

Road Rash: Understanding a Challenging Form of Burn Injury

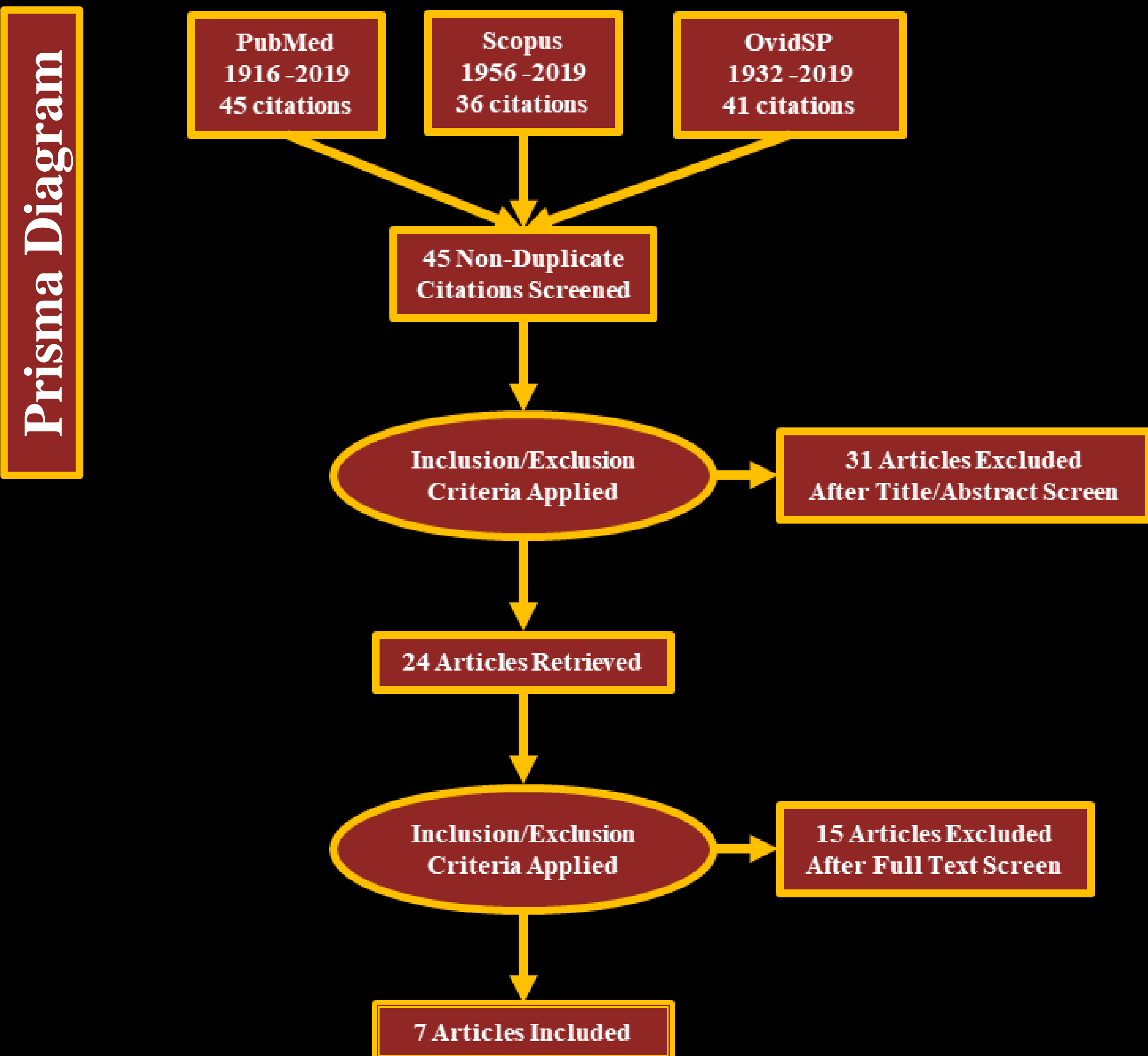
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Introduction:

- Road rash (a.k.a. friction burns) present unique challenges due to:
 - Mixed mechanism of injury
 - Thermal
 - Sheer
 - Blunt
 - Penetrating
 - Extensive contamination
 - Environmental Pathogens (i.e. bacteria, fungus)
 - Foreign debris (i.e. organic & synthetic materials)
- Available literature is heterogeneous & inconsistent.
- Optimal treatments have not been fully elucidated.
- A systematic literature review was performed to further elucidate friction burn characteristics & standards of management.
- A retrospective review was done to assess our burn unit's experience with treating this unique type of burn injury.

Methods:

- Systematic literature review (January 1916 to September 2019)
- 3 reviewers for consensus
- Databases: PubMed, Scopus, and OvidSP Medline
- Keywords: friction burn, road rash, traumatic tattoo, and sheer injury
- Excluded: case reports, reviews, opinion papers, studies using treadmill etiologies, and studies without wound details
- Analysis of patients treated by our burn center for friction injuries (January 1, 2015 to September 15, 2019)
- Tracked: demographics, wound distribution & characteristics, interventions, and hospital outcomes



Results:

Literature Review Findings

- 45 non-duplicate articles
- Full-text review of 24 articles
- 7 studies met all criteria
- 225 patients overall
- Average age 22 years old, 66% male
- Mechanism: 74% MVC
- No studies recorded TBSA!
- Depth: 29% partial thickness, 49% full thickness
- 31% had exposed tendon, nerve, and/or bone
- 61% required surgery (14% underwent local, regional, or free flap reconstruction)

Table 1: Literature Review

Author	Year	N	Age (yrs)	General				Depth			Other Trauma		Vital Structures				Mechanism				
				Gender (% M)	TBSA	2nd	3rd	4th	Associated Injuries	Head Injury	Fracture	Tendon	Bone	Auto	Blast	Industrial	Other				
Kurokawa	1993	20	23	-	NA	-	-	-	-	-	-	-	-	100%	0%	0%	0%	-	-	-	-
Troilius	1998	12	-	-	NA	-	-	-	-	-	-	-	-	83%	17%	0%	0%	-	-	-	-
Moreno-Arias	1999	9	26.3	44%	NA	-	-	-	-	-	-	-	-	22%	56%	0%	22%	-	-	-	-
Al-Qattan	2000	25	7.5	80%	NA	60%	24%	8%	28%	-	-	4%	24%	100%	0%	0%	0%	-	-	-	-
Agrawal	2008	60	22.4	73%	NA	20%	48%	0%	50%	35%	10%	10%	0%	93%	0%	0%	7%	-	-	-	-
Castana	2009	34	26	71%	NA	18%	53%	0%	41%	14%	23%	3%	0%	91%	0%	0%	9%	-	-	-	-
Al-Qattan	2010	65	31	62%	NA	18%	69%	12%	25%	-	-	69%	12%	26%	0%	74%	0%	-	-	-	-
Averages	225	23	66%	NA	29%	49%	5%	36%	25%	17%	22%	9%	74%	10%	11%	5%	-	-	-	-	

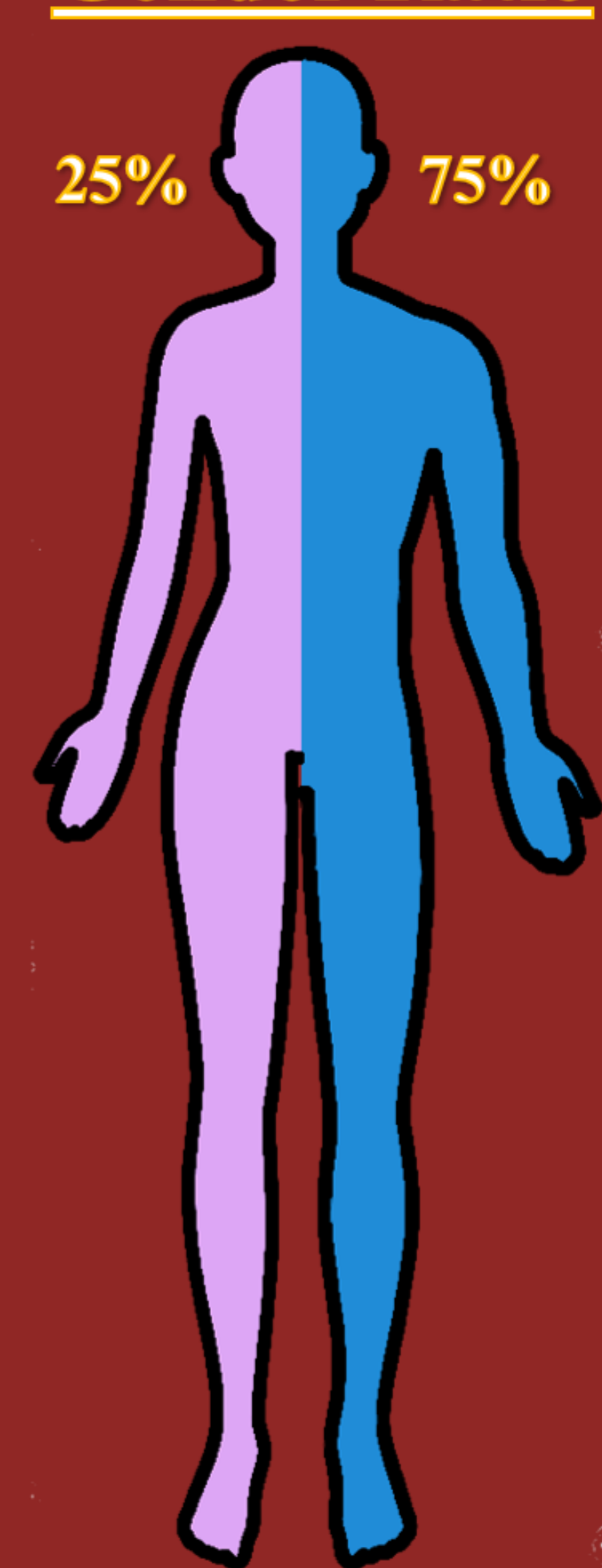
Author	Year	N	Location					Intervention							Follow-up (months)
			Head	Upper Limb	Hand	Torso	Lower Limb	Wound Care Only	Laser	Debride	Skin Graft	Local Flap	Regional/Free Flap		
Kurokawa	1993	20	-	-	-	-	-	0%	0%	100%	0%	0%	0%	0%	15
Troilius	1998	12	83%	8%	0%	0%	8%	0%	100%	100%	0%	0%	0%	8	
Moreno-Arias	1999	9	89%	0%	0%	33%	0%	0%	100%	0%	0%	0%	0%	7	
Al-Qattan	2000	25	0%	0%	0%	0%	100%	32%	0%	0%	36%	8%	4%	-	
Agrawal	2008	60	13%	18%	0%	2%	67%	48%	0%	0%	42%	10%	0%	-	
Castana	2009	34	18%	53%	0%	6%	74%	53%	0%	0%	41%	6%	0%	-	
Al-Qattan	2010	65	0%	0%	100%	0%	0%	9%	0%	0%	9%	54%	15%	6	
Averages	225	15%	36%	0%	4%	70%	20%	29%	29%	18%	11%	3%	9		

Table 2: Retrospective Cohort

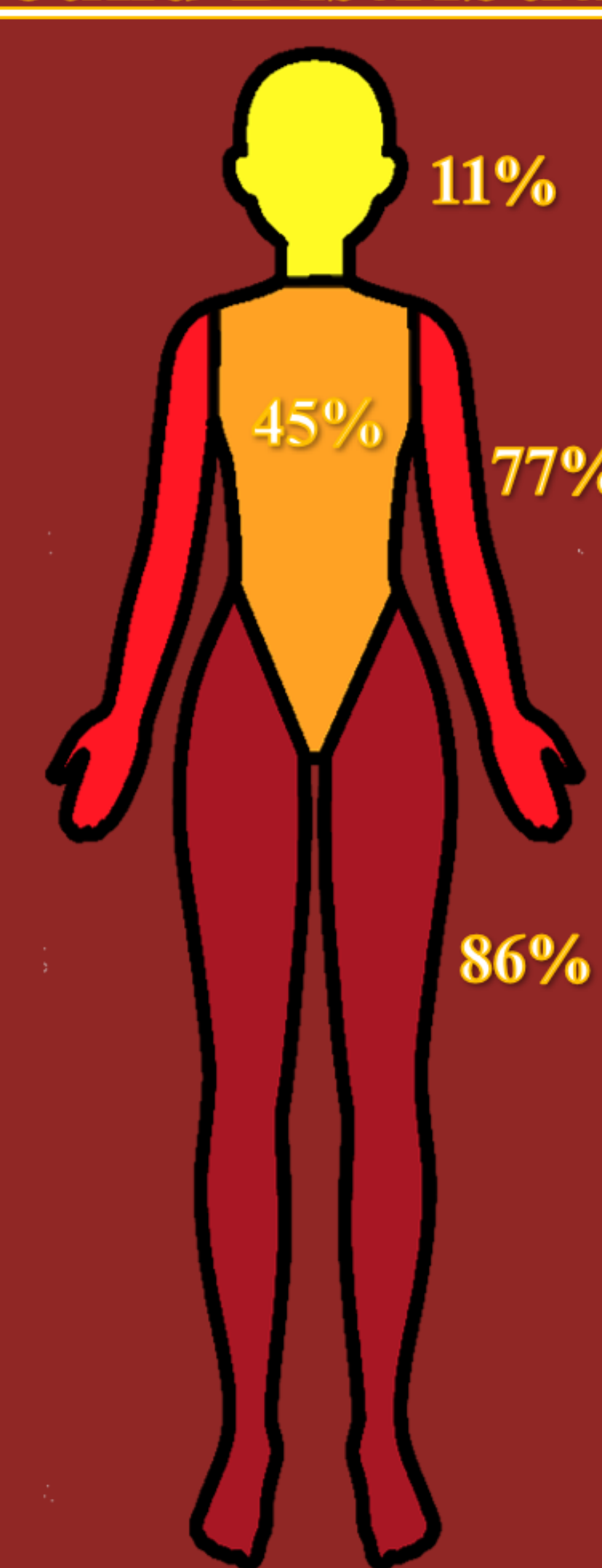
Patient Demographics		Wound Characteristics	
Age (years)	24 ± 18	TBSA (%)	6.3±6%
Gender (% male)	75% (33)	Full thickness (%)	57% (25)
Mechanism of Injury		Associated Injuries	77% (34)
MVA	20% (9)	Exposed Bone	6.8% (3)
MCC	37% (16)	Exposed Tendon	14% (6)
AVP	26% (11)	Fractures	55% (24)
Other*	18% (8)	Tattooing	27% (12)
Wound Distribution		Hospital Course	
Head	11% (5)	LOS (days)	12±11
Upper Limb	77% (34)	ICU LOS (days)	0.9±3
Trunk	45% (20)	MV (days)	0.4±2
Lower Limb	86% (38)	Surgery	72% (32)
		Infection	18% (8)
		Delayed* Evaluation	14% (6)
		Delayed & Infection	75% (6)

MVA = motor vehicle accident, MCC = motorcycle crash, AVP = auto vs. pedestrian, other* = home accidents, LOS = length of stay, MV = mechanical ventilator, delayed* > 24 hours from time of injury to evaluation

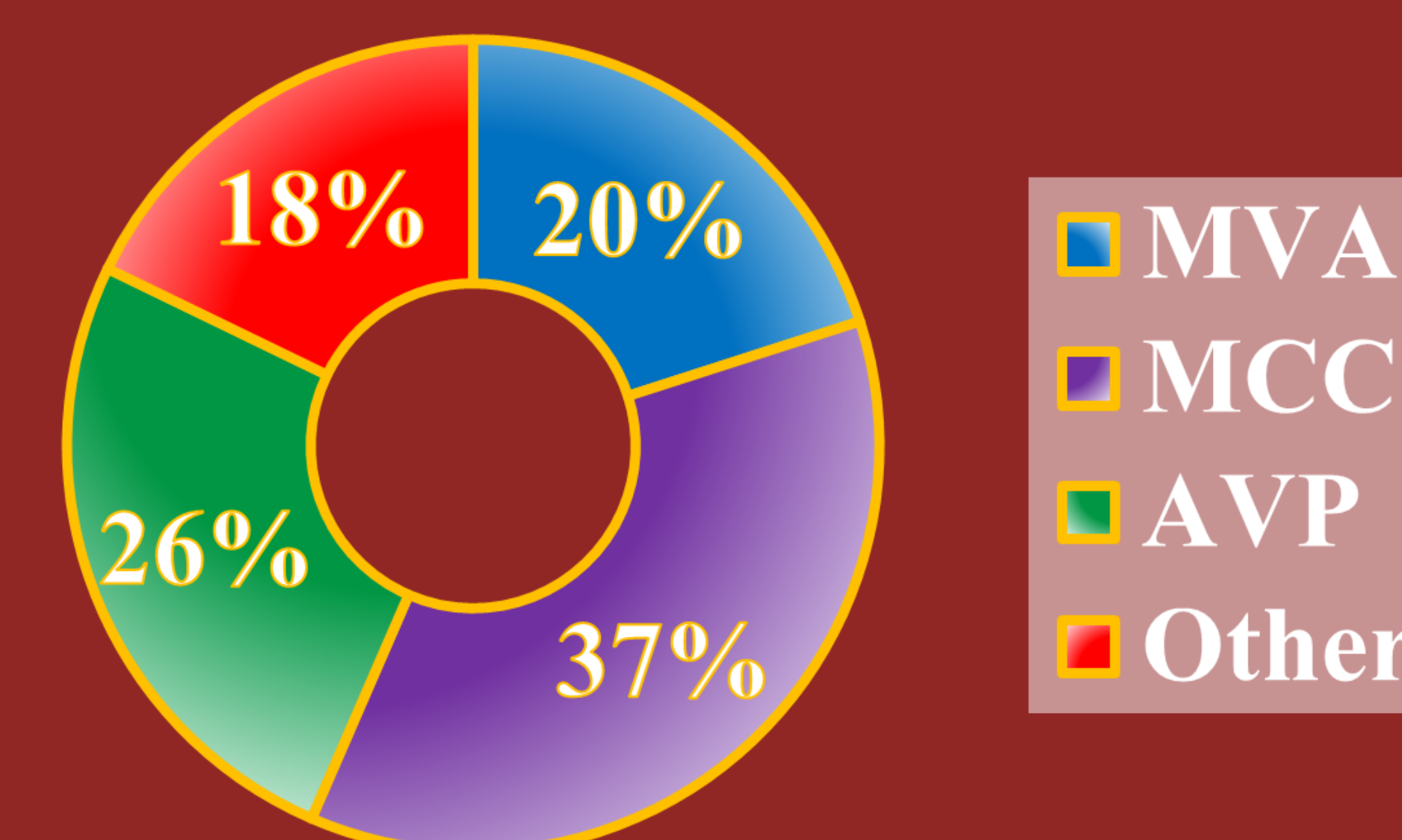
Gender Ratio



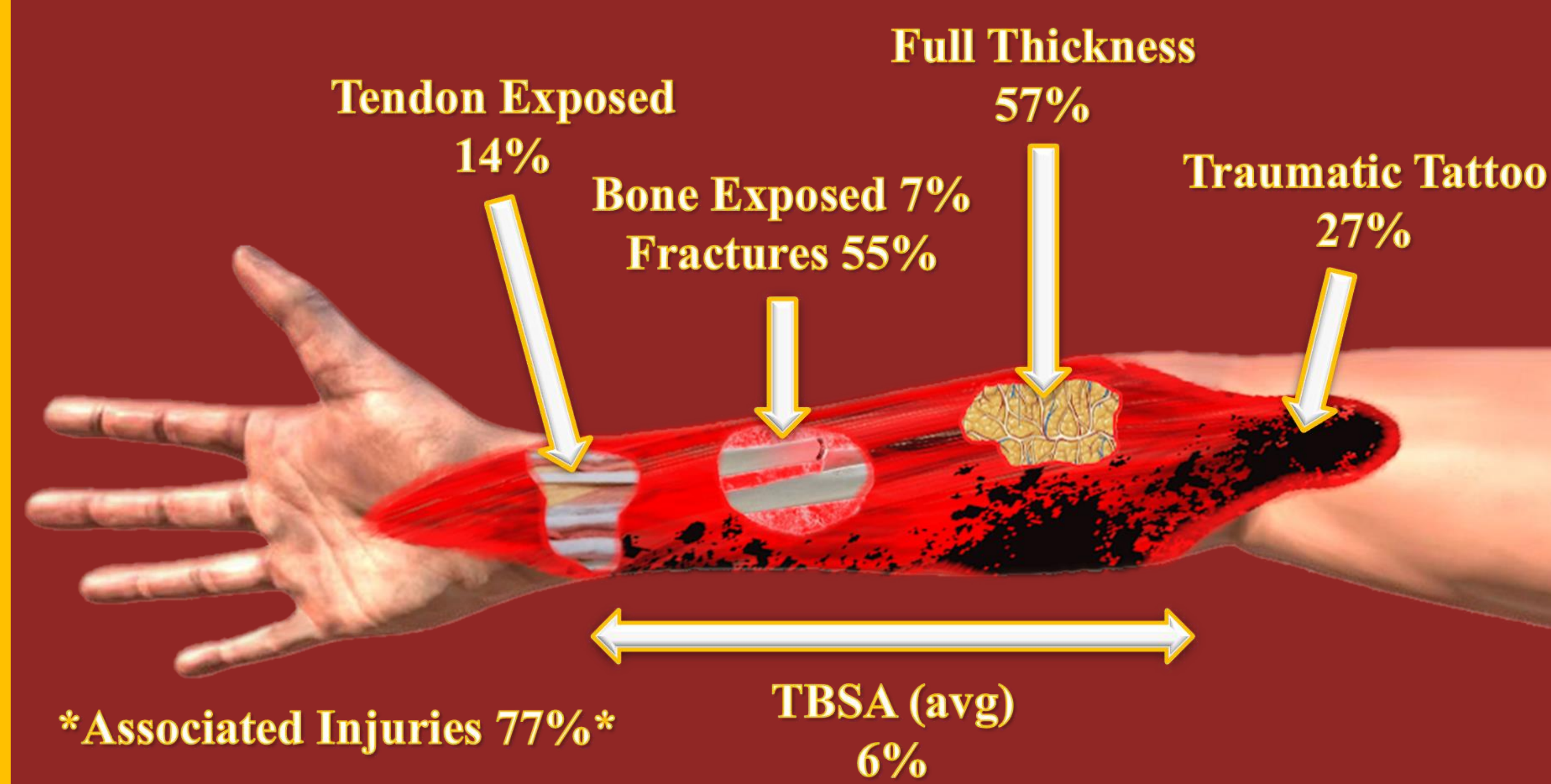
Wound Distribution



Mechanism of Injury



Wound Characteristics



Conclusion:

- Road rash most commonly occurs in young (24 yrs) men (75%) due to motorcycle crashes (37%) and frequently involves upper (77%) and lower (86%) extremities.
- The majority of these injuries comprise a small TBSA (6%) but are often full thickness (57%) and have a high rate of associated underlying injuries (77%).
- Due to the depth of injury and exposure of underlying structures, surgical intervention is required in over 70% of patients.
- When patients present with traumatic tattooing (27%), early bedside and/or operative debridement facilitated complete removal of foreign debris in 92% of cases.
- Infection occurred in nearly 20% of cases with 75% of those patients presenting in a delayed fashion (i.e. >24 hours after injury).

Applicability to Practice:

Road rash is a complex and challenging form of burn injury that warrants prompt evaluation by a burn specialist along with targeted debridement of foreign debris via operative or bedside interventions to prevent infection, minimize hypertrophic scarring, and expedite recovery.