

Table 3 Moderate vs deep neuromuscular blockade

	level of NMB	Baseline characteristics of study population				surgical characteristics		anaesthetic background		Outcomes		
		n	ASA	Age	Sex (m/f)	Procedure	Technique	Hypnotic	Volatile	Surgical conditions	Pain	Perioperative Complications
Baete S, et al ⁴⁵	moderate (TOF 1-2)	30	I - III	41 (13)		Gastric bypass	Laparascopy	propofol -remi		quality of surgical exposure, 5 point rating scale DNMB 4.2±1, MNMB 3.9±1.1 NS); number of intra-abdominal pressure increases > 18 cm H2O (DNMB 0.2±0.9, MNMB 0.3±1.0, NS); duration from skin incision to skin closure (DNMB 61.3±15.1, MNMB 70.6±20.8, NS)	not reported	not reported
	deep (PTC 1-2)	30	I - III	42 (11)		Gastric bypass	Laparascopy					
Barrio J, et al ⁴⁶	moderate (TOF 1-3)	90	I-II	unclear	unclear	Laparoscopic cholecystectomy	Laparascopy	propofol group 1 and 2, unclear for group 3	unclear	Group 1 low-pressure pneumoperitoneum, moderate NMB TOF 1-3, group 2 low-pressure pneumoperitoneum with deep NMB PTC 1-5; Group 3 standard pressure (12 mm Hg), standard management anesthetist's choice; Surgical conditions 4 point scale at 3 time points: surgical field exposure (group 1 96.7, group 2 96.7 NS) ; dissection of the gallbladder (group1 90% group 2 89,6); extraction-closure(group 1 89.6%, group 2	not reported	not reported

Barrio J, et al ⁴⁷										92.3%); Group 3 versus group 2: greater percentage of good surgical conditions during standard pressure pneumoperitoneum; conclusion BNMB not superior to MNMB; IAB better conditions with normal pressure pneumoperitoneum,		
	deep (1-5 PTC)	90	I-II	unclear	unclear	Laparoscopic cholecystectomy	Laparoscopy					
	moderate (TOF 1-3)	76	I-II	unclear	unclear	unclear	Laparoscopy	Propofol		Pneumoperitoneum 8 mm Hg versus 12, MNMB TOF 1-3, DNMB PTC< 5; Volume of CO2 insufflation during establishment of pneumoperitoneum (41 patients, DNMB 8mm: 2.81±1.13, MNMB 8mm 2.24±1.1, L CO2, P<0.001; DNMB 12 mm: 4.09±1.31 MNMB 12 mm 3.52±1.31 L CO2, P<0.001) and skin-sacral promontory distance (35 patients), DNMB 8 mm 12.16±1.51 cm, MNMB 8 mm 11.78±1.52 cm, P=0.002; DNMB 12 mm 13.8±1.81, MNMB 12 mm 13.34±1.87 cm, P<0.001	not reported	not reported
	deep (PTC<5)	76	I-II	unclear	unclear	unclear	Laparoscopy					
Blobner M, et al ⁴⁸	no NMB	57	I - III	18-75 yrs	(8m/17f)	Laparoscopic cholecystectomy	Laparoscopy		Desflurane	surgical conditions on a visual analog.	No difference in pain 24 h	No difference in FVC and PEF

										Scale (0-100); Significant difference between DNMB and no NMB, P<0.001, difference between groups 36 (CI 20-53), significant improvement after 0.3mg/kg rocuronium (see fig 1 p 631); Intraoperative adverse evnets No NMB 12/25 DNMB 1/25, P<0.001 (see table 2 p631)		
	deep (TOF 0)	57	I - III	18-75 yrs	(7m/18f)	Laparoscopic cholecystectomy	Laparascopy		Desflurane			
Bruinjes MHD, et al ⁴⁹	moderate (TOF 1-3)	51	unclear	56.6 +/- 9.7	24m, 27f	g laparoscopic donor nephrectomy (LDN)	Laparascopy	remifentanil and propofol		not measured	Q of recovery score 40: DNMB 169'0, MNMB 169±15, NS; secondary analysis improved pain scores with DNMB; impossible to summarize;	no difference in postoperative complications
	deep (PTC 1-3)	50	unclear	55.7 +/- 10.2	21m, 29f	g laparoscopic donor nephrectomy (LDN)	Laparascopy	remifentanil and propofol				
Choi BM, et al ⁵⁰	moderate (TOF 1-2)	49	I - III	58 (51-61)	33m, 16f	laparoscopic gastrectomy	Laparascopy	propofol and remifentanil		Outcome VAS (0-10) pain score and oxycodone effective dose; NO difference between DNMB and MNMB in oxycodone doses, 8 mg in both groups	No difference in wound pain and shoulder pain	not reported
	deep (PTC 1-2)	51	I - III	58 (49-63)	35m, 16f	laparoscopic gastrectomy	Laparascopy	propofol and remifentanil				
Dubois PE et al ⁵¹	moderate (unclear)	50	I-II	51.7 +/- 10.9	50f	aparoscopic hysterectomy	Laparascopy		desflurane general anaesthesia	DNMB: TOF<2, versus shallow NMB intubating dose, further dose only if surgical conditions grade 4. Surgical fiels 1 (excellent) - 4 (unacceptable); significant improvement in	not reported	not reported

										surgical field scores in the DNMB group compared to shallow block (not MNMB), see results page 433 and fig 2-3 page 434)		
Fuchs-Buder T, et al ⁵²	deep (unclear)	50	I-II	49,9 +/- 9.8	50f	aparoscopic hysterectomy	Laparoscopy		desflurane general anaesthesia			
	moderate (TOF 1-4)	31	I-III	43 (12,3)	8/23	Gastric bypass	Laparoscopy		Desflurane	Intraoperative surgical conditions (King Score), improvement 29/34, 85,3%	not reported	reported as complication according to surgical conditions, not per group allocation
	deep (PTC 1-3)	34	I-III	45,2 (10,6)	9/25	Gastric bypass	Laparoscopy		Desflurane			
Honing GHM, et al ⁵³	moderate (TOF 1-2)	49	I-III	57 (20-77)	21/28	elective renal surgery	Laparoscopy		sevoflurane	surgical conditions L-SRS, 4,8 (0,4)	Pain NRS > 5: 31%	10%, (N=5)
	deep (PTC 1-2)	49	I-III	51 (22-84)	20/29	elective renal surgery	Laparoscopy		sevoflurane			
Kim HJ, et al ⁵⁴	moderate (TOF 1-2)	28	I-III	51 (41-58)	16/12	gastrectomy	robotic laparoscopy		desflurane	not reported	primary outcome QoR 40 score preop 191 (181-197), POD1: 169 (154-182), POD2 181 (172-186); Pain scores for shoulder pain, abdominal resting pain and active pain, analgetic use: NS reported for 4 time frames, how to summarize this in this sheet ?	not reported
	deep (PTC 1-2)	28	I-III	57 (50-64)	19/9	gastrectomy	robotic laparoscopy		desflurane			
Kim MH, et al ⁵⁵	moderate (TOF 1-2)	31	I-III	56,8 (9,6)	18/13	colorectal surgery	Laparoscopy		desflurane	primary endpoint titrated average IAP 12,0 (0,5)	NRS abdominal pain four time ppoints how to resume ?	not reported
	deep (PTC 1-2)	30	I-III	57,1 (7,7)	18/12	colorectal surgery	Laparoscopy		desflurane			
King M, et al ⁵⁶	moderate (PLACEBO, no NMB)	61	I-II	62,3 (7,0)	61/0	radical retropubic prostatectomy	open		isoflurane	surgical field rating before	VAS 3,0 (2,8)	0%

										after study drug(1-4): treatment failure 17:61 (27,9%)		
Koo BW, et al ⁵⁷	deep (TOF ≤ 1)	59	I-II	62,8 (7,6)	59/0	radical retropubic prostatectomy	open		isoflurane			
	moderate (TOF 1-2)	32	I-II	60 (12)	20/12	colorectal surgery	Laparoscopy		desflurane	primary outcome IAP alarms 14/32; secondary surgical rating (1-5) acceptable 21/32	pain not reported separately, acceptable patient satisfaction score 20/32	not reported
	deep (PTC 1-2)	32	I-II	58 (12)	19/13	colorectal surgery	Laparoscopy		desflurane			
Koo BW, et al ⁵⁸	moderate (TOF 1-2)	32	I-II	48,5 (28-67)	13/19	cholecystectomy	Laparoscopy	propofol TCI		primary outcome necessity to increase IAP, 11/32 (34,4%); secondary outcome intraop patient movement 7/32 (21,9)	postop pain 24 h VAS 5 (0-8); shoulder pain 24 h VAS 4 (0-10)	not reported
	deep (PTC 1-2)	32	I-II	45,1 (27-68)	19/13	cholecystectomy	Laparoscopy	propofol TCI				
Koo CH, et al ⁵⁹	moderate (TOF 1-2)	54 (53)	I - II	70 (11)	46 / 7	transurethral resection of bladder		Propofol	Desflurane	1 = extremely poor, 2 = poor, 3 = acceptable, 4 = good, 5 = optimal		
	deep (PTC 1-2)	54 (51)	I - II	68 (10)	42 / 9	transurethral resection of bladder		Propofol	Desflurane			
Leeman M, et al ⁶⁰	moderate (TOF 1-2)	29 (factorial design, low vs high IAP)		49 (8)	5 / 24	Roux-en-Y gastric bypass	Laparoscopy	Propofol	Desflurane	Directly after the procedure, the surgeon evaluated the overall quality of the surgical field on the Leiden-Surgical Rating Scale (L-SRS), ranging from 1 (extremely poor quality) to 5 (perfect quality)		
	deep (PTC 1-2)	33 (factorial design, low vs high IAP)		48 (13)	6 / 27	Roux-en-Y gastric bypass	Laparoscopy	Propofol	Desflurane			
Madsen MV, et al ⁶¹	moderate (No NMBI)	14 (Crossover Trial --> 7 started with Int. and 7 with Comp.)		44 (7)	7	Gynaecologic	Laparoscopy	Propofol	Propofol Maintenance	Intra-abdominal distance from the sacral promontory to the inserted trocar at pneumoperitoneum of 12 mmHg		
	deep (PTC 0-1)	14 (Crossover Trial --> 7 started		44 (7)	7	Gynaecologic	Laparoscopy	Propofol	Propofol Maintenance			

		with Int. and 7 with Comp.)											
Madsen MV, et al ⁶²	moderate + 12 mmHg pneumoperitoneum ("spontaneous recovery". No fixed TOF count)	55 (50 analyzed)	I - II	48 (5)	0 / 55	Hysterectomy	Laparoscopy	Propofol	Propofol Maintenance				
	deep + 8 mmHg pneumoperitoneum(PTC 0-1)	55 (49 analyzed)	I - II	47 (5)	0 / 55	Hysterectomy	Laparoscopy	Propofol	Propofol Maintenance				
Madsen MV et al ⁶³	moderate ("spontaneous recovery". No fixed TOF count. ~ 10 mg Roc on request)	63	I - III	65 (35-85)	34 / 29	Laparotomy	open	Propofol	Propofol Maintenance	1 = extremely poor, 2 = poor, 3 = acceptable, 4 = good, 5 = optimal			
	deep (PTC 0-1)	65	I - III	63 (31-78)	38 / 27	Laparotomy	open	Propofol	Propofol Maintenance				
Martini CH, et al ⁶⁴	moderate (TOF 1-2)	12	II-III	median (IQR): 60 (24-70)	(10/2)	Prostatectomy	Laparoscopy	propofol	NA	5-point Leiden rating scale ranging from 1 (extremely poor conditions) to 5 (optimal conditions) (by surgeons during surgery and secondly by impartial anaesthesiologist via video analysis) and duration of surgery	10 point-pain score postop in recovery room and length of stay in recovery room	N/A	
	deep (PTC 1-2)	12	II-III	median (IQR): 59 (28-74)	(10/2)	Prostatectomy	Laparoscopy	propofol	NA				
Ozdemir-van-Brunschot DMD, et al ⁶⁵	moderate (TOF 0-1)	19	NR	NR	(13/6)	donor nephrectomy	Laparoscopy with low-pressure PNP (6 mmHg)	propofol	sevoflurane	5-point Leiden rating scale ranging from 1 (extremely poor conditions) to 5 (optimal conditions), duration of surgery, blood loss, duration of pneumoperitoneum; need to increase intra-abdominal pressure, first warm ischemia time (WIT1),	postoperative pain scores (not defined) (different types of pain: superficial and deep wound pain and referred shoulder pain) 1h and 1d postop; opiate use on day 1 and cumulative opiate use after 48 h	Conversions to open procedure; intra-, and postoperative complications (such as bleeding, neuralgia, hypertension)	
	deep (PTC 1-5))	15	NR	NR	(9/6)	donor nephrectomy	Laparoscopy with low-pressure PNP (6 mmHg)	propofol	sevoflurane				
Rosenberg J, et al ⁶⁶	moderate (TOF 2-3)	66 (subgroup 1: N=30)	I - III	mean (SD): 46.1 (17.7); low pressure: 39.1 (13.6)	overall: 40/26	Cholecystectomy	Laparoscopy	propofol	NA	Surgeon's assessment of overall satisfaction with	11-point scale for postoperative pain score	adverse events (AEs)	

		normal pressure ; subgroup 2: n=36 low intra-abdominal pressure)								surgical conditions during surgery (10-point scale)	within 24 h (also 1h,2h,4h, 48h, and on day 3-8)	
	deep (PTC 1-2)	61 (subgroup 1: N=30 normal pressure ; subgroup 2: n=31 low intra-abdominal pressure)	I - III	mean (SD): 43.5 (15.76); low pressure: 46.7 (13.8)	overall: 39/22	Cholecystectomy	Laparoscopy	propofol	NA			
Soderstrom C, et al ⁶⁷	no nmb -> deep (TOF = 0, PTC > 1)	19	I - III	mean (SD): 57 (17)	NR	ventral hernia repair	Laparoscopy	propofol	NA	5-point Leiden rating scale ranging from 1 (extremely poor conditions) to 5 (optimal conditions), change of conditions when switching NMB-technique; duration of surgery/suture time	NR	SAEs
	deep (TOF = 0, PTC > 1) -> no nmb	15	I - III	mean (SD): 55 (15)	NR	ventral hernia repair	Laparoscopy	propofol	NA			
Staehr-Rye AK, et al ⁶⁸	moderate (no measurement; 0.3 mg/kg IV rocuronium was given and neuromuscular function was allowed to recover spontaneously)	23	NR	median (IQR): 48 (35-59)	(10/15)	Cholecystectomy	Laparoscopy	propofol	NA	surgical space conditions (assessed by the surgeon as 1 on a 4-point scale); surgical space conditions on a numeric rating scale (NRS), where NRS 0 (optimal surgical space condition) and NRS 100 (unacceptable surgical space conditions and an intervention was needed to	pain was evaluated as abdominal pain, incisional pain, shoulder pain, and overall pain using VAS (VAS 0 = no pain, 100 = worst possible pain) from the first postoperative assessment to 1 week after surgery, pain	AEs,SAEs, incidence of PONV

										secure acceptable surgical space)	at arrival in the postoperative care unit, 2 hours after surgery and 1 day after surgery, postoperative consumption of analgesics	
	deep (PTC 0 to 1)	25	NR	median (IQR): 45 (42-49)	(6/17)	Cholecystectomy	Laparoscopy	propofol	NA			
Torensma B. et al ⁶⁹	moderate (TOF 1-2)	50	II-III	mean (SD): 47.2 (11.1)	(11/39)	elective Roux-Y-Gastric Bypass (bariatric)	Laparoscopy	propofol	NA	5-point Leiden rating scale ranging from 1 (extremely poor conditions) to 5 (optimal conditions), duration of surgery	11-point numerical rating scale (NRS), ranging from 0 (no pain) to 10 (most pain imaginable) (measurement 4x in the PACU (at 10 min intervals starting upon arrival) and twice on the ward day of surgery + postop day 1); different types of pain: superficial and deep wound pain and referred shoulder pain;	incidence of PONV
	deep (PTC 2-3)	50	II-III	mean (SD): 46.9 (10.6)	(9/41)	elective Roux-Y-Gastric Bypass (bariatric)	Laparoscopy	propofol	NA			
Veelo DP. et al ⁷⁰	no NMB (on demand boluses rocuronium 0.30 mg·kg ⁻¹)	33	I - III	mean (SD): 63 (9)	(27/6)	esophagectomy	thoraco-laparoscopic	propofol	sevoflurane	5-point Leiden rating scale ranging from 1 (extremely poor conditions) to 5 (optimal conditions) and surgical space conditions on a numeric rating scale (NRS), where NRS 0 (optimal surgical space condition) and NRS 100(unacceptable conditions); number of on-demand boluses of rocuronium	postoperative numerical pain rating (NRS) up to 12 hr postoperatively	surgical events or complications intraoperatively; surgical or anesthesia-related intraoperative adverse events; postoperative outcomes (such as complications, ICU length of stay, or mortality)

	deep (0.6 mg/kg/hr + on demand boluses rocuronium 0.30 mg·kg ⁻¹)	33	I - III	mean (SD): 61 (9)	(28/5)	esophagectomy	thoraco-laparoscopic	propofol	sevoflurane			
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Risk of Bias:

low	intermediate	high	not applicable
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