Management of the Obese Major Trauma Patient

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Background

The proportion of the UK population that is overweight or obese is steadily increasing[1]; in 2012 67% of adult men and 57% of adult women were overweight or obese. Significant obesity causes anatomical and physiological changes throughout the body, and poses additional challenges to the optimal assessment, resuscitation, and treatment of the major trauma patient.[2]

The principles of trauma care are not altered for this patient group. The practicalities of how to achieve the goals do need consideration. This guideline highlights key considerations in each element of trauma care, and suggests modifications to the standard approach that may aid the provision of high quality care.

Airway

Consider:

- Low FRC leading to rapid desaturation
- Increased soft tissue leading to difficult views at laryngoscopy and increased difficulty in passing ET tube
- Increased aspiration risk

Suggest:

- Meticulous attention to pre-oxygenation including use of PEEP via Water's/Bain circuit
- Use of apnoeic oxygenation techniques with high flow nasal oxygen (15lpm) during laryngoscopy/intubation
- Intubation by senior anaesthetist with second trained anaesthetist available to assist
- Ramped position when feasible
- Verbalise failed intubation plan prior to administration of anaesthetic drugs
- Use of size 4 Macintosh blade and bougie at first intubation attempt

C-spine control

Consider:

- Standard collars will often be poorly fitting

Suggest:

- Manual control or use of head blocks alone without collar may be most appropriate. If a collar is used, ensure correct size and fit.

Breathing

Ventilation

Consider:

- Reduced functional residual capacity and vital capacity
- Any further impairment of respiratory function (supine position, pain, drug-induced) poorly tolerated

Suggest:

- Regular ABG monitoring
- Sit up or reverse trendelenburg position when permitted by overall clinical condition
- May need early intubation and ventilation
- May need NIPPV if intubation not required or delayed

Monitoring

Consider:

- Increased tissue thickness may rarely impede light transmission in pulse oximetry

Suggest:

- Consider alternative sites (5^{th} digit, earlobe)
- Arterial line with regular ABG sampling if no reliable trace obtained

Haemopneumothorax

Consider:

- Depth of tissue from skin to pleural space increased; needle decompression of pneumothorax unlikely to be successful

Suggest:

- Scalpel/finger thoracostomy as first-line option for decompression of tension pneumothorax
- Extend skin incision to facilitate insertion of intercostal drain
- Passing anaesthetic bougie into pleural space to guide intercostal drain

Circulation

Assessment

Consider:

- Large arm size can lead to inaccurate non-invasive blood pressure readings
- Physical assessment of the abdomen can be unreliable

Suggest:

- Ensure BP cuff is of an adequate size (bladder at least 80% of arm circumference), may need early move to invasive monitoring

- Lower threshold for imaging of abdomen if examination equivocal (see also notes under CT); may require exploratory laparotomy

Fluid requirements

Consider:

- Metabolic acidosis resolves more slowly than in lean patients[3]

Suggest:

- If no concerns for active bleeding requiring permissive hypotension, may need increased intravenous fluid infusion rate to correct metabolic derangement

Burns

Consider:

- Traditional 'rule of nines' and Lund and Browder chart may be inaccurate in obese patients

Suggest:

- Additional weighting to thoracic/abdominal area and corresponding reduction in limb contribution – see modified rule of nines in appendix A.[4]

Procedures

Consider:

- Peripheral veins may be more difficult to identify and deeper to the skin

Suggest:

- Multiple tourniquets, blind attempt at cannulation using landmarks, or ultrasound guidance.
- Early move to central access under ultrasound guidance
- Use of intraosseous access – most drugs can be given via IO route, including those required for rapid sequence induction of anaesthesia.[5] There is a risk with sodium bicarbonate if it extravasates – the IO route should be a last resort for administration.

Disability

Assessment and management are not significantly altered in the obese patient.

Exposure and secondary survey

Consider:

- Extrication at scene is frequently prolonged increasing risk of hypothermia.
- Multiple, deep skin folds can conceal wounds.
- Increased soft tissue depth complicates clinical assessment for musculoskeletal injuries. Range of movement of joints can be reduced by the presence of fat around joints.

Suggest:

- Close attention to temperature control and rewarming. Consider pre-positioning an under-body bair hugger blanket on the trolley prior to patient arrival.
- Ensure the entire skin surface has been examined for wounds, in particular after penetrating trauma
- Repeated assessment for musculoskeletal injuries and have a low threshold for performing x-rays.

Imaging

Ultrasound

Consider:

- Ultrasound beams are attenuated by soft tissues, and so FAST and thoracic ultrasound are technically more challenging to perform with reduced sensitivity.

Suggest:

- Frequency to 'Pen' instead of 'Gen' or 'Res'
- Switch Harmonic Imaging (THI) off
- Alter Time Gain Control (TGC) to optimise image

CT

Consider:

- Maximum rated load for ED CT table is 30 stone. Lumen of scanner may also be limiting factor in some patients.
- Reducing image resolution with increasing BMI.

Suggest:

- Ensure patient within tolerances of scanner.
- Senior surgical opinion if CT not possible or not diagnostic to assess relative safety of observation and serial examination or exploratory laparotomy.

Plain x-ray

Consider:

- X-rays are also attenuated by soft tissues. Higher energy settings and use of a bucky grid can offset this to some extent. Better quality images can be obtained in a dedicated x-ray room than are possible using a portable film.

Suggest:

- When clinical priorities permit, consider delaying plain films until the patient can be transferred to a dedicated x-ray area.

Drugs

Administration

Consider:

- Standard needles may not penetrate the adipose tissue layer for administration of intramuscular medications.

Suggest:

- Use of larger needle size than typically chosen. In some cases a spinal needle will be necessary.

Dosing:

Consider:

- Hydrophilic drugs will not distribute to fat compartment; using actual body weight will overdose. Conversely lipophilic drugs will be underdosed if ideal body weight is used. Lipophilic drugs have a large volume of distribution and may take extended periods of time to clear.

Suggest:

- Dose hydrophilic drugs by ideal body weight, consider need for regular serum level monitoring
- Dose lipophilic drugs by actual body weight; anticipate prolonged duration of action
- See list of commonly used drugs in Appendix B.
- See ideal body weight calculation in Appendix C.

Ongoing care

Details are beyond the scope of this document. Consider increased risk of thromboembolic disease, risk of pressure area breakdown, nutritional needs, and risks involved with moving and handling. Early involvement of tissue viability team, dietician, and moving & handling team advocated.

References

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2. Solh AE (Ed.) Critical Care Management of the Obese Patient. Wiley-Blackwell 2012

3. Winfield RD, Delano MJ, Lottenberg L, Cendan JC, Moldawer LL, Maier RV, Cuschieri J. (2010) Traditional resuscitative practices fail to resolve metabolic acidosis in morbidly obese patients after severe blunt trauma. *J Trauma.* 68(2):317-30

4. Neaman KC, Albert AL, McClure AM, Curton ME, Kemmeter PR, Ford RD. (2011) A New Method for Estimation of Involved BSAs for Obese and

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Appendix A: Modified Rule of Nines

	Normal/overweight	**Obese**	**Morbidly obese**
BMI	<30kg/m^2	30-40kg/m^2	>40kg/m^2
Head	5%	5%	5%
Arms	15%	15%	15%
Trunk	35%	40%	45%
Legs	45%	40%	35%

Appendix B: Lipophilic and hydrophilic drugs

Lipophilic

- Propofol (Caution in trauma patients; reduced dose)
- Benzodiazepines
- Fentanyl
- Suxamethonium
- Atracurium

Hydophilic:

- Ketamine
- Rocuronium

Appendix C: Ideal Body Weight

Men: 50 + 2.3 x [height (inches) – 60]
Women: 45.5 + 2.3 x [height (inches) – 60]

(Devine formula)