Is NMB required during laparoscopic surgery in the morbidly obese patient?

Jan P Mulier MD PhD
Sint-Jan Brugge-Oostende & KULeuven, Belgium
Is laparoscopy possible without NMB?

- The effects of NMB on peak airway pressure and abdominal elastance during pneumoperitoneum.
  - Chassard D Anesth Analg 1996; 82: 525: *Elastance is not changing by NMB in pigs (idem in humans)*
  - *No change in elastance does not mean that NMB have no effect!*

- Gynecologic laparoscopy with or without curare?
  - Chassard D Ann Fr Anesth Reanim 1996; 15: 1013 *Additional dose of NMB is given if the blinded surgeon could not work*
  - *No difference in request for additional dose!*

- A comparison of the effect of two anaesthetic techniques on surgical conditions during gynaecological laparoscopy
  - Williams MT. Anaesthesia. 2003; 58: 574
  - *Without NMB shorter operation, but higher abd pressures and trocar placement difficult.*
Surgeons complain whatever we do.

argent:

- I have no surgical workspace and some anesthesiologists are not willing to do anything!
- They add relaxation (what I assumed) only when I asked it.
- Nevertheless patient starts to press half-way the operation!
- And still the anesthesiologist tells that the patient is relaxed. (he measures TOF = 0, but I believe only in what I feel and see)!

Is deep anesthesia (with suppression of respiration) sufficient to satisfy the surgeon or do we need to give also deep NMB?
How a surgeon recognizes insufficient workspace?

- At the first inflation with the verres needle
  - High abd pressure to start $> 8$ mmHg
  - No flow is going inside
  - Multiple attempts to reposition the verres needle
- Insufficient space to reach certain laparoscopic area’s
  - Tunnel vision
  - Insufficient angulation between instruments
- During surgery or at end surgery, patient start to press suddenly
  - Abdominal wall and diaphragm movements
  - Coughing or breathing against ventilator, ventilator alarm
  - Sudden higher pressures intra abdominal than the set value, inflator alarm.
  - No laparoscopic view suddenly, lens need frequent cleaning
Is Laparoscopy possible with TIVA only? (without NMB?)

- No supplemental muscle relaxants are required during propofol and remifentanil total intravenous anesthesia for laparoscopic pelvic surgery.
  - *Effect is not measured. Moderate block given on request of the surgeon in a small group of gynecologic laparoscopies.* (pelvic surgery)

But Reduce opioids per operative as much as you can to

- To reduce post operative pain (with multimodal pain management)
- To avoid obstructive breathing and OSAS post operative
- Avoid inflammation, hyperalgesia, persistent pain syndrome
- Enhance recovery after surgery (ERAS)

Therefore Remifantanyl should be avoided at all
But what needs the surgeon?

Surgeon needs high IAP to put trocar at the start

Surgeon needs space to work during laparoscopy

Low pressure vs high

Low volume vs high
When do we need extra space?

- In which patients is laparoscopic space frequently not enough?
- How much space do surgeons need?
- How do we make space?

![Variability of inflated abdominal volume at 15 mmHg pneumoperitoneum](image.png)
Can we predict workspace?

Compliance (C) and Elastance (E)

\[ C = \frac{\text{change in } V}{\text{change in } P} \quad (C = 1/E) \]

\[ PV_0 = 5 \]

\[ E = 4 \text{ mmHg/l} \]

Higher insufflation pressures needed

Insufficient intra abdominal volume

J Mulier,
On the abdominal pressure volume relationship.
Pneumoperitoneum monitor connected between patient and inflator to measure E, the abdominal elastance and PVO, the pressure at zero volume according to the Mulier abdominal model.

Mulier Jan Paul,
Dept. of Anesthesiology, AZ Geel Antwerp, Belgium
and Katholieke Universiteit Leuven, Leuven, Belgium

Contact email: jan.mulier@kuleuven.be
More info: www.publicationsmulier.com/jan.mulier

Introduction and goal of the study:
- Every patient has a different abdomen
- E and PVO characterizes the abdomen
  - Setting the inflation pressure to reach a certain volume
  - Try to improve workspace
  - Decide to change to laparoscopy
  - Understand why insufficient workspace
  - Improve lung ventilation
- Calculate automatically instead of manual
  - Faster
  - More accurate
  - PV loop gives more information

Materials and Methods

Results: examples of measurements:

Conclusion
- Monitor is possible but should be standardized.
- E and PVO can be calculated.
- Separate pressure monitoring line is needed.
- Relation not linear at higher pressure.

References
1. Obes Surgery 2007, 7
2. Anesthesiology 2006, 103:677-681

PV0 : 7
E: 1 mmHg/L

Scientific exhibit: ASA Orlando October 2008, USA
Can we predict space? Yes by E and PV0

<table>
<thead>
<tr>
<th></th>
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<th>( P_{VO} ) sig</th>
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<td>Muscle relaxation</td>
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* Sig p<0.05
BMI effect on abdominal P/V relation

- J Mulier ISPUB 2009
- Pressure volume relation is linear
- PV0 and E are patient determined

Effect of BMI on PV0

Effect of BMI on E

Pressure volume relation is linear

PV0 and E are patient determined

J Mulier IFSO 2007
Android versus Gynoid fat distribution has a different Elastance.

Abdominal pressure volume relation: Android vs Gynoid

Figure 1. Obesity phenotypes initially described by Vague in 1947 (adapted from 1)
Two types of android obesity

**Intra visceral adiposity**
- Subcutaneous fat is scant and
- Intra abdominal fat is thick and

**Extra visceral adiposity**
- Subcutaneous fat is thick and
- Intra abdominal fat is scant.
When do we need more space?

✦ In which patients is space frequently not enough?
  ✦ Morbid obese patients have higher abdominal starting pressure
  ✦ Apple shaped man with intra abdominal fat.
  ✦ Young woman, never pregnant, never laparoscopy

✦ How much space do surgeons need?
  ✦ No clear data, surgeon, procedure dependent
  ✦ Below 2 L surgeon can not work, above 4 L happy.

✦ How do we make space?
Effect of NMB on space?

✧ More space with NMB


✧ Low-pressure pneumoperitoneum possible with NMB giving less shoulder pain

T. Sandhu *Surg Endosc* 2008

*The Cochrane Library* 2009, Issue 2

Visual field during a laparoscopic procedure approaching recovery from NMB (top) and deep NMB (bottom).

NMB=neuromuscular blockade; CO₂=carbon dioxide.
Abdominal pressure volume relation

1. No muscle relaxation
2. Active contraction against ventilator
3. Full muscle relaxation
1 liter workspace no NMB pressure 11
Not sufficient no access to upper abdomen

2 liter workspace no NMB pressure 13
Ceiling is higher but still not enough access from every incidence

3 liter workspace no NMB pressure 15
Sufficient access for upper abdomen

4 liter workspace with NMB pressure 14
Sufficient access, easy to come from above
different angles of approach are possible
Pressure volume relation without vs with NMB

Abdominal pressure volume relation

IAP mmHg vs volume insufflated Liter

- Vol with no NMB
- Vol with NMB

ISPCOP 2012 ASA
TIVA or 1 MAC Desflurane?

- Propofol anaesthesia
  - + Remifentany
  - + Remifentany and Rocuronium

- Propofol anaesthesia
  - Replaced by Desflurane
  - Desflurane + Rocuronium
Effect of table position on APVR

- PV0 decreases
- E no change

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Mulier JP Obes Surg 2009
Effect of leg flexion on APVR

- PV0 no change
- E decreases

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Mulier JP  Obes Surg 2009
ARM?
Metabolic benefits of modest weight loss.

- 80% of reduction occurred at 2 weeks (0.001) with a maximum effect at 6 weeks.

- Visceral adipose tissue is lost early and preferentially.
  - Susan L Colles Am J Clin Nutr 2006;84:304
  - Kanaley JA Int J Obes 2007;31:147
How do we make space?

1. Avoid breathing against ventilator
2. Deep NMB: PTC <4
3. Hip flexion and trendelenburg
4. Higher IAP but more shoulder pain
5. Reduce tidal volume (permissive hypercapnia)
6. Reduce intra abdominal fat (2 weeks prot diet)
7. ARM (short effect)
Difference Between Diaphragm and Adductor Pollicis

- Monitoring of the peripheral muscles often overestimates the degree of diaphragmatic relaxation, but is a safe predictor of recovery.

- The diaphragm is more resistant than the adductor pollicis to rocuronium and has a faster recovery of the twitch height.
  - Cantineau JP *Anesthesiology*. 1994;81:585

<table>
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NMB effect on adductor pollicis vs other muscles

1. At induction last to relax  OKE
2. During surgery most sensitive  Not OKE
3. Last to recover during surgery  Not OKE
4. Last to recover at end surgery  OKE

Fig. 21.4 Onset and recovery of neuromuscular blockade after injection of vecuronium 0.07 mg/kg at four muscles. (Data from Donati et al. 1990, 1991.)
Deep block in adductor pollicis means moderate block in abdominal muscles and diaphragm

- Intense blockade: no response to either TOF or PTC stimulation
- Deep blockade: response to PTC but not to TOF stimulation
- Moderate blockade: reappearance of response to TOF stimulation
- Superficial blockade: T4 response divided by T1 response

PTC, posttetanic count; TOF, train-of-four.

Solution to Both Problems: Deep Block and Continuous NMB Infusion
How I give anesthesia for morbid obese

opioid free anesthesia

_induction_

- Clonidine 75 ug + metoprolol 2 mg iv or dexmedetomidine 1 ug/kg at induction
- Ketamine 12 mg iv no sedation post op
- Propofol 2,5 mg/kg
- Lidocaine 1,5 mg/kg IBW: 70 mg iv
- Rocuronium 0,6 - 1,2 mg/kg deep NMB

_maintenance_

- Desflurane 1 MAC pas de TIVA no remifentanil
- Esmolol or dexmedetomidine 1 ug/kg/h
- Ketamine 0,2 mg/kg/h and Lidocaine 3 mg/kg/h
- Rocuronium 0,6 mg/kg IBW/h
- Paracetamol 3 - 2 gr loading dose, 1 gr /6 h; ketorolac or diclofenac

_post operative_

- Pressure support Ventilation
- Low Dose morphine < 3 mg or Clonidine ou dexmedetomidine 0,1 ug/kg/h
- Skin fascia Infiltration, spray diaphragm
Useful perioperative approaches to reducing complications in obese and OSA patients

This congress is credited with 8 continuing medical education points

Sat 24 Nov 2012
Vienne

SOBA UK
Society for Obesity and Bariatric Anaesthesia

Key issues in anaesthesia for the morbidly obese
Royal College of Physicians, 11 St Andrew’s Place, London NW1 4LE
Thursday 6th December 2012

9:15 Registration & Coffee
9:45 Introduction and Welcome: Aims of the Day
Dr Mike Margarson – Secretary, SOBA

10:00 The Problem: The Epidemic, Appetite, Diabesity, Co-morbidities
Dr Jonathan Cousins, Charing Cross

10:25 The Solution: Risks and benefits of surgery and alternatives
Mr Guy Slater, Chichester

10:50 Mortality of bariatric surgery & risk prediction: The killers
Dr Euan Shearer, Aintree

11:15 Coffee

11:45 Pre-operative Assessment and Cardiac Disease
Dr Jonathan Cousins, Charing Cross

12:15 Obstructive Sleep Apnoea
Dr Claire Nightingale, High Wycombe

12:45 Lunch & Trade Exhibition

13:45 Pharmacokinetics of Obesity: Induction, Maintenance, Analgesia
Dr Mike Margarson, Chichester

14:15 Relaxants, Airway & Ventilation
Dr Claire Nightingale, High Wycombe

14:45 Afternoon Tea

15:15 The Pneumoperitoneum and Obesity
Dr Mike Margarson, Chichester

15:40 Thromboprophylaxis & Post-op Care: Avoiding the ICU
Dr Euan Shearer, Liverpool

15:50 Discussion
16:00 Close of Meeting

5 CPD Points applied for
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