

# The effect of body mass index on chest trauma severity and prognosis



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## The effect of body mass index on chest trauma severity and prognosis

**AIM:** Patients with thoracic trauma constitute one third of all the trauma cases, in west Sicily were recorded 941 thoracic trauma during the period between 2006 and 2009. Sicily is one of the Italian regions with the highest rate of obesity: some studies have demonstrated that obesity is an independent risk factor for mortality in high energy blunt traumas.

**MATERIAL OF STUDY:** This study was conducted with trauma patients older than 20 years old who presented to our Department during the last five years. We only included thoracic injuries and politrauma with a thoracic involvement and a BMI >25. Patients were divided into two groups: HET and LET patients.

**RESULTS:** Thoracic trauma was more common in patients with a BMI >25 than in normo-weight and clinic admission rate, length of hospital stay and ISS score increased in proportion with the increase of BMI. Both HET (high energy trauma) and LET (low energy trauma) revealed that overweight, obese and morbidly obese patients had greater admissions and length of hospital stay.

**DISCUSSION:** The overweight and obese population has increased substantially over the last two decades and 61,5% of the Sicilian population is above normal weight. A large body mass with excess adiposity may contribute to HET injuries in several ways. Obesity has a number of comorbidities that reduce chances of recovery in overweight and obese patients experienced thoracic trauma both HET and LET.

**CONCLUSION:** Obesity increases morbidity independently of injury severity in thoracic trauma patients. As BMI increased, length of hospital stay increased and prognosis deteriorates.

**KEY WORDS:** BMI, Obesity, Thoracic trauma

## Introduction

Patients with thoracic trauma constitute one third of all the trauma cases. Of traumatic patients, 20-25 % die because of thoracic trauma (Hasan Mansur Durgun; Todd L. Demmy, 2001). The majority of lung injuries can be managed non-operatively, but in less than 15% is required a thoracotomy <sup>1</sup>.

According to local data, in west Sicily were recorded 941

thoracic trauma during the period between 2006 and 2009 and among this only 36,4% required surgical treatment.

Sicily is one of the Italian regions with the highest rate of obesity: in line with the National Institute of Health's data, 10.9% of population is obese and 50.6% overweight <sup>2</sup>.

Some studies have demonstrated that obesity is an independent risk factor for mortality in high energy blunt traumas <sup>3,4</sup>. Obesity has been identified as a risk factor for adverse outcomes after trauma in adult patients, and mortality and morbidity rates, length of hospital stay, and injury severity score (ISS) have been found higher in obese adolescents with traumatic injury compared to their normal weight counterparts <sup>5,6</sup>.

Aim of the present study is investigated whether or not

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body mass index (BMI) has an incremental effect on trauma severity in thoracic trauma patients about prognosis, hospital admission, and duration of hospital stay between obese or overweight patients and normal-weight patients in high-energy (HET) and low-energy traumas (LET).

## Material and Method

This study was conducted with trauma patients older than 20 years old who presented to our Department during the last five years. We only included thoracic injuries and politrauma with a thoracic involvement.

According to BMI (kg/m<sup>2</sup>) values, participants were clustered into 4 groups but only people with a BMI >25–29.9 (overweight), BMI of 30–34.9 (obese), and BMI ≥35 (morbidly obese) were included and divided into HET patients (including motor vehicle accidents and falls from a height) and LET patients (simple falls such as falls while walking <sup>7</sup>).

Data are presented as mean±SD for continuous variables and as percentage for categorical variables. Data were compared across the 3 BMI groups. Hospital admission rate, length of hospital stay, and ISS scores were provided using cross tables. To assess impact of BMI on outcome, multivariate logistic regression analysis was performed.

## Results

During the five years period of study, a total of 233 thoracic trauma patients met the study criteria and were enrolled. Mean BMI of whole patient population was 26.49 (range 19–43). Among this, 42% (n=98) were normo-weight and excluded from the study, 36.9% (n=86) were overweight, 17.1% (n=40) were obese, and 3.8% (n=9) were morbidly obese, so 57.8% had a BMI >25. Patients were divided into 2 groups based on trauma severity: 65.3% (n=152) formed HET group, and 34.7% (n=81) the LET one. Among patients who experienced HET, 41.3% (n=95) were normo-weight, 39.7% (n=93) were overweight, 14.4% (n=35) were obese, and 4.5% (n=10) were morbidly obese. In the LET group 44.1% (n=36) were normo-weight, 31.1% (n=25) were over-

weight, 22.3% (n=18) were obese, and 2.5% (n=2) were morbidly obese (Table I).

In our sample we observed that thoracic trauma was more common in patients with a BMI >25 than in normo-weight and clinic admission rate, length of hospital stay and ISS score increased in proportion with the increase of BMI.

Analysis of patients presenting both with HET and with LET revealed that overweight, obese and morbidly obese patients had greater admissions and length of hospital stay.

## Discussion and Comments

Thoracic trauma are one of the most common reason of urgent hospital admissions and constitute one third of all the trauma cases.

The overweight and obese population has increased substantially over the last two decades and represents a major public health concern in most industrialized countries (Mokdad et al. 2001; World Health Organization 2003). According to data, 61,5% of the Sicilian population is above normal weight. Although the number of studies investigating the effect of obesity on prognosis of trauma patients is still limited, some studies have demonstrated that obesity is an important risk factor for hospital admission and severe prognosis in blunt traumas <sup>8-9</sup>.

According to literature data, our study, investigating the relationship between thoracic trauma and obesity, have observed that obesity increased morbidity rates independently of injury severity.

A large body mass with excess adiposity may contribute to HET injuries in several ways, although little is known about the relation between obesity and the risk of <sup>10</sup> Furthermore, high incidence of comorbid conditions in obesity (DM, insulin resistance, chronic obstructive pulmonary disease, hypertension, hyperlipidemia, coronary artery disease, and other vascular diseases) may contribute to deteriorate general conditions of these patients <sup>11</sup>.

Obese, compared to normo-weight subject, suffer severe consequences of a trauma due to the less adaptability of body to the impact, the different distribution of fat on the body surfaces which are thus not protected by muscles.

Obese patients are at especially higher risk for certain disorders such as cancer, hypertension,

TABLE I - Analysis of body mass index groups in the patient population with respect to HET and LET

	Normo-weight		Overweight		Obese		Morbidly obese	
	%	N	%	n	%	N	%	N
Thoracic injury	98	42	86	36,9	40	17,1	9	3,8
HET	95	41,3	93	39,7	35	14,4	10	4,5
LET	36	44,1	25	31,1	18	22,3	2	2,5

heart disease, diabetes mellitus (DM), hyperlipidemia, insulin resistance, and arthritis. In addition, they also have higher risk of mortality<sup>1,2</sup>.

This comorbidity reduce chances of recovery in overweight and obese patients experienced thoracic trauma both HET and LET.

Another remarkable point in the present study was that hospital admission rate, length of stay and ISS score were significantly greater in overweight, obese and morbidly obese patients than normo-weight, and they increased in proportion to BMI increase in case both of HET and LET.

## Conclusions

Obesity increases morbidity independently of injury severity in thoracic trauma patients. As BMI increased, length of hospital stay increased and prognosis deteriorates. Sicily is one of the Italian regions with the highest rate of obesity and the number of studies in literature is rather limited so the findings of the present study may contribute to our understanding of the potential mechanism of obesity on thoracic trauma's injury.

## Riassunto

SCOPO: Circa un terzo di tutti I casi di trauma è rappresentato da trauma del torace. Nella Sicilia occidentale, tra il 2006 e il 2009, sono stati riportati 941 casi di trauma del torace. La Sicilia è una delle regioni italiane con il tasso di obesità maggiore: alcuni studi hanno dimostrato come l'obesità rappresenti un fattore di rischio per mortalità nei traumi contusivi ad alta energia.

MATERIALE E METODO: Questo studio è stato condotto su pazienti traumatizzati, di età superiore a 20 anni, afferiti al nostro Dipartimento negli ultimi cinque anni. Nel campione abbiamo selezionato solo I trauma del torace e I politraumi con interessamento toracico e pazienti con BMI >25. I pazienti sono stati suddivisi in due gruppi: HET e LET.

RISULTATI: I trauma del torace sono più comuni in pazienti con BMI >25 che nei normo-peso. Tasso di ammissione ospedaliera, durata della degenza e indice ISS aumentano all'aumentare del BMI sia negli HET che nei LET.

DISCUSSIONE: La popolazione sovrappeso e obesa è aumentata nelle ultime due decadi; il 61,5% dei siciliani sono sovrappeso. Una massa corporea con eccesso di adipe sembra contribuire alla morbilità nei traumi ad alta ener-

gia. L'obesità si accompagna a comorbidità che riducono le possibilità di recupero nei pazienti sovrappeso e obesi con un trauma toracico ad alta e a bassa energia.

CONCLUSIONE: L'obesità aumenta la morbilità indipendentemente dalla gravità delle lesioni nei pazienti con trauma toracico. All'aumentare del BMI, si allunga la durata della degenza ospedaliera e la prognosi peggiora.

## References

1. Wall MJ, Soltero E, Mattox KL: *Penetrating Trauma – Thoracic Surgery* by Pearson FG et al. / 2<sup>nd</sup> ed. 2002; Patrizio Petrone and Juan A Asensio.
2. National Institute of Health: *Epicentro: portal of epidemiology to public health*. <http://www.epicentro.iss.it>
3. Durgun HM, Dursun R, Zengin Y, Özhasenekler A, Orak M, Üstündağ M, Güloğlu C: *The effect of body mass index on trauma severity and prognosis in trauma patients*. *Ulus Trauma Acil Cerrahi Derg*, 2016; 22(5):457-65.
4. Ciesla DJ, Moore EE, Johnson JL, Burch JM, Cothren CC, Sauaia A: *Obesity increases risk of organ failure after severe trauma*. *J Am Coll Surg*, 2006; 203:539-45.
5. Ryb GE, Dischinger PC: *Injury severity and outcome of overweight and obese patients after vehicular trauma: A crash injury research and engineering network (CIREN) study*. *J Trauma*, 2008; 64:406-11.
6. Brown CV, Neville AL, Salim A, Rhee P, Cologne K, Demetriades D: *The impact of obesity on severely injured children and adolescents*. *J Pediatr Surg*, 2006; 41:88-91.
7. Lee WT, Murphy D, Kagda FH, Thambiah J: *Proximal femoral locking compression plate for proximal femoral fractures*. *J Orthop Surg (Hong Kong)*, 2014; 22:287-93.
8. Neville AL, Brown CV, Weng J, Demetriades D, Velmahos GC: *Obesity is an independent risk factor of mortality in severely injured blunt trauma patients*. *Arch Surg*, 2004; 139(9):983-87.
9. Hoffmann M, Lefering R, Gruber-Rathmann M, Rueger JM, Lehmann W: *Trauma registry of the german society for trauma surgery. the impact of BMI on polytrauma outcome*. *Injury*, 2012; 43:184-88.
10. Zhu S, Kim JE, Ma X, Shih A, Laud PW, Pintar F, Shen W, Heymsfield SB, Allison DB: *BMI and Risk of Serious Upper Body Injury Following Motor Vehicle Crashes: Concordance of Real-World and Computer-Simulated Observations*. *PLoS Med*, 2010; 7(3):e1000250.
11. Ryb GE, Dischinger PC: *Injury severity and outcome of overweight and obese patients after vehicular trauma: a crash injury research and engineering network (CIREN) study*. *J Trauma*, 2008; 64:406-11.