Current Practice of Rapid Sequence Induction in the United Kingdom - A National Survey

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Abstract

BACKGROUND:

The 'classical' technique of rapid sequence induction (RSI) was described in 1970. With the introduction of new drugs and equipment in recent years, a wide variation in this technique has been used. The role of cricoid pressure is controversial due to the lack of scientific evidence. Moreover, gentle mask ventilation has been recommended in situations such as obesity and critically ill patients to prevent hypoxaemia during apnoeic period. In identifying multiple techniques, we conducted a national postal survey to establish the current practice of RSI in the United Kingdom.

METHODS:

A survey consisting of 17 questions was created and posted to 255 National Health Service (NHS) hospitals in the United Kingdom. We included two copies of the questionnaire in each envelope; one to be completed by the airway lead and the other by a trainee in the same department. The difference in responses from consultants and trainees were assessed using the chi-squared test and the Fisher's exact test.

RESULTS:

In total we received 272 responses (response rate 53%) of which 266 (58% from consultants and 42% from trainees) were analysed. A majority of the respondents (67.7%) pre-oxygenated by monitoring end-tidal oxygen concentration and 76.3% of the respondents use 20-25^{o} head up tilt for all RSIs. Propofol is the most commonly used induction agent (63.9% of all respondents). Opioid has been used by 80.5% of respondents and only 17.7% of respondents use suxamethonium for all cases and others choose rocuronium or suxamethonium based on clinical situation. Although 92% of anaesthetists use cricoid pressure, 83% of them never objectively measure the force used. During apnoeic period 17% of the respondents use gentle mask ventilation.

CONCLUSIONS:

Our survey demonstrated a persistent variation in the practice of RSI amongst the anaesthetists in the UK. The 'classical' technique of RSI is now seldom used. Increasing awareness of optimising oxygenation during apnoeic period and wider use of newer drugs such as propofol, rocuronium, and opioids has driven the current practice of RSI.

Key words: Anaesthetics; Great Britain; Intubation; Neuromuscular Blockade; Oxygen; Propofol; Questionnaires

Rapid sequence induction (RSI) is such a fundamental skill in anaesthetic practice in the United Kingdom, that the Royal College of Anaesthetists (RCOA)[1] has set it as one of the initial assessment competencies for novices. The 'classical' approach to RSI, as advocated by Stept and Safar, describes pre-oxygenation, administration of a pre-determined dose of thiopentone and suxamethonium, application of cricoid pressure, avoidance of face mask ventilation and intubation with a cuffed tracheal tube[2]. This ensures an optimal condition for rapid tracheal intubation.

The national survey[3] of anaesthetists in the United Kingdom in 2001, exploring the practice of RSI, found that all respondents used pre-oxygenation and applied cricoid pressure. The same survey found that thiopentone and suxamethonium were the most widely used drugs and the majority of respondents (75%) also routinely administered an opioid. Considerable variation in the practice of RSI has also been further demonstrated both nationally and internationally[4 5].

There is controversy regarding the choice of drugs, patient position, ventilation during apnoeic period and application of cricoid pressure during RSI[6]. In recent years, newer techniques of pre-oxygenation[7–9], patient positioning[10 11] and delivery of oxygen during apnoeic period [12 13] have been described. Rocuronium, at a dose of 1.2 $mg.kg^{-1}$, has been shown to produce rapid onset of muscle paralysis similar to suxamethonium[14] and sugammadex rapidly reverses even profound level of rocuronium induced neuromuscular blockade[15]. To prevent hypoxaemia during apnoeic period, gentle mask ventilation has been used in situations such as the obese, paediatrics and critically ill patients[6]. Although the purpose of cricoid pressure is to prevent regurgitation of gastric contents, there are reports of its failure [6 16 17]. Using a national survey, we aimed to evaluate the current practice of RSI amongst the anaesthetic community across the United Kingdom.

Methods

The initial list of National Health Service (NHS) hospitals in the United Kingdom (UK) was sourced from the medical education department, University Hospital Coventry, UK. This was cross checked for completeness with the list of hospitals with airway leads obtained from the Health Services research centre, RCOA. Finally, airway leads were searched on the RCOA online database. The NHS hospitals in the UK with resources for anaesthetising adult, non-pregnant patients were included in the survey.

A survey questionnaire consisting of a total 17 questions was designed in Microsoft Word® with 5 sections: demographic details, techniques of pre-oxygenation including patient position, drugs used, details of cricoid pressure and technique of oxygenation during apnoeic period. The questionnaire clearly requested the respondent to answer the questions with regard to their clinical practice of RSI for a haemodynamically stable adult, non-obstetric patient.

The postal survey, addressed to airway leads, was sent to 234 hospitals. In each envelope, we included a short covering letter and two questionnaires, one to be completed by the airway lead and the other one by a junior trainee in their department. The initial round of survey questionnaire were posted between 1st October and 15th October 2014. Six weeks later, the non-responders were reminded by email or telephone call. The questionnaires were re-sent to those who stated that they had not received it. During this stage, we posted 21 envelopes addressed to the college tutors to those hospitals assumed to have no nominated airway leads. In total 255 envelopes containing 510 questionnaires were sent in the post.

The responses of returned questionnaires were entered into a Microsoft Excel® spreadsheet. The incomplete responses and those received from paediatric and obstetric specialist hospitals were excluded from the analysis. Analysis of the data was carried out using statistical software SPSS (Version 18, SPSS Inc., Chicago, IL). The differences in responses between consultants and trainees were compared using the chi-squared test or, if very few anaesthetists selected specific responses, the Fisher's exact test. All comparison tests were performed at 5% significance level.

Results

We received 272 questionnaires with an overall response rate of 53%. Six returned questionnaires could not be analysed. Total 266 questionnaires; 155 (58%) from consultants and 111 (42%) from trainees were included in the analysis.

Pre-oxygenation and position

All respondents, except one trainee and three consultants, performed pre-oxygenation. A majority of the respondents (67.7%) pre-oxygenated by monitoring end-tidal oxygen concentration (FEO_2) with proportionately higher number of trainees monitoring the FEO_2 (table1). Head up position of 20 to 25^o was chosen by 203/266 (76.3%) of respondents as a routine practice during pre-oxygenation and another 11.3% of the respondents use up to 45^o head up tilt (sitting up position). There was no significant difference between the consultants and trainees in terms of position used during RSI (p=0.629).

Table 1 here

Table 1. Methods of pre-oxygenation during RSI
Values are actual numbers (%). VT= tidal volume, FEO_2 =End tidal oxygen concentration, VC = vital capacity breathing, CPAP = continuous positive airway pressure. An individual anaesthetist can have more than one response.

Method	All respondents (n=266)	Consultants (n=155)	Trainees (n=111)	*p*
Until $FEO_2 \geq 0.9$	180 (67.7)	97 (62.6)	83 (74.8)	0.036
3 minute TV breathing	178 (66.9)	101 (65.2)	77 (69.4)	0.472
1 minute VC breathing	63 (23.7)	40 (25.8)	23 (20.7)	0.336

Other methods $FEO_2 \geq 0.8$ or 2 minute VC breathing	25 (9.4)	16 (10.3)	9 (8.1)	0.542

Continuous positive airway pressure (CPAP) during pre-oxygenation

In total 41.7% (111/266) of the respondents (65 consultants and 46 trainees) stated that they use CPAP during pre-oxygenation. Of these, 22.5% use CPAP for all patients whilst 77.5% use it for obese patients only. In comparison to trainees, proportionately higher numbers of consultants use CPAP for obese patients (p=0.032).

Drugs used in RSI

Propofol is the most commonly used agent (table 2) for induction and significantly higher proportion of consultants use propofol in comparison to trainees (p<001).

Table 2: Induction agents used in RSI. Values are number (%). Respondents could choose more than one induction agents.

Induction agent	All respondents (n=266)	Consultants (n=155)	Trainees (n=111)	*p*
Propofol	170 (63.9)	113 (72.9)	57 (51.4)	<0.001
Thiopentone	135 (50.8)	66 (42.6)	69 (62.2)	0.002
Etomidate	10 (3.8)	7 (4.5)	3 (2.7)	0.529
Ketamine	2 (0.8)	2 (1.3)	0 (0)	0.512

Only 17.7% of the respondents use suxamethonium for all cases and 6% only use rocuronium for all patients requiring RSI. A majority of anaesthetists (150/266, 56.4%) stated that they would use rocuronium in selected cases such as elective cases with aspiration risk and in anticipated difficult airway (table 3). Another 19.5% of anaesthetists use suxamethonium only in selected cases.

Table 3. Reasons for using rocuronium in selected cases. Values are numbers (%). Respondents could choose more than one reason.

Use of rocuronium	All respondents (n=150)	Consultants (n=86)	Trainees (n=64)	p
When suxamethonium is contra-indicated	135 (90.0)	78 (90.7)	57 (89.1)	0.741
Elective cases with aspiration risk	42 (28.0)	32 (37.2)	10 (15.6)	0.004
When a difficult airway is anticipated	33 (22.0)	26 (30.2)	7 (10.9)	0.005

Emergency cases with aspiration risk	12 (8.0)	10 (11.6)	2 (3.1)	0.071

Proportionately higher numbers of consultants choose to administer opioid as compared to trainees, fentanyl being most commonly chosen opioid (table 4).

Table 4: Use of opioids. Values are number (%). There is more than one reply for each question hence total adds > 100%.

	All respondents (n=266)	Consultants (n=155)	Trainees (n=111)	*p*
Opioid chosen	214 (80.4)	132 (85.2)	82 (73.8)	0.022
Fentanyl	160 (74.8)	103 (78)	57 (69.5)	0.163
Alfentanil	68 (31.8)	36 (27.3)	32 (39.0)	0.073
Remifentanil	21 (9.8)	19 (14.4)	2 (2.4)	0.004
Morphine	1 (0.5)	1 (0.8)	0 (0)	

Cricoid Pressure

A total of 244 (92%) anaesthetists who responded to our survey stated that they always apply cricoid pressure during RSI. The other 8% would apply cricoid pressure only in selected cases such as bowel obstruction. A higher proportion of trainees always apply cricoid pressure as compared to consultants (99.1% and 87% respectively, $p<0.001$). Most anaesthetists (84.2%) allow ODPs to identify cricoid cartilage by manual palpation whereas 15.5% identify it themselves and handover to ODP. Only one consultant anaesthetist said that he uses ultrasound to identify the cricoid cartilage.

A vast majority of respondents 220/266 (83%) never objectively measure cricoid force applied. Only 52% of respondents check that their assistants are trained in applying cricoid force. A higher number of consultants check that their assistants are trained as compared to trainees (60.4% and 39.6% respectively). There is a wide variation in the timing when cricoid pressure is applied (table 5)

Table 5: Timing of cricoid pressure in relation to administration of induction agent. Values are number (%). One respondent did not reply to this question.

Start of cricoid pressure	All respondents (n=265)	Consultants (n=154)	Trainees (n=111)
Just before administering of induction agent	94 (35.7)	47 (30.5)	47 (42.3)
During administration of induction agent	129 (48.6)	75 (48.7)	54 (48.6)
Immediately after administering induction	21 (8)	18 (11.6)	3 (2.7)

agent			
After confirming loss of consciousness	20 (7.6)	13 (8.4)	7 (6.3)
Variable; depends on risk of aspiration	1 (0.4)	1 (0.6)	0 (0)

Oxygenation during apnoea:

Seventeen percent of respondents use gentle mask ventilation during the apnoeic period and a further 6% of respondents use oxygen insufflation using a nasal catheter.

Discussion

This national survey demonstrates that the current practice of RSI in the UK differs considerably from the 'classical' technique. Only a minority of anaesthetists routinely practice RSI with the drugs and techniques advocated over 40 years ago. The recently introduced new methods of pre-oxygenation, newer drugs, increasing awareness of maintaining oxygenation during apnoeic period and the persisting controversy on the use of cricoid pressure may all be contributing factors.

The wide variations in practice of RSI in this survey follows similar UK studies published in 2001[3] and 2009[4]. Another recent survey of over 2900 anaesthetists in Germany also described similar variation in pre-oxygenation, patient positioning and the use of neuromuscular blocking agents[18]. In their survey, one third of the anaesthetists did not use cricoid pressure. A similar survey conducted in the United States demonstrated that the majority of anaesthetists attempt to ventilate the lungs during apnoeic period as part of modified RSI[5]. This survey also identified a significant variation in the practice between trainee and consultant anaesthetists. A recent European survey evaluated the presence of guidelines in managing RSI and identified a lack of consistent standard in the technique of RSI[19].

Effective pre-oxygenation is an essential component of RSI. The majority of our respondents said they use either 3 minute tidal volume breathing or aim for a $FEO_2 \geq 0.9$. A recent study has shown that eight vital capacity breaths in one minute provides a better safety margin with almost double the apnoeic time without hypoxia compared to 3 minute tidal volume breathing[20].

The application of positive airway pressure increases the duration of apnoeic period without hypoxia in morbidly obese patients[8] and also in non-obese patients[9 21]. Although 41.7% of anaesthetists in our survey stated that they use CPAP during RSI, 77.5% of them use CPAP only for obese patients. This indicates the need to emphasise this simple and effective technique in the airway training.

A 20 to 25^{o} head up position has shown to improve pre-oxygenation in both obese and non-obese patients [22 23]. In our survey, 76.3% of anaesthetists use this position for all patients and most of the remaining practitioners use it only for obese patients.

There has been a significant change in drugs used for RSI since the previous national survey in 2001. Propofol has been increasingly used for RSI instead of thiopentone. This could be due to the comparative efficacy of propofol [24] and also due to the familiarity of its use in the elective situations[25].

The intubating conditions produced by 1.2 $mg.kg^{-1}$ of rocuronium are comparable to that of suxamethonium[26] [27]. However a recent Cochrane review[28] has concluded that suxamethonium created superior intubation conditions to rocuronium. Sugammadex at a dose $16mg.kg^{-1}$ reverses the neuromuscular blockade of rocuronium more predictably than the spontaneous recovery from suxamethonium[29] [27]. This higher predictability of reversal of neuromuscular block could be the reason for increasing use of rocuronium. Consultant anaesthetists are more likely to choose rocuronium as compared to trainees. They indicated rocuronium would be chosen in elective patients with aspiration risk and in anticipated difficult airways and situations where suxamethonium is contraindicated.

Although opioids are not part of the 'classical' RSI, 85.2% of consultants and 73.8% of trainees indicated that they use this class of drug in addition to an induction agent and neuromuscular blocking agent. Fentanyl was the most commonly used opioid during an RSI, followed by alfentanil. Interestingly, around 14.4% (19/132) of those consultants who use opioids mentioned that they use remifentanil. In certain situations such as open globe injury of eye, remifentanil offers the benefit of haemodynamic stability[30].

In total 92% (244/265) of the respondents answered that they always use cricoid pressure (CP) in RSI. Fifty-five years since Sellick[31] described CP there is still no consensus of its benefits amongst the anaesthetists worldwide[32] [33]. A randomised controlled trial performed in 2007 did not find any evidence to support the reduced incidence of aspiration with CP[34]. Consistent with the previous study in the United States[5], majority of anaesthetists we surveyed would apply cricoid force immediately prior to or during administration of induction agent.

Although there have been descriptions of methods to measure cricoid force[35] in experimental settings, they are not used in routine clinical practice. Objective measurement of cricoid force is practically difficult and it is not surprising that 83% of respondents do not measure it routinely. Fifty two percent of anaesthetists check that their assistants are trained in applying cricoid pressure (CP). Most anaesthetists work with assistants already known to them routinely and therefore may be fully aware of their competency. Checking of competency to apply CP is required when an RSI is performed outside a theatre environment or when a new colleague is assisting with RSI. A significantly higher number of consultants check the competency of their assistants as compared to trainees (60.4% and 39.6% respectively); this could be due to the relatively junior trainees working in well-established teams.

Oxygen insufflation using a nasal catheter [12] or the trans-nasal humidified rapid-insufflation ventilatory exchange technique [36] has been shown to be effective in prolonging the time to desaturation during apnoeic period. Despite its intuitive nature and the now available evidence, only 6% of the surveyed anaesthetists in the UK use a form of nasal oxygen insufflation to prevent potential desaturations and hypoxaemia during RSI.

Our study questionnaire was limited to the various components of RSI. In recent years, there has been an increasing use of videolaryngoscopes which may also contribute to modification of RSI technique. The indirect view obtained on the monitor screen can give feedback to the anaesthetic assistant on the effect of their cricoid pressure[37]. We did not question participants regarding their use of videolaryngoscopes in RSI. Furthermore, we did not ask about the management strategies and rescue techniques for failed intubation during RSI, which might have included the release of cricoid pressure and use of supraglottic airway devices.

This study concludes that, RSI has continued to evolve since the previous UK survey[3]. The authors propose that this is as a result of the introduction of newer drugs, equipment and current techniques of optimising oxygenation during apnoeic period. Of note, a minority of anaesthetists practices the classical RSI technique. These findings have specific implications on teaching the technique of RSI to trainees in anaesthetics. Therefore a standardised RSI technique, applicable to the current practice should be incorporated in to the current curriculum in the UK.

Authors' Individual contributions

C.M contributed to the study design, study co-ordination and critical revision of manuscript. A.S, N.U and J.W jointly performed the literature search, study design, data collection and manuscript preparation. P.K contributed to the data analysis and drafting of manuscript.

Declaration of Interests

None to declare

1. Abdallah R, Galway U, You J, Kurz A, Sessler DI, Doyle DJ. A randomized comparison between the pentax aws video laryngoscope and the macintosh laryngoscope in morbidly obese patients. *Anesth Analg* 2011;**113**:1082–7

2. Stept WJ, Safar P. Rapid induction-intubation for prevention of gastric-content aspiration. *Anesth Analg* [Internet] [cited 2015 Jun 19];**49**:633–6 Available from: http://www.ncbi.nlm.nih.gov/pubmed/5534675

3. Morris J, Cook TM. Rapid sequence induction: a national survey of practice. *Anaesthesia*

[Internet] 2001 [cited 2015 Jun 24];**56**:1090–7 Available from: http://www.ncbi.nlm.nih.gov/pubmed/11703243

4. Koerber JP, Roberts GEW, Whitaker R, Thorpe CM. Variation in rapid sequence induction techniques: current practice in Wales. *Anaesthesia* 2009;**64**:54–9

5. Ehrenfeld JM, Cassedy EA, Forbes VE, Mercaldo ND, Sandberg WS. Modified rapid sequence induction and intubation: a survey of United States current practice. *Anesth Analg* [Internet] 2012 [cited 2015 Jun 25];**115**:95–101 Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3270153&tool=pmcentrez&rendertype=abstract

6. El-Orbany M, Connolly L a. Rapid sequence induction and intubation: Current controversy. *Anesth Analg* 2010;**110**:1318–25

7. Cressey DM, Berthoud MC, Reilly CS. Effectiveness of continuous positive airway pressure to enhance pre-oxygenation in morbidly obese women. *Anaesthesia* [Internet] 2001 [cited 2015 Jun 24];**56**:680–4 Available from: http://www.ncbi.nlm.nih.gov/pubmed/11437771

8. Gander S, Frascarolo P, Suter M, Spahn DR, Magnusson L. Positive end-expiratory pressure during induction of general anesthesia increases duration of nonhypoxic apnea in morbidly obese patients. *Anesth Analg* 2005;**100**:580–4

9. Herriger A, Frascarolo P, Spahn DR, Magnusson L. The effect of positive airway pressure during pre-oxygenation and induction of anaesthesia upon duration of non-hypoxic apnoea. *Anaesthesia* 2004;**59**:243–7

10. Dixon BJ, Dixon JB, Carden JR, et al. Preoxygenation is more effective in the 25 degrees head-up position than in the supine position in severely obese patients: a randomized controlled study. *Anesthesiology* 2005;**102**:1110–5; discussion 5A

11. Baraka AS. Preoxygenation during pregnancy in the head-up versus the supine position. *Anesthesiology* [Internet] 2006 [cited 2015 Jun 24];**104**:380; author reply 381 Available from: http://www.ncbi.nlm.nih.gov/pubmed/16436868

12. Weingart SD, Levitan RM. Preoxygenation and prevention of desaturation during emergency airway management. *Ann Emerg Med* [Internet] Elsevier Inc.; 2012;**59**:165–75 Available from: http://dx.doi.org/10.1016/j.annemergmed.2011.10.002

13. Taha SK, Siddik-Sayyid SM, El-Khatib MF, Dagher CM, Hakki MA, Baraka AS. Nasopharyngeal oxygen insufflation following pre-oxygenation using the four deep breath technique. *Anaesthesia* 2006;**61**:427–30

14. Magorian T, Flannery KB, Miller RD. Comparison of rocuronium, succinylcholine, and vecuronium for rapid-sequence induction of anesthesia in adult patients. *Anesthesiology* [Internet] 1993 [cited 2015 May 28];**79**:913–8 Available from: http://www.ncbi.nlm.nih.gov/pubmed/7902034

15. Jones RK, Caldwell JE, Brull SJ, Soto RG. Reversal of profound rocuronium-induced blockade with sugammadex: a randomized comparison with neostigmine. *Anesthesiology* [Internet] 2008 [cited 2015 Jun 3];**109**:816–24 Available from: http://www.ncbi.nlm.nih.gov/pubmed/18946293

16. Brimacombe JR, Berry AM. Cricoid pressure. *Can J Anaesth* [Internet] 1997 [cited 2015 Jun 24];**44**:414–25 Available from: http://www.ncbi.nlm.nih.gov/pubmed/9104526

17. Escott ME, Owen H, Strahan AD, Plummer JL. Cricoid pressure training: how useful are descriptions of force? *Anaesth Intensive Care* [Internet] 2003 [cited 2015 Jun 24];**31**:388–91 Available from: http://www.ncbi.nlm.nih.gov/pubmed/12973961

18. Rohsbach C, Wirth S, Lenz K, Priebe H. Survey on the current management of rapid sequence induction in Germany. *Minerva Anestesiol* 2013/03/21 ed. 2013;**79**:716–26

19. Agarwal J, Tandon MS, Singh D, Ganjoo P. Quadriplegia in a child following adenotonsillectomy.

Anaesthesia 2013/01/16 ed. 2013;**68**:523–6

20. Rajan S, Mohan P, Paul J, Cherian A. Comparison of margin of safety following two different techniques of preoxygenation. *J Anaesthesiol Clin Pharmacol* [Internet] Medknow Publications; 2015 [cited 2015 Jun 14];**31**:165–8 Available from: http://www.joacp.org/article.asp?issn=0970-9185;year=2015;volume=31;issue=2;spage=165;epage=168;aulast=Rajan

21. Sreejit M, Ramkumar V. Effect of positive airway pressure during pre-oxygenation and induction of anaesthesia upon safe duration of apnoea. *Indian J Anaesth* [Internet] 2015;**59**:216 Available from: http://www.ijaweb.org/text.asp?2015/59/4/216/154998

22. Langeron O, Birenbaum A, Le Saché F, Raux M. Airway management in obese patient. *Minerva Anestesiol* [Internet] 2014 [cited 2015 Jun 24];**80**:382–92 Available from: http://www.ncbi.nlm.nih.gov/pubmed/24122033

23. Lane S, Saunders D, Schofield a, Padmanabhan R, Hildreth a, Laws D. A prospective, randomised controlled trial comparing the efficacy of pre-oxygenation in the 20 degrees head-up vs supine position. *Anaesthesia* 2005;**60**:1064–7

24. Dobson AP, McCluskey A, Meakin G, Baker RD. Effective time to satisfactory intubation conditions after administration of rocuronium in adults. Comparison of propofol and thiopentone for rapid sequence induction of anaesthesia. *Anaesthesia* [Internet] 1999 [cited 2015 Jun 24];**54**:172–6 Available from: http://www.ncbi.nlm.nih.gov/pubmed/10215713

25. Sury MRJ, Palmer JHMG, Cook TM, Pandit JJ. The State of UK anaesthesia: a survey of National Health Service activity in 2013. *Br J Anaesth* [Internet] 2014;**113**:575–84 Available from: http://bja.oxfordjournals.org/lookup/doi/10.1093/bja/aeu292

26. Marsch SC, Steiner L, Bucher E, et al. Succinylcholine versus rocuronium for rapid sequence intubation in intensive care: a prospective, randomized controlled trial. *Crit Care* [Internet] 2011;**15**:R199 Available from: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3387641&tool=pmcentrez&rendertype=abstract

27. Sørensen MK, Bretlau C, Gätke MR, Sørensen AM, Rasmussen LS. Rapid sequence induction and intubation with rocuronium-sugammadex compared with succinylcholine: a randomized trial. *Br J Anaesth* [Internet] 2012 [cited 2015 Jun 24];**108**:682–9 Available from: http://www.ncbi.nlm.nih.gov/pubmed/22315329

28. Perry JJ, Lee JS, Sillberg VAH, Wells GA. Rocuronium versus succinylcholine for rapid sequence induction intubation. Cochrane Database Syst. Rev. 2008.

29. Lee C, Jahr JS, Candiotti KA, Warriner B, Zornow MH, Naguib M. Reversal of profound neuromuscular block by sugammadex administered three minutes after rocuronium: a comparison with spontaneous recovery from succinylcholine. *Anesthesiology* [Internet] 2009 [cited 2015 May 17];**110**:1020–5 Available from: http://www.ncbi.nlm.nih.gov/pubmed/19387176

30. Hanna SF, Ahmad F, Pappas ALS, et al. The effect of propofol/remifentanil rapid-induction technique without muscle relaxants on intraocular pressure. *J Clin Anesth* [Internet] 2010 [cited 2015 Jun 24];**22**:437–42 Available from: http://www.ncbi.nlm.nih.gov/pubmed/20868965

31. SELLICK BA. Cricoid pressure to control regurgitation of stomach contents during induction of anaesthesia. *Lancet (London, England)* [Internet] 1961 [cited 2015 Jun 30];**2**:404–6 Available from: http://www.ncbi.nlm.nih.gov/pubmed/13749923

32. Ellis DY, Harris T, Zideman D. Cricoid pressure in emergency department rapid sequence tracheal intubations: a risk-benefit analysis. *Ann Emerg Med* [Internet] 2007 [cited 2015 Jun 24];**50**:653–65 Available from: http://www.ncbi.nlm.nih.gov/pubmed/17681642

33. Lerman J. On cricoid pressure: 'may the force be with you'. *Anesth Analg* [Internet] 2009 [cited 2015 Jun 24];**109**:1363–6 Available from: http://www.ncbi.nlm.nih.gov/pubmed/19843770

34. Neilipovitz DT, Crosby ET. No evidence for decreased incidence of aspiration after rapid sequence induction. *Can J Anaesth* [Internet] 2007 [cited 2015 Jun 24];**54**:748–64 Available from: http://www.ncbi.nlm.nih.gov/pubmed/17766743

35. Clayton TJ, Vanner RG. A novel method of measuring cricoid force. *Anaesthesia* [Internet] 2002 [cited 2015 Jun 24];**57**:326–9 Available from: http://www.ncbi.nlm.nih.gov/pubmed/11939989

36. Patel a., Nouraei S a. R. Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE): a physiological method of increasing apnoea time in patients with difficult airways. *Anaesthesia* [Internet] 2015;**70**:323–9 Available from: http://doi.wiley.com/10.1111/anae.12923

37. Kaplan MB, Ward DS, Berci G. A new video laryngoscope-an aid to intubation and teaching. *J Clin Anesth* [Internet] 2002 [cited 2015 Apr 23];**14**:620–6 Available from: http://www.ncbi.nlm.nih.gov/pubmed/12565125