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Obesity and Trauma

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Objectives

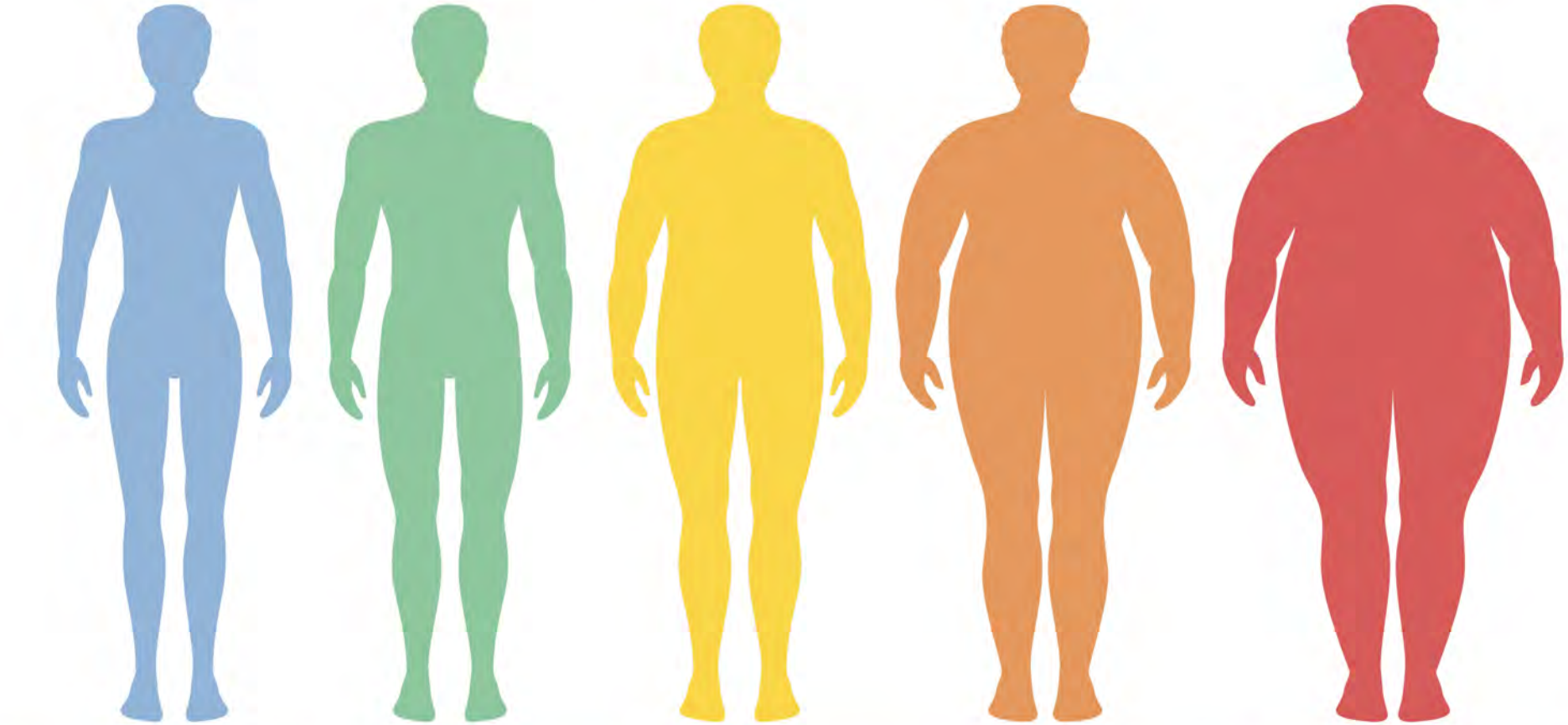
At the conclusion of this presentation, the participant will be able to:

- Describe how the obesity epidemic impacts the delivery of trauma care
- Describe how obesity impacts body systems
- Discuss the challenges and considerations associated with resuscitation and management of the obese trauma patient
- Describe management approaches to care of the injured obese patient with blunt, penetrating, or burn injuries

Introduction

1 out of every 3 U.S. adults is obese.
(Harvard, 2020)

Body Mass Index



<18,5	18,5-24,9	25-29,9	30-34,9	35<
UNDERWEIGHT	NORMAL	OVERWEIGHT	OBESE	EXTREMLY OBESE

Consequences of Obesity

- Obesity is associated with the leading causes of death in the United States and worldwide, including:
  - Diabetes
  - Heart disease
  - Stroke
  - A wide range of cancers
- Low quality of life
- Mental illness such as clinical depression, anxiety, and other mental disorders
- Body pain and difficulty with physical functioning

Societal Costs

Direct

- 2016, the aggregate in medical cost due to obesity among adults in the United States was $260.6 billion. (Cowley, 2021)
- The effects of obesity raised costs in every category of care: inpatient, outpatient, and prescription drugs.

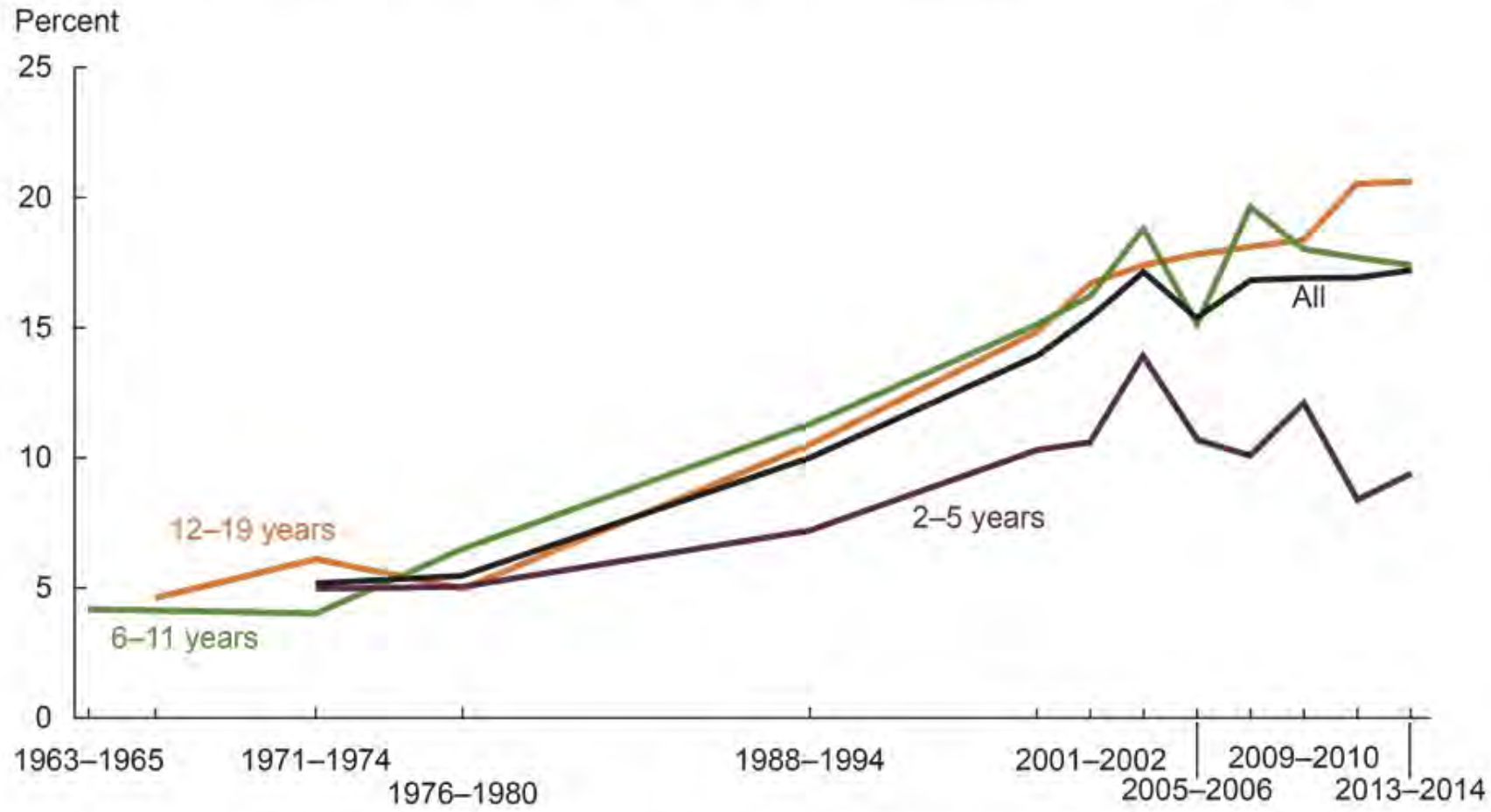
Indirect

- Absent from work for obesity-related health reasons
- Decreased productivity while at work
- Premature death and disability

Injury Patterns

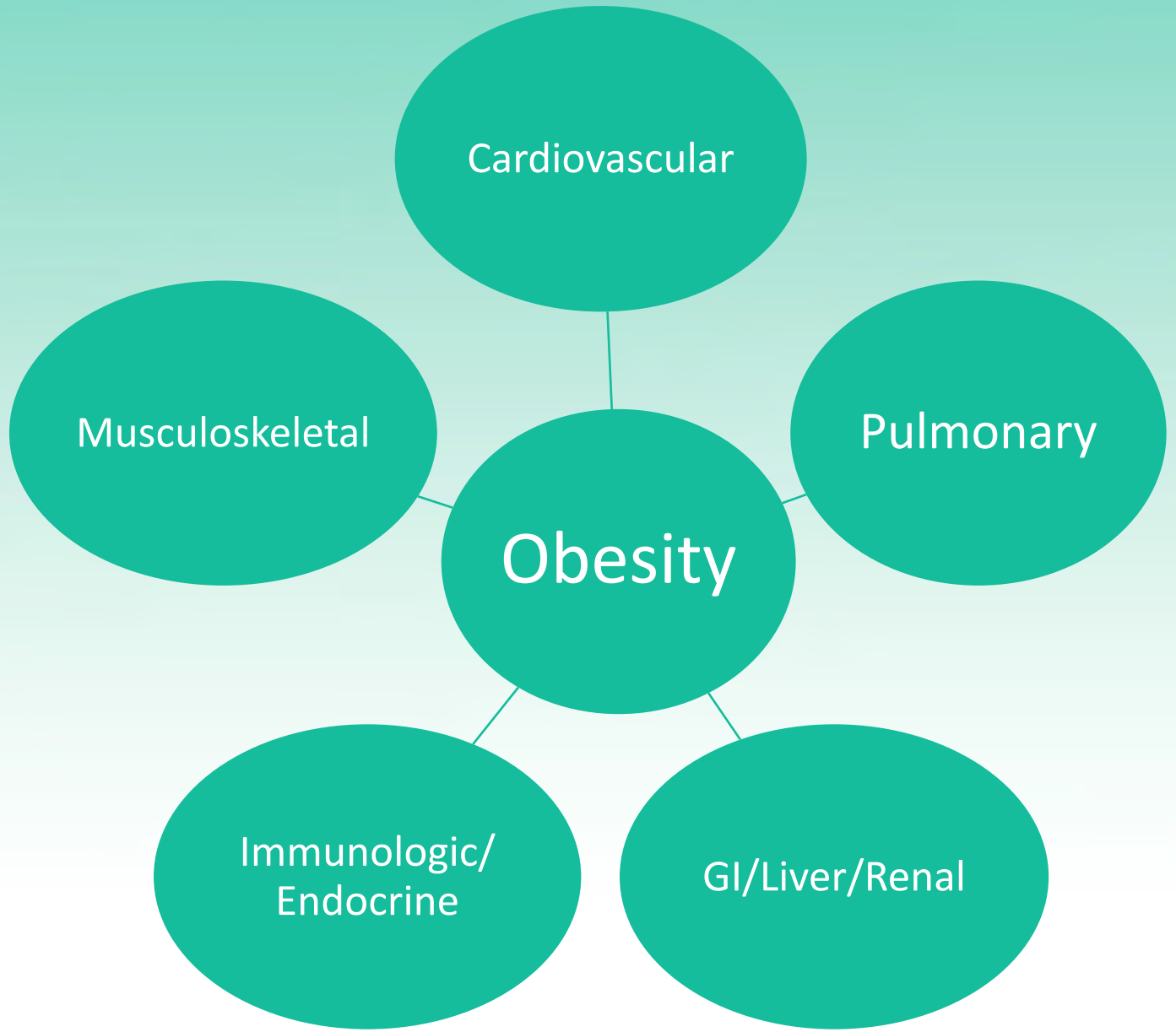
- Increased BMI = increased rates
  - Extremity fractures (humerus, femur, tibia/fibula)
  - Chest injuries
  - Spinal injuries
  - Increased mortality
  - Increased complications
- Increased BMI = decreased rates
  - Hip fractures
  - Head injuries (more fatal)
  - Liver lacerations

Trends in obesity among children and adolescents aged 2–19 years, by age: United States, 1963–1965 through 2013–2014



NOTES: Obesity is defined as body mass index (BMI) greater than or equal to the 95th percentile from the sex-specific BMI-for-age 2000 CDC Growth Charts.
SOURCES: NCHS, National Health Examination Surveys II (ages 6–11) and III (ages 12–17); and National Health and Nutrition Examination Surveys (NHANES) I–III, and NHANES 1999–2000, 2001–2002, 2003–2004, 2005–2006, 2007–2008, 2009–2010, 2011–2012, and 2013–2014.

Witt, Arbabi, Nathens, Vavilala, & Rivara, 2017. NIH, 2017)


Cardiovascular
Musculoskeletal
Obesity
Pulmonary
Immunologic/
Endocrine
GI/Liver/Renal

Cardiovascular

- Obesity is an independent risk factor for cardiac disease.
- Increased circulating blood volume, cardiac output
- Increased risk of thromboembolism
- Increased systemic vascular resistance

Pulmonary

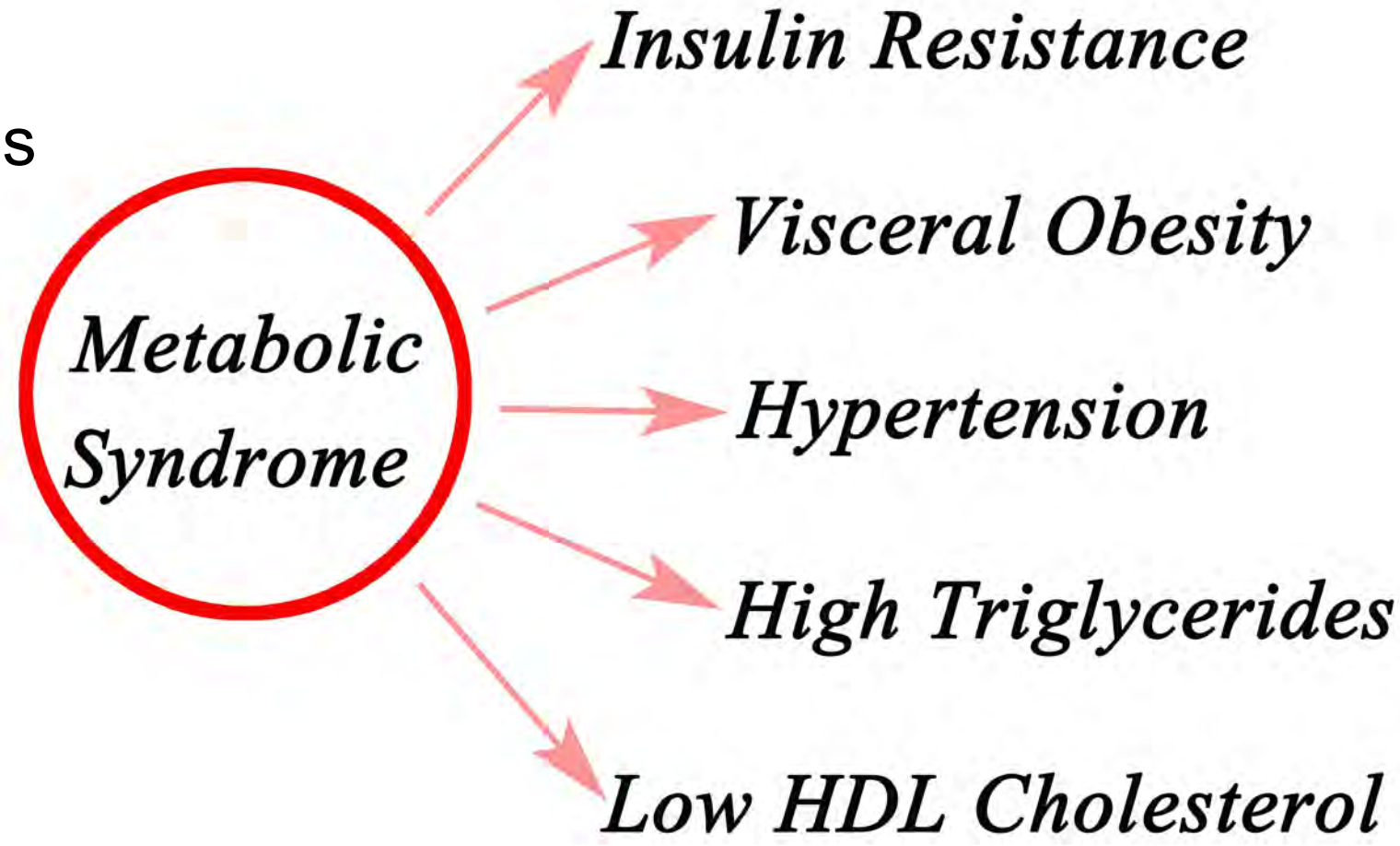
- Increased chest wall resistance
- Increased intra-abdominal pressure
- Dysfunctional chest wall
- Obstructive sleep apnea

GI/Liver/Renal

- Decreased gastric motility
- Increased intra-abdominal pressure
- Gastroesophageal reflux
- Increased aspiration risk during intubation
- Chronic elevations liver enzymes
- Pancreatitis
- Chronic renal failure

Endocrine/Immunologic

- Inflammation
- Metabolic syndrome
- Elevated cortisol levels



Musculoskeletal

- Normal increased stress on bones and joints
  - Can be described as severe pain
- Osteoarthritis
- Osteoporosis


From the field, prehospital, to the acute care setting, obstacles arise that complicate and delay the care of the obese and morbidly obese patient.

Pre-Hospital

- Prolonged extrication time
- O2 masks may not fit
- Larger C Collars
- Inability to lie flat
- Stretchers/backboards limited size and loads
- Increased staff
- Assistive equipment
- Evacuation
- BP cuffs

The BEAR stair chair, Bearatrics.com

Emergency Department

- Monitoring
  - BP cuffs
  - Pulse ox
  - Introducers

- Supplies
  - Stretcher
  - Wheelchairs
  - Splints
  - Tourniquets
  - Scales
- Diagnostics
  - Radiology tables, plates
  - CT/MRI tables, circumference
  - OR
- Staffing ratio

Admitted Patient Care Rooms

- Bed
- Portable or fixed overhead lifts
- Scales
- Extra large BP cuffs
- Wheelchairs
- Toilets/shower/grab bars
- Bedside commode
- Gowns/bottoms

https://www.arjo.com/en-us/about-us/

Assessment Principles

- Primary
- Secondary
- Disposition
- Management

Airway (C-Spine Protection)

CHALLENGES

- Short thick necks
- Poor extension
- Loss of landmarks
- Adipose tissue
- Fat deposits in pharyngeal tissue
- Gastro-esophageal reflux
- Backboard weight limits

Airway (C-Spine Protection)

CONSIDERATIONS

- Position with head of bed slightly elevated or reverse Trendelenburg
- Use of sandbags and tape for immobilization
- Gastric tube insertion if concern for reflux/emesis/airway
- Dedicated member to maintain c-spine control
- Early surgical cricothyrotomy
- Optical equipment (i.e. video laryngoscope)
- History of gastric banding

Breathing

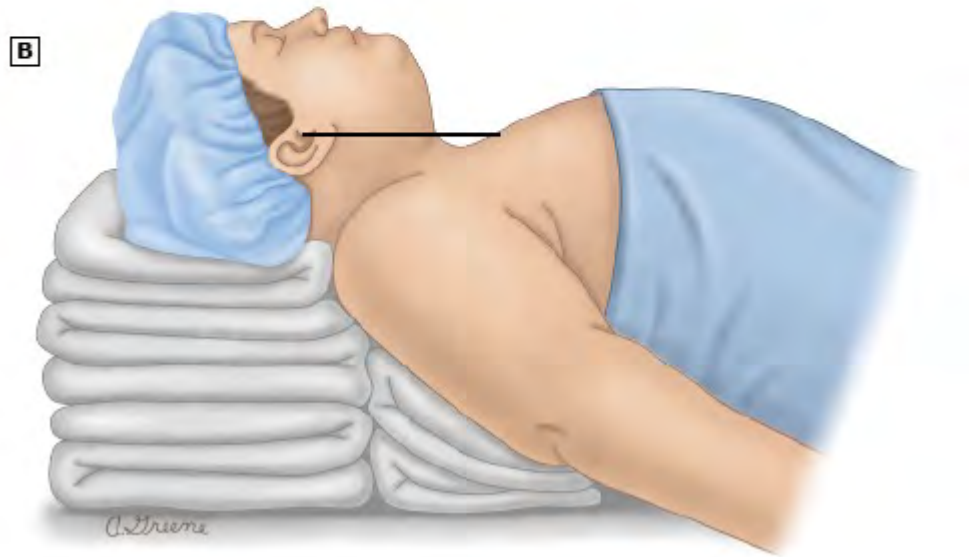
CHALLENGES

- Fat deposits in diaphragm and intercostal muscles
- Elevated diaphragm
- Rapid desaturation
- Chest weight
- Increased work of breathing
- Sleep apnea
- Impaired lung compliance
- Difficulty auscultating breath sounds

Breathing

CONSIDERATIONS

- CPAP/PEEP
- Reverse Trendelenburg
- 2-person bag-mask
- Needle decompression/chest tube placement
- “Awake” intubation vs RSI/DAI
- Longer recovery time with failed attempted intubation
- Neck circumference
- Ramping position



https://www.uptodate.com/contents/image?imageKey=ANEST%2F95285

Troop, 2018

Circulation

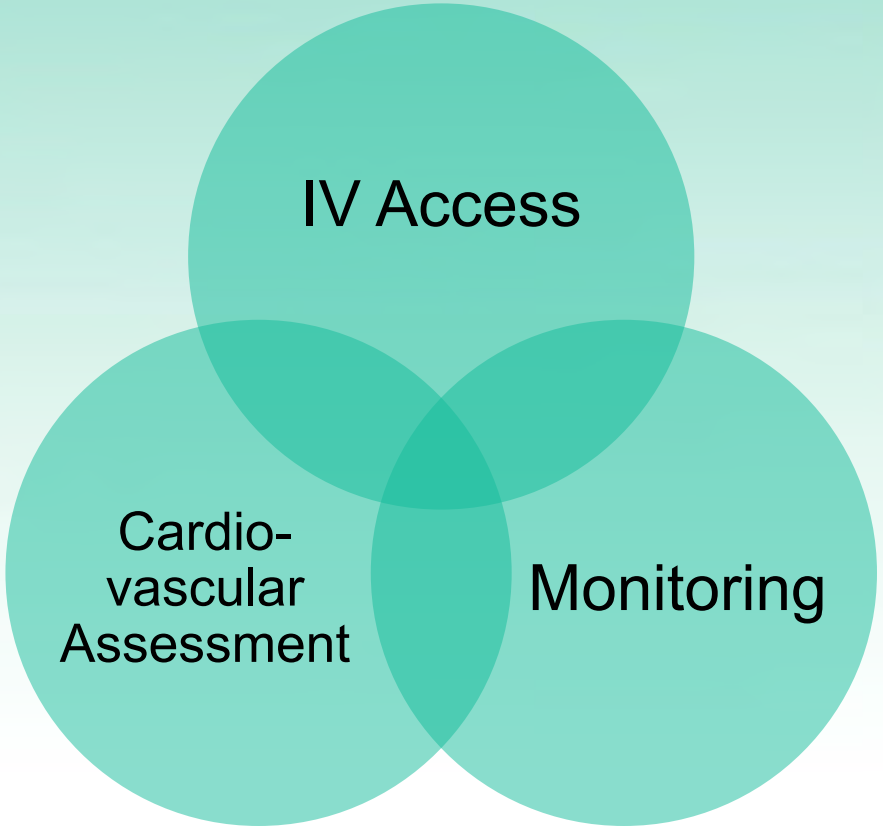
CHALLENGES

- Difficulty palpating central and peripheral pulses
- BP assessment
- Auscultation heart sounds
- High oxygen supply and demand
- IV access
- Accuracy of pulse ox

Circulation

CONSIDERATIONS

- Longer introducers
- Use of intra-osseous needle
- Arterial line
- Intra-abdominal hypertension
- Lactate
- pH
- CVP
- PA catheter
- TEE



Disability

Considerations

- CPAP at home?
- Lack of mobility
- Toileting

Challenges

- Establish baseline
- Early discharge planning

Exposure/Environment

- Skin shearing
- Hypothermia
- Inspect for skin rashes, fungal infections, decubitus, wounds
- Large pannus
- Larger patient gowns
- Moving boards
- Assistance
- Stretchers/ beds

Secondary Survey

CONSIDERATIONS

- Clinical exams less reliable
- Skin folds may mask penetrating injury
- Difficult to assess abdominal or bone tenderness
- Masses/deformities difficult to palpate
- Use of inappropriate cuff size
- Difficult to assess the back
- Imaging issues

Give Comfort

CHALLENGES

- Patient Size
- Bias
- Stigma
- Psychosocial Issues

CONSIDERATIONS

- Addressing bias may be first step to improving outcomes
- Medications
  - Right dose
  - Right route
- Specialized beds and equipment

History/Inspect Posterior

History

- Pre-hospital
- Referring Facility
- Medications
- Co-morbidities
- Surgeries

Inspect the Back

- Number of people needed to log roll
- Patient safety
- Bed width
- Skin folds

https://www.healthcaredailyonline.com/hospitals-using-obesity-suit-to-better-understand-patients/

Disposition

- Decide early if transfer is necessary.
- Inform transferring agency of patient's size.
- Inform admitting unit of the patient's size ASAP to allow them to prepare.
- Make preparations to ensure patient safety.
  - Interfacility
  - Intrafacility

Nutritional Requirements

- Nutritional requirements differ
- Increased caloric requirements in trauma, but hypocaloric high protein diet preferred in obese patients
- High percentage of Vitamin D deficiency in obesity
- May need indirect calorimetry to prescribe diet
- Maintain blood sugar control
- Monitor weight

Global Industrial™ Wheelchair Scale, 1,000 lb x 0.5 lb

Pharmacology

- Consult on admission for your PharmD or Clinical Pharmacist to review all current medications and to compute dosing of:
  - Antibiotics
  - Anti-thrombotics
  - Analgesics
- Restart home medications when appropriate
- Individualize pain management

- Calculations
  - Dose weight (DW)
  - Ideal body weight (IBW)
  - Total body weight (TBW)

  DW = IBW + 0.3 (TBW – IBW)

Labs to Watch

- BUN
- Creatinine
- Insulin levels
- Cortisol
- Hyperlipidemia
- PT/PTT
- C-reactive protein
- Cytokine
- Lactate
- Amylase/lipase
- ABG
- Anti-Xa
- Growth hormone
- Prolactin
- TSH

Missed Injury/Delayed Diagnosis

- Sternal fractures
- Flail chest
- Pelvic fractures
- Rib fractures
- Pulmonary contusions
- Long bone fractures

Limitations with traditional evaluations:

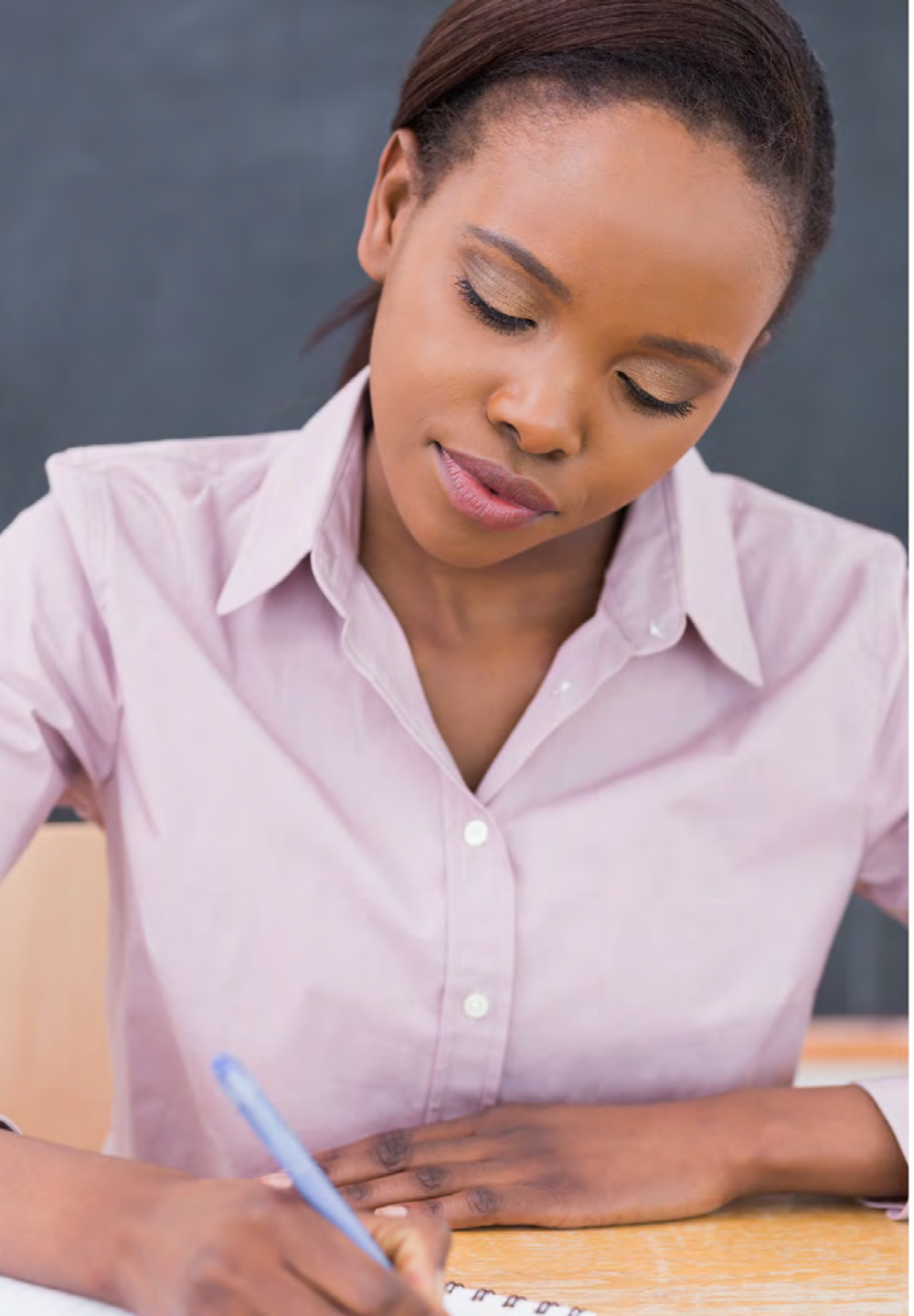
- Chest x-ray
- Ortho x-rays
- FAST
- CT scan
- Exploratory laparotomy

Complications

- Atelectasis
- Anastomotic leaks
- Higher risk of re-operation
- Higher infection rates
- Abdominal compartment syndrome
- Thrombophlebitis/PE
- Urinary tract infections
- Decubiti

Fractures

- Strength of rods
- Compartment syndrome
- Casting more difficult
- Vascular assessment challenges
- Higher rate of amputation
- Vitamin D insufficiency
- During hip and knee arthroplasty, the infection rate is nearly 5% in obese patients and nearly 10% in obese, diabetic patients.



Consultations

- Nutrition
  - Hypocaloric
  - Higher protein
  - Prebiotics/probiotics
- Pharm D
- Primary care providers
- Case management
- Social work
- Sleep apnea

Functional Independence Measurement (FIM)

- Admission, discharge, 6 months post-discharge
- Domains
  - Self-care
  - Sphincter control
  - Mobility
  - Locomotion
  - Communication
  - Social cognition
- Compared with nonobese patients, the rate of recovery was reduced by 30% in overweight, 37% in obese, and 48% in morbidly obese patients. (Dhungel 2015)

Mortality Risk

- There was no statistically significant difference in mortality. (Drury 2021)
- Severely obese trauma patients were at least 30% more likely to die and approximately twice as likely to have a major complication. (Glance 2014)
- Obese trauma patients undergoing emergent trauma laparotomy have a high likelihood for both complications and mortality, with morbidly obese trauma patients having the highest likelihood for both. (Covarrubias 2021)
- In a cohort of matched patients, morbid obesity is a risk factor for the development of in-hospital complications and mortality after blunt traumatic injury. (Ditillo 2014)
- Increasing BMI by category was associated with a stepwise increase in odds of acute kidney injury, cardiovascular events, total hospital length of stay (LOS), intensive care unit LOS, and ventilator days. (Hakam 2021)

Summary

- Obesity places challenges on healthcare costs by stressing infrastructure, requiring specialized equipment, and evidence-based education.
- Obesity independently impacts body systems, thus increasing the complexity of trauma care.
- Anticipatory preparation for the challenges and barriers to providing good trauma care to the obese patient will lead to provision of optimum care.

Obesity and Trauma

1. Roughly two out of three U.S. adults are overweight or obese (69 percent) and one out of three are obese (36 percent).
    a. True
    b. False

2. Obstacles to Pre-Hospital care of the obese patient include all of the following EXCEPT:
    a. Prolonged extrication time
    b. Inability to lie flat
    c. Increased staff
    d. Difficulty assessing pain

3. Accuracy in blood pressure readings in an obese patient depend upon:
    a. An arterial line
    b. Proper sized BP cuff
    c. A new generation doppler
    d. Palpating the blood pressure

4. The best way to acquire an accurate weight on the obese patient is:
    a. Ask the patient
    b. Estimate
    c. Use bariatric scale
    d. Ask the primary care physician

5. Common complications in the obese trauma patient include:
    a. VTE, Decubiti, urinary tract infections
    b. Gastric ulcers, stroke
    c. Lumbar fractures, retained sponges after surgery, pneumothorax

6. There is no difference in the recovery rate of obese versus non-obese trauma patients.
    a. True
    b. False

7. Nutritional requirements in the obese trauma patient include all of the following EXCEPT:
    a. Increased protein
    b. Increased Vitamin D
    c. Restricted carbohydrates
    d. Weight monitoring

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References

Obesity and Trauma

5th Edition

ACS TQIP (2018). Best practices guidelines in imaging. Retrieved from https://www.facs.org/-/media/files/quality-programs/trauma/tqip/imaging_guidelines.ashx

Agrawal A. Complex Interaction between Obesity and Trauma. Panam J Trauma Crit Care Emerg Surg 2014;3(3):109-113. https://www.pajtcces.com/doi/PAJT/pdf/10.5005/jp-journals-10030-1101

Borelli, C. (2020) Should bed up head elevated be the new standard position for RSI in the ED? Retrieved from https://rebelem.com/should-bed-up-head-elevated-buhe-be-the-new-standard-position-for-rsi-in-the-ed/#:~:text=Background%3A%20Although%20the%20standard%20positioning,view%20and%20reduced%20airway%20complications.

Bozzio, A. E., Gala, R. J., Villasenor, M. A., Hao, J., & Mauffrey, C. (2014). Orthopedic trauma surgery in the morbidly obese patient. European journal of orthopaedic surgery & traumatology : orthopedie traumatologie, 24(4), 421–425. https://doi.org/10.1007/s00590-013-1220-3

Center for Disease Control and Prevention, (2021). Adult Obesity Causes & Consequences. https://www.cdc.gov/obesity/adult/causes.html

Cawley, J., Biener, A., Meyerhoefer, C., Ding, Y., Zvenyach, T. (2021). Direct medical costs of obesity in the United States and the most populous states. J Manag Care Spec Pharm.27(3):354-66. https://www.jmcp.org/doi/pdf/10.18553/jmcp.2021.20410

Covarrubias, J., Grigorian, A., Schubl, S., Gambhir, S., Dolich, M., Lekawa, M., Nguyen, N., & Nahmias, J. (2021). Obesity associated with increased postoperative pulmonary complications and mortality after trauma laparotomy. *European journal of trauma and emergency surgery : official publication of the European Trauma Society*, *47*(5), 1561–1568. https://doi.org/10.1007/s00068-020-01329-w

Dhungel, V., Liao, J., Raut, H., Lilienthal, M. A., Garcia, L. J., Born, J., & Choi, K. C. (2015). Obesity delays functional recovery in trauma patients. The Journal of surgical research, 193(1), 415–420. https://doi.org/10.1016/j.jss.2014.07.027

Ditillo, Michael, Pandit, Viraj, Rhee, Peter, Aziz, Hassan, Hadeed, Steven, Bhattacharya, Bishwajit, et al. (2014). Morbid obesity predisposes trauma patients to worse outcomes: A National Trauma Data Bank analysis. Journal of Trauma and Acute Care Surgery, 76, 176-179. https://doi.org/10.1097/TA.0b013e3182ab0d7c

Drury B, Kocharians C, Ditillo, M., Pandit, V., Rhee, P., Aziz, H., Hadeed, S., Bhattacharya, B., Friese, R. S., Davis, K., & Joseph, B. (2014). Morbid obesity predisposes trauma patients to worse outcomes: a National Trauma Data Bank analysis. *The journal of trauma and acute care surgery*, *76*(1), 176–179. https://doi.org/10.1097/TA.0b013e3182ab0d7c

Dong F, et al. (2021) Impact of Obesity on Mortality in Adult Trauma Patients. Cureus 13(2): e13352. https://pubmed.ncbi.nlm.nih.gov/33747653/

Gray, S., & Dieudonne, B. (2018). Optimizing Care for Trauma Patients with Obesity. Cureus, 10(7), e3021. https://doi.org/10.7759/cureus.3021

Hakam, N., Nabavizadeh, B., Sadighian, M. J., Holler, J., Shibley, P., Li, K. D., Low, P., Amend, G., Stein, D. M., & Breyer, B. N. (2021). The Impact of Obesity on Renal Trauma Outcome: An Analysis of the National Trauma Data Bank from 2013 to 2016. *World journal of surgery*, *45*(12), 3633–3642. https://doi.org/10.1007/s00268-021-06275-1

Hamoud, S., Abdelgani, S., Mekel, M. *et al.* Gastric and urinary bladder pressures correlate with intra-abdominal pressure in patients with morbid obesity. *J Clin Monit Comput* (2021). https://doi.org/10.1007/s10877-021-00728-7

Fakhry, S. M., Morse, J. L., Garland, J. M., Wilson, N. Y., Shen, Y., Wyse, R. J., & Watts, D. D. (2021). Increasing BMI is associated with higher mortality, worsening outcomes and highly specific injury patterns following trauma: A multi-institutional analysis of 191,274 patients. The journal of trauma and acute care surgery, 90(2), 376–383. https://doi.org/10.1097/TA.0000000000003040

Fu, CY., Bajani, F., Bokhari, M. et al. (2020). Obesity is Associated with Worse Outcomes Among Abdominal Trauma Patients Undergoing Laparotomy: A Propensity-Matched Nationwide Cohort Study. World J Surg 44, 755–763 (2020). https://doi.org/10.1007/s00268-019-05268-5

Glance, L. G., Li, Y., Osler, T. M., Mukamel, D. B., & Dick, A. W. (2014). Impact of obesity on mortality and complications in trauma patients. *Annals of surgery*, *259*(3), 576–581. https://doi.org/10.1097/SLA.0000000000000330

Koba, Patricia MSN, AGACNP-BC, CCRN, ATCN Identifying Obstacles for the Obese Trauma Patient, Journal of Trauma Nursing: January/February 2016 - Volume 23 - Issue 1 - p 45-48 doi: 10.1097/JTN.0000000000000178 https://journals.lww.com/journaloftraumanursing/Fulltext/2016/01000/Identifying_Obstacles_for_the_Obese_Trauma_Patient.10.aspx

Le, David, Shafi, Shahid, MD, MPH, Gwirtz, Patricia, Bennett, Monica, Reeves, Rustin, et al. (2015). Effect of Obesity on Motor Functional Outcome of Rehabilitating Traumatic Brain Injury

Patients. American Journal of Physical Medicine & Rehabilitation, 94, 627-632. https://doi.org/10.1097/PHM.0000000000000222

Merelman, A. H., Perlmutter, M. C., & Strayer, R. J. (2019). Alternatives to Rapid Sequence Intubation: Contemporary Airway Management with Ketamine. *The western journal of emergency medicine*, *20*(3), 466–471. https://doi.org/10.5811/westjem.2019.4.42753

Murphy, C., Wong, D.T. Airway management and oxygenation in obese patients. *Can J Anesth/J Can Anesth* **60,** 929–945 (2013). https://doi.org/10.1007/s12630-013-9991-x

Nickson, C. (2016). Obesity and trauma. Life in the Fast Lane Critical Care Compendium. https://litfl.com/obesity-and-trauma/

Phelan, S. M., Burgess, D. J., Yeazel, M. W., Hellerstedt, W. L., Griffin, J. M., & van Ryn, M. (2015). Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. *Obesity reviews : an official journal of the International Association for the Study of Obesity*, *16*(4), 319–326. https://doi.org/10.1111/obr.12266

Riad, W., Ansari, T., & Shetty, N. (2018). Does neck circumference help to predict difficult intubation in obstetric patients? A prospective observational study. *Saudi journal of anaesthesia*, *12*(1), 77–81. https://doi.org/10.4103/sja.SJA_385_17

Reddy, Raj & Adke, Manish & Patil, Pranava & Kosheleva, Irina & Ridley, Saxon. (2016). Comparison of glottic views and intubation times in the supine and 25 degree back-up positions. BMC Anesthesiology. 16. 10.1186/s12871-016-0280-4. https://bmcanesthesiol.biomedcentral.com/articles/10.1186/s12871-016-0280-4

Shaikh, Saamia, MDc, JD, Boneva, Dessy, MD, FACS, Hai, Shaikh, MD, FACS, et al. (2020). Venous thromboembolism chemoprophylaxis regimens in trauma and surgery patients with obesity: A systematic review. Journal of Trauma and Acute Care Surgery, 88, 522-535. https://doi.org/10.1097/TA.0000000000002538

Southam, Brendan, et. al. {2020}, Obese trauma patients who sustain orthopaedic fractures experience increased length of stay, ICU admissions and mortality. {45}, Open Journal of Trauma, http://dx.doi.org/10.17352/ojt.000024

Troop, C. (2018). The importance of proper positioning for airway management for obese patients. Retrieved from https://www.intechopen.com/chapters/60584

Tsan, S., Lim, S. M., Abidin, M., Ganesh, S., & Wang, C. Y. (2020). Comparison of Macintosh Laryngoscopy in Bed-up-Head-Elevated Position With GlideScope Laryngoscopy: A Randomized, Controlled, Noninferiority Trial. *Anesthesia and analgesia*, *131*(1), 210–219. https://doi.org/10.1213/ANE.0000000000004349

Tsymbal, E., Ayala, S., Singh, A. *et al.* (2021)Study of early warning for desaturation provided by Oxygen Reserve Index in obese patients. *J Clin Monit Comput* **35,** 749–756 (2021). https://doi.org/10.1007/s10877-020-00531-w

Twaij, A., Sodergren, M. H., Pucher, P. H., Batrick, N., & Purkayastha, S. (2013). A growing problem: implications of obesity on the provision of trauma care. Obesity surgery, 23(12), 2113–2120. https://doi.org/10.1007/s11695-013-1093-x

Winfield, R. D., & Bochicchio, G. V. (2013). The critically injured obese patient: a review and a look ahead. Journal of the American College of Surgeons, 216(6), 1193–1206. https://pubmed.ncbi.nlm.nih.gov/23522437/

World Health Organization, 2017. Fact Sheet on Obesity and Overweight. Retrieved from http://www.who.int/mediacentre/factsheets/fs311/en/index.html

Ziglar, Michele K. RN, MSN Obesity and the Trauma Patient, Journal of Trauma Nursing: January 2006 - Volume 13 - Issue 1 - p 22-27. https://journals.lww.com/journaloftraumanursing/pages/articleviewer.aspx?year=2006&issue=01000&article=00006&type=Fulltext