Complications of Traumatic Frictional Burns in the Emergency Setting

Presented by Kyirsty Unger

Road Rash in the Adult ED

- Current practice standards
- TICU/13 A
- Wound Care / Burn Unit recommendations



Background

- Road rash is one of the most common conditions seen in the ED
- Road rash is a burn
- Often this injury is complicated by orthopedic or internal injuries
- Road rash does not trigger the clinical response for rapid wound care, fluid resuscitation, or surgical considerations that traditional burns receive.



(u/infamousboon1, 2018)





(Miles & Elis 2006)

Early Hypothesis

 Patients who do not get comprehensive wound care for their severe traumatic abrasions will have significant complications.



Review of Literature 1965-2019

- Lay literature widely available
- 22 articles had some reference to road rash
- 7 articles specifically discussed road rash complications and/or management
- Level of evidence expert opinion & case study
- Small sample sizes

Multiple Studies Are Needed

Preliminary Study 1: Quality Improvement chart review 2014 (n=100)

- -- wound care documentation
- -- discharge instructions

-- Does this population experience complications related to soft tissue infections?

Study 2: Retrospective Chart Review. (n=261)

Aims to define the scope of the problem.

- Who is the population?
- How may people experience problems?
- What treatment are they given?
- When do problems occur?

Study 3: Prospective Cohort Study:

What does the problem look like and what are the long term outcomes? Goals of this study will be to accurately describe the wound, how it changes over time, how is the patient affected?

Study 4: Intervention

Preliminary Study (n = 100, Jan - Oct 2014)

Care provided and documented				
	Wound care within 24 hours	27%		
	Any wound care documented			
	during ED or hospital stay	48%		
	Discharge instructions that			
	referenced wound care	40%		
Patient outcomes experienced with 4 months of injury				
	Cellulitis	17%		
	Sepsis	8%		
	Surgical Site Infection	16%		
	Readmission	15%		
	Skin Grafting	2%		

Study 2: Retrospective Chart Review

- Complications of Severe Frictional Abrasions in the Emergency Department Setting: A Retrospective Study
- Retrospective chart review of cases from 2016 to determine magnitude of complications in patients treated at OHSU (n = 261)

Snapshot in Oregon in 2016

- 1,660 motorcycle and bicycle accidents were reported in Oregon.
 - OHSU treated 589 motorcycle and bicycle patients (entered into the OHSU trauma registry)
 - Of those patients, 84% (497) had ICD-10 codes associated with skin abrasions and traumatic wounds



INJURIES BEYOND ROAD RASH



Wound Care Documentation

150





Discharge Instructions for Wound Care



POST-DISCHARGE COMPLICATIONS



Limitations

- Depends on retrospective data / subjective and limited documentation
- Only involves patients treated at OHSU, relies on Epic records that are seen at OHSU and CareEverwhere
- No information about patient outcomes following hospital treatment if they didn't have a complication
- We have no information about scarring, residual pain, functional changes
- ICD 9 versus ICD 10

2019-2020 updates

- Finished data collection
- Worked with biostatistician for analysis
- Presented at WIN conference
- Developing manuscript and plan for submission to the Journ Burn care & Research.

Updated Analysis

- We included 207 patients for analysis.
- 1/3 of patients (74, 35.8%) received rapid wound care
- ½ received any wound care documented (116, 56.0%)
- 1/3 of patients received discharge orders or instructions related to wound care (64, 30.9%)
- 1/3 (72, 34.8%) had poor outcomes associated with road rash.
- Of these, (50 ,69.4%) during admission and (34, 47.2%) patients had post-discharge outcomes

	All patients n=207(100%)	Rapid wound care		Any wound care			
		No rapid wound care 133(64.3%)	Rapid wound care 74(35.8%)	p-value	No recorded wound care 91(44.0%)	Any wound care recorded 116(56.0%)	p-value
Patient demographics, n(%)	11 12(16 72)	AA 57(1A 0C)	0.9493	0.95	AA FA(16 2)	44.00(15.52)	0.94
Patient age, mean(SD)	44.13(16.72)	44.57(14.06)	0,8483	0.85	44.54(16.2)	44.09(15.53)	0.84
Patient sex (male)	175(100+0%)	112(64.0%)	63(36,0%)	0.86	80(45+7%)	95(54.3%)	0.24
Trauma survey or EMS note of "road rash"	30(100.0%)	12(40.0%)	18(60,0%)	<0.01	8(26,7%)	22(73.3%)	0.04
Full thickness abrasion	39(100.0%)	16(41.0%)	23(59.0%)	<0.01	10(25.6%)	29(74.4%)	0.01
Multiple abrasions	204(100.0%)	131(64.2%)	73(35.8%)	1.00	91(44.6%)	113(55.4%)	0.26
Abrasions to back, thorax or flank	61(100.0%)	38(62.3%)	23(37,7%)	0.70	24(39.3%)	37(60,7%)	0.39
Injuries beyond severe road rash n(%)	182(100.0%)	118(64.8%)	64(35,2%)	0.64	77(42.3%)	105(57.7%)	0.20
Orthopedic	146(100.0%)	95(65.1%)	51(34.9%)	0.70	60(41.1%)	86(58,9%)	0.20
Neurologic	57(100.0%)	40(70.2%)	17(29.8%)	0.27	20(35.1%)	37(64.9%)	0.11
Cardiothoracic	35(100.0%)	26(74.3%)	9(25.7%)	0.17	21(60.0%)	14(40.0%)	0.04
Gastrointestinal	8(100.0%)	7(87.5%)	1(12.5%)	0.26	7(87.5%)	1(12.5%)	0.02
Urologic	4(100.0%)	2(50.0%)	2(50.0%)	0.62	1(25.0%)	3(75.0%)	0.63
Laceration	42(100.0%)	13(31.0%)	29(69.0%)	<0.01	7(16.7%)	35(83.3%)	<0.01
Head, eyes, ears, nose or throat	34(100.0%)	18(52.9%)	16(47.1%)	0.13	12(35.3%)	22(64.7%)	0.27
Care provided, n(%)					(
Antibiotics prescribed	76(100.0%)	36(47.4%)	40(52.6%)	<0.01	14(18.4%)	62(81.6%)	<0.01
Discharge orders or instructions related to wound care.	64(100.0%)	27(42.2%)	37(57.8%)	<0.01	9(14.1%)	55(85,9%)	<0.01
Inpatient outcomes, n(%)							
Inpatient admission	168(100.0%)	113(67.3%)	55(32.7%)	0.06	72(42.9%)	96(57.1%)	0.51
Inpatient length of stay	4.8(5.33)	5.82(6.37)	0.2764	0.76	3.71(4.51)	6.2(6.25)	<0.01
Diagnoses or interventions during							
Surgical site infection	3(100.0%)	1(33.3%)	2(66,7%)	0.50	0(0.0%)	3(100.0%)	0.26
Bacteremia	9(100.0%)	5(55.6%)	4(44.4%)	0.48	2(22.2%)	7(77.8%)	0.30
Sepsis	8(100.0%)	5(62.5%)	3(37,5%)	0.31	3(37.5%)	5(62,5%)	1.00
Surgical interventions related to road rash during inpatient admission	44(100.0%)	18(40.9%)	26(59.1%)	<0.01	4(9.1%)	40(90.9%)	<0.01
Skingrafting	4(100.0%)	0(0.0%)	4(100.0%)	0.01	0(0.0%)	4(100.0%)	0.14
Incision and debridement	42(100.0%)	18(42.9%)	24(57,1%)	<0.01	4(9.5%)	38(90.5%)	<0.01
5 1	0(100.00)	2(25.02()	c(75.00()	0.02	0(0.00)	2(100.021)	0.01
Flap surgery	8(100.0%)	2(25.0%)	6(75.0%)	0.02	0(0.0%)	8(100.0%)	0.01
Any diagnoses or surgical interventions related to road rash during inpatient admission	50(100.0%)	22(44.0%)	28(56.0%)	<0.01	7(14.0%)	43(86.0%)	<0.01
Post-discharge outcomes (4 months post-injury), n(%)							
Clinic visit for road rash complaint	45(100.0%)	19(42.2%)	26(57.8%)	<0.01	8(17.8%)	37(82.2%)	<0.01
Readmission	25(100.0%)	10(40.0%)	15(60.0%)	0.01	6(24.0%)	19(76.0%)	0.03
Number of readmissions, median(IQR)	0(0-5)	0(0-3)	0(0-5)				
Any post-discharge outcome related to road	34(100.0%)	13(38.2%)	21(61.8%)	<0.01	4(11.8%)	30(88.2%)	<0.01
Cellulitis	23(100.0%)	8(34.8%)	15(65,2%)	0.00	3(13.0%)	20(87.0%)	<0.01
Sepsis	4(100.0%)	1(25.0%)	3(75.0%)	0.13	0(0.0%)	4(100.0%)	0.13
Surgical site infection	13(100.0%)	3(23.1%)	10(76.9%)	0.00	0(0.0%)	13(100.0%)	<0.01
Incision and debridement	16(100.0%)	5(31.3%)	11(68.8%)	0.00	1(6.3%)	15(93.8%)	<0.01
Skingrafting	1(100.0%)	0(0.0%)	1(100.0%)	0.36	0(0.0%)	1(100.0%)	1.00
Amputation	1(100.0%)	0(0.0%)	1(100.0%)	0.36	0(0.0%)	1(100.0%)	1.00
Vacuum-assisted closure of a wound	13(100.0%)	4(30.8%)	9(69.2%)	0.02	0(0.0%)	13(100.0%)	<0.01
Flap surgery	2(100.0%)	0(0.0%)	2(100.0%)	0.13	0(0.0%)	2(100.0%)	0.51
Any outcome related to road rash: any surgical site infection, clinic visit or surgical interventions related to road rash	72(100.0%)	33(45.8%)	39(54.2%)	<.001	13(18.1%)	59(81.9%)	<0.01



Complications of Traumatic Frictional Burns in the Emergency Department Setting: A Kyirsty Unger MSN, RN¹, Amber Hin, MS, Departiced & Find, Strudy, Ones MD, MBS, MCR, FACEP¹

¹Department of Emergency Medicine, Oregon Health & Science University ²Nursing Administration, Oregon Health and Science

University

Abstract

Traumatic frictional burns and abrasions or "road rash" are skin injuries caused by frictional and thermal contact with contaminated surfaces such as gravel or asphalt. The pathophysiology more closely resembles a burn rather than a simple abrasion. In the trauma setting, these wounds are prioritized lower than more critical injuries they are often associated with. This study aims to define population demographics of patients with traumatic frictional burns, and to identify any associated complications. 207 patients met inclusion criteria for being aged ≥15, involved in a motorcycle or bicycle accident and experienced severe traumatic frictional burns between 1/1/2016 and 12/31/2016. Our primary exposure was rapid wound care of the burn sites, and our secondary exposure was any wound care received prior to discharge. We used descriptive statistics to classify patient and injury characteristics as well as prevalence of wound care, prescribing of antibiotics, and inpatient admission in this cohort. Approximately one-third of patients (35.8%) received rapid wound care and approximately one-half received any wound care documented (116, 56.0%). Discharge orders or instructions related to wound care was present in 64 (30.9%) of patients. 72 patients (34.8%) had poor outcomes associated with road rash. Of these, 50 (69.4%) were diagnosed or occurred during the index admission and 34 (47.2%) patients had post-discharge outcomes. Overall, one-third of the patients experienced poor outcomes such as cellulitis, sepsis, surgical interventions or readmission. While severe wounds are initially described, the majority of patients did not receive rapid or any documented wound care throughout hospitalization and most patients were not given discharge instructions related to wound care. After discharge, over 20% of patients returned to clinic for wound related concerns, most required additional procedures within a 4-month period. Patients with traumatic frictional burns were observed to have frequent complications that should merit





(u/infamousboon1, 2018)

Methods

207 patients met inclusion criteria at a level 1 trauma center. EMR records selected for patients aged \geq 15 who were involved in a motorcycle or bigvle acident and experienced severe traumatic frictional burns between 1/1/2016 and 12/31/2016. Patients were included if the trauma system was activated and their injuries were identified as: wounds to trons flank, or if described by the provider as a deep wounds to trons flank, or if described by the provider as a deep wound.

We used descriptive statistics to classify patient and injury characteristics as well as prevalence of wound care, prescribing of antibiotics, and inpatient admission in this cohort. For those patients who received rapid wound care versus those who did not, we calculated two-sample t-tests for continuous data and chi-square tests for categorical data. The associations between rapid wound care and clinical outcomes were adjusted for injury and care characteristics, and analyzed with multiple logistic regression.



*Discharge instructions for wound care, in percent

Approximately one-third of patients (74, 35.8%) received rapid wound care and approximately one-half received any wound care documented (116, 56.0%). Discharge orders or instructions related to wound care was present in 64 (30.9%) of patients. 72 patients (34.8%) had poor outcomes associated with road rash. Of these, 50 (69.4%) were diagnosed or occurred during the index admission and 34 (47.2%) patients had post-

ischarge outcomes.	Odds of any outcome related to road rash* OR(95% CI)	p-value
Any wound care provided	3.1(1.4-6.9)	<0.01
Full thickness abrasion	3.4(1.4-8.4)	0.01
Antibiotics prescribed	8.6(4.1-18)	<0.01
		c-statistic 0.

*any surgical site infection, clinic visit or surgical interventions related to road rash

Results: When controlling for related patient and injury characteristics, receipt of rapid wound care was not significantly associated with any poor outcome (OR 1.7, 95% CI: 0.8–3.7, p=0.20). In fact, the trend was toward rapid wound care being associated with an increase in odds of poor outcomes. Full thickness abrasion was associated with a 230% increase (95%: 30–720%) in odds of poor outcomes, and antibiotics prescribed was associated with an 96% (95% CI: 20–200%) increase in odds of poor outcomes.

	Odds of any outcome related to road rash* OR(95% CI)	p-value	
Rapid wound care provided	1.7(0.8-3.7)	0.20	
Full thickness abrasion	3.3(1.3-8.2)	0.01	
Laceration injury present	1.8(0.7-4.7)	0.20	
Antibiotics prescribed	10.6(5.2-21.8)	<0.01	
		c-statistic 0.	

*any surgical site infection, clinic visit or surgical interventions related to road rash

Results: When controlling for related patient and injury characteristics, receipt of any wound care was significantly associated with an increase in poor outcomes (OR 3.1, 95% CI: 1.4-6.9, p<0.01).

	All patients n=207(100%)	Rapid wound care		Any wound care			
		No rapid wound care 133(64.3%)	Rapid wound care 74(35.8%)	p-value	No recorded wound care 91(44.0%)	Any wound care recorded 116(56.0%)	p-value
Patient demographics. n(%)							
Patient age, mean(SD)	44.13(16.72)	44.57(14.06)	0.8483	0.85	44.54(16.2)	44.09(15.53)	0.84
Patient sex (male)	175(100.0%)	112(64.0%)	63(36.0%)	0.86	80(45.7%)	95(54.3%)	0.24
Road rash characteristics, n(%)							
Trauma survey or EMIS note of "road rash"	30(100.0%)	12(40.0%)	18(60.0%)	<0.01	8(25.7%)	22(75-5%)	0.04
Full thickness abrasion	39(100.0%)	16(41.0%)	23(59.0%)	<0.01	10(25.6%)	29(74.4%)	0.01
Multiple abrasions	204(100.0%)	131(64.2%)	73(35.8%)	1.00	91(44.6%)	113(55.4%)	0.26
Abrasions to back, thorax or flank	61(100.0%)	38(62.3%)	23(37.7%)	0.70	24(39.3%)	37(60.7%)	0.35
Injuries beyond severe road rash, n(%)	182(100.0%)	118(64.8%)	64(35.2%)	0.64	77(42.3%)	105(57.7%)	0.20
Orthopedic	146(100.0%)	95(65.1%)	51(34.9%)	0.70	60(41.1%)	86(58.9%)	0.20
Neurologic	57(100.0%)	40(70.2%)	17(29.8%)	0.27	20(35.1%)	37(64.9%)	0.11
Cardiothoracic	35(100.0%)	26(74.3%)	9(25.7%)	0.17	21(60.0%)	14(40.0%)	0.04
Gastrointestinal	8(100.0%)	7(87.5%)	1(12.5%)	0.26	7(87.5%)	1(12.5%)	0.02
Urologic	4(100.0%)	2(50.0%)	2(50.0%)	0.62	1(25.0%)	3(75.0%)	0.63
Laceration	42(100.0%)	13(31.0%)	29(69.0%)	<0.01	7(16.7%)	35(83.3%)	<0.01
Head, eyes, ears, nose or throat	34(100.0%)	18(52.9%)	16(47.1%)	0.13	12(35.3%)	22(64.7%)	0.27
Care provided. n(%)			10(00.00)				
Antibiotics prescribed	76(100.0%)	36(47,4%)	40(5Z/6%)	<0.01	14(18.4%)	62(81,6%)	<0.01
Discharge orders or instructions related to wound care.	64(100.0%)	27(42.2%)	37(57.8%)	<0.01	9(14.1%)	55(85.9%)	<0.01
Inpatient outcomes.n(%)							
Inpatient admission	168(100.0%)	113(67.3%)	55(32.7%)	0.06	72(42.9%)	96(57,1%)	0.51
Inpatient length of stay	4.8(5.33)	5.82(6.37)	0.2764	0.76	3.71(4.51)	6.2(6.25)	<0.01
Diagnoses or interventions during inpatient admission*							
Surgical site infection	3(100.0%)	1(33.3%)	2(66.7%)	0.50	0(0.0%)	3(100.0%)	0.26
Bacteremia	9(100.0%)	5(55.6%)	4(44.4%)	0.48	2(22.2%)	7(77.8%)	0.30
Sepsis Surgical Internetions	8(100.0%) 44(100.0%)	18(40.9%)	3(37,5%)	<0.01	4(9.1%)	5(6Z.5%) 40(90.9%)	<0.01
related to road rash during inpatient admission	44(100070)	10(40.570)	10(33110)	-0.01	4(31270)	40(30.3%)	-0103
Skingrafting	4(100.0%)	0(0.0%)	4(100.0%)	0.01	0(0.0%)	4(100.0%)	0.14
debridement Incision and	42(100.0%)	18(42.9%)	24(57.1%)	<0.01	4(9.5%)	38(90.5%)	<0.01
Flap surgery	8(100.0%)	2(25.0%)	6(75.0%)	0.02	0(0.0%)	8(100.0%)	0.01
Any diagnoses or surgical interventions related to road rash during inpatient admission	50(100.0%)	22(44.0%)	28(56.0%)	<0.01	7(14.0%)	43(86.0%)	<0.01
Post-discharge outcomes (4 months post-injury), n(%)							
Clinic visit for road rash complaint	45(100.0%)	19(42.2%)	26(57.8%)	<0.01	8(17.8%)	37(82.2%)	<0.01
Readmission	25(100.0%)	10(40.0%)	15(60.0%)	0.01	6(24.0%)	19(76.0%)	0.03
Number of readmissions, median (IOR)	0(0-5)	0(0-3)	0(0-5)				
Any post-discharge outcome related to road rash	34(100.0%)	13(38.2%)	21(61.8%)	<0.01	4(11.8%)	30(88.2%)	<0.01
Cellulitis	23(100.0%)	8(34.8%)	15(65.2%)	0.00	3(13.0%)	20(87.0%)	<0.01
Sepsis	4(100.0%)	1(25.0%)	3(75.0%)	0.13	0(0.0%)	4(100.0%)	0.13
Surgical site infection	13(100.0%)	3(23.1%)	10(76.9%)	0.00	0(0.0%)	13(100.0%)	<0.01
Incision and debridement	16(100.0%)	5(31.3%)	11(68.8%)	0.00	1(6.3%)	15(93.8%)	<0.01
Skingrafting	1(100.0%)	0(0.0%)	1(100.0%)	0.36	0(0.0%)	1(100.0%)	1.00
Amoutation	1(100.0%)	0(0.0%)	1(100.0%)	0.36	0(0.0%)	1(100.0%)	1.00
Vacuum-assisted closure of a wound	13(100.0%)	4(30.8%)	9(69.2%)	0.02	0(0.0%)	13(100.0%)	<0.01
Flap surgery Any outcome related to road rash: any surgical site	2(100.0%) 72(100.0%)	0(0.0%) 33(45.8%)	2(100.0%) 39(54.2%)	0.13	0(0.0%) 13(18.1%)	2(100.0%) 59(81.9%)	0.51
infection, clinic visit or surgical interventions			aa(a Akin)				

Conclusions

Patients with traumatic frictional burns were observed to have frequent complications that should merit additional clinical consideration. One-third of the patients experienced poor outcomes such as cellulitis, sepsis, surgical interventions or readmission. While severe wounds are initially described, the majority of patients did not receive rapid or any documented wound care throughout hospitalization and most patients were not given discharge instructions related to wound care. After discharge, over 20% of patients returned to clinic for wound related concerns, most required additional procedures within a 4-month period. Further investigation is needed to accurately describe traumatic frictional burns and their clinical course as well as track contributing factors that lead to poor inpatient and outpatient outcomes.

Conclusions/Next Steps...

- Retrospective data isn't accurate for capturing the impact and severity of traumatic abrasions.
- Further studies are needed-> Prospective Cohort Study
- Providing treatment and education for acute wounds could improve short term and long term patient outcomes
- Changing practice and expectations for nurses, physicians, patients



RESOURCES

- Agrawal, A., Raibagkar, S. C., & Vora, H. J. (2008). Friction burns: epidemiology and prevention. Ann Burns Fire Disasters, 21(1), 3-6.
- Al-Qattan, M. M., Al-Zahrani, K., Al-Shanawani, B., & Al-Arfaj, N. (2010). Friction burn injuries to the dorsum of the hand after car and industrial accidents: classification, management, and functional recovery. J Burn Care Res, 31(4), 610-615. doi:10.1097/BCR.0b013e3181e4d6b9
- Bernabe, K. Q., Desmarais, T. J., & Keller, M. S. (2013). Management of Traumatic Wounds and a Novel Approach to Delivering Wound Care in Children. Adv. Wound Care (New. Rochelle). 3(4), 335--343. doi:10.1089/wound.2013.0465
- Castana, O., Dagdelenis, J., Rempelos, G., Paneris, P., Anagiotos, G., Diplas, D., & Alexakis, D. (2009). Traumatic injuries with deep abrasion: "a burn". Ann Burns Fire Disasters, 22(1), 44-47.
- Prevaldi, C., Paolillo, C., Locatelli, C., Ricci, G., Catena, F., Ansaloni, L., & Cervellin, G. (2016). Management of traumatic wounds in the Emergency Department: position paper from the Academy of Emergency Medicine and Care (ACEMC) and the World Society of Emergency Surgery (WSES). World J. Emerg. Surg., 11, 30. doi:10.1186/s13017-016-0084-3
- Nunez Lopez, O., Cambiaso-Daniel, J., Branski, L. K., Norbury, W. B., & Herndon, D. N. (2017). Predicting and managing sepsis in burn patients: current perspectives. Therapeutics and clinical risk management, 13, 1107-1117. doi:10.2147/TCRM.S119938
- Vrints, I., Den Hondt, M., Van Brussel, M., & Nanhekhan, L. (2014). Immediate debridement of road rash injuries with Versajet(R) hydrosurgery: traumatic tattoo prevention? Aesthetic Plast Surg, 38(2), 467-470. doi:10.1007/s00266-014-0290-x

