傷口的病生理、評估及處置

國軍左營總醫院
李易晟醫師

傷口癒合的步驟

- Hemostasis
- Inflammation
- Proliferation
- Remodeling

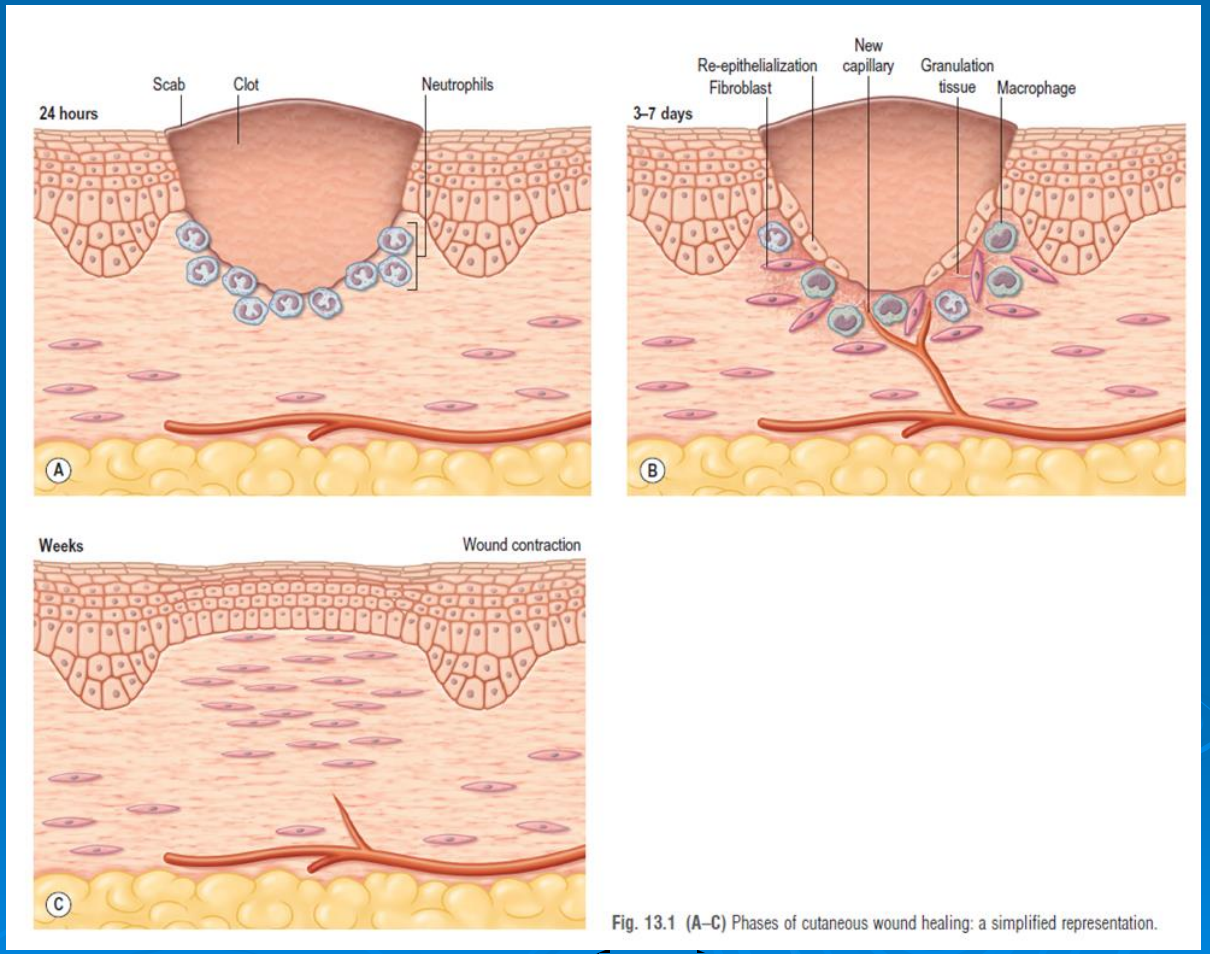
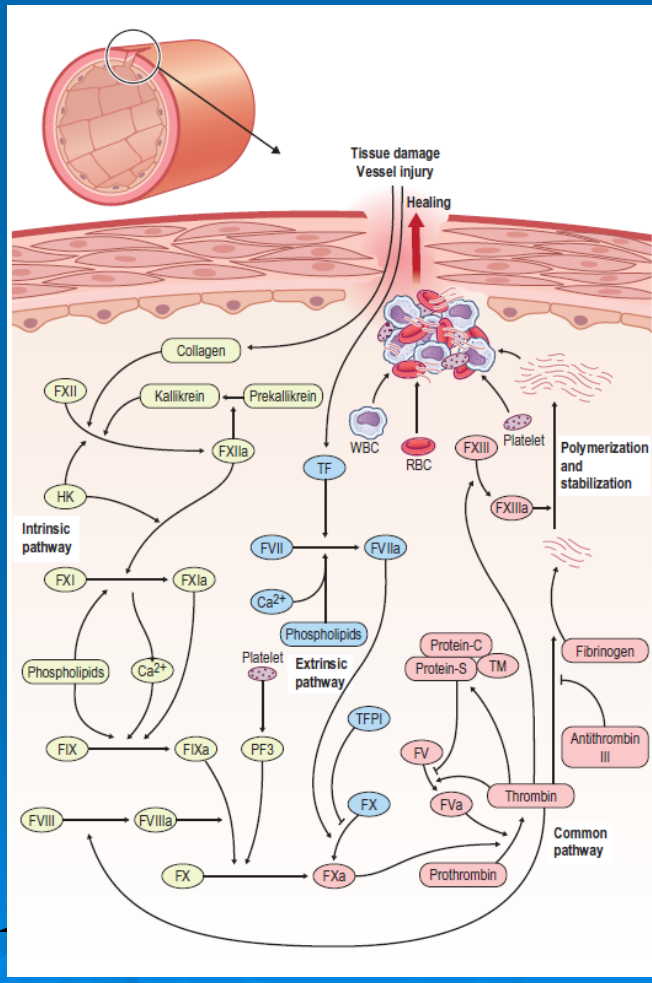


Fig. 13.1 (A–C) Phases of cutaneous wound healing: a simplified representation.

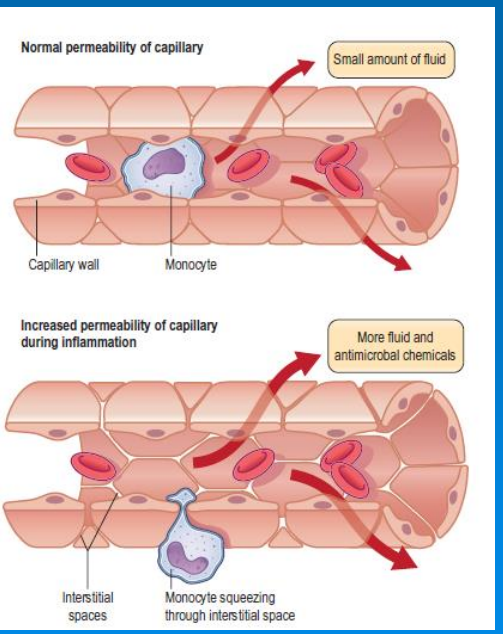
Hemostasis(止血)

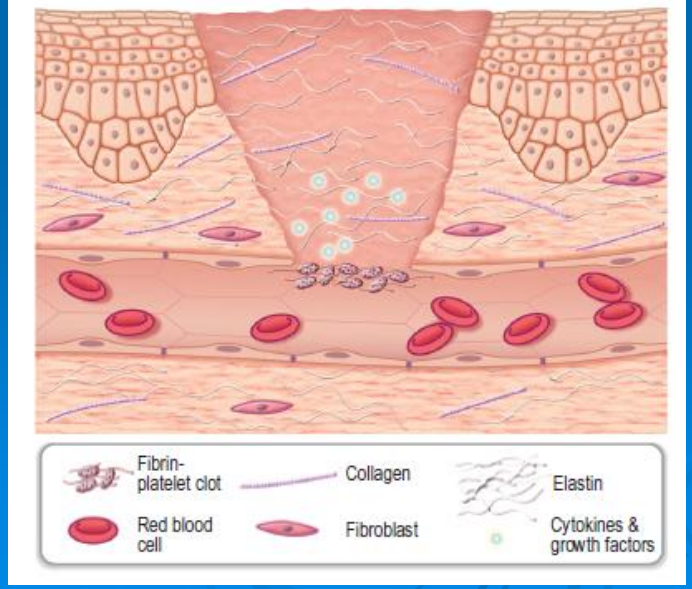
- Platelets and fibrin
- Extrinsic pathway:Initiation ;
- Intrinsic pathway : amplification
- Blood clot含WBC, RBC , platelet and fibrinogen
- Protein-C ,protein-S , thrombomodulin(TM) , Antithrombin III ,以上是抑制

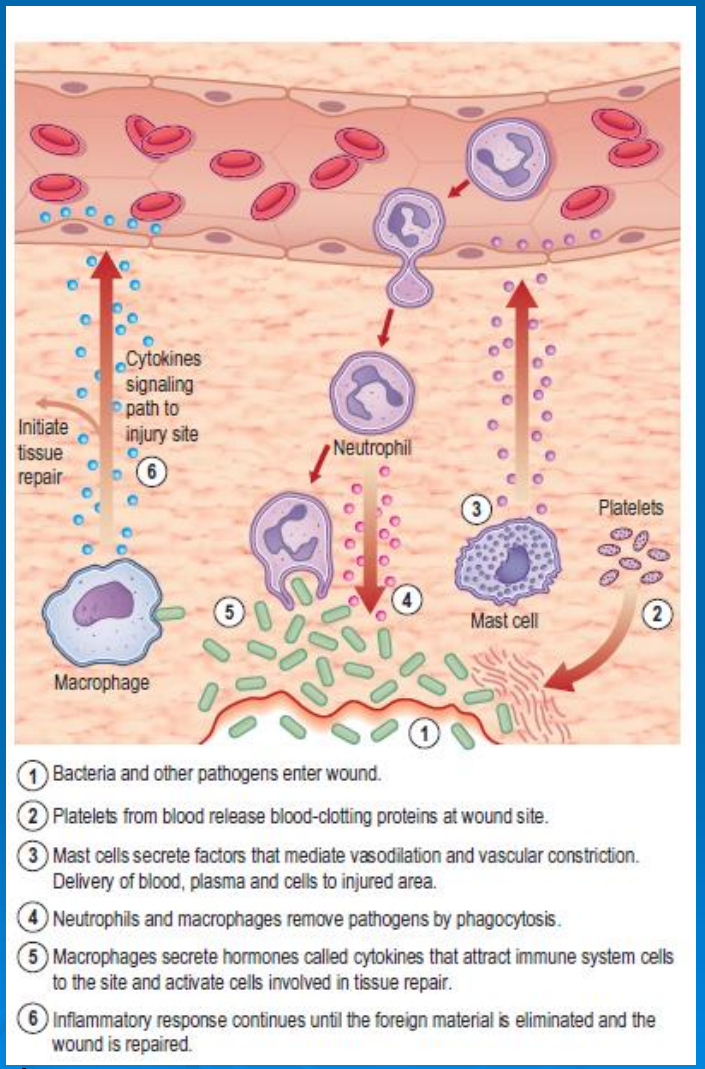


Inflammation(發炎)

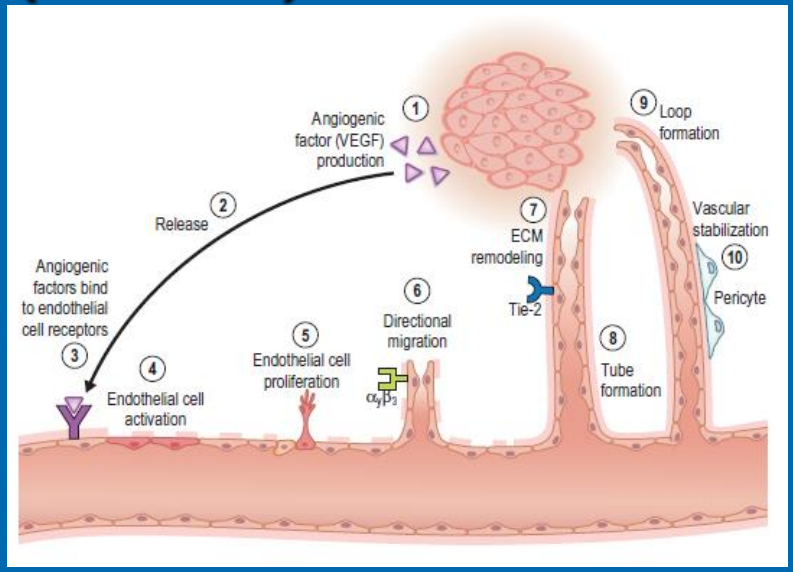
- 0-3天
- Redness紅,swelling腫, heat熱, and pain痛
- Platelet, Neutrophil , Mast cell and Macrophage







Proliferation(增生)



- 2天 → 3週
- Granulation肉芽
- Vascularization血管增生
- Wound contraction攣縮
  Collagen III(弱快)
- Epithelialization上皮化 –
  Macrophage ->PDGF & TNF-α ->
  keratinocyte growth factor

Remodeling(再塑造)

- Weeks to years
- Collagen deposition
- Acquisition of wound tensile strength(Collagen I強硬，疤痕的主要膠原)
- Turnover of extracellular matrix ECM components

傷口的評估

- Acute and chronic
- 傷口之深度
- 感染環境可能造成的感染

Acute wounds

- Lacerations
- Puncture
- Abrasions
- Avulsions
- Amputations

- Wound treatment:
- **1.** Primary intention- closed with suture material
- **2.** Secondary intention- left open and closes naturally
- **3.** Tertiary intention- left open for a number of days and then closed if it is found to be clean.

Factors that promote healing

- Pre-albumin (transerythrin) & CRP 每3-5天測
- Protein intake : 0.8~1g/kg/day (wound healing)
  2g /kg /day (chronic wound)
- Amino acids - arginine and glutamine :collagne deposition, angiogenesis and immune function
- Vitamins A, C and E : antioxidant and anti-inflammatory effects
- Micronutrients : magnesium, copper, zinc and iron
-

Chronic wounds

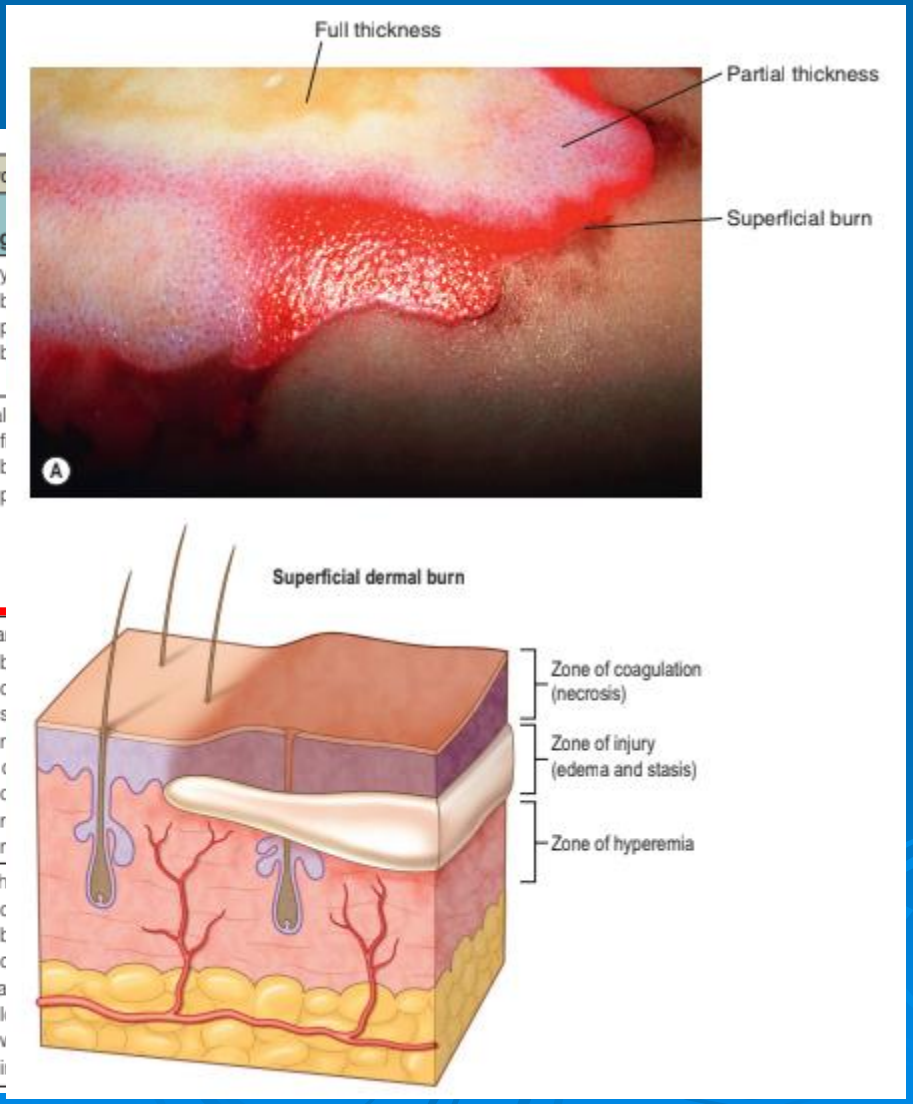
- Infection and biofilm(Bacterial colonization)
- Bacterial loads $>10^5$ organisms /gram of tissue are a threat to wound healing
- *Staphylococcus aureus* and coagulase-negative staphylococci(CONS) are the most commonly ;MRSA and VRE

- 原則上指超過90天未癒合之傷口

以燒傷傷口深度

Table 18.2 Clinical presentation of thermal burn wo

Depth of burn	Skin involvement	Examples	Sig
Epidermal burn	Epidermis	Brief flame or flash; Sunburn	Dry b p b
Superficial partial-thickness burn	Epidermis and part of the papillary dermis	Scald (spill or splash), short flash	Pal f b p
Deep partial-thickness burn	Epidermis, the entire papillary dermis down to reticular dermis	Scald (spill), flame, oil or grease	Da b c s r In c r r
Full-thickness burn	Entire thickness of the skin and possibly deeper	Scald (immersion), flame, steam, oil, grease, chemical, high-voltage electricity	Wh c b c Ma l v i



淺2度，非常痛，淡粉色，淺壓變白會回血，14天內傷口可癒合；原則上會留淡粉色疤，低風險增生性疤痕。

手術傷口的感染率

- Class I/Clean清潔傷口：預期感染率:1-2%
- Class II/Clean-contaminated清潔汙染傷口：開刀位置在呼吸道、消化道、泌尿生殖，像是膽道、闌尾、陰道和口咽，預期感染率:3%
- Class III/Contaminated汙染傷口：開放、新鮮、意外造成的傷口，此外重大進入無菌區的手術像是開胸心臟按摩或是目視滲出物的消化道，預期感染率:6%
- Class IV/Durty-infected 髒或汙染傷口： 已知道感染或穿孔的臟器，預期感染率:7-13%

傷口的治療

Reconstruction ladder

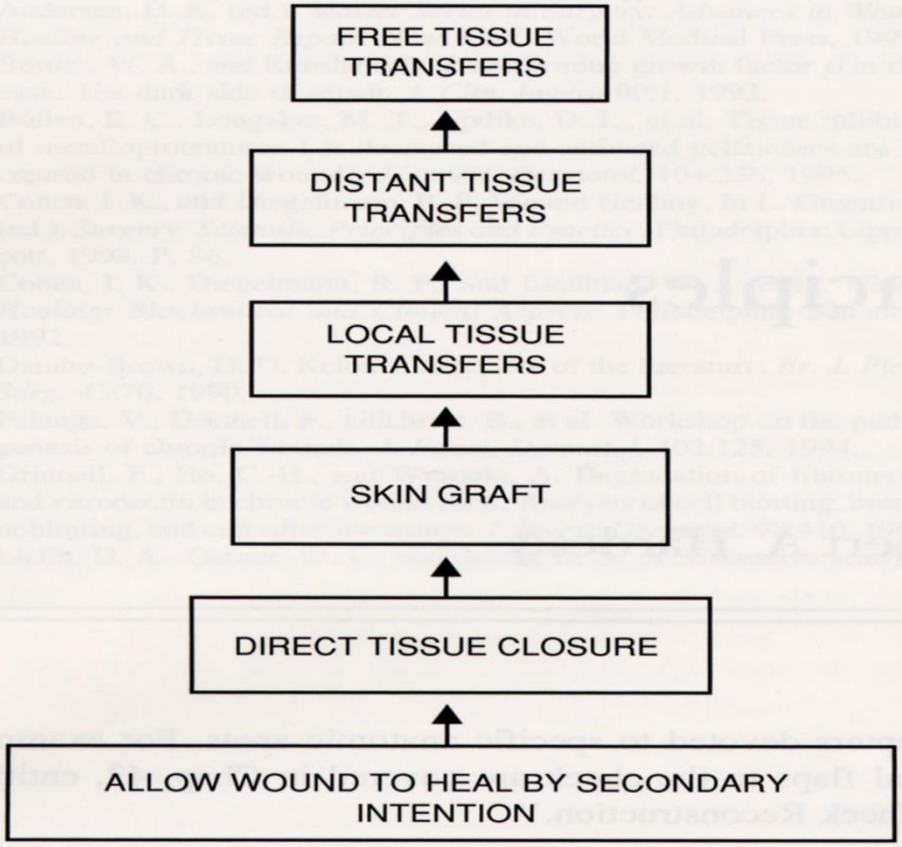
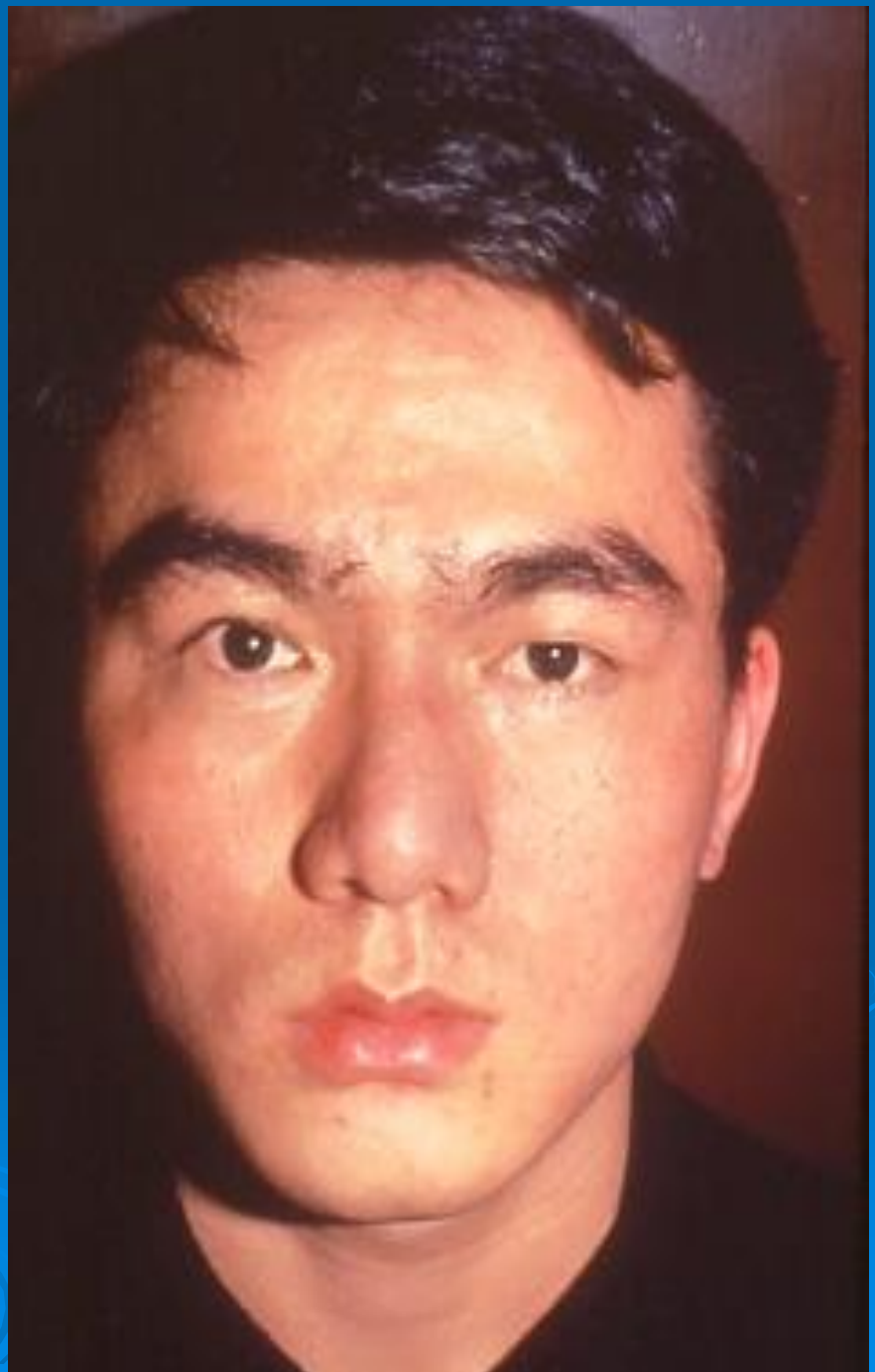


FIG. 1. Reconstructive ladder demonstrating the fundamental principle in planning closure of a defect from simple to more complex.



Wound care problems/questions

Types of dressing and application

a.Open method

Face/perineum/trunk

b.Semi-open method-Gauze

Extremities/hand/foot/finger/toe/fold

C.Occlusive method-Duoderm, tagaderm, opsite, porcine skin

Wound care problems/questions

Materials for occlusive wound dressing

*Biological dressings: fibrin-elastin binding power

Porcine skin, amnion

*Synthetic dressings: hydrophilic power

tagaderm, opsite

*Biosynthetic dressings:

Biobrane, artificial skin

Wound care problems/questions

Occlusive wound dressings

- Seal wound
- Reduce pain remarkably
- Reduce inflammatory

Wound care problems/questions

How to handle the wound

*Wet dressing (saline, iodine, antibiotics)

Vaseline gauze dressing (sofra-tulle, fucidin, scarlet red)

*Frequency

Wound care problems/questions

Factors may effect wound healing

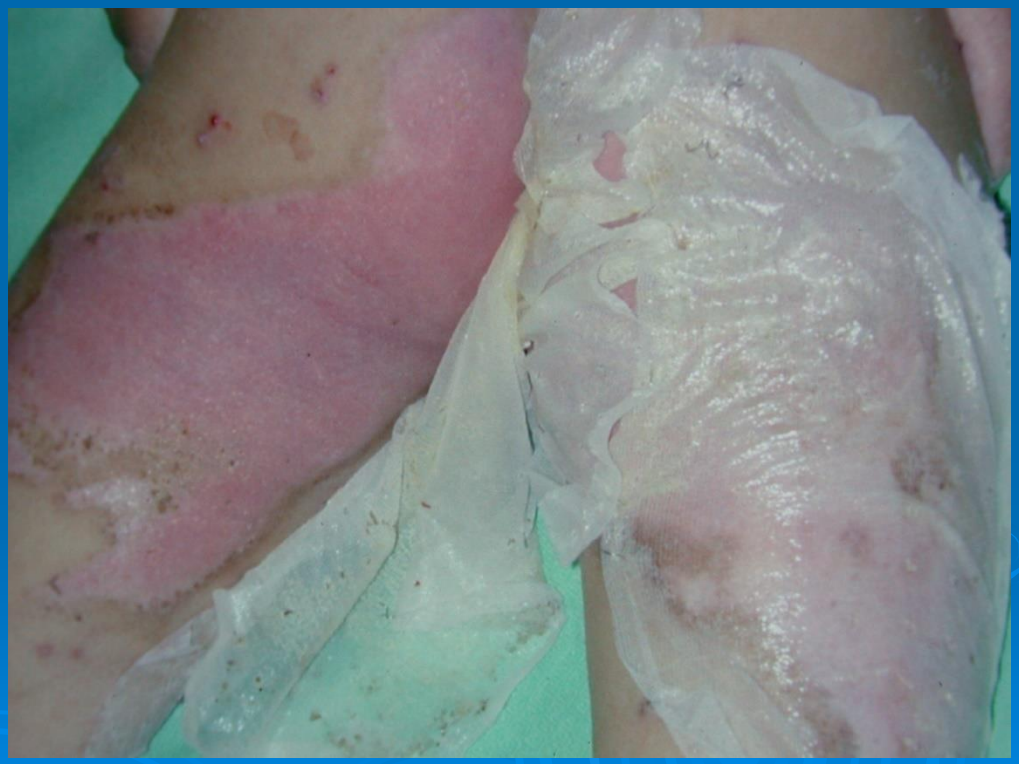
- Age
- Nutrition
- Infection
- Circulation
- Location (Immobilization)
- Drugs
- Therapies
- Technique

Current categories of Wound Dressing

- Absorbents
- Impregnated Dressing
- Transparent Films
- Foams
- Hydrogel
- Xerogels
- Hydrocolloids


BC

Impregnated Dressing
Transparent Films

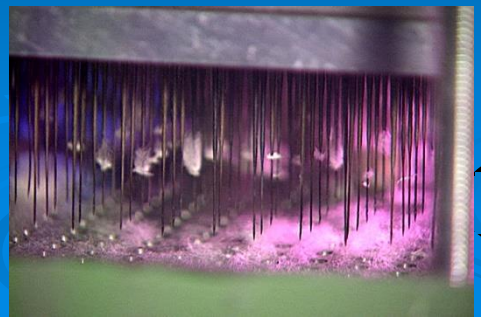


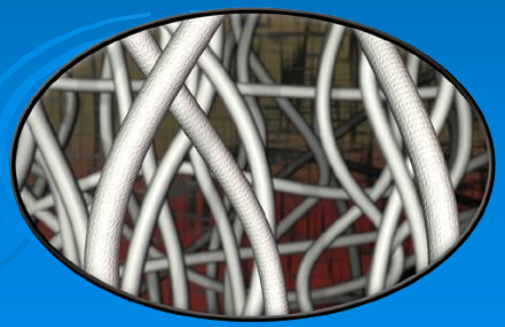
Aquacel

Silver powered antimicrobial dressing

－ 預防傷口感染的敷料 －

- Aquacel Ag 的組成成份是由
  - Hydrofiber: Na-CMC
    - Sodium Carboxymethycellulose (脫甲基化纖維醣)
  - Ionic silver : Ag-CMC
    - Silver ion replacing 30% of Sodium ion in the fiber
    - Silver ion weighs about 1.2% of total dressing
  - Patened weaving process -通過專利以內鎖編織方式製造





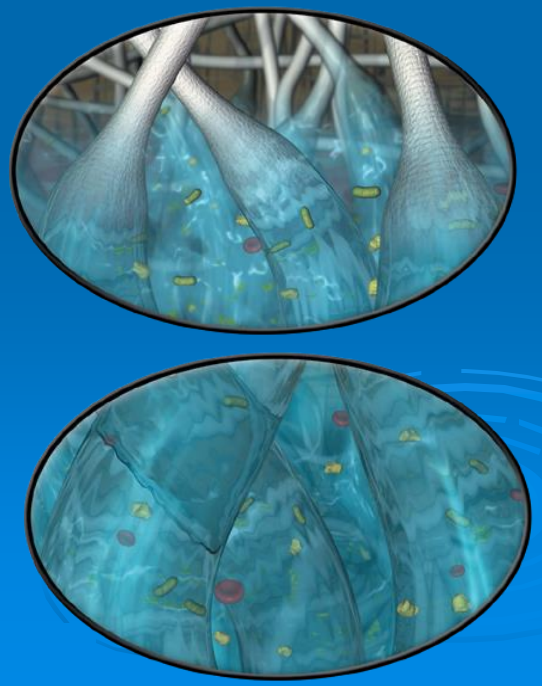
Gentle on the outside - 柔

- Aquacel Ag 吸收傷口滲液後會形成凝膠
  - 親水性纖維會將滲液直接吸收於纖維內，並可鎖住滲液與細菌

Aquacel Ag 吸收滲液後會形成柔順的凝膠

Ferocious on the inside - *剛*

- Aquacel Ag 有雙重的鎖住功能
  - Sequestration:
    - 親水性纖維吸收滲液後可將細菌traps於纖維內，讓細菌無法活動，而且也不會釋回傷口床中.

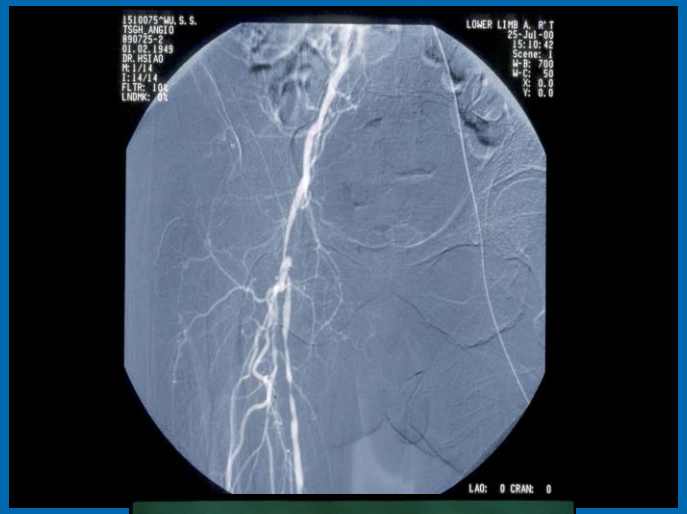


Vaccum assisted closure (VAC)

VAC (Vaccum-assisted closure)




Porcine skin



Hydrocolloids



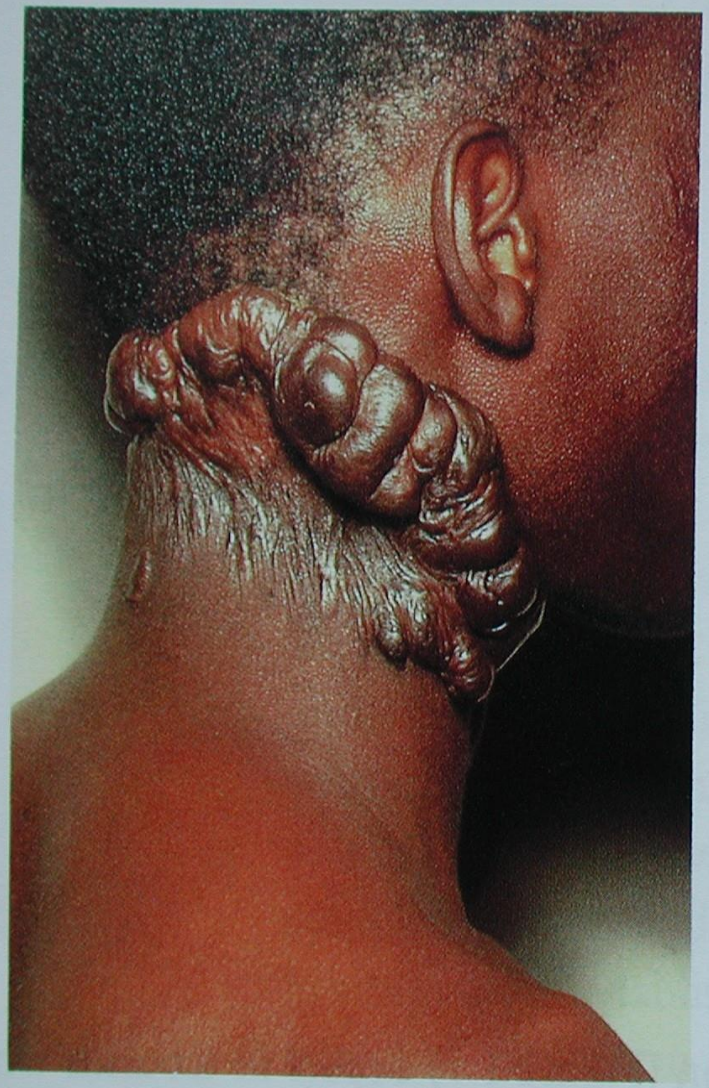



Figure 1.8 *Keloid scarring.*

Figure 1.9 *Hypertrophic scarring.*

Comparison of Keloids and Hypertrophic Scars

	Keloid	Hypertrophic scar
Genetics	significant	less
Race	blacks	less
Sex	F > M	equal
Age	most common 10-30 years	any, but mostly < 20 years
Borders	outgrows	remains within wound borders
Natural history	rarely subsides	subsides with time
Location	face, earlobes, ant. Chest	across flexor surfaces
Etiology	possible autoimmune	tension and timing of closure
Treatment	often worse after surgery	improves with surgery,

燒燙傷之急救與治療

燒燙傷分類：

接觸性燒燙傷Contact burn injury(ex:排煙管)

液氣性熱燙傷Scald burn injury(ex:水/油/湯/茶/蒸氣）

摩擦性熱燒傷Friction burn injury（ex:車禍摩擦傷）

火燄性燒燙傷Flame burn injury（ex:火/氣爆/酒精/火災）

電擊燒燙傷Electric burn injury（ex:高壓電/電擊）

化學性燒燙傷Chemical burn injury（ex:氫氟酸/強酸/強鹼）

其它種類燒燙傷Other burn injury（ex:凍傷/曬傷/輻射傷）

吸入性燒燙傷(Inhalation injury)：任何型態呼吸道的燒燙傷

燙傷 (Scald Burn)

火焰傷 (Flame Burn)

•化學灼傷
(Chemical Burn)




- 電擊傷 (Electric Burn)

- 接觸灼傷 (Contact Burn)

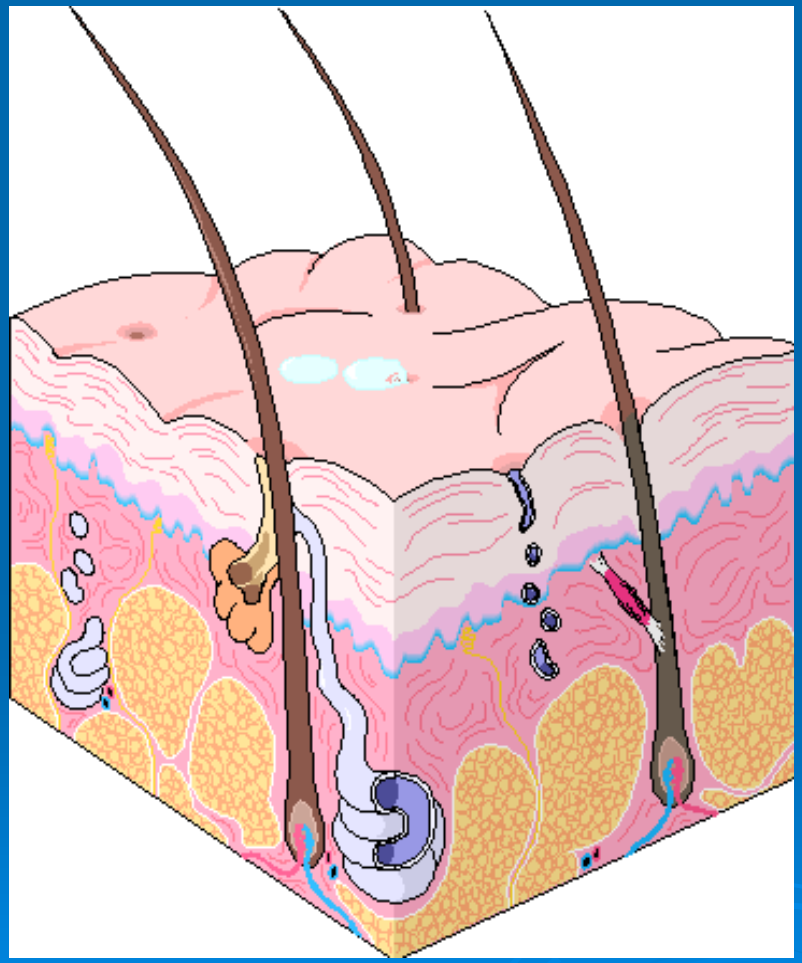

摩擦灼傷 (Friction Burn)

輻射性灼傷 (Radiation Burn)

皮膚的構造與功能

- 人體最大器官
  - 面積：2平方公尺
  - 重量：4.5~5公斤
  - 厚度：1.4~4.0毫米
  - 血液循環：25%
    (70公斤成年男性)
- 功能
  - 保護外界微生物的入侵
  - 防止體內水分散失
  - 調節體溫
  - 感覺
  - 美觀

皮膚的構造與功能

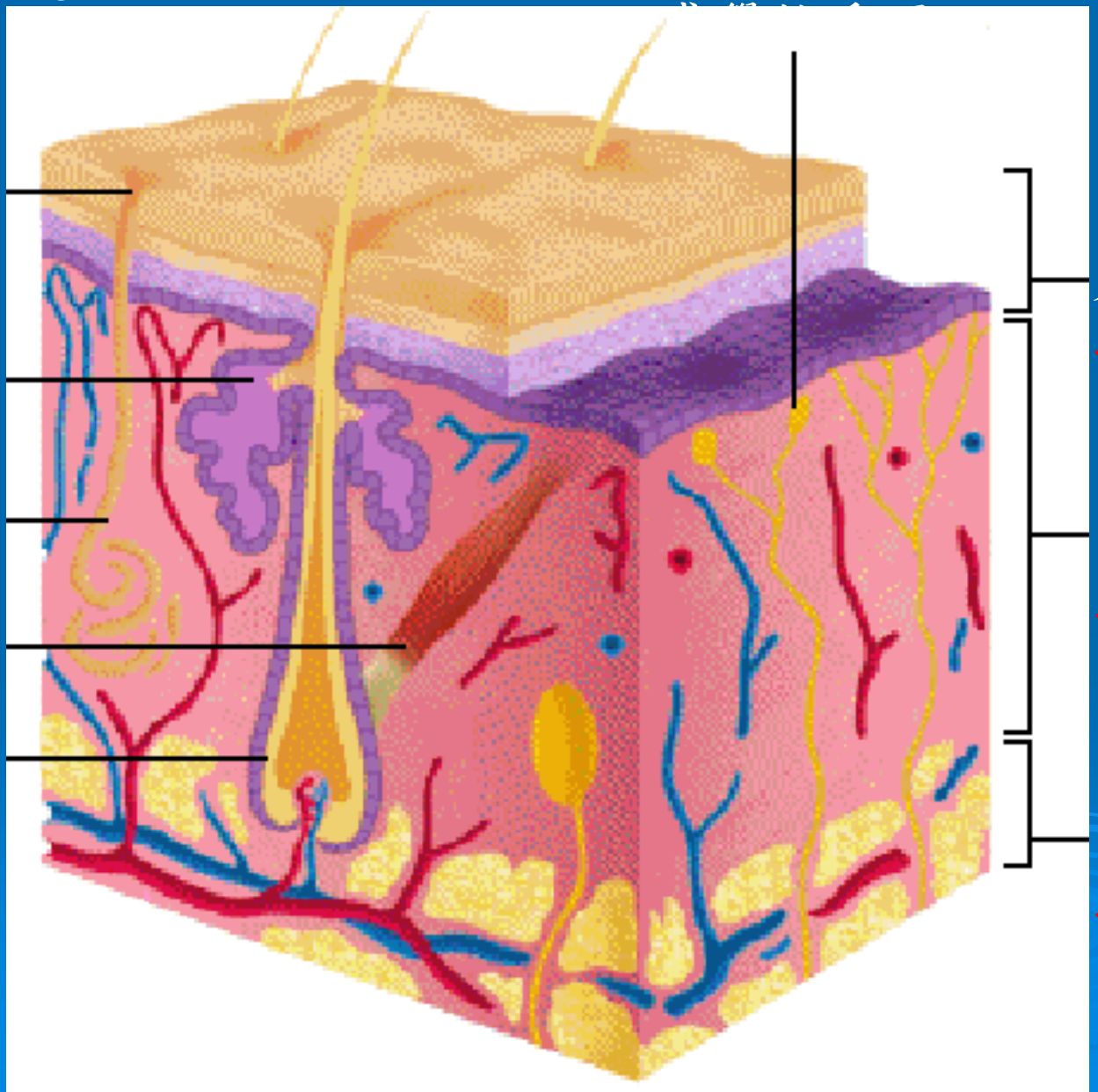


- 表皮層 (5%)
  - 角質層、透明層、顆粒層、棘狀層、增生層
  - 角質細胞、黑色素細胞
- 真皮層 (95%)
  - 乳突層、網狀層
  - 纖維母細胞，膠原蛋白
  - 感覺接受器
  - 皮膚附屬器官

燒燙傷的深度分類

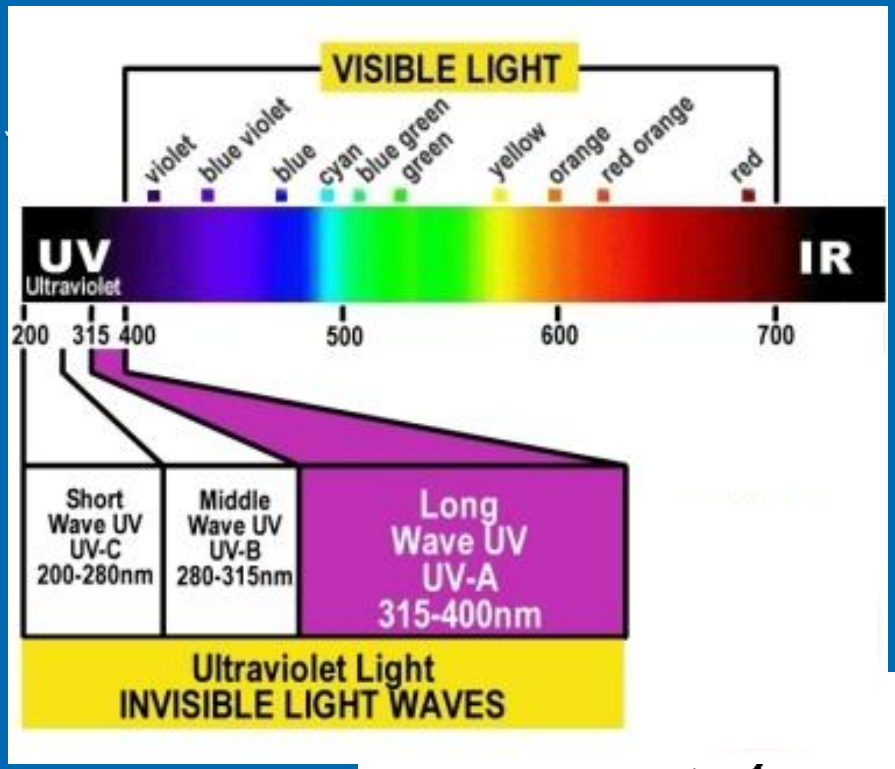
- 一度傷
  - 深度達表皮層
- 二度傷
  - 深度達真皮層
  - 淺二度傷
  - 深二度傷
- 三度傷
  - 深度達皮下結締組織
- 四度傷
  - 傷及肌肉、骨骼

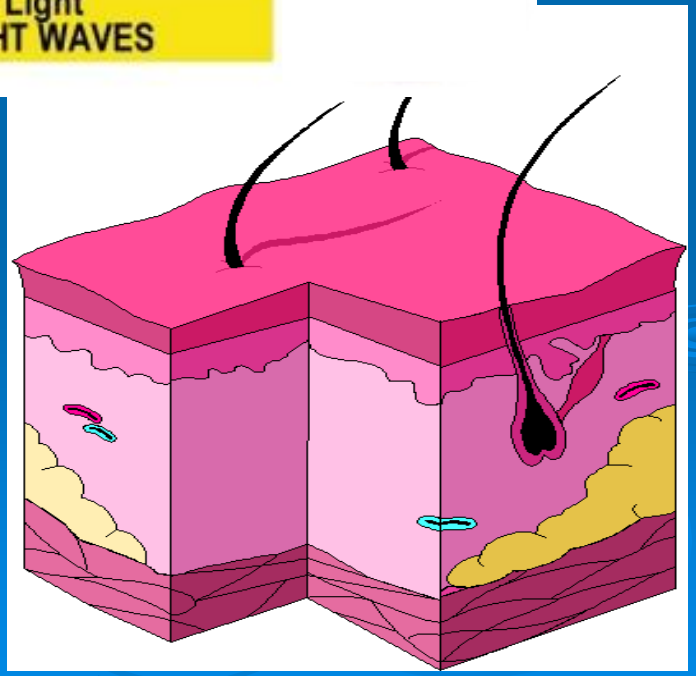
灼傷深度



一度燒傷

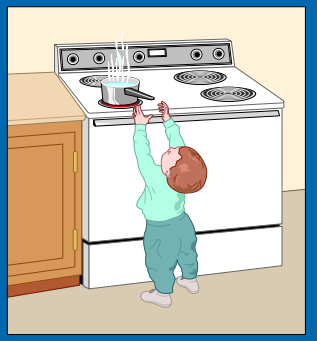
- 發生原因
  - 曬傷
- 症狀
  - 紅、腫、熱、痛
- 傷口照顧
  - 冰敷，止痛劑
- 復原時間
  - 7 至 10 天
  - 不留疤痕



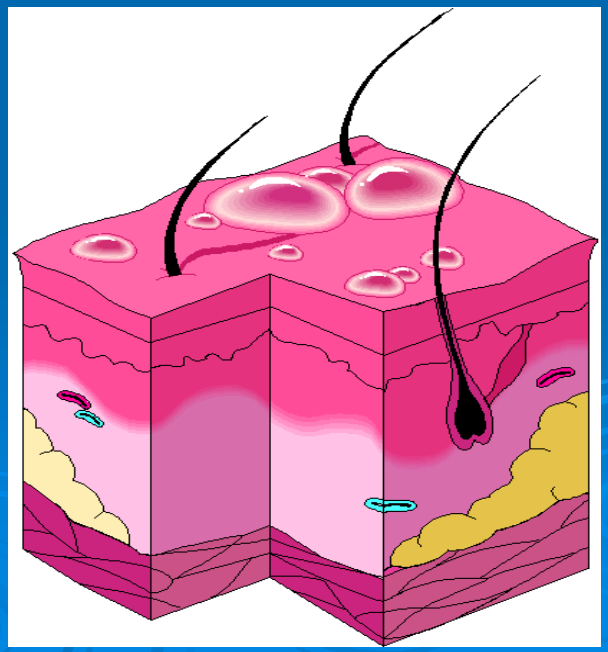


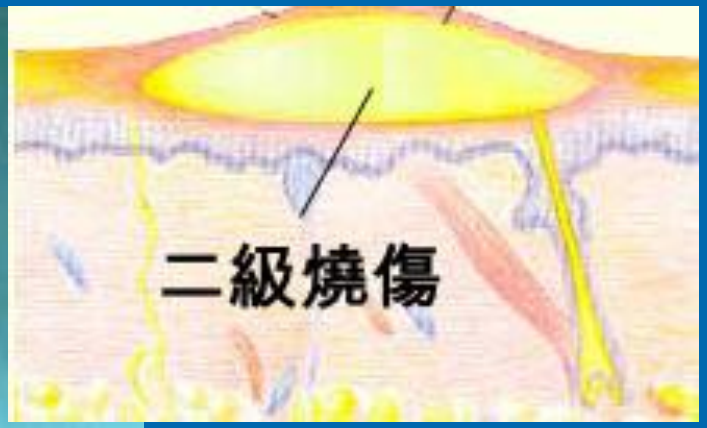

一級燒傷

二度傷



- 發生原因
  - 燙傷、蒸氣
- 症狀
  - 紅、腫、熱、痛
  - 起水泡
- 傷口照顧
  - 沖、脫、泡、蓋、送
  - 可自然癒合
- 復原時間
  - 14 至 21 天
  - 留下疤痕

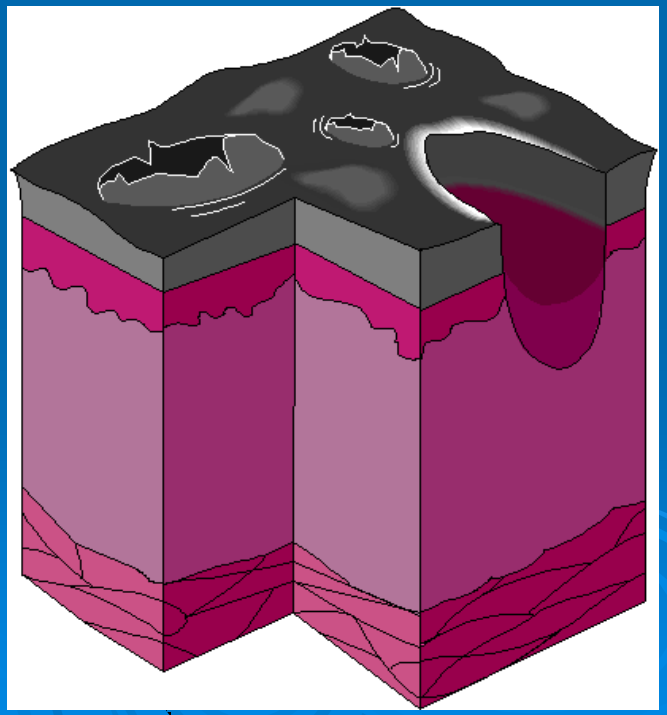



二級燒傷

熱水二度燙傷　排氣管二度燙傷

三度傷

- 發生原因
  - 燒傷、電擊傷、化學藥品灼傷
- 症狀
  - 皮革狀皮膚，呈焦黑或珍珠白
  - 無痛覺
- 傷口照顧
  - 須經植皮手術始可癒合
- 復原時間
  - 留下疤痕，疤痕攣縮

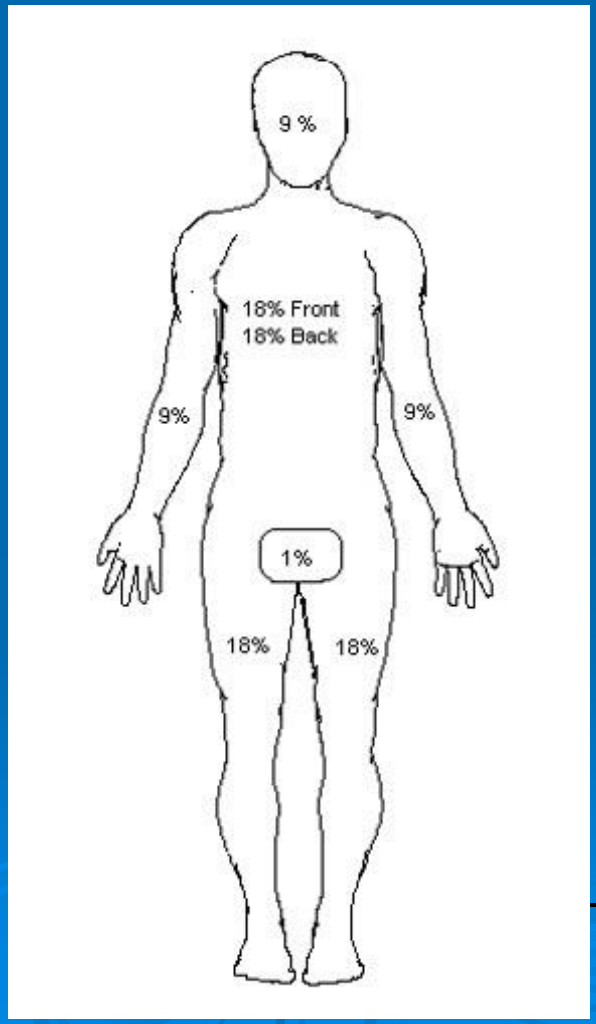


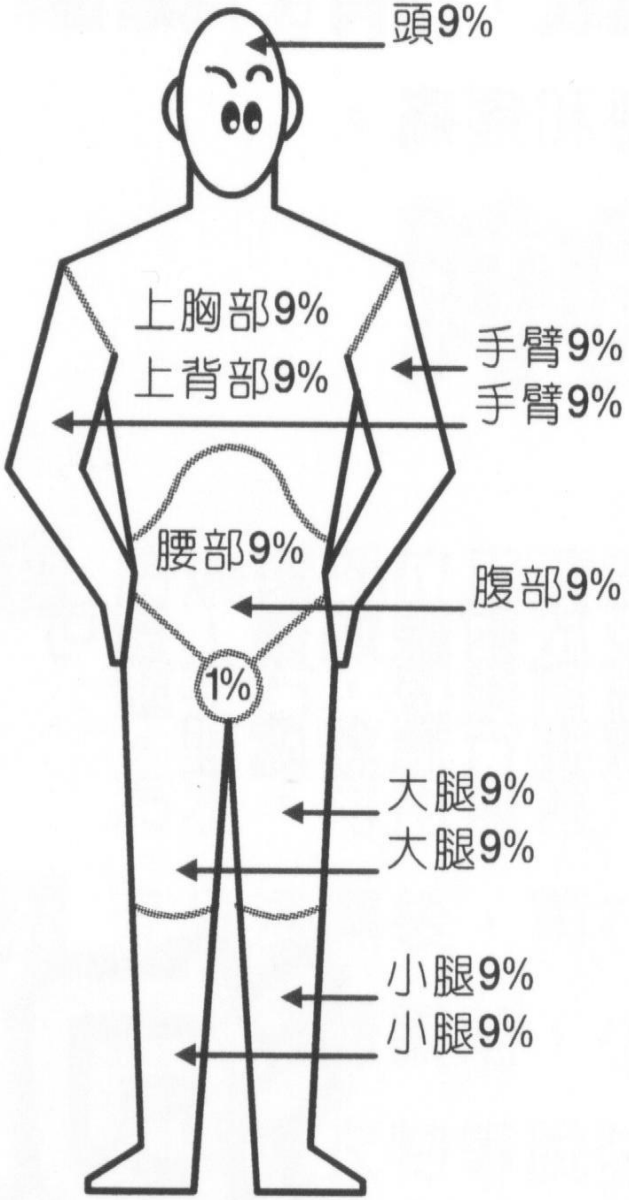
三度燒燙傷
Third Degree

四度燒燙傷
Fourth Degree

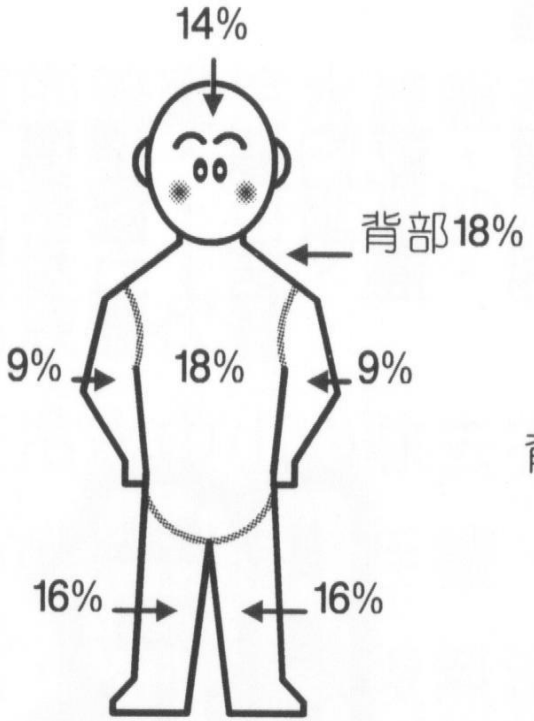
燒燙傷面積估算

- “九” 的原則
  - 頭、頸部 (9%)
  - 前軀幹 (18%)
  - 後軀幹 (18%)
  - 上肢 (9%) x 2
  - 下肢 (18%) x 2
  - 會陰部 (1%)

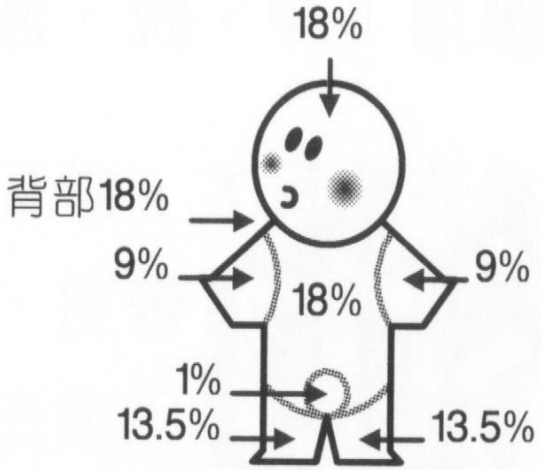




成人燒傷面積計算



五歲左右小孩燒傷面積計算



嬰兒燒傷面積計算

燒傷的嚴重度

輕度燒傷 Minor Burn

中度燒傷 Moderate Burn

嚴重燒傷 Major Burn

美國燒傷學會(American Burn Association)

輕度燒傷 Minor Burn

- 二度燒傷　成人 < 15% TBSA
  兒童 < 10% TBSA
- 三度燒傷　成人或兒童均 < 2% TBSA

中度燒傷 Moderate Burn

- 二度燒傷　成人介於 15%到25% TBSA
  兒童介於 10%到20% TBSA
- 三度燒傷　成人或兒童
  介於 2%到10% TBSA

嚴重燒傷(Major Burn)

- 二度燒傷　成人＞25%TBSA
  兒童＞20%TBSA ,或
- 三度燒傷　成人或小孩＞10%TBSA

(臉部、手、足及會陰部燒傷，
吸入性燒傷、電擊傷、化學燒傷、
或燒傷合併有頭部或腹部外傷、骨折
或慢性肺疾病、中風、糖尿病等)

燒燙傷的治療

- 送醫前的處置
- 燒燙傷的急救治療
- 燒燙傷的中期治療
- 燒燙傷的晚期治療

送醫前

「沖脫泡蓋送」

- 沖：在流動的冷水中沖洗約三十分鐘。
- 脫：在冷水中慢慢將衣物脫去，記住勿將水泡弄破。
- 泡：在冷水中連續泡三十分鐘，將餘熱完全除去。
- 蓋：用乾淨的紗布毛巾、或床單將傷口覆蓋。
- 送：儘速送醫治療。

「沖脱泡蓋送」

“沖”　“泡”　的作用

- 保護真皮層微血管的血循
- 減少微血管的通透性及水腫
- 減少疼痛
- 降低化學物質的濃度

其他注意事項

- 傷處未腫脹前，小心脫除戒指、皮帶、鞋子或其他緊身衣物
- 手腳受傷可抬高傷處，減輕腫脹
- 不可挑破水泡或在傷處吹氣，以免傷口污染
- 不可在傷處塗抹牙膏、醬油、草藥
- 不可將大面積燒燙傷患者、小孩、老人持續浸泡冷水中

燒燙傷的急救治療

- 急救復甦
- 體液補充
- 傷口處理
- 止痛及鎮靜治療
- 胃腸障礙治療
- 各項實驗室檢查

急救復甦

- A、B、C

  維持呼吸道暢通、血壓及脈搏穩定
- 檢查有無合併其他外傷

  如骨折、顱內出血、血氣胸、腹部外傷等。

傷口處理

- 傷口冷卻及沖洗
- 剃除患部毛髮
- 焦痂或筋膜切開術 (Escharotomy or Fasciotomy)
- 抗菌藥物治療
- 抗破傷風預防注射

肢體環繞性深度燒燙傷
焦痂切開術 (Escharotomy)

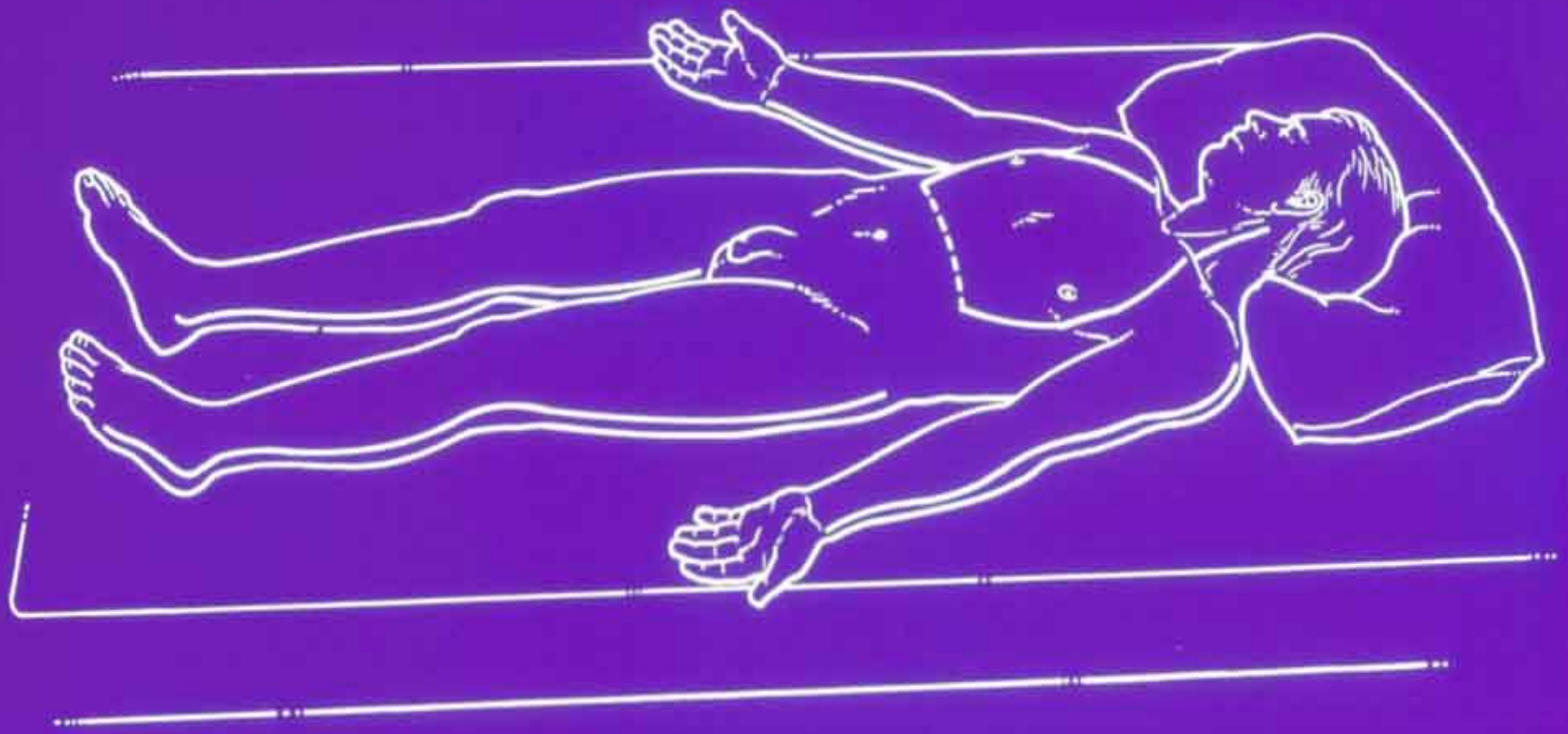
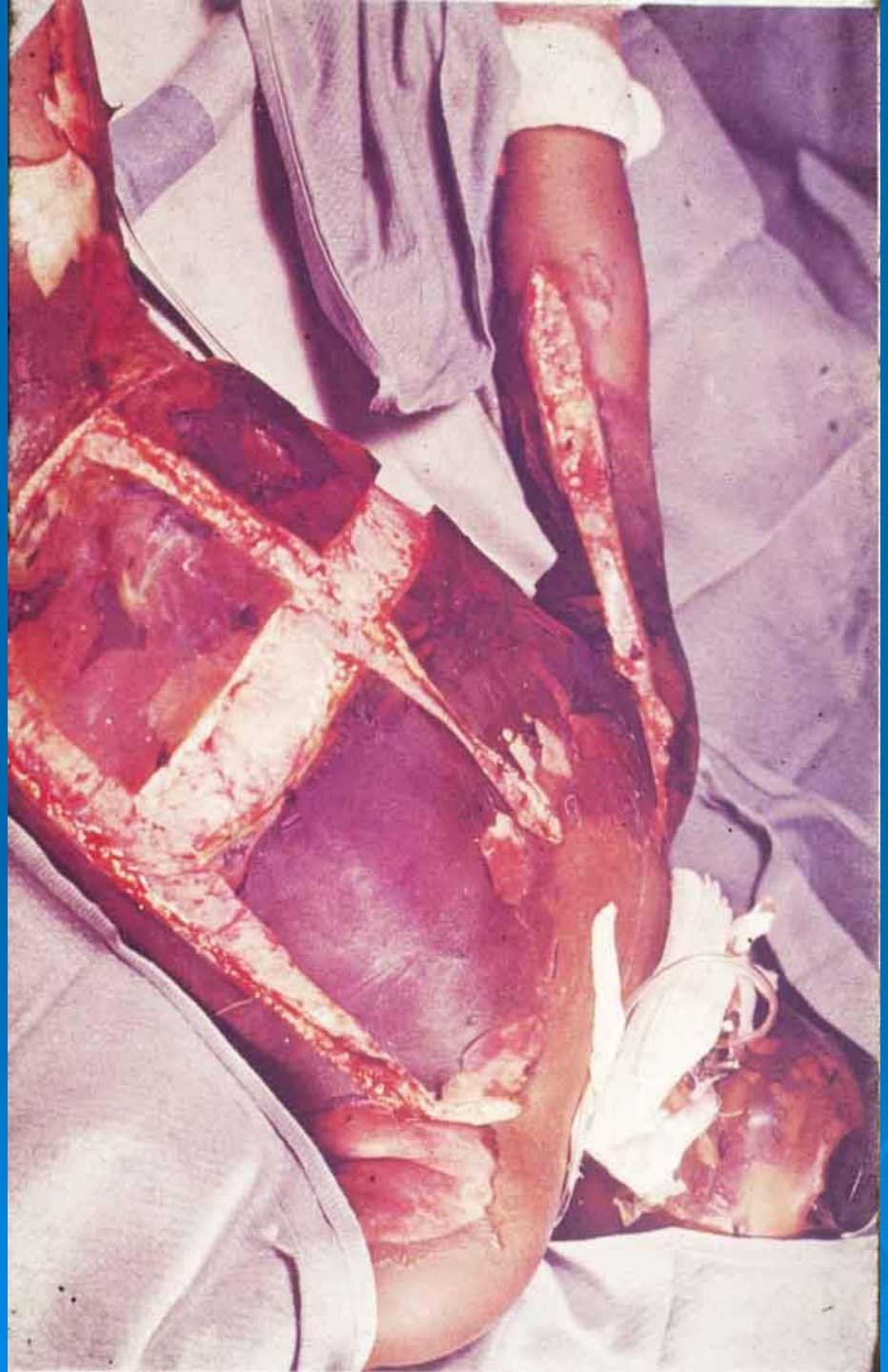


FIGURE 1-11. Proper placement of escharotomy incisions. Notice that the incisions must cross affected joints.



(C)

(D)

體液補充公式

成人灼傷後體液補充的公式，前24小時各種公式均建議以大量體液快速補充，通常前8小時輸入總量一半，所餘一半在次16小時輸入以求迅速重建循環系統的功能。

FORMULAE USED FOR ESTIMATING ADULT BURN PATIENT RESUSCITATION FLUID NEEDS

FIRST TWENTY-FOUR HOURS

FORMULA:	ELECTROLYTE	COLLOID	GLUCOSE IN WATER
Burn Budget of F. D. Moore	Lactated Ringer's 1000-4000 ml 0.5 N saline 1200 ml	7.5% of body weight	1500-5000 ml
Evans	Normal Saline 1.0 ml/kg/%burn	1.0 ml/kg/%burn	2000 ml
Brooke	Lactated Ringer's 1.5 ml/kg/%burn	0.5 ml/kg/%burn	2000 ml
Parkland	Lactated Ringer's 4 ml/kg/%burn		
Hypertonic Sodium Solution	Volume to maintain urine output at 30 ml/hr (Fluid contains 250 mEq Na/L)		
Modified Brooke	Lactated Ringer's .2 ml/kg/%burn		

次24小時補充之公式，請注意，在此時期，各公式均強調膠質 (Colloid)的補充，以求增加血管內之膠體滲透壓 (Oncotic Pressure)，以維持血壓及減少組織水腫。

FORMULAE USED FOR ESTIMATING ADULT BURN PATIENT RESUSCITATION FLUID NEEDS

SECOND TWENTY-FOUR HOURS

FORMULA:	ELECTROLYTE	COLLOID	GLUCOSE IN WATER
Burn Budget of F. D. Moore	Lactated Ringer's 1000-4000 ml 0.5 N saline 1200 ml	2.5% of body weight	1500-5000 ml
Evans	1/2 of 1st 24 hour requirement	1/2 of 1st 24 hour requirement	2000 ml
Brooke	1/2 to 3/4 of 1st 24 hour requirement	1/2 to 3/4 of 1st 24 hour requirement	2000 ml
Parkland		20%-60% of calculated plasma volume	To maintain adequate urinary output
Hypertonic Sodium Solution	1/3 isotonic salt solution orally up to 3500 ml limit		
Modified Brooke		0.3-0.5 ml/kg/%burn	To maintain adequate urinary output

PARKLAND FORMULA

1st 24 hours

LACTATED RINGER'S 4ml/kg/%

RATE OF ADMINISTRATION

1/2 dose – first 8 hours
1/4 dose – second 8 hours
1/4 dose – third 8 hours

2nd 24 hours

GLUCOSE IN WATER - 2000 ml

(add potassium)

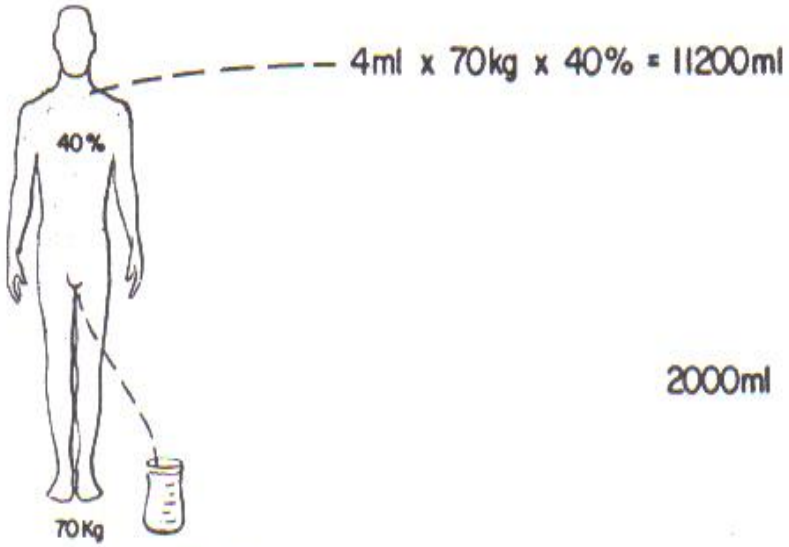


Fig 5. Parkland formula. Baxter introduced this formula, which is based on the work of Moyer suggesting that sodium ion is the sine qua non for successful resuscitation in the immediate postburn period.

PARKLAND FORMULA

燒燙傷的中期治療

- 監控生命徵象, 電解質及各項器官功能
- 治療各項併發症
- 傷口檢視及換藥
- 營養補充
- 感染控制
- 各項手術治療

  擴創術,植皮手術,皮瓣重建,截肢等...

監控生命徵象

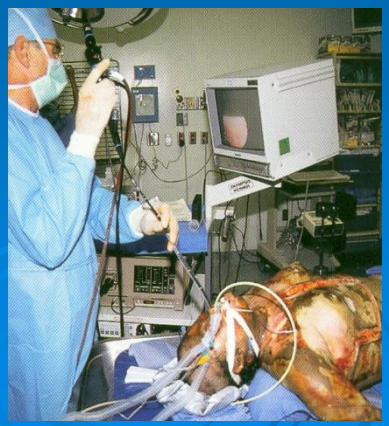
定期血液、生化檢查，TPR的監測

維持 I/O 的平衡

有吸入性傷害則需監測血氧狀態，

維持呼吸道暢通，呼吸器的支持使用

和做支氣管鏡檢查。



傷口檢視

定期水療

檢視傷口情況

傷口檢視

傷口包紮

傷口記錄

感染控制

A.隔離措施

B.導管護理

C.抗菌藥物使用

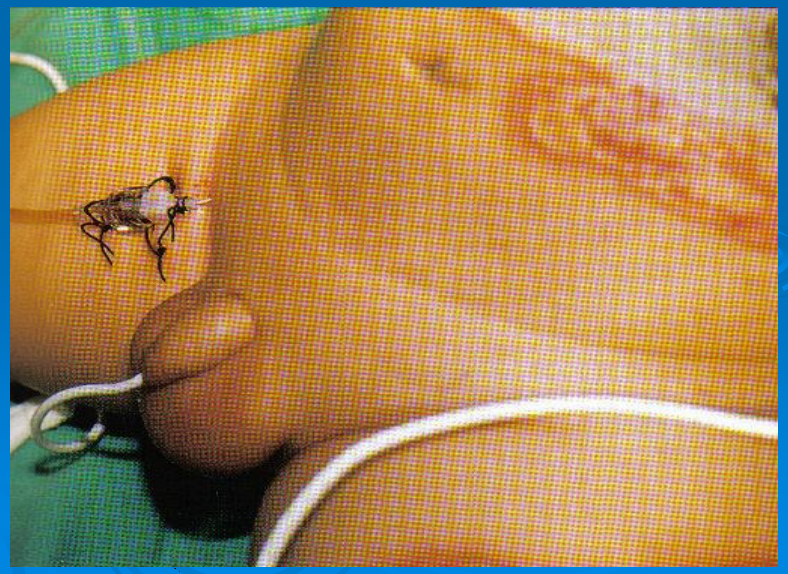
D.增強免疫功能

隔離措施

避免外在環境及水療時、換藥時的交互感染

放置CVP Line及導尿管

- 中心靜脈壓(CVP)
  維持在 5 – 12 cmH_2O
- 尿量維持每小時每公斤體重 0.5 ml 以上
- 尿比重維持在
  1.010 至 1.020之間



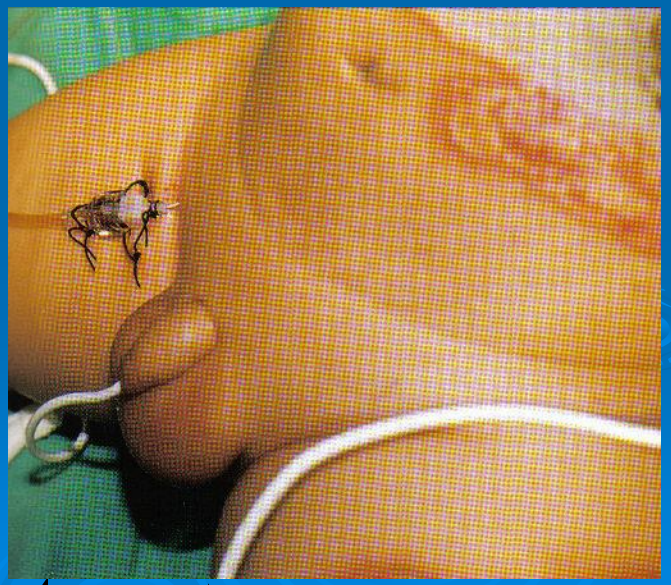
導管護理

包括 血管導管(CVP, A-line 等)

氣管插管

氣切導管

導尿管



抗菌藥物使用

Topical Antibiotic:

Silver sulfadiazine(Flamazine)

Sulfamylon

Betadine

Systemic Antibiotic:

依細菌培養及敏感試驗選用

早期的復健治療

PSE 原則

Positioning: 灼傷部位的姿勢擺放

Splinting: 副木的使用

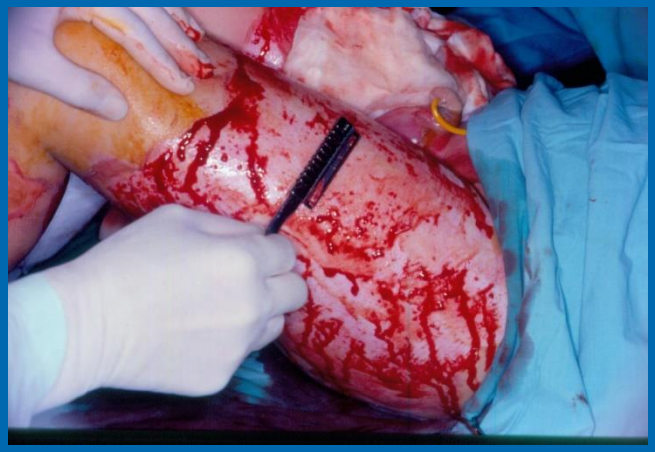
Exercise: 運動的執行

避免關節的攣縮與變形，及肌肉萎縮

燒燙傷的手術治療

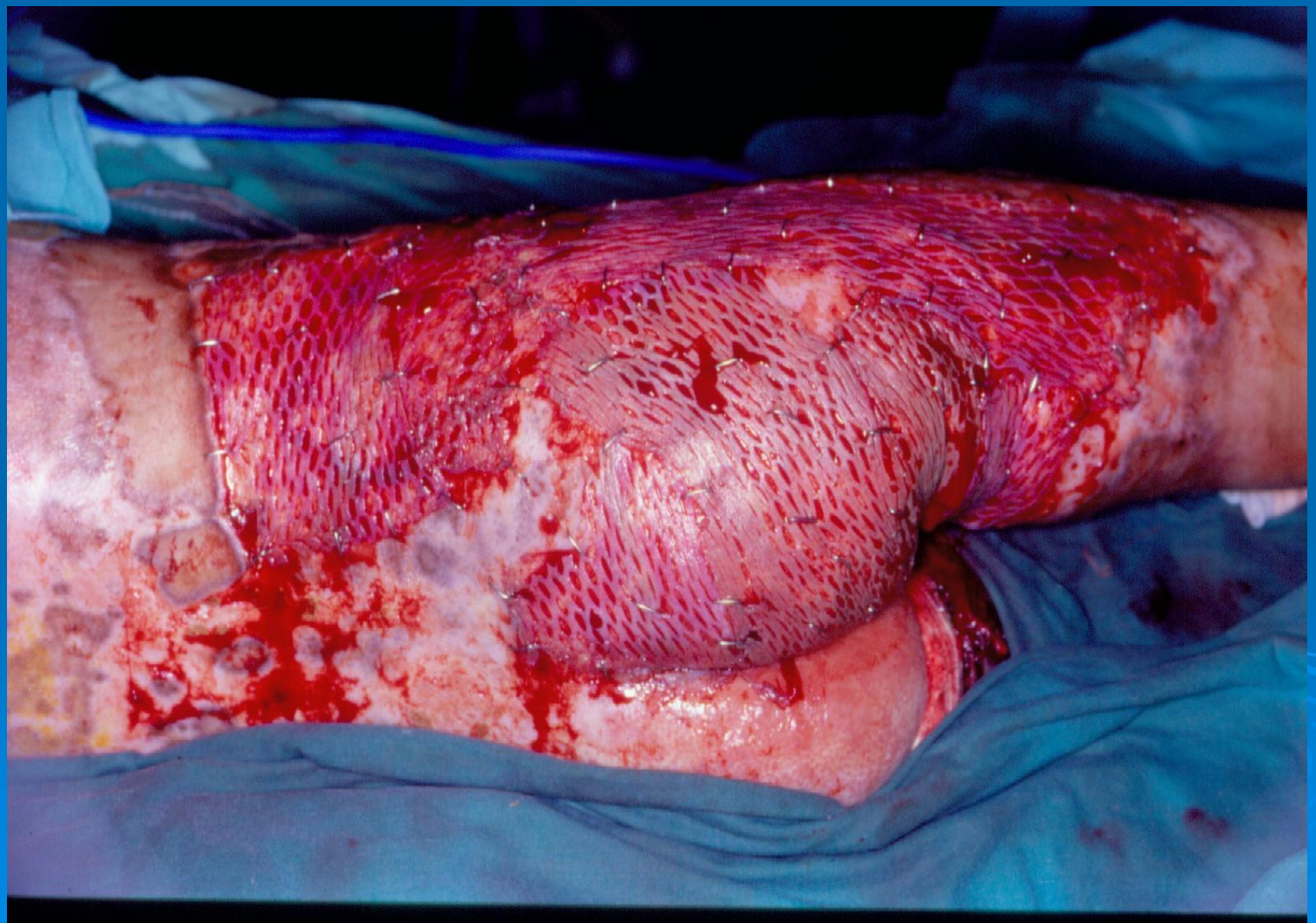
- 擴創術及各種生物敷料覆蓋
- 自體皮膚移植
- 皮瓣手術
- 截肢
- 重建及整形

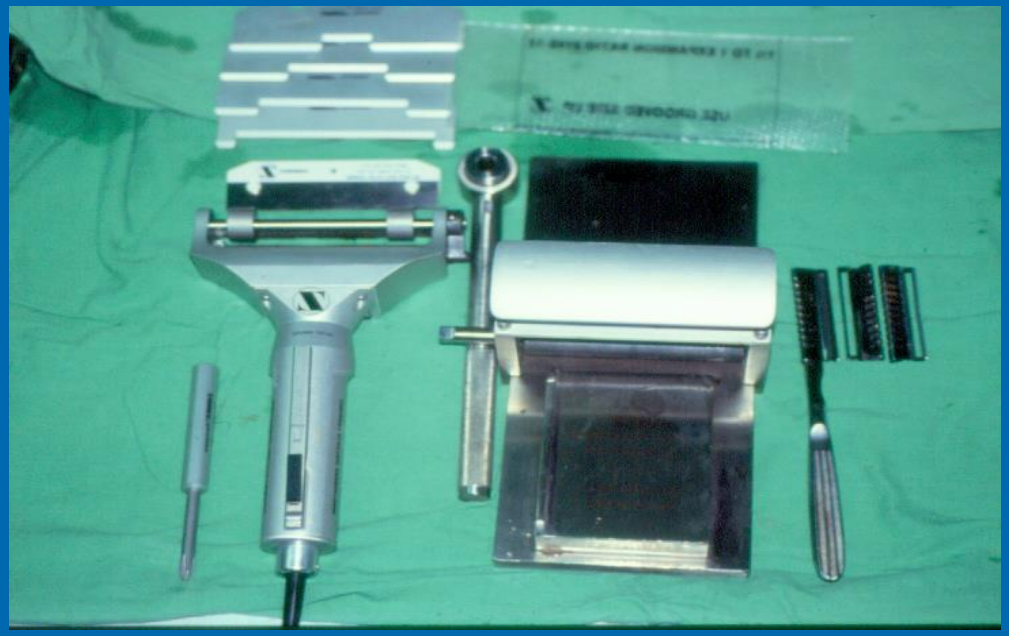
擴創術和各種敷料覆蓋

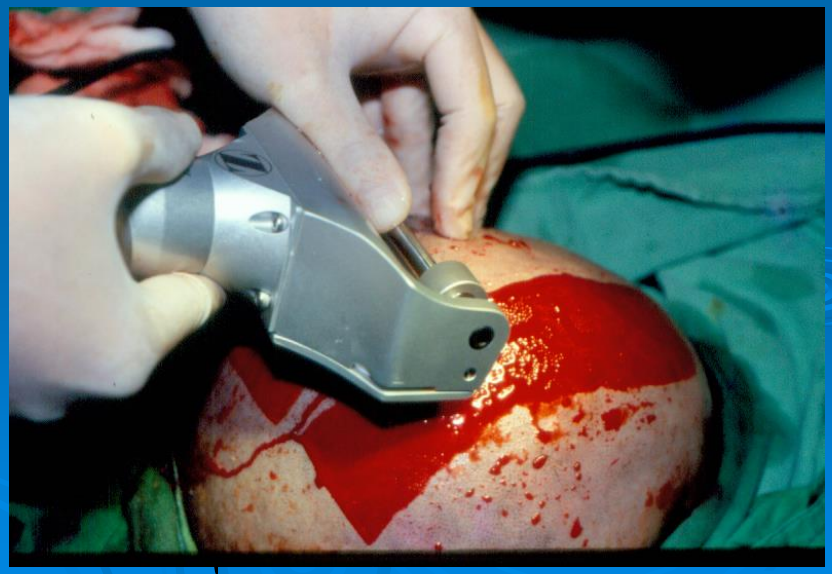


擴創術及各種生物敷料覆蓋

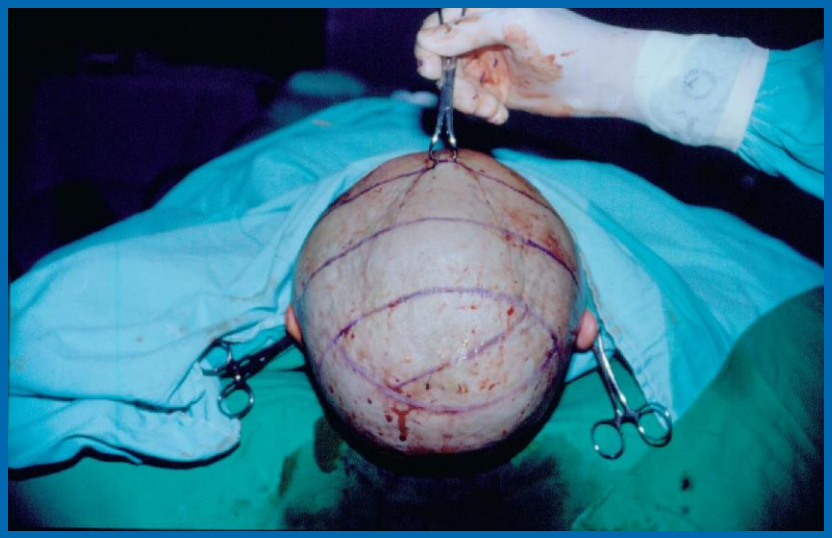
自體皮膚移植

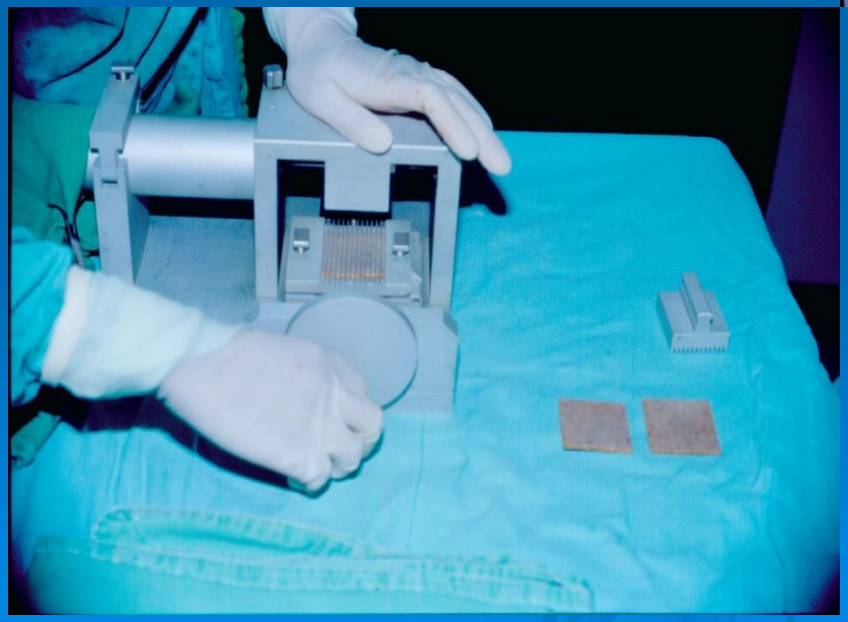


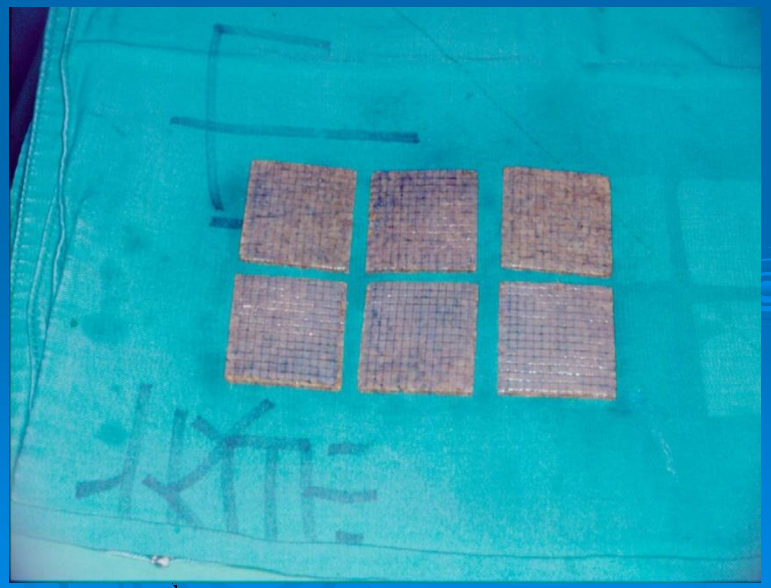




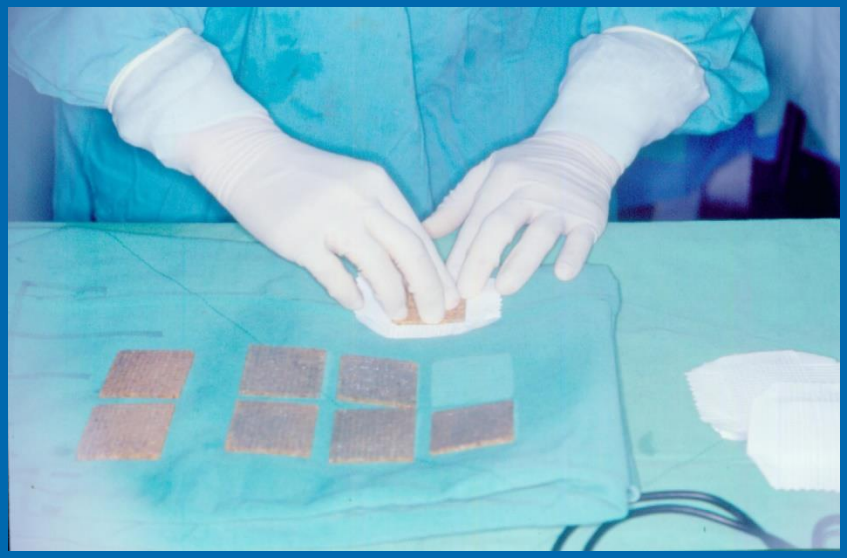
擴皮墊式顯微植皮術(Humeca)─ (1)

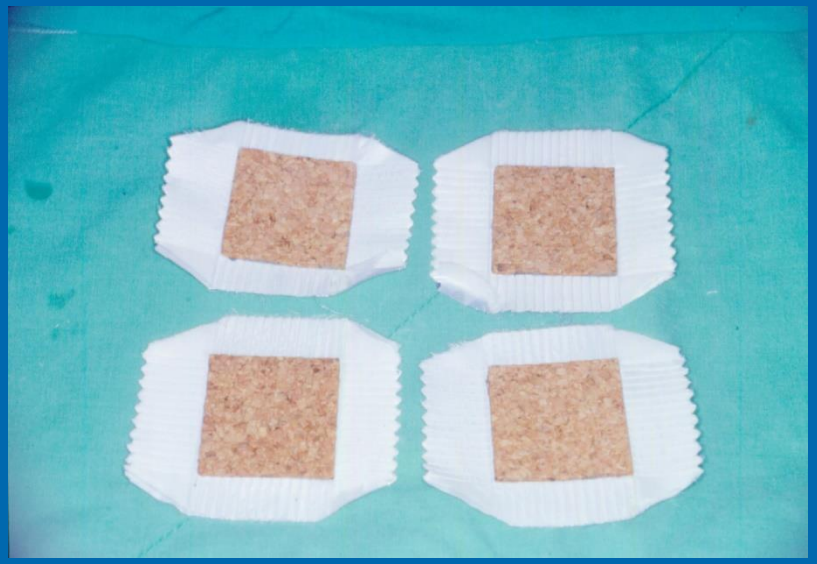


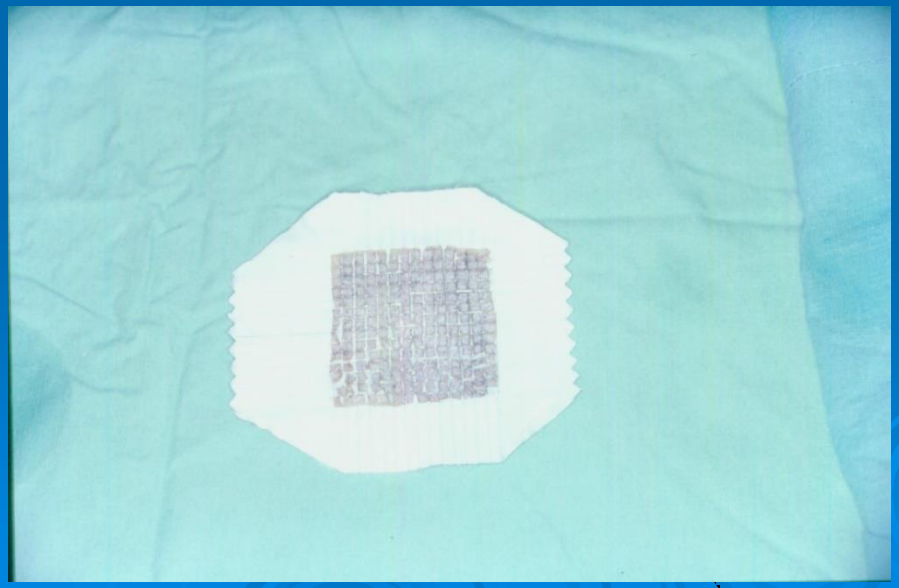




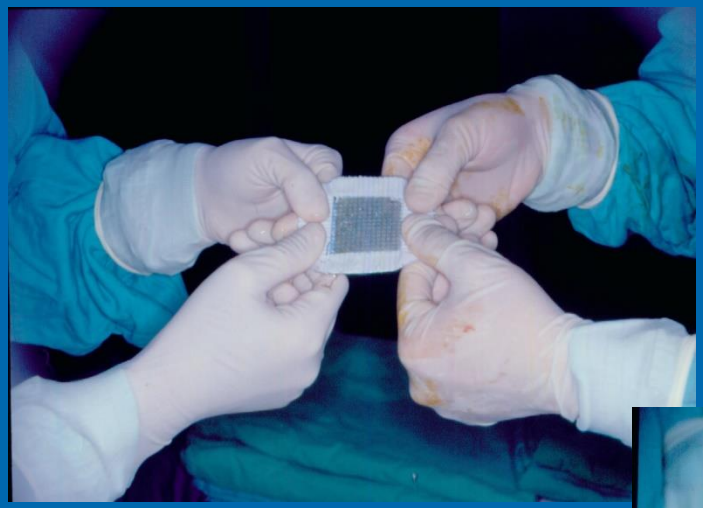
擴皮墊式顯微植皮術(Humeca)– (2)

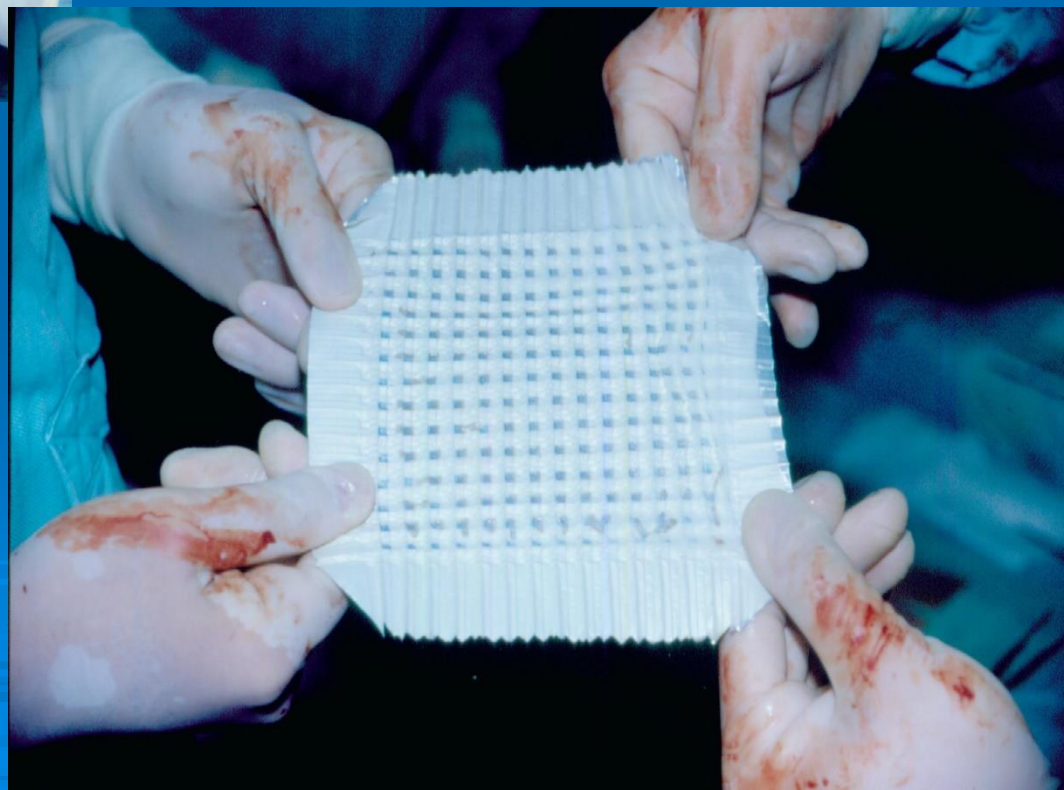




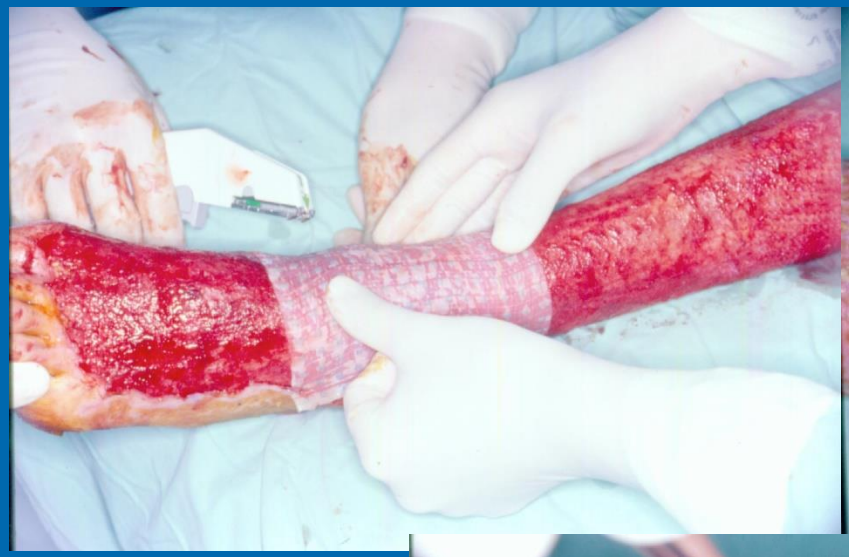


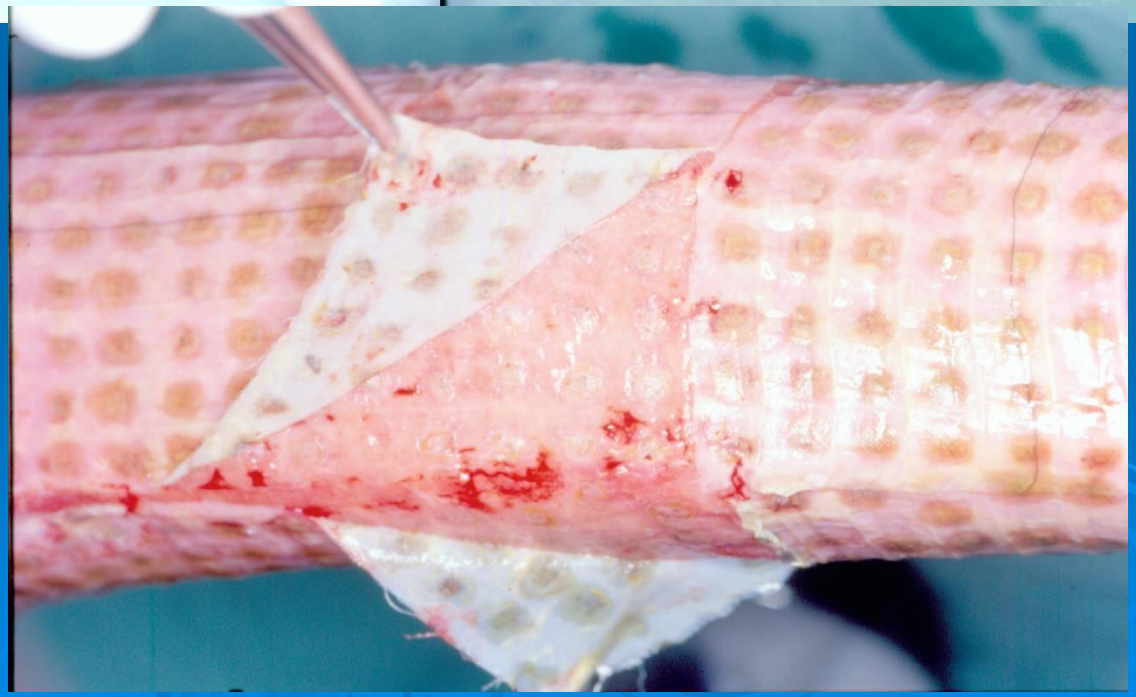
擴皮墊式顯微植皮術(Humeca)– (3)





擴皮墊式顯微植皮術(Humeca)─(4)

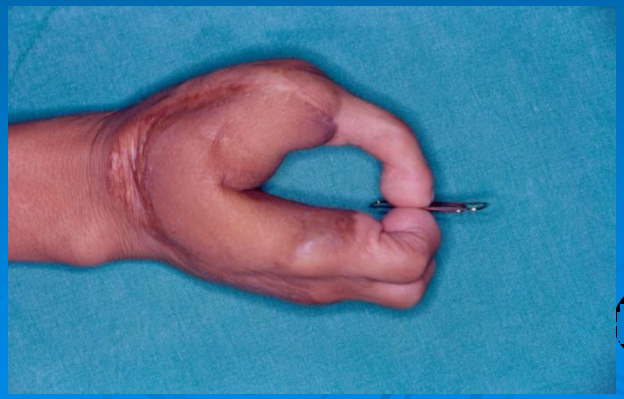




擴皮墊式顯微植皮術(Humeca)─(5)

皮瓣治療+截肢+自體皮膚移植

皮瓣治療+截肢+自體皮膚移植



燒燙傷的晚期治療

- 傷口的照顧
  - — 傷口清潔;疤痕按摩; 癢,水泡,
    潰瘍處理;避免陽光紫外線
- 穿戴彈性衣
- 持續復健治療
- 適當的心情舒解
  - — 心理調適及治療, 社會參與
- 定期回診




燒燙傷後遺症

- 疤痕增生
- 疤痕及關節攣縮，變形
- 肢體缺損及功能喪失
- 心理創傷及適應不良

Thanks for your attention !!