

ABSTRACT

Purpose: While obesity is associated with increased mortality and decreased functional outcomes in adult burn patients, the ramifications of larger than average body size in the pediatric burn population are less well understood. Building on the finding that obese pediatric burn patients have a significantly longer length of hospital stay than their lean counterparts, the present study sought to determine whether obesity was associated with poor outcomes following burn injuries. **Methods:** Data on patients ≤ 18 years of age who were admitted to a large regional burn unit between the years of 2000 and 2010 and for whom height and weight data was available (n=540) was collected from the hospital's burn database. Using the definition of obesity as ≥ 95 th percentile of weight for height according to the World Health Organization growth charts (< 2 years of age) or BMI for age according to the Centers for Disease Control growth charts (2 to 18 years of age), outcomes were compared between thermally-injured children classified as obese (n=155) and those classified as non-obese (n=385). Outcome parameters examined were total body surface area injury (TBSA), % full thickness injury, days in the ICU, non-ICU hospital days, days requiring mechanical ventilation, incidence of sepsis, pneumonia, number of operations, and overall mortality. All data was collected in accordance with IRB (#STU 032012-032) regulations. **Results:** Obese and non-obese thermally-injured children did not differ significantly with respect to TBSA, percentage of full thickness burn, or overall mortality. However, these groups were significantly different with respect to age (obese=7.26 \pm 0.46 years, non-obese=9.36 \pm 0.32 years, p=0.00015) and days requiring mechanical ventilation (obese=4.86 \pm 1.28 days, non-obese=2.72 \pm 0.49 days, p=0.029). When considering only those thermally-injured children admitted to the BICU without inhalation injury (n=177), the obese (n=46) and non-obese (n=131) groups did not differ significantly with respect to TBSA, percentage of full thickness burn, or overall mortality. However, significant differences between these groups were noted for number of days spent in the ICU (obese=18.59 \pm 5.12 days, non-obese=9.38 \pm 1.79 days, p=0.017) and number of days requiring mechanical ventilation (obese=11.65 \pm 3.87 days, non-obese=3.87 \pm 0.83 days, p=0.002). **Conclusion:** These data show thermally-injured obese pediatric patients required longer and more intensive medical support in the form of BICU care and respiratory intervention. Counter to findings in adult populations, differences in mortality were not observed. Collectively, these findings suggest obesity as a risk factor for increased morbidity in the pediatric burn population.

PURPOSE

The aim of this study was to determine the morbidity and potential mortality associated with obesity in the care of post-burn pediatric patients.

INTRODUCTION

Mortality from severe thermal injury in the pediatric population is related to age, burn size, presence of inhalation injury, delayed resuscitation, anemia, sepsis, thrombocytopenia, hyper-osmolarity, and ventilator dependence. Currently, 30% of individuals younger than 18 years of age are considered overweight, while 16% are estimated to be obese. Despite a direct correlation between obesity and poor outcomes of non-burn pediatric trauma, the implications of obese body habitus in thermally-injured children is less well defined.

METHODS

Data on patients ≤ 18 years of age who were admitted to a large regional burn unit between the years of 2000 and 2010 (n=571) was collected from the hospital's burn database.

Obesity was defined as ≥ 95 th percentile of weight for height according to the World Health Organization growth charts for children < 2 years of age. For children 2 years to 18 years of age, a body mass index (BMI=weight(kg)/height² (m²)) ≥ 95 th percentile for age according to the Centers for Disease Control growth charts was utilized to determine obesity. Demographic, burn-related data and outcome parameters were compared between thermally-injured children classified as obese and those classified as non-obese. Thirty-one patients were excluded (9/164 obese and 22/407 non-obese) for non-thermal cutaneous injury.

RESULTS

The obese (n=155) and non-obese (n=385) cohorts of thermally-injured children did not differ in overall mortality, TBSA, % full thickness TBSA, inhalation injury, ICU admissions, PRBC transfused, sepsis or operative procedures. Obese children required longer ventilator support and had a significantly higher incidence of lung cultures positive for pathogens. (Table I) While non-obese children showed a tightly clustered range of BMI around the mean for each age group, obese children showed a greater range of BMI for each age. (Figure I) Of children needing BICU (n=208), obese children (n=55) required longer ICU stays, longer ventilator support and more PRBC transfusions, while also experiencing a higher incidence of positive lung cultures than their non-obese counterparts (n=153). (Table II) Thirty-one patients were treated for thermal injury and smoke inhalation. There was no difference in the incidence of smoke inhalation injury between obese and non-obese children admitted to BICU. If burn-injured children with smoke inhalation were omitted from the overall BICU cohort, obese children (n=46) were noted to be younger, have longer BICU stay, longer ventilator support, more PRBC transfusions, and a higher number of positive lung cultures than their non-obese (n=131) counterparts. (Table III)

CONCLUSIONS

These data demonstrate that thermally-injured obese pediatric patients required longer and more intensive medical support in the form of BICU care, infusion of blood products, and respiratory intervention. In line with the increased requirement for intensive hospital management, obese pediatric patients appear to be at greater risk for colonization by pulmonary pathogens. Interestingly, the obese and non-obese groups did not require significantly different numbers

of surgical interventions, and, counter to findings in adult populations, differences in mortality were not observed. While the causal relationships between obesity and clinical outcomes cannot be inferred from the data, a compelling case can be made for considering a patient's body habitus as a risk factor for increased morbidity in the form of ventilator days, ICU days, transfusion of blood products and

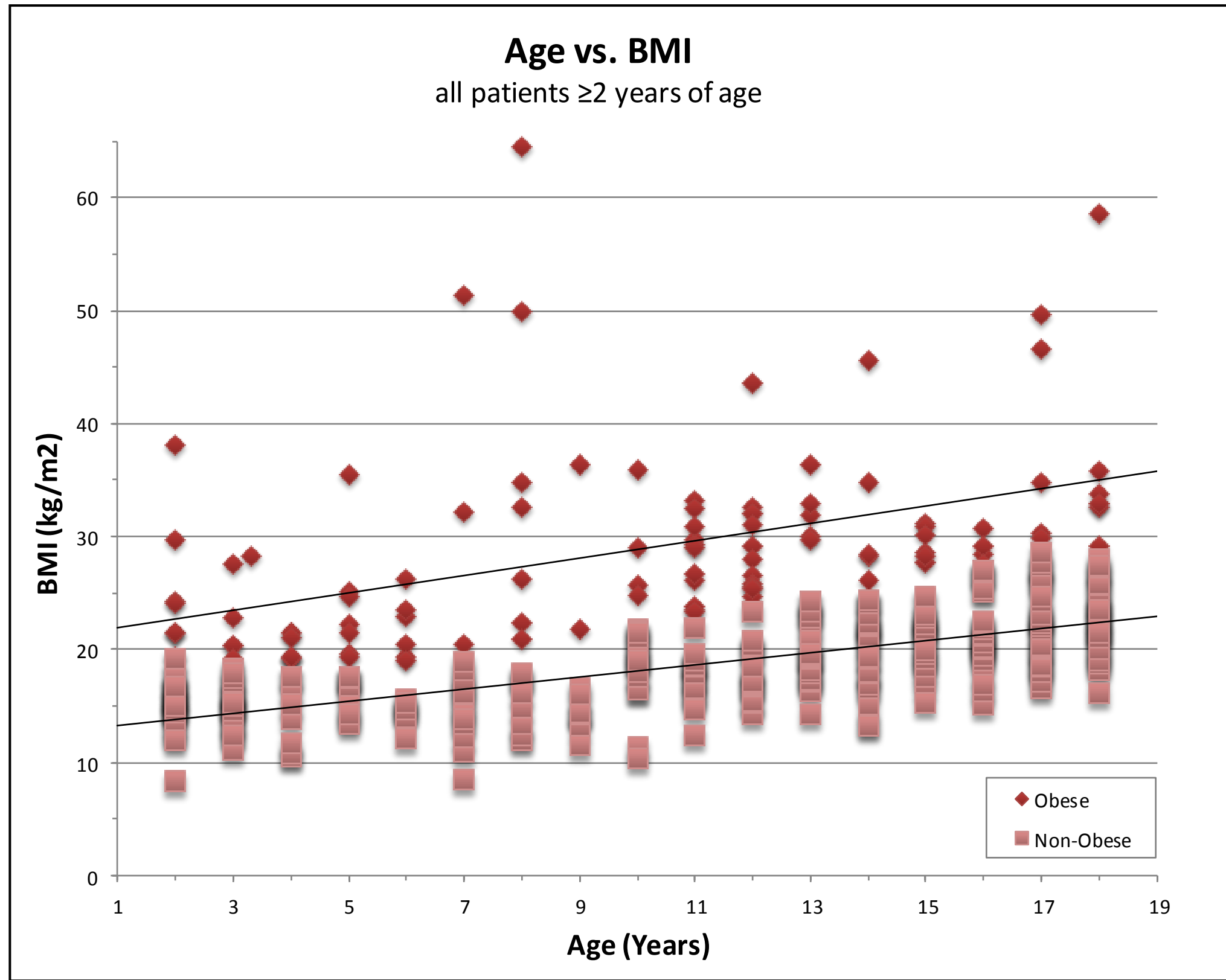


Figure I

All Patients

	n=155		n=385		
	Obese	SEM	Non-Obese	SEM	p value
Age (years)	7.26	0.46	9.38	0.32	0.00015
Weight (pounds)	43.55	2.74	37.78	1.21	0.013
Height (inches)	45.66	1.25	52.85	0.76	0.00000038
Gender (% male)	66%	3.80%	77%	2.10%	0.0062
Mortality rate	0.0065	0.0064	0.016	0.0063	0.2
TBSA (%)	14.17%	1.28%	15.08%	0.78%	0.27
Full Thickness (%)	4.72%	0.99%	5.97%	0.68%	0.16
Inhalation injury rate	0.058	0.019	0.057	0.012	0.48
ICU Days	7.3	1.73	4.98	0.79	0.082
Ventilator days	4.86	1.28	2.72	0.49	0.029
Rate of sepsis	0.026	0.013	0.016	0.006	0.21
Rate of pneumonia	0.09	0.023	0.075	0.013	0.28
Operations	0.91	0.19	0.85	0.091	0.38
Units of Blood	2.02	0.59	1.24	0.25	0.077
Wound Culture	0.13	0.055	0.11	0.029	0.38
Blood Culture	0.065	0.031	0.062	0.02	0.48
Lung Culture	0.43	0.1	0.24	0.04	0.018

Table I

pulmonary infection. Further research into the connection between body habitus and morbidity in pediatric thermal injury is warranted.

ICU Patients (including inhalation injuries)

	n=55		n=153		
	Obese	SEM	Non-Obese	SEM	p value
Age (years)	7.12	0.76	8.51	0.5	0.076
Weight (pounds)	43.95	4.15	34.53	1.89	0.0104
Height (inches)	46.11	2.16	50.84	1.23	0.027
Gender (% male)	75%	5.90%	73%	3.60%	0.39
Mortality rate	0.02	0.02	0.039	0.016	0.23
TBSA (%)	25.84%	2.85%	25.61%	1.50%	0.47
Full Thickness (%)	10.87%	2.53%	12.07%	1.56%	0.35
Inhalation injury rate	0.16	0.05	0.14	0.028	0.36
ICU Days	20.56	4.34	12.52	1.83	0.024
Ventilator days	13.69	3.3	6.84	1.15	0.007
Rate of sepsis	0.073	0.035	0.039	0.016	0.16
Rate of pneumonia	0.25	0.059	0.19	0.032	0.15
Operations	1.96	0.48	1.48	0.21	0.15
Units of Blood	5.49	1.56	3.03	0.6	0.038
Wound Culture	0.33	0.15	0.25	0.068	0.31
Blood Culture	0.18	0.086	0.16	0.05	0.4
Lung Culture	1.2	0.25	0.6	0.09	0.003

Table II

ICU Patients (excluding inhalation injuries)

	n=46		n=131		
	Obese	SEM	Non-obese	SEM	p value
Age (years)	6.7	0.78	8.61	0.55	0.033
Weight (pounds)	41.87	4.19	34.88	2.08	0.054
Height (inches)	45.67	2.36	51.01	1.34	0.024
Gender (% male)	78%	6.10%	76%	3.80%	0.36
Mortality rate	0.02	0.02	0.023	0.013	0.48
TBSA (%)	26.28%	3.23%	25.38%	1.53%	0.39
Full Thickness (%)	10.87%	2.82%	10.99%	1.62%	0.48
ICU Days	18.59	5.12	9.38	1.79	0.017
Ventilator days	11.65	3.87	3.87	0.83	0.002
Rate of sepsis	0.087	0.042	0.031	0.015	0.06
Rate of pneumonia	0.2	0.058	0.12	0.029	0.11
Operations	1.98	0.54	1.34	0.21	0.1
Units of Blood	5.13	1.84	2.31	0.58	0.029
Wound Culture	0.39	0.17	0.24	0.071	0.16
Blood Culture	0.2	0.1	0.13	0.049	0.26
Lung Culture	1.04	0.28	0.39	0.084	0.0016

Table III