A HISTORY OF WOUND CARE FROM ANCIENT TIMES TO THE PRESENT

DR. STEVE BERLIN
CHIEF MEDICAL OFFICER
OGENIX

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ADAM & EVE

What if Eve was bitten by the snake & had not eaten the APPLE – if no apple, no sin & no wounds?

CAVE MAN ERA, 8000 BC+

1. Wound Care – Magical Incantations
2. Trial-Error & Instinct
3. Possibly stones used for Pressure – Bleeding
4. Leaves & barks for dressings
5. Pressure ulcers have been noted on Mummies 5000 years old.
**SUMARIAN CLAY TABLET 2100 B.C.**

1. Believed to be the oldest manuscript
2. Describes wound cleansing, dressings/plasters
3. Bandages – represented basic principles
4. Ancient World describes herbs, dried wine, prunes, beer etc., for healing.


**EGYPT: 2700 BC – 1500 BC**

1. 1st known surgery – 2750 BC
2. Egyptian: Imhotep (2667-2647 BC) first known physician by name
4. 1800 BC Kahun Genealogical Papyrus – Oldest
5. 1530 – 1600 BC – Ebers Papyrus – provided info on disease management, anatomy and hygiene; detailed animal grease as a barrier, honey used as an antibiotic; aloe & poppy seeds used for pain control.
6. Berlin Papyrus - Believed closing the wound preserved the soul & prevent infernal demons
BABYLONIAN TIMES...1069 - 1046 BC

1. Introduced concepts of diagnosis

GREEK & ROMAN PERIOD 700 BC - 300 BC

1. Greece opened first Greek Medical School (CNIDUS)
2. Trojan War 500 BC - 300 BC - Greek Army develops bandaging basics - linen, sponge (soaked in wine/vinegar)
3. No understanding at this time of cautery & ligation for bleeding
4. Removal of foreign bodies
5. Reduce pain (poppy-opium) & inflammation (celery)

GREEK & ROMAN PERIOD...CONTINUED

★ Anaximander (educator) 600 B.C. – Greece – all matter was made of elements – Earth, Wind, Air and Fire.
★ Alexander the Great (300 B.C. Greece) – increased education and learning. Developed confinement for illness – 40 day periods of time.
GREEK & ROMAN PERIOD 700 BC – 300 BC

I asked my doctor to treat me according to the principles of Ancient Greek medicine.

But I think he is just humouring me.

GREEK MEDICINE

HIPPOCRATES 460 BC – 377 BC

1. Known as the Father of Medicine – Hippocratic Oath
2. Discussed diseases & medicine
3. Thought wounds should be treated with salves
4. Necrotic tissue to be removed
5. Thought wounds should be left dry
6. Collection of 60+ Medical Works from ancient Greece
**OTHER FAMOUS GREEK PHYSICIANS**

1. Apollo – 400 BC – swore to protect patients from poisons
2. Diocles of Carystus – developed surgical instruments
3. Proxagores of COS – noted for discovery of pulses (artery & vein)


**HINDUISM – 600 – 400 BC**

1. Text on concepts of demons & magic
2. Ayurvedic – Indian Medicine Development
3. Developed several branches of medicine
   1. Distillation, Operative skills, Cooking, Metallurgy, Sugar manufacturing, pharmacy, analysis & separation of minerals

**INDIAN MEDICINE BC**

Sushruta, likely a historical physician from the 6th century BC, author of Sushruta Samhita, a Sanskrit redaction text on medicine.
SOME ANCIENT WOUND FINDINGS (TRIAL & ERROR)

1. Bleeding – pressure – rocks
2. Plant extracts - styptics(wine & vinegar)
3. Ice & snow – reduced pain
4. Herbs – found to help heal in different parts of the world (leaves & grasses often used as early bandages)
5. Poultices & ointments made from animal fat, vegetables or minerals often mixed. Honey & Butter & metallic copper (antibacterial)

ROMAN TIMES AD

1. Claudius Galen 129 – 217 AD – a Greek physician who went to Rome to revive the ideas of Hippocrates. A great surgeon famous as a surgeon for a school of gladiators
2. Spoke of cautery & ligation for bleeding
3. First to distinguish acute and chronic wounds
4. Thought “pus” was a sign of healing
5. Believed in wound closure

http://www.historylearningsite.co.uk/claudius_galen.htm
CAINES PLINEY (23-79 AD)

1. Wrote “Historia Naturalis”
2. Consisted of 20,000 facts in 37 books
   (Documentation)

CORNELIUS CELSUS 37 AD

1. Medical writer on Medicine & Woundcare
   (8 books) “De Medicine” 50 AD
2. Noted four Cardinal signs of Inflammation – rubor
   (redness), calore (heat), dolore (pain), tumore
   (swelling)

MIDDLE AGES – 7TH – 14TH CENTURY

* The Church had assumed much of the medical care during this
  period which was a deterrent to Surgical Principles that were
  adopted in Galen’s time. Kept wound care possibly as a secretive
  form of care?
10th Century (936-1013)

1. Islamic Medicine influenced the fields of chemistry, distillation and crystallization & produced medicines
2. Abdul Quasim Al Zahrawi (936-1013) quoted methods to stop bleeding, cautery, and division of vessels.

12th Century Italy

1. Surgical dominance moved to Italy
2. School of Surgery founded by Hugh de Lucca (1160-1257); he also advocated wounds be kept “dry”.

13th Century – France

1. Surgery spread from Italy to France
   a. Maite Henri de Mondeville (1260 – 1320) & Guy de Chauliac (1300-1368) agreed with Galen’s thoughts about wounds.
   b. Wrote 5 principles of Wound Treatment: reduce foreign bodies, reapproximate the separate parts, maintain your aposition, conservation of substance, treatment of complications.
14TH CENTURY – WOUND HEALING

1. Development of Gun Powder
2. Gun powder wounds – Boiling oil was used to inactivate its effect.
3. Gun shot wounds became treated with cautery (100 years)

19TH CENTURY – WOUND HEALING

1. Ignaz Phillip Semmelweis (1818 - 1865) an Austrian (OB) noted that washing hands reduced infection – prevented medical death
2. Robert Koch (1843-1910), famous bacteriologist from Germany: Proper hygiene and medication reduced infection.
4. Lister in 1867 used Carbolic Acid into open fractures & dressings and noticed that it prevented infection and reduced amputations.
5. Ernst von Bergman (1886) Introduced heat sterilization to prevent infection – Beginning of Aseptic Surgery.
6. Paul Leopold Friedrich (1898) introduced wound excision/debridement to reduce infection
WARS & WOUND HEALING

1. American Revolutionary War (1775-1783)
   Few licensed doctors – up to 50% of surgeries were fatal.
2. Napoleonic Wars (1803-1815) – pioneered triage; earliest documented use of maggots to clean wounds
3. 1860s US Civil War
   a. Compound fractures: 25 - 90% were infected – increased amputation rate.
   b. Dr. Jonathan Letterman (1824-1872) developed medical organization within armies – ambulance core establishment.
4. WWI – wounds due to poison gas, shell fragments, machine guns
5. WWII – Medivac – combat medicine 1940s
6. Korean War, Vietnam war (Dr. Harry Coover, Kodak labs & Ethicon in 1966 developed Traumaseal & Dermabond - Superglue & Gulf wars – in each war, new theories of handling the wounded soldiers developed and refined.

20TH CENTURY WOUND HEALING

1. Alexander Fleming 1881-1955 (London Microbiologist) discovered Penicillin in 1928
2. William S.Halsted (1852-1922), Prof. Surgery, Johns Hopkins – first to inject cocaine as a nerve block for surgery. Instrumental in sterile techniques in surgery - introduced rubber gloves to Drs and RNs. His students became routine users (J.Bloodgood)
3. Howard Florey (1940) – first to administer Penicillin.

Antibiotics at Work

How do antibiotics work?

Antibiotics are a type of chemotherapy that kill off harmful bacteria. They come in many forms, such as pills, ointments, poultices, and even powders. They work by interfering with the bacteria's cell wall synthesis, which prevents them from growing and reproducing.

In the image, a bacterium is shown with an antibiotic attached to it, indicating the mechanism by which antibiotics kill bacteria.
WOUND HEALING 1950-1960

1. Drs. Weber, Hinman & Malbach found wounds heal faster if moist.
2. Theory developed on migration of wound care factors (e.g., VEGF, FGF, PDGF & others) to encourage epithelialization.
3. New advances developed polymers & synthetics for wound dressings and suture material for wound closure – Nylon, Stainless steel

WOUND HEALING 1970 - 1990

1. Wound Dressings continue to make more progress in these 20 years than the past 2000 years
   1. 1980 – birth of hydrocolloids, hydrogels (wound moisture)
   2. Non-stick dressings, Ca Alginate, Ag dressings etc.

WOUND HEALING 1990s

1. Understanding of wound care growth factors
2. Biotechnology development – skin substitutes
3. New focus on wound pain
4. Electrical, laser, shockwave & ultrasound modalities introduced to enhance wound care
PHASES OF WOUND HEALING

1. **Primary (1st Intention):** approximate the wound edge
2. **Secondary (2nd Intention):** Healing by contraction & epithelialization
3. **3rd Intention: Delayed Primary – Healthy granulation before primary closure**

STAGES OF WOUND HEALING

1. **Inflammation** – 7-10 days – stop bleeding & infection
2. **Proliferation** – weeks to months – Fibroblast proliferation, capillary formation, early epithelialization
3. **Remodeling** – 1-2 years – Collagen formation & epithelialization

SOME WOUND CARE FINDINGS

1. **Hydration** – enables faster wound epithelialization
2. **Temperature** – wound healing best at ambient temperature ~ 30°C; cooler temperatures (12°C) decrease tensile strength by 20%
3. **Radiation** – decreases tensile strength, inhibits normal fibroblasts
4. **Smoking** – inhibits oxygen, reduces hemoglobin development
5. **Hypoxia** – prevents wound healing; increases infection, prevents collagen synthesis, fibroblast proliferation
6. **Edema** – compromises perfusion, increases tissue pressure, causes cell death and tissue ulceration (venous wounds)
7. **Infection** – decreases tissue pH & increases inflammation; impairs angiogenesis & epithelialization; increases collagenase activity.
8. **Anti-inflammatory drugs** – steroids, NSAIDs, aspirin
9. **Cancer Treatment** – Systoxic agents
10. **Age & nutritional status**
11. **Other factors** – obesity, protein deficiency, co-morbidities
LIVE MEDICAL DEVICES – LEECHES & MAGGOTS

1. Ancient Greece to Present Day
2. Leeches primarily for graft sites to reduce hematoma, prevent blood clotting
3. WW I – Dr. William Baer noted GIs had less infection and swelling
4. Maggots clean wounds, used in resistant strains of bacteria and curbs inflammation
5. FDA approved leeches and maggot therapy – 2004
6. Drug-secreting maggots may be in the future. It suppresses the immune system and believed to increase the oxygen concentration and increase cellular growth

20-21ST CENTURY WOUND TREATMENT MODALITIES
NEGATIVE PRESSURE WOUND THERAPY (NPWT) - 1996

1. Invented by Russian scientists first in 1947 and successfully applied to wound healing in 1986
2. Foam interface developed in USA by Dr. Louis Argenta & Michael Morykwas, Wake Forest University
3. NPWT commercialized by KCI to promote wound healing by a) reducing edema, b) preparing wound bed for closure, c) promoting formation of granulation tissue, d) removing infectious material
4. Utilizes granular foam to enhance metabolic activity and pressure sensitive areas to wound healing

NPWT DEVICES IN THE MARKET

PICO® disposable battery powered NPWT unit by S+N
KCI V.A.C.®
SNAP® mechanical disposable unit by Spiracur
20-21st CENTURY WOUND TREATMENT MODALITIES

1. Hyperbaric Oxygen Therapy (HBOT)
   1. Developed in 1662 by Henshaw - Understanding subcutaneous oxygen tension – 30 -50 mm Hg; <30 mm means chronic wound.
   2. Increased usage 1990s to present
   3. Fibroblasts are oxygen dependent
   5. Proliferation phase has greatly increased metabolism & protein synthesis.
   6. Enhances angiogenesis & epithelialization

HBOT

TOPICAL OXYGEN MODALITIES

1. Uses oxygen tank and bag or box enclosures
2. 6 liters/min rate of flushing the wound – may cause the wound to dry
3. Intermittent application – 60-90 minutes/day for up to 3 days/week
TOPICAL OXYGEN

- Topical Oxygen devices (Box & Bag)

TRANSDERMAL CONTINUOUS OXYGEN THERAPY (TCOT)

1. EPIFLO – Developed in MA (Sarang Sarangapani, Ph.D.) & OH (Dan Scherson, Ph.D., CWRU)
2. Totally ambulatory
3. 15-day disposable device
4. No recorded complications
5. 24/7 delivery system
6. 3 ml/hr slow drip rate

TRANSDERMAL CONTINUOUS OXYGEN (TCOT)

- Transdermal Continuous Oxygen Therapy (TCOT)
Application Guidance for Transdermal Continuous Oxygen Therapy (EPIFLO)

Steps in the installation of EPIFLO w/ compression wrap
Step One:
Place the sterile EPIFLO® cannula beneath an absorbent and/or anti-microbial dressing in the centre of the wound bed.

Step Two:
A compression dressing is secured to the leg according to the manufacturer’s instructions for use. The cannula is weaved outside each successive wrap of the compression dressing.

Step Three:
The compression dressing can be covered with a protective bandage and EPIFLO® is secured into place with tape. Alternatively, EPIFLO® can be positioned elsewhere on the patient.

21ST CENTURY KNOWLEDGE
1. Knowledge continues
2. Better understanding of wound types and wound healing
   a. Most common Wounds: 1) Diabetic ulcer - glucose control, 2) Venous ulcer – control edema,
      3) Pressure ulcer – control pressure
3. Clean wounds – irrigation & removing foreign bodies
4. Appropriate dressings for wound types (over 200 available);
   a. Off-loading wound pressure when applicable for plantar foot & pressure ulcers
5. Wound closure when possible
6. Repeat debridement & biofilm removal
   a. Reduce edema (compression therapy in venous wounds), and reduce bacterial burden
7. Resource intensive and expensive care
8. Vascular perfusion is essential in wound healing
9. Prevention of amputation – ABI, TcPO2, Skin Perfusion Pressure & CLI
10. Oxygen essential in wound healing

CONCLUSIONS
1. Florence Nightingale RN (1820-1910) with 38 volunteers in Turkey organized sanitation within hospitals which lead to the development of modern healthcare teams.
2. Wound care is a team effort with the internists, surgeons, podiatrists, dermatologists, endocrinologists, nurses, nutritionists and physical therapists providing the care giving effort.
3. 5-7 million wounds occur each year in USA.
4. Wound care cost is 25+ Billion dollars increasing at 15% yearly.
5. Stem cell therapy in the future?
6. Education & documentation continues with multiple WC journals, Publications and conferences.
REFERENCES

5. Ayrilo, E.A., Twenty years of wound care, where we have been, where we are going, Advanced Skin Care, 2005, 10-33
6. Baronoski, S., Choosing a wound dressing 1 & 2, Nursing 2008, 38

REFERENCES.......


Special wound healing methods used in ancient Egypt & the mythological background:

1. Nurses – Information & Resources, WorldMeds, Wound Care History pages 1-3, Nurses
3. Abigail E Chaffin MD, “Wound Healing & the Problem Wound”, Tulane University Presentation