20TH INTERNATIONAL CONGRESS OF THE EUROPEAN ASSOCIATION FOR ENDOSCOPIC SURGERY (EAES)

BRUSSELS, BELGIUM • 20 – 23 JUNE 2012

Focusing on **Patient Outcomes** Through

Deep Block and Improved Visual Field in Laparoscopic Surgery –

What More Can Be Done?

Chairman:

Jacob Rosenberg (Denmark)

MSD

Welcome and Introductions

Jacob Rosenberg (Denmark)

Housekeeping

Please switch off all mobile devices

No photography or audio recording of the meeting is permitted

Questions cards are included in your welcome materials. Hostesses will be available to collect your question cards throughout the meeting

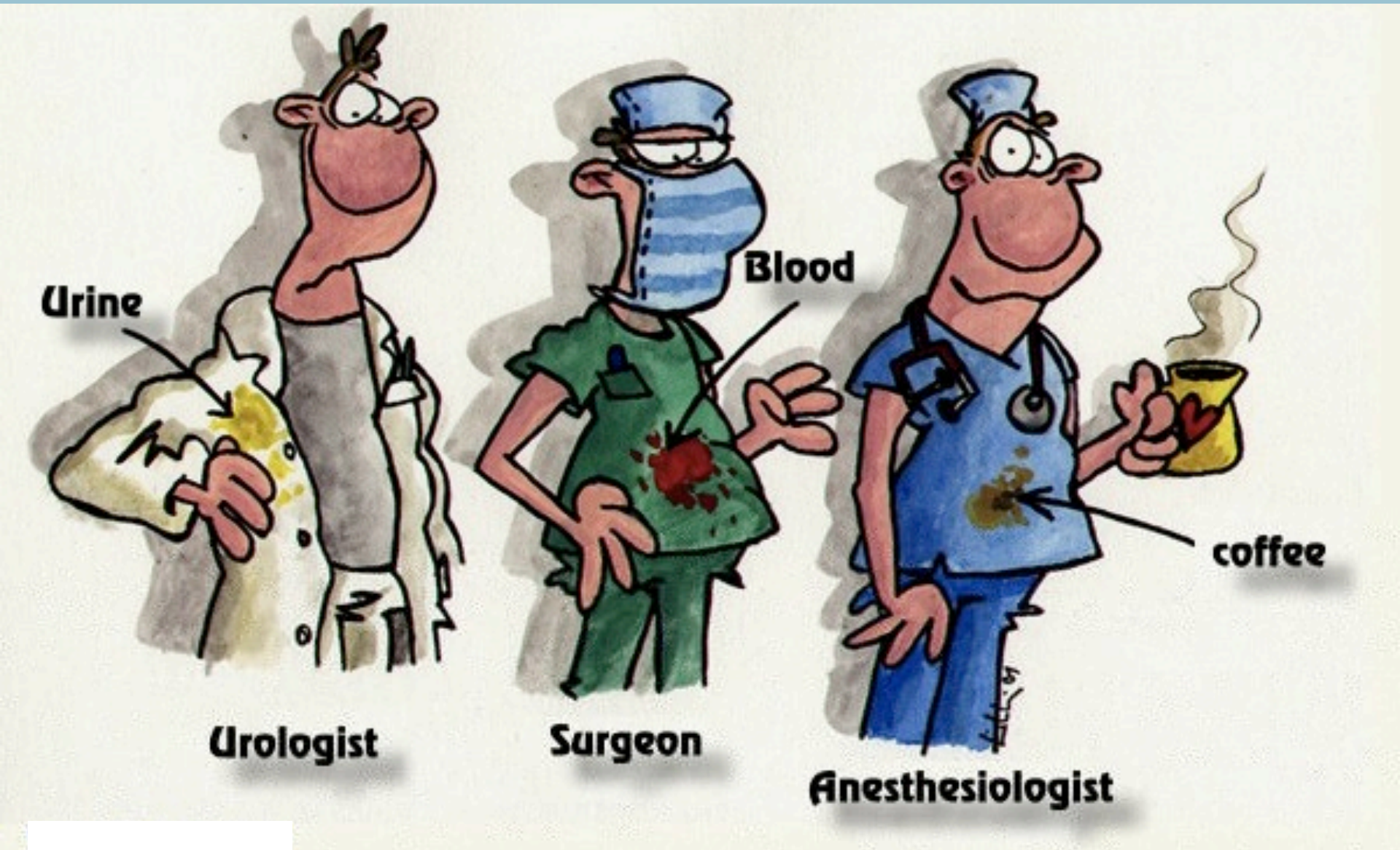
You will find an evaluation form in your welcome materials. This form should be completed during the meeting and handed to a hostess at the end of this session

MSD

Agenda

12:15 – 12:25	*Welcome and Introductions*	Jacob Rosenberg
12:25 – 12:40	*Challenges in the Surgical Field*	Olav Istre
12:40 – 12:55	*Benefits of Deep Neuromuscular Blockade*	Jan Mulier
12:55 – 13:10	*Achieving Optimal Surgical Conditions*	Olav Istre
13:10 – 13:25	*Advancing Practice with Predictable NMB Management*	Jan Mulier
13:25 – 13:40	*Surgeon-Anaesthetist Collaborative Question and Answer Session*	Jacob Rosenberg
13:40 – 13:45	*Closing Comments*	Jacob Rosenberg

MSD


Urine
Blood
coffee
Urologist
Surgeon
Anesthesiologist

daily problems around NMB

- hesitation around routine use of deep NMB
- most surgeons have never experienced a truly deep block throughout the procedure
- all surgeons have asked for additional blockade because of contractions in abdominal wall or even movement of arms etc.

surgeon's perspective on deep NMB

- typical scenario is that surgeon asks for more blockade but (nurse) anaesthetist says that blockade is OK – why?
- who is right and who is wrong?
- lack of knowledge on pharmacodynamics of NMB

combined surgical and anaesthesiological goals

- “do no harm” !!!
- best possible outcomes of treatment
  - maximize surgical view
  - no sudden contractions
  - minimize residual blockade
- ensure reasonable OR turnover

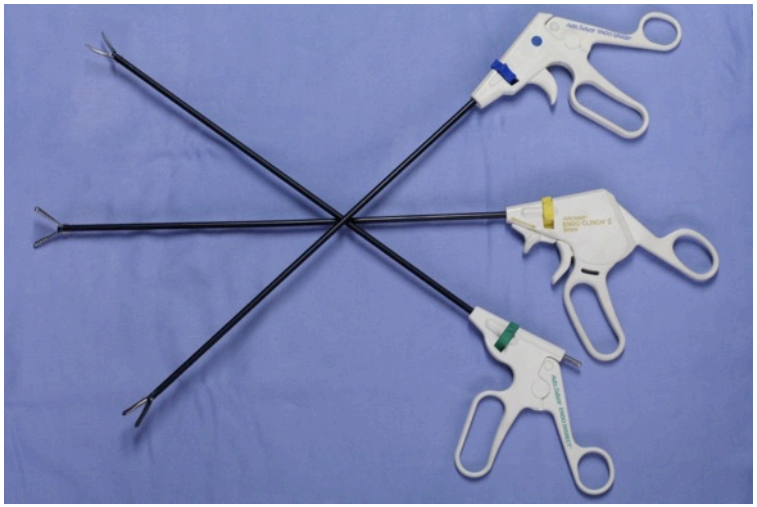
laparoscopic field of view

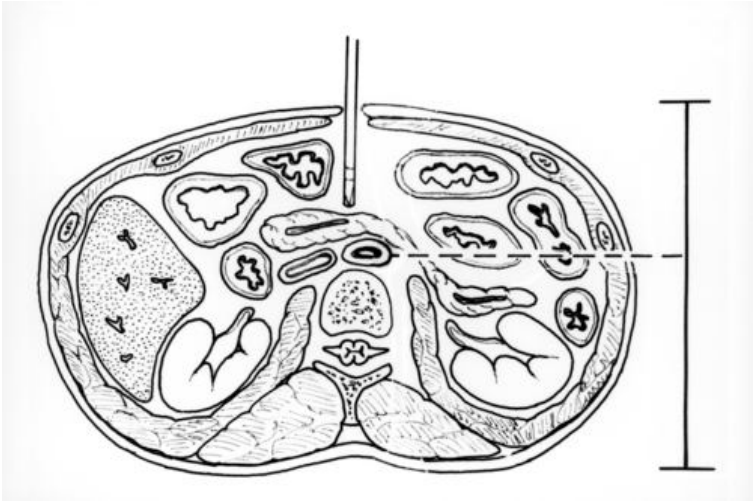
- this is a safety issue!
- even the slightest muscle tone in the abdominal wall will decrease the field of view
- gradual changes may not be noticed till errors and lack of operative efficiency have arisen
- how do you know there is a problem: the fat or bowel suddenly ”grows” in the surgical field

the fat or bowel suddenly ”grows” in the surgical field

safety – no coughing or sudden contractions

- part of training program for laparoscopic surgery to <u>immediately</u> remove instruments when coughing





immediately remove instruments when coughing

safety – no coughing or sudden contractions

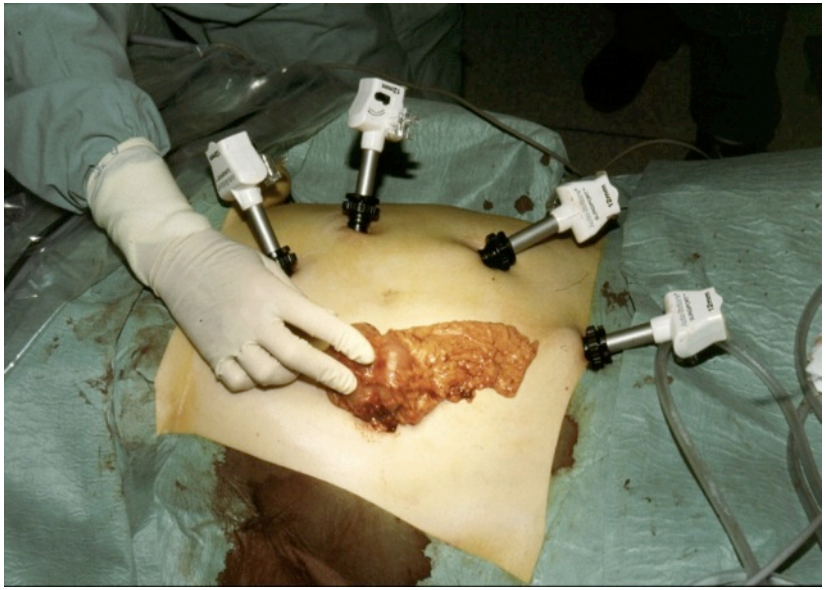
- special problem in robotic surgery

what is the value in maintaining NMB through to the end of abdominal surgery?

- if NMB is given towards end of operation, then OR turnover may be severely impaired
- sometimes NMB or deep anaesthesia is required to close the abdomen – both during laparotomy and laparoscopy

NMB necessary for extraction of excised tissues

- this is often at the end of surgery…
- we therefore need relaxation also very late in the operation
- thus, another indication for a reversal agent



conclusions - introductions

- during surgery there are numerous clinical problems that may be solved by intense NMB continued to the very end of procedure
- impractical to do without an effective reversal agent

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Challenges in the Surgical Field

Olav Istre (Denmark)

CHALLENGE IN THE SURGICAL FIELD

Olav Istre MD, DMSc.
Head of Gynecology Aleris-Hamlet Hospital, Scandinavia
Professor in Minimal Invasive Gynecology
University of Southern Denmark

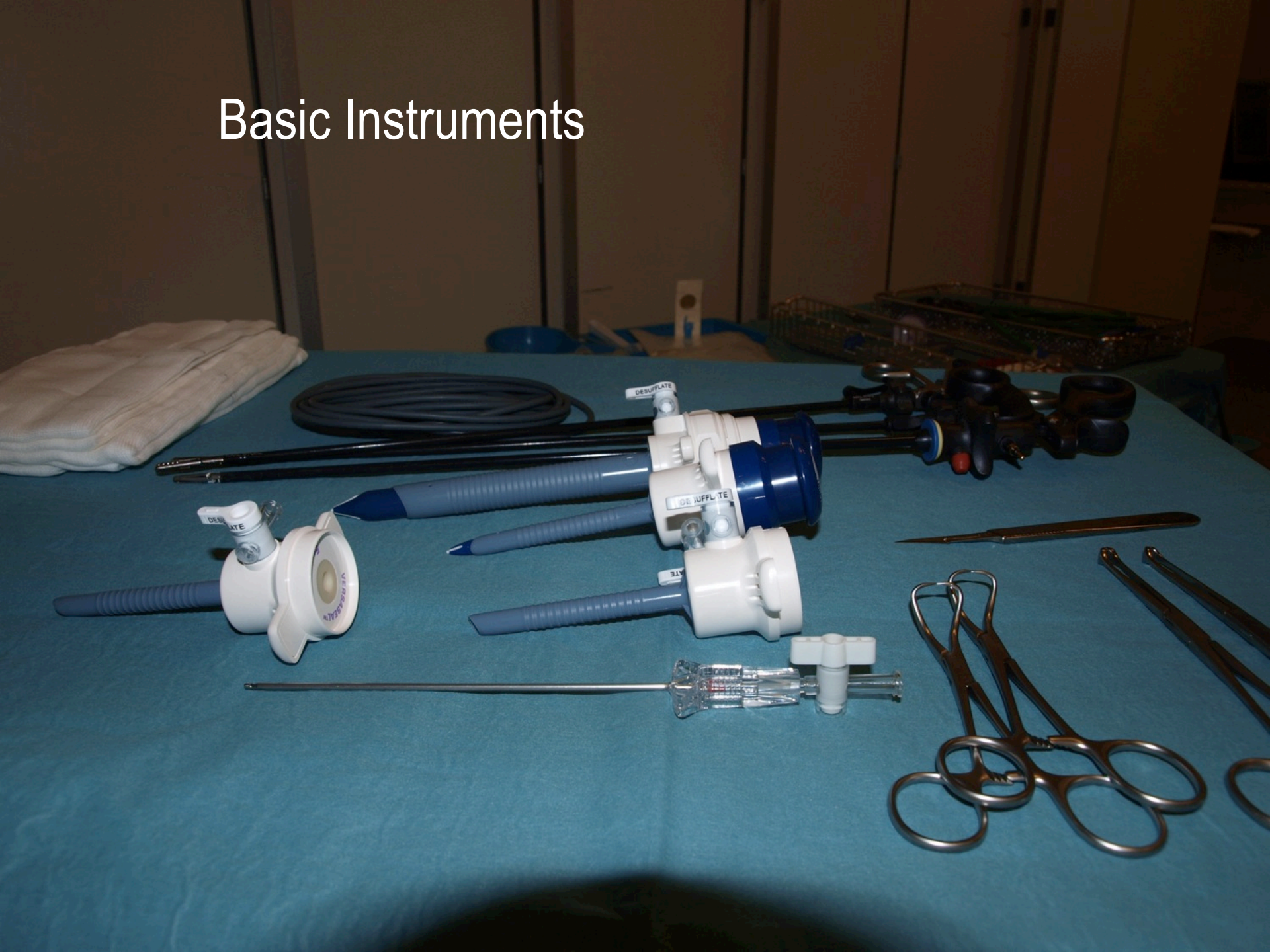
SUMMARY

- Selecting patients for surgery
- Entry technique
- High pressure-low pressure
- Complications
- Closure technique
- Port placement

SUCCESFUL ENDOSCOPY

- Operating rooms
- Equipment
- Dedicated nursing staff
- Smooth hospital enviroment
- A ``´nerd´´ Doctor burning for it,
- Anaethesiologist
- Training, training, suturing suturing
- Low complication rate
- Good follow up and control of data
- Satisfied patients

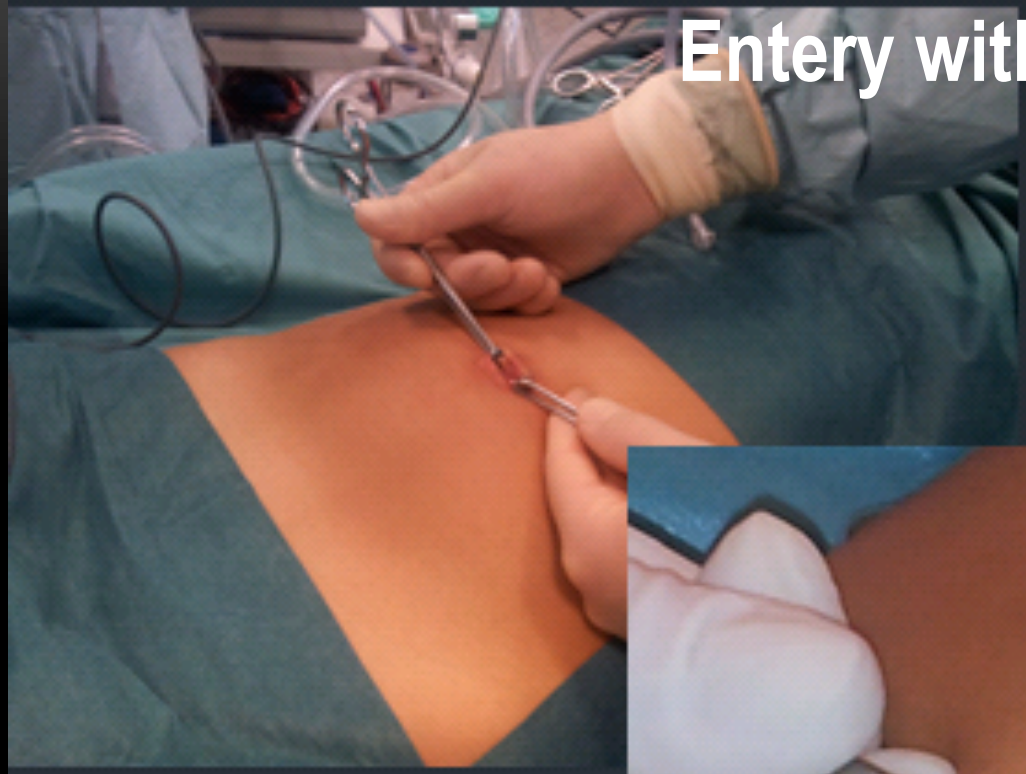
Basic Instruments

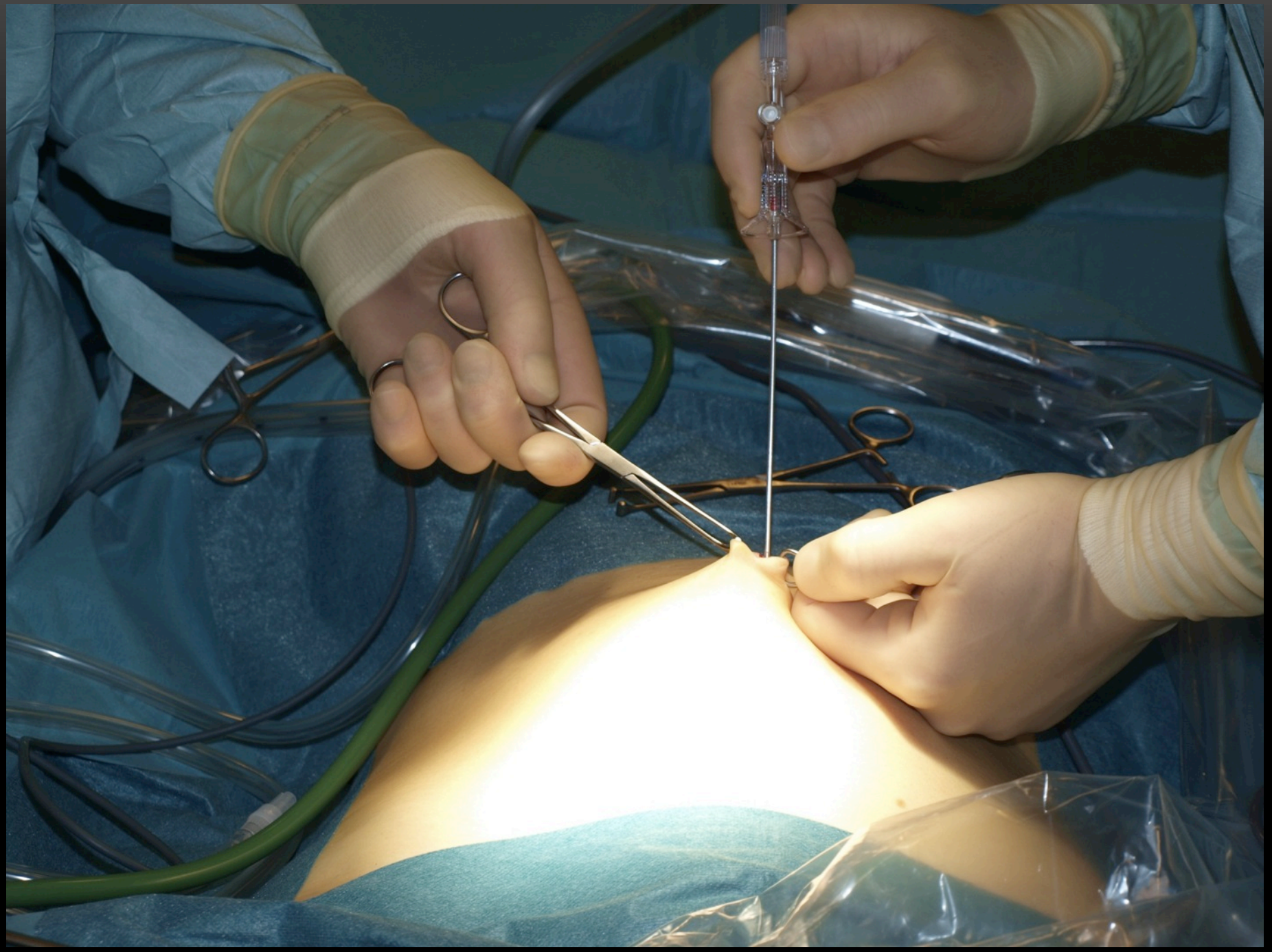


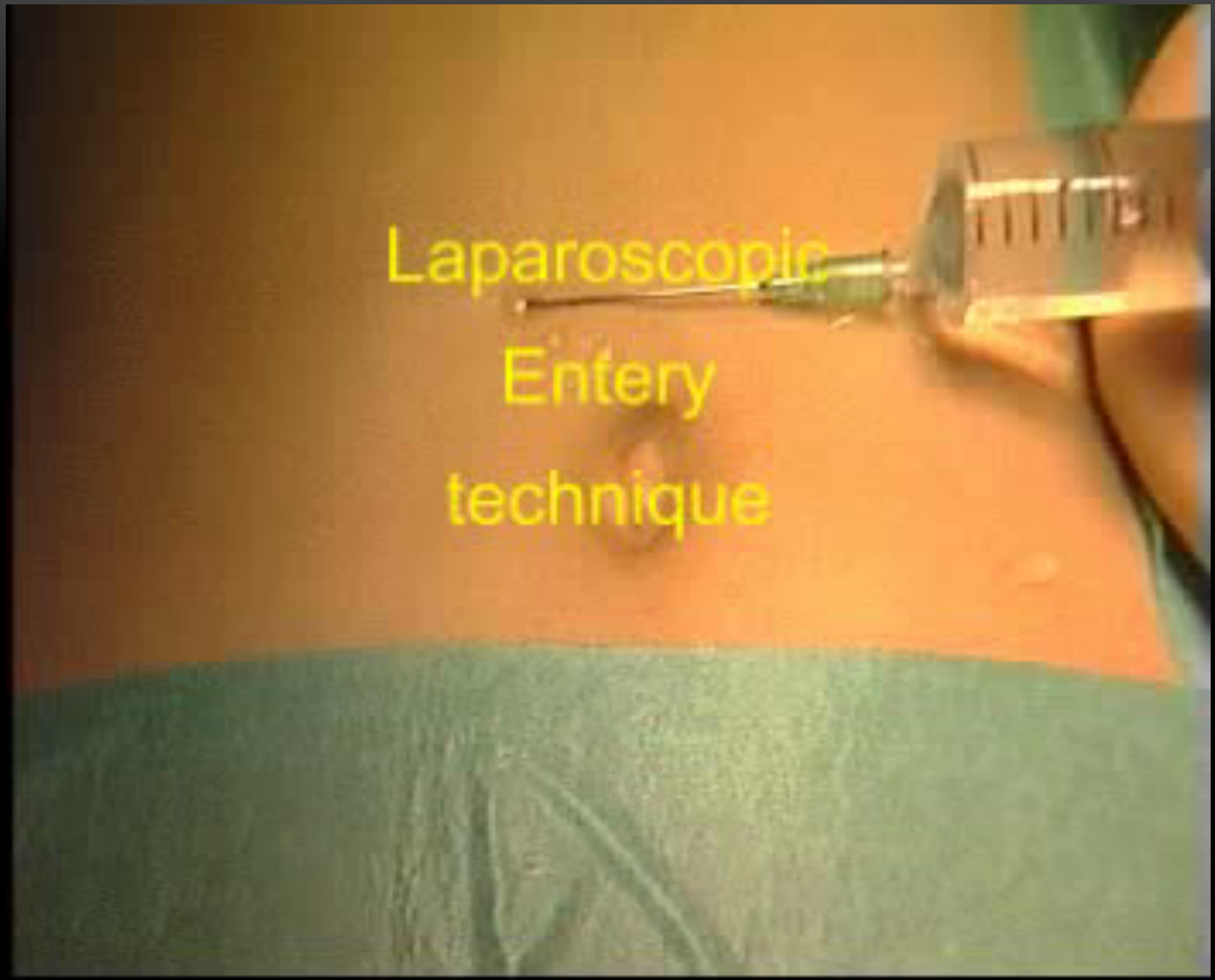
EQUIPMENT

- Verres cannula or Single port cannula
- Optic
  - 5 mm, 30 degree, High Definition(HD)
- Able for port jumping
  - Change angle (flex scope), special good for single port
  - Big fibroids
  - Difficult endometriosis
  - Coming around the corners
- Graspers and cutting device
  - Bipolar
  - Ultra Sound, thunderbeat (combined ultrasound and bipolar)
  - scissors

Entery with Verres needle






Laparoscopic
Entery
technique

COMPLICATIONS OF LAPAROSCOPIC SURGERY

- physical and emotional suffering for
  - patients
  - relatives
  - doctors
- financial costs
- legal proceedings

COMPLICATIONS OF LAPAROSCOPIC SURGERY

Example:

- during 1984 in the UK: 124548 gynecological laparoscopies.
- We would expect 300-500 serious complications each year.
- Or in the US: 5000 serious complications each year.

COMPLICATIONS OF LAPAROSCOPIC SURGERY

PNEUMOPERITONEUM

1. Emphysema (subcut/preperit/omental)
2. Pneumothorax
3. Pneumomediastinum
4. Gas embolism (more freq. with air)
5. Failure to maintain pneumoperitoneum
6. Cardiac arrhytmias (bradycardia)
7. Hypercarbia

COMPLICATIONS OF LAPAROSCOPIC SURGERY
SURGICAL INJURY

1. Thermal injury
2. Dissection injury
3. Inability to complete procedure
4. Vascular injury
5. Bowel injury
6. Bladder/ureteral injury
7. Nerve injury
8. Lymphoedema/lymphocele

COMPLICATIONS OF LAPAROSCOPIC SURGERY

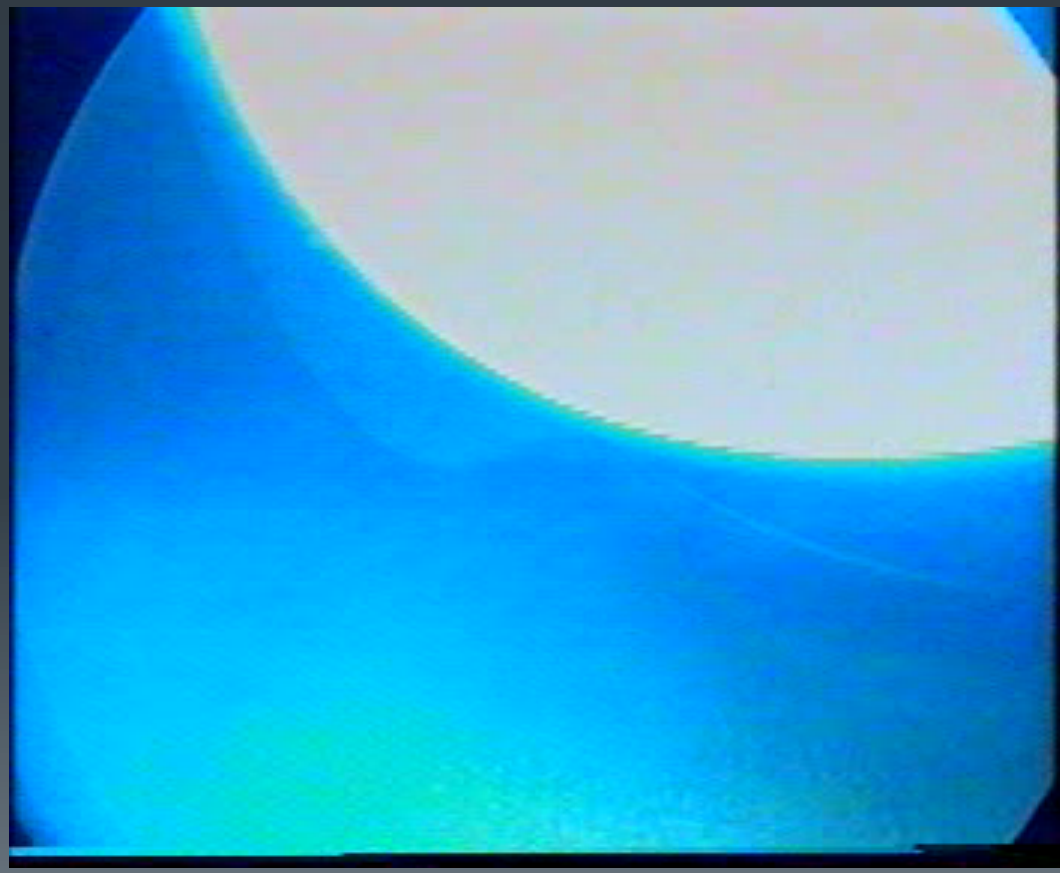
1. Anaesthesia related
2. Verres needle and trocar insertions
3. Pneumoperitoneum
4. Surgical injury
5. Closure

First incision cut upwards

- Call for a laparotomy kit. If need be open the patient immediately using a midline incision and put pressure on the bleeder and/or aorta
- Call for help
- Call for blood products
- Call for vascular surgery
- or a general surgeon
- Notify anesthesia immediately
- Do not panic
- Do not freeze

Bowel injuries, use umbilical ultrasound pre op

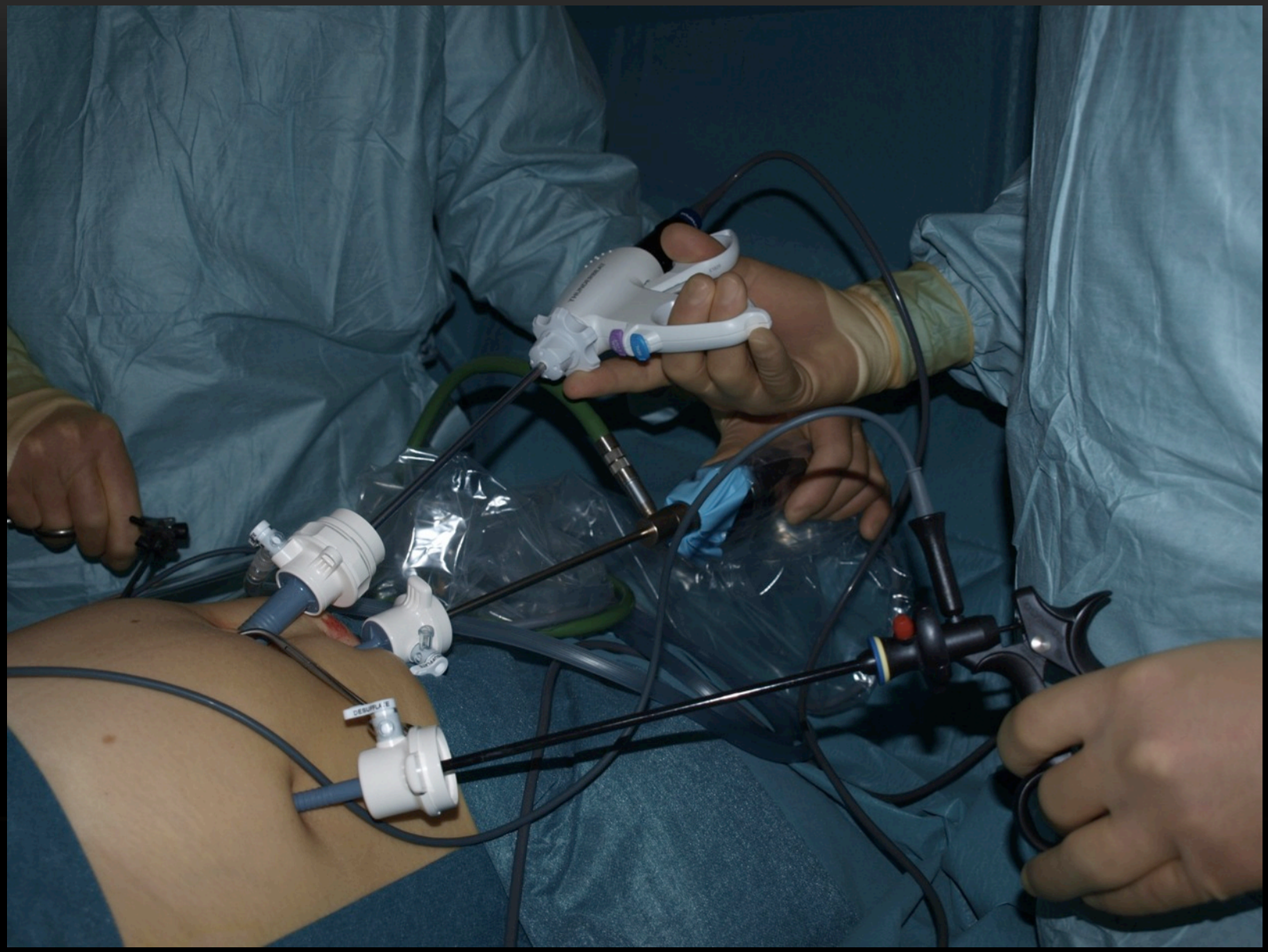
- Favorable outcome, IF they are recognized intra-operatively
- Mechanical bowel preparation. No improvement in prognosis in the colorectal literature)
- Mechanical bowel preparation does not improve visibility during laparoscopy
- MBP does significantly increase patient discomfort, dehydration, nausea, vomiting and abdominal discomfort

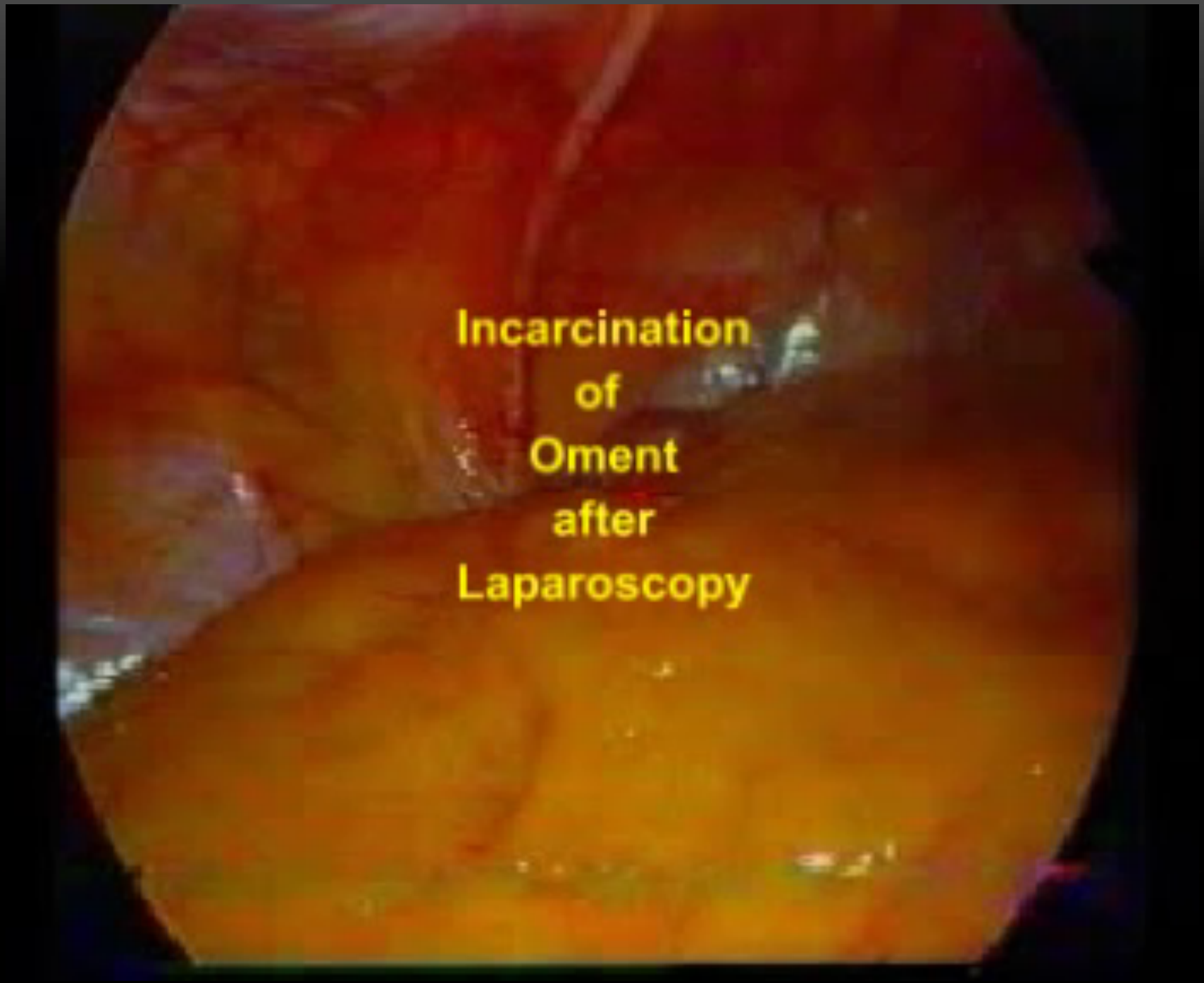


Obstet Gynecol. 2011;4(1):28-31 doi: 10.3909

During surgery, use 4 hands, and nurse handling the uterine manipulator

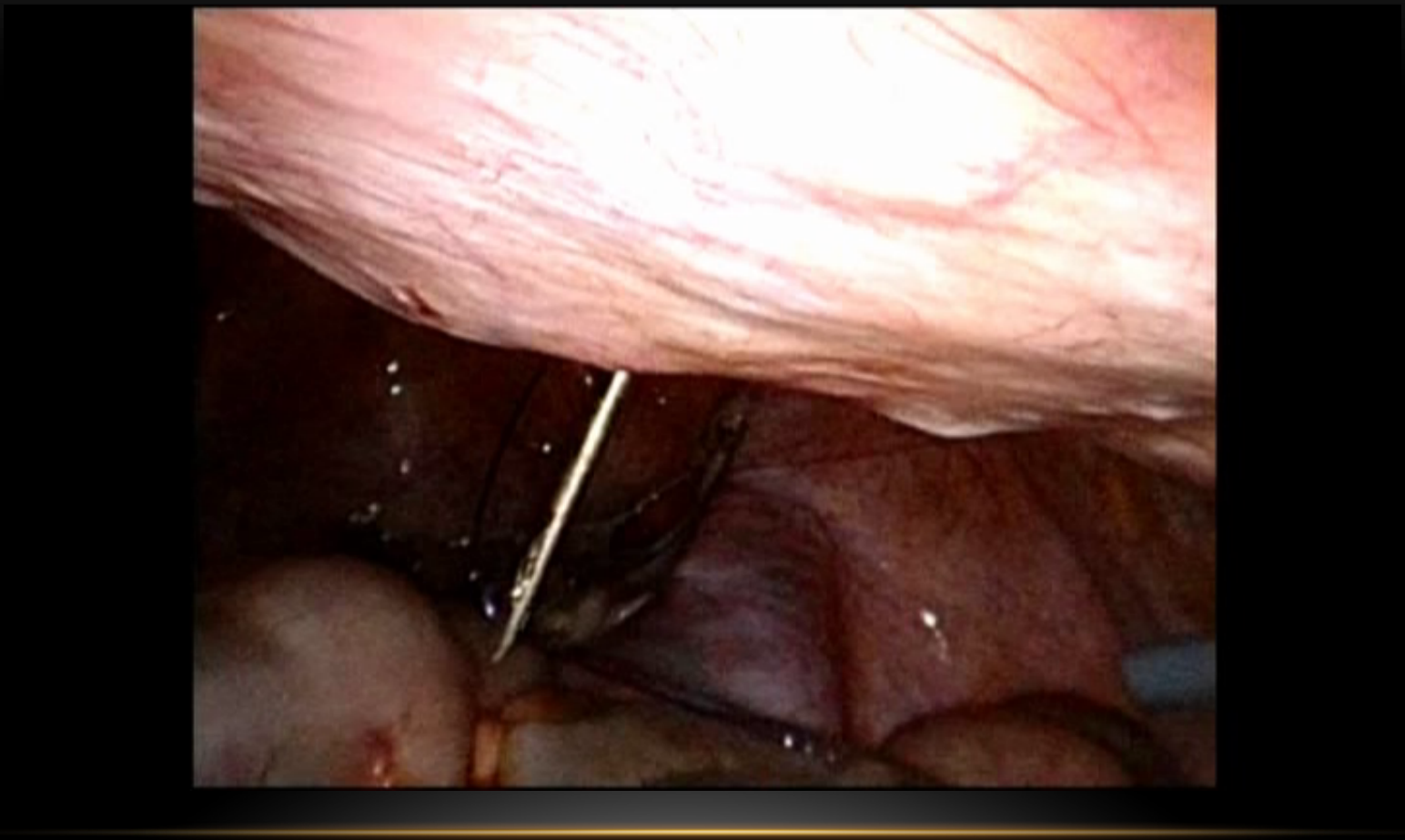
PORT PLACEMENT WORKING CONDITION FOR LARGE UTERI/FIBROIDS




Incarcination
of
Oment
after
Laparoscopy

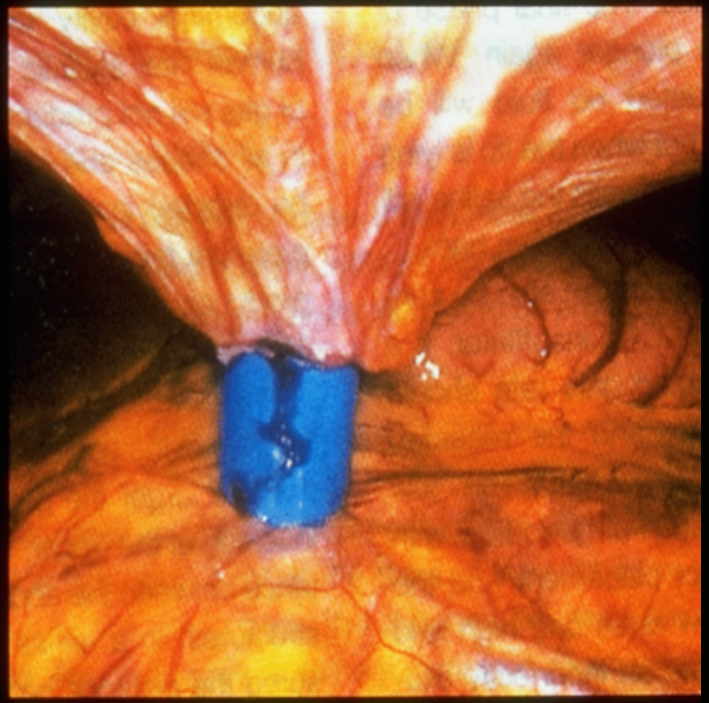
POST OP ILEUS HERNIATION

CLOSURE TECHNIQUE

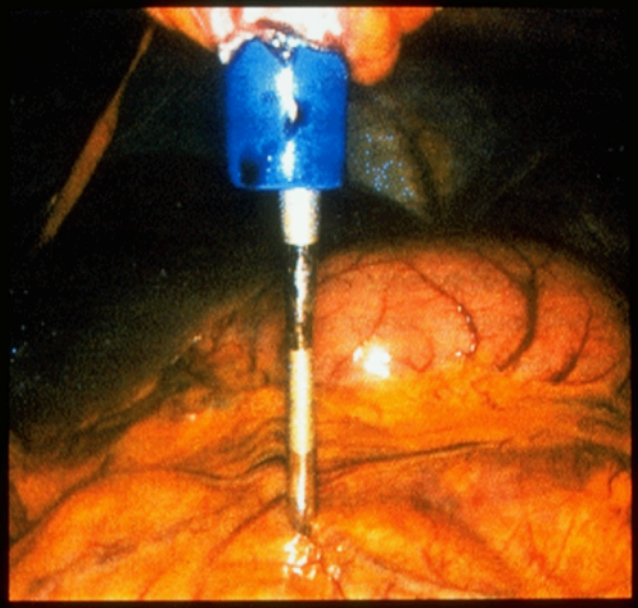


Sufficient Workspace!

Low pressure entry



High pressure entry



Thanks for your attention

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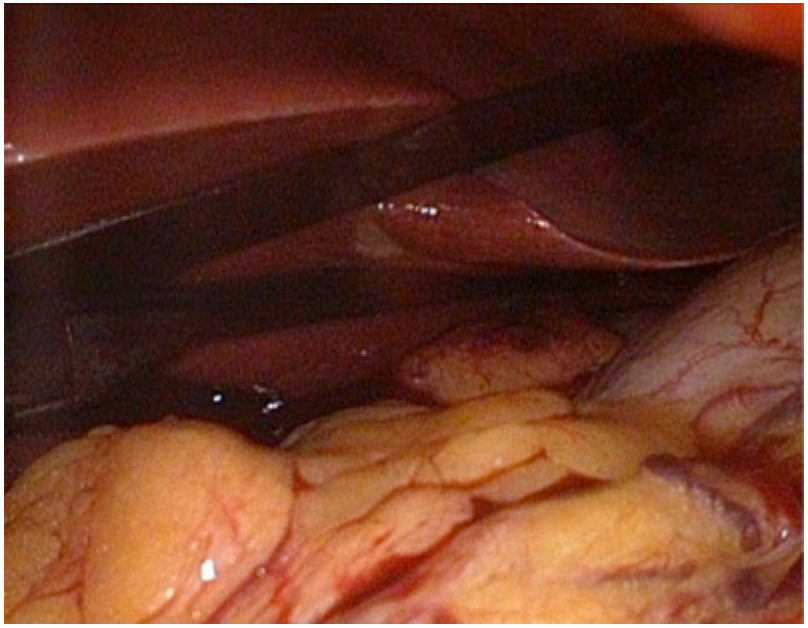
Benefits of Deep Neuromuscular Blockade

Jan Mulier (Belgium)

Can we do something to improve the situation?



Intraabdominal pressure?
Intraabdominal volume?
Workspace?

Surgeon: I have not enough workspace.

Anesthesiologist: Your problem. I am okay.

Surgeon: Look at the video screen. I can´t work.

Anesthesiologist: If you want more volume, you should increase the pressure, but an experienced surgeon can handle this.

Surgeon: But it is already 18 mmHg. Do you want me to change to a laparotomy?

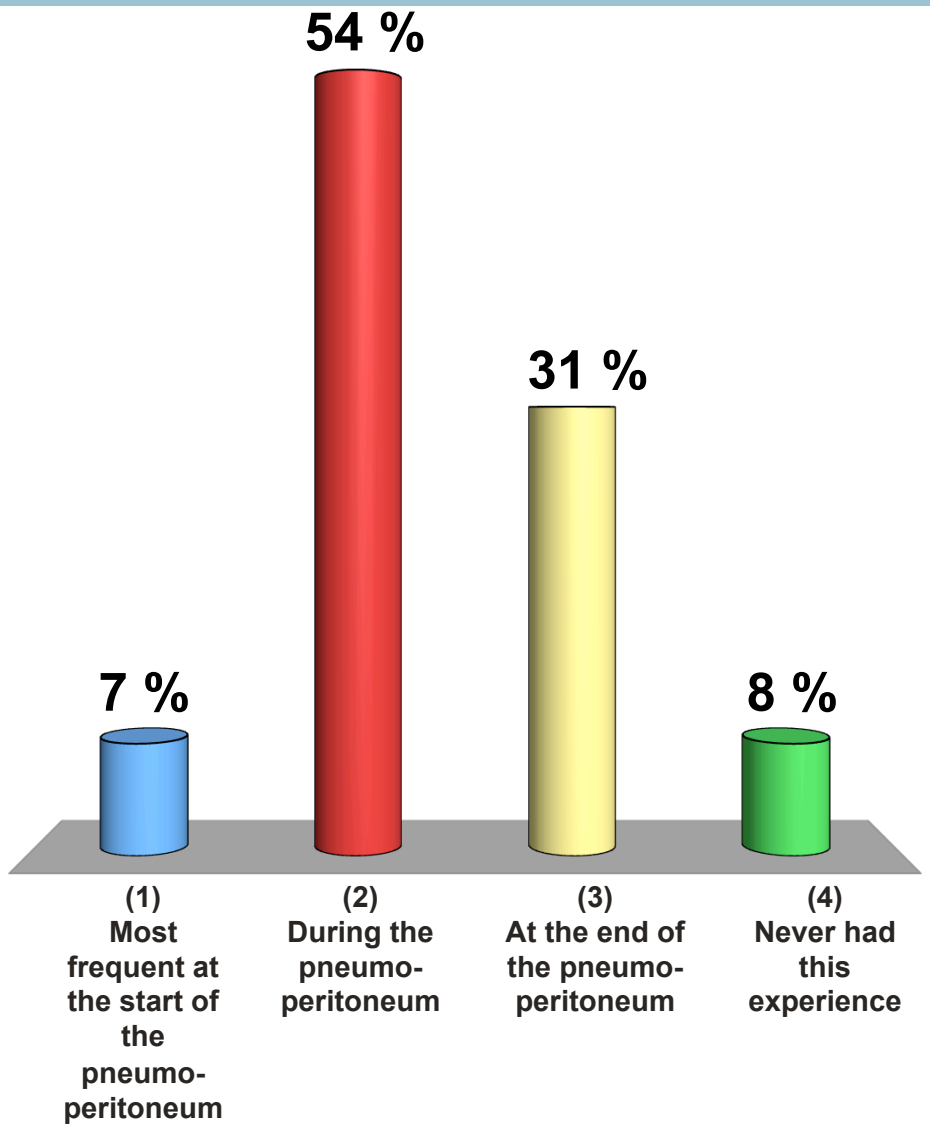
Anesthesiologist: The patient has only one TOF response in the AP. Last time this was enough. Why not today with you?

Surgeon: I don't know what "one TOF response" means. What I said is I can't work.

Me or my surgeon has insufficient workspace

1. Most frequent at the start of the pneumoperitoneum
2. During the pneumoperitoneum
3. At the end of the pneumoperitoneum
4. Never had this experience

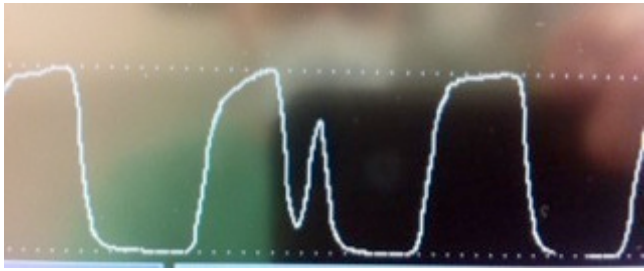
Questionnaire at local meeting of abdominal surgeons and anesthesiologists Leuven Dec 2011



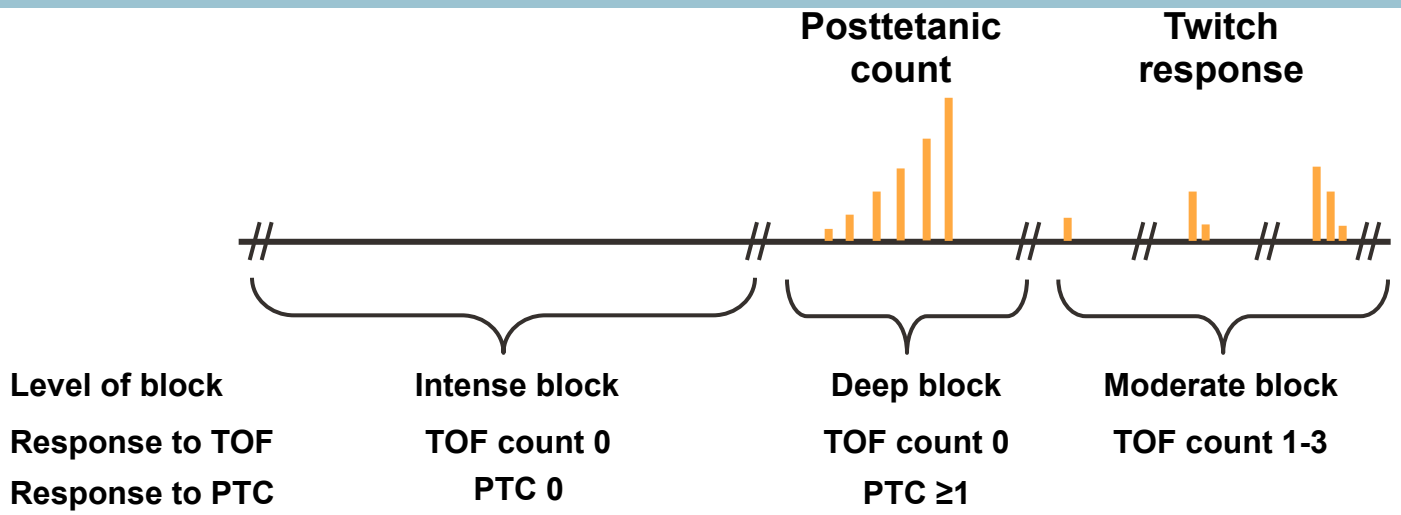
Insufficient NMB during lap: how do you recognize it?

- At the first insufflation with the verres needle
  - High abd pressure to start > 8 mmHg.
  - No flow is going inside.
  - Multiple attempts to reposition.

- Insufficient space to reach certain areas
  - Flat abdomen, no view
- Patient start to press suddenly
  - Abdominal wall, diaphragm movements
  - ventilator alarm
    - Coughing or breathing against ventilator
  - insufflator alarm
    - IAP sudden > set pressure.



Various Depths of Blockade

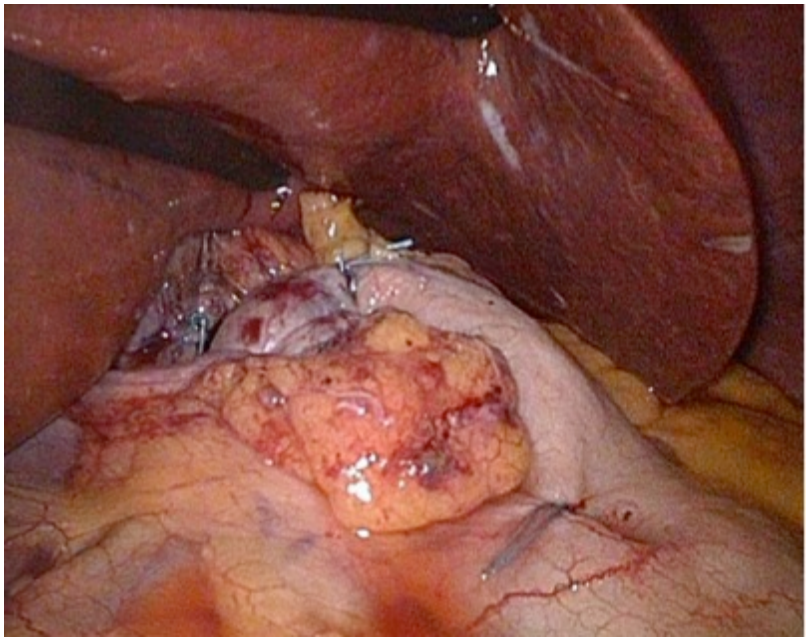


- Intense blockade: no response to either TOF or PTC stimulation
- Deep blockade: response to PTC but not to TOF stimulation
- Moderate blockade: reappearance of response to TOF stimulation

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

Fuchs-Buder T, et al. *Acta Anaesthesiol Scand*. 2007;51:789-808.

YES WE CAN



Surgeon: Now I have very good surgical conditions

Anesthesiologist: The patient is OK

Surgeon: Look at the screen. I have enough workspace and the IAP is low

Anesthesiologist: The patient is now on a deep neuromuscular block

Surgeon: How many PTCs has the patient in the adductor pollicis?

Anesthesiologist: only 3 PTCs. I will keep him on a deep NMB until the end of surgery

Surgeon: Thanks. Then we will end in time and can have drink together.

First description of the value of NMB in abdominal surgery

- In 1912, Läwen demonstrated the clinical usefulness of curarine by injecting it i.m. to achieve abdominal relaxation for peritoneal surgery.
  - Läwen A. Uber die Verbindung Lokalanaesthesie mit der Narkose, uber hohe Extradural Anaesthesie und epidurale Injektionen anaesthesierende Loesungen bei tabetischen Magenkriesen. *Beit Klin Chir* 1912; 80:168

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.
  - Moerer O. *Anasthesiol Intensivmed Notfallmed Schmerzther*. 2005;40:217

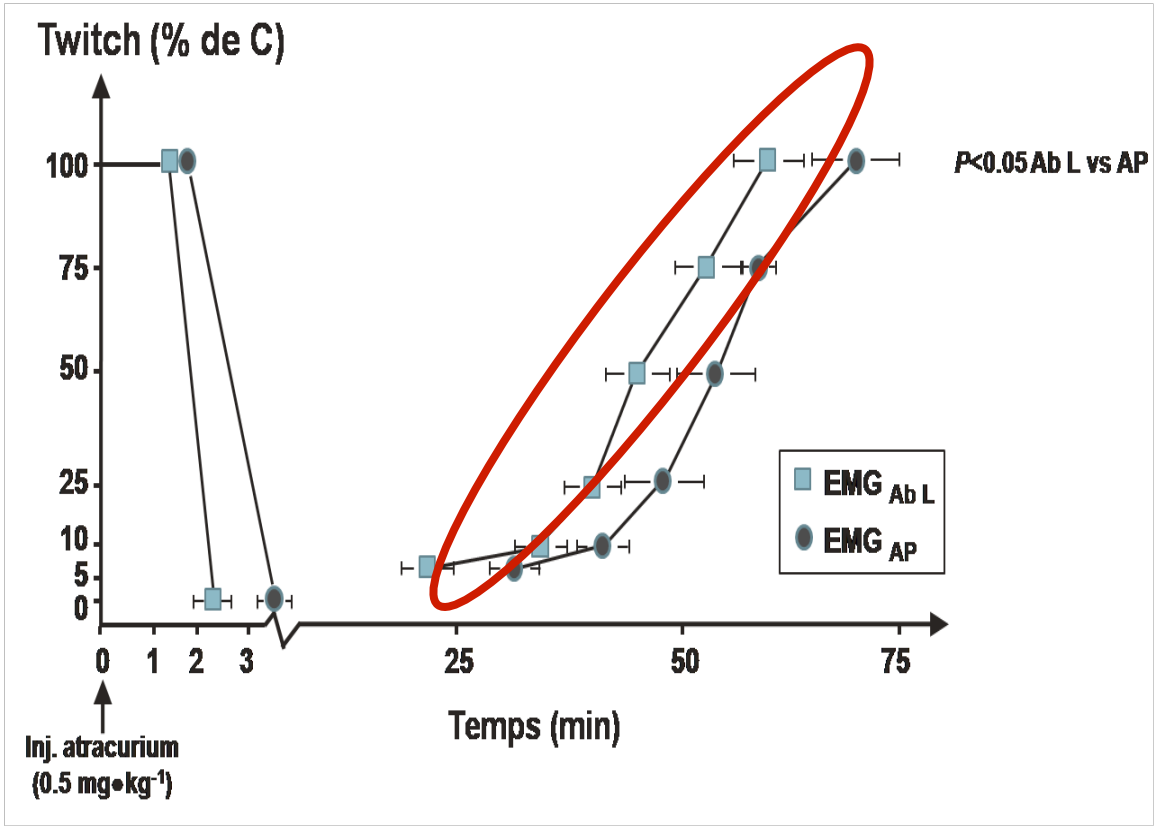
- The diaphragm is more resistant than the adductor pollicis to rocuronium and has a faster recovery of the twitch height.
  - Cantineau JP *Anesthesiology*. 1994;81:585

Time difference when bolus NMB given between abdomen – adductor pollices

Sensibilité à l'atracurium des muscles abdominaux latéraux*

K. Kirov, C. Motamed, X. Combes, P. Duvaldestin, G. Dhonneur**

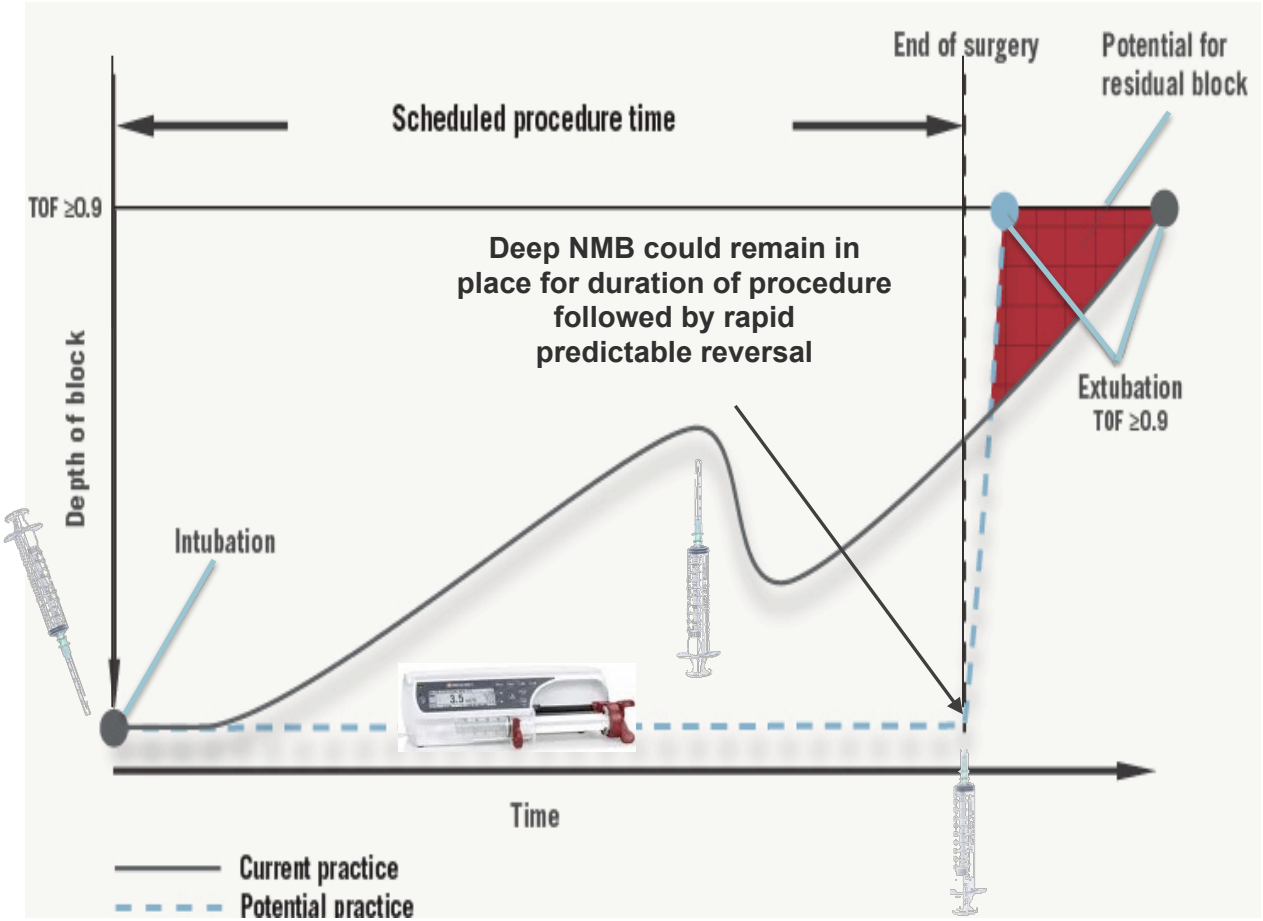
Sensibility to atracurium of the lateral abdominal muscles
Objective: To study the effect of atracurium on the electromyographic activity of the lateral abdominal muscles and adductor pollicis in anaesthetized subjects.



Lateral abdominal muscles blockade have a faster onset and recovery than adductor pollices

Kirov K et al. *Ann Fr Anesth Reanim.* 2000;19:734–738.

Solution to Both Problems: Continuous Infusion to a Deep Block

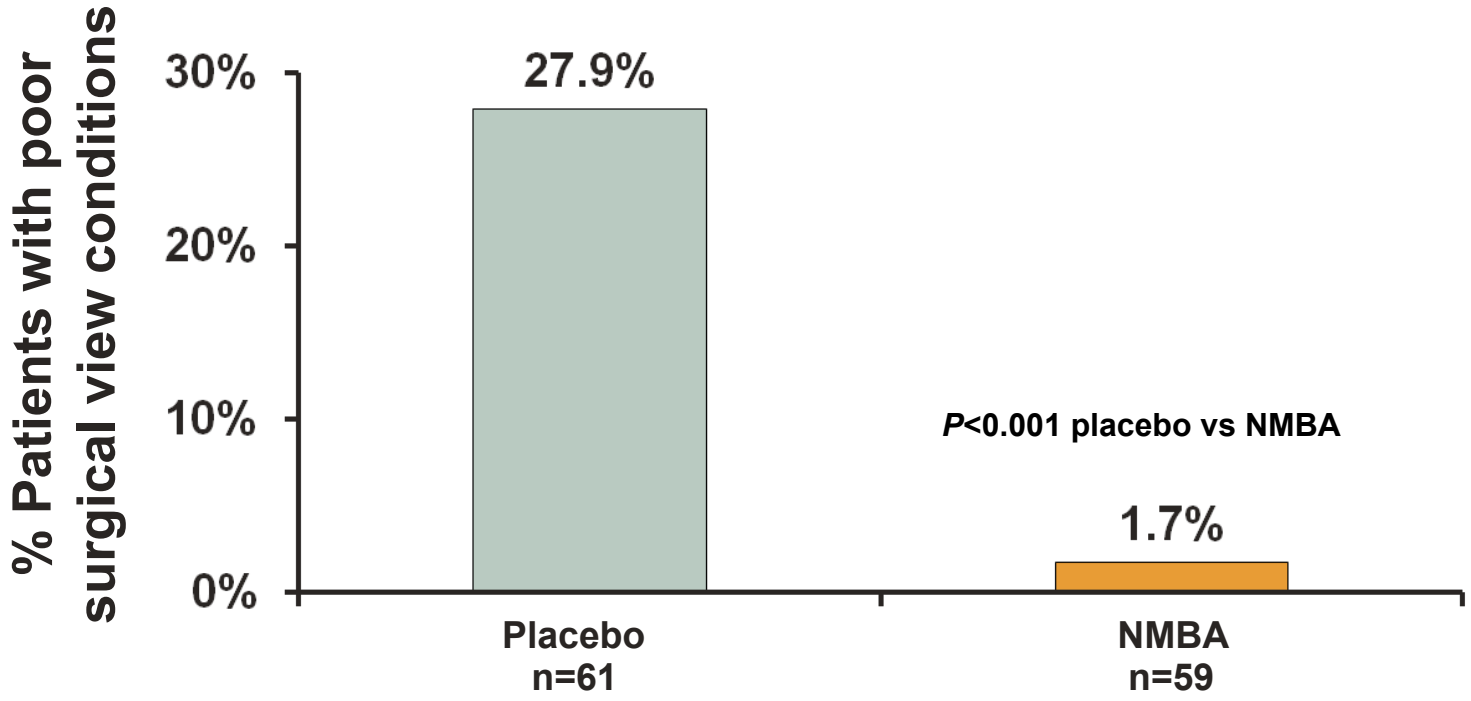


What Is the Value in Maintaining NMB Through the End of Abdominal Surgery?

- May provide sufficient relaxation of abdominal muscles to maintain good surgical conditions and workspace
- May avoid the need for high insufflation pressure to achieve adequate workspace
- Potential to allow lower insufflation pressures and reduce the associated risks of higher pressures

NMB=neuromuscular blockade.

NMBA Decreases Frequency of Poor Surgical View Conditions



[a] In a randomized, blinded, placebo-controlled study of 120 patients undergoing radical retropubic prostatectomy, patients received an infusion of NMBA (n=59) or saline (placebo, n=61) beginning 5 minutes after fascial incision. At 15 minute intervals, the surgical field was graded from 1 (excellent) to 4 (unacceptable). Patients who were graded as having an unacceptable surgical field received rescue NMBA.

NMBA=neuromuscular blocking agent.

1. King M. *Anesthesiology*. 2000;93:1392–1397.

Limited Ability to Reverse NMBAs Has Led to moderate blockade or the Use of Substitutes.

- Historically, there has been limited ability to reverse deeper levels of NMB,
  - Allowing spontaneous reversal toward the end.
- Reversal agents interfering with cholinergic nervous system have adverse side effects.
- The difficulty in managing the reversal of NMBAs has led to the use of alternate therapies as a substitute.
  - The high doses required for these substitutes to achieve “NMB”-like effects may have an increased risk of side effects.
    - Opiates
    - Inhalation hypnotics
  - They Prevent active contraction, never have relaxation effects.

NMBAs=neuromuscular blocking agents; NMB=neuromuscular blockade.

1. Plaud B et al. *Anesthesiology.* 2010;112:1013–1022.

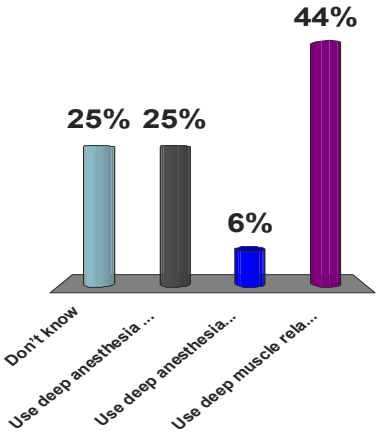
What is most effective for you to increase the laparoscopic workspace

A. Don’t know, never paid attention

B. High dose inhalation

C. High dose morphine (ultiva: remifentanil)

D. Deep muscle relaxation



Opioids Did Not Provide Complete Muscle Relaxation, Even at Higher Doses[1,a]

Remifentanil Dose, μg/kg/min[b]	Probability of Movement, %[c]	95% Confidence Limits
0.10	65.4	(48.6, 79.0)
0.12	56.9	(44.0, 68.6)
0.14	47.9	(38.3, 57.7)
0.16	39.1	(30.6, 48.3)
0.18	31.0	(21.9, 41.9)
0.20	23.9	(14.2, 37.1)
0.21	20.7	(11.2, 35.1)

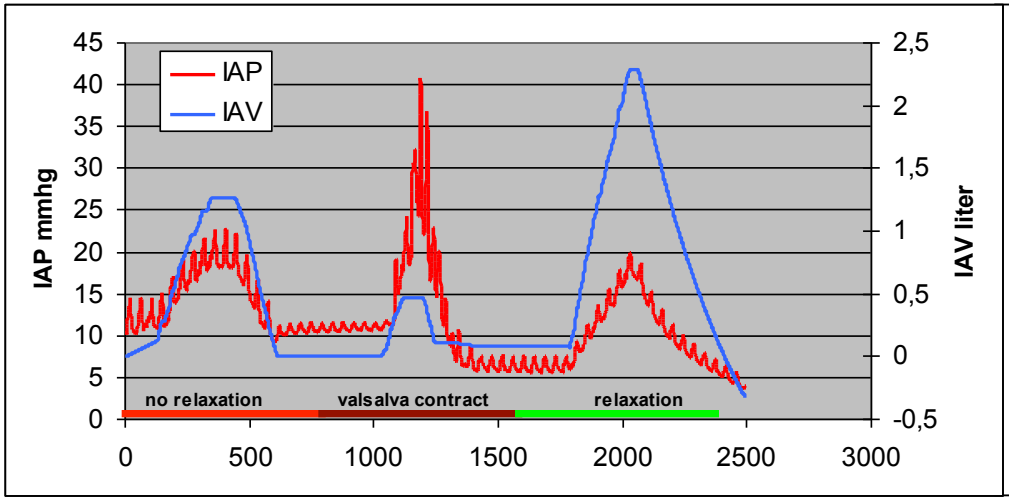
[a] In this study, 131 patients undergoing elective craniotomy received one of 12 remifentanil dose regimens (0.10 to 0.21 μg/kg/min)
[b] Normal doses range from 0.1–0.5 μg/kg/min.
[c] Logistic regression results.

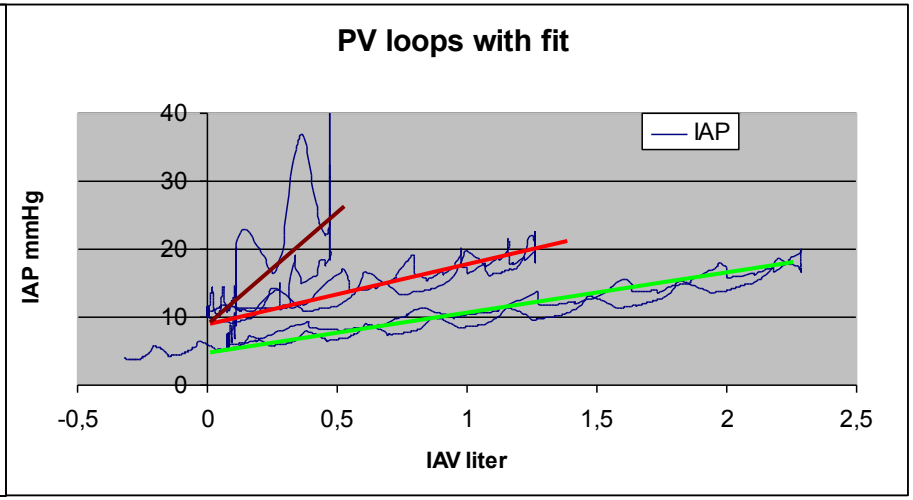
- Higher doses of remifentanil decreased the risk of movement in the absence of neuromuscular blockade but increased frequency of hypotension and bradycardia.
- Even at maximum dose (0.21 μg/kg/min), there is a 20% chance of movement.

1. Maurtua MA et al. *J Neurosurg Anesthesiol.* 2008;20:221–225.

Example of Difference between active muscle contraction and relaxation

- Active contraction very small compliance C
- Relaxation by NMB IAP drops with same C





Clinical Example of a Laparoscopy in a Patient With BMI of 46

- More Workspace with NMBAs at Similar Insufflation Pressure
  - 3 liter workspace without NMBAs
    - IAP 15 mmHg

  - 4 liter workspace with NMBAs
    - IAP 14 mmHg

NMBAs=neuromuscular blocking agents; IAP=intra-abdominal pressure.

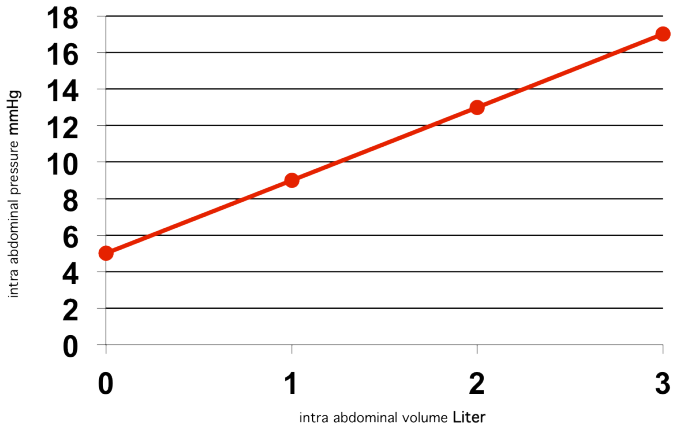
Measurement of abd Compliance

Volume 1 L
Volume 2 L
Volume 3 L

Pressure 8
Pressure 9
Pressure 10

PV0 : 7 mmHg

E: 1 mmHg/L
C: 1 L/mmHg



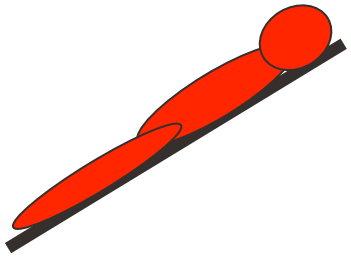
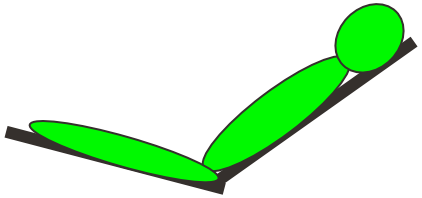
J Mulier, B Dillemans, M Crombach, C Missant, A Sels
On the abdominal pressure volume relationship.
The Internet Journal of Anesthesiology. 2009; 21: 1.

Fast Guess using Inflated volume: 1.2 L versus 7.2 L

Deep continuous NMB absolutely needed

NMB needed?
Yes and drop the IAP

Impact of patient's body position on the laparoscopic workspace

	Reverse trendelenburg	Beach chair
		
E (mmHg/L)	3,6	2,6
PV0 (mmHg)	4,8	4,8
IAV (L)	2,99	3,76

Impact of the patient's body position on the intraabdominal workspace during laparoscopic surgery.
Mulier JP, Dillemans B, Van Cauwenberge S.
Surg Endosc. 2010.

Decreased Level of Insufflation Pressure With NMB-Induced Relaxation[1]

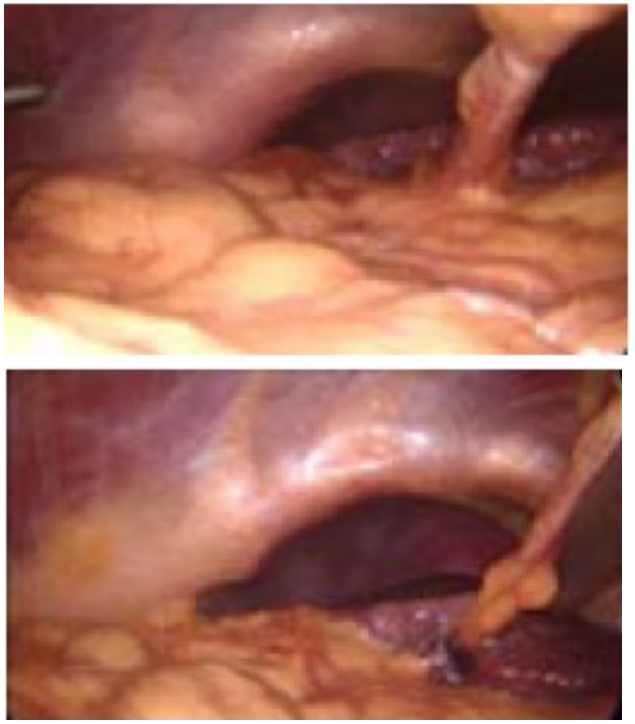
- NMB-induced relaxation maintained the integrity of pneumoperitoneum without increased CO_2 insufflation pressure

Chui PT et al. *Anaesth Intensive Care*. 1993;21(2):163–171

- Low-pressure pneumoperitoneum gives Less shoulder pain

T. Sandhu Surg Endosc 2008

The Cochrane Library 2009, Issue 2

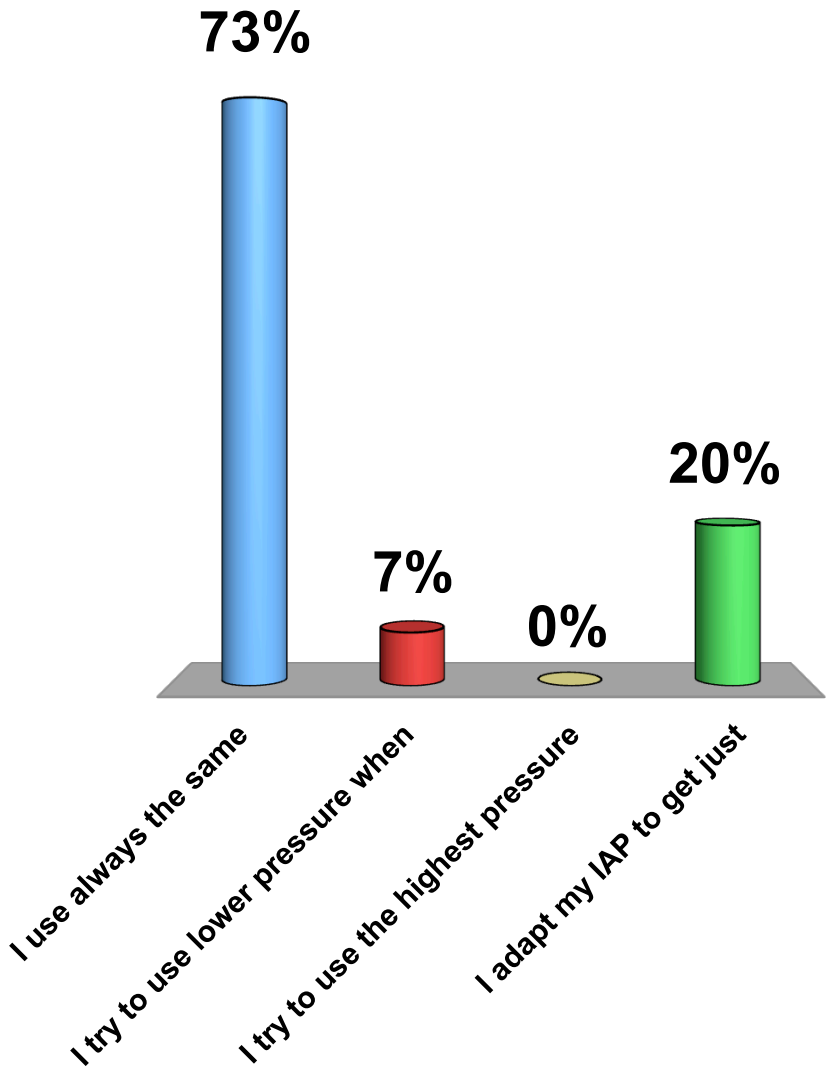


Visual field during a laparoscopic procedure approaching recovery from NMB (top) and deep NMB (bottom).

NMB=neuromuscular blockade; CO_2=carbon dioxide.

Intra abdominal pressure (IAP)

1. I use always the same insufflation pressure like 15 mmHg for a pneumoperitoneum
2. I try to use lower pressure when possible
3. I try to use the highest pressure possible to be sure to have sufficient space
4. I adapt my IAP to get just enough workspace



Conclusion

- Continuous infusion of NMBAs to a deep block
  - Helps to improve Laparoscopic workspace
  - Allows to work at lower insufflation pressure
  - Avoids abdominal or diaphragmatic movements.

Only possible today.

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Focusing on **Patient Outcomes** Through

Deep Block and Improved Visual Field in Laparoscopic Surgery –

What More Can Be Done?

Chairman:

Jacob Rosenberg (Denmark)

MSD

Achieving Optimal Surgical Conditions

Olav Istre (Denmark)

Summary

- Equipment, video, HD, Robotic
- Trendelenburg position
- Flow, pressure
- Assistant, training
- Pain management
- Practical tricks
- Deep block

Comparing HD versus sd video

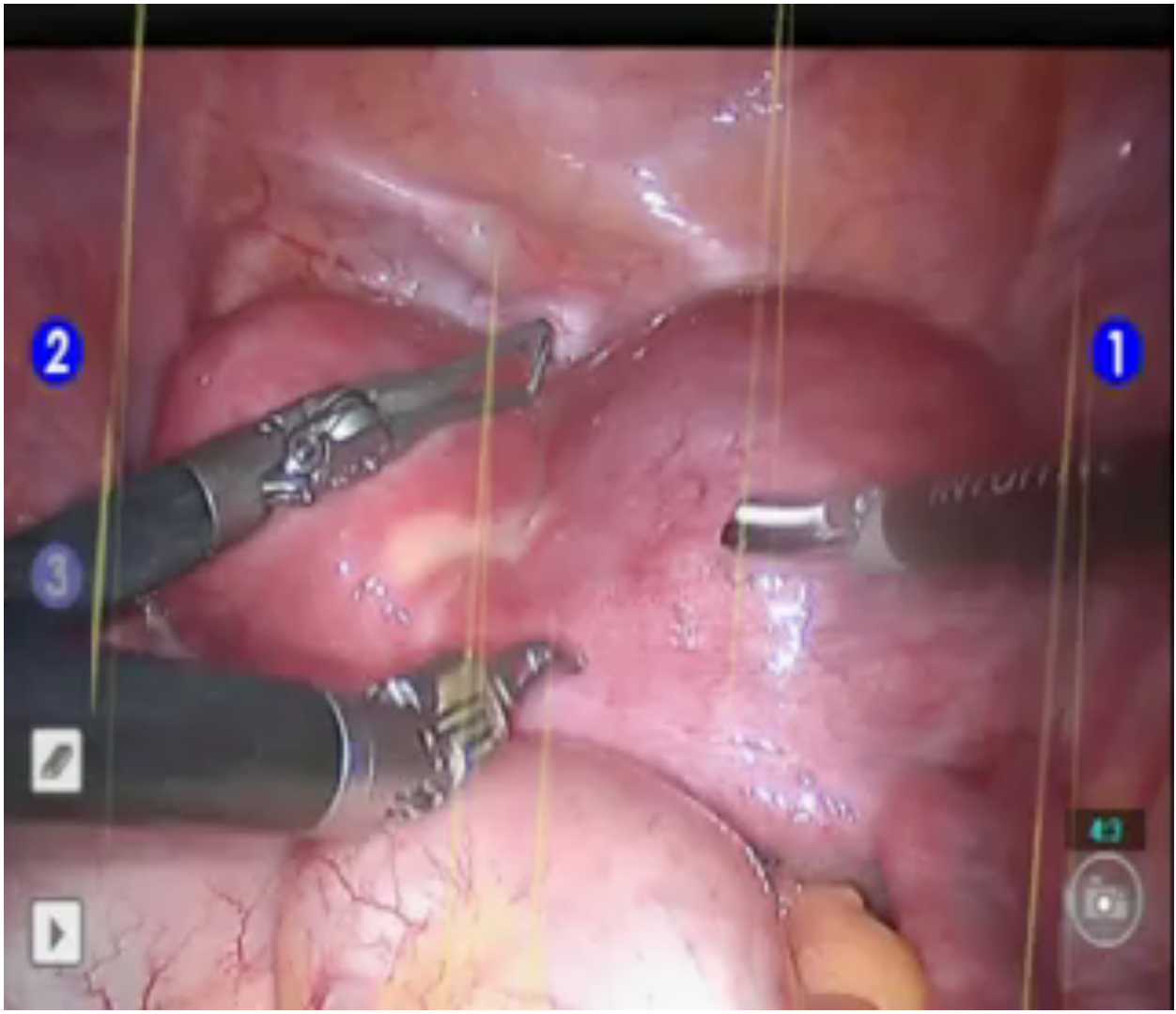
Robotic surgery

Facilitates

- View
- Handling
- Suturing
- Short learning curve

However

- **Expensive**
- **Prolonged or time**
- **Setup procedure**



The Key Component of Laparoscopic Surgery Is the Creation of a PPT (pneumo peritoneum)

- Allows for proper visualization of intra-abdominal structures through elevation of the anterior abdominal wall
- Higher pressure results in a better surgical view. But at what physiological changes to the patient?

Srivastava A. *J Minim Access Surg*. 2010;6:91–94.

Why deep block anaesthesia during laparoscopy

- Stable condition through out the procedure
- Shorter surgical time
- Reduction in insufflation pressure
  - Reduced Pain (50% reduction in shoulder pain)
  - Reduced Ventilation problems
  - Reduced Hemodynamic problems
- Reduction in surgical complications
  - More workspace, less damage to other organs
  - During Closure
    - Avoids herniation

Trendelenburg Position Creates Anaesthetic Challenges

Increases the need for improved communication between surgeon and anaesthesiologist

Ventilation challenges due to:

- Upward movement of the diaphragm
- Thoracic compliance reduced and inspiration pressure increased
  - High Intraocular pressure
  - High Intracranial pressure
- Perfusion challenges
  - Hemodynamics
  - Volume dynamics

1. Suh MK, et al. *Korean J Anesthesiol*. 2010;59:329-334.
2. Henny CP, et al. *Surg Endosc.* 2005;19:1163–1171.

NMB May Improve Access and Visualization While Allowing for the Use of Lower Insufflation Pressure

- NMB may facilitate introduction of instruments into the cavity and extraction of tissue[1, 3]
- NMB created a more open surgical field for greater mobility[1,2]

NMB improved visualization of the abdominal cavity during laparoscopic surgery

3 Williams MT Anestesia 2003,58,571-596

1. Ogunnaike BO et al. *Anesth Analg*. 2002;95(6):1793–1805. **2.** Welliver M et al. *Drug Des Devel Ther*. 2008;2:49–59.

Postoperative Analgesic Benefits of dNMB and Lower Insufflation Pressures

- Postlaparoscopic pain is often caused by[1]
  - Trocars
  - Surgical dissection
  - Pneumoperitoneum expansion under high pressure
- Lower peritoneal pressure results in less postoperative pain, lower incidence of shoulder tip pain and improved QOL during the first 5 postoperative days[2]
- Lower peritoneal pressure requires less analgesics and allows for a shorter hospital stay[3]
  - cochrane review (Low pressure vs standard pressure pneumoperitoneum in laparoscopic cholecystectomy Gurusamy KS 2009).

1.Wills. *British Journal of Surgery*. 2000;87:273–284.
2. Barczynski. *Surg Endosc*. 2003;17:533–538.
3. Joshipura VP. *Surg Laparosc Endosc Percutan Tech*. 2009;19:234–240.

Pressure related adhesion formation during laparoscopy

- A low IPP (8 mmHg) may be better than the standard IPP (12 mmHg) to minimize the adverse impact on the surgical peritoneal environment during a CO_2 pneumoperitoneum.

- Expression levels of connective tissue growth factor

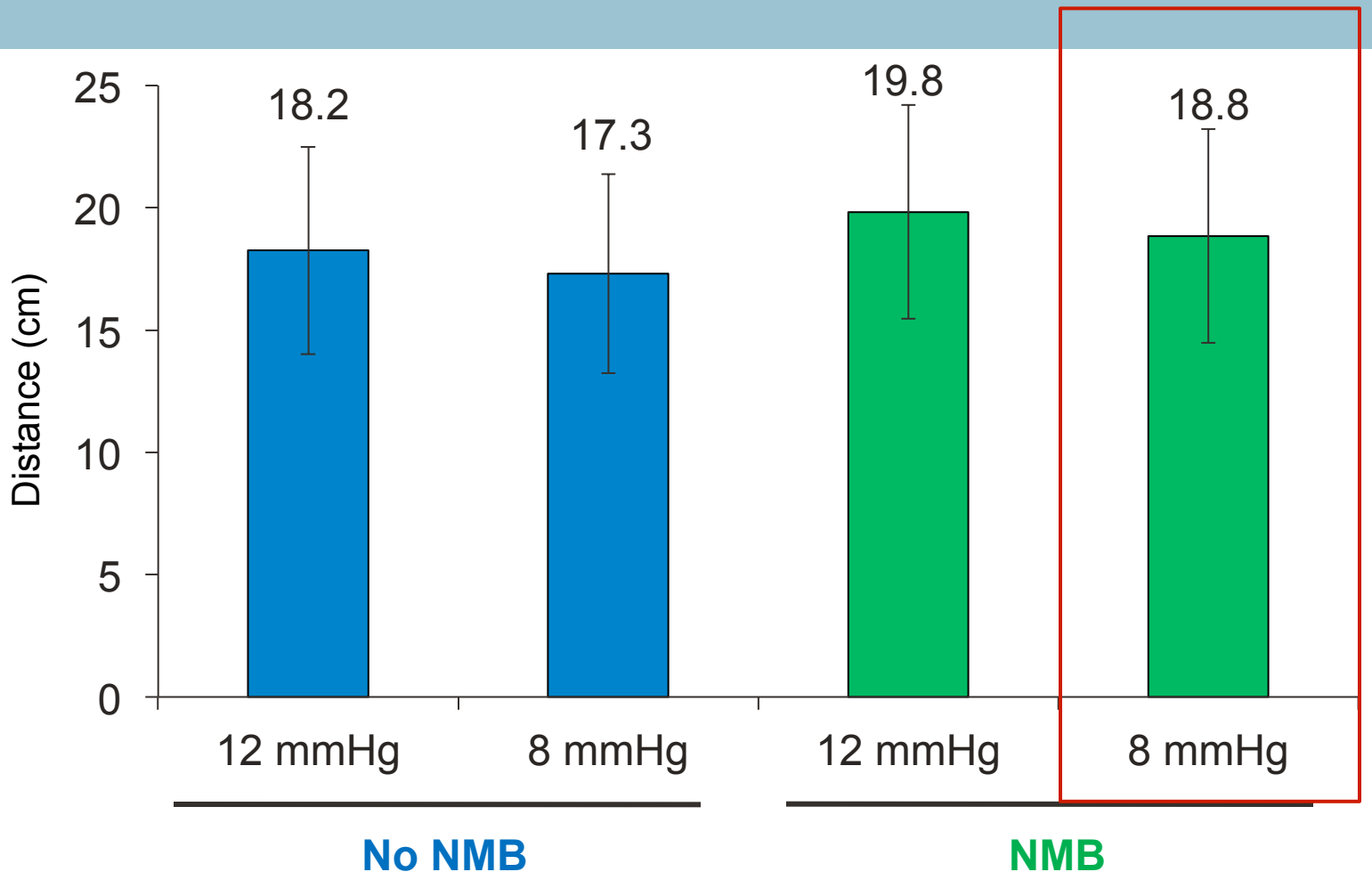
  (CTGF), matrix metalloproteinase-9, E-selectin, chemokine (C-X-C motif) ligand 2 (CXCL-2), Hyal-1 and Hyal-2

  were significantly lower in 8 mmHg group

  Potential for less adhesion formation

Hum Reprod. 2012 Jun;27(6):1613-23.

Similar Intra-abdominal Distances at Lower Pressure with NMB



Data shown as mean ± standard deviation. From Istre 2012 non published data

N=15

Pneumo peritoneum measurement

Conclusions

- Lower abdominal laparoscopy with decreased abdominal pressure was facilitated by deep neuromuscular block

  – creates an optimal working environment,

  – allows the surgeon to properly maneuver instrumentation and organs

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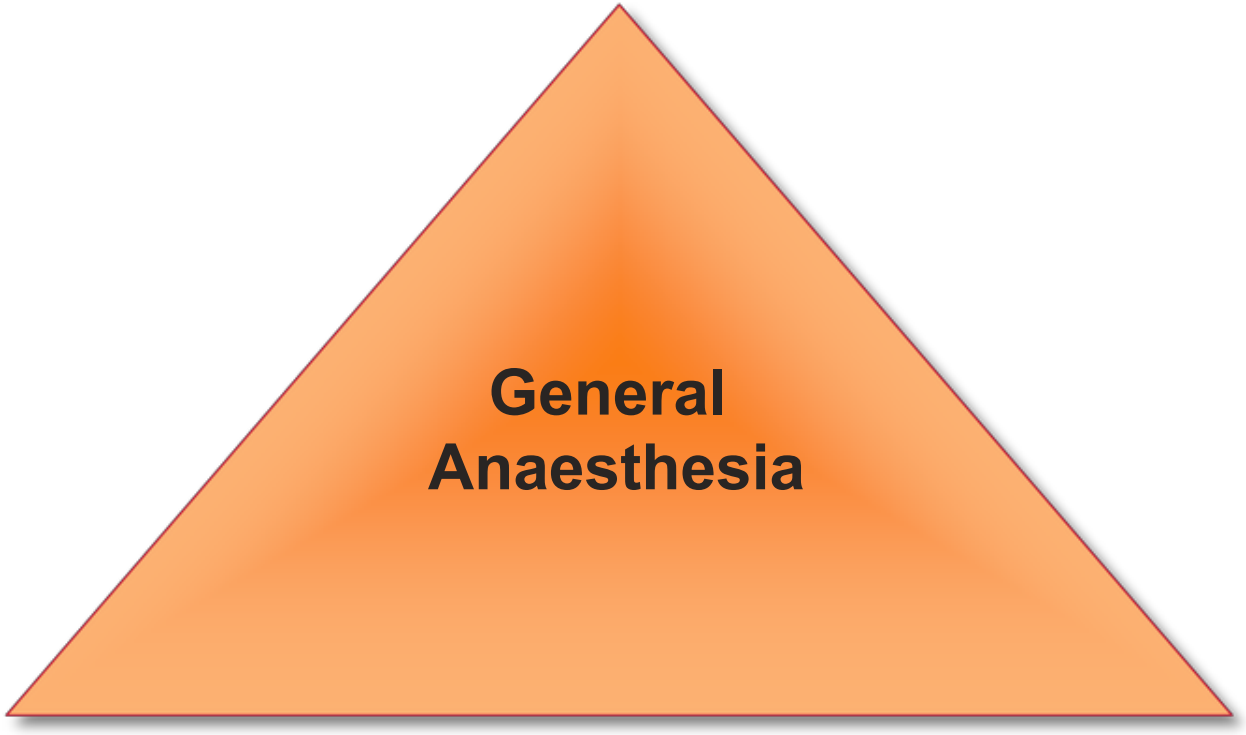
Advancing Practice with Predictable NMB Management

Jan Mulier (Belgium)

The General Anaesthesia Triad: Balanced anaesthesia

Relaxation: Provides Optimal Intubating and Surgical Conditions

NMBAs (neuromuscular blocking agents)



Analgesia: Is Needed to Block Pain

Opioids, non opioids, alpha agonists, LRA

Hypnosis: Creates Amnesia and sleep

Propofol, Inhalation Agents, ketamine,

History of NMB reversal

- 1955: Neostigmine 5 mg is integral part of the ‘Liverpool anaesthetic technique’, because of repeated reports of incomplete recovery at the end of surgery.
  - Ballance J. Obituary. Professor Thomas Cecil Gray.
    Anaesthesia 2008; 63: 564
- 2009: Reversal should be given at any time without muscarinic side-effects.
  - A. Srivastava Reversal of neuromuscular block
    Br J Anaesth 2009; 103: 115

In search for the Ideal NMBA

- Rapid onset, predictable duration and recovery times, and negligible hemodynamic effects.
  - Martinez E. Neuromuscular blocking agents Vet Clin North Am Equine Pract. 2002 Apr;18(1):181-8.

An ideal reversal created the ideal NMBA

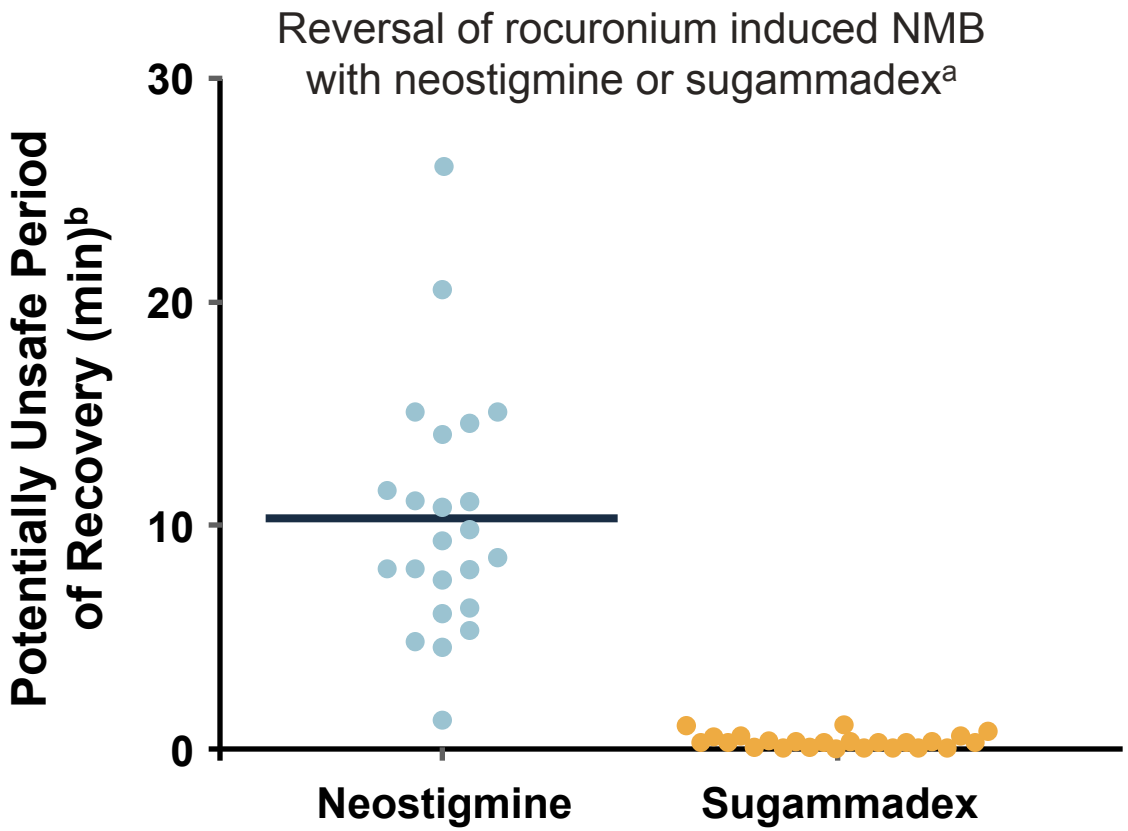
- At this point, it appears that research should now be directed toward finding a non-depolarizing muscle relaxant with the properties of succinylcholine…

- However the ideal was found by the invention of an ideal reversal "cyclodextrine" by Anton Bom

"Sugammadex"

Rapid onset and offset even better than succinylcholine, minimal side effects, predictable duration, easy titration and complete recovery possible at every moment.

Sugammadex vs Neostigmine in Routine Practice[1]



- The potentially unsafe period of recovery was significantly longer in the neostigmine group compared with the sugammadex group (10.3 ± 5.5 min vs 0.3 ± 0.3 min, respectively; *P*<0.001)

[a] In this double-blind and randomized multicenter study, 47 patients scheduled for elective surgery requiring general anaesthesia received either 50 µg/kg neostigmine plus 10µg/kg glycopyrrolate or 2 mg/kg sugammadex when 2 twitch responses were detected after the last dose of rocuronium.

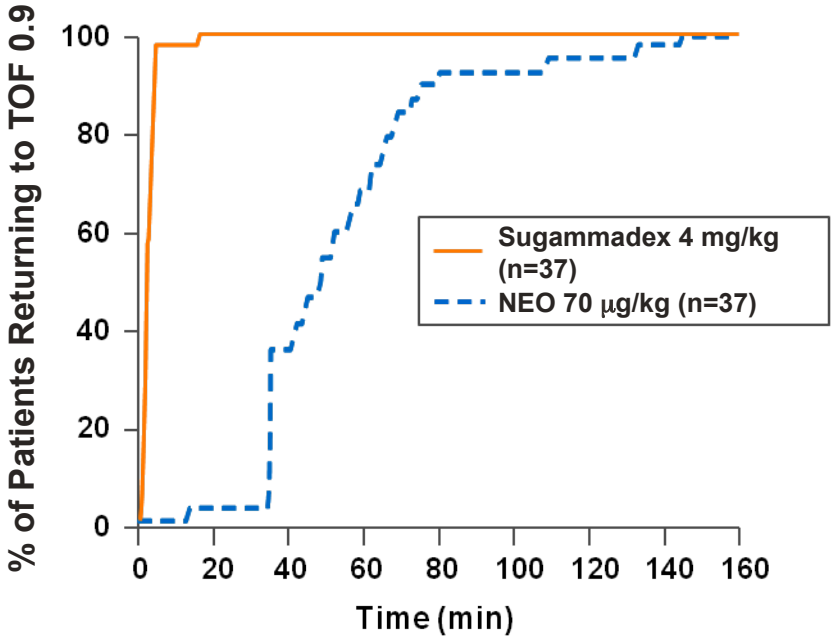
[b] Potentially unsafe period of recovery: time gap between the loss of visual fade to the return of a TOF ratio of 0.90 (alternatively, the "no visual fade paralysis period").

TOF=train of four.

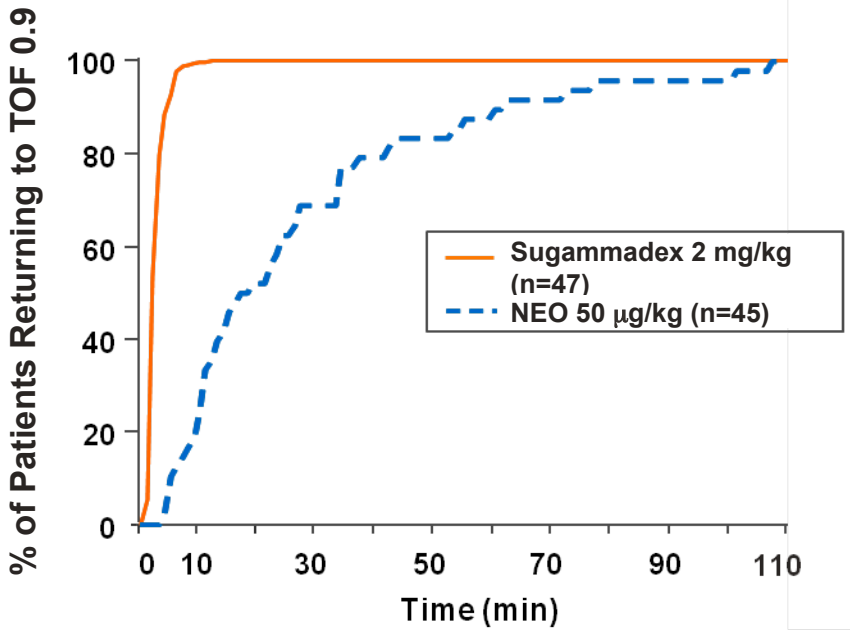
1. Illman HL et al. *Anesth Analg*. 2011;112:63–68.

Predictability and Consistency of Sugammadex Reversal in Moderate and Deep NMB

Reversal from 1 to 2 PTCs following rocuronium[1] 0.6 mg/kg



Reversal from T2 following rocuronium[2] 0.6 mg/kg



NMB=neuromuscular blockade; PTCs=posttetanic counts; TOF=train of four; NEO=neostigmine.

1. Adapted from Jones RK et al. *Anesthesiology*. 2008;109:816–824. **2.** Adapted from Blobner M et al. *Eur J Anaesthesiol.* 2010;27:874–881.

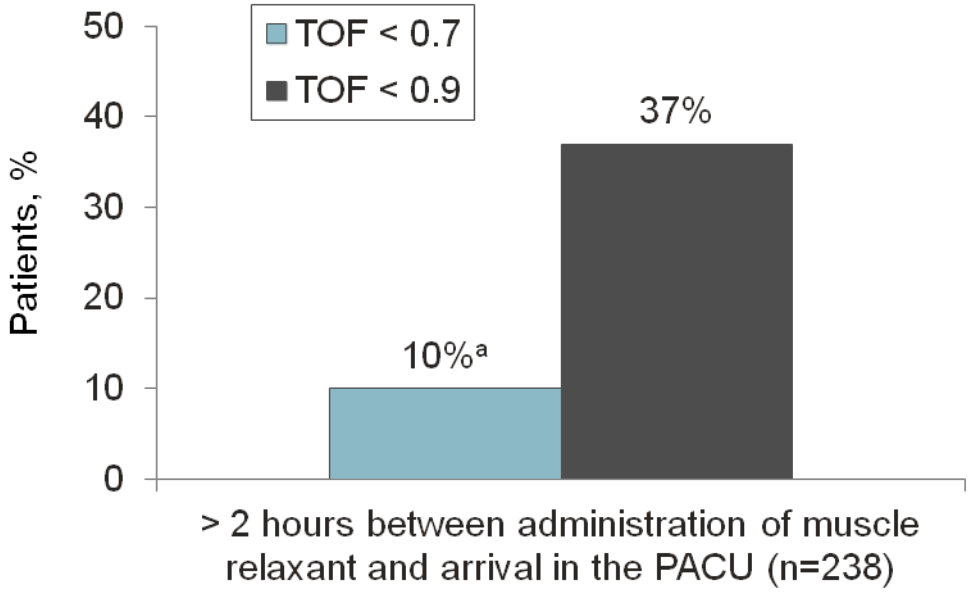
The Ideal Neuromuscular Block Management Tool Exists Today!

- An ideal reversal agent could be given at any time after the administration of a neuromuscular blocking agent (NMBA), and should have no muscarinic side-effects.
  - A. Srivastava Reversal of neuromuscular block Br J Anaesth 2009; 103: 115
- Rocuronium has a fast onset which provides good intubating conditions
- It allows the anaesthesiologist to achieve the desired level of block
- With sugammadex NMB can be reversed rapidly, completely, and predictably at the end of the surgical procedure

The Use of NMBAs Is Associated With High Incidence of Residual NMB

Residual blockade continues to be a common problem, **even after just 1 dose of an NMB agent** with an intermediate duration of action.[1,b]

- 45% of patients had a TOF <0.9 on arrival in the PACU after only a single intubating dose of NMB.[1]



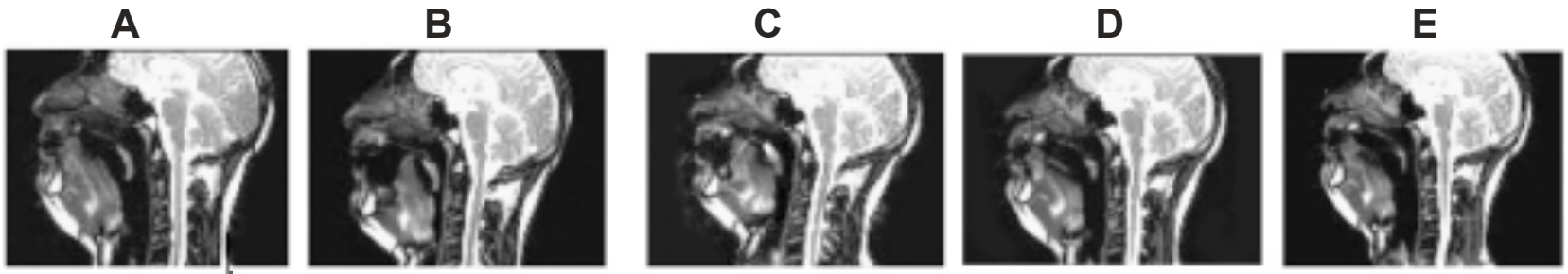
[a] *P*<0.01

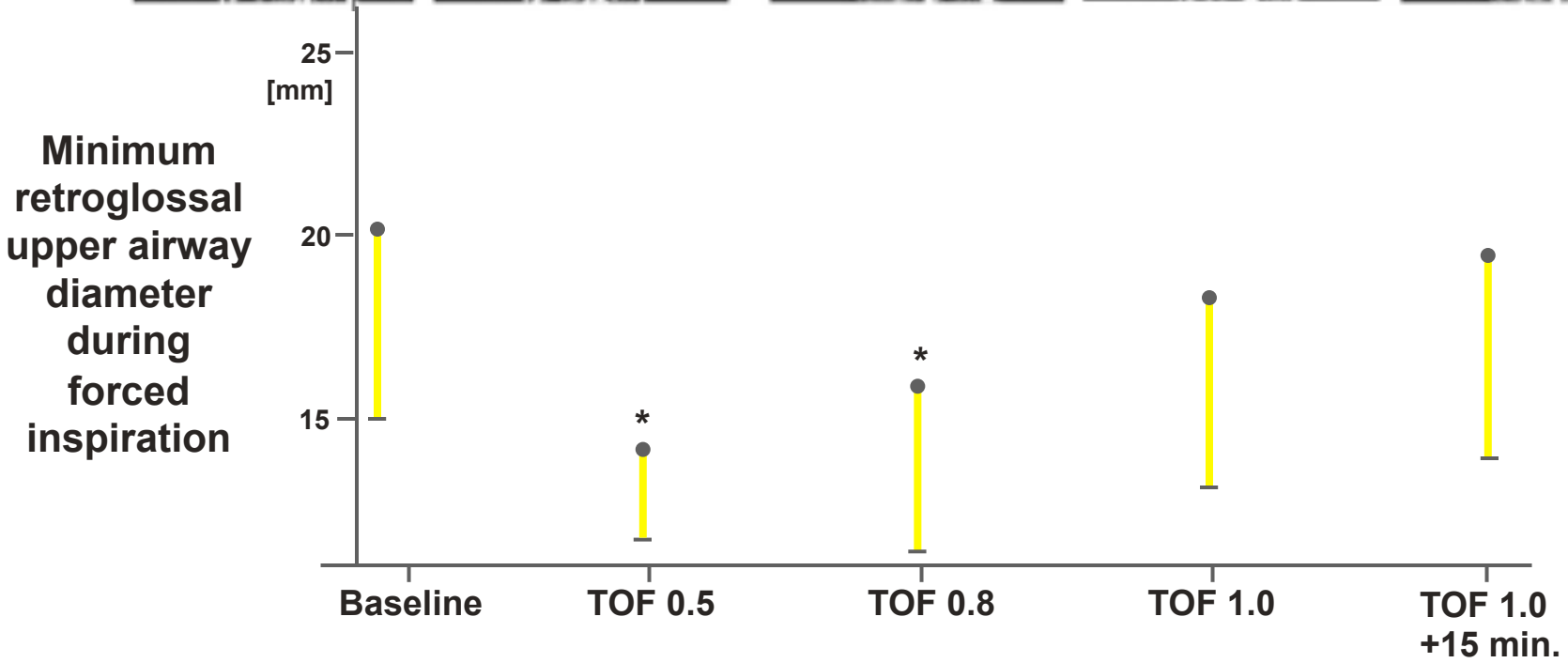
[b] A single, prospective, open-label, nonrandomized, observational study of 526 adult patients with ASA status I-III undergoing gynecologic or plastic surgery. On arrival in the PACU, an anaesthesiologist and a nurse not involved in the surgery, used TOF ratios <0.7 and <0.9 to assess the presence of residual NMB.

NMBAs=neuromuscular blocking agents; NMB=neuromuscular blockade; TOF=train of four; PACU=postanaesthesia care unit; ASA=American Society of Anesthesiologists.

1. Debaene B et al. *Anesthesiology*. 2003;98(5):1042–1048.

TOF < 0.9 increases the risk for Obstructive Breathing with Hypoxia



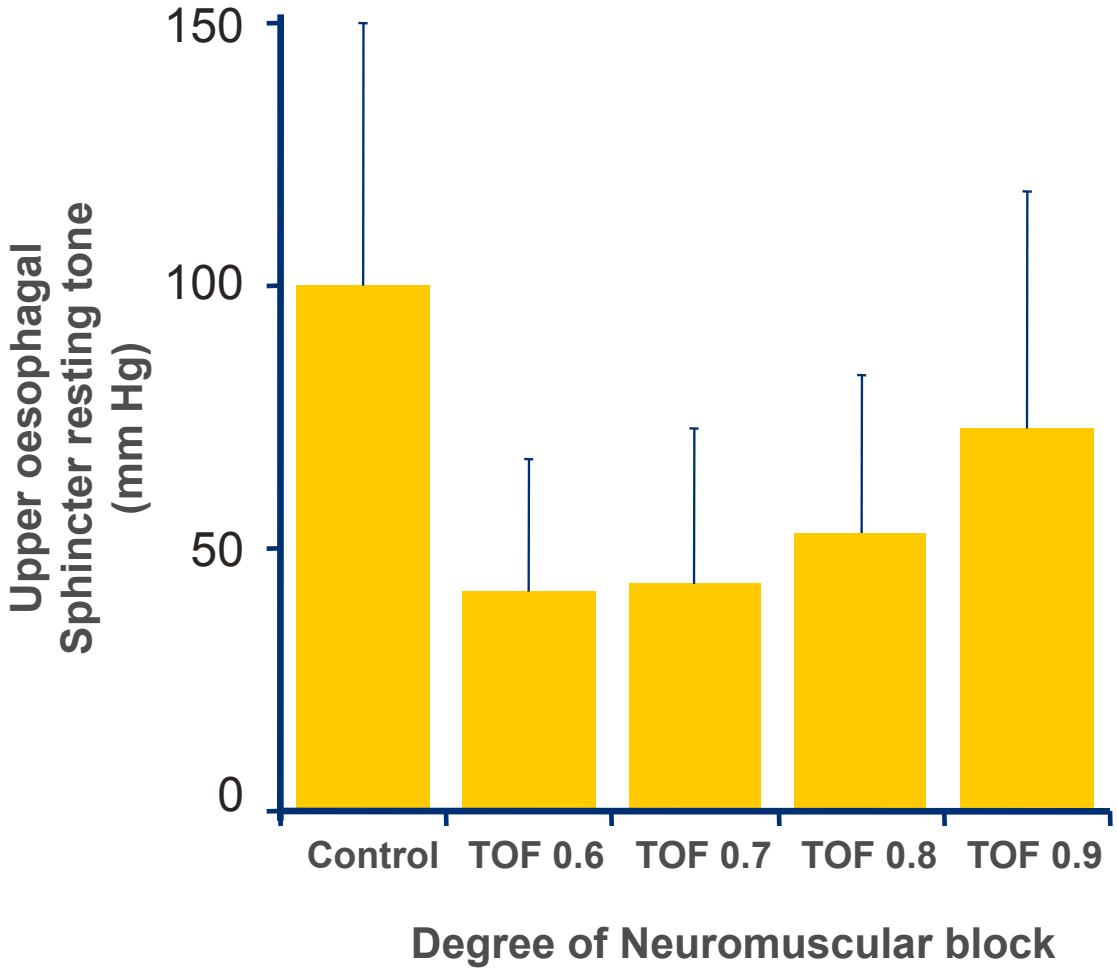


Eikermann, et al. *Am J Respir Crit Care Med*. 2007;175:9-15.

* **P*<0.05 versus baseline

TOF < 0.9 increases the risk of Pharynx Dysfunction with Aspiration

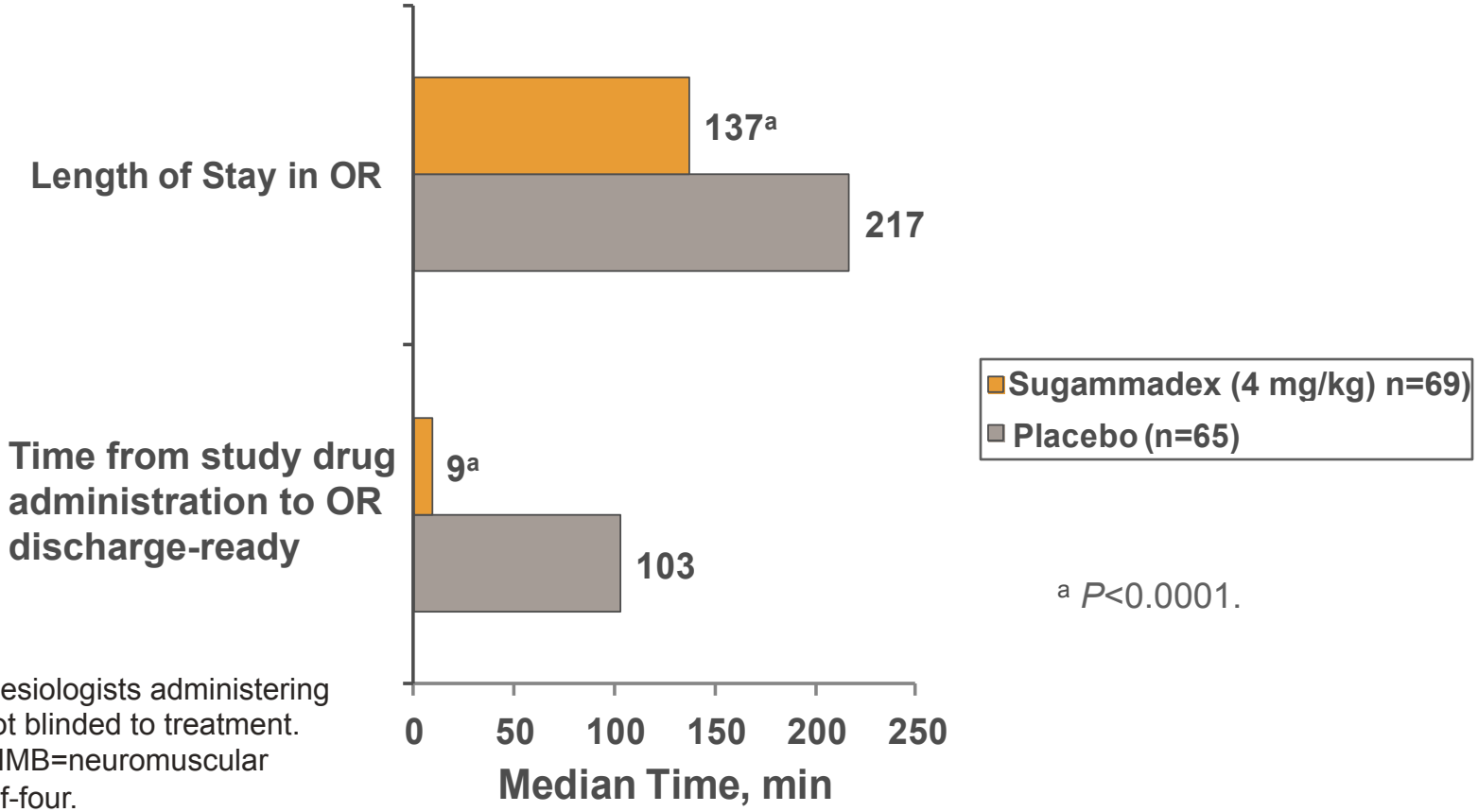
Human volunteers
Partially paralyzed



Eriksson LI, et al. *Anesthesiology*. 1997;87:1035

Length of Stay in OR and OR Discharge-Ready Time Decreased With Sugammadex Reversal of Deep NMB[1,a]

- The primary efficacy endpoint was the time from start of sugammadex or placebo administration to recovery of TOF ratio to 0.9
- Median times to recovery to a TOF ratio of 0.9 were 2.0 and 95.8 min in the sugammadex (n=69) and placebo groups (n=65), respectively (*P*<0.0001)



[a] *P*<0.0001.

[a] In this study, anaesthesiologists administering the study drug were not blinded to treatment.
OR=operating room; NMB=neuromuscular blockade; TOF=train-of-four.

1. Rahe-Meyer N et al. Poster presentation from ESA 2011.

Risk Factors for Postoperative Mortality and Severe Morbidity[1]

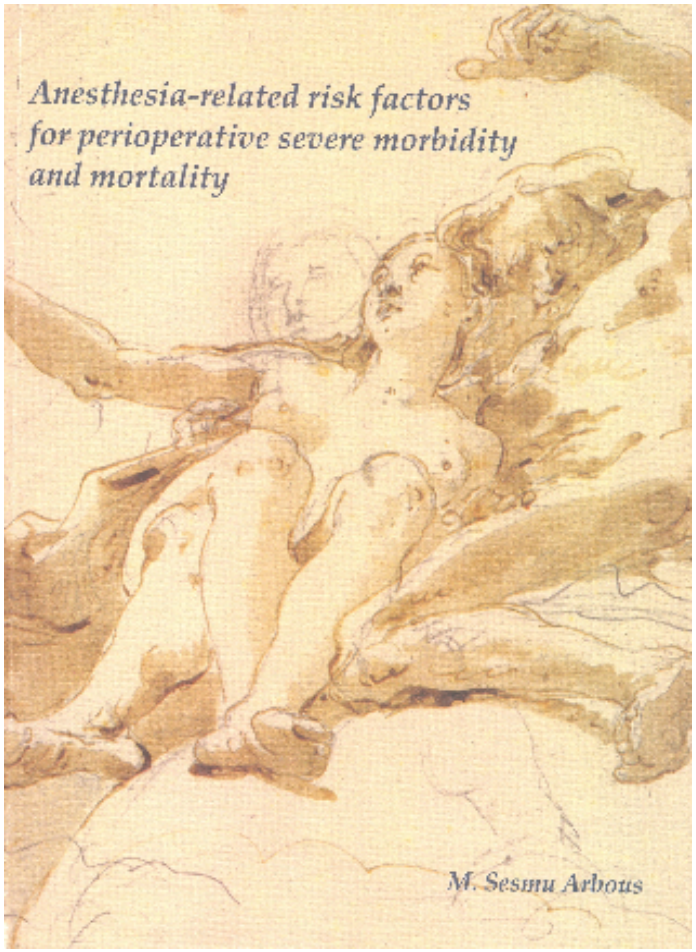
Risk Factor	Category	Odds Ratio
Equipment check	With/without	0.640
Documentation of equipment check	Yes/no	0.607
Reversal of anaesthesia (relaxant)	Yes/no	0.101
Reach ability of anaesthesiologist	Direct/indirect	0.455
Intraoperative change of an anaesthetic	Yes/no	0.444
Presence of anaesthetic nurse	Part time/full time	0.408
Presence at emergence of anaesthesia	1/2	0.687
Opiates/local anaesthetics		0.17/0.06
Epidural/intramuscular		0.23/0.13

869,483 patients, 807 cases and 883 controls

1. Arbous MS et al. *Anesthesiology.* 2005;102:257–268.

Reversal Reduces the Risk for 24-Hour Postoperative Mortality and Coma

- Omitting to reverse residual NMB was associated with a 10-fold increased risk for death or coma

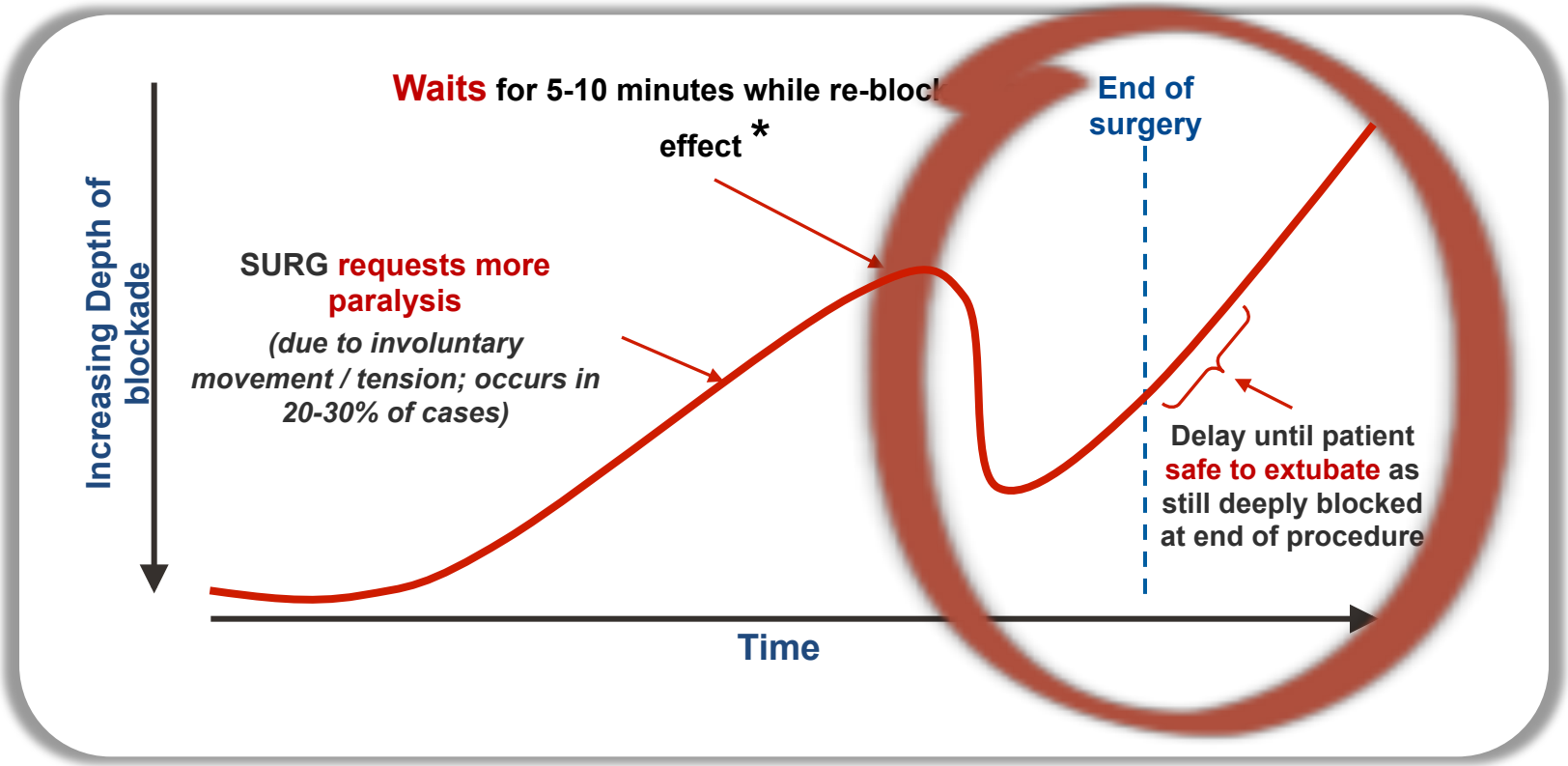


Arbous et al. *Anesthesiology* 2005;102:257-68

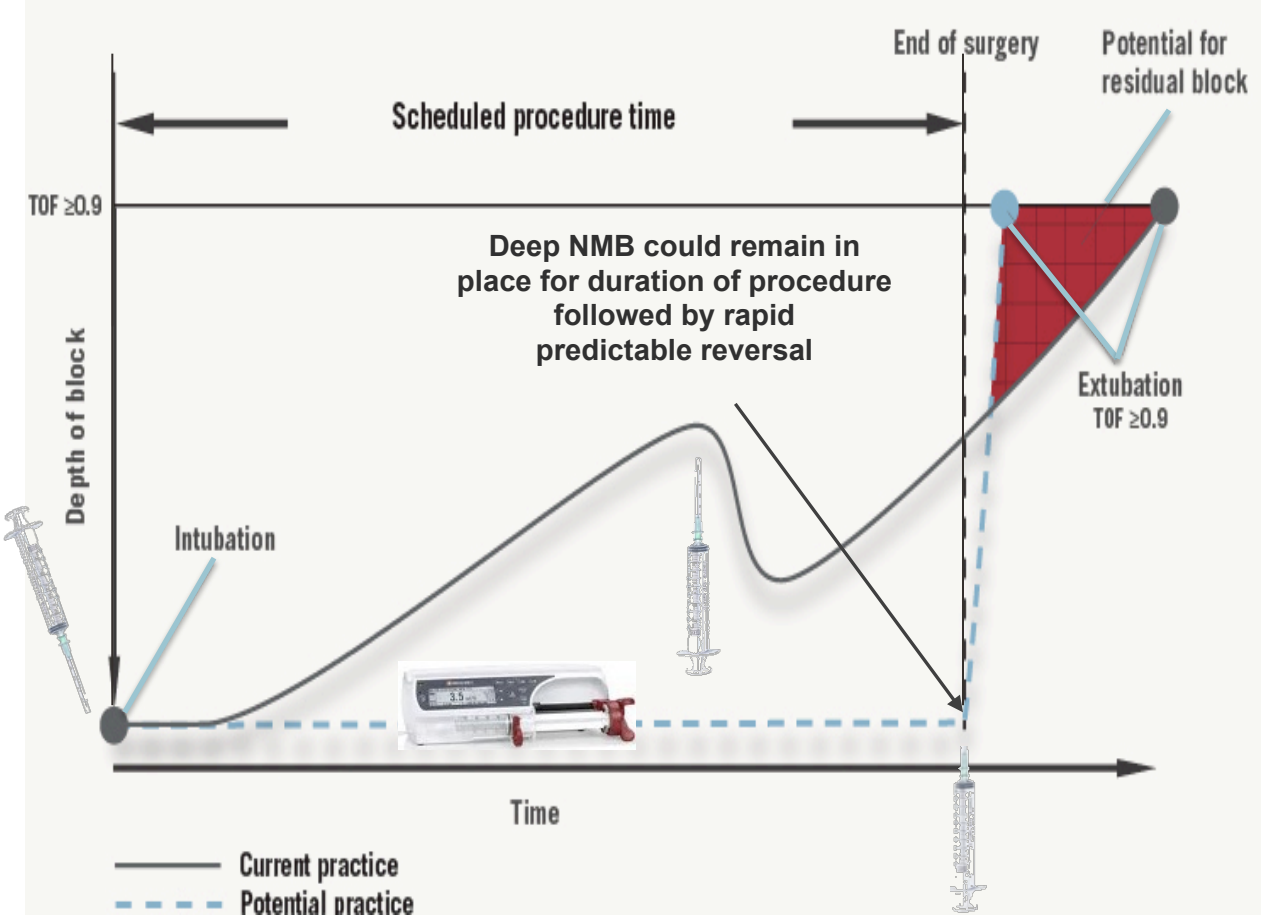
Surgeon Survey Results: Delays Resulting from Sub-optimal NMB

Surgeons described the implications of sub-optimal blockade as extended surgeries resulting from difficult surgical conditions or potentially delays as re-block takes effect

Perception of sub-optimal neuromuscular blockade amongst surgeons



Improved Surgical Conditions Through Sustained Deep NMB Throughout the Procedure



A new neuromuscular management strategy is possible: Relaxant in continuous infusion and a rapid predictable full reversal is always possible.

Conclusion

- *Achieving deep NMB to the end of the procedure is possible and should become the standard.*
  - *Better visual field, no early wake up or pressing*
  - *Lower insufflation pressures*
  - *No waiting time between surgeries*
  - *No residual block in recovery, less respiratory distress*

The Ideal Neuromuscular Block Management Tool Exists Today!

Surgeon-Anaesthetist Collaborative Question-and-Answer Session

Jacob Rosenberg (Denmark)

Closing Comments

Jacob Rosenberg (Denmark)

key take home messages

- talk to your anaesthesiologist!!
- you have to know about anaesthesia
- we have the same goals
  - do no harm
  - improve outcome
- has the potential to benefit patients, administrators, surgeons, and anaesthetists

potential clinical consequences and risks of suboptimal block

- limited field of view
  - safety issue
  - operative time
- sudden contractions
  - safety issue
- block is given too late or not reversed
  - residual blockade
  - slow OR turnover

surgeon

sugammadex

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