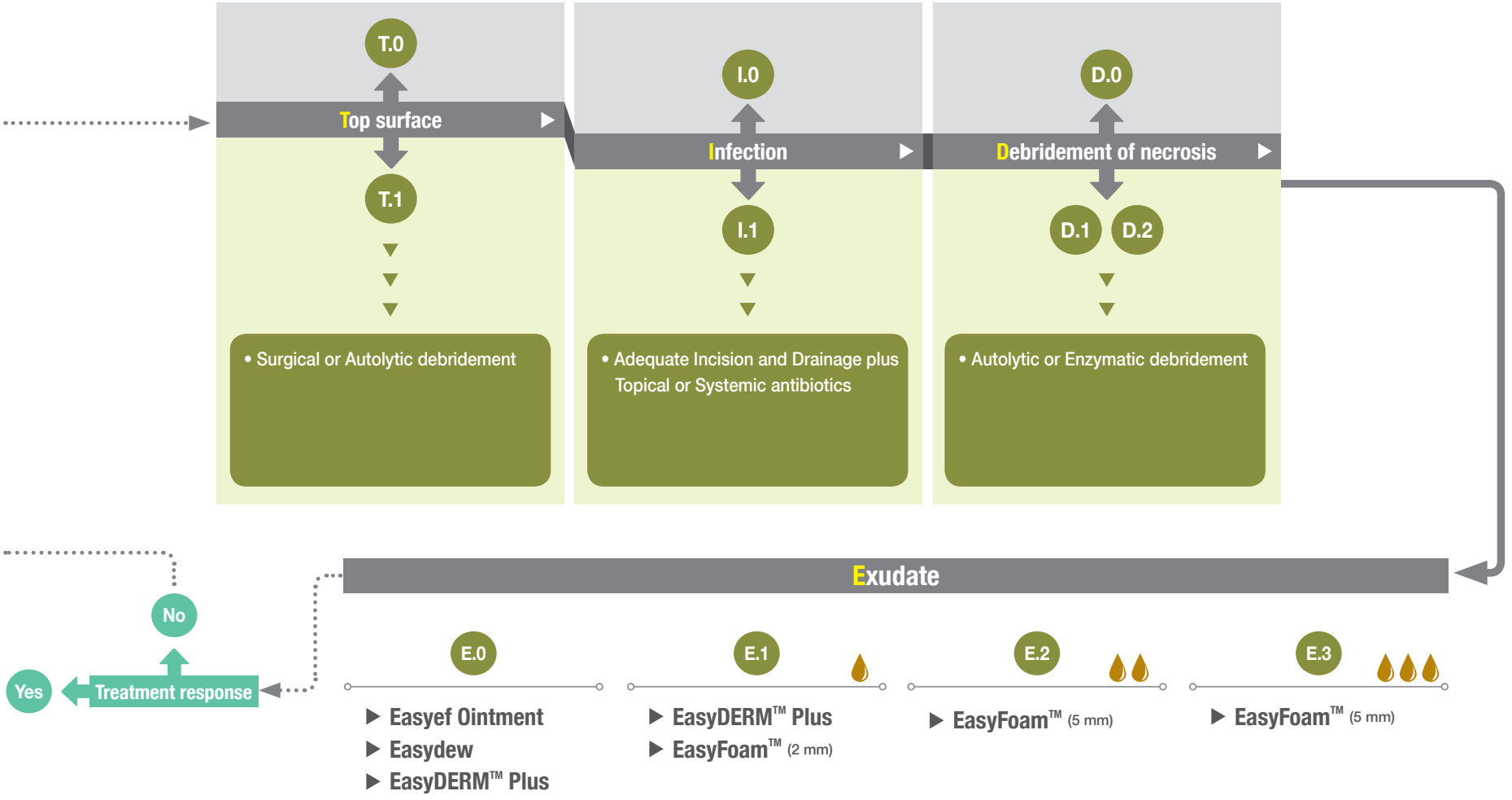


The state that the wound is open or projected so the wound bottom is revealed.

D+Solution

- Surgical or Autolytic debridement
- See Category E (Exudate Control)
  → EasyDERM™ Plus, EasyFoam™ etc.

09. Cancerous Wound | ALGORITHM

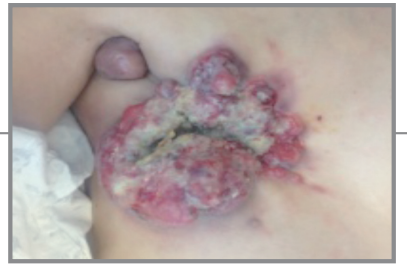


Cancerous Wound

ALGORITHM

09. Cancerous Wound | Examples of representative coding combinations

D.2 Wet | I.1 Infection | R | E.1 Light | C | T.1 Open



❶ Apply hydrogel/saline wet gauze/antimicrobial ointment.
❷ Contract the layer (Vaseline gauze, flagyl gauze)
❸ Apply EasyFoam™
❹ Apply Easydew to the surrounding skin.

D.2 Wet

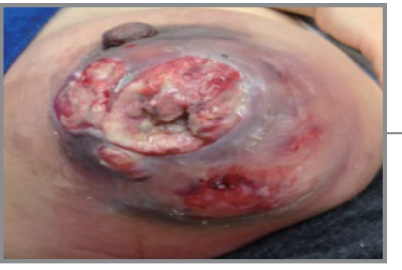
I.1 Infection

R

E.3 Heavy

C

T.1 Open



❶ Apply hydrofiber/calcium alginate/EasyFoam™ or
❷ Apply antimicrobial ointment.
❸ Apply Easydew to the surrounding skin.

09. Cancerous Wound | Expert Opinion

1. NPWT contraindication

Use of NPWT in the presence of malignancy is listed as a contraindication by most manufacturers. At least one product can be used for palliative care. A study on the use of NPWT in palliative care reported improved quality of life through reduced frequency of painful dressing changes and containment of exudates and odor. Following surgical excision of the malignancy, NPWT can be implemented in the acute surgical wound to aid in closure.

2. Radiation and chemotherapy

Treatment options for these fungating malignant wounds are aimed at the underlying pathology and include radiotherapy, chemotherapy, hormone therapy, surgery, cryotherpy, or laser therapy. External beam radiation therapy may be used to control local metastases, which in turn may help control malignant cutaneous wound symptoms.

3. Control pain

Cause of pain in the malignant wound may be multiple and include emotional factors, neuropathic pain(due to nerve damage from the tumor), and procedural pain, as occurs with dressing removal. Systemic analgesia and rapid-onset, short-acting analgesics administered before beginning dressing changes, topical anesthetics can be used to control pain. Topical lidocaine or benzocaine or ice packs applied before or after wound care may be beneficial. Daily application of a topical opioid-infused amorphous hydorgel(10mg morphine sulfate in 8g of hydrogel) has been used anecdotally to manage painful pressure ulcers and malignant wounds as well as in randomized controlled studies with significantly improved pain control compared with pretreatment medications. Similar results have been reported with use of either crushed oxycodone or meperidine topically in two patients with sickle cell ulcers. Clearly these portions should be considered in conjunction with systemic pain control measures. Although a malignant of fungating wound is characteristically painful, a key source of pain is the trauma associated with dressing changes. Consequently, controlling or minimizing pain requires attention to the reduction or elimination of mechanical trauma. Two primary interventions are (1) minimization of trauma associated with dressing changes by using nonadhesive dressings and (2) infrequent dressing changes. The malignant or fungating wound site has an increased tendency to bleed when disturbed, which may aggravate the presence of pain. Infrequent dressing changes reduce the potential for bleeding. When bleeding is a concern, appropriate dressing that reduce the potential for a bleeding episode must be selected.

4. Atraumatic dressing changes

Nonadhesive but absorbent dressings are recommended to achieve atraumatic dressing removal. Dressing selection options include a contact-layer dressing, nonadherent gauze, impregnated gauze and semipermeable foam dressings. To eliminate unnecessary dressing changes dressings that have a long wearing time should be selected and preferably changed no more often than every 3 days. However, once-daily dressing changes may be necessary for the highly exudative wound. Protective barrier films, particularly those without alcohol, can be applied to the surrounding skin to further decrease trauma to periwound skin. Atraumatic tapes and mesh netting can be used to affix dressings, thereby avoiding trauma to the surrounding skin upon removal.

5. Control or prevent bleeding

Erosion of capillaries can lead to significant spontaneous bleeding. Atraumatic dressing removal is critical to avoid precipitating a bleeding episode. If bleeding occurs even with the use of atraumatic dressing removal techniques, direct pressure and an ice pack can be applied initially. If these are ineffective, many different types of dressings and products are available that assist in the control of bleeding. Monsel solution has been shown to be an effective adjunct to comprehensive wound assessment should direct the choice of which dressing is most appropriate. Absorbable hemostatic dressings and silver nitrate cautery sticks can be used to specifically control small bleeding points. Alginates have been demonstrated to exhibit hemostatic effects and have been useful for heavily exudative wounds. Nonadherent gauze is an option that will absorb exudates without adhering to the wound bed. Significant bleeding events may require oral antifi brinolytics, radiotherapy, and embolization. Although vasoconstrictive effects can result in ischemia and consequently necrosis, gauze saturated with topical adrenaline 1:1,000 may be applied for emergent situations; however the patient should be monitored for systemic adsorption of the medications. These more aggressive options are appropriate if they will improve the quality of life in patients with a malignant wound.

6. Control odor

Interventions appropriate for control of odor include wound cleansing, use of wound deodorizers, debridement, and treatment of infection. Many of these interventions can be used simultaneously to aggressively attack the problem of odor. Grocott suggests three approaches for the management of odor: systemic antibiotics, topical antimicrobials, and charcoal dressings.

• **Topical Antimicrobials**

Antimicrobial creams and sodium–impregnated gauze both may assist in reducing bacterial numbers, thereby reducing odor. Dressings with an antimicrobial component that assist in controlling the wound bioburden include those that contain silver, iodine, or honey. Exudate can increase and become viscous and malodorous when a wound becomes infected. Infections are treated systemically, locally, or both. Oral metronidazole can be given as 200–mg tablets twice per day to reduce the anaerobic bacterial load in the wound. Although this treatment has been reported to be quite successful, notable adverse effects are metallic taste in mouth, furred tongue, nausea and vomiting, and intolerance to alcohol in addition to development of resistance to the bacteria. In contrast, topical metronidazole decreases bacterial load at the wound site but without the nausea and vomiting that sometimes accompanies oral metronidazole. Metronidazole has been applied directly to the wound or on petrolatum gauze and can be used in combination with calcium alginate, hydrofiber, or foam dressing. Seaman described crushing metronidazole tablets in sterile water and creating ether a 0.5% saluting or a 1% solution. The solution can then be used as a wound irrigant or used to saturate gauze and pack on the wound bed, including any tunnels or undermining.

Metronidazole gel is commercially available and can be applied to the wound bed and then covered with a salinesoaked gauze or hydrogel. Topical metronidazole is changed daily, and odor should be eradicated or greatly diminished between 3 and 7 days.

• **Charcoal Dressings**

Charcoal dressings can reduce odor b filtering out the chemicals that cause the odor and by absorbing bacteria. As an outer covering, charcoal–impregnated dressing can be used ether as a primary dressing or as a secondary dressing to suppress odor. These dressings are changed when they become moist and when the charcoal is saturated so that is no longer effective. Charcoal dressings are effective only when they are "sealed" around all four edges so that odor is forced to pass through the charcoal filter. Because some wounds are so irregularly shaped and the topography is so varied, securing the charcoal dressing may be too difficult to attain. Charcoal dressing may require changed ranging from daily to every 2 or 3 days depending on the extent of the odor. Charcoal dressings combined with an antimicrobial are available and serve the dual purpose of reducing bioburden and odor.

09. Cancerous Wound | References

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IO.

Scar

10. Scar

Definition

A degeneration occurred on the skin where a wound has healed. Scars can be dented due to a loss of dermal tissues or subcutaneous tissues, or raised due to abnormal growth of cellulose, such as collagen due to excessive stimulation.

Pathologic physiology

A normal regeneration of dermal tissues is impossible if the boundary of the dermis and epidermis is destroyed by stimulation; thus, the collagen layer is formed in an irregular shape. Sometimes, pigmentation or discoloration is accompanied due to dysplasia of melanin pigments.

Classification

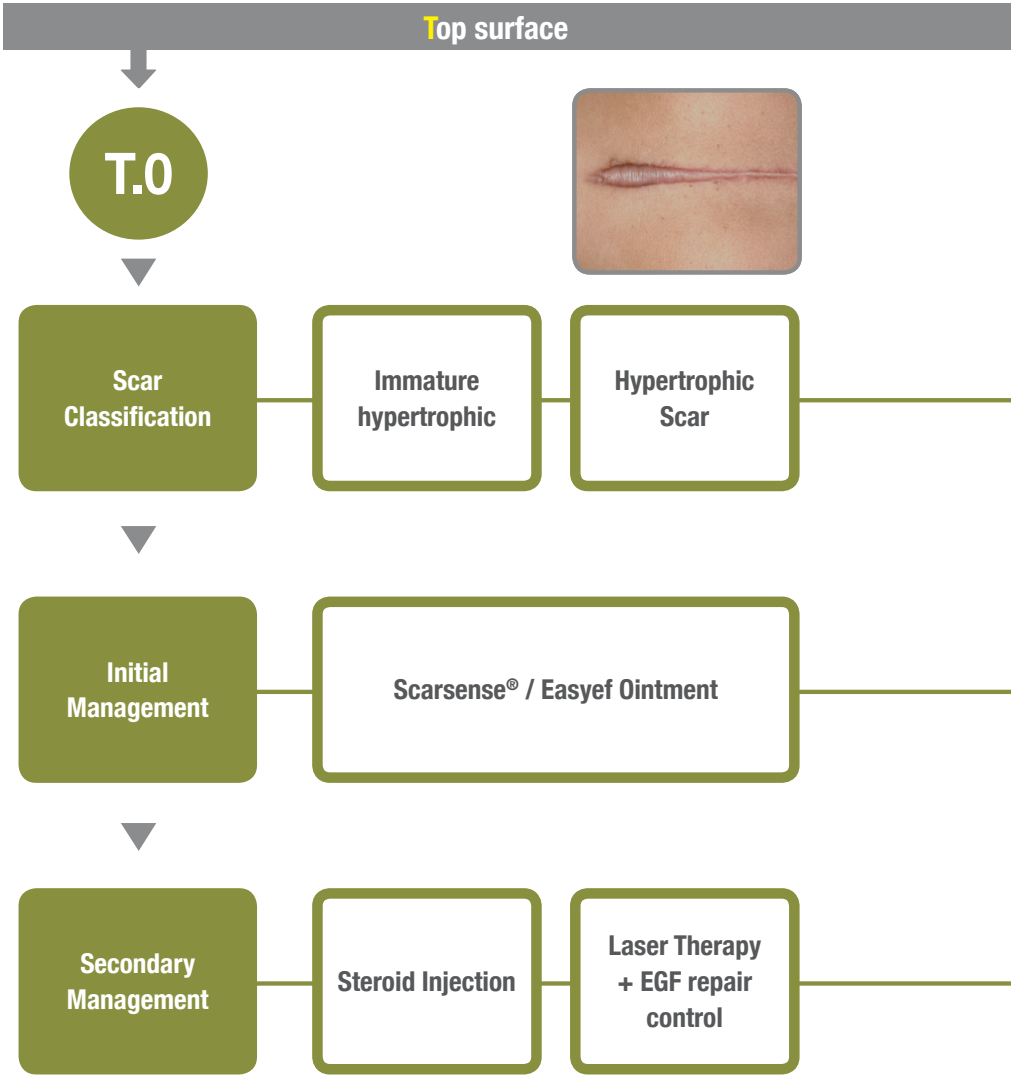
Scars are classified depending on the form as follows :

Hypertrophic	A red scar raised above the plane of the skin as the body forms excess tissues to withstand the tension in the damaged site. It is generally accompanied by itching and pain.
Keloid	A red scar raised above the plane of the skin beyond the damaged site after tissues are damaged.
Depressed	A depressed scar generated as tissues are damaged by a traumatic wound or inflammation.
Contracted	As a trace generated when the skin damage is deep or the wound has not been treated properly, the scar site is recessed slightly lower than normal skin.

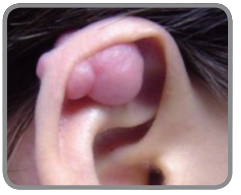
Treatment

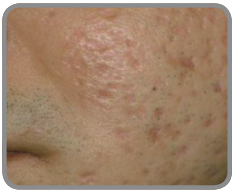
There are several scientifically proven methods, including steroid injection, compression therapy using silicone gel sheets, scar revision, and laser treatment. In case the scar is unsightly, radiation therapy or anticancer drugs can be used on rare occasions. A scar does not appear all of a sudden but about 3 months after the wound. Therefore, it is important to prevent scarring by taking appropriate measures in advance.[1–5]

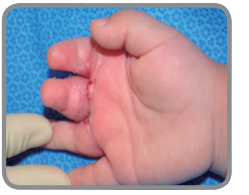
IO. Scar | ALGORITHM



Top surface







Keloid Scar

Depressed Scar

Contracted Scar

Taping

Laser Therapy

Adjunctives : Moisturizing cream (Easydew) / Sun block

Skin Resurfacing /Soft Tissue Filler (Facetem™)

Scar Revision /Scar Release and Coverage

10. Scar | Expert Opinion

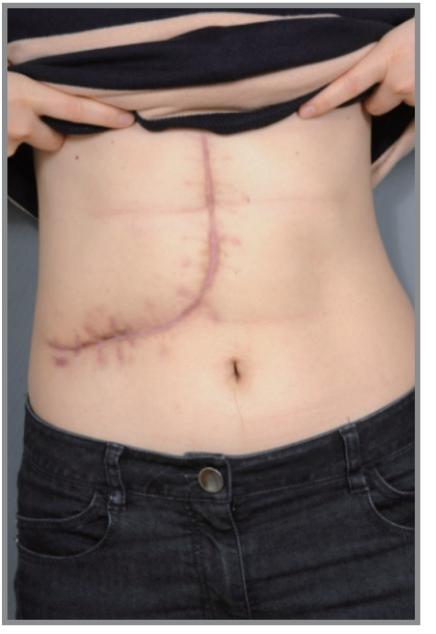
1. Marjolin's ulcers

Marjolin's ulcers are malignant tumors that arise in chronic ulcers, chronic scars, and chronic inflammation sites. Marjolin's ulcers are generally generated in the arms and legs. Cancers occur in about 0.1–2.9% of burn scars and more than 90% of the malignant tumors are squamous–cell cancers, basal cell cancers, and malignant melanomas. Very rarely, glandular cancer, malignant fibrous histiocytoma, liposarcoma, fibrosarcoma, and carcinosarcoma have been reported. Because Marjolin's ulcers have the possibility to become carcinosarcoma in the future, they require aggressive treatment after the definite diagnosis, and flap reconstruction is recommended in many cases.

2. Examples of surgery scar treatment

▷ **Patient**

A 20–year–old female patient visited the orthopedic clinic 2 months after liver donation surgery for the scar generated in the abdominal postoperative wound site after donating her liver to her father, who required liver transplantation due to liver cancer.



▷ **An example of treatment**

After the wound heals and the suture thread is removed, a scar becomes mature. Generally, it takes about 18 months for a scar to reach complete maturity. In the case of immature scars, unsightly scars should be prevented through the early treatment. At this time, a silicon gel sheet such as Scarsense® is useful. Laser treatments are also useful for preventing hypertrophic scars about 2 months after surgery. After laser treatment, Easydew repair control including EGF may be applied to promote epithelial regeneration. In particular, at this time, sunblock should be used in order to minimize the skin pigmentation.

As the scar comes to maturity, scar tissues may be hard to the touch. In such a case, steroid injections can be administered to the scar directly. If a keloid scar is generated beyond the wound site, surgical scar revision should be considered. The scar tissues basically tend to become dry during the entire process of the scar treatment. The application of Easydew helps stop the scar from getting dry.

3. Indications and expected effects for scar managements

Initial management

1) Scarsense®

- Indication : Applicable to all types of scars before scar maturation
- Expected effects : Scar prevention through reducing fibrogenesis and preventing moisture evaporation from scar surface

2) Easyef Ointment

- Indication : Applicable to all types of scars before scar maturation
- Expected effects : Scar prevention by promoting the wound healing process and forming mature scar faster

3) Taping

- Indication : Applicable to incisional wounds after suture removal
- Expected effects : Scar prevention by reducing tension on the suture site after stitch removal

4) Laser therapy (initial management)

- Indication : Applicable to all types of scars before scar maturation
- Expected effects : Scar prevention by suppressing fibrogenesis during scar maturation

5) Moisturizing cream (Easydew)

- Indication : Applicable to all types of scars before scar maturation
- Expected effects : Scar prevention by moisturizing the wound area and reducing fibrogenesis

6) Sunblock

- Indication : Applicable to all types of scars before scar maturation
- Expected effects : Prevention of pigmentation by blocking UV light

Secondary management

1) Steroid injection

- Indication : Applicable to hypertrophic scars or keloids.
- Expected effects : Reduction of the size of scar by minimizing inflammatory response

2) Laser therapy (Secondary management)

- Indication : Applicable to all types of mature scars
- Expected effects : Ablation of mature scars and induction of re-epithelialization

3) Soft tissue filler (Facetem™)

- Indication : Applicable to the depressed scars (including acne scars)
- Expected effects : Uplifting the depressed area by injecting it around depressed scars.

4) Scar revision

- Indication : Applicable to hypertrophic scars or keloids, or relaxation of contracted scars
- Expected effects : Reduction of the scar size by surgery and relaxation of contracted scars

10. Scar | References

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Chapter

III

Introduction of D+Wound Solution products

Easyef® dermal solution 0.005%

Easyef® is a recombinant human epidermal factor (rhEGF) external dermal agent, which has the same structure and activity as human EGF. As the world's first patented product to contain Nepidermin component, Easyef® facilitates the activity of epithelial cells and fibroblasts important in treating wounds.

Mechanisms

1. **Re-epithelialization**
   EGF promotes epithelial cells to proliferate and move to fill wounds quickly.
2. **Proliferation of granulation tissues**
   EGF stimulates fibroblasts in dermis to facilitate granulation tissues to proliferate.
3. **Angiogenesis**
   EGF promotes endothelial cells composed of blood vessels to move and proliferate to regenerate blood vessels.

Key Features

1. Korea's first new bio drug and the world's first EGF medicine.
2. Has the same structure and activity as EGF.
3. The efficacy has been proven as a result of various clinical trials; in particular, it showed a high cure rate of 73% for diabetic foot ulcer.

Indication

Diabetic foot ulcer[3, 11, 16, 25, 27, 28] burn[13] pressure ulcer[18] stomatitis[4, 7, 9, 12, 14, 17, 23, 24, 26] roentgen ulcer[8, 21, 22, 30] traumatic wound[2] and other various acute and chronic wounds[1, 5, 6, 10, 15, 19, 20, 29]

How to use

1. After removing the label of "Caution," hold the body with one hand and the injector portion of the container bottom with the other hand.
2. Turn the injector 360 degrees in the direction of the arrow.
   After a 2/3 rotation (240 degrees), more effort is required to turn the injector. However, keep rotating it to mix main components.
3. Turn the injector 360 degrees until the bump of the injector matches the arrow, it clicks, and the semi-circular transparent window turns to green. Use it when the window turns to green after turning it 360 degrees. (After turning it 360 degrees, do not turn it in the opposite direction.)
4. Remove the lid of the container in which mixing is completed and spray Easyef® evenly at a distance of 5 cm from the affected area. (Recommended use is twice a day.)

Storage Store at 2 ~8 ℃

Easyef® dermal solution 0.005%

Debridement of necrosis	D.0 D.1 D.2
Infection control	I.0 I.1
Revascularization	R.0 R.1
Exudate control	E.0 E.1 E.2 E.3
Chronicity evaluation	C.0 C.1
Top surface	T.0 T.1

D.0

Apply Easyef® when necrotic tissues are not present. If there are necrotic tissues, set a goal to make the affected area a state of D.0 though debridement, and then apply Easyef®.

I.0

Apply Easyef® when there is no infection. If there is an infection, ensure the affected area reaches a state of I.0 through appropriate measures before applying Easyef®.

E.0 E.1 E.2 E.3

In case the exudate amount is E.2–3, apply Easyef® along with CuraVAC®. When the exudate amount reaches E.1–2 after the wound has healed to some extent, apply EasyFoam™ and EasyDERM™ Plus as well.

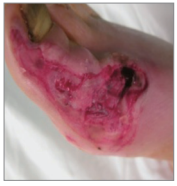
C.0 C.1

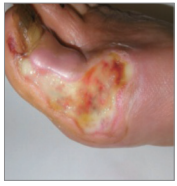
Easyef® can be applied not only to chronic ulcers caused by diabetes but also to acute wounds.

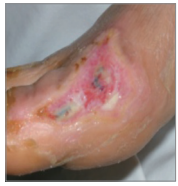
T.1

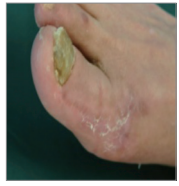
Easyef® may be applied in the state that has the largest affected area open.

• Case 1 – A 58–year–old female suffering from chronic diabetic foot ulcer over 6 months is presented.


▲ after debridement the wound

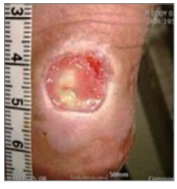

▲ compound dressing for 3 weeks

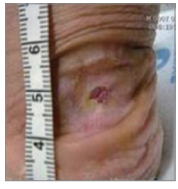

▲ application of Easyef® and compound dressing at 4 weeks


▲ fully epithelialized at 8 weeks

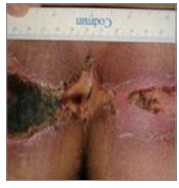
• Case 2 – stage 3 or 4 pressure ulcer [18]

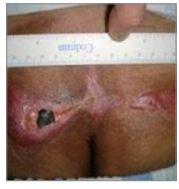
01


▲ Prior to treatment with Easyef®

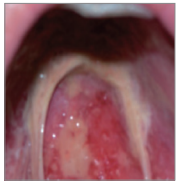

▲ 3 weeks of Easyef® treatment

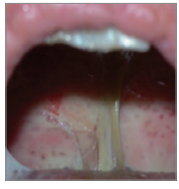
02


▲ Prior to treatment with Easyef®

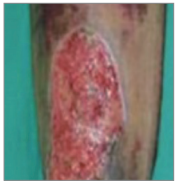

▲ 4 weeks of Easyef® treatment.

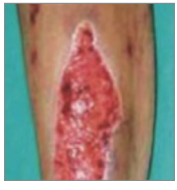
• Case 3 – patient with oral mucositis during radiation treatment [14]

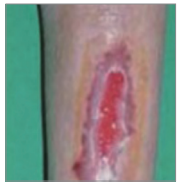

▲ RTOG grade 4 mucositis prior to treatment with Easyef®

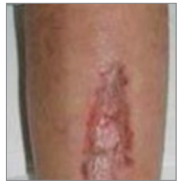

▲ Improvement to RTOG grade 2 after 1 week of treatment with Easyef®

• Case 4 – 35–year–old female patient using immunosupressant developed degloving injury due to acute mechanical trauma.[2]


▲ Before treatment


▲ Easyef® treatment after 4 weeks


▲ Easyef® treatment after 8 weeks


▲ Easyef® treatment after 12 weeks

Easyef® dermal solution 0.005%

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Easyef® dermal solution 0.005%

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23. Hong JP. The use of recombinant human epidermal growth factor(rh–EGF, Nepidermin) to minimize scar formation. J Wound Technol 2010; 10: 22–5.
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25. Kim EK, Li G, Lee TJ, Hong JP. The effect of human adipose–derived stem cells on healing of ischemic wounds in a diabetic nude mouse model. Plast Reconstr Surg 2011; 128(2): 387–94.
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27. Hong JP, Park SW. The combined effect of recombinant human epidermal growth factor and erythropoietin on full–thickness wound healing in diabetic rat model. Int Wound J 2012; doi: 10.1111/j.1742–481X.2012.01100.x.
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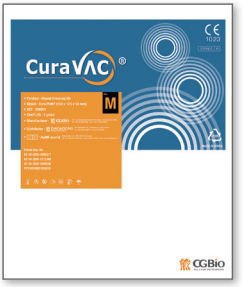
CuraVAC®



CuraVAC®/ KulaVAC® is a dressing foam for the application of negative pressure wound therapy (NPWT) to facilitate the formation of granulation tissue. The foam is hydrophobic and thus prevents contamination from exudate. The pores in the foam are interconnected and their diameter ranges 400–600m to remove excessive exudates efficiently.
CuraVAC®/ KulaVAC® is designed to be compatible with conventional wall suction to maximize convenience.

Mechanisms

1. **Removal of excessive interstitial fluid**
   - Acceleration of cell proliferation by reducing inflammatory cytokines
   - Reduction of bacterial count
   - Relief of wound edema
2. **Mechanical stress**
   - Stimulation of angiogenesis and microvascular blood flow velocity
   - Promoting mitogenesis of cells involved in wound repair process
3. **Moist wound environment**
   - Providing optimal condition for wound healing

Key Features

1. **Advanced concept of negative pressure application**
   - Cyclic mode improves tissue perfusion and reduces pain caused by negative pressure application[7].
2. **Convenient**
   - CuraVAC®/ KulaVAC® is compatible with conventional wall suction.
3. **Reasonable cost**
4. **Patent protection**
   - One-touch silicone suction head facilitates complete vacuum application.
   - The film dressing is not rolled up while it is applied to the foam dressing, permitting convenient application.

Indication

Diabetic foot ulcer[4], pressure ulcers, burns, skin grafts[1, 3, 9, 10], dehisced wounds[2], and other various acute and chronic wounds[5, 6, 7, 8, 11]

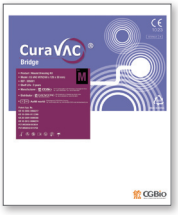
CuraVAC® Silver

CuraVAC®/ KulaVAC® Silver foam is a CuraVAC®/ KulaVAC® foam that contains silver. It is well known that silver has an excellent antiseptic effect, to which tolerance does not occur, and is harmless to the human body. For these reasons, silver has been widely used in medical supplies and medical equipment.

Key Features

1. Silver is uniformly applied on the surface of the polyurethane foam so that it can be released uniformly on the contact surface of the wound.
2. Silver is coated only on the surface so that the excellent effect of silver can be obtained without side effects, even with a small amount of silver.

CuraVAC® Bridge



As patients sometimes complain of pains due to physical contact when using CuraVAC®/ KulaVAC® in the wounds by the soles or elbows, CuraVAC®/ KulaVAC® Bridge Foam is a product that has been developed to improve this situation. It is designed so that bridges are connected to wounds in curved sites, such as the back, hips, and heels to make exudate move along the bridges. Therefore, the CuraVAC®/ KulaVAC® Bridge provides a new level of convenience.

Key Features

1. A CuraVAC®/ KulaVAC® Bridge can be applied to all curved sites or any sites to which pressure is applied. It is made to maximize the mobility and convenience of patients.
2. For the bridge foam, double film dressing is applied. It protects the skin of the bridge connection site.

How to use

1. Cut the foam dressing to fit the size and shape of the wound.
2. After attaching a 10X79 cm film dressing with no hole onto the skin to be covered with bridge foam, remove the protective film.
3. Place the foam and bridge foam onto the wound site so that the edges overlap, as shown in the figure.
4. Place the bridge foam over the pre-attached film dressing.
5. Cut the 35X35 film dressing properly, and remove the release paper and protective film to fix the foam.
6. Place a suction head on a round site and remove the release paper of the 10X79 cm film dressing with a hole and attach it to the foam.
7. Remove the protective film of the film dressing covering the entire part of the suction head and bridge foam.
8. Connect a tube to the suction head (connect the connected tube to the negative pressure source).

CuraVAC®

Debridement of necrosis	D.0 D.1 D.2
Infection control	I.0 I.1
Revascularization	R.0 R.1
Exudate control	E.0 E.1 E.2 E.3
Chronicity evaluation	C.0 C.1
Top surface	T.0 T.1

D.0

Apply CuraVAC® to the sites where necrotic tissues are not present. If there are necrotic tissues, bring the affected area to a state of D.0 though debridement, and then apply CuraVAC®.

I.0 I.1

Apply CuraVAC® when there is no infection. If there is an infection, ensure that the affected areas reach a state of I.0 through appropriate measures before applying CuraVAC®. Depending on the degree and status of infection, CuraVAC® may be changed more frequently or used along with irrigation system at the judgment of the surgeon. CuraVAC® Silver is also available.

R.0

Do not use CuraVAC® in the affected area where ischemia is confirmed, and apply CuraVAC® only after proper revascularization has been performed.

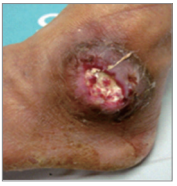
E.1 E.2 E.3

In the case of E.3, apply CuraVAC® for the purpose of controlling the exudate. Even for E.1 or E.2 patients, CuraVAC® may be applied for the purpose of causing the granulation tissues to proliferate.

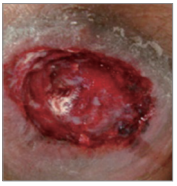
T.0 T.1

CuraVAC® can be applied to open wound or closed incisional wound with underlying dead space.

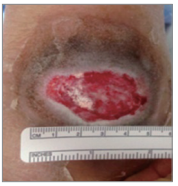
• Case 1 – A 70–year–old male patient who has suffered from gout for 20 years[6]



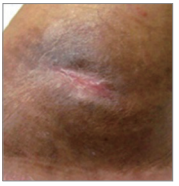
▲ Skin defects, flare, and purulent exudate are observed



▲ After surgical debridement

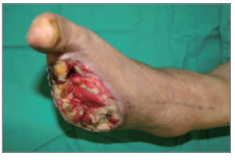


▲ Application of CuraVAC® for 6 weeks. The soft tissue defect site is completely filled with granulation tissues

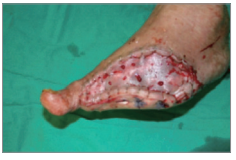


▲ 4 weeks after removing CuraVAC® (total 10 weeks). The wound is completely healed and currently being epithelialized.

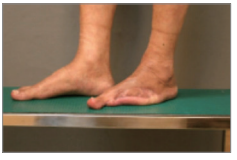
• Case 2 – A–71–year–old male patient who has suffered from diabetic foot[9]



▲ After percutaneous transluminal angioplasty, before skin graft



▲ After grafting of CGDerm™ and STSG



▲ 6 months after application of CuraVAC® with cyclic mode for 10 days. Graft remained soft without any hypertrophic scar.

CuraVAC®

Product Publication List

1. Kim EK, Hong JP. Efficacy of negative therapy to enhance take of 1–stage allodermis and a split–thickness graft. Ann Plast Surg 2007; 58: 536–40.
2. Lee KN, Seo DM, Hong JP. The effect and safety after extended use of continuous negative pressure of 75 mmHg over mesh and allodermis graft on open sternal wound from oversized heart transplant in a 3–month–old infant. Int Wound J 2010; 7(5): 379–84.
3. Lee SP, Ji SY, Lee JW, Yang WS. Efficacy of CuraVAC® system to enhance skin graft survival in chronic intractable wound. J Korean Wound Management Soc 2010; 6(1): 18–24.
4. Kim BJ, Suk JH, Jo AR, et al. Negative–pressure wound therapy using modified vacuum–assisted closure in patients with diabetic foot ulcers. J Korean Diabetes 2011; 12(2): 122–7.
5. Han WS, Kim K. Acute postpneumonectomy empyema with bronchopleural fistula treated with vacuum–assisted closure device. Korean J Thorac Cardiovasc Surg 2012; 45(4): 260–2.
6. Kim YH, Kim JS, Young KW, Lee HS, Hur JU, Lee KT. Treatment of a chronic gouty ulcer on the lateral malleolus with vacuum–assisted closure (VAC) therapy. J Rheum Dis 2012; 19(4): 230–3.
7. Lee KN, Ben–Nakhi M, Park EJ, Hong JP. Cyclic negative pressure wound therapy: an alternative mode to intermittent system. Int Wound J 2013; doi: 10.1111/iwj.12201.
8. Oh BH, Lee SH, Nam KA, Lee HB, Chung KY. Comparison of negative pressure wound therapy and secondary intention healing after excision of acral lentiginous melanoma on the foot. Br J Dermatol 2013; 168(2): 333–8.
9. Suh H, Hong JP. One stage allogenic acellular dermal matrices (ADM) and split–thickness skin graft with negative pressure wound therapy. InTech. 2013; http://dx.doi.org/10.5772/53304.
10. Lee KT, Pyon JK, Lim SY, Mun GH, Oh KS, Bang SI. Negative–pressure wound dressings to secure split–thickness skin grafts in the perineum. Int Wound J 2014; 11(2): 223–7.
11. Suh H, Lee AY, Park EJ, Hong JP. Negative pressure wound therapy on closed surgical wounds with dead space: animal study using a swine model. Ann Plast Surg 2014; doi: 10.1097/SAP.0000000000000231.

Curasys™

Curasys™ is a motorized medical aspirator for applying negative pressure. A certain negative pressure is applied to dressing foam (CuraVAC®/ KulaVAC®) covering the wound and stimulates the formation of granulation tissues by physical stimulus.[2, 3]

Key Features

1. The unique cyclic mode of Curasys™ not only maximizes the effect of the application of negative pressure but also reduces the patient's pain.[1]
2. Curasys™ can be normally operated for more than 12 hours when the battery is fully charged, so it has mobility and convenience.
3. With a lightweight design (890 g), it can be used conveniently, even on the bed or wheelchair. It provides mobility to the patient.
4. When an alarm and a warning light display the same function at the time of failure, it can be used safely.

How to use

1. Assemble all components, and press the orange power button on the left side of the product to turn it on. The initial pressure value is set at –125 mmHg.
2. Adjust the mode and pressure settings using the buttons on the front panel, and then press the Start/Stop button to activate the therapy.
3. If there is no button input for a certain period of time, it enters the lock mode. Press any key for more than 2 seconds to exit the lock mode.
4. Press any button when the alarm sounds, then it will enter silent mode.
5. Operate it after verifying whether it is in vacuum.
6. When the use is over, press the power button on the left side for about 2 seconds to turn off the unit.

Product Publication List

1. Lee KN, Ben–Nakhi M, Park EJ, Hong JP. Cyclic negative pressure wound therapy: an alternative mode to intermittent system. Int Wound J 2013; doi: 10.1111/iwj.12201.
2. Suh H, Hong JP. One stage allogenic acellular dermal matrices (ADM) and split–thickness skin graft with negative pressure wound therapy. InTech. 2013; http://dx.doi.org/10.5772/53304.
3. Lee KT, Pyon JK, Lim SY, Mun GH, Oh KS, Bang SI. Negative–pressure wound dressings to secure split–thickness skin grafts in the perineum. Int Wound J 2014; 11(2): 223–7.

CGDerm™
CGCRYODERM®

CGDerm™/CGCRYODERM® is an acellular dermal matrix that has been processed from donated human dermal tissues. With CGBio's patented technology, the cells in the epidermis layer and dermis, which are antigen targets of the cell-mediated immune response, are removed, and a lyophilization (CGDerm™) or a freezing procedure (CGCRYODERM®) is passed through to maintain the three-dimensional structure of the dermis layer. Therefore, in the absence of an immune response, it provides a framework necessary for the influx of fibroblasts and regeneration of nerves and blood vessels, which are the roles of the dermis. Therefore, soft tissue defects may be treated safely and effectively in burn and reconstructive plastic surgery patients with CGDerm™/CGCRYODERM®.

Key Features

1. **Excellent safety certified by the Food and Drug Administration (FDA)**
   CGDerm™/CGCRYODERM® has passed all safety screening criteria of the Korean Food and Drug Administration (KFDA) and the United States Food and Drug Administration (US FDA).
2. **Engrafted promptly to the affected area after transplantation**
   After transplantation, the graft shows a minimal absorption rate, and it re-vascularized quickly. In this way, skin is engrafted promptly to the tissue of a patient.
3. **Simply operable with various specifications**
   It is provided as various specifications depending on its intended use, and surgery is possible at one stage.

How to use

1. **For CGDerm™, make preparations for rehydration for about 30 minutes.**
   (1) Insert it into the first bottle in an aseptic way.
   (2) Fill a sheet of CGDerm™ with a physiological saline solution of 100~200 ml, and rehydrate it for at least 10 minutes.
   (3) Transfer it to the second bottle in an aseptic way. Again, fill a sheet of CGDerm™ with a physiological saline solution of 100~200 ml.
   (4) The rehydrated CGDerm™ must be used within 4 hours.
2. **For the CGCRYODERM®, stabilize it in the physiological saline at room temperature for 30~60 sec.**
   (1) Melt it until all the ice thaws in the physiological saline of 36℃~38℃, and maintain 36℃~38℃ by constantly adding more saline solution.
   (2) Let the solution thaw for 10~30 minutes depending on the amount of tissue graft materials.
   (3) When thawing is complete, open the last package and place the tissues in a sterile bottle.
   (4) Conduct a step-by-step washing in order to remove residual reagents used during processing.
   (5) Wrap it with gauze moistened with physiological saline to prevent the tissues from becoming dry.
3. **For the prepared tissues, trim them to an appropriate size, and perform a transplant.**

Indication

Transplantation to a site whose tissues were defective was due to various causes[1, 2], including breast reconstruction[3] and abdominal wall reconstruction

CGDerm™
CGCRYODERM®

Debridement of necrosis	D.0 D.1 D.2
Infection control	I.0 I.1
Revascularization	R.0 R.1
Exudate control	E.0 E.1 E.2 E.3
Chronicity evaluation	C.0 C.1
Top surface	T.0 T.1

D.0

Apply CGDerm™/CGCRYODERM® to the sites where necrotic tissues are not present. If there are necrotic tissues, bring the affected area to a state of D.0 though debridement, and then apply CGDerm™/CGCRYODERM®.

I.0

Apply CGDerm™/CGCRYODERM® when there is no infection. If there is an infection, ensure that the affected areas reach a state of I.0 through appropriate measures before applying CGDerm™/CGCRYODERM®.

R.0

Do not use CGDerm™/CGCRYODERM® in the affected area where ischemia is confirmed, and apply CGDerm™/CGCRYODERM® only after proper revascularization has been performed for successful engrafting.

E.1 E.2 E.3

Apply CGDerm™/CGCRYODERM® after controlling the exudate in advance.

T.1

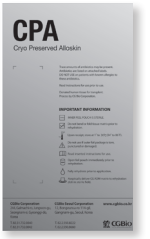
CGDerm™/CGCRYODERM® can be applied if the affected area is open.

Product Publication List

1. Kim EK, Hong JP. Efficacy of negative pressure therapy to enhance take of 1–stage allodermis and a split–thickness graft. Annals Plast Surg 2007; 58(5): 536–40.
2. Suh H, Hong JP. One stage allogenic acellular dermal matrices (ADM) and split–thickness skin graft with negative pressure wound therapy. InTech 2013; http://dx.doi.org/10.5772/53304.
3. Lee JH, Park KR, Kim TG, et al. A comparative study of CGCryoDerm and AlloDerm in direct–to–implant immediate breast reconstruction. Arch Plast Surg 2013; 40(4): 374–9.

CPA

Cryo Preserved Alloskin



CPA is allografted skin preserved in an anti–cold damage solution after asepticizing the human dermal tissue (including the epithelium and some of the dermis) donated from a tissue donor. As a biologic dressing solution that is applied to the site of skin defects, CPA forms a temporary protective wall and provides a biologic environment so that the wound can be healed.

Key Features

1. There is no secondary wound caused by skin picking when compared to an autogenous graft.
2. The CPA may be used as needed if it is stored in a freezer.
3. When compared to allograft skin preserved in glycerol, the activity of cells in CPA is superior, so the treatment effect is excellent.
4. CPA minimizes the infection rate of burn wound sites by protecting the affected area.
5. Nutrients, such as protein, are helpful in wound healing inside the dressing and are supplied to burned skin, which helps the tissue regeneration.
6. It protects the eschar excision site after eschar excision surgery in a patient with a wide range of burns, and it helps maintain body temperature.

How to use

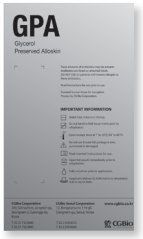
Store it at a cryogenic refrigerator (below −70℃), and thaw the frozen skin at 37℃ before using it on a patient. Wash it for 5 minutes using physiological saline before use.

Indication

Escharotomy due to a wide range of burns, treatments of skin–damaged portions due to burns or chronic diseases, prevention of infection from a damaged skin portion, temporary wound site protection before split thickness skin graft, and external dressing after an autogenous skin graft.

GPA

Glycerol
Preserved Alloskin



GPA is an allograft skin preserved by being immersed in 85% glycerol after asepticizing the human dermal tissue (including the epithelium and some of the dermis) donated from a tissue donor. As a biologic dressing applied to the site where the skin defects are generated, GPA has a role as a temporary protective wall and provides a biologic environment in which that the wound may heal.

Key Features

1. There is no secondary wound caused by skin picking when compared to autogenous grafting.
2. Compared to cryopreserved allograft skin or synthetic skin alternatives, the cost is low, and GPA can be handled easily and conveniently, so it is easy to transport and use.
3. Cold storage is both possible and very simple. And, as there is no special processing process that may affect the state's actions regarding the tissues, there was no tissue damage even at room temperature.
4. The GPA minimizes the infection of the burn wound site by protecting the affected area.
5. Nutrients, such as protein, are helpful in wound healing because nutrient supplies are placed inside the dressing to aid in tissue regeneration.
6. GPA protects the eschar excision site after eschar excision surgery in a patient with a wide range of burns, and it helps maintain the body temperature.

How to use

Store it at 4℃, and wash it for 4~10 minutes using physiological saline to remove glycerol before use.

Indication

Escharotomy due to a wide range of burns, treatments of skin–damaged portions due to burns or chronic diseases, prevention of infection from a damaged skin portion, temporary wound site protection before split thickness skin graft, and external dressing after an autogenous skin graft.

CPA
Cryo Preserved Alloskin

GPA
Glycerol
Preserved Alloskin

Debridement of necrosis	D.0 D.1 D.2
Infection control	I.0 I.1
Revascularization	R.0 R.1
Exudate control	E.0 E.1 E.2 E.3
Chronicity evaluation	C.0 C.1
Top surface	T.0 T.1

D.0	Apply CPA/GPA to the sites where necrotic tissues are not present. If there are necrotic tissues, bring the affected area to a state of D.0 though debridement, and then apply CPA/GPA.
I.0	Apply CPA/GPA when there is no infection. If there is an infection, ensure that the affected areas reach a state of I.0 through appropriate measures before applying CPA/GPA.
R.0	Do not use CPA/GPA in the affected area where ischemia is confirmed, and apply CPA/GPA only after proper revascularization has been performed for successful engrafting.
E.1 E.2 E.3	Apply CPA/GPA after controlling the exudate in advance.
T.1	CPA/GPA can be applied if the affected area is open.

EasyFoam™

The Professional's Choice

EasyFoam™ is a foam dressing product that is composed of hydrophilic polymer particles, which has an excellent exudate absorption capacity compared to conventional products and maintains its moist condition by fixing the moisture. In addition, it has excellent adhesion and excellent keeping capacity, thereby preventing erosion.

Mechanisms

Wound healing is accelerated in a wet state containing a moderate amount of moisture than in a dry state. In addition, as the exudate secreted from the wound contains a lot of growth factors needed for skin regeneration, rapid formation of the epithelium and skin regeneration is desireable. EasyFoam™ keeps the wound site moistened, so it allows the wound to heal faster.

Key Features

1. Vertical Diffusion Technology (VDT)
   - It absorbs exudate vertically, by which it prevents erosion.
2. The method of hydrophilic polymer formation was as follows:
   - As its moisture content (32%) is high, EasyFoam™ will easily adhere even to curved surfaces, and it has a high keeping capacity.
   - It forms a wet environment even when applied to a dry wound.
3. A small pore size less than 100 μm
   - EasyFoam™ alleviates a patient's pain at the time of replacement of the dressing.
4. Excellent absorption and absorption rate – It prevents erosion around the wound by quickly absorbing excessive exudate.

Indication

Diabetic foot ulcer, pressure ulcer, traumatic wound, venous ulcer, arterial ulcer, burn, post-operative wound, dehisced wound, cancerous wound, and wounds with heavy exudate such as skin grafts and donor sites.

How to use

1. Wash the wound site with running water or physiological saline. In case an antiseptic solution is used for the infected wound, wash it with sterilized physiological saline so that no antiseptic solution is left.
2. After selecting a product larger than the size of the wound site, remove the packing, take out the wound dressing using tweezers and remove the release film.
3. Using tweezers, apply the side on which the release film was attached to the wound site, paying attention to cover the wound site completely.
4. Fix it to a product using adhesive dressing or an elastic bandage. At this time, it may irritate the skin. Thus, be careful not to attach it too tightly.
5. In case the exudate secreted from the wound is heavy and leakage is expected, replace it frequently. If there is no leak of exudate and no clinical sign of infection, replace it after 3~4 days.

EasyFoam™
The Professional's Choice

Debridement of necrosis	D.0 D.1 D.2
Infection control	I.0 I.1
Revascularization	R.0 R.1
Exudate control	E.0 E.1 E.2 E.3
Chronicity evaluation	C.0 C.1
Top surface	T.0 T.1

D.0 D.1 D.2

I.0 I.1

R.0 R.1

E.0 E.1 E.2 E.3

C.0 C.1

T.0 T.1

EasyFoam™ can be applied to various types of wound for the protection of the affected area and exudate control.

100% Hydrocolloid Dressing

EasyDERM™ Plus

EasyDERM™ Plus is a 100% hydrocolloid dressing that is a safe product even for patients with sensitive skin because it does not use a cross linking agent, and hydrophilic polymers are connected to each other, unlike existing products.

Mechanisms

An appropriate moist environment of a wound reduces the wound healing period by promoting movement and proliferation of epithelial cells. EasyDERM™ Plus allows wounds to heal faster with excellent exudate management feature.

Key Features

1. **UV protection (=SFP 50)**
   With SFP 50, it prevents pigmentation of the wound site.
2. **100% hydrocolloid**
   It is a hypo-allergenic dressing with no odor/no color/no preservatives. The skin irritation index has been proved as "0.0" by the skin irritation test conducted by the investigation for the Korea Testing and Research Institute. It has obtained a certificate as a non-allergic product from the British Allergy Foundation.
3. **Breathing moist dressing**
   It has a 3-7 times higher absorption capacity and very excellent water vapor permeability compared to competitor's products.

Indication

Abrasions, slight burns, postoperative wounds, wounds with a small amount of exudate, such as a pressure ulcer (1st stage~2nd stage).

100% Hydrocolloid Dressing

EasyDERM™ Plus

Debridement of necrosis	D.0 D.1 D.2
Infection control	I.0 I.1
Revascularization	R.0 R.1
Exudate control	E.0 E.1 E.2 E.3
Chronicity evaluation	C.0 C.1
Top surface	T.0 T.1

D.0 D.1

Apply EasyDERM™ Plus to the sites where necrotic tissues are not present. In case of D.2, bring the affected area to a state of D.0 though debridement, and then apply EasyDERM™ Plus. For D.1, EasyDERM™ Plus may be used to soften the wound area.

I.0

Apply EasyDERM™ Plus when there is no infection. If there is an infection, ensure that the affected areas reach a state of I.0 through appropriate measures before applying EasyDERM™ Plus.

E.0 E.1 E.2

EasyDERM™ Plus is applicable to the wound with little or almost no exudate.

T.0 T.1

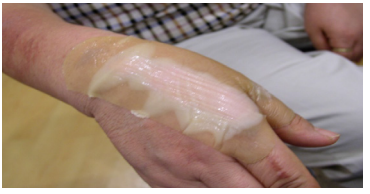
EasyDERM™ Plus is for closed or superfical wound.

EasyFoam™ The Professional's Choice

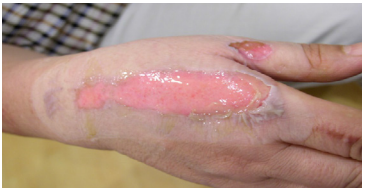
100% Hydrocolloid Dressing EasyDERM™ Plus

The selection of an appropriate dressing according to the state of the wound

An example of improper use

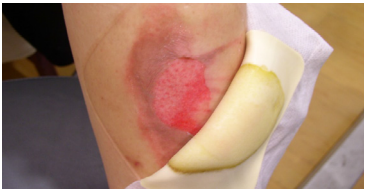


Application of hydrocolloid dressing
to the wound with heavy exudate
–〉 The exudate was not absorbed enough

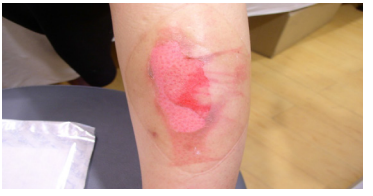


Generation of maceration around the wound
as the exudate spreads to the side.
–〉 Induction of a secondary wound

An example of proper use



Application of an appropriate foam dressing to
a wound with a large quantity of exudate
–〉 Excessive exudate is absorbed in the foam dressing, and an environment suitable for wound healing is shaped.



Epithelialization is formed properly,
and the wound is healed.

Easyef Saesal Ointment

Easyef Ointment is a wound treatment ointment containing recombinant human Epidermal Growth Factor (rhEGF), the growth factor for granulation tissues and epithelial cells.

Mechanisms

1. **Re-epithelialization**
   EGF promotes epithelial cells to proliferate and move to fill wounds quickly.
2. **Proliferation of granulation tissues**
   EGF stimulates fibroblasts in dermis to facilitate granulation tissues to proliferate.
3. **Angiogenesis**
   EGF promotes endothelial cells composed of blood vessels to move and proliferate to regenerate blood vessels.

Key Features

1. It heals wounds quickly and safely with EGF.
   EGF promotes epithelial cells to proliferate and move to fill wounds.
2. No steroids or antibiotics
   It is safe because it does not contain steroids with side effects or antibiotics with a concern over resistance.
3. It is a proven ointment that completed the 1, 2, and 3-phase tests for the first time in the country. It has demonstrated its safety and therapeutic efficacy through national clinical trials.

Indication

Topical application of various types of acute and chronic wounds[1-4]

How to use

Apply it on the affected area multiple times a day

Storage

Store at 2 ~ 8 ℃

Easyef Saesal Ointment

Debridement of necrosis	D.0 D.1 D.2
Infection control	I.0 I.1
Revascularization	R.0 R.1
Exudate control	E.0 E.1 E.2 E.3
Chronicity evaluation	C.0 C.1
Top surface	T.0 T.1

D.0

Apply Easyef Ointment to the sites where necrotic tissues are not present. If there are necrotic tissues, bring the affected area to a state of D.0 though debridement, and then apply Easyef Ointment.

I.0

Apply Easyef Ointment when there is no infection. If there is an infection, ensure that the affected areas reach a state of I.0 through appropriate measures before applying Easyef Ointment.

E.0 E.1 E.2

E.0~1 : After applying the Easyef Ointment, use gauze or a band as a secondary dressing.

E.2 : After applying the Easyef Ointment, use EasyFoam™ as a secondary dressing.

T.0 T.1

After most granulation tissues are raised to the epidermis layer, apply the Easyef Ointment.

Product Publication List

1. Hong JP, Kim YW, Jung HD, Jung KI. The effect of various concentrations of human recombinant epidermal growth factor on split-thickness skin wounds. Int Wound J 2006; 3(2): 123-30.
2. Kwon YB, Kim HW, Roh DH, Yoon SY, Baek RM, Kim JY, Kweon HY, Lee KG, Park YH, Lee JH. Topical application of epidermal growth factor accelerates wound healing by myofibroblast proliferation and collagen synthesis in rat. J Vet Sci 2006; 7(2): 105-9.
3. Hong JP. The use of recombinant human epidermal growth factor(rh-EGF, Nepidermin) to minimize scar formation. J Wound Technol 2010; 10: 22-5.
4. Kim YS, Lew DH, Tark KC, Rah DK, Hong JP. Effect of recombinant human epidermal growth factor against cutaneous scar formation in murine full-thickness wound healing. J Korean Med Sci 2010; 25(4): 589-96.

Scarsense®

Scarsense® is a silicone gel sheet, which is effective and safe as the first medicine for managing scars when the wound is completely healed and scars are left behind. By providing an optimal environment to remove a scar by controlling moisture, pressure, and temperature properly, it prevents hypertrophic scars and keloid scars and blocks their pigmentation.

Mechanisms

1. **Prevention of the loss of moisture**
   Hydration of the stratum corneum –〉 increased oxygen partial pressure –〉 decreased angiogenesis –〉 reduction of collagen being generated –〉 scar contraction
2. **Temperature rise**
   Temperature rise –〉 activation of collagenase –〉 degradation of collagen –〉 scar contraction
3. **Formation of an electrostatic field**
   Friction between the sheet and the skin –〉 formation of an electrostatic field -〉 redistribution of collagen –〉 scar contraction

Key Features

1. **Thin and flexible sheet**
   With excellent elasticity and adhesion through silicone technology, it can expand and contract along with the skin.
2. **Breathing high-tech sheet**
   Oxygen is transmitted through the sheet. It enters from the wound site, and the excess carbon dioxide is discharged to the outside, by which it maintains the proper level of moisture.
3. **UV-blocking function**
   The fabric type is the only product that can block ultraviolet light as the surface is coated with silk fabric.

Indication

Hypertrophic scars, keloid scars, all scars, pigmented scars

Scarsense®

How to use

1. Wash the site thoroughly with physiological saline and dry it.
2. Cut the product to fit the application site (enough to cover the scar).
3. Remove the release paper that protects the product. Keep the protective paper (white) for reuse.
4. Attach the adhesive part to the application site. Use it for 12–23 hours a day depending on the state of the application site.
5. Cleanse the product and the application site at least once a day.
6. Wash it with water and dry it before reuse.

Scarsense®

Top surface T.0 T.1

T.0

Scarsense® should not be used with an open wound :
wait to apply until the wound is completely healed and the scar is left.

Easydew
Containing DW EGF

Easydew is a cosmetic used only in the clinic to recover damaged skin quickly by containing high activity, high-purity rhEGF in the form of nano-liposomes and by keeping the skin moist with natural moisturizing components.

Mechanisms

1. **Re-epithelialization**
   EGF promotes epithelial cells to proliferate and move to fill wounds quickly.
2. **Proliferation of granulation tissues**
   EGF stimulates fibroblasts in dermis to facilitate granulation tissues to proliferate.
3. **Angiogenesis**
   EGF promotes endothelial cells composed of blood vessels to move and proliferate to regenerate blood vessels.

Key Features

1. **Skin regeneration and protection**
   Nano-liposomal EGF and madecassoside components stabilize the damaged skin and protect it.
2. **Formation of a skin barrier**
   By containing aquaxyl, a patented moisturizing ingredient, plant-derived oils, and natural ceramides, it improves skin elasticity and moisturization.
3. **Strong moisturization and skin immunity**
   By containing 100% natural moisturizing components without steroids, it has powerful moisturizing effects.
4. **No addition of three irritating components**
   (artificial pigments, mineral oil, parabens)

Indication

Xerosis, wrinkle improvement, Skin care after laser treatment[1, 2, 3, 5], radiation dermatitis[4, 6, 7]

How to use

1. Prevent future wounds by applying it to dry skin frequently.
2. Manage the damaged skin by applying it around the ulcer frequently.
3. Apply it in the morning and again in the evening after laser treatment, and the pigmentation and scar may be prevented.

Easydew
Containing DW EGF

Top surface

T.0 T.1

T.0

Easydew can be applied to closed area.

Product Publication List

1. Ryu SH, Kim YH, Lee SW, Hong JP. The preventive effect of recombinant human growth factor (rhEGF) on the recurrence of radiodermatitis. J Radiat Res 2010; 51(5): 511–7.
2. Rhee DY, Park GH, Rho NK, Chang SE. The prediction and prevention of laser–induced post–inflammatory hyperpigmentation. . Korean J Cosmet Dermatol 2012; 9: 38–41.
3. Ben–Nakhi M, Park EJ, Hong JP. The combined use of recombinant human epidermal growth factor (rh–EGF, Nepidermin) and fractional carbon dioxide laser in reducing cutaneous scar formation. J Wound Technol 2012; 15: 18–20.
4. Kong M, Hong SE. Topical use of recombinant human epidermal growth factor (EGF)–based cream to prevent radiation dermatitis in breast cancer patients: a single–blind randomized preliminary study. Asian Pac J Cancer Prev 2013; 14(8): 4859–64.
5. Yun WJ, Bang SH, Min KH, Kim SW, Lee MW, Chang SE. Epidermal growth factor and epidermal growth factor signaling attenuate laser–induced melanogenesis. Dermatol Surg 2013; 39(12): 1903–11.
6. Kang HC, Ahn SD, Choi DH, Kang MK, Chung WK, Wu HG. The safety and efficacy of EGF–based cream for the treatment of radiotherapy–induced skin injury: Results from a multicenter observational study. Radiat Oncol J 2014.
7. Lee JH, Lee SW, Hong JP, Shon MW, Ryu SH, Ahn SD. Foam dressing with epidermal growth factor for severe radiation dermatitis in head and neck cancer patients. Int Wound J 2014; doi: 10.1111/iwj.12317.

Chapter

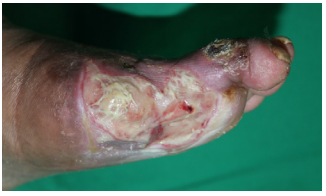
IV

Case study of the D+Wound Solution

Case study of the D+Wound Solution at all stages of wound healing

Case 01. Diabetic Foot Ulcer

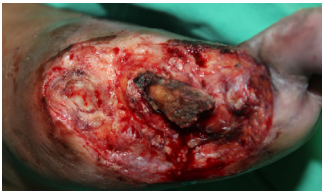
01



D.2 I.1 R.1 E.3 C.1 T.1

The diabetic foot ulcer is covered with sloughy dead tissues and accompanied by a heavy odor due to infection. A previously grafted material is not observed any more.

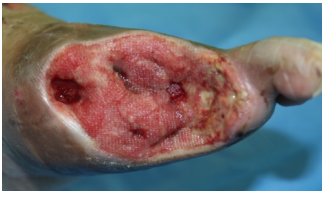
02



D.0 I.0 R.1 E.3 C.1 T.1

Debridement was performed first. EasyFoam™ was applied after daily cleansing of the wound. After the infection control, the exposed bone was amputated up to the distal foot area.

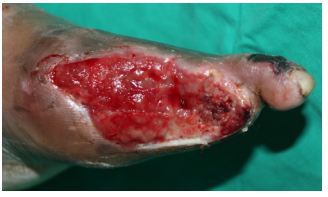
03



D.0 I.0 R.1 E.2 C.1 T.1

The granulation tissue was formated after the application of CGDerm™ paste and CuraVAC®.

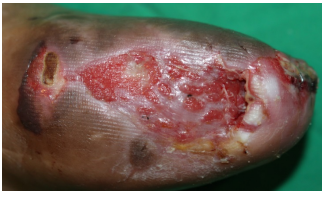
04



D.0 I.0 R.1 E.2 C.1 T.1

The wound was covered with CGCRYODERM® and CuraVAC® was applied further for more granulation tissue formation. Later, the wound area was dressed with EasyFoam™ after spraying Easyef®.

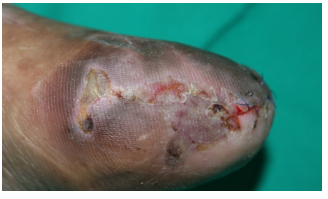
05



D.0 I.0 R.1 E.1 C.1 T.1

Ischemic necrosis was progressed in the rest of the toes, which were amputated. For promoting epithelialization, Easyef® was continuously applied and the wound was covered with EasyFoam™ for absorbing exudate and protecting the affected area.

06



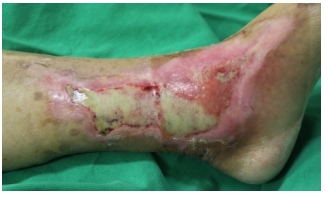
D.0 I.0 R.1 E.0 C.1 T.0

Easyef® and EasyFoam™ was continuously applied until the wound area is fully epithelialized. After complete wound healing, Easydew was applied for sufficient moisturization.

Case study of the D+Wound Solution at all stages of wound healing

Case 02. Venous Ulcer

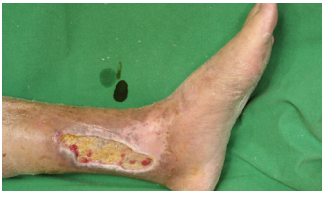
01



D.2 I.0 R.0 E.3 C.0 T.0

The wound represents the initial stage of venous ulcer. EasyFoam™ (5 mm) and compression therapy are applicable.

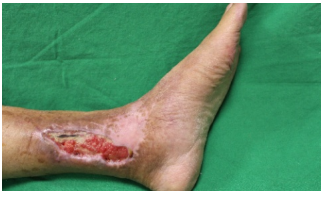
02



D.2 I.0 R.0 E.2 C.0 T.1

Four weeks have passed since the occurrence of a venous ulcer. Partial debridement was performed on the demarcated necrosis area. EasyFoam™ (2 mm) and compression therapy were applied. If patients compliance in the compression therapy, CuraVAC® / CuraVAC® Silver in a low pressure setting may be used if care is taken not to interrupt the blood flow of the artery.

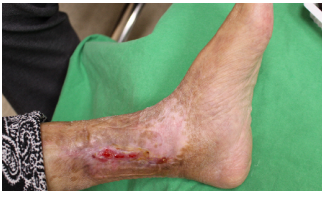
03



D.0 I.0 R.0 E.1 C.1 T.1

Eight weeks have passed since the occurrence of a venous ulcer. The amount of exudate was gradually decreased and healthy granulation tissue was observed. After partial debridement, the wound was treated with Easyef Ointment and EasyFoam™ (2 mm), followed by compression therapy.

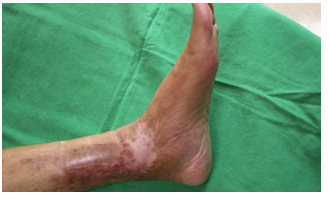
04



D.0 I.0 R.0 E.0 C.1 T.0

Twelve weeks have passed since the occurrence of a venous ulcer. Almost no exudate is observed and epithelialization is shown. After Easyef Ointment and EasyDERM™ Plus were applied, compression therapy was performed.

05



D.0 I.0 R.0 E.0 C.0 T.0

Sixteen weeks have passed since the occurrence of a venous ulcer. Wound healing is noticed by complete epithelialization. Easydew was applied to relieve the stretch while walking or moving.

Chapter

V

Appendices

Appendix I Classifications of Diabetic Foot Ulcer

1. Wagner classification

Grade	Lesion
0	No open lesions; may have deformity or cellulitis
1	Superficial diabetic ulcer (partial or full thickness)
2	Ulcer extension to ligament, tendon, joint capsule, or deep fascia without abscess or osteomyelitis
3	Deep ulcer with abscess, osteomyelitis, or joint sepsis
4	Gangrene localized to portion of forefoot or heel
5	Extensive gangrenous involvement of the entire foot

Wagner FW, Jr. The dysvascular foot: a system for diagnosis and treatment. Foot Ankle 1981; 2(2): 64-122.

2. UT(University of Texas) grading

		Grade			
		0	1	2	3
Grade	A	Pre or postulcerative lesion completely epithelialized	Superficial wound, not involving tendon, capsule or bone	Wound penetrating to tendon or capsule	Wound penetrating to bone or joint
	B	With infection	With infection	With infection	With infection
	C	With ischemia	With ischemia	With ischemia	With ischemia
	D	With infection and ischemia	With infection and ischemia	With infection and ischemia	With infection and ischemia

Lavery LA, Armstrong DG, Harkless LB. Classification of diabetic foot wounds. J Foot Ankle Surg 1996; 35(6): 528-31.

Appendix I

Classifications of Diabetic Foot Ulcer

3. PEDIS grading

Grade	Infection Severity	Clinical Manifestations	Treatment Parameters	Medications
1	Uninfected	Wound without purulence or inflammation	Outpatient	Topical antibiotics
2	Mild	≥2: purulence or erythema, pain, tendemess, warmth, or induration; cellulitis ≤2cm around ulcer; infection limited to skin/ subcutaneous tissue; no other complications	Most not limb-threatening; most outpatient treatment	Cephalexin, trimethoprim-sulfamethoxazole(TMP-SMX), levofloxacin, amoxicillin-clavulanate, clindamycin
3	Moderate	Infection as above plus >1: cellulitis>2cm, streaking, deep tissue abscess, gangrene and with some life-threatening; involvement of muscle, tendon, joint, or bone	Most limb-threatening with some life-threatening; requires hospital treatment	TMP-SMX, amoxicillin-clavulanate, levofloxacin, ceftriaxone, linezolid, ertapenem, ticarcillin-clavulanate
4	Severe	Infection plus systemic toxicity or metabolic instability; fever, chillis, tachycardia, hypotension, confusion, vomiting, severe hyperglycemia, acidosis, or azotemia	Life-threatening; requires hospital treatment	Imipenem-cilastatin, vancomycin-ceftazidime, levofloxacin-clindamycin, piperacillin-tazobactam, ticarcillin-clavulanate

Schaper NC. Diabetic foot ulcer classification system for research purposes: a progress report on criteria for including patients in research studies. Diabetes Metab Res Rev 2004; 20 Suppl 1: S90-5.

TIP

The Wagner classification is one of the most popular classification systems. The classification is simple and easy to use but only based on wound depth and necrosis, and thus it is limited to plan appropriate treatment strategies. The PEDIS grading is mainly used in the division of infectious disease. The UT classification is considered as the most appropriate system for wound specialists because it assesses ulcer depth and the presence of wound infection along with the presence of clinical signs of lower–extremity ischemia.

APPENDIX II

Classification of Pressure Ulcer

NPUAP (National Pressure Ulcer Advisory Panel) Classification

Stage. 1

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 area.

Stage. 2

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.

Stage. 3

Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscles are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling.

Stage. 4

Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often includes undermining and tunneling.

http://www.npuap.org/resources/educational-and-clinical-resources/npuap-pressure-ulcer-stagescategories/

Appendix III

Classification of Chronic Venous Disorders

CEAP classification

CEAP	Description
1. Clinical classification	
C0	no visible or palpable signs of venous disease
C1	telangiectasies or reticular veins
C2	varicose veins
C3	edema
C4a	pigmentation or eczema
C4b	lipodermatosclerosis or atrophie blanche
C5	healed venous ulcer
C6	active venous ulcer
2. Etiologic classification	
Ec	congenital
Ep	primary
Es	secondary (post-thrombotic)
En	no venous cause identified
3. Anatomic classification	
As	superficial veins
Ap	perforator veins
Ad	deep veins
An	no venous location identified
4. Pathophysiologic classification	
Pr	reflux
Po	obstruction
Pr.o	reflux and obstruction
Pn	no venous pathophysiology identifiable

Eklof B, Rutherford RB, Bergan JJ, et al. Revision of the CEAP classification for chronic venous disorders: consensus statement. J Vasc Surg 2004; 40(6): 1248-52.

Appendix IV

Classification of Peripheral Arterial Disease

Classification of Fontaine[1] and Rutherford[2]

Fontaine		Rutherford		
Stage	**Clinical**	**Grade**	**Category**	**Clinical**
I	Asymptomatic	**0**	**0**	Asymptomatic
IIa	Mild claudication	**I**	**1**	Mild claudication
IIb	Moderate-severe claudication	**I**	**2**	Moderate claudication
		I	**3**	Severe claudication
III	Ischemic rest pain	**II**	**4**	Ischemic rest pain
IV	Ulceration or gangrene	**III**	**5**	Minor tissue loss
		IV	**6**	Ulceration or gangrene

1. Fontaine R, Kim M, Kieny R. [Surgical treatment of peripheral circulation disorders]. Helv Chir Acta 1954; 21(5-6): 499-533.
2. Norgren L, Hiatt WR, Dormandy JA, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). Eur J Vasc Endovasc Surg 2007; 33 Suppl 1: S1-75.

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D+Wound Solution

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