In recent years, we gained a new insight about "neuromuscular blockade"(NMB). We can consider that this is one of the "classical" concepts of our branch: its theory is very well-known; the scientific background has been exclusively studied decades ago. New developments have led to the fact that NMB has become again be a subject of debates and new studies.

In recent years, there has been only one molecule which has been introduced as a new-comer to our daily practice: Sugammadex. Sugammadex has changed a lot of things:

On one hand, we have now the feeling that we can use the neuromuscular blocking agents ("NMBA's") in a wider, safer margin. Yes, we are not so afraid of "rest-curarisation" or "re-curarisation", as we were before. We can allow a "deep" blockade, if necessary. And even during a deep block, we can safely (safely?) antagonise the effects of NMBA. Is this information really so true?

On the other hand, we have suddenly "realised" that in the past, we had probably more patients than we suggest who were suffering of the continuing effects of NMBA's. We see studies showing that actually we always need a TOF >0.9, and "older" methods of reversal are often insufficient to achieve this goal. Again, we have suddenly "realised" that we actually needed a deep block more often than we performed. Is this information really so true, too?

These questions (and more) have to be discussed, even in 2018, decades after the "scientific clarification" of neuromuscular blockade.

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Deep Neuromuscular Block Facilitates Laparoscopic Surgery- or Probably Does Not?

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During the past couple of years several authors reported on favourable effects of deep neuromuscular block (NMB) during laparoscopic surgery, suggesting that deep NMB provides suitable surgical space at a reduced inflation pressure, which in turn decreases postoperative pain perception and finally improves outcome of surgery. No matter how promising this suggestion would appaer, the issue is still open to be debated (1).

What we know about this topic is that the inflation of the abdominal cavity may result in hemodynamic changes and that early postoperative pain increases along with incrementally augmented pressure (2). We know that low intraabdominal pressure may compromise the visibility in surgical space and thus may increase the risk of conversion to laparotomy.

To get clear indications for the use of deep NMB during laparoscopic procedures, the following questions have to be answsered.

Firstly, is low inflation pressure is really necessary for laparoscopic surgeries? A Cochrane review compared the effect of low (12 mmHg) and standard (16 mmHg) pressure pneumoperitoneum on the outcome of laparoscopic cholecystectomies. No difference was found between the two groups in surgical morbidity, in conversion rate to open surgery and in patient satisfaction (3). The haemodynamic differences were insignificant and may also have been attributed to differences in inflation techniques or in patients' positioning. Thus low pressure pneumoperitoneum does not appear to offer significant advantage.

Secondly, is their a close correlation between surgical space conditions and surgeons' satisfaction? Surly every anaestitists experienced the typical bad mood of surgeons about poor surgical space conditions like "the patient is pressing, I cannot see properly" sometimes justified, but more often not, irrespective of the depth of NMB. Although several investigators reported batter rating score by surgeons when deep NMB was administred, the quality of data leaves something to be desired (e.g.better assessor blinding, less subjectivity).

For example Martini et al. (4) compared the effect of moderate vs. deep block on operation conditions using a rating score of 1 to 5, the difference being 4.0±0.4 vs. 4.7±0.7, respectively, showing that operating conditions were fairly acceptable under moderate block. Adequate definition and accurate measurement of the depth of NMB is indisponseble for comparison of operating conditions. The stability of the block during the study period is a key point. Deep block defined as posttetanic count 1 (PTC-1) may recover

to moderate block (TOF count 1 or 2) during the study period. Many investigators used a single dose muscle relaxant or gave top-up dose late, at TOFC-1 or 2 (moderate block) (5-7). This means that evaluation of the surgical space did not happen at deep, but at moderate NMB. In other studies the effect of deep block was compared with shallow or minimal block (8). The duration of the majority of laparoscopic procedures is between 60-90 minutes. It is not clear whether the deep block should extend to the entire period of surgery, including also the closure of the fascia, or is it enough to cover the intraabdominal phase. Although the closure of abdominal wall may be easier under deep relaxation, reversal of deep block takes time and prolongs the time to tracheal extubation.

The third question is whether objective neuromuscular monitoring is a must during laparoscopic surgery? Actually, the majority of anesthetist rely on clinical evaluation of the relaxant effect instead of objective monitoring (9). Under these circumstances the wide use of deep NMB increses the risk of postoperative muscle paralysis, thus cannot be recommended. Kotake et al. (10) assessed patients who recieved sugammadex for reversal before extubation of the trachea based on clinical signs of residual paralysis. They found that in 4.3% of patients the reversal of the block was insufficient (TOFR <0.9). Recently Nemes et al. (11) demonstrated that pharmacological reversal based on clinical signs of muscle paralysis was superior to spontaneous recovery, but it did not preclude postoperative residual block, irrespective of the reversal agent. Therefore, we recommend the routine use of objective neuromuscular monitoring during laparoscopic surgery in order to verify the depth of block as well as adequate recovery. This is in line with a recently published international Consensus Statment about the use of neuromuscular monitors (12).

Last but not least the costs generated by using deep NMB should also be taken into account. When intermediate acting relaxants are given, deep block is maintained by administration of repeated boli or IV infusion creating cost increase. The recommended dose of sugammadex is minimum 4 mg kg^{-1} for the reversal of a deep rocuronium or vecuronium induced block. Accordingly, 2 vials of 200 mg sugammadex must be opened for avarege patients weighing 70 or 80 kg; this doubles the cost of reversal versus moderate block. However, if pipecuronium is used instead of rocuronium to elicit deep NMB and sugammadex 2 mg kg^{-1} for reversal, costs can be reduced to the half. Pipecuronium is a steroidal neuromuscular blocker with long duration of action. Its use was discontinued in the 1990s due to its long duration of action being afraid of postoperative residual blockade. Nevertheless, pipecuronium is an excellent, potent NMB agent without side effects and histamine release does not appear to be a problem. With the emergence of sugammadex it turned out that this new reversal agent has high affinity for pipecuronium. A recent clinical study proved that sugammadex 2 mg kg^{-1} promptely and safely reverses deep NMB from pipecuronium (13). Therefore, the combination of pipecuronium block with sugammadex reversal can be regarded a new paradigm for deep NMB.

In summary, there is no convincing evidence for the routine use of deep NMB during laparoscopic surgery. Further studies specifically designed and based on appropriate electrophysiological measurements are needed to prove the benefit of deep NMB during laparoscopic surgery.

References

1. Kopman AF, Naguib M. Is deep neuromuscular block helpful in laparoscopic surgery? No, probably not. Acta Anaesth Scand 2016; 60: 717-22. [CrossRef]
2. Sárkány P, Lengyel S, Nemes R, Orosz L, Páll D, Molnár C, Fülesdi B. Non-invasive pulse wave analysis for monitoring the cardiovascular effects of CO2 pneumoperitoneum during laparoscopic cholecystectomy--a prospective case-series study. BMC Anesthesiol 2014; 14: 98. [CrossRef]
3. Gurusamy KS, Vaughan J, Davidson BR: Low pressure versus standard pressure pneumoperitoneum in laparoscopic cholecystectomy. Cochrane Database Syst Rev 2014; 3: CD006930
4. Martini CH, Boon M, Bevers RF, Aarts LP, Dahan A. Evaluation of surgical conditions during laparoscopic surgery in patients with moderate vs deep neuromuscular block. Br J Anaesth 2014; 112: 498-505. [CrossRef]
5. Madsen MV, Staehr-Rye AK, Gätke MR, Claudius C. Neuromuscular blockade for optimising surgical conditions during abdominal and gynaecological surgery: a systematic review. Acta Anaesthesiol Scand 2015; 59: 1-16. [CrossRef]
6. Madsen VM, Istre O, Springborg HH, Staehr-Rye AK, Rosenberg J, Lund J, et al. Deep neuromuscular blockade and low insufflation pressure during laparoscopic hysterectomy. Dan Med J 2017; 64: 1-5.
7. Bruintjes MH, van Helden EV, Braat AE, Dahan A, Scheffer GJ, van Laarhoven CJ, et al. Deep neuromuscular block to optimize surgical space conditions during laparoscopic surgery: a systematic review and meta-analysis. Br J Anaesth 2017; 118: 834-42. [CrossRef]
8. Staehr-Rye AK, Rasmussen LS, Rosenberg J, Juul P, Lindekaer AL, Riber C, et al. Surgical space conditions during low-pressure laparoscopic cholecystectomy with deep versus moderate neuromuscular blockade: a randomized clinical study. Anesth Analg 2014; 119: 1084-92. [CrossRef]
9. Naguib M, Kopman AF, Lien CA, Hunter JM, Lopez A, Brull SJ. A survey of current management of neuromuscular block in the United States and Europe. Anesth Analg 2010; 111: 110-9. [CrossRef]
10. Kotake Y, Ochiai R, Suzuki T, Ogawa S, Takagi S, Ozaki M, et al. Reversal with sugammadex in the absence of monitoring did not preclude residual neuromuscular block. Anesth Analg 2013; 117: 345-51. [CrossRef]
11. Nemes R, Fülesdi B, Pongrácz A, Asztalos L, Szabó-Maák Z, Lengyel S, et al. Impact of reversal strategies on the incidence of postoperative residual paralysis after rocuronium relaxation without neuromuscular monitoring: A partially randomised placebo controlled trial. Eur J Anaesthesiol 2017; 34: 609-16. [CrossRef]
12. Naguib M, Brull SJ, Kopman AF, Hunter JM, Fülesdi B, Arkes HR, et al. Consensus Statement on Perioperative Use of Neuromuscular Monitoring. Anesth Analg 2017: DOI: 10.1213/ANE.0000000000002670. [CrossRef]
13. Tassonyi E, Pongrácz A, Nemes R, Asztalos L, Lengyel S, Fülesdi B. Reversal of Pipecuronium-Induced Moderate Neuromuscular Block with Sugammadex in the Presence of a Sevoflurane Anesthetic: A Randomized Trial. Anesth Analg 2015; 121: 373-80. [CrossRef]