

## Appendix 1

### Neuromuscular blocking drugs (NMB), monitoring and reversal

Please select the answer that best reflects your clinical practice, thank you!

*\*Required*

**1. Anaesthetist's experience:**\* (Mark only one oval.)

- < 6 months
- 6 months to < 1 year
- 1–5 years
- 5 years

**2. How often do you use Train of Four monitoring in patients given non-depolarising NMB?**\* (Mark only one oval.)

- Never
- < 10% of the time
- 10% to < 50% of the time
- 50%
- Always

**3. Use of a peripheral nerve stimulator is essential for all stages of anaesthesia when NMB drugs are administered.**\* (Mark only one oval.)

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

**4. Have been taught how to use Train of Four COUNT in theatres?**\* (Mark only one oval.)

- Yes
- No

**5. Have been taught how to use Train of Four RATIO in theatres?**\* (Mark only one oval.)

- Yes
- No

**6. Case: you give a standard intubating dose of NMB (atracurium 0.5 mg/kg or rocuronium 0.6 mg/kg) for intubation, which lasts 30–40 mins, after surgery lasting ONE hour, do you give reversal?**\* (Mark only one oval.)

- Yes, always
- Yes, depending on time of last dose of NMB
- Yes, depending on if the patient has started breathing
- Yes, depending on mixture of time of last dose of NMB and if the patient has started breathing
- Yes, depending on Train of Four COUNT
- Yes, depending on Train of Four RATIO
- No, not usually
- No, never

**7. Case: you give a standard intubating dose of NMB (atracurium 0.5 mg/kg or rocuronium 0.6 mg/kg) for intubation, which lasts 30–40 mins, after surgery lasting TWO hours, do you give reversal?**\* (You can tick one or more boxes but please be consistent with yes and no.)

- Yes, always
- Yes, depending on time of last dose of NMB
- Yes, depending on if the patient has started breathing
- Yes, depending on mixture of time of last dose of NMB and if the patient has started breathing
- Yes, depending on Train of Four COUNT
- Yes, depending on Train of Four RATIO
- No, not usually
- No, never

**14. A patient is fully reversed when you have:** (Mark only one oval.)

- Train of Four ratio  $\geq 0.7$
- Post tetanic count  $\geq 10$
- Train of Four ratio  $\geq 0.9$
- Double burst stimulation with strong twitches and no fade
- Train of Four with four strong twitches and no fade
- Don't know

**8. You GENERALLY use train of four monitoring for the following cases if given non-depolarising NMB:**\* (You can tick one or more boxes.)

- Short cases
- Long cases
- Difficult airway cases
- Obese or morbidly obese
- Laparoscopic cases
- Renal disease (severe)
- Liver disease (severe)
- Patients on IV infusion of NMB drugs
- I don't generally/never use Train of Four monitoring

**9. For CARDIAC senior anaesthetists (AC, C or SC) anaesthetising CARDIAC CASES, you generally use Train of Four monitoring for your cases:**\* (Mark only one oval.)

- Yes
- No
- I'm not a cardiac senior anaesthetist

**10. For NEURO senior anaesthetists (AC, C or SC) anaesthetising NEURO cases, or juniors in charge of a neuro EOT case, you generally use Train of Four monitoring for your cases:**\* (Mark only one oval.)

- Yes
- No
- I'm not a neuro senior anaesthetist or junior in charge of a neuro EOT case

**11. I would use Train of Four monitoring MORE often BUT:**\* (You can tick one or more boxes.)

- I not familiar with it
- My senior in theatre with me has said that they do not want to use it
- There are not enough Train of Four monitors in theatres
- I don't think it's necessary
- Wouldn't use it more, as I use it often or all the time

**12. Which of the following do you use for Train of Four monitoring?**\* (You can tick one or more boxes.)

- Facial nerve orbicularis oculi muscle
- Facial nerve corrugator supercilii muscle
- Ulnar nerve adductor pollicis muscle
- Common peroneal nerve big toe
- Posterior tibial nerve big toe
- I don't use Train of Four monitoring

**13. Definition of duration of a standard intubating dose of NMB is from time to IV administration of the NMB to:**\* (Mark only one oval.)

- T1 twitch return of 25% baseline
- TOF ratio of 0.9
- TOF count 4 twitches with no fade
- EtCO<sub>2</sub> showing diaphragmatic notching, or return of adequate spontaneous ventilation
- Don't know

**21. If using neostigmine as a reversal agent, the ideal time to give reversal is:**\* (Mark only one oval.)

- 30–60 minutes after the last dose of NMB depending on NMB used
- TOF count 2 twitches
- TOF count 4 twitches
- Post-tetanic count of 10
- Don't know

15. You can confidently teach and demonstrate the clinical use of Train of Four count, Train of Four ratio and Post Tetanic Count?\*

(Mark only one oval.)

- Yes
- No

16. Definition of INTENSE block is:\* (Mark only one oval.)

- Train of four 0, double burst stimulation 0
- Train of four 0, post tetanic count 0
- Train of four 0, post tetanic count 12
- Train of four 0, single twitch 0
- Don't know

17. Definition of DEEP block is:\* (Mark only one oval.)

- Train of four 0, double burst stimulation 0
- Train of four 0, post tetanic count 0
- Train of four 0, post tetanic count 12
- Train of four 0, single twitch 0
- Don't know

18. You have administered a non-depolarising NMB to your patient for intubation. At the end of surgery, the patient is spontaneously breathing with good tidal volumes, do you generally give reversal?\*

(You can tick one or more boxes but please be consistent with yes and no.)

- Yes
- No
- Depends on TOF COUNT
- Depends on TOF RATIO
- Don't know

19. Neostigmine is clinically useful for reversal of:\* (You can tick one or more boxes.)

- Suxamethonium
- Mivacurium
- Atracurium
- Rocuronium
- Pancuronium
- Vecuronium

20. Sugammadex is clinically useful for reversal of:\* (You can tick one or more boxes.)

- Suxamethonium
- Mivacurium
- Atracurium
- Rocuronium
- Pancuronium
- Vecuronium

22. What is the incidence of post operative residual block in PACU (recovery) following intraoperative administration of NMB?\*

(Mark only one oval.)

- 0%–19%
- 20%–39%
- 40%–59%
- 60%–79%
- 80%–100%
- Don't know

23. Neostigmine:\* (Mark only one oval.)

- Can increase Train of Four ratio (reverse neuromuscular block)
- Can decrease Train of Four ratio (increase neuromuscular block)
- Both above answers
- Don't know

24. Which clinical test do YOU use to decide whether a patient is adequately reversed?\*

(You can tick one or more boxes.)

- Head lift 5 seconds
- Hand grip 5 seconds
- Leg lift 5 seconds
- Return of spontaneous ventilation with good tidal volumes
- Tongue depressor test
- I don't use clinical tests to decide

25. The following order of muscles is the correct order of resistance (first being the most, and last being the least resistant) to NMB?\*

(Mark only one oval.)

- Diaphragm, vocal cords, orbicularis oculi, abdominal muscle, adductor pollicis, pharyngeal & tongue
- Diaphragm, vocal cords, adductor pollicis, orbicularis oculi, abdominal muscle, pharyngeal & tongue
- Diaphragm, vocal cords, adductor pollicis, pharyngeal & tongue, orbicularis oculi, abdominal muscle
- Orbicularis oculi, abdominal muscle, diaphragm, vocal cords, adductor pollicis, pharyngeal & tongue
- Adductor pollicis, pharyngeal & tongue, diaphragm, vocal cords, orbicularis oculi, abdominal muscle
- Don't know

## Appendix 2

### Results of postoperative residual neuromuscular block survey (n = 150).

Question	No. (%)	%	
		Incorrect answer*	Non-adherence*
<b>1. Anaesthetist's experience</b>			
< 6 months	23 (15.3)		
6 months to < 1 year	7 (4.7)		
1–5 years	58 (38.7)		
> 5 years	62 (41.3)		
<b>2. How often do you use TOF monitoring in patients given non-depolarising NMB?</b>			
Never	12 (8.0)		98.7
< 10% of the time	116 (77.3)		
10% to < 50% of the time	16 (10.7)		
> 50% of the time	4 (2.7)		
100% <sup>†</sup>	2 (1.3)		
<b>3. Use of a peripheral nerve stimulator is essential for all stages of anaesthesia when NMB drugs are administered.</b>			
Strongly disagree	5 (3.3)		62.0
Disagree	42 (28.0)		
Neither agree nor disagree	46 (30.7)		
Agree <sup>‡</sup>	48 (32.0)		
Strongly agree <sup>‡</sup>	9 (6.0)		
<b>4. Have you been taught TOF count in theatres?</b>			
Yes	141 (94.0)		
No	9 (6.0)		
<b>5. Have you been taught TOF ratio in theatres?</b>			
Yes	94 (62.7)		
No	56 (37.3)		
<b>6. You give a standard intubating dose of NMB (atracurium 0.5 mg/kg or rocuronium 0.6 mg/kg) for intubation, which lasts 30–40 min. After surgery lasting ONE hour, do you give reversal?</b>			
Yes, always <sup>‡</sup>	101 (67.3)		
Yes, depending on time of last dose of NMB	18 (12.0)		12.0
Yes, depending on if the patient has started breathing	1 (0.7)		0.7
Yes, depending on mixture of time of last dose of NMB and if the patient has started breathing	16 (10.7)		10.7
Yes, depending on TOF count <sup>‡</sup>	8 (5.3)		94.7
Yes, depending on TOF ratio <sup>‡</sup>	5 (3.3)		96.7
No, not usually	0 (0)		0
No, never	1 (0.7)		0.7
<b>7. You give a standard intubating dose of NMB (atracurium 0.5 mg/kg or rocuronium 0.6 mg/kg) for intubation, which lasts 30–40 mins. After surgery lasting TWO hours, do you give reversal?<sup>§</sup></b>			
Yes, always <sup>‡</sup>	53 (35.3)		
Yes, depending on time of last dose of NMB	44 (29.3)		29.3
Yes, depending on if the patient has started breathing	10 (6.7)		6.7
Yes, depending on mixture of time of last dose of NMB and if the patient has started breathing	38 (25.3)		25.3
Yes, depending on TOF count <sup>‡</sup>	20 (13.3)		86.7
Yes, depending on TOF ratio <sup>‡</sup>	16 (10.7)		89.3
No, not usually	10 (6.7)		6.7
No, never	0 (0)		0
<b>8. You generally use TOF monitoring for the following cases if given non-depolarising NMBA<sup>§</sup></b>			
Short cases <sup>‡</sup>	53 (35.3)		64.7
Long case <sup>‡</sup>	32 (21.3)		78.7
Difficult airway cases <sup>‡</sup>	65 (43.3)		56.7
Obese or morbidly obese <sup>‡</sup>	62 (41.3)		58.7
Laparoscopic cases <sup>‡</sup>	8 (5.3)		94.7
Renal disease (severe) <sup>‡</sup>	31 (20.7)		79.3

Liver disease (severe) <sup>†</sup>	32 (21.3)		78.7
Patients on intravenous infusion of NMB drugs <sup>†</sup>	74 (49.3)		50.7
I don't generally/never use TOF monitoring	38 (25.3)		25.3
<b>9. For cardiac anaesthetists anaesthetizing cardiac cases, you generally use TOF monitoring for your cases:</b>			
Yes	0 (0)		
No	10 (6.7)		
I'm not a cardiac senior anaesthetist	140 (93.3)		
<b>10. For neurology senior anaesthetists anaesthetizing neurosurgical cases, or juniors in charge of a neurosurgical emergency case, you generally use TOF monitoring for your cases:</b>			
Yes	4 (2.7)		
No	34 (22.7)		
I'm not a neuroanaesthetist or junior in charge of neurosurgical cases	112 (74.7)		
<b>11. I would use TOF monitoring more often but:<sup>5</sup></b>			
I'm not familiar with it	13 (8.7)		
My senior in theatre with me has said that they do not want to use it	56 (37.3)		
There are not enough TOF monitors in theatres	64 (42.7)		
I don't think it's necessary	51 (34.0)		
Wouldn't use it more, as I use it often or all the time	7 (4.7)		
<b>12. Which of the following do you use TOF monitoring?<sup>5</sup></b>			
Facial nerve – orbicularis oculi muscle	35 (23.3)		
Facial nerve – corrugator supercilii muscle	5 (3.3)		
Ulnar nerve – adductor pollicis muscle	142 (94.7)		
Common peroneal nerve – big toe	9 (6.0)		
Posterior tibial nerve – big toe	9 (6.0)		
I don't use TOF monitoring	7 (4.7)		
<b>13. Definition of duration of a standard intubating dose of NMB is from time to IV administration of the NMB to:</b>			
T1 twitch return of 25% baseline <sup>†</sup>	47 (31.3)	68.7	
TOF ratio of 0.9	37 (24.7)		
TOF count 4 twitches with no fade	27 (18.0)		
EtCO <sub>2</sub> showing diaphragmatic notching or return of adequate spontaneous ventilation	4 (2.7)		
Don't know	35 (23.3)		
<b>14. A patient is fully reversed when you have:</b>			
TOF ratio ≥ 0.7	7 (4.7)	46.0	
Post tetanic count ≥ 10	1 (0.7)		
TOF ratio ≥ 0.9 <sup>†</sup>	81 (54.0)		
Double burst stimulation with strong twitches and no fade	8 (5.3)		
TOF with four strong twitches and no fade	41 (27.3)		
Don't know	5 (3.3)		
<b>15. You can confidently teach and demonstrate the clinical use of train of four count, train of four ratio and post-tetanic count?</b>			
Yes	56 (37.3)		
No	94 (62.7)		
<b>16. Definition of INTENSE block is:</b>			
TOF 0, double burst stimulation 0	16 (10.7)	39.3	
TOF 0, post-tetanic count 0 <sup>†</sup>	91 (60.7)		
TOF 0, post-tetanic count 1–2	13 (8.7)		
TOF 0, single twitch 0	4 (2.7)		
Don't know	26 (17.3)		
<b>17. Definition of DEEP block is:</b>			
TOF 0, double burst stimulation 0	10 (6.7)	43.3	
TOF 0, post-tetanic count 0	22 (14.7)		
TOF 0, post-tetanic count 1–2 <sup>†</sup>	85 (56.7)		
TOF 0, single twitch 0	2 (1.3)		
Don't know	31 (20.7)		
<b>18. You have administered a non-depolarising NMB to your patient for intubation. At the end of surgery, the patient is spontaneously breathing with good tidal volumes, do you generally give reversal?<sup>5</sup></b>			
Yes <sup>‡</sup>	91 (60.7)		

No	29 (19.3)		19.3
Depends on TOF count <sup>†</sup>	26 (17.3)		82.7
Depends on TOF ratio <sup>†</sup>	35 (23.3)		76.7
Don't know	2 (1.3)		1.3
<b>19. Neostigmine is clinically useful for the reversal of:<sup>5</sup></b>			
Suxamethonium	4 (2.7)	2.7	
Mivacurium	45 (30.0)	30.0	
Atracurium <sup>†</sup>	150 (100.0)	0	
Rocuronium <sup>†</sup>	126 (84.0)	16.0	
Pancuronium <sup>†</sup>	111 (74.0)	26.0	
Vecuronium <sup>†</sup>	118 (78.7)	21.3	
<b>20. Sugammadex is clinically useful for the reversal of:<sup>5</sup></b>			
Suxamethonium	5 (3.3)	3.3	
Mivacurium	3 (2.0)	2.0	
Atracurium	1 (0.7)	0.7	
Rocuronium <sup>†</sup>	147 (98.0)	2.0	
Pancuronium <sup>†</sup>	28 (18.7)		
Vecuronium <sup>†</sup>	72 (48.0)	52.0	
<b>21. If using neostigmine, the ideal time to give it is:</b>			
30–60 min after the last dose of NMB, depending on NMB used	15 (10.0)	45.3	
TOF count 2 twitches	45 (30.0)		
TOF count 4 twitches <sup>†</sup>	82 (54.7)		
Post-tetanic count of 10	3 (2.0)		
Don't know	5 (3.3)		
<b>22. What is the incidence of postoperative residual block in PACU after intraoperative administration of NMB?</b>			
0%–19%	36 (24.0)	58.7	
20%–39% <sup>†</sup>	42 (28.0)		
40%–59% <sup>†</sup>	20 (13.3)		
60%–79%	6 (4.0)		
80%–100%	2 (1.3)		
Don't know	44 (29.3)		
<b>23. Neostigmine</b>			
Can increase TOF ratio (reverse NMB)	49 (32.7)	43.3	
Can decrease TOF ratio (increase NMB)	1 (0.7)		
Both above answers <sup>†</sup>	85 (56.7)		
Don't know	15 (10.0)		
<b>24. What clinical tests do you use to decide whether a patient is adequately reversed?<sup>5</sup></b>			
Head lift 5 seconds	109 (72.7)		72.7
Hand grip 5 seconds	60 (40.0)		40.0
Leg lift 5 seconds	8 (5.3)		5.3
Return of spontaneous ventilation with good tidal volumes	99 (66.0)		66.0
Tongue depressor test	4 (2.7)		2.7
I don't use clinical tests to decide <sup>†</sup>	15 (10.0)		90.0
<b>25. The following order of muscles is the correct order of resistance (first being the most, and last being the least resistant) to NMB?</b>			
Diaphragm, vocal cords, orbicularis oculi, abdominal muscle, adductor pollicis, pharyngeal & tongue <sup>†</sup>	49 (32.7)	67.3	
Diaphragm, vocal cords, adductor pollicis, orbicularis oculi, abdominal muscle, pharyngeal & tongue	24 (16.0)		
Diaphragm, vocal cords, adductor pollicis, pharyngeal & tongue, orbicularis oculi, abdominal muscle	26 (17.3)		
Orbicularis oculi, abdominal muscle, diaphragm, vocal cords, adductor pollicis, pharyngeal & tongue	15 (10.0)		
Adductor pollicis, pharyngeal & tongue, diaphragm, vocal cords, orbicularis oculi, abdominal muscle	12 (8.0)		
Don't know	24 (16.0)		

\*Incorrect answers (including 'don't know') to knowledge-based questions or non-adherence to best clinical practice. For multiple-choice questions with

only one answer allowed, % incorrect answer or non-adherence was calculated per question =  $((150 - \text{correct responses})/150) \times 100$ . For multiple choice questions with multiple answers allowed, % incorrect answer or non-adherence was calculated per answer option. If the answer was incorrect, the % incorrect or non-adherence was the same % as those who answered this option. If the answer was correct, % incorrect or non-adherence =  $((150 - \text{correct responses})/150) \times 100$ . †Correct answer. ‡Equivocal answers were possible, so % incorrect answer or non-adherence were not calculated. \$Multiple answers allowed. IV: intravenous; NMB: neuromuscular block; PACU: postoperative anaesthetic care unit; TOF: train of four