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LASER SCAR TREATMENT

Surgical Specialty:	Plastic Surgery
Authors:	Nicole McCoy, MD; Mariah Tanious, MD, MPH, FAAP Medical University of South Carolina, Charleston, SC

Background:

- General Considerations
  - Laser treatment is frequently used to manage children with hypertrophic scars, keloids, and burns[1-3] to reduce scar erythema, texture, pruritus or discomfort, and related contractures.[4-7]
  - Laser scar treatment can also be used to facilitate the efficacy of topically administered medications, as it improves absorption and penetration.[8]
  - Pulse dye laser can be used to erase large capillary malformations (port wine stain)

- Patient Considerations
  - Large heterogeneity of population (i.e. healthy patients with isolated superficial skin lesions vs. patients with prior life-threatening injury)
  - Patients with significant total body surface area burns may have challenging or limited vascular access options.
  - Contractures may also result in difficulties with airway management and positioning.
  - Medical environment-related anxiety is common in patients undergoing serial procedures
  - Chronic pain, allodynia, and hyperalgesia occur frequently in this patient population
  - Children with hemangiomas may be on oral beta-blocker therapy (propranolol)

Anesthetic Planning:

- Pre-Anesthetic Evaluation
  - Thorough pre-operative assessment to evaluate for non-dermatologic sequelae of the original injury that led to scarring (inhalation smoke injury, neurologic damage, etc.).
  - Assess the need for anxiolytic and/or analgesic premedication
    - Consider oral agents like acetaminophen and oxycodone to facilitate adequate intraoperative and postoperative analgesia
  - Review previous anesthetics and discuss with the family about any prior postoperative issues
  - Discuss with the surgeon the planned area of laser treatment and anticipated length of treatment, especially if treatment involves the head/neck region.

- Specific or Unique Room Set-up Requirements
  - Airway
    - Many cases may be performed with mask/natural airway maintenance due to the short nature of the case.
    - May utilize LMA if longer case duration is anticipated. Consider endotracheal tube if need to protect the airway and/or need to reliably titrate FiO_2 to reduce fire risk
  - Drugs/Infusions
    - Multimodal analgesia can be helpful, consider:
      - Dexmedetomidine for emergence delirium prevention, pain relief adjunct, sedation (0.5-1 mcg/kg)
      - Ketamine for longer and more extensive cases, less useful for short cases with a high risk of emergence delirium (0.5-1 mcg/kg/bolus)
      - Fentanyl (1-2 mcg/kg) vs. morphine (0.1 mg/kg) or hydromorphone (0.01 mg/kg) if no preoperative opioid is given
      - Ketorolac (0.5 mg/kg) as a pain relief adjunct, if minimal anticipated bleeding
    - Antiemetics
      - Ondansetron (0.1 mg/kg up to 4 mg)
      - Dexamethasone (0.1 mg/kg)
        - Avoid if child undergoing very frequent laser treatment: risk of depression of hypothalamic-pituitary-adrenal axis
  - Monitors
    - Standard ASA monitors
    - May need to utilize ear or nasal probe for SpO_2 monitoring if limited access to extremity options
  - Blood Availability
    - Usually not needed
  - PICU Bed Availability
    - Usually not needed
  - Other Indicated Resources for Patient
    - Consider several sources of active warming (warmed operating room, forced air warmer, radiant warmer), especially if a large surface area and/or longer laser treatment is planned.
    - If lasering near the face, the patient may require metal eye shields. Also, consider placing soaked towels over the patient's mask/face to reduce fire risk
  - Staff Resources
    - Laser-protective eyewear must be available for all team members
    - High-filtration face masks are recommended given the risk of airborne particles generated by laser treatment
    - A "Danger: laser in use" warning sign should be visible on each access door giving access to the procedure room

Intraoperative Considerations:

- General
  - Highly stimulating, short-duration procedures
  - Pre-incision time out or safety pause should include:
    - Shared airway goals, especially if lasering in areas around the face or neck.
    - Confirm the appropriateness of ketorolac with the surgeon

        - Specific laser timeout for all OR staff to ensure proper safety equipment for providers and the patient.
        - Assess fire risk; minimize the presence of flammable material in the surgical field: e.g., alcohol-containing skin preparation solution, dry gauze
- Induction:
    - Mask vs. IV per preference
- Positioning:
    - The patient often remains on a stretcher as the operating room bed is likely not needed.
- Maintenance:
    - Inhalation agent is often preferred due to the highly stimulating nature of the procedure.
- Hemodynamic/Physiologic goals:
    - Age-appropriate hemodynamic parameters
- Surgical Considerations
    - Neuromuscular blockade is typically not indicated
    - Blood loss is often minimal
- Emergence/Disposition
    - Increased risk of emergence delirium[12]
    - Typically an outpatient procedure
- Postoperative Pain
    - Acute pain can lead to a significant opioid requirement in PACU
    - Consider short-acting opioids (i.e. fentanyl) for pain control in PACU if oral opioids were given as a premedication

Case-Specific Complications/Pitfalls

- Fire Risk:
    - Recognize the high risk of fire given laser (ignition source), fuel, and oxidizing agent often without a controlled airway.
- Anxiety:
    - Many patients will have anxiety secondary to their injury, hospitalization post-injury, and repeated outpatient visits for burn/scar management.
- Opioid Requirements:
    - Patients may develop tolerance to opioids and require higher or additional doses to achieve adequate pain control.
- Succinylcholine & other non-depolarizing paralytics:
    - Neuromuscular blockade is not routinely indicated. Avoid use of succinylcholine in patients with significant total body surface area burn injury < 1 year from burn/injury to avoid severe hyperkalemic response[10]. Patients with extensive burns may also be resistant to non-depolarizing neuromuscular blockade agents, requiring both higher doses and a longer onset time to achieve the desired effect.
- Structured Time Out:
    - A standardized time-out process improves communication, reinforces patient safety, and clarifies intraoperative goals between anesthesia, surgeon, and OR staff.[13]

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Reviewed by:

Reviewer #1: Bob Weaver, MD, University of Kentucky

Reviewer #2: Francis Veyckemans, MD (Retired)

Reviewer #3: Kamie Yang, M.D., University of Michigan

Created: 07/14/22; Last revised: 5/11/23