



CONSORCI  
HOSPITAL GENERAL  
UNIVERSITARI  
VALÈNCIA



Servicio de Anestesia,  
Reanimación y Tratamiento del Dolor  
HOSPITAL GENERAL UNIVERSITARIO VALENCIA

# **DIRECTRICES ACTUALIZADAS SOBRE RELAJANTES MUSCULARES Y REVERSIÓN EN ANESTESIA.**

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**Servicio de Anestesia Reanimación y Tratamiento del Dolor  
Consortio Hospital General Universitario de Valencia**

# Índice

- 1) Introducción: Importancia del problema
- 2) Recomendaciones. Documentos:
  - 1) 2023 ESAIC Guidelines
  - 2) 2023 ASA Guidelines
  - 3) 2023 SEDAR Documento de consenso
- 3) Conclusiones: Mensajes para casa
- 4) Bibliografía

# 1. INTRODUCCIÓN

¿Cuál es la incidencia de bloqueo neuromuscular residual en nuestro centro?

a) < 5%

b) 5% – 10%

c) 10% - 20%

d) > 20%

# 1. INTRODUCCIÓN

¿Cuál es la incidencia de bloqueo

neuromuscular residual en **Europa**?

a) < 5%

b) 5% – 10%

c) 10% - 20%

d) > 20%

# Post-anaesthesia pulmonary complications after use of muscle relaxants (POPULAR): a multicentre, prospective observational study

211 ciudades  
28 países

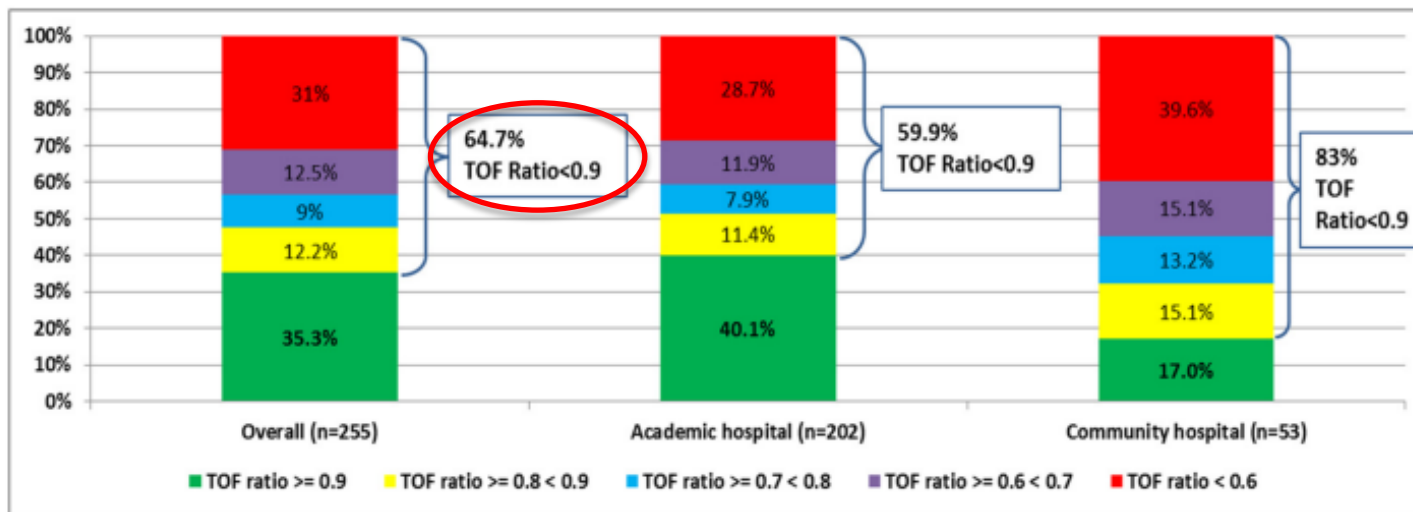
Eva Kirmeier, Lars I Eriksson, Heidrun Lewald, Malin Jonsson Fagerlund, Andreas Hoeft, Markus Hollmann, Claude Meistelman, Jennifer M Hunter, Kurt Ulm, Manfred Blobner, and the POPULAR Contributors

	Anaesthetised patients (n=21 694)	Patients receiving NMBA's (n=17 150)	Patients with any NMM (n=6868)	Patients with quantitative NMM (n=4182)	Patients receiving a reversal agent (n=8795)
<b>Outcomes*</b>					
Any postoperative pulmonary complication	1658 (7.6%)	1441 (8.4%)	733 (10.7%)	441 (10.5%)	780 (8.9%)
Intermediate or severe postoperative pulmonary complication	1028 (4.7%)	884 (5.2%)	428 (6.2%)	245 (5.9%)	483 (5.5%)
<b>Factors in neuromuscular management*</b>					
NMBA used	17 693 (81.6%)	All	All	All	All
Any combination of NMBA's	NA	2070 (12.1%)	803 (11.7%)	422 (10.1%)	1290 (14.7%)
Expected duration of NMBA	NA	119 (79)	122 (77)	119 (79)	132 (74)
<68 min	NA	3448 (20.1%)	1335 (19.4%)	912 (21.8%)	997 (11.3%)
68 to <91 min	NA	3325 (19.4%)	1349 (19.6%)	849 (20.3%)	1516 (17.2%)
91 to <115 min	NA	3462 (20.2%)	1342 (19.5%)	768 (18.4%)	1904 (21.6%)
115 to <159 min	NA	3462 (20.2%)	1381 (20.1%)	804 (19.2%)	2197 (25.0%)
≥159 min	NA	3453 (20.1%)	1461 (21.3%)	849 (20.3%)	2181 (24.8%)
Expected duration of last NMBA dose	NA	59 (42)	55 (41)	55 (42)	55 (41)
No incremental NMBA	NA	8845 (51.6%)	3178 (46.3%)	2034 (48.6%)	3422 (38.9%)
<19 min	NA	2079 (12.1%)	1029 (15.0%)	647 (15.5%)	1443 (16.4%)
19 to <25 min	NA	2079 (12.1%)	900 (13.1%)	505 (12.1%)	1411 (16.0%)
25 to <39 min	NA	2101 (12.3%)	933 (13.6%)	537 (12.8%)	1358 (15.4%)
≥39 min	NA	2046 (11.9%)	828 (12.1%)	459 (11.0%)	1161 (13.2%)
NMM used	NA	7223 (42.1%)	All	All	4312 (49.0%)
Quantitative NMM during emergence	NA	NA	4182 (60.9%)	All	NA
Train-of-four ratio ≥0.90 at extubation	NA	NA	NA	2839 (67.9%)	NA
Reversal agent given	NA	8223 (47.9%)	2619 (38.1%)	1874 (44.8%)	All
Sugammadex but not neostigmine	NA	NA	NA	NA	1990 (22.6%)
<b>Cofactor†</b>					



Original Contribution

# Incidence, risk factors, and consequences of residual neuromuscular block in the United States: The prospective, observational, multicenter RECITE-US study

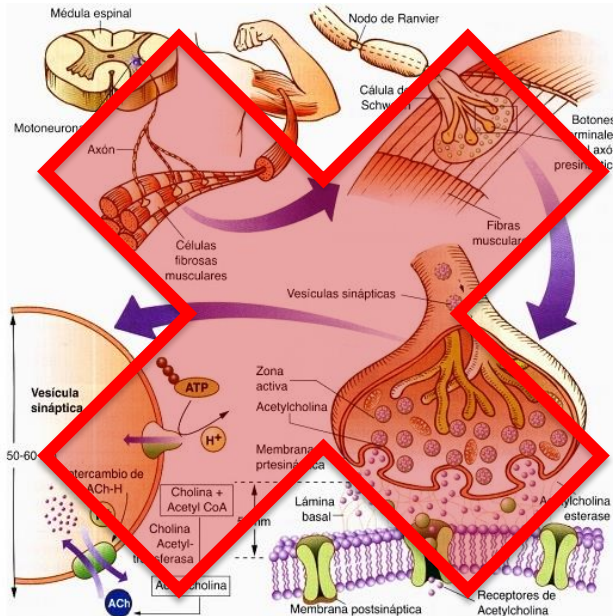


**Fig. 2.** Incidence of residual neuromuscular block at tracheal extubation. Train-of-four (TOF) ratio (T4/T1); Per protocol population (n = 255); Data are n with [%; 95% confidence intervals].



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Valencia, 07 de marzo de 2023**

# Focused guidelines.



Anestesia,  
n y tratamie  
ERAL... SI

**EDITORIAL**

**Adapt or perish**

*Introducing focused guidelines*



# Focused Guidelines



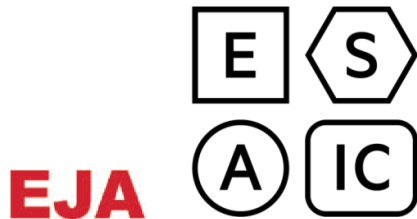
**Infodemic**: *Too much information including false or misleading information in digital and physical environments during a disease outbreak. It causes confusion and risk-taking behaviours that can harm health.*

- Más cortas.
- Más dirigidas a un tema en concreto.
- Misma metodología = mismo nivel de evidencia científica.

STAY FOCUSED



# 2. Recomendaciones



European Society of  
Anaesthesiology and  
Intensive Care

*Eur J Anaesthesiol* 2022; **39**:1–13

## GUIDELINES

### Peri-operative management of neuromuscular blockade

*A guideline from the European Society of Anaesthesiology and Intensive Care*

Thomas Fuchs-Buder, Carolina S. Romero, Heidrun Lewald, Massimo Lamperti, Arash Afshari, Ana-Marjia Hristovska, Denis Schmartz, Jochen Hinkelbein, Dan Longrois, Maria Popp, Hans D. de Boer, Massimiliano Sorbello, Radmilo Jankovic and Peter Kranke

### 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade

Stephan R. Thilen, M.D., M.S. (co-chair),  
Wade A. Weigel, M.D. (co-chair), Michael M. Todd, M.D.,



American Society of  
**Anesthesiologists®**

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Valencia, 07 de marzo de 2023

# 2. Recomendaciones

DOCUMENTO DE CONSENSO

DOI: 10.1016/j.redar.2022.02.005

## Bloqueo neuromuscular perioperatorio. Actualización 2020 de las Recomendaciones de la Sociedad Española de Anestesiología, Reanimación y Terapéutica del Dolor (SEDAR)

Perioperative neuromuscular blockade. 2020 update of the SEDAR (Sociedad Española de Anestesiología y Reanimación) recommendations

O. Díaz-Cambrero<sup>a</sup>, A. Serrano<sup>b</sup>, A. Abad-Gurumeta<sup>c</sup>, I. Garutti Martínez<sup>d</sup>, N. Esteve<sup>e</sup>, E. Alday<sup>f</sup>, C. Ferrando<sup>g</sup>, G. Mazzinari<sup>a</sup>, P. Vila-Caral<sup>h</sup>, C.L. Errando Oyonarte<sup>i</sup>, Grupo de Trabajo de Bloqueo Neuromuscular de la SEDAR



# SEDAR

Sociedad Española de Anestesiología, Reanimación y  
Terapéutica del Dolor

DOCUMENTO DE  
CONSENSO.

### 10 recomendaciones:

- 1 “extra”
- 1 “diferente”

- ❖ No se recomienda el uso de RNM de forma rutinaria para la inserción de dispositivos supraglóticos.

# 2. Recomendaciones

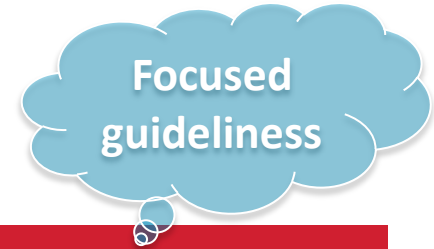
¿Es necesario el uso de relajantes musculares para facilitar la intubación traqueal en adultos?

¿La intensidad del BNM tiene alguna influencia en el resultado final en cirugía abdominal (LPS o LPT)?

¿Cuáles son las estrategias para el diagnóstico y el tratamiento del BNMr?

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Valencia, 07 de marzo de 2023

# Sistema GRADE



Grade of recommendation	Clarity of risk/benefit	Quality of supporting evidence
1A: Strong recommendation, high-quality evidence	Benefits clearly outweigh risk and burdens, or <i>vice versa</i> .	Consistent evidence from well performed randomised, controlled trials or over-whelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk.
1B: Strong recommendation, moderate-quality evidence	Benefits clearly outweigh risk and burdens, or <i>vice versa</i> .	Evidence from randomised, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate
1C: Strong recommendation, low-quality evidence	Benefits appear to outweigh risk and burdens, or <i>vice versa</i> .	Evidence from observational studies, unsystematic clinical experience, or from randomised controlled trials with serious flaws. Any estimate of effect is uncertain.
2A: Weak recommendation, high quality evidence	Benefits closely balanced with risks and burdens.	Consistent evidence from well performed randomised controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk.
2B: Weak recommendation, moderate-quality evidence	Benefits closely balanced with risks and burdens, some uncertainty in the estimates of benefits, risks and burdens.	Evidence from randomised controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate.
2C: Weak recommendation, low-quality evidence	Uncertainty in the estimates of benefits, risks and burdens benefits may be closely balanced with risks and burdens.	Evidence from observational studies, unsystematic clinical experience, or from randomised controlled trials with serious flaws. Any estimate of effect is uncertain.

*Eur J Anaesthesiol* 2022; **39**:1 – 13

**SARTD-CHGUV Sesión de Formación Continuada  
Valencia, 07 de marzo de 2023**

# Recomendaciones

¿Es necesario el uso de relajantes musculares para facilitar la intubación traqueal en adultos?

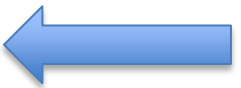
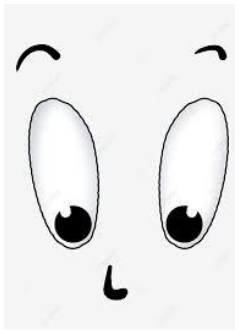
PRE-QUIRÓFANO		
ESAIC	QUIRÓFANO → INDUCCIÓN	ASA
✓ Se recomienda el uso de RNM para facilitar la IT → <b>1A.</b>		
✓ Se recomienda el uso de RNM para reducir lesiones faringolaríngeas secundarias a la IT → <b>1C.</b>		∅
✓ Se recomienda el uso de RNM de acción rápida para ISR (succinilcolina 1mg/kg o rocuronio 0.9 – 1.2 mg/kg) → <b>1B.</b>		

**Table 2** Randomised controlled trials to facilitate tracheal intubation and reduce pharyngeal discomfort

Study	Dose finding design	Patients	ASA	Exclusions	NMB	Main findings: Difficult intubation				Main findings: Upper airway discomfort			
						NMB Avoidance		NMB use		NMB Avoidance		NMB use	
						Events	Total	Events	Total	Events	Total	Events	Total
Alexander, 1999 <sup>2</sup>	yes	60/60	1 & 2	a	Sux	3	20	0	20	-	-	-	-
Barbosa, 2020 <sup>3</sup>	-	34/34	1 & 2	a,b	Roc	29	34	0	34	-	-	-	-
Barclay, 1997 <sup>4</sup>	yes	60/60	-	a,b	Roc	19	20	2	20	-	-	-	-
Beck, 1993 <sup>5</sup>	-	64/64	1 & 2	-	Sux	1	31	0	33	-	-	-	-
Bouvet, 2008 <sup>6</sup>	-	130/129	1 & 2	a	Cisatr	3	65	0	64	14	65	17	64
Collins, 2000 <sup>7</sup>	-	48/48/48	1&2	a	Sux	6	48	0	48	-	-	-	-
Combs, 2007 <sup>8</sup>	-	300/300	1 & 2	a,b	Roc	18	150	1	150	86	150	64	150
Dominici, 1990 <sup>9</sup>	-	60	1,2,3	-	Sux	11	30	10	30	-	-	-	-
Gonzalez, 2010 <sup>10</sup>	-	100/100	1 & 2	a	Roc	1	50	4	50	0	50	0	50
Gulhas, 2013 <sup>11</sup>	-	80/80	1 & 2	-	Sux	0	40	5	40	4	40	2	40
Hanna, 2010 <sup>12</sup>	-	50/47	1 & 2	a	Roc/Sux	3	23	2	24	-	-	-	-
Harsten, 1997 <sup>13</sup>	-	80/79	1 & 2	-	Sux	6	39	0	40	-	-	-	-
Iamaroon, 2001 <sup>14</sup>	-	120/120	1 & 2	a,b	Sux	4	60	0	60	-	-	-	-
Isesele, 2012 <sup>15</sup>	-	96/88	1 & 2	a	Sux	18	44	0	44	-	-	-	-
Jiao, 2014 <sup>16</sup>	-	55/55	1 & 2	b	Sux	13	28	1	27	-	-	-	-
Kahwaji, 1997 <sup>17</sup>	yes	181/176	1,2,3	a	Rapr	18	30	1	29	-	-	-	-
Kirkegaard-Nielsen, 1999 <sup>18</sup>	yes	80/80	1 & 2	b	Roc	13	20	1	20	-	-	-	-
Kohli, 2008 <sup>19</sup>	-	40/40	1&2	a,b	Sux	0	40	0	40	-	-	-	-
Kopman, 2001 <sup>20</sup>	yes	100/100	1 & 2	b	Rapr	7	10	0	30	-	-	-	-
Lieutaud, 2003 <sup>21</sup>	yes	170/160	1 & 2	a	Atr	13	20	2	45	-	-	-	-
Lowry, 1999 <sup>22</sup>	yes	140/140	1 & 2	a,b	Roc	19	20	2	20	-	-	-	-
McNeil, 2000 <sup>23</sup>	yes	60/60	1 & 2	a,b	Sux	1	23	0	17	-	-	-	-
Mencke, 2014 <sup>24</sup>	-	83/83	1,2,3	a,b	Roc	11	43	1	40	17	31	12	31
Mencke, 2003 <sup>25</sup>	-	8073	1 & 2	a,b	Atr	12	36	2	37	18	36	6	37
Naguib, 2003 <sup>26</sup>	yes	200/200	1	a	Sux	35	50	1	50	-	-	-	-
Naguib, 2006 <sup>27</sup>	yes	180/180	1	a	Sux	21	30	0	30	-	-	-	-
Nimmo, 1995 <sup>28</sup>	yes	60/60	1 & 2	-	Sux	9	20	0	20	-	-	-	-
Pang, 2014 <sup>29</sup>	-	40/40	1 & 2	a,b	Cisatr	0	20	0	20	-	-	-	-
Pino, 1998 <sup>30</sup>	yes	100/98	1 & 2	a,b	Miva/Roc	10	10	0	15	-	-	-	-
Rousseau, 1998 <sup>31</sup>	-	152/152	1	a	Vec	4	75	2	77	-	-	-	-
Scheller, 1992 <sup>32</sup>	yes	75/75	1	a	Sux	0	15	0	15	-	-	-	-
Schlaich, 2000 <sup>33</sup>	-	120/120	1 & 2	a	Roc	12	30	0	30	-	-	-	-
Sivalingam 2001 <sup>34</sup>	yes	100/100	1 & 2	a	Sux	2	25	1	25	34	75	8	25
Soltez, 2001 <sup>35</sup>	-	30/30/30/30	1 & 2	a	Roc	24	30	0	30	-	-	-	-
Stevens, 1997 <sup>36</sup>	yes	140/140	1 & 2	a	Sux	2	20	1	20	-	-	-	-
Striebel, A 1995 <sup>37</sup>	yes	100/100	1 & 2	a	Vec/Sux	8	50	2	50	-	-	-	-
Wrong, 1996 <sup>38</sup>	yes	120/120	1 & 2	a	Sux	0	30	0	30	-	-	-	-
Yazdi, 2016	-	66/66	1 & 2	a	Atr	14	35	4	31	-	-	-	-
<b>Total<sup>39</sup></b>						<b>370</b>	<b>1364</b>	<b>45</b>	<b>1405</b>	<b>173</b>	<b>447</b>	<b>109</b>	<b>397</b>

**27%**    **3%**

Thomas Fuchs-Buder et al. Peri-operative management of neuromuscular blockade A guideline from the European Society of Anaesthesiology and Intensive Care. Eur J Anaesthesiol 2022; 39:1-13



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## RESPIRATION AND THE AIRWAY

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# Avoidance of neuromuscular blocking agents may increase the risk of difficult tracheal intubation: a cohort study of 103 812 consecutive adult patients recorded in the Danish Anaesthesia Database

L. H. Lundstrøm<sup>1 2\*</sup>, A. M. Møller<sup>1</sup>, C. Rosenstock<sup>3</sup>, G. Astrup<sup>4</sup>, M. R. Gätke<sup>1</sup>  
and J. Wetterslev<sup>2</sup> and the Danish Anaesthesia Database

<sup>1</sup>Department of Anaesthesia and Intensive Care, Herlev Hospital, Copenhagen University Hospital, Herlev, Denmark. <sup>2</sup>Copenhagen Trial Unit, Copenhagen Centre of Clinical Intervention Research, Rigshospitalet, Copenhagen University Hospital, Copenhagen, Denmark. <sup>3</sup>Department of Anaesthesia, Hillerød Hospital, Hillerød, Denmark. <sup>4</sup>Department of Anaesthesia Århus Sygehus, Århus University Hospital, Århus, Denmark

\*Corresponding author. E-mail: lars\_hyldborg@hotmail.com

**Intubación sin RNM = FR independiente para VAD.  
OR 1,48 (IC 95%: 1.39 – 1.58, p < 0.0001)**





**Table 2** Randomised controlled trials to facilitate tracheal intubation and reduce pharyngeal discomfort

Study	Dose finding design	Patients	ASA	Exclusions	NMB	Main findings: Difficult intubation				Main findings: Upper airway discomfort			
						NMB Avoidance		NMB use		NMB Avoidance		NMB use	
						Events	Total	Events	Total	Events	Total	Events	Total
Alexander, 1999 <sup>2</sup>	yes	60/60	1 & 2	a	Sux	3	20	0	20	-	-	-	-
Barbosa, 2020 <sup>3</sup>	-	34/34	1 & 2	a,b	Roc	29	34	0	34	-	-	-	-
Barclay, 1997 <sup>4</sup>	yes	60/60	-	a,b	Roc	19	20	2	20	-	-	-	-
Beck, 1993 <sup>5</sup>	-	64/64	1 & 2	-	Sux	1	31	0	33	-	-	-	-
Bouvet, 2008 <sup>6</sup>	-	130/129	1 & 2	a	Cisatr	3	65	0	64	14	65	17	64
Collins, 2000 <sup>7</sup>	-	48/48/48	1&2	a	Sux	6	48	0	48	-	-	-	-
Combs, 2007 <sup>8</sup>	-	300/300	1 & 2	a,b	Roc	18	150	1	150	86	150	64	150
Dominici, 1990 <sup>9</sup>	-	60	1,2,3	-	Sux	11	30	10	30	-	-	-	-
Gonzalez, 2010 <sup>10</sup>	-	100/100	1 & 2	a	Roc	1	50	4	50	0	50	0	50
Gulhas, 2013 <sup>11</sup>	-	80/80	1 & 2	-	Sux	0	40	5	40	4	40	2	40
Hanna, 2010 <sup>12</sup>	-	50/47	1 & 2	a	Roc/Sux	3	23	2	24	-	-	-	-
Harsten, 1997 <sup>13</sup>	-	80/79	1 & 2	-	Sux	6	39	0	40	-	-	-	-
Iamaroon, 2001 <sup>14</sup>	-	120/120	1 & 2	a,b	Sux	4	60	0	60	-	-	-	-
Iselese, 2012 <sup>15</sup>	-	96/88	1 & 2	a	Sux	18	44	0	44	-	-	-	-
Jiao, 2014 <sup>16</sup>	-	55/55	1 & 2	b	Sux	13	28	1	27	-	-	-	-
Kahwaji, 1997 <sup>17</sup>	yes	181/176	1,2,3	a	Rapr	18	30	1	29	-	-	-	-
Kirkegaard-Nielsen, 1999 <sup>18</sup>	yes	80/80	1 & 2	b	Roc	13	20	1	20	-	-	-	-
Kohli, 2008 <sup>19</sup>	-	40/40	1&2	a,b	Sux	0	40	0	40	-	-	-	-
Kopman, 2001 <sup>20</sup>	yes	100/100	1 & 2	b	Rapr	7	10	0	30	-	-	-	-
Lieutaud, 2003 <sup>21</sup>	yes	170/160	1 & 2	a	Atr	13	20	2	45	-	-	-	-
Lowry, 1999 <sup>22</sup>	yes	140/140	1 & 2	a,b	Roc	19	20	2	20	-	-	-	-
McNeil, 2000 <sup>23</sup>	yes	60/60	1 & 2	a,b	Sux	1	23	0	17	-	-	-	-
Mencke, 2014 <sup>24</sup>	-	83/83	1,2,3	a,b	Roc	11	43	1	40	17	31	12	31
Mencke, 2003 <sup>25</sup>	-	80/73	1 & 2	a,b	Atr	12	36	2	37	18	36	6	37
Naguib, 2003 <sup>26</sup>	yes	200/200	1	a	Sux	35	50	1	50	-	-	-	-
Naguib, 2006 <sup>27</sup>	yes	180/180	1	a	Sux	21	30	0	30	-	-	-	-
Nimmo, 1995 <sup>28</sup>	yes	60/60	1 & 2	-	Sux	9	20	0	20	-	-	-	-
Pang, 2014 <sup>29</sup>	-	40/40	1 & 2	a,b	Cisatr	0	20	0	20	-	-	-	-
Pino, 1998 <sup>30</sup>	yes	100/98	1 & 2	a,b	Miva/Roc	10	10	0	15	-	-	-	-
Rousseau, 1998 <sup>31</sup>	-	152/152	1	a	Vec	4	75	2	77	-	-	-	-
Scheller, 1992 <sup>32</sup>	yes	75/75	1	a	Sux	0	15	0	15	-	-	-	-
Schlaich, 2000 <sup>33</sup>	-	120/120	1 & 2	a	Roc	12	30	0	30	-	-	-	-
Sivalingam 2001 <sup>34</sup>	yes	100/100	1 & 2	a	Sux	2	25	1	25	34	75	8	25
Soltez, 2001 <sup>35</sup>	-	30/30/30/30	1 & 2	a	Roc	24	30	0	30	-	-	-	-
Stevens, 1997 <sup>36</sup>	yes	140/140	1 & 2	a	Sux	2	20	1	20	-	-	-	-
Striebel, A 1995 <sup>37</sup>	yes	100/100	1 & 2	a	Vec/Sux	8	50	2	50	-	-	-	-
Wrong, 1996 <sup>38</sup>	yes	120/120	1 & 2	a	Sux	0	30	0	30	-	-	-	-
Yazdi, 2016	-	66/66	1 & 2	a	Atr	14	35	4	31	-	-	-	-
<b>Total<sup>39</sup></b>						<b>370</b>	<b>1364</b>	<b>45</b>	<b>1405</b>	<b>173</b>	<b>447</b>	<b>109</b>	<b>397</b>

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**Discomfort**  
**Dolor**  
**Ronquera**  
**Lesión cuerdas**

...

**Pocos estudios**  
**Extubación**

**1C**

**38%**    **27%**



Anaesthesia 2017, 72, 765-777

doi:10.1111/anae.13903

## Review Article

CPD available at <http://www.learnataagbi.org>

### Rocuronium vs. succinylcholine for rapid sequence intubation: a Cochrane systematic review\*

D. T. T. Tran,<sup>1,8</sup> E. K. Newton,<sup>2,3</sup> V. A. H. Mount,<sup>4</sup> J. S. Lee,<sup>5</sup> C. Mansour,<sup>2</sup> G. A. Wells<sup>6</sup> and I. I. Perry<sup>6,7</sup>

- > 60 RCTs.
- **Gral: Succ 1 mg/kg > rocuronio**

➤ **Análisis por subgrupos:  
NO DIFERENCIAS**



- **Paciente**
- **Intervención**
- **Efectos adversos**
- **Disponibilidad reversor**
- ...

**SARTD-CHGUV Sesión de Formación Continuada  
Valencia, 07 de marzo de 2023**

# Profundidad del bloqueo

Profundidad	TOF	PTC	<i>Fade</i>
Intenso	0	0	-
Profundo	0	$\geq 1$	-
Moderado	1 – 3	-	-
Leve	4 – TOFr < 0.4	-	Presente
Mínimo	TOFr 0-4 – 0.9	-	Ausente

# Recomendaciones

¿La intensidad del BNM tiene alguna influencia en el resultado final en cirugía abdominal (LPS o LPT)?

QUIRÓFANO → INDUCCIÓN

QUIRÓFANO → MANTENIMIENTO

ESAIC

ASA

✓ Se recomienda profundizar el BNM si se necesita una mejora en las condiciones quirúrgicas → **1B.**

✓ No hay suficiente evidencia para recomendar de forma rutinaria el BNM profundo para reducir el dolor postoperatorio o la incidencia de complicaciones perioperatorias → **2C.**

∅

# 26 RCTs

- Sólo 3 encuentran diferencias en grados de dolor
- Solo 3 encuentran diferencias en incidencia de complicaciones postoperatorias
- Los 6 son de pequeña muestra (n<60)
- Diferencias de significado clínico dudoso



**- 0.5 pts.**

Bloqueo neuromuscular perioperatorio. Actualización 2020 de las Recomendaciones de la Sociedad Española de Anestesiología y Reanimación.

**SARTD-CHGUV S  
Valen**

Díaz-Cambronero O (1), Errando CL (2), Alday E (3), Serrano A (4), Garutti I (5), Esteve N (6), Abad-Gurumeta A (7), Ferrando C (8), Mazzinari G (1), Vila P (9).

# Condiciones del campo quirúrgico

Muchos factores influyentes:

- Relajación
- Posición
- Tamaño de vísceras
- Adherencias
- ...

Beneficios en entredicho.



**Deep neuromuscular blockade improves surgical conditions during gastric bypass surgery for morbid obesity**

*A randomised controlled trial*

Thomas Fuchs-Buder, Denis Schmartz, Cédric Baumann, Ludovic Hilt, Claire Nomine-Criqui, Claude Meistelman and Laurent Brunaud

**Eliminación:**

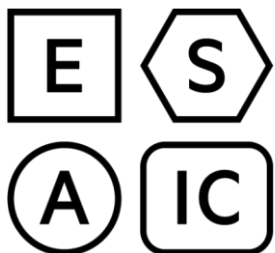
- Factores externos
- Variabilidad inter-personal

**Individualizar!**

**Table 3** Evolution of surgical conditions between the first rating ( $E_1$ ) and the second rating ( $E_2$ ) in the 65 patients randomised to maintain a moderate neuromuscular block or to induce a deep neuromuscular block

	Moderate neuromuscular block (n = 31)	Deep neuromuscular block (n = 34)
Improvement of surgical conditions	4	29
Unchanged surgical conditions	26	5
Aggravation of surgical conditions	1	0

**85 % > 12 %**



European Society of  
Anaesthesiology and  
Intensive Care



**SEDAR**

Sociedad Española de Anestesiología, Reanimación y  
Terapéutica del Dolor

Se recomienda profundizar el bloqueo si se necesita una mejora en las condiciones quirúrgica.

Se recomienda un nivel profundo de bloqueo neuromuscular para la cirugía laparoscópica.

# Recomendaciones

¿Cuáles son las estrategias para el diagnóstico y el tratamiento del BNMr?

QUIRÓFANO → INDUCCIÓN



ESAIC	MANTENIMIENTO	ASA
<p>✓ Se recomienda el uso de la estimulación del nervio cubital y la monitorización cuantitativa del aductor del pulgar para excluir BNMr → <b>1B.</b></p>	<p>No usar solo evaluación cualitativa del BNM para excluir BNMr cuando se administran RNM → <b>S-mod</b></p> <p>Usar monitorización cuantitativa por encima de cualitativa para excluir el BNMr. → <b>S-mod</b></p> <p>Usar el aductor del pulgar para la monitorización del BNM → <b>S-mod</b></p> <p>No usar la musculatura ocular para la monitorización del BNM → <b>S-mod</b></p>	



# ¿CUÁLES SON LAS ESTRATEGIAS PARA EL DIAGNÓSTICO Y EL TRATAMIENTO DEL BNM<sub>r</sub>?

## CONCEPTOS CLAVE

### Monitorización BNM:

- Signos clínicos.
- Monit. Cualitativa.
- **Monit. Cuantitativa.**

Prof.	TOF	PTC	<i>Fade</i>
Int.	0	0	-
Prof.	0	≥1	-
Mod.	1 – 3	-	-
Leve	4 – TOFr < 0.4	-	Presente
Mín.	TOFr 0-4 – 0.9	-	Ausente

**BNM<sub>r</sub> = TOFr < 0.9**

**Recuperación espontánea avanzada = TOFr > 0.2**

## Can Acceleromyography Detect Low Levels of Residual Paralysis?: A Probability Approach to Detect a Mechanomyographic Train-of-four Ratio of 0.9



Florent Capron, M.D.; Francois Alla, M.D.; Claire Hottier, M.D.; Claude Meistelman, M.D.;  
Thomas Fuchs-Buder, M.D.

*Anesthesiology* May 2004, Vol. 100, 1119–1124.

VPN

	Calibrado	No calibrado
TOFr: 0,9	37	40
TOFr: 0,95	70	60
TOFr: 1,0	<b>97</b>	77

# ¿CÓMO?

## Strength of Evidence for Quantitative Monitoring Compared with Qualitative or Clinical Assessment

Stephan R. Thilen, et al.  
2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade. *Anesthesiology* 2023; 138:13–41

Outcome*	Studies			Strength of Evidence	Effect (95% CI)
	Nonrandomized	Randomized Controlled Trial	Patients		
Residual neuromuscular blockade					Risk ratio
Train-of-four ratio < 0.7, < 0.8, or < 0.9					
Quantitative versus clinical		3	232		0.18 (0.06 to 0.50)
Train-of-four ratio < 0.9					
Quantitative versus qualitative		2	329		0.24 (0.13 to 0.43)
Train-of-four ratio < 0.7, < 0.8, or < 0.9 (network meta-analysis)*				Moderate	
Quantitative versus clinical	3	8	1,211		0.15 (0.10 to 0.22)
Quantitative versus qualitative					0.36 (0.26 to 0.51)

**Table 3** Residual paralysis: quantitative neuromuscular monitoring vs. qualitative neuromuscular monitoring or clinical signs

Ref.	Intervention	Study design	Primary outcome
Mortensen <i>et al.</i> <sup>71</sup>	quantitative NMM vs. clinical criteria	RCT	TOF ratio ≤ 0.7 1/10 vs. 11/17
Gatke <i>et al.</i> <sup>72</sup>	quantitative NMM vs. clinical criteria	RCT	TOF ratio ≤ 0.8 9/60 vs. 18/60
Murphy <i>et al.</i> <sup>73</sup>	quantitative vs. qualitative NMM	RCT	TOF ratio ≤ 0.9 4/89 vs. 15/90
Murphy <i>et al.</i> <sup>74</sup>	quantitative vs. qualitative NMM	RCT	TOF ratio ≤ 0.9 3/76 vs. 14/74
Wardhana <i>et al.</i> <sup>75</sup>	quantitative NMM vs. clinical criteria with neostigmine reversal	RCT	TOF ratio ≤ 0.9 1/36 vs. 6/36
Domenech <i>et al.</i> <sup>76</sup>	quantitative NMM vs. clinical criteria	Retrospective observational study	TOF ratio ≤ 0.9 1/63 vs. 57/177

Risk of bias.

low	intermediate	high	not applicable
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**QT = 6%**  
**QL = 18%**  
**SC = 32%**

Thomas Fuchs-Buder et al. Peri-operative management of neuromuscular blockade. A guideline from the European Society of Anaesthesiology and Intensive Care. *Eur J Anaesthesiol* 2022; 39:1–13

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**Valencia, 07 de marzo de 2023**

# ¿CÓMO?

BJA

British Journal of Anaesthesia, 125 (4): 466–482 (2020)

doi: 10.1016/j.bja.2020.05.063

Advance Access Publication Date: 14 July 2020

Review Article

## CLINICAL PRACTICE

### Forty years of neuromuscular monitoring and postoperative residual curarisation: a meta-analysis and evaluation of confidence in network meta-analysis

Hugo Carvalho<sup>1,\*†</sup>, Michael Verdonck<sup>1,2,†</sup>, Wilfried Cools<sup>3</sup>, Lieselot Geerts<sup>4</sup>, Patrice Forget<sup>5</sup> and Jan Poelaert<sup>1</sup>



#### Quantitative vs quantitative vs no NMM

Patients: Adult patients.

Setting: Elective surgical procedures under general anaesthesia in operation room setting requiring administration of intermediate dose neuromuscular blocking agents.

Intervention: Quantitative or qualitative neuromuscular monitoring.

Comparison: No neuromuscular monitoring.

Outcome	Absolute risk (95% CI)			Relative risk		
	Quantitative NMM	Qualitative NMM	No NMM	Quantitative vs no NMM	Qualitative vs no NMM	Quantitative vs qualitative NMM
PORC (TOF ratio <0.9)	0.119 (0.061; 0.191)	0.311 (0.216; 0.415)	0.338 (0.243; 0.440)	0.352	0.920	0.383

# ¿También monitorizamos la succinilcolina?



No drug	Nondepolarizing block	Depolarizing block	
		Phase I	Phase II
Train-of-four TOF-R = 1.0 	Fade TOF-R = 0.4 	Constant but diminished TOF-R = 1.0 	Fade TOF-R = 0.4 
Double burst 	Fade 	No fade 	Fade 

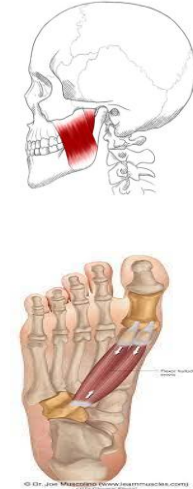
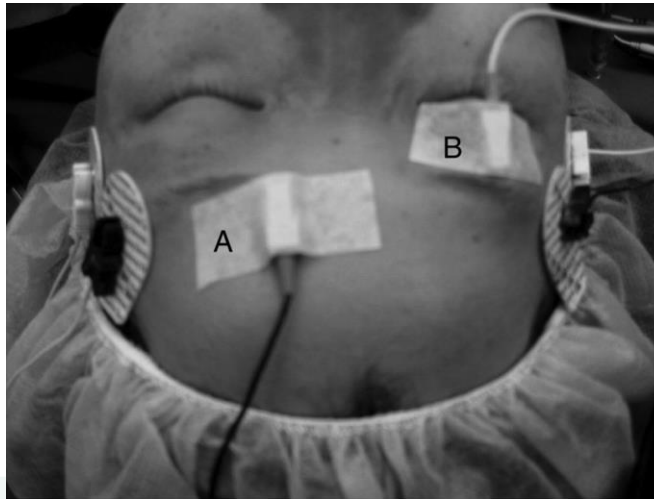
## SINGLE TWITCH

1 estímulo único  
comparado con valor  
basal

HOSPITAL GENERAL UNIVERSITARIO VALENCIA

SARTD-CHGUV Sesión de Formación Continuada  
Valencia, 07 de marzo de 2023

# ¿DÓNDE?

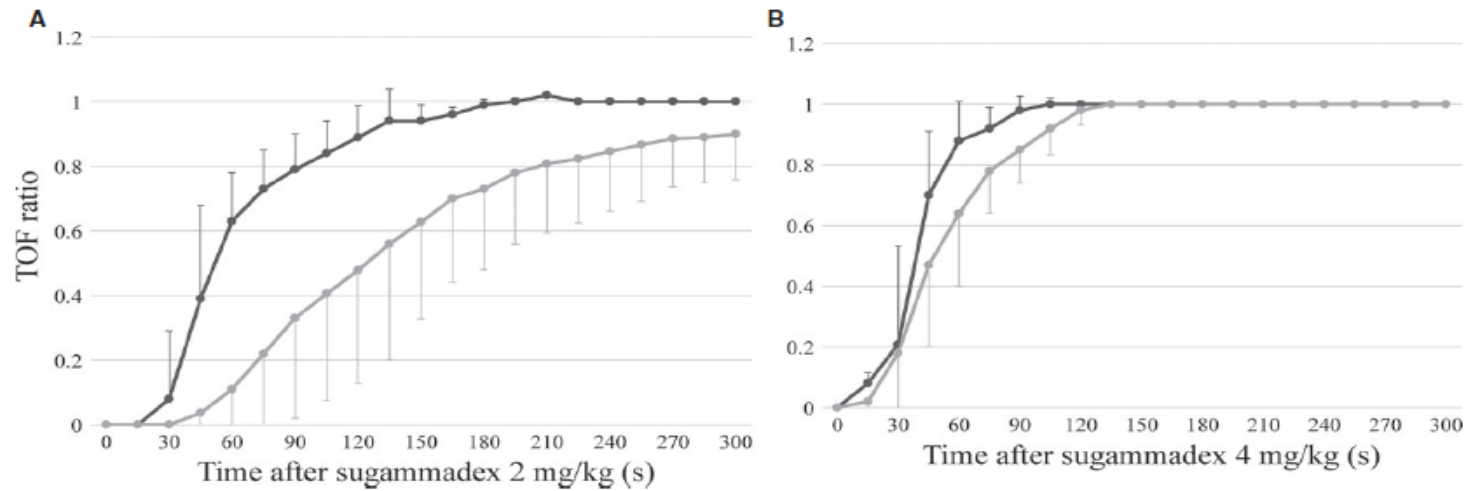


**Table 4.** Summary and Strength of Evidence for Technical Performance of Neuromuscular Monitors by Muscle and Normalization

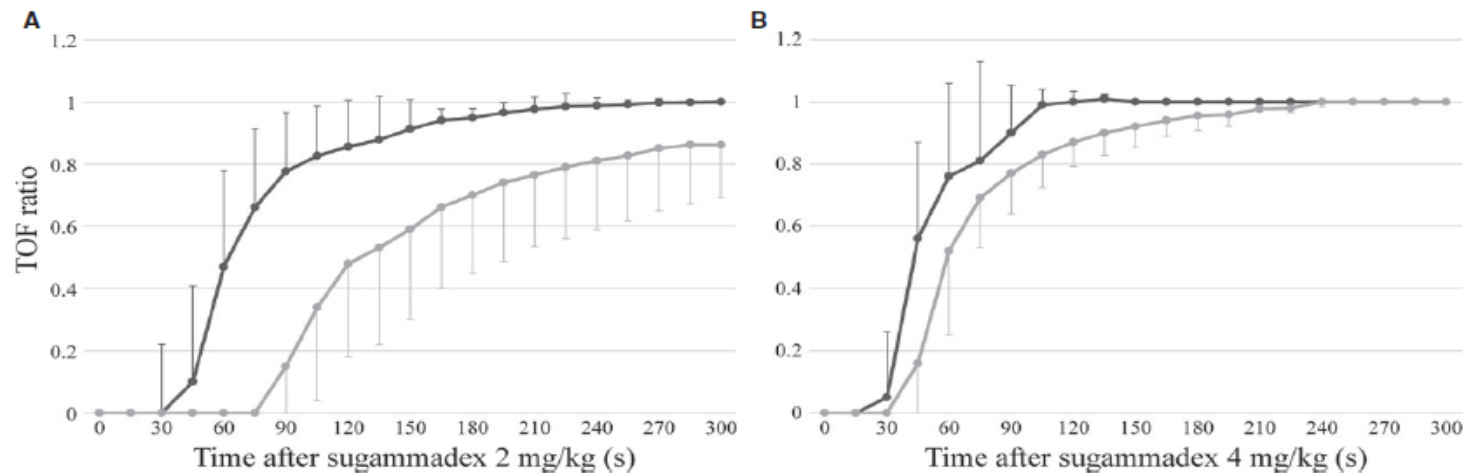
Comparisons	Studies		Patients	Strength of Evidence	Summary
	Nonrandomized	Paired/Randomized Controlled Trial			
Train-of-four ratios					
Adductor pollicis <i>versus</i> Corrugator supercilii		4	140	Moderate	Three of four studies reported longer times to train-of-four ratio greater than or equal to 0.9 or greater than or equal to 1.0 at adductor pollicis <i>versus</i> corrugator supercilii
Orbicularis oculi		2	46	Low	Longer times to train-of-four ratio greater than or equal to 0.8 or greater than or equal to 0.9 at adductor pollicis <i>versus</i> orbicularis oculi
Masseter		1	10	Very low	Difference not detected
Flexor hallucis brevis		1	52	Very low	Longer time to train-of-four ratio greater than or equal to 0.9 at adductor pollicis <i>versus</i> flexor hallucis brevis

# ¿DÓNDE?

Yamamoto S, et al. Reversal of neuromuscular block with sugammadex: a comparison of the corrugator supercilii and adductor pollicis muscles in a randomized dose-response study. *Acta Anaesthesiologica Scandinavica* 2015



**Fig. 2.** Time course of facilitated recovery after a bolus of 2 mg/kg (A) and 4 mg/kg (B) sugammadex in the 20–60 y age group. A black line and a gray line show the response of the corrugator supercilii muscle and adductor pollicis muscle, respectively. Data are shown as mean and SD.



**Fig. 3.** Time course of facilitated recovery after a bolus of 2 mg/kg (A) and 4 mg/kg (B) sugammadex in the 70 y age group. A black line and a gray line show the response of the corrugator supercilii muscle and adductor pollicis muscle, respectively. Data are shown as mean and SD.

# ¿DÓNDE?

Yamamoto S, et al. Reversal of neuromuscular block with sugammadex: a comparison of the corrugator supercilii and adductor pollicis muscles in a randomized dose-response study. Acta Anaesthesiologica Scandinavica 2015

Las dosis de sugammadex aprobadas por la FDA no son válidas si se monitoriza el BNM en el superciliar.



TOF	Dosis
TOF 0 – PTC 0 (intenso)	16 mg/kg
TOF 0 – PTC $\geq$ 1 (prof.)	4 mg/kg
TOF $\geq$ 1 (mod-leve-mín)	2 mg/kg



# Recomendaciones

¿Cuáles son las estrategias para el diagnóstico y el tratamiento del BNMr?

QUIRÓFANO → MANTENIMIENTO

QUIRÓFANO → (PRE)-EDUCCIÓN

ESAIC

ASA

✓ Se recomienda usar sugammadex para el BNM prof./mod./leve inducido por aminoesteroides (rocu/vecuronio) → **1A**

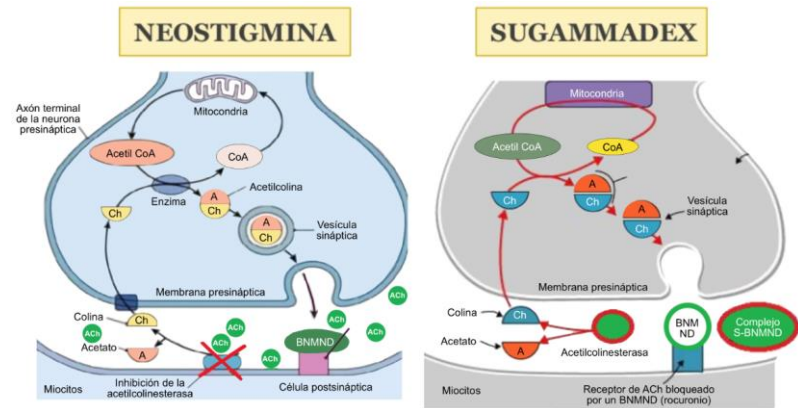
\*Se recomienda una reversión espontánea avanzada antes de usar estrategias de reversión basadas en neostigmina, así como continuar con la monit. QT hasta obtener un TOFr > 0.9 → **1C**

Confirmar un TOFr > 0.9 antes de extubar → **S-mod**

\*Se sugiere la neostigmina como alternativa razonable al sugammadex en BNM mínimo → **C-Low**.

\*Se sugiere neostigmina si BNM mínimo tras usar (cis)atracurio (10 min. si monit. QL // TOFr > 0.9 si monit. QT) → **C-Very Low**

# Neostigmina vs. sugammadex



Anaesthesia 2018, 73, 631-641

doi:10.1111/anae.14160

## Review Article

41 estudios  
> 4200 pacientes

The comparative efficacy and safety of sugammadex and neostigmine in reversing neuromuscular blockade in adults. A Cochrane systematic review with meta-analysis and trial sequential analysis

A.-M. Hristovska,<sup>1</sup> P. Duch,<sup>2</sup> M. Allingstrup<sup>3</sup> and A. Afshari<sup>4</sup>

*1 Specialist Registrar, 3 Specialist Registrar, 4 Consultant, Department of Pediatric and Obstetric Anaesthesia, Juliane Marie Centre, 2 Specialist Registrar, Department of Neuroanaesthesia, Juliane Marie Centre, Copenhagen University Hospital, Copenhagen, Denmark*

**Moderado:**  
2 min vs. 12.9 min.  
**Profundo:**  
2,9 min vs. 48,8 min.

**Table 4** Residual paralysis: neostigmine vs. sugammadex

**IA de BNMr.**  
 2% sugammadex (2-4mg/kg)  
 24% neostigmine (30-50mg/kg)  
**RAR = 22%.**

**9 RCTs**



Thomas Fuchs-Buder et al. Peri-operative management of neuromuscular blockade guideline from the European Society of Anaesthesiology and Intensive Care. Eur J Anaesthesiol 2022; 39:1-13

**Table 6.** Benefits and Strength of Evidence Comparing Sugammadex with Neostigmine for Incidence of Residual Neuromuscular Blockade and Time to Recovery to Train-of-four Ratio Greater than or Equal to 0.9

Outcome	Effect (95% CI)
Less residual neuromuscular blockade	Risk ratio
Train-of-four ratio < 0.9	0.18 (0.07 to 0.42)
	Risk difference
Train-of-four ratio < 0.9	-21.6% (-33.8 to -9.4%)
Shorter time to train-of-four ratio ≥ 0.9 from	Mean difference, min
Deep block	-33.6 (-59.3 to -7.9)
Moderate block	-10.0 (-12.7 to -7.2)
Shallow block	-3.9 (-6.1 to -1.6)
Minimal block	-1.4 (-2.0 to -0.8)

**27 RCTs**

Stephan R. Thilen, et al. 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade. Anesthesiology 2023; 138:13-41

# ¿Diferencias en POPCs?

## Sugammadex versus Neostigmine for Reversal Of Neuromuscular Blockade and Postoperative Pulmonary Complications (STRONGER): A Multicenter Matched Cohort Analysis

Sachin Kheterpal, MD, MBA [Professor],

Department of Anesthesiology, University of Michigan, Ann Arbor, Michigan, USA

45712 pacientes estudiados

- Neumonía
- Fallo respiratorio
- Otros (congestión, neumotórax, etc.)

**RAR de 1.9%**

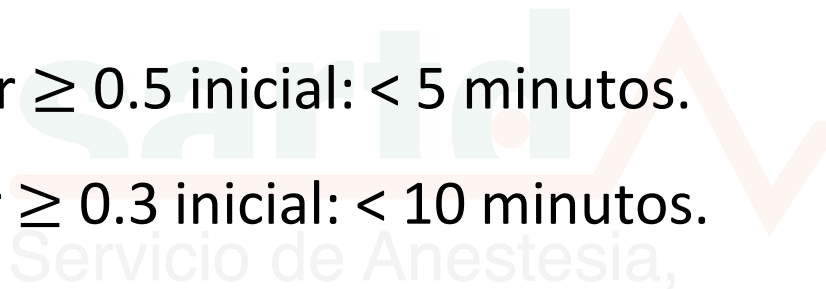
# ¿CUÁNDO USAR NEOSTIGMINA?

TOFr > 0.2 de forma espontánea: NO DIFERENCIAS

→ Tiempo hasta TOFr > 0.9 en TODOS los pacientes:

→ TOFr ≥ 0.5 inicial: < 5 minutos.

→ TOFr ≥ 0.3 inicial: < 10 minutos.

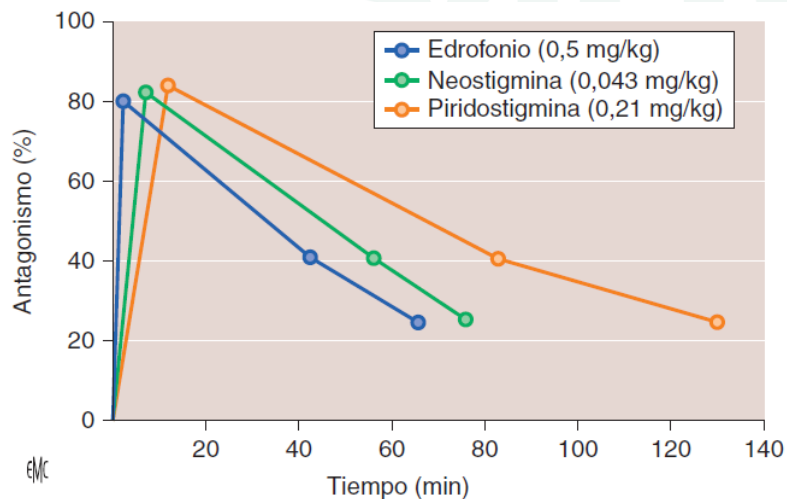


**Table 5** Prereversal train-of-four and neostigmine-induced recovery

Prereversal recovery	Neostigmine dose	Neuromuscular outcome	Ref
TOF-ratio 0.6	30 µg kg <sup>-1</sup>	TOF-ratio > 0.9 in all patients in < 10 min	99
TOF-ratio 0.5	34 µg kg <sup>-1</sup>	TOF-ratio >0.9 in all patients in <5 min	84
TOF-ratio 0.4	30 µg kg <sup>-1</sup>	TOF-ratio >0.9 in all patients in <10 min	99
TOF-ratio 0.2	10–70 µg kg <sup>-1</sup>	Impossible to have a TOF-ratio >0.9 in all patients in <10 min, independent of neostigmine dose	81
TOF-count 4 and TOF-ratio 0.1	50 µg kg <sup>-1</sup>	15 min after neostigmine still 25% of patients with TOF-ratio <0.9	82
TOF-count 4 and TOF-ratio 0.1	50 µg kg <sup>-1</sup>	30 min after neostigmine 3/13 patients with TOF-ratio <0.9	83
TOF-count 4	40 µg kg <sup>-1</sup>	10 min after neostigmine still 35% of patients with TOF-ratio <0.9	97
TOF-count 4	70 µg kg <sup>-1</sup>	20 min after neostigmine still 25% of patients with TOF-ratio <0.9	100
TOF-count 4	70 µg kg <sup>-1</sup>	10 min after neostigmine still 75% of patients with TOF-ratio <0.9	100



	Sugammadex	Neostigmina
Anafilaxia	No diferencias	
TC/BC/Arritmias	No diferencias (si glucopirrolato en neostigmina)	
Hipoxia	No diferencias	
Reintubación	Menor incidencia	
Reparalisis	No diferencias	
n/v	No diferencias	
Coste	Mayor (tempos, - ef adv, etc).	



- Permitir recuperación espontánea.
- Usar sugammadex si es posible.
- Administrar más dosis de neostigmina hasta 50 µg/kg si se usó menor dosis.

# Sugammadex vs. neostigmina

- ✓ Si BNM  $\geq$  leve (TOF  $< 0.4$ ): Sugammadex.
- ✓ Si BNM mínimo (TOFr 0.4 - 0.9): individualizar.
  - Fármaco utilizado.
  - Tiempo permitido de reversión.
  - Características clínicas de nuestro paciente.
  - ...

# Recomendaciones

QUIRÓFANO → EDUCACIÓN

URPQ

ESAIC

ASA

## Complicaciones pulmonares del BNMr:

- Debilidad muscular
- Disminución de la respuesta ventilatoria a la hipoxia
- Disminución de los reflejos protectores de la VA
- Aumento del riesgo de atelectasias, reintubación, broncoaspiración, obstrucción VAS.
- No ha demostrado aumento de mortalidad. Sí de morbilidad.



# Conclusiones

- ☀ **Se recomienda el uso de RNM en la inducción para facilitar la IOT.**
- ☀ **Se recomienda sugammadex para revertir el BNM profundo, moderado y leve cuando se han usado RNMND aminoesteroides.**

**RECOMENDACIONES 1A**

# Conclusiones

- ☀ Se recomienda el uso de relajantes musculares de acción rápida para ISR:
  - *Rocuronio 0.9 – 1.2 mg/kg.*
  - *Succinilcolina 1 mg/kg.*
- ☀ Se recomienda profundizar el BNM si se necesita mejorar las condiciones quirúrgicas.
- ☀ Se recomienda la estimulación del nervio cubital y la monitorización cuantitativa del BNM en el aductor corto del pulgar para excluir parálisis residual (TOFr > 0.9).

## GUIDELINES

## Management of severe peri-operative bleeding: Guidelines from the European Society of Anaesthesiology and Intensive Care

Second update 2022

Sibylle Kietaihl, Aamer Ahmed, Arash Afshari, Pierre Albaladejo, Cesar Aldecoa, Giedrius Barauskas, Edoardo De Robertis, David Faraoni, Daniela C. Filipescu, Dietmar Fries, Anne Godier, Thorsten Haas, Matthias Jacob, Marcus D. Lancé, Juan V. Llau, Jens Meier, Zsolt Molnar, Lidia Mora, Niels Rahe-Meyer, Charles M. Samama, Ecaterina Scarlatescu, Christoph Schlimp, Anne J. Wikkelsø and Kai Zacharowski

Rossaint et al. *Critical Care* (2023) 27:80  
<https://doi.org/10.1186/s13054-023-04327-7>

Critical Care

## GUIDELINES

Open Access

## The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition



Rolf Rossaint<sup>1\*</sup>, Arash Afshari<sup>2</sup>, Bertil Bouillon<sup>3</sup>, Vladimir Cerny<sup>4,5</sup>, Diana Cimpoesu<sup>6</sup>, Nicola Curry<sup>7,8</sup>, Jacques Duranteau<sup>9</sup>, Daniela Filipescu<sup>10</sup>, Oliver Grottko<sup>1</sup>, Lars Grønlykke<sup>11</sup>, Anatole Harrois<sup>9</sup>, Beverley J. Hunt<sup>12</sup>, Alexander Kaserer<sup>13</sup>, Radko Komadina<sup>14</sup>, Mikkel Herold Madsen<sup>2</sup>, Marc Maegele<sup>15</sup>, Lidia Mora<sup>16</sup>, Louis Riddez<sup>17</sup>, Carolina S. Romero<sup>18</sup>, Charles-Marc Samama<sup>19</sup>, Jean-Louis Vincent<sup>20</sup>, Sebastian Wiberg<sup>11</sup> and Donat R. Spahn<sup>13</sup>

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# Peri-operative management of neuromuscular blockade (NMB)

A guideline from the European Society of Anaesthesiology and Intensive Care

## Clinical questions

- 1 Is the use of myorelaxants necessary to facilitate tracheal intubation in adults?
- 2 Does the intensity of NMB influence a patient's outcome in abdominal surgery (i.e. laparotomy or laparoscopy)?
- 3 What are the strategies for the diagnosis and treatment of residual neuromuscular paralysis?

## Patients

Adults undergoing surgery with general anesthesia and tracheal intubation

## Interventions

NMB (type of neuromuscular blocking agent: suxamethonium, atracurium, cisatracurium, mivacurium, pancuronium, vecuronium and rocuronium), quantitative neuromuscular monitoring or acceleromyography or electromyography, sugammadex-based reversal

## Comparator

No or any different degree of NMB, no neuromuscular monitoring or qualitative neuromuscular monitoring, neostigmine-based reversal

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## Key Messages

- 1 **POOR INTUBATION CONDITIONS** in 27% of patients without NMB versus 3 % in the group with NMB
- 2 **IN FAVOR OF A PERSONALISED APPROACH**, i.e., rather than routinely applying a deep block
- 3 **USING QUANTITATIVE NEUROMUSCULAR MONITORING** at the adductor pollicis muscle to exclude residual paralysis