

Hand Burns – What is Unknown and Where We Need to Go

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Hand Burns – Goals

- Describe basic principles
- Describe “unknowns”
- Speculate on the future

Format

- Based on two schemas
 - Time
 - Immediate – first 24 hours
 - Acute
 - Initial healing or coverage
 - Wound maturation
 - Initial scar management
 - Late
 - Dealing with scarring complications
 - Reconstructive surgery

Format

- Based on two schemas
 - Anatomy
 - Skin (wound coverage)
 - Muscle
 - Tendon
 - Joint
 - Bone
 - Nerve
 - Vasculature

Basic Principles for Hand Burns

- Re-epithelialize (“Heal”) within 2 weeks – minimal scarring
 - Goal should be to optimize epithelialization
 - Moist healing
 - Minimize infections
 - Biologic dressings
 - Optimize costs

Basic Principles for Hand Burns

- Full-thickness burns
 - Early excision and grafting improves results
 - Autografts work well
 - Sheet grafts are best
 - Use thickest skin possible
 - Minimize and optimize seams
 - Hands have priority over less important areas
 - Early range of motion

Basic Principles for Hand Burns

- Exposed joints (minor)
 - Immobilize (K-wires)
- Exposed bones, tendons, joints
 - Skin grafts are inadequate
 - Flaps required

Basic Principles for Hand Burns

- Wound coverage
 - Simple to complex continuum
 - Preserve length
 - Preserve or create opposition

Hand Burns – Unknowns

Immediate

- Escharotomies
 - Hand - probably
 - Fingers – no consensus
- Fasciotomies
 - Hand compartments
 - Finger compartments
- Nerve risk areas
 - Carpal tunnel (median)
 - Guillan’s canal (ulnar)

Hand Burns – Unknowns

Acute

- Skin – which is better?
 - Autograft alone
 - Allograft followed by autograft
 - Dermal substitute and autograft
 - Use of cultured skin substitutes
 - Role of stem cells



Hand Burns – Unknowns

Acute

- Skin anatomy differences
 - Dorsal skin similar to rest of skin
 - Palmar skin markedly different
 - Thicker epidermis
 - Less mobile
 - No hair
 - No pigment

Hand Burns – Unknowns

Acute

- Best treatment for palm burns
 - Allow more time to heal on own
 - Full-thickness nonspecialized skin (groin)
 - Good function
 - Hyperpigmented
 - Harvest from sole of foot
 - Better pigment
 - Worse skin





Hand Burns – Unknowns

Acute

- Pigment treatment
 - Why do grafts tend to hyperpigment?
 - Why do donor sites tend to hypopigment?
 - How do we decrease pigment?
 - Decrease sun exposure
 - Hydroquinones
 - Dermabrasion and glabrous grafts
 - How do we increase pigment?
 - Tattoo
 - Dermabrasion and autograft

Hand Burns – Unknowns

Acute

- Fingertips and fingernails
 - Graft?
 - Decreases sensitivity
 - Tips will contract without problems
 - Optimizing nail replacement
 - Minimizing nail disfigurement

Hand Burns – Unknowns

Acute

- Muscle
 - Preserving intrinsic function
 - Few other issues
 - Grafts will take on muscle

Hand Burns – Unknowns

Acute

- Tendons
 - Early versus late coverage
 - How to maintain viability
 - Best way to minimize adhesions
 - Splint versus early range of motion
 - Repair of transected tendons
 - When
 - Where
 - All extensor tendons?

Hand Burns – Unknowns

Acute

- Open joints
 - Dorsal PIP – K-wire and allow to heal
 - Other methods to cover joints
 - Flaps
 - Role of artificial joints
 - Control of late arthritis

Hand Burns – Unknowns

Acute

- Exposed bone
 - Amputate or preserve?
 - How much effort should be spent to preserve length?
 - Flap design – which is best?
 - Local (cross finger, island, radial)
 - Abdominal, groin flaps
 - Free flaps

Hand Burns – Unknowns

Acute

- Bone damage
 - Dealing with growth plate damage
 - Preventing osteomyelitis
 - Optimal treatment of fractures and burns

Hand Burns – Unknowns

Acute

- Nerves
 - Decompress early?
 - Carpal tunnel
 - Guillan's canal
 - Repair?
 - Digital
 - More proximal injury

Hand Burns – Unknowns

Acute

- Nerves
 - Why do injured nerves autolyze?
 - What controls re-innervation?
 - Why do some wounds get hypersensitivity?
 - Why do some get sympathetic dystrophies?

Hand Burns – Unknowns

Acute

- Vasculature
 - Vasoconstrictive diseases
 - Raunaud's
 - Spasticity after frost bite

Hand Burns – Unknowns

Acute

- Salvage versus amputation
 - How far and how long should preservation go?
 - Should a viable hand be saved with a nonviable arm
 - Proximal loss of nerve or wound coverage
 - Role of prosthetics
 - For single amputee?
 - Best type

Hand Burns – Unknowns

Late

- Scar issues
 - Causes of scarring
 - Methods to treat/prevent hypertrophic scarring
 - Getting grafts/scars to grow with hands

Hand Burns – Unknowns

Late

- Scar contractures
 - Timing of releases
 - Early – before maturation
 - Maintains strength and range of motion
 - Prevents tendon shortening?
 - Recurs more often?
 - Late – after maturation
 - Does waiting reduce recurrence?
 - Does the scar milieu cause recurrence?

Hand Burns – Unknowns

Late

- Scar contracture
 - Type of release
 - Z-plasties
 - Release with grafts
 - Flaps
 - Capsulotomies

Hand Burns – Unknowns

Late

- Total hand replacement
 - Role of transplants
 - Really viable?
 - Really functional?
 - Immune control optimal?
 - Worth the risk?

Hand Burns – The Future

- Reduce/prevent edema
- Eliminate compartment syndromes
- Determine accurate burn depth
- Reduce burn depth progression
- Healing accelerated
 - Epithelialization
 - Graft take

Hand Burns – The Future

- Skin
 - Better autograft
 - No seams
 - Rapid take
 - Easy hemostasis
 - Minimal donor site morbidity
 - Rapid maturation
 - Skin adnexa recreated
 - Pigment controlled

Hand Burns – The Future

- Skin
 - Ideal skin substitute
 - Readily available
 - No rejection
 - Resistant to infection
 - Takes and matures rapidly
 - Grows with hand
 - Heals
 - Has skin adnexa
 - Pigment controlled

Hand Burns – The Future

- Muscle
 - Regeneration of muscle
 - Strength and endurance maintained

Hand Burns – The Future

- Tendon
 - Rapid repair possible
 - No delay in range of motion
 - No scarring or adhesions
 - Tissue engineered tendon
 - Tendon for large defects
 - Creation of tendon/muscle units

Hand Burns – The Future

- Joints
 - Better control of arthritis
 - Joint transplants
 - Artificial joints

Hand Burns – The Future

- Bone
 - Tissue engineered bone
 - Readily available
 - All sizes and shapes
 - Becomes viable tissue that repairs itself

Hand Burns – The Future

- Nerves
 - Rapid and effective repair
 - Prevention of autolysis
 - “Instant hookup”
 - Prevention of compression syndromes
 - Tissue engineered
 - Conduit
 - Actual nerve segments

Hand Burns – The Future

- Vasculature
 - Control of angiogenesis
 - Understanding regulation of vascular spasticity
 - Tissue engineered conduits
 - Small caliber
 - Thrombosis controlled

Hand Burns – The Future

- Prosthetics
 - Best prosthetic designed
 - Functions optimally
 - Looks like a hand
 - Mixes biomaterials with artificial materials

Hand Burns – The Future

- Total hand replacement
 - Viable transplant
 - Rapid return of normal function
 - “Used” by patient
 - Rejection issues resolved

Hand Burns – The Future

- Total hand replacement
 - Tissue engineered hand
 - “Bionic”
 - Totally human tissues