

# **Epidemiology and Timing of Infectious Complications** from Battlefield-Related Burn Injuries

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## Background

- Burn injuries are a cause of significant morbidity and mortality, representing approximately 8.8% of all casualties medically evacuated from Iraq and Afghanistan
- Combat-related burn injuries became more common with use of improvised explosive devices (IEDs)
- Increasing burn total body surface area (TBSA) is associated with infectious complications with most frequent etiologies to include skin and soft-tissue infection (SSTI), pneumonia, bloodstream infection, and urinary tract infection
- The Trauma Infectious Disease Outcomes Study (TIDOS) is an observational study of short and long-term infectious complications associated with trauma sustained during deployment
- Descriptive understanding of the epidemiologic timing of infectious complications in our deployed soldiers with burn injuries will provide critical information for management of casualties and serve as important comparators to previously published burn data

### **Methods**

### Eligibility criteria:

- TIDOS population: active-duty personnel or DOD beneficiary injured during deployment (6/1/2009 - 12/31/2014) and required medical evacuation to Landstuhl Regional Medical Center (Germany) before transition to a participating U.S. military hospital
- $\circ$  Sustained ≥1 burn injury and were admitted to the U.S. Army Institute of Surgical Research Burn Center at Brooke Army Medical Center
- Infections were defined using Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network definitions based on clinical, laboratory findings, and microbiological data
  - Initial infection was defined based on the date of 1<sup>st</sup> available microbiological culture
- Multidrug-resistant organisms (MDRO) were defined as either resistance to  $\geq$  3 classes of antibiotics (aminoglycosides,  $\beta$ -lactams, carbapenems, and/or fluoroquinolones), or presence of an extendedspectrum β-lactamase (ESBL) or *Klebsiella pneumoniae* carbapenemase (KPC) producer.
  - Methicillin-resistant Staphylococcus aureus and vancomycinresistant *Enterococcus* spp. were also classified as MDR.
- Demographic and clinical characteristics of patients with ≥1 infection were compared to patients without infections
- Microbiology of initial infections among military personnel with burn injuries were categorized by type of infection (blood stream infection, SSTI, pneumonia, and intra-abdominal infection), time to infection, and by injury mechanism (blast vs. non-blast)
- Statistical analysis was performed using Chi-squared and Fisher's exact test for categorical data and Mann-Whitney U for continuous data

		Resu	ılts			Results (cont.)							Re
Table 1	: Demographic ar	Table 3	: Microbi	<ul> <li>Blast injury was the infectious complications</li> </ul>									
person	nel with burn inju	ries, No. (%)				Patient	Injury Mechanis	Days to m Infectio	(aram-	-positive	Gram-negative	Fungus	<ul> <li>All patients with pneum</li> </ul>
		Total	Patients with	Patients	P	4	Blast	m infectio 6	n		Escherichia coli	-	injury at time of initial in
	Characteristic	Patients (N=144)	≥1 Infection (N=26)	without Infections (N=118)	P- value	5	Blast	2		rococcus ecium	Escherichia coli*	Aspergillus spp.; Geotrichum spp.;	<ul><li>Initial infection was poly</li><li>Only one initial infection</li></ul>
	ears, median (IQR)	24 (22-29)	24 (22-29)	24 (21-29)	0.678							Alternaria spp.	(polymicrobial, <i>Enteroc</i>
Male		143 (99)	26 (100)	117 (99)	0.638	6	Blast	8		-	Acinetobacter	_	<ul> <li>Gram-negative organis</li> </ul>
	echanism		18 (CO)		0.162						complex*		which 15% were MDR
Bla	st n-blast	65 (45) 79 (55)	18 (69) 8 (31)	64 (54) 54 (46)	0.162	7	Blast	13		-		<i>Mucor</i> spp.; Fusarium spp.	Gram-positive organism
Source o		79 (55)	8 (51)	54 (40)	0.102	8	Blast	22		-	Proteus mirabilis	-	<ul> <li>Fungi as the initial isola</li> </ul>
	mbat	89 (62)	21 (80)	68 (58)	0.028						Pseudomonas		
	n-combat	55 (38)	5 (20)	50 (42)	0.028	9	Blast	3		rococcus	aeruginosa; Bacteroides	-	С
	verity score, median,	9 (4-21)	30 (17-45)	6 (4-12)	<0.001				Jue	ecium	fragilis		
(IQR)	· · · · · · · · · · · · · · · · · · ·	* Indic	ates MDR						<ul> <li>This study provides a</li> </ul>				
TBSA %,	median (IQR)			microbiology of initial in									
Baux sco	re, median (IQR)	30 (27-41)	59 (34-66)	29 (26-36)	<0.001								members
Inhalatio	n injury	24 (17)	12 (46)	14 (12)	<0.001	Table 4	: Microbic	ology of in	itial infec	ctious cor	nplication: Pn	eumonia	<ul> <li>In the TIDOS population</li> </ul>
Mechani	cal ventilation (MV)	56 (39)	25 (96)	31 (26)	<0.001			Days to	Inhalation				briefest time from injury of pneumonia patients
Median	days MV, median (IQR)	7 (4-14)	15 (8-27)	0 (0-2)	<0.001	Patient	Injury	Infection	Injury	Intubated	•	Gram-negative	intubation
Length o days (IQ	f hospital stay, median R)	15 (7-24)	48 (30-79)	11 (6-19)	<0.001	11	Non-blast	6	Ν	Y	Staphylococcus aureus	Haemophilus influenza	Infectious complication
	days from injury to Bur dmission (IQR)	<b>ו</b> 5 (3-6)	4 (3-6)	6 (3-5)	0.350	12	Non-blast	14	Y	Y	-	Escherichia coli*	<ul><li>organisms most freque</li><li>Infectious complication</li></ul>
	days from injury to first procedure (IQR)	7 (6-10)	6 (4-8)	8 (6-10)	0.007	13	Non-blast	7	N	Ŷ	-	Citrobacter spp. Klebsiella	score, larger TBSA b longer delays to definiti
	days to definitive graft	13 (8 – 32)	35 (15-56)	10 (8-14)	<0.001	14	Non-blast	4	Y	Y	-	pneumoniae	<ul> <li>Infection in these service</li> </ul>
(IQR) Death		4 (2.7)	4 (15)	0	<0.001	15	Non-blast	3	N	Y	Staphylococcus aureus;	Haemophilus	mortality. A better unde improve long-term man
IQR – interquartile range; TBSA – total body surface area											Streptococcus spp.	influenza	
Infections were diagnosed in 26 (18%) patients							Non-blast	3	Y	Y	Staphylococcus aureus; Streptococcus spp.	-	Ack
<ul> <li>Pneumonia was most common (N=16, 62%), followed by SSTI (N=6, 23%), bloodstream infections (N=3, 12%), and intra-abdominal infections (N=1, 4%)</li> </ul>						17	Non-blast	3	Ν	Y	-	Escherichia coli; Enterobacter cloacae	We are indebted to the TIDOS managers, clinical site managers, success of this project. This proj Infectious Diseases, National Instit the Defense Health Program, U.S
<ul> <li>Median time from injury to initial infecting syndrome was 4 days (IQR 3-5 days) for pneumonia, 7 days (IQR 4-12) for SSTI, 7 days (IQR 6-7) for bloodstream infections, and 17 days (IQR 17-17) for intra-abdominal infections</li> </ul>							Blast	2	Y	Y	Streptococcus spp.	-	Navy under the Wounded, III, and Program.
							Blast	3	Y	Y	-	Klebsiella aerogenes	<b>Disclaimer.</b> The views expressed are position of the Uniformed Services Ur Advancement of Military Medicine, Inc.
							Blast	3	Ν	Y	-	Haemophilus spp.	Services, Brooke Army Medical Cent Surgeon General, the Departments of
Table 2: Microbiology of initial infectious complication: Bloodstream         Infections							Blast	3	Y	Y	-	Enterobacter cloacae	Government. This research has been a
							Blast	4	Ν	Y	Staphylococcus aureus	-	
Patient	Injury Days Mechanism Infect	Gram-no	sitive Gra	m-negative	Fungus	23	Blast	5	Y	Y	-	Serratia marcescens	***
1	Non-blast 7	Staphyloc aureu		-	-	24	Blast	5	Ν	Y	Staphylococcus aureus		
2	Blast 5	-		bacter cloacae	-	25	Blast	23	N	Y	-	Serratia	Сог
3	Blast 7	-		trophomonas altophilia	-	26	Blast	4	Y	Y	Staphylococcus	marcescens Klebsiella	001
		* Inc	licates MD	R			aureus	aerogenes	Contact info: CPT Matthew				

Table 1: binding prior and with the data of the data		Resu	ilts			Results (cont.)							Re		
pdfsforming with gurn putting with gurn putting with graph with grap	able 1: Demographic and	military	Table 3: Microbiology of initial infectious complication: SSTI							<ul> <li>Blast injury wa</li> </ul>					
Lance brittle         Table of products with without with without without without without without with without without without without without without with without without without without without without with without with without	ersonnel with burn injuri	ies, No. (%)				Patient		-	(aram)	-positive	Gram-negative	Fungus	infectious compl		
Low redention         Particles         Water (red)         Interction         Value (red)         Value		Total	Patients with			4			on	-	Escherichia coli	-	<ul> <li>All patients with injury at time of</li> </ul>	•	
Age is again, median (108)         24 (2) 2.99         24 (2)	Characteristic			Infections		5	Blast	2			Escherichia coli*	Geotrichum	<ul><li>Initial infection w</li><li>Only one initial</li></ul>	vas poly	
intro         methodation         methodation <th< td=""><td>ge in years, median (IQR)</td><td>24 (22-29)</td><td>24 (22-29)</td><td>24 (21-29)</td><td>0.678</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>(polymicrobial, E</td><td></td></th<>	ge in years, median (IQR)	24 (22-29)	24 (22-29)	24 (21-29)	0.678								(polymicrobial, E		
Integrate densities         March densities	/lale	143 (99)	26 (100)	117 (99)	0.638			-			Acinetobacter		Gram-negative	organis	
Nomebasic         7         Bist         3         -         Production points         -         -         Production points         -         Producti	njury mechanism					6	Blast	8		-	complex*	-	which 15% were	-	
Non-solids         79 (25)         8 (31)         5 (46)         0.162           Source of Law         89 (62)         21 (80)         66 (15)         0.025           Non-context         55 (62)         51 (20)         66 (15)         0.025           Non-context         55 (20)         51 (21)         0.012         0.025           Non-context         55 (20)         51 (21)         0.012         0.025           Non-context         55 (20)         51 (21)         0.025 <th< td=""><td>Blast</td><td>65 (45)</td><td>18 (69)</td><td>64 (54)</td><td>0.162</td><td>7</td><td>Blast</td><td>13</td><td></td><td>-</td><td></td><td></td><td><ul> <li>Gram-positive o</li> </ul></td><td>raanisn</td></th<>	Blast	65 (45)	18 (69)	64 (54)	0.162	7	Blast	13		-			<ul> <li>Gram-positive o</li> </ul>	raanisn	
Source Total         #8 (42)         2 (40)         66 (58)         0.028         Participants         Participants         Participants           Total Sa, W, median (0R)         6 (1-44)         3 (1-34)         5 (2-33)         -0.001         -1.0000         -1.000         -1.000 <td>Non-blast</td> <td>79 (55)</td> <td>8 (31)</td> <td>54 (46)</td> <td>0.162</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>o</td> <td><i>Fusarium</i> spp.</td> <td><ul> <li>Fungi as the init</li> </ul></td> <td>-</td>	Non-blast	79 (55)	8 (31)	54 (46)	0.162						o	<i>Fusarium</i> spp.	<ul> <li>Fungi as the init</li> </ul>	-	
Control         99 162         21 800         66 8150         0.028         0.027	ource of burn					8	Blast	22		-		-			
Indications         Soliding	Combat	89 (62)	21 (80)	68 (58)	0.028	0	Dlact	2	Enter	rococcus				C	
(j Gray)		55 (38)	5 (20)	50 (42)	0.028	9	BIGST	3	fae	ecium		-		С	
Base score, median (1QR)         30 (2/-41)         59 (34-66)         42 (26-36)         40.001           Itmihalation (ling)         24 (12)         12 (65)         14 (12)         40.001           Median days (M, mediun (0Q)         7 (4-14)         15 (8-27)         0.00-2         40.001           Median days (M, mediun (0Q)         7 (4-14)         15 (8-27)         0.00-2         40.001           Median days (M, mediun (0Q)         7 (4-14)         15 (8-27)         0.00-2         40.001           Median days (M, mediun (0Q)         7 (4-14)         15 (8-27)         0.00-2         40.001           Median days (M, mediun (0Q)         7 (4-10)         5 (4-8)         2 (6-00)         0.007           Median days to drinitive graft (GR)         7 (5-10)         5 (4-8)         2 (6-00)         0.007           Median days to drinitive graft (GR)         4 (2.7)         4 (12.7)         0 (0-2)         4.001           Dash         4 (2.7)         4 (12.7)         0 (0-2)         4.001         4.001           Median days to drinitive graft (IGR)         5 (5 (8-3))         10 (8-14)         4.001         3.00         9.00         5.56ph/Jocccccus           1/2         Non-blast         3         Y         Y         5.56ph/Jocccccus <tb< td=""><td></td><td>* Indic</td><td>cates MDR</td><td></td><td></td><td></td><td>fragilis</td><td></td><td>This study prov</td><td></td></tb<>		* Indic	cates MDR				fragilis		This study prov						
$ \frac{1}{2} = 1$	BSA %, median (IQR)	6 (3-14)	31 (13-43)	5 (2-8)	<0.001								microbiology of	initial ir	
Mechanical ventilation (MV)         56 (39)         23 (96)         31 (26)          Control         Control         Multiand age MV, median (UR)         7 (1-34)         15 (2-34)         48 (30-79)         11 (6-19)         (0.001)         Inhibition         Inhibition <thinhib< td=""><td>aux score, median (IQR)</td><td>30 (27-41)</td><td>59 (34-66)</td><td>29 (26-36)</td><td>&lt;0.001</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>members</td><td></td></thinhib<>	aux score, median (IQR)	30 (27-41)	59 (34-66)	29 (26-36)	<0.001								members		
median division         median div	nhalation injury	24 (17)	12 (46)	14 (12)	<0.001	Table 4	I: Microbio	ology of in	nitial infec	ctious cor	nplication: Pn	eumonia	<ul> <li>In the TIDOS</li> </ul>		
Median days My, median (1QR)         7 (4-14)         15 (8-27)         0 (0-2)         < 0.017         Initiation         Initiation <thinitiation< th="">         Initiation         <th< td=""><td>Aechanical ventilation (MV)</td><td>56 (39)</td><td>25 (96)</td><td>31 (26)</td><td>&lt;0.001</td><td></td><td></td><td>Days to</td><td>Inhalation</td><td></td><td></td><td></td><td>briefest time fro of pneumonia</td><td>-</td></th<></thinitiation<>	Aechanical ventilation (MV)	56 (39)	25 (96)	31 (26)	<0.001			Days to	Inhalation				briefest time fro of pneumonia	-	
Length of hospital star, median dys (IQR)       15 (7-24)       48 (30-79)       11 (6-19)       <0.001       11       Non-blast       6       N       Y       Staphylocccus       Harmophilus aureus       Infections       Infection       Staphylocccus       Harmophilus aureus       Infection       Infection       Staphylocccus       Harmophilus aureus       Infection       Infection       Staphylocccus       Harmophilus aureus       Infection       Infection <td>/ledian days MV, median (IQR)</td> <td>7 (4-14)</td> <td>15 (8-27)</td> <td>0 (0-2)</td> <td>&lt;0.001</td> <td>Patient</td> <td>Injury</td> <td>-</td> <td></td> <td>Intubated</td> <td>Gram-positive</td> <td>-</td> <td>intubation</td> <td>patient</td>	/ledian days MV, median (IQR)	7 (4-14)	15 (8-27)	0 (0-2)	<0.001	Patient	Injury	-		Intubated	Gram-positive	-	intubation	patient	
Infection days from injury to first vergical proceeding (QR)       7 (6-10)       6 (4-8)       8 (6-10)       0.007         Median days form injury to first vergical proceeding (QR)       7 (6-10)       6 (4-8)       8 (6-10)       0.007         Median days form injury to first vergical proceeding (QR)       13 (8-32)       35 (15-56)       10 (8-14)       <0.001	• • •	15 (7-24)	48 (30-79)	11 (6-19)	<0.001	11	Non-blast	6	Ν	Y		•	<ul> <li>Infectious comp</li> </ul>		
Image: a days from lajury to first: surgical procedure (IQR)       7 (6-10)       6 (4-8)       8 (6-10)       0.007         surgical procedure (IQR)       13 (8-32)       35 (15-56)       10 (8-14)       <0.001		5 (3-6)	4 (3-6)	6 (3-5)	0.350	12	Non-blast	14	Y	Y	-	Escherichia coli*	organisms most <ul> <li>Infectious comp</li> </ul>	-	
Median days to definitive graft (QR)       13 (8-32)       25 (15-56)       10 (8-14)       <0.001         Death       4 (2.7)       4 (15)       0       <0.001	• • •	7 (6-10)	6 (4-8)	8 (6-10)	0.007	13		7	Ν	Y	-		score, larger T longer delays to	BSA b	
(iQR)       is (e tr)       is (e tr) <this (e="" th="" tr)<="">       is (e tr)</this>		13 (8 – 32)	35 (15-56)	10 (8-14)	<0.001	14	Non-blast	4	Y	Y	-		<ul> <li>Infection in the</li> </ul>		
IQR - interquartile range; TBSA - total body surface area       Interctions were diagnosed in 26 (18%) patients       Stephylococcus       Stephylococcus         Infections were diagnosed in 26 (18%) patients       Interctions (N=16, 62%), followed by SSTI (N=6, 23%), bloodstream infections (N=3, 12%), and intra-abdominal infections (N=1, 4%)       Interctions (N=1, 4%)       Interctions (N=1, 4%)       Escherichia coli; success of infections (N=1, 4%)         Median time from injury to initial infecting syndrome was 4 days (IQR 6-7) for bloodstream infections, and 17 days (IQR 17-17) for intra-abdominal infections       Infections       N       Y       Y       Stephylococcus       Interchancement Success of infections (N=1, 4%)         Table 2: Microbiology of initial infectious complication: Bloodstream infections infections intra-abdominal infections       Gram-positive fram-negative Fungus       Fungus       Interchancement Success of aureus       Interchancement Success of aureus       Stephylococcus aureus       Interchancement Success of aureus         20       Blast       3       Y       Y       -       Exterchancement Success of aureus       Stephylococcus aureus       Interchancement Success of aureus       Interchancement Success of aureus       Stephylococcus aureus       Interchancement Success of aureus       Interchancement Success of aureus       Stephylococcus aureus       Interchancement Success of aureus       Interchancement Success of aureus       Interchancement Success of aureus       Interchancement Succes       Interchancement						15	Non-blast	3	N	Y	aureus;	•	mortality. A bett improve long-ter	er unde	
Infections were diagnosed in 26 (18%) patients       Infections were diagnosed in 26 (18%) patients       Infections (N=1, 4%)       Infections (N=1, 4%	QR – interquartile range; T							, and a second sec			spp.	influenza			
<ul> <li>International and the second of the second of</li></ul>	•	•	2 -		0071	16	Non-blast	3	Y	Y	aureus; Streptococcus	-	We are indebted to the		
Median time from injury to initial infecting syndrome was 4 days (IQR 3-5 days) for pneumonia, 7 days (IQR 4-12) for SSTI, 7 days (IQR 17-17) for intra-abdominal infections, and 17 days (IQR 17-17) for intra-abdominal infections   18 Blast 2 Y Y Streptococcus spp. Navy under program.   19 Blast 3 Y Y - Klebsiella aerogenes Advancement   20 Blast 3 N Y - Haemophilus spp.   20 Blast 3 N Y - Haemophilus spp.   20 Blast 3 N Y - Haemophilus spp.   20 Blast 3 Y Y - Haemophilus spp.   20 Blast 3 Y Y - Haemophilus spp.   20 Blast 3 Y Y - Enterobacter cloace   20 Blast 3 Y Y - Enterobacter cloace   20 Blast 3 Y Y - Enterobacter cloace   21 Blast 3 Y Y - Straphylococcus aureus   1 Non-blast 7 Staphylococcus aureus   2 Blast 5 - Enterobacter cloace -   2 Blast 5 N Y Staphylococcus aureus -   2 Blast 5 N Y Staphylococcus aureus -   3 Blast 7 Staphylococcus aureus - Staphylococcus aureus -	(N=6, 23%), bloodstream infections (N=3, 12%), and intra-						Non-blast	3	Ν	Y	-	Enterobacter	managers, clinical site m success of this project. Infectious Diseases, National the Defense Health Prog	anagers, a This proj onal Institu	
(IQR 6-7) for bloodstream infections, and 17 days (IQR 17-17) for intra-abdominal infections       19       Blast       3       Y       Y       - <i>klebsiella</i> arrogenes <i>acrogenes acrogenes spp. spp.</i>		18	Blast	2	Y	Y		-	Navy under the Wounder	, ,					
Intra-addominal infections       Intra-addominal infections         Table 2: Microbiology of initial infectious complication: Bloodstream Infections       20       Blast       3       N       Y       -       Haemophilus spp.       Survees Bro Surgeon Gen Coacae         1       Non-blast       7       Gram-positive aureus       Fungus       24       Blast       5       N       Y       -       Haemophilus spp.       Servetar cloacae       -       24       Blast       5       N       Y       -       Servetar cloacae       -       24       Blast       23       N       Y       -       Servetar cloacae       -	(IQR 6-7) for bloodstream infections, and 17 days (IQR 17-17) for						Blast	3	Y	Y	-		<b>Disclaimer.</b> The views expr position of the Uniformed S Advancement of Military Me	Services U	
Table 2: Microbiology of initial infectious complication: Bloodstream 21 Blast 3 Y Y Enterobacter cloacae   Infection Days to Infection Gram-positive Gram-negative Fungus 22 Blast 4 N Y Staphylococcus aureus -   1 Non-blast 7 Staphylococcus aureus <td< td=""><td>initia-abdominal infectio</td><td>ภาร</td><td></td><td></td><td></td><td>20</td><td>Blast</td><td>3</td><td>Ν</td><td>Y</td><td>-</td><td>Haemophilus</td><td>Services, Brooke Army Me Surgeon General, the Depa</td><td>edical Cent artments of</td></td<>	initia-abdominal infectio	ภาร				20	Blast	3	Ν	Y	-	Haemophilus	Services, Brooke Army Me Surgeon General, the Depa	edical Cent artments of	
Infections   Infection   Infection <tr< td=""><td colspan="6">Table 2: Microbiology of initial infectious complication: Bloodstream</td><td>Blast</td><td>3</td><td>Y</td><td>Y</td><td>-</td><td>Enterobacter</td><td>Government. This research</td><td>has been a</td></tr<>	Table 2: Microbiology of initial infectious complication: Bloodstream						Blast	3	Y	Y	-	Enterobacter	Government. This research	has been a	
Injury Mechanism         Days to Infection         Gram-positive         Fungus         Pungus         Blast         5         Y         Y         Serratia marcescens         Serratia marcescens           1         Non-blast         7         Staphylococcus aureus         -							Blast	4	Ν	Y		-		*	
Image: Staphylococcus aureus       Staphylococcus aureus       -        -	atient	Gram-po	ositive Gra	m-negative	Fungus	23	Blast	5	Y	Y	-			* *	
2     Blast     5     -     Enterobacter cloacae     -       3     Blast     7     -         3     Blast     7     -         5     Find the second sec		Staphyloc		-	-	24	Blast	5	N	Y				~	
<b>3</b> Blast 7 - Stenotrophomonas - Stenotrophomonas - Stenotrophomonas	2 Blast 5		Entero		-	25	Blast	23	Ν	Y	-			Cor	
	3 Blast 7	-		•	-	26	Blast	4	Y	Y		Klebsiella			
* Indicates MDR						* In	dicates MD	R			uureus	uerogenes	Contact info: CPT M	latthew	



### esults (cont.)

mechanism of injury in 69% of patients with

monia were intubated and 50% had an inhalation injury

olymicrobial in 35% of patients

ting syndrome was an intra-abdominal infection pcoccus spp., K. pneumoniae, and B. fragilis)

nisms were isolated in 20 (77%) of patients, in

sms were identified in 42% of patients

late were seen in 2 patients (8%) with SSTIs

### Conclusions

a better understanding of both the timing and infectious complications in these burned service

lation, the most frequent initial infection and ury to infection was pneumonia and the majority nts had an inhalation injury and all required

ons were often polymicrobial with Gram-negative Jently isolated

ons were associated with higher injury severity burned, higher rates of inhalation injury, and itive grafting

ervice members was associated with a higher derstanding of the risk factors of burn injury will anagement and outcomes

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