Alcohol Use Effects on Burn Related Reconstruction Patient Outcomes and Complications

Kevin M. Klifto, PharmD; Pragna N. Shetty, BS; Benjamin R. Slavin, BS; Caresse F. Gurno, BA, BS; Stella M. Seal, MLS; Mohammed Asif, MD; C. Scott Hultman MD, MBA

Department of Plastic and Reconstructive Surgery, The Johns Hopkins University School of Medicine, Baltimore, MD

ABSTRACT

Summary

Patients suffering from burn-related injuries admitted to the hospital concurrently consuming alcohol are believed to be at an increased risk of poor outcomes and the development of complications following burn reconstruction, however data varies within the literature and remains controversial. This systematic review and meta-analysis compared outcomes and complications from studies during the years 1958 to 2018 between 813 burn patients admitted to the hospital with alcohol use reported by a positive blood alcohol concentration (BAC), intoxication, or the patient on admission to 299543 burn patients admitted who were not consuming alcohol. The PubMed, EMBASE, Cochrane Library, and Web of Science databases were systematically and independently searched. Clinical characteristics, alcohol use, outcomes and complications were recorded. PRISMA and Cochrane guidelines where used throughout the review. Eleven of the 14 studies included in our study, were eligible for meta-analysis, with results from 9 of the possible 21 outcomes and complications queried. In conclusion, this systematic review and meta-analysis found that compared to patients suffering from burn-related injuries who did not consume alcohol, patients consuming alcohol spent more days on a ventilator, had a higher rate of intubation, had a higher rate of inhalation injury, longer intensive care unit length of stay, and increased mortality.

INTRODUCTION

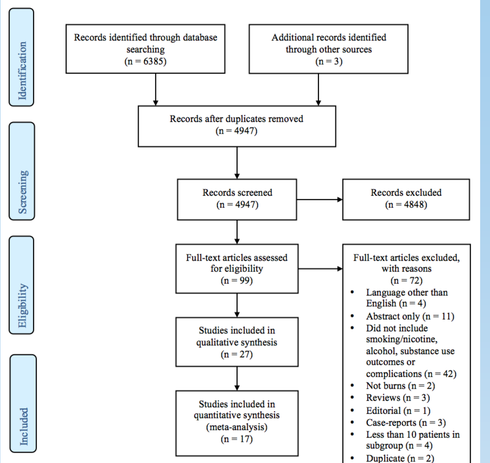
This new systematic review and meta-analysis compared outcomes and complications between alcohol use in burn patients admitted to the hospital to burn patients admitted without these characteristics. This review is an attempt to compile information to create a uniform set of data for clinical interpretation in diverse populations. Based on peer-reviewed literature, it was hypothesized that alcohol would increase the risks of poor outcomes and complications in patients admitted to the hospital following a burn related injury, compared to burn patients admitted without any of these characteristics.

MATERIAL AND METHODS

Search

A medical library informationist (SMS) conducted the initial literature search using four databases (MEDLINE via PubMed, Embase, Cochrane, and Web of Science) from inception to December 20, 2018. Reference lists of relevant articles were hand searched to identify additional relevant studies. All references were imported into Covidence (Veritas Health Innovation Ltd, Melbourne, Australia) and reference management software and duplicates were removed.

Figure 1. PRISMA flow chart summarizes the results of the screening process and final article selections.



Data Extraction

Two reviewers (KMK and PS) systematically and independently performed the title screening, followed by abstract screening, and full-article review to ensure quality and accuracy throughout the process. Any disagreements regarding studies to be included or excluded were resolved by discussion. If disagreements were still present after discussion, a third reviewer (CSH) resolved remaining conflict. The following data were extracted qualitatively and quantitatively for outcome and complication variables of interest: authors, year of publication, type of study, sample size, male and female distributions, alcohol used on admission to the hospital, burn related operations, graft loss/failure, percent total body surface area burned (%TBSA), depth of burn (superficial, superficial partial thickness, deep partial thickness, full thickness), skin grafting, amputations, length of hospital stay (LOS), time period of wound closure, inhalation injury, number of days on a ventilator, rate of intubation, intensive care unit (ICU) LOS, mortality, overall infections, wound/local skin infections, sepsis, decubitus ulcer (hospital acquired pressure injury), deep vein thrombosis (DVT)/pulmonary embolism (PE), renal failure, respiratory complications, and ventilator-associated events. If there were multiple reports from the same study, one data collection form was completed for the study from all of the reports to avoid duplicating results.

Table Alcohol use individual study results

Author	Group	Sample size (n)	Burn related operations (n)	%TBSA (mean±SD)	LOS (mean±SD)	Ventilator days (mean±SD)	Intubation (n)	Inhalation injury (n)	ICU LOS (mean±SD)	Mortality (n)	Infection (n)	Wound/local infection (n)	Sepsis (n)	DVT/PE (n)
Anous et al.	Alcohol	11	---	34±18	35.6±26	---	---	---	---	10	---	---	---	---
	Control	31	---	36±19	63.1±58	---	---	---	---	23	---	---	---	---
Clark et al.	Alcohol	20	---	---	---	---	---	---	---	13	---	---	---	---
	Control	20	--	---	---	---	---	---	---	8	---	---	---	---
Darko et al.	Alcohol	110	---	---	---	---	---	---	---	15	---	---	---	---
	Control	478	---	---	---	---	---	---	---	22	---	---	---	---
Davis et al.	Alcohol	12	---	7.4±20	24±25	20.3±31	---	12	22.6±28	---	6	---	2	---
	Control	37	---	19.7±43	27.3±39	18.3±32	---	37	24.6±36	---	22	---	10	---
Germann et al.	Alcohol	78	---	---	---	---	---	---	---	35	---	---	---	---
	Control	290	---	---	---	---	---	---	---	64	---	---	---	---
Griffin et al.	Alcohol	47	---	14.8	15.8	6.2	---	11	23.5	---	21	1	5	---
	Control	511	---	12.5	10.5	2.1	---	46	11.6	---	---	---	---	---
	Alcohol	56	---	15.9	15.3	4.8	---	13	14.7	8	31	1		---
	Control	511	---	12.5	10.5	2.1	---	46	11.6	---	---	---	---	---
Haum et al.	Alcohol	70	---	27.6	41.3±30	---	---	35	28.3±25	22	---	---	---	---
	Control	155	---	27.4	41.3±30	---	---	45	23.9±25	28	---	--	---	---
McGill et al.	Alcohol	53	---	23±24	---	---	---	15	---	10	---	---	---	---
	Control	237	---	17±17	---	---	---	17	---	7	---	---	---	---
Silver et al.	Alcohol	24	---	29.2	29	14.9	18	10	22.9	4	---	---	---	---
	Control	24	---	29.3	15.7	4.23	12	10	9.5	2	---	---	---	---
Powers et al.	Alcohol	50	28	21.8±18	23±103	---	---	---	---	---	---	---	---	---
Palmus et al.	Alcohol	56	---	9.9	---	---	---	---	---	---	---	---	---	---
	Control	51	---	8	---	---	---	---	---	---	---	---	---	---
Rehou et al.	Alcohol	103	---	9.75±11	17±16	17±31	34	16	---	7	---	---	---	---
	Control	794	---	7.3±10.8	11.3±15	8±18	200	77	---	28	---	---	---	---
Sikora et al.	Alcohol	13	---	---	---	---	---	---	---	---	---	---	---	2
Hodgeman et al.	Alcohol	229	---	6.76±16	9.3±21	1.6±4	---	57	2.6±8	24	---	---	---	---
	Control	9118	---	16.7±10	5.6±12	0	---	716	1±3	433	---	---	---	---
Bennett et al.	Control	107	---	24	34	14	---	107	---	20	---	---	---	---

RESULTS

%TBSA

Ten studies evaluated %TBSA. [1, 3, 5, 6, 9, 10, 22, 28, 29, 31] In five studies, means ranged from 4% to 12% TBSA in patients consuming alcohol compared to 7.3% to 36% TBSA in patients not consuming alcohol. These results were not significant (SMD: -0.17, 95% CI: -0.88, 0.53, I^2 = 97%, p = 0.63).[1, 3, 5, 6, 9]After removing the study Hodgman et al, heterogeneity dropped from I^2 = 97% to I^2 = 22%, with a p = 0.63 to p = 0.08). [9] These results were still not significant.

Hospital LOS

Eight studies evaluated hospital LOS. [1, 3, 6, 9, 10, 22, 29, 31] In five studies, hospital LOS means ranged from 9.3 to 41.3 days in 425 patients consuming alcohol compared to 5.6 to 63 days in 10135 patients not consuming alcohol (SMD: 0.16, 95% CI: -0.05, 0.37, I^2 = 63%, p = 0.14). [1, 3, 6, 9, 10] After removing the studies Anous et al and Haum et al, heterogeneity dropped from I^2 = 67% to I^2 = 0%, with a p = 0.14 to p < 0.00001 (SMD: 0.31, 95% CI: 0.20, 0.42, I^2 = 0%, p < 0.00001).[1, 10]

Ventilator days

Five studies evaluated the number of days patients were on a ventilator. [3, 6, 9, 22, 31] In three studies, the number of days a patient was on a ventilator means ranged from 1.6 to 17 days in 344 patients consuming alcohol compared to 0 to 18.3 days in 9949 patients not consuming alcohol. The mean number of days on a ventilator in patients consuming alcohol was 0.38 longer (SMD: 0.38, 95% CI: 0.11, 0.66, I^2 = 17%, p = 0.006). [6, 9, 10]

Intubation

In two studies, 52/127 (41%) patients consuming alcohol were intubated compared to 212/818 (26%) patients not consuming alcohol (RR: 1.36, 95% CI: 1.06, 1.75, I^2 = 0%, p = 0.02).[6, 31]

Inhalation injury

In seven studies, 169/594 (28%) patients consuming alcohol sustained an inhalation injury compared to 994/11387 (9%) patients not consuming alcohol (RR: 1.97, 95% CI: 1.06, 3.66, I^2 = 96%, p = 0.03). [3, 5, 6, 9, 10, 22, 31] After removing the studies Davis et al, Haum et al, Rehou et al, and Silver et al, heterogeneity dropped from I^2 = 96% to I^2 = 0%, with a p = 0.03 to p < 0.00001 (RR: 3.09, 95% CI: 2.54, 3.75, I^2 = 0%, p < 0.00001).[3, 6, 10, 31]

ICU LOS

Five studies evaluated ICU LOS. [3, 9, 10, 22, 31] In three studies, ICU LOS means ranged from 2.6 to 28.3 days in 311 patients consuming alcohol compared to 1 to 24.6 days in 9310 patients not consuming alcohol. The mean length of ICU stay in patients consuming alcohol was 0.29 longer (SMD: 0.29, 95% CI: 0.00, 0.58, I^2 = 64%, p = 0.05). [3, 9, 10] After removing the study Hodgman et al, heterogeneity dropped from I^2 = 64% to I^2 = 0%, with a p = 0.05 to p < 0.30 (SMD: 0.14, 95% CI: -0.12, 0.40, I^2 = 0%, p < 0.30).[9]

Mortality

In nine studies, mortality occurred in 140/698 (20%) patients consuming alcohol compared to 615/11147 (6%) patients not consuming alcohol (RR: 2.02, 95% CI: 1.51, 2.70, I^2 = 63%, p < 0.00001). [1, 2, 5-7, 9, 10, 21, 31] After removing the studies Anous et al and McGill et al, heterogeneity dropped from I^2 = 63% to I^2 = 0%, with no change in p < 0.00001 (RR: 2.05, 95% CI: 1.69, 2.48, I^2 = 0%, p < 0.00001).[1, 5]

Infections

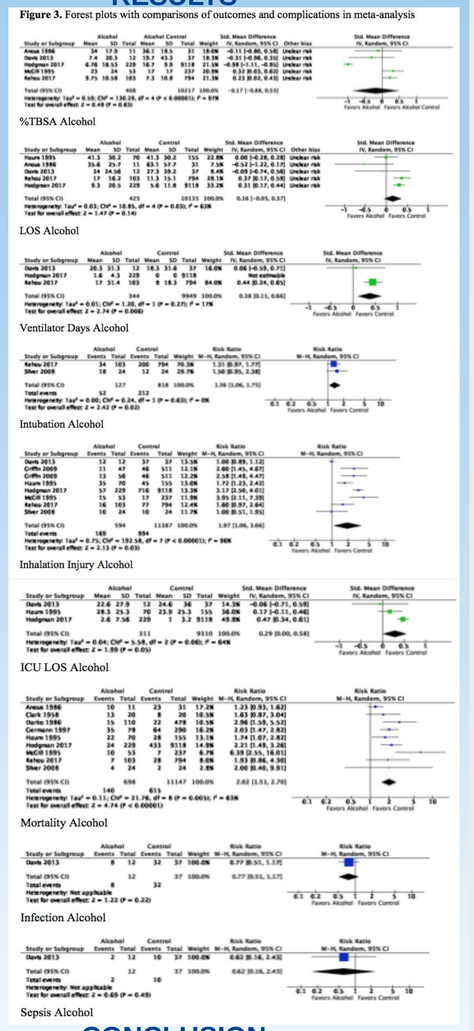
Two studies evaluated the rates of overall infections. [3, 22] One study found 8/12 (67%) infections in patients with inhalation injuries consuming alcohol compared to 32/37 (86%) infections in patients with inhalation injuries not consuming alcohol. These results were not significant (RR: 0.77, 95% CI: 0.51, 1.17, I^2 = Not applicable, p = 0.22). [3]

Sepsis

Two studies. [3, 22] One study found 2/12 (17%) sepsis infections in patients consuming alcohol compared to 10/37 (27%) sepsis infections in patients not consuming alcohol. These results were not significant (RR: 0.62, 95% CI: 0.16, 2.43, I^2 = Not applicable, p = 0.49).[3]

RESULTS

Figure 3. Forest plots with comparisons of outcomes and complications in meta-analysis



CONCLUSION

Compared to patients suffering from burn-related injuries who did not consume alcohol, patients consuming alcohol spent more days on a ventilator, had a higher rate of intubation, had a higher rate of inhalation injury, longer intensive care unit length of stay, and increased mortality.

REFERENCES

1. Anous MM, Heimbuch DM. Causes of death and predictors in burned patients more than 60 years of age. J Trauma 1986;26:135-139.
2. Clark AG, Hanson JH. Mortality rates in patients with burns: a report of experience at San Francisco City and County Hospital, 1943-1956. Calif Med 1958;89:210-214.
3. Davis CS, Esposito TJ, Palladino-Davis A, et al. Implications of Alcohol Intoxication at the Time of Burn and Smoke Inhalation Injury: An Epidemiologic and Clinical Analysis. Journal of Burn Care & Research 2013;34:120-126.
4. Grobmyer SR, Maniscalco SP, Purdue GF, et al. Alcohol, drug intoxication, or both at the time of burn injury as a predictor of complications and mortality in hospitalized patients with burns. Journal of Burn Care and Rehabilitation 1996;17:533-539.
5. McGill V, Kowal-Vern A, Fisher SG, et al. The impact of substance use on mortality and morbidity from thermal injury. J Trauma 1995;38:931-934.
6. Rehou S, Mason S, MacDonald J, et al. The influence of substance misuse on clinical outcomes following burn. Burns 2017;43:1493-1498.
7. Darko DF, Wachtel TL, Ward HW, et al. Analysis of 585 burn patients hospitalized over a 6-year period. Part III: Psychosocial data. Burns Incl Therm Inj 1986;12:395-401.
8. Bennett SPH, Trickett RW, Potokar TS. Inhalation injury associated with smoking, alcohol and drug abuse: An increasing problem. Burns 2009;35:882-887.
9. Hodgman EI, Subramanian M, Wolf SE, et al. The Effect of Illicit Drug Use on Outcomes Following Burn Injury. J Burn Care Res 2017;38:e89-e94.
10. Haum A, Perbix W, Hack HJ, et al. ALCOHOL AND DRUG-ABUSE IN BURN INJURIES. Burns 1995;21:194-199.
11. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. PLoS Med 2009;6:e1000100.
12. Savovic J, Weeks L, Sterne JA, et al. Evaluation of the Cochrane Collaboration's tool for assessing the risk of bias in randomized trials: focus groups, online survey, proposed recommendations and their implementation. Syst Rev 2014;3:37-4053-3-37.
13. Higgins JP, Thompson SG, Deeks JJ, et al. Measuring inconsistency in meta-analyses. BMJ 2003;327:557-560.
14. Wan X, Wang W, Liu J, et al. Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range. BMC Med Res Methodol 2014;14:135-2288-14-135.
15. Corbett MS, Higgins JP, Woolacott NF. Assessing baseline imbalance in randomised trials: implications for the Cochrane risk of bias tool. Res Synth Methods 2014;5:79-85.
16. Afshar M, Netzer G, Mosier MJ, et al. The Contributing Risk of Tobacco Use for ARDS Development in Burn-Injured Adults With Inhalation Injury. Respir Care 2017;62:1456-1465.
17. Al Kassis S, Savetamal A, Assi R, et al. Characteristics of patients with injury secondary to smoking on home oxygen therapy transferred intubated to a burn center. J Am Coll Surg 2014;218:1182-1186.
18. Bell C, Slim J, Flaten HK, et al. Butane Hash Oil Burns Associated with Marijuana Liberalization in Colorado. Journal of Medical Toxicology 2015;11:422-425.
19. Carlos WG, Baker MS, McPherson KA, et al. Smoking-Related Home Oxygen Burn Injuries: Continued Cause for Alarm. Respiration 2016;91:151-155.
20. Danks RR, Wibbenmeyer LA, Faucher LD, et al. Methamphetamine-associated burn injuries: A retrospective analysis. Journal of Burn Care and Rehabilitation 2004;25:425-429.
21. Germann G, Barthold U, Lefering R, et al. The impact of risk factors and pre-existing conditions on the mortality of burn patients and the precision of predictive admission-scoring systems. Burns 1997;23:195-203.
22. Griffin R, Poe AM, Cross JM, et al. The association between blood alcohol level and infectious complications among burn patients. Journal of Burn Care and Research 2009;30:395-399.
23. Heard JP, McDonald KM, Xing Y, et al. Regional and national review of factors associated with burn wound cellulitis. J Burn Care Res 2015;36:23-32.
24. Hickey S, Goverman J, Friedstat J, et al. Thermal injuries from exploding electronic cigarettes. Burns 2018;44:1294-1301.
25. Jehle CC, Nazir N, Bhavsar D. The rapidly increasing trend of cannabis use in burn injury. Journal of Burn Care and Research 2015;36:e12-e17.
26. Kelley D, Lynch JB. Burns in alcohol and drug users result in longer treatment times with more complications. Journal of Burn Care and Rehabilitation 1992;13:218-220.
27. Knowlin L, Stanford L, Cairns B, et al. The effect of smoking status on burn inhalation injury mortality. Burns 2017;43:495-501.
28. Palmu R, Partonen T, Suominen K, et al. Alcohol use and smoking in burn patients at the Helsinki Burn Center. Burns 2018;44:158-167.
29. Powers PS, Stevens B, Arias F, et al. Alcohol disorders among patients with burns: Crisis and opportunity. Journal of Burn Care and Rehabilitation 1994;15:386-391.
30. Sikora S, Papp A. Venous thromboembolism in burn patients is not prevented by chemoprophylaxis. Burns 2017;43:1330-1334.
31. Silver GM, Albright JM, Schermer CR, et al. Adverse clinical outcomes associated with elevated blood alcohol levels at the time of burn injury. Journal of Burn Care and Research 2008;29:784-789.
32. Warner P, Connolly JP, Gibran NS, et al. The methamphetamine burn patient. Journal of Burn Care and Rehabilitation 2003;24:275-278.