Rocuronium versus succinylcholine for rapid sequence induction intubation (Review)

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[Intervention Review]

Rocuronium versus succinylcholine for rapid sequence induction intubation

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ABSTRACT

Background

Patients often require a rapid sequence induction (RSI) endotracheal intubation technique during emergencies or electively to protect against aspiration, increased intracranial pressure, or to facilitate intubation. Traditionally succinylcholine has been the most commonly used muscle relaxant for this purpose because of its fast onset and short duration; unfortunately, it can have serious side effects. Rocuronium has been suggested as an alternative to succinylcholine for intubation. This is an update of our Cochrane review published first in 2003 and then updated in 2008 and now in 2015.

Objectives

To determine whether rocuronium creates intubating conditions comparable to those of succinylcholine during RSI intubation.

Search methods

In our initial review we searched all databases until March 2000, followed by an update to June 2007. This latest update included searching the Cochrane Central Register of Controlled Trials (CENTRAL; 2015, Issue 2), MEDLINE (1966 to February Week 2 2015), and EMBASE (1988 to February 14 2015) for randomized controlled trials (RCTs) or controlled clinical trials (CCTs) relating to the use of rocuronium and succinylcholine. We included foreign language journals and handsearched the references of identified studies for additional citations.

Selection criteria

We included any RCT or CCT that reported intubating conditions in comparing the use of rocuronium and succinylcholine for RSI or modified RSI in any age group or clinical setting. The dose of rocuronium was at least 0.6 mg/kg and succinylcholine was at least 1 mg/kg.

Data collection and analysis

Two authors (EN and DT) independently extracted data and assessed methodological quality for the 'Risk of bias' tables. We combined the outcomes in Review Manager 5 using a risk ratio (RR) with a random-effects model.

Main results

The previous update (2008) had identified 53 potential studies and included 37 combined for meta-analysis. In this latest update we identified a further 13 studies and included 11, summarizing the results of 50 trials including 4151 participants. Overall, succinylcholine was superior to rocuronium for achieving excellent intubating conditions: RR 0.86 (95% confidence interval (CI) 0.81 to 0.92; n = 4151) and clinically acceptable intubation conditions (RR 0.97, 95% CI 0.95 to 0.99; n = 3992, 48 trials). A high incidence of detection bias amongst the trials coupled with significant heterogeneity provides moderate-quality evidence for these conclusions, which are unchanged from the previous update. Succinylcholine was more likely to produce excellent intubating conditions when using thiopental as the induction agent: RR 0.81 (95% CI: 0.73 to 0.88; n = 2302, 28 trials). In the previous update, we had concluded that propofol was the superior induction agent with succinylcholine. There were no reported incidences of severe adverse outcomes. We found no statistical difference in intubation conditions when succinylcholine was compared to 1.2 mg/kg rocuronium; however, succinylcholine was clinically superior as it has a shorter duration of action.

Authors' conclusions

Succinylcholine created superior intubation conditions to rocuronium in achieving excellent and clinically acceptable intubating conditions.

PLAIN LANGUAGE SUMMARY

Comparison of two muscle relaxants, rocuronium and succinylcholine, to facilitate rapid sequence induction intubation

Review question

Which drug (rocuronium or succinylcholine) is better at providing excellent conditions to quickly insert breathing tubes into participants of all ages for elective and emergency situations?

Background

In emergency situations some people need a general anaesthetic with an endotracheal tube (a tube to help them breathe). It is important to have fast-acting medications to allow physicians to complete this procedure quickly and safely. Currently, the medication used most frequently to relax muscles is succinylcholine. Succinylcholine is fast-acting and lasts for only a few minutes, which is very desirable in this setting. However, some people cannot use this medication as it can cause serious salt imbalances or reactions, so an equally effective medication without these side effects would be advantageous. One possible alternative medication is rocuronium, a muscle relaxant with fewer side effects but longer duration of action. This review compares the quality of intubation conditions (the ease with which physicians can quickly and safely pass the endotracheal tube) between rocuronium and succinylcholine in all ages and varying clinical situations.

Study characteristics

We included in the review controlled trials from 1966 to February 2015 involving participants of all ages needing rapid intubation using rocuronium and succinylcholine . The minimum dose of rocuronium given was 0.6mg/kg and succinylcholine was 1mg/kg. We have combined the results of 50 trials, with a total of 4151 participants, which compared the effectiveness of succinylcholine versus rocuronium on intubation conditions. No major side effects from use of the drugs were reported.

Key results

We have found that rocuronium is slightly less effective than succinylcholine for creating excellent and acceptable intubation conditions. Rocuronium should therefore only be used as an alternative to succinylcholine when it is known that succinylcholine should not be used and a more prolonged intubation is expected.

Quality of evidence

The level of evidence is of moderate GRADE due to imperfect study designs and varying techniques used across trials .

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON *[Explanation]*

Rocuronium any dose versus succinylcholine for rapid sequence induction intubation

Patient or population: People requiring rapid sequence induction intubation
Settings: Elective Operating Room, Emergency Room or Intensive Care Unit
Intervention: Rocuronium, any dose
Comparison: Succinylcholine

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk[1]	Corresponding risk				
	Succinylcholine	Rocuronium any dose[2]				
Excellent versus other intubation conditions	Study population		RR 0.86 (0.81 to 0.92)	4151 (50 RCTs)	⊕⊕⊕◯ MODERATE [3]	**Risk of bias**: 50% of the studies were at high risk for detection bias because the outcome assessor was not blinded to the fasciculations caused by succinylcholine **Inconsistency**: High statistical heterogeneity in the studies could not be explained by subgroup analyses. However we did not downgrade because exclusion of trials contributing to heterogeneity did not significantly change the direction or size of effect
	76 per 100	65 per 100 (61 to 69)				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval; **RR:** risk ratio; **RCT:** randomized controlled trial

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]Assumed risk is the average number of excellent intubations with succinylcholine.
[2]Rocuronium minimum dose 0.6 mg/kg. Succinylcholine minimal dose is 1mg/kg.

BACKGROUND

Description of the condition

Patients who need endotracheal intubation in the emergency department or the operating room often require a rapid sequence induction (RSI) technique to protect against aspiration of gastric contents or to facilitate urgent airway protection in cases of imminent airway closure, haemodynamic instability, failing gas exchange and urgent surgical emergencies (Huizinga 1992; McCourt 1998; Stollings 2014).

Description of the intervention

The RSI technique involves the rapid sequential administration of medications (including a sedative, induction anaesthetic and a muscle relaxant, with or without narcotic) followed by endotracheal intubation within one minute of administering the muscle relaxant. In emergency situations, intubation is often required in unstable situations with the potential of haemodynamic instability. This frequently requires modification of the rapid sequence induction for the individual patient, with the goal of securing a patent airway as safely and quickly as possible.

How the intervention might work

Succinylcholine, a depolarizing muscle relaxant, is the most common agent used for a RSI technique in both the controlled and emergency settings (Weiss 1997). Succinylcholine has been the preferred muscle relaxant because it has a rapid onset of 40 to 60 seconds and a short duration, lasting only six to 10 minutes (Combs 1994). Succinylcholine's depolarizing action can lead to hyperkalaemia, possibly inducing fatal cardiac arrhythmias (Combs 1994; Schreiber 2005; Sullivan 1994). As a result, It is contraindicated in patients with major burns (beyond 48 hours), major crush injuries (beyond 48 hours), severe abdominal sepsis, denervation syndromes (such as amyotrophic lateral sclerosis or Guillain Barré Syndrome), muscular dystrophy and major nerve or spinal cord injuries (Martyn 2006). It is also contraindicated in patients with known hyperkalaemia, a history of malignant hyperthermia or previous allergic reaction to succinylcholine (Lebowitz 1989). Succinylcholine use has also been associated with variable increases in intracranial pressure (Minton 1986) and to a lesser extent intraocular pressure (Vinik 1999), and should be administered with drugs that help mitigate these side effects.

Alternative agents, among others, include pancuronium, vecuronium, atracurium and cisatracurium; however, none achieve acceptable intubating conditions as rapidly as succinylcholine (Mazurek 1998). Rocuronium is a steroid-based non-depolarizing muscle relaxant, which has been proposed for creating intubating conditions similar to those of succinylcholine. The duration of action is longer, lasting 37 to 72 minutes with standard doses (Magorian 1993). The only absolute contraindication to rocuronium is allergy. Care must be taken with people who have myasthenia gravis or myasthenic syndrome, hepatic disease, neuromuscular disease, carcinomatosis, or severe cachexia, as the duration of action may be profoundly increased (Stollings 2014).

Why it is important to do this review

There have been many studies looking at the equivalence of rocuronium and succinylcholine, with conflicting outcomes. It has been suggested that inconsistencies in the use of narcotics, the sedative propofol, or the dose of rocuronium administered may have accounted for these differences (Magorian 1993). No previous systematic review comparing the intubation conditions created by rocuronium and succinylcholine had been published prior to our initial review (Perry 2003). This review allows for subgroup analyses to assess for sources of inconsistency between studies. This latest update is important, given that several additional studies have been published since our last update (Perry 2008).

OBJECTIVES

To determine whether rocuronium creates intubating conditions comparable to those of succinylcholine during RSI intubation.

METHODS

Criteria for considering studies for this review

Types of studies

We included all randomized clinical trials (RCTs) and controlled clinical trials (CCTs) meeting the following inclusion criteria:

1. the study reported a score of intubation conditions as one of the main outcomes;
2. the study compared rocuronium to succinylcholine;
3. the dose of rocuronium administered was at least 0.6 mg/kg and the dose of succinylcholine was at least 1 mg/kg (Danzl 2000).

Types of participants

We included in the analysis men, women and children of any age who underwent a rapid sequence induction (RSI), or modified RSI, intubation either electively or emergently. We defined a modified RSI as using both a sedative and a muscle relaxant followed by intubation, with either a delay between the administration of

the two drugs or a delay of more than 60 seconds between the administration of the muscle relaxant and the intubation attempt, or both.

Types of interventions

All of the trials we included in this review compared rocuronium to succinylcholine for neuromuscular blockade. The sedative used for induction anaesthesia was thiopental, propofol, benzodiazepines, ketamine or etomidate. We accepted trials with or without narcotic agents. Additional medications allowed in this review were the use of pre-treatment sedatives (e.g. low-dose benzodiazepines).

Types of outcome measures

We assessed intubating conditions using the Goldberg scale (see Table 1), (Goldberg 1989; Weiss 1997). This is a widely used scale (although not always attributed to Goldberg et al.) that allocates a score for each of: ease of intubation, vocal cord movement, and patient response to intubation (diaphragmatic movement, coughing or bucking). This scale gives a total point value of 12, in which three represents excellent; four to six represents good; seven to nine represents poor, and 10 to 12 represents impossible or inadequate intubation conditions. Excellent intubation conditions had a score of three which means there must have been good conditions recorded by the operator, open vocal cords that were immobile, and no response by the patient to intubation. We converted trials to this scale if this had not been directly reported, but sufficient detail was available to do so. We compared rocuronium with succinylcholine by comparing the proportions of excellent intubation scores and the proportions of clinically acceptable intubation scores (good or excellent).

Primary outcomes

The primary outcome assessed was excellent intubation conditions created during RSI (or modified RSI) comparing rocuronium with succinylcholine.

Secondary outcomes

The secondary outcome assessed was clinically acceptable (excellent or good) intubation conditions created during RSI (or modified RSI) comparing rocuronium with succinylcholine.

Search methods for identification of studies

Electronic searches

In our initial systematic review (Perry 2003) we searched all databases until March 2000. We reran the search to 2007 in our first update (Perry 2008). For this latest updated version we searched the Cochrane Central Register of Controlled Trials (CENTRAL; 2015, Issue 2), MEDLINE (1966 to February 14 2015), and EMBASE (1988 to February 14 2015) to identify all clinical trials relating to the use of rocuronium and succinylcholine during RSI. We used the validated RCT filter for the search (Haynes 1994).
Please refer to Appendix 1 (MEDLINE) , Appendix 2 (EMBASE) and Appendix 3 (CENTRAL) for our search strategies.
The local director of our library services reviewed our search strategy.

Searching other resources

We handsearched the references of included trials to add any citations missed by the electronic searches. We did not apply any language restrictions to the search.

Data collection and analysis

We combined all trials using Review Manager 5 software (RevMan 5.3). We produced the 'Summary of findings' table using GRADEpro software (GRADEpro 2015).

Selection of studies

We retrieved studies by searching by title or abstract. Two independent appraisers (JP, JL, VS, EN or DT) reviewed relevant articles using specific criteria defined in 'Types of studies'. We measured Inter-rater agreement Kappa statistics. We resolved all disagreements by consensus. If we could not reach consensus, then a third author (GW or JP) was available to give a final decision.

Data extraction and management

Two authors (JP, JL, VS, EN, or DT) independently extracted data using standardized data collection forms. We converted intubation conditions to the Goldberg scale (four levels) if required and if adequate information was provided to do so. Rocuronium was compared to succinylcholine by comparing the proportion of excellent intubation scores to non-excellent scores and the proportion of clinically acceptable scores (good or excellent) to the proportion of non-clinically acceptable scores (poor or impossible). We resolved disagreements by consensus, with both extractors referring to the original text together, or by consulting a third author (JP). All data presented were from published literature only. Exact numbers for intubating conditions were provided by the authors for Sluga 2005.

Assessment of risk of bias in included studies

In this update, DT and EN reviewed and assessed all trials included in the review using the 'Risk of bias' tool.

Measures of treatment effect

We calculated dichotomous variables as risk ratios (RRs) for both excellent and acceptable intubation conditions, both with 95% confidence intervals (95% CIs) with a random-effects model.

Unit of analysis issues

The unit of analysis was the intubation scores provided by each of the included trials. Sometimes the distribution of scores was provided only in graphical format, in which case the authors had to extrapolate from the graphs manually. We converted intubations scores when available to the Goldberg scale.

Dealing with missing data

We only included trials if they reported intubating conditions as a scale or in components which could be converted to the Goldberg scale. We performed analysis on an intention-to-treat basis. We conducted subgroup analyses for applicable trials and reported details of excluded information in included trials.

Assessment of heterogeneity

We assessed statistical heterogeneity by using the I statistic with thresholds of 25%, 50% and 75% to indicate mild, moderate and high degrees of heterogeneity respectively (Higgins 2003). Visual inspection was performed of the graphic representation of the trials with their 95% CIs. We explored the causes of significant heterogeneity with subgroup analyses and influence analyses.

Assessment of reporting biases

We performed this by visual inspection of a funnel plot of the included trials, to assess for publication bias.

Data synthesis

We conducted a meta-analysis for the primary outcome of excellent intubation conditions and the secondary outcome of clinically acceptable conditions (where data were available) using Review Manager 5 software (RevMan 5.3). For trials comparing multiple drugs, we used only data points involving succinylcholine and rocuronium with the same induction agents.

Subgroup analysis and investigation of heterogeneity

A priori subgroup analysis for the outcome of excellent intubation conditions compared the following groups: simulated RSI (i.e. the neuromuscular-blocking agent is administered immediately following the sedative and conditions evaluated within 60 seconds) versus modified RSI; induction agent; use versus non-use of a narcotic; doses of rocuronium (0.6, 0.9, or 1.2 mg/kg); adult versus paediatric age groups; and emergency intubations (added in the previous update, Perry 2008).

After we completed the assessment of bias, we conducted subgroup analyses according to categorization of blinding of outcome assessment, to further identify the source of heterogeneity.

Sensitivity analysis

In order to assess their impact on the effect direction, size and precision of the summary estimate,we conducted analyses excluding trials in turn that:

1. contributed most to heterogeneity;
2. were most heavily weighted;
3. showed marked differences in intubation sequence (such as very short time between delivery of muscle relaxant and intubation).

Summary of findings table

We imported data from Review Manager 5 into the online GRADEpro software to produce the 'Summary of findings' table. The assumed risk population was set as the average incidence of excellent intubating conditions in the pooled control group. There is one primary outcome for which we assessed the overall quality of evidence using GRADE methodology by starting at a high level of evidence for RCTs and downgrading for serious deficiencies in the categories of study limitations, indirectness, imprecision, inconsistency and publication bias.

RESULTS

Description of studies

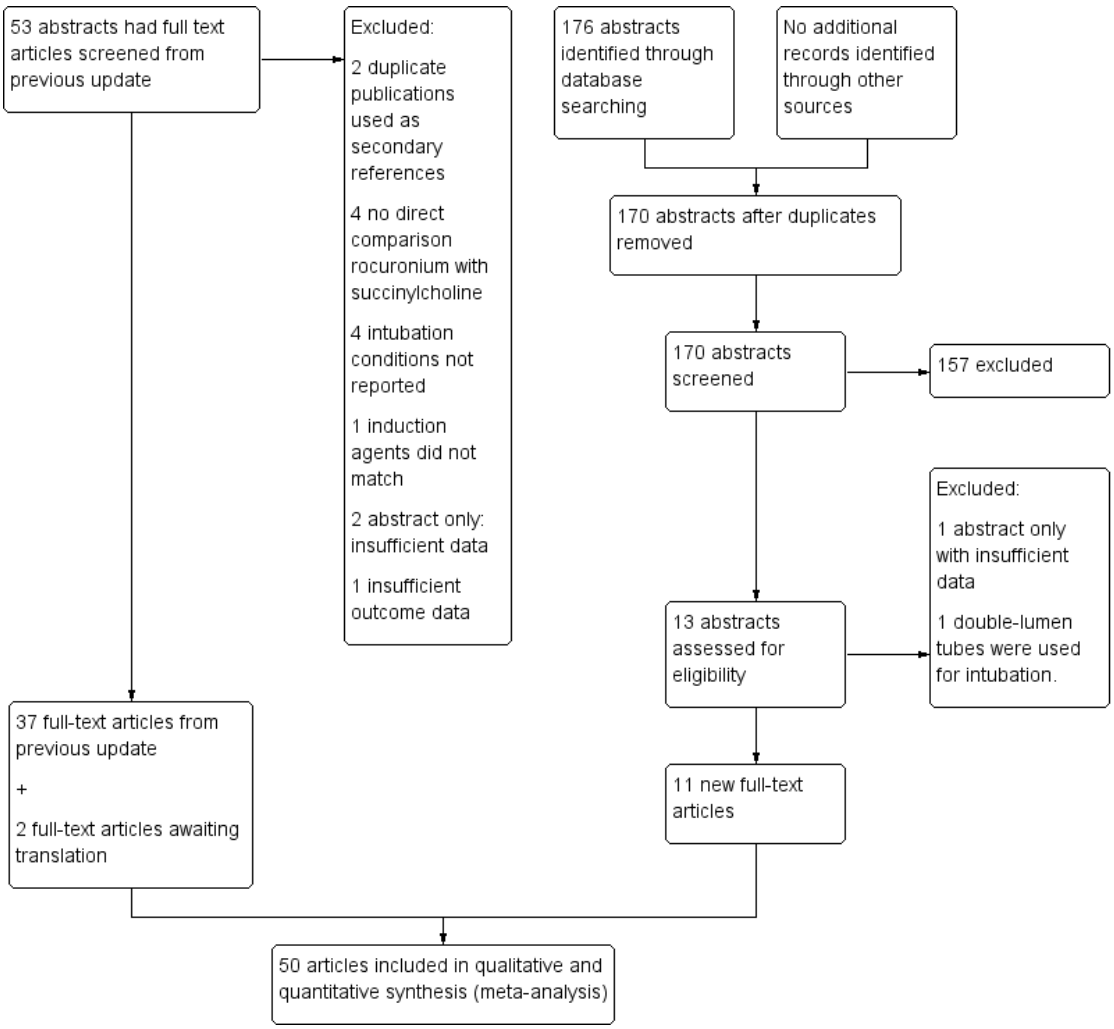
Results of the search

In our previous update (Perry 2008) we identified 53 studies and included 37. For this update we identified 13 new studies. All the included studies are RCTs, with the exception of one CCT identified for this update (De Almeida 2009).

Included studies

We include 11 new trials in this review (Abu-Halaweh 2007; Ali 2008; Belyamani 2008; De Almeida 2009; Iqbal 2013; Kulkarni 2010; Kwon 2013; Marsch 2011; Tripathi 2010; Singh 2011; Sorensen 2012;) (see table Characteristics of included studies). Two articles identified from the previous update were translated and the results incorporated in this update (Mencke 2005; Türkmen 2004) (Figure 1). The revised search identified 66 studies, of which 52 met the inclusion criteria. Two of these were duplicate publications (Dubois 1991a; Mirakhur 1994a) and were therefore included as secondary references.

Figure 1. Search flow diagram for this update from July 2007 to February 2015



We now include 50 trials incorporating results from 4151 individuals in this updated review.

Rationale for excluded information from included studies

Andrews 1999 and McCourt 1998 are two of the largest trials conducted to date. Both trials had planned to conduct interim analyses at the halfway mark, and in both cases the steering committees decided to drop the lower dose rocuronium, as it was shown to be inferior to the larger dose (Dubois 1995). Neither trial reported the results of the low-dose control groups. Hence, the data for the low-dose rocuronium are not included in this meta-analysis. In addition, Sparr 1996b used four different treatment groups with only one control group. Only one of the four treatment groups using rocuronium was appropriately controlled for, i.e. the succinylcholine group which used thiopentone without alfentanyl. Hence we have not included the rocuronium groups with propofol or alfentanyl in this meta-analysis (no control group). Belyamani 2008 performed a trial assessing the benefit of ephedrine on in-

tubating conditions when using either succinylcholine or rocuronium. Of the four treatment groups, we used only the data from the two control groups in this analysis. De Almeida 2009 enrolled morbidly obese participants given different doses of muscle relaxant based on ideal body weight versus total body weight. We have included only data for the two groups dosed for total body weight in this analysis, because the ideal body weight groups would have lower drug levels than those specified in the inclusion criteria. The second trial to involve emergency intubations (Marsch 2011), involved either propofol or etomidate as an induction agent. The authors did not provide separate data for the two groups of participants and we therefore did not include this trial in the induction agent analysis. The figures and tables in Türkmen 2004 were unavailable, and we were therefore able to include only data points for excellent intubation conditions.

Excluded studies

We excluded two of the 13 new studies identified in this update (Misiolek 2009; Stourac 2013).
We have excluded a total of 14 studies, for the reasons detailed in the Characteristics of excluded studies

Studies awaiting classification

There are no studies awaiting classification.

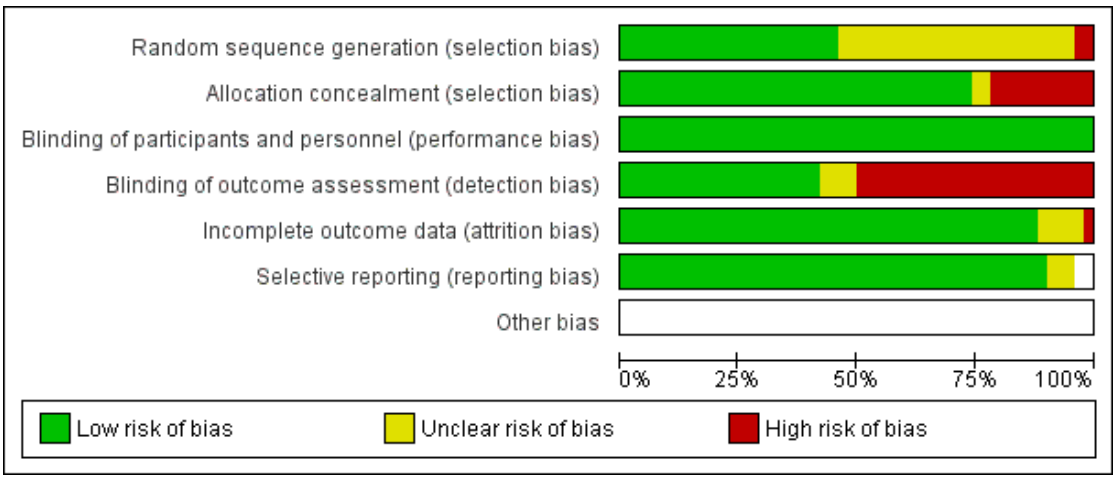
Ongoing studies

There are no ongoing studies

Risk of bias in included studies

Figure 2 summarizes the findings in the four domains of random sequence generation, allocation concealment, blinding of outcome assessment and completeness of data.

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies



Allocation

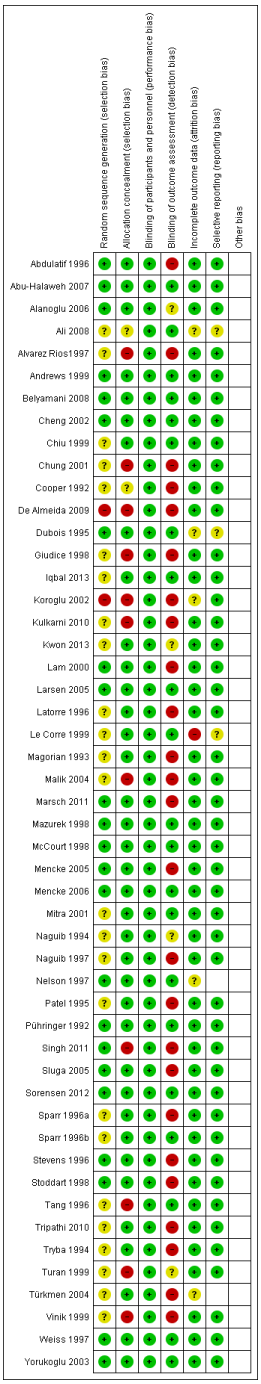
All but one of the trials (De Almeida 2009) was described as a randomized control trial. However, the exact method of randomization was not always described. We rated two of the 50 included trials at high risk of bias for allocation, due to lack of randomization (De Almeida 2009) and randomization by arrival sequence for surgery (Koroglu 2002).

Blinding

The most prevalent area of high risk of bias was blinding of outcome assessment, resulting in downgrading of the quality of evidence to moderate. Although many investigators blinded the intubator to the medication injected, 50% did not blind the assessor to the obvious effects of the drugs (Figure 3). Succinylcholine causes very discernible fasciculations (muscle twitches) that can be observed by the intubator, unblinding the study drug and bias assessment of the primary outcome. Please refer to individual 'Risk

of bias' tables for specific details of each trial .

Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included trial



Incomplete outcome data

Completeness of data was almost uniformly low-risk in the included trials, with the majority of them being complete.

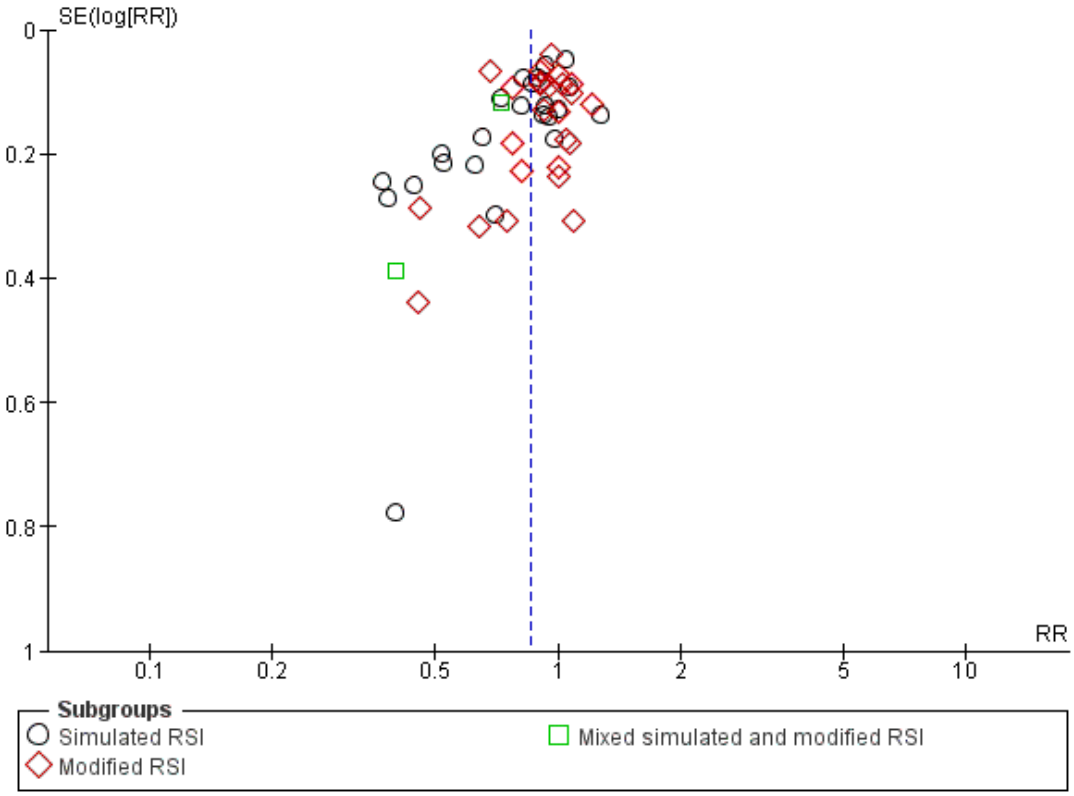
Selective reporting

There were no concerns regarding selective reporting of results, as the outcome data were complete for all randomized participants in all included trials.

Other potential sources of bias

We assessed publication bias with a funnel plot. Visual inspection revealed an equal number of trials on either side of the effect estimate, although there was more scatter to the left indicating a paucity of trials in the lower right quadrant representing small unpublished trials favouring the use of rocuronium (Figure 4).

Figure 4. Funnel plot of comparison: Rocuronium any dose versus succinylcholine, outcome: Excellent versus other intubation conditions.



Effects of interventions

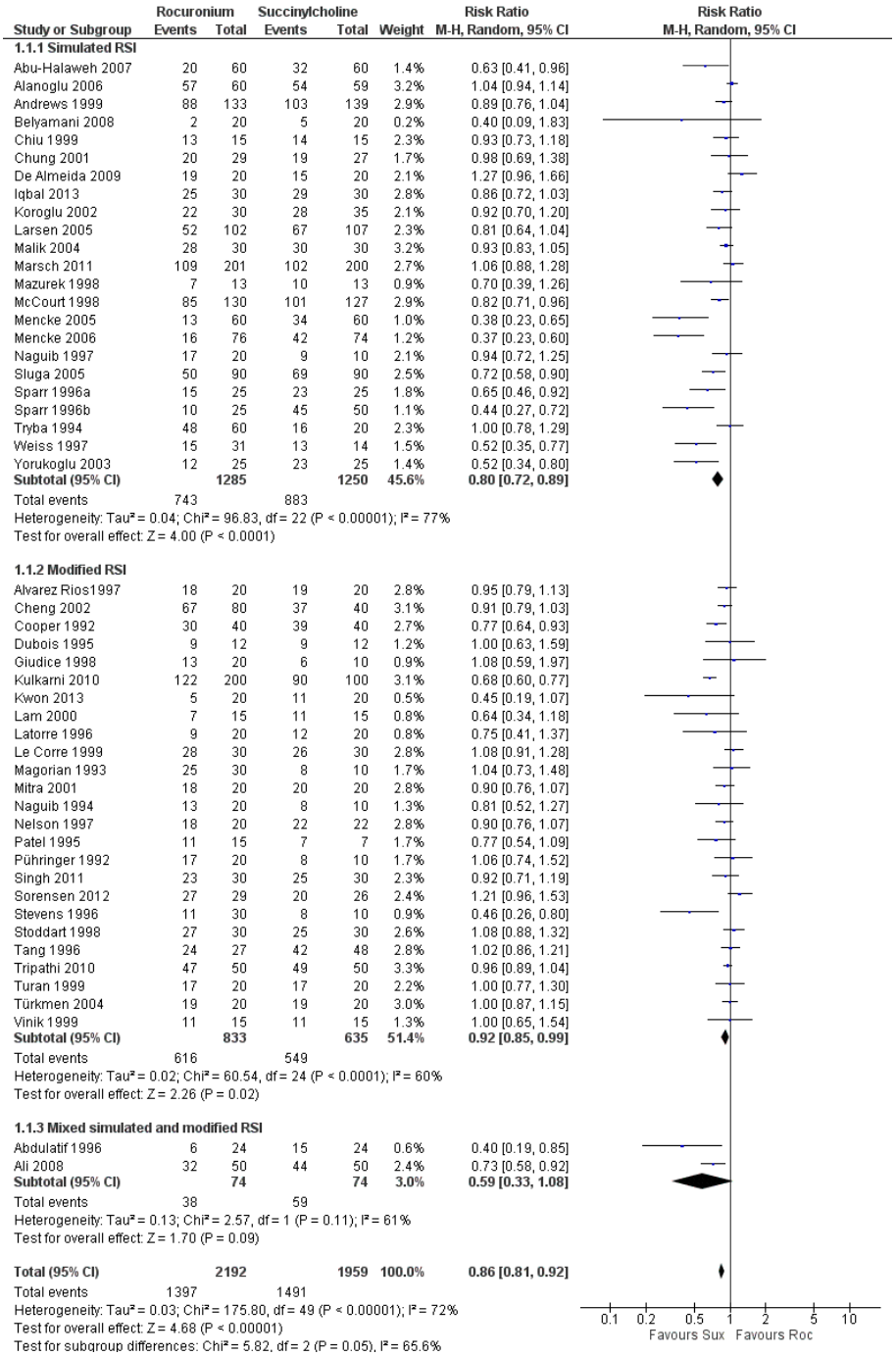
See: **Summary of findings for the main comparison** Rocuronium any dose versus succinylcholine for rapid sequence induction intubation

Primary outcome of excellent intubation conditions

There was a statistically significant risk ratio (RR) favouring succinylcholine in the comparison for the primary outcome of excellent intubating conditions, with a RR 0.86 (95% CI 0.81 to 0.92; participants = 4151; studies = 50; I^2 statistic = 72%; Analysis 1.1). The number needed to treat for an additional harmful outcome (NNTH) for this outcome was eight (95% CI 12 to 6). There was

heterogeneity present in this comparison, as demonstrated graphically with the 95% CIs for each trial . The Chi² test for heterogeneity was significant (Figure 5). An analysis of the influence on heterogeneity demonstrated that no single trial , regardless of size, significantly altered the I² statistic, with the exception of Kulkarni 2010 for the subgroup of modified RSI. These assessments and the following subgroup analyses were unable to explain the heterogeneity in the trials . However, this did not result in a downgrading of the quality of the evidence because we decided that the sources of heterogeneity were clinical variables which contributed to the generalizability of these results.

Figure 5. Forest plot of comparison: 1 Rocuronium any dose versus succinylcholine, outcome: 1.1 Excellent versus other intubation conditions



Secondary outcome of clinically acceptable intubations

We also found a statistically significant difference using the less stringent endpoint of clinically acceptable conditions (excellent or good, excluding poor or failed) with a RR 0.97 (95% CI 0.95 to 0.99; participants = 3992; studies = 48; I^2 statistic = 68%; Analysis 1.2).

Subgroup analysis for the primary outcome of excellent intubation conditions: simulated versus modified RSI

The subgroup which used a simulated RSI technique had a statistically significant RR favouring succinylcholine (RR 0.80, 95% CI 0.72 to 0.89; participants = 2535; studies = 23; I^2 statistic = 77%). The NNTH for this outcome was eight (95%CI 12 to 6) and there was significant heterogeneity present. The subgroup using modified RSI also had significantly better intubation conditions in the succinylcholine group (RR 0.92, 95% CI 0.85 to 0.99; participants = 1468; studies = 25; I^2 statistic = 60%), and an NNTH of eight (95% CI 11 to 5). There was also significant heterogeneity present for this subgroup. The subgroup using mixed simulated and modified RSI now includes two trials with no statistical difference observed.

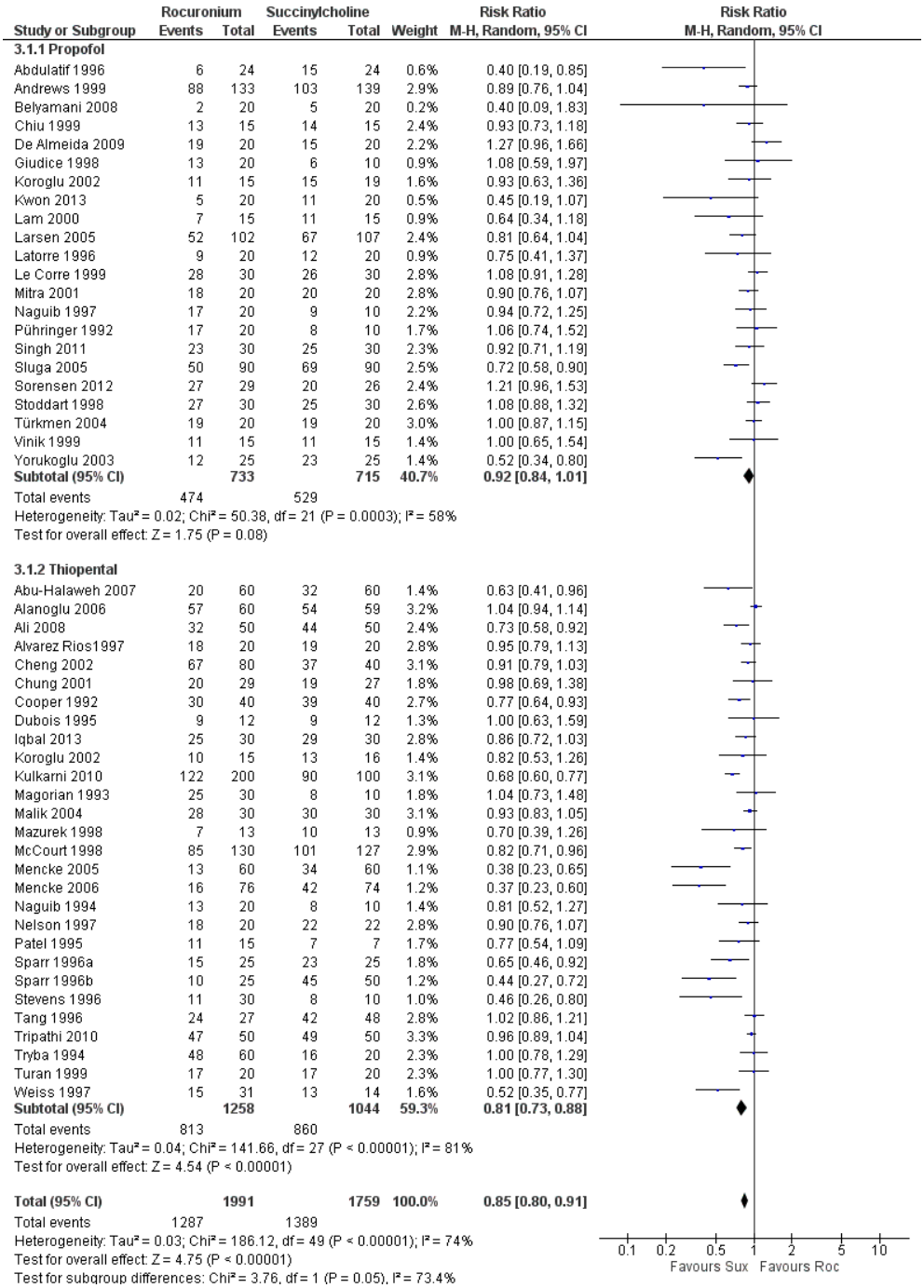
Subgroup analysis for the primary outcome of excellent intubation conditions: comparing the dose of rocuronium

The subgroup using a dose of rocuronium of 0.6 to 0.7 mg/kg had a RR favouring succinylcholine for excellent conditions (RR 0.80, 95% CI 0.72 to 0.88; participants = 2808; studies = 39; I^2 statistic = 77%). The NNTH for this subgroup is six (95% CI 7 to 5). There was significant heterogeneity between the trials. There were no statistical differences for excellent or acceptable intubation conditions in the group that received 0.9 to 1.0 mg/kg of rocuronium or the group that received 1.2 mg/kg of rocuronium. (Analysis 2.1)

Subgroup analysis for the primary outcome of excellent intubation conditions: induction agents

The thiopental subgroup displayed a statistical difference between succinylcholine and rocuronium for the outcome of excellent intubation conditions (RR 0.81, 95% CI 0.73 to 0.88; participants = 2302; studies = 28; I^2 statistic = 81%)(Figure 6). The NNTH for this outcome was six (95% CI 7 to 5). The Chi² test for heterogeneity was significant. Further analysis of the thiopental subgroup compared the effect of thiopental when used with or without a narcotic. Succinylcholine created significantly better outcomes with narcotics ((RR 0.82, 95% CI 0.73 to 0.92; participants = 1300; studies = 17; I^2 statistic = 79%; Analysis 4.1) or without narcotics (RR 0.80, 95% CI 0.69 to 0.94; participants = 1002; studies = 12; I^2 statistic = 84%; Analysis 5.1) in sequence with thiopental. In a change from our previous update, propofol as an induction agent is no longer associated with better intubating conditions. There were no trials that used benzodiazepines for induction, comparing rocuronium to succinylcholine.

Figure 6. Forest plot of comparison: 3 Rocuronium versus succinylcholine for induction agent, outcome: 3.1 Excellent versus other intubation conditions



Subgroup analysis for the primary outcome of excellent intubation conditions: use of narcotics

Succinylcholine provided better intubating conditions with or without opioid use. The subgroup of trials using a narcotic in the sequence favoured the succinylcholine group (RR 0.85, 95% CI 0.78 to 0.93; participants = 2292; studies = 34; I^2 statistic = 74%; Analysis 4.1). The NNTH for the subgroup using narcotics was seven (95% CI 10 to 6). The subgroup without a narcotic in sequence also demonstrated a statistically significant difference (RR 0.85, 95% CI 0.76 to 0.95; participants = 1428; studies = 16; I^2 statistic = 76%; Analysis 5.1). The NNTH for this subgroup was six (95% CI 9 to 5). There was significant heterogeneity present for both groups.

Subgroup analysis for the primary outcome of excellent intubation conditions: age groups

The paediatric subgroup demonstrated no statistically significant difference between rocuronium and succinylcholine (RR 0.86, 95% CI 0.70 to 1.06; participants = 536; studies = 5; I^2 statistic = 81%). There was significant heterogeneity between the five paediatric trials (Figure 6).

Subgroup analysis for the primary outcome of excellent intubation conditions: emergency intubation

For the subgroup comparing rocuronium and succinylcholine in emergency participants, there was a statistically significant RR favouring succinylcholine (RR 0.84, 95% CI 0.73 to 0.98; participants = 1073; studies = 5; I^2 statistic = 53%; Analysis 7.1). The NNTH was 12 (95% CI 38 to 7) for this subgroup, and there was no significant heterogeneity between trials .

Inter-observer agreement

In the first version of this review (Perry 2003), there was complete agreement between both evaluators regarding article selection (Kappa statistics 1.0). For this most recent update, the Kappa statistic was 0.9 for the articles.

DISCUSSION

Summary of main results

Primary and secondary outcomes

This review summarizes the results of 50 trials in 41521 participants, demonstrating moderate-quality evidence that succinylcholine creates better intubation conditions than rocuronium for both excellent and clinically acceptable intubation conditions during a rapid sequence induction. This is the same conclusion that we drew in our previous update (Perry 2008). The number of failed intubations was very small, with no clinically or statistically significant difference between rocuronium and succinylcholine.

Subgroup analysis

We have demonstrated that succinylcholine is superior to rocuronium when either a simulated or modified RSI technique is used. There are now two trials (n = 148) with mixed simulated RSI and modified RSI demonstrating no difference between the two muscle relaxants.

An interesting finding in this current update is the conclusion regarding an induction agent used with the muscle relaxant. Thiopental was found to provide superior intubating conditions with or without the use of a narcotic. This is contrary to the conclusions of the last update (Perry 2008). This switch in induction agent of choice was the result of the addition of six trials which used thiopental in this update, representing a total of 800 participants (Abu-Halaweh 2007; Ali 2008; Iqbal 2013; Kulkarni 2010; Mencke 2005; Tripathi 2010). Unfortunately, this finding will have limited clinical applicability in North America, where the availability of thiopental has become very limited. When propofol was used as an induction agent, we found no significant difference between the two muscle relaxants with or without narcotics. The failure of narcotics to make a difference to the quality of intubation conditions is contrary to research which has reported significantly improved intubation conditions with the addition of a narcotic to the induction sequence (Sparr 1996b). This suggests that narcotics can safely be omitted in patients for whom they are contraindicated.

The dose of rocuronium has been thought to be important in creating intubation conditions equivalent to succinylcholine. This meta-analysis did not find conclusive evidence that increasing doses of rocuronium led to better intubating conditions. Succinylcholine created significantly more excellent intubation conditions than rocuronium at doses of 0.6 to 0.7 mg/kg. There was no statistically significant difference for the 0.9 to 1.0 mg/kg or 1.2 mg/kg groups, reaffirming the dose of rocuronium used in current practice for RSI when succinylcholine is not clinically indicated. It is difficult to draw conclusions regarding the higher doses of rocuronium, as there are relatively few studies which have examined the higher dose (1.2 mg/kg) of rocuronium (n = 86). It is possible that

there may be a benefit to using an increased dose of rocuronium but this meta-analysis does not support this from the studies conducted to date. However, it should be noted that rocuronium has a longer duration of action compared to succinylcholine, and that increasing the dose of rocuronium increases its duration of action (73 ± 32 minutes for 1.2 mg/kg dose, Magorian 1993) which can result in an increased incidence of adverse outcomes (i.e. increased duration of paralysis in a patient who cannot be successfully intubated).

We include a subgroup analysis for participants undergoing emergency intubation from the last updated version of the review (Perry 2008). We have demonstrated that succinylcholine is superior to rocuronium in creating excellent intubation conditions. This is consistent with our findings in the less than 60-second time delay subgroup. There was, however, no significant difference between groups for the outcome of clinically acceptable intubation, indicating that in emergency patients for whom succinylcholine is contraindicated, rocuronium can still be used to reliably create acceptable intubating conditions.

The five paediatric trials (Cheng 2002; Kulkarni 2010; Mazurek 1998; Naguib 1997; Stoddart 1998) did not demonstrate a difference in creating excellent intubation conditions between the rocuronium and succinylcholine groups. However, these had very little power to demonstrate any statistically significant difference due to the small sample size (i.e. underpowered for an equivalence trial). In addition, two of the trials (Naguib 1997; Stoddart 1998) used propofol in the sequence, while a third (Mazurek 1998) used a high dose of rocuronium (1.2 mg/kg) which may have confounded the results. This update includes a trial where ketamine was used in addition to a benzodiazepine as a premedication for particularly young children, further confounding the comparison (Kulkarni 2010).

Overall completeness and applicability of evidence

Although the search parameters were designed to identify any articles that could be pertinent to our research question, it is still possible that we have missed research not included in the databases accessible to the English-speaking community. The inclusion of non-English articles necessitated translation which, if performed poorly, could be a source of error, especially when assessing the specific domains of risk of bias. For the majority of cases, we pooled data presented in the publications for meta-analysis. We obtained data from one trial (Sluga 2005) through correspondence with the authors.

This review has identified trials involving participants from a wide age range (one to 77 years) in a variety of clinical settings, including both elective and emergency intubations in the operating room, emergency department and intensive care unit. The funnel plot of the included trials indicates a lack of trials in the right lower quadrant which may represent small unpublished trials favouring the use of rocuronium (Figure 4). However, the reason for such trials not being reported is not evident. Another reason for the asymmetric funnel plot is heterogeneous study effects that can be seen with varying study sizes, intubation sequences and study populations. More effective intubation conditions can be achieved with larger doses of rocuronium, with the drawback of prolonging muscle paralysis and length of intubation. This adverse outcome was not reported in the included trials, although there is a report of tachycardia and coughing. This review is unable to draw conclusions regarding safety.

Quality of the evidence

We found a significant amount of heterogeneity in the analysis of the primary outcome, which we tried to explore with subgroup analyses separating by age, emergencies, doses of rocuronium, timing of muscle relaxant, induction agent and opioid use. The I^2 statistical value never fell below the 50% thresholds with these sensitivity analyses, nor did the direction or size of the summary estimate. As a result, we did not downgrade the quality of evidence, because unexplored reasons for heterogeneity include:

1. Different populations (varying from simple elective limb surgery to more complex gastric bypass on morbidly obese patients and emergent intensive care intubations);
2. Varying clinical settings;
3. Different medications in induction sequences;
4. Different timing of intubation.

All of these contribute to the generalizability of our results and to reducing concerns about indirectness.

Assessments of the risk of biases demonstrate that the series of trials included in this review are at low risk of selection and attrition bias . All but one trial was described as a randomized controlled trial, with 11% of trials being at high risk for lack of allocation concealment. The area of most concern was the high incidence of detection bias due to lack of blinding of the outcome assessor, which led to a downgrading of the quality of evidence to moderate. Succinylcholine will cause significant fasciculations, and intubators who are not blinded to this effect may assign biased scores to the intubating conditions. We conducted a subgroup analysis based on the blinding of the outcome assessor which failed to explain the source of the heterogeneity in the meta-analysis (Analysis 8.1). There were no concerns regarding the precision of the estimate, with more than 4000 participants included in the pooled estimate.

Potential biases in the review process

Because the original review was published in 2003 (Perry 2003), this update had to retrospectively formulate 'Risk of bias' tables, a 'Summary of findings' table and GRADE the quality of evidence in accordance with updated Cochrane guidelines. This process may

have led to loss of details, now regarded as pertinent, involving inclusions/exclusion decisions made in the previous updates.
With the large number of possible sequences used, multiple testing can result in erroneous conclusions just by chance. This effect was minimized with the use of sensitivity analysis in prespecified subgroups. We conducted an additional subgroup analysis post hoc based on detection bias, to try and account for the heterogeneity observed in the results. At the time of inception of this review, doses of 0 .6 mg/kg of rocuronium were being given for RSI, but higher doses of 1 mg/kg are now favoured, and the subgroup analyses allowed for assessment of these different doses.

Agreements and disagreements with other studies or reviews

A retrospective review of 327 RSI intubations using etomidate with rocuronium or succinylcholine in the emergency department showed equivalent success at first intubation attempts (Patanwala 2011). Median doses for rocuronium were 1.19 mg/kg and 1.5 mg/kg of succinylcholine. Herbstritt 2012 is a short review looking at use of equivalent doses of rocuronium and succinylcholine (1 mg/kg) for RSI. They included seven papers of varying quality (retrospective review, RCT and meta-analysis), and concluded that there are no differences in intubating conditions between the two. This is consistent with our finding in the 0.9 to 1.0 mg/kg dose range (RR 0.95, 95% CI 0.89 to 1.00; participants = 1458; studies = 16; I^2 statistic = 44%). When using doses of 0.6 mg/kg of rocuronium, Larsen 2005 used alfentanil and propofol as their induction agents and found no difference between rocuronium and succinylcholine 1 mg/kg in achieving clinically acceptable intubating conditions. These results are also consistent with those reported in this review for the secondary outcome (RR 0.99, 95% CI 0.96 to 1.02; participants = 952; studies = 16; I^2 statistic = 19%).

AUTHORS' CONCLUSIONS

Implications for practice

There is moderate-quality evidence to show that succinylcholine creates excellent intubation conditions more reliably than rocuronium and should still be used as a first-line muscle relaxant for rapid sequence induction endotracheal intubations. If an alternative agent is required, rocuronium 1 mg/kg can be used to create acceptable intubation conditions but should only be used as a second-line treatment because the length of paralysis will be significantly prolonged. The introduction of suggamadex to facilitate reversal of non-depolarizing muscle relaxants may decrease the incidence of this complication, but this drug is not currently widely available (Soto 2015).

Implications for research

Any further trials comparing succinylcholine should make certain to blind the outcome assessor to the obvious fasciculations triggered by succinylcholine. Most of the included trials assessed intubation conditions using the variables: ease of laryngoscopy, vocal cord motion and diaphragm movement. These measures should be maintained to allow for consistent comparison between trials. Although there are now five trials (Larsen 2005; Marsch 2011; Mazurek 1998; McCourt 1998; McCourt 1998) involving emergency participants, further trials in this patient population may reveal differences in results because etomidate is more often used as an induction agent than in the operating room. There was a lack of reporting of adverse outcomes in the trials, which should be remedied in any trials performed in the future.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Abdulatif 1996

Methods	RCT Mixed simulated and modified RSI N = 144
Participants	ASA I-II 19 - 57 years Elective OR Baseline comparison information not provided
Interventions	1. Rocuronium 0.6 mg/kg (n = 24) 2. Succinylcholine 1 mg/kg (n = 24) 3. Atracurium 0.5 mg/kg (n = 24)* 4. above groups with priming dose of Rocuronium (n = 24 each) * Premedication: diazepam 10 mg po Sequence with: fentanyl 2 mcg/kg, propofol 2.5 - 3.0 mg/kg
Outcomes	1. Intubating conditions 60s after muscle relaxant evaluated by blinded observer. Reported as scores (0 - 3) adapted from Fahey et al. Definitions table include vocal cord movement, visualization, participant movement 2. Adductor pollicis response to TOF stimulation
Adverse events	None reported
Time & Place	Study dates not reported. Article accepted November 1995. King Fahad University Hospital, Al-Khobar, Saudi Arabia.
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sealed envelopes
Allocation concealment (selection bias)	Low risk	Participants were randomly allocated via closed envelope
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions

Abdulatif 1996 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	High risk	No mention of blinding
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data for all participants reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Abu-Halaweh 2007

Methods	RCT Elective and emergency caesarean section N = 120
Participants	ASA I - II Pregnant women Mean age 32 Mean weight 78 kg
Interventions	1, Rocuronium 1 mg/kg (n = 60) 2, Succinylcholine 1 mg/kg (n = 60) Sequence with: thiopental 5 mg/kg
Outcomes	1. Intubating conditions by senior anaesthetist 60s after muscle relaxant. Reported as excellent, good and poor, as modified Viby-Mogenson Grading system. Features included jaw relaxation, vocal cord position and diaphragmatic activity
Adverse events	Slight increase in heart rate after 5 mins with rocuronium use
Time & Place	December 2005 to May 2006 Jordan University Hospital, Jordan
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomly shuffled envelopes, probably adequate
Allocation concealment (selection bias)	Low risk	Randomly shuffled sealed envelopes indicating the type of the muscle relaxant to be used for intubation

Abu-Halaweh 2007 (*Continued*)

Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The intubator who was blinded to the type of administered muscle relaxant was called to the theatre 40s after the relaxant administration
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data for all participants reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Alanoglu 2006

Methods	RCT Modified RSI N = 119	
Participants	ASA II - III Adult Controlled hypertensive	
Interventions	1. Succinylcholine 1.0 mg/kg with lidocaine (n = 30) 2. Rocuronium 1 mg/kg with lidocaine (n = 30) 3. Succinylcholine 1.0 mg/kg with remifentanil (n = 29) 4. Rocuronium 1.0 mg/kg with remifentanil (n = 30) Sequences with opiate (remifentanil) or no opiate and thiopental	
Outcomes	1. Intubating conditions 60s after muscle relaxant. Reported as excellent, good, poor based on 6 variables (jaw relaxation, resistance to blade, vocal cord position and movement, movement of limbs and coughing) with table of definitions 2. Haemodynamics before inductio, after induction and at intubation	
Adverse events	Mild muscle rigidity in 6 participants with the use of remifentanil	
Time & Place	Study dates not reported. Article accepted June 2005 Ankara University, Ankara, Turkey	
Funding and declarations	Funding source: none declared Declarations of interest: none declared	
Notes	ITT analysis	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**

Alanoglu 2006 (*Continued*)

Random sequence generation (selection bias)	Low risk	Sealed envelope
Allocation concealment (selection bias)	Low risk	Allocated to 4 groups at random by sealed envelope technique
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	"Authors performing the intubation and scoring intubation conditions were blinded to the study medications. " Unclear if blinded allocation or drug administration
Incomplete outcome data (attrition bias) All outcomes	Low risk	Adequately described in detail
Selective reporting (reporting bias)	Low risk	All outcomes reported

Ali 2008

Methods	RCT Mixed simulated and modified RSI N = 100
Participants	ASA I - II Age 18 - 60 Elective OR
Interventions	1. Rocuronium 0.6 mg/kg at 60s (n = 25) 2. Rocuronium 0.6 mg/kg at 90s (n = 25) 3. Succinylcholine 1.5 mg/kg at 60s (n = 25) 4. Succinylcholine 1.5 mg/kg at 90s (n = 25) Sequence with thiopental 5 mg/kg
Outcomes	Intubation conditions at 60 or 90s after muscle relaxant. Reported as score (0 - 3) based on 3 variables (jaw relaxation, vocal cords and response to intubation) from Cooper et al with definitions table
Adverse events	None reported
Time & Place	Study dates not reported. Article published 2008. Sheri Kashmir Institute of Medical Sciences, Soura, Srinagar, India
Funding and declarations	Funding source: none declared Declarations of interest: none declared

Ali 2008 (*Continued*)

Notes	Did not provide results of individuals groups. Used aggregate data, classified as modified RSI

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"randomized" but did not elaborate
Allocation concealment (selection bias)	Unclear risk	Used "double-blind" fashion
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Same fully-trained anaesthetist (Intubator) performed all the intubations, who was called in the study room 45s after the administration of the neuromuscular blocker in group A participants and after 75s in group B participants (to eliminate possible bias because of fasciculations induced by succinylcholine) and intubation was attempted 15s later
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Data were not presented for all 4 groups, aggregated into 2 groups
Selective reporting (reporting bias)	Unclear risk	Only aggregate data presented

Alvarez Rios1997

Methods	RCT Modified RSI N = 60
Participants	ASA I - II Elective OR Mean age 28.5 Mean weight 62.5 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 20) 2. Mivacurium 0.25 mg/kg (n = 20)* 3. Succinylcholine 1 mg/kg (n = 20) Premedication: midazolam 2 mg Sequence with: no opioid

Alvarez Rios1997 (*Continued*)

	thiopental titrated to response (average 5.3 mg/kg with succinylcholine group and 5.9 mg/kg in rocuronium group)
Outcomes	1. Intubating conditions 90s after muscle relaxant. Reported as excellent, good, poor with definitions described for madibular relaxation, vocal cords and participant movement
Adverse events	None reported.
Time & Place	Study dates were not reported. Article published 1997. Mexico
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Established groups were formed randomly, but does not state how
Allocation concealment (selection bias)	High risk	No comment made
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No statement regarding blinding
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data on all participants reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Andrews 1999

Methods	RCT Simulated RSI N = 366
Participants	ASA I - V 18 - 75 years Elective OR Mean age 47.5 Mean weight 61.5 kg

Andrews 1999 (*Continued*)

Interventions	1. Rocuronium 0.6 mg/kg (n = 48)* 2. Rocuronium 1.0 mg/kg (n = 46)* 3. Rocuronium 1.0 mg/kg (n=133) 4. Succinylcholine 1 mg/kg (n = 139) Sequence with: no opioid, propofol 2.5 mg/kg
Outcomes	1. Intubating conditions 50s after muscle relaxant. Reported as excellent, good, poor based on 6 variables (jaw relaxation, resistance to laryngoscope, vocal cord position and movement, limb movement and diaphragmatic activity) with definitions described
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted September 1998. University of Newcastle-upon-Tyne, Turnhout, Belgium
Funding and declarations	Funding source: Organon Teknika Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	States randomly without replacement and stratified for centre
Allocation concealment (selection bias)	Low risk	Allocation concealed from investigator performing the randomization
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"blinding was achieved by concealing patient from the investigator until immediately before laryngoscopy."
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants accounted for
Selective reporting (reporting bias)	Low risk	All outcomes reported

Belyamani 2008

Methods	RCT Simulated RSI N = 80
Participants	ASA I - II Elective OR Mean age 34 Mean BMI 23.5
Interventions	1. Succinylcholine 1 mg/kg + ephedrine (n = 20)* 2. Rocuronium 0.6 mg/kg + ephedrine (n = 20)* 3. Succinylcholine 1 mg/kg + saline (n = 20) 4. Rocuronium 0.6 mg/kg + saline (n = 20) Premedication: Hydroxyzine 1 mg/kg Sequence with: propofol 2.5 mg/kg, fentanyl 3 mcg/kg
Outcomes	1. Intubation conditions 30s after muscle relaxant. Reported as excellent, good, poor based on criteria from the Copenhagen conference. No definitions provided 2. Heart rate, blood pressure
Adverse events	None reported
Time & Place	Study dates not reported. Article accepted December 2007. Mohammed-V Military Hospital, Rabat, Maroc
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	In French.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Used a randomization table
Allocation concealment (selection bias)	Low risk	The participant and the anaesthesiologist were not informed of the contents of the syringes (prepared by a separate individual)
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	30s after injection of the muscle relaxant, another blinded staff anaesthetist performed intubation of the participant

Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Cheng 2002

Methods	RCT Modified RSI N = 120
Participants	ASA I 1 - 10 years Elective OR
Interventions	1. Rocuronium 0.6 mg/kg (n = 40) 2. Rocuronium 0.9 mg/kg (n = 40) 3. Succinylcholine 1.5 mg/kg (n = 40) Sequence with: alfentanil 10 mcg/kg, thiopentone 5 mg/kg
Outcomes	1. Intubating conditions 30s after muscle relaxant. Reported as excellent, good, poor and impossible with table of definitions. Clinical features included: vocal cord movement, participant response to intubation and jaw relaxation
Adverse events	One participant developed bronchospasm during intubation after receiving rocuronium 0.9 mg/kg. This resolved spontaneously
Time & Place	Study dates not reported. Article published 2002. Prince of Wales Hospital, New Territories, Hong Kong
Funding and declarations	Funding source: Organon Teknika China Ltd provided rocuronium for study Declarations of interest: none declared
Notes	ITT analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomized by sealed envelopes
Allocation concealment (selection bias)	Low risk	"children were randomly assigned by means of opaque, sealed envelopes"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions

Cheng 2002 (*Continued*)

Blinding of outcome assessment (detection bias) All outcomes	Low risk	"observer had her back turned to the patient during the 30s before attempting to intubate"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Chiu 1999

Methods	RCT Simulated RSI N = 30
Participants	ASA I 18 - 50 years Elective OR Mean age 32.4 Mean weight 55.6 kg
Interventions	1. Rocuronium 0.9 mg/kg (n = 15) 2. Succinylcholine 1 mg/kg (n = 15) Premedication: midazolam 0.15 mg/kg po Sequence with: fentanyl 2 mcg/kg, propofol 2 mg/kg
Outcomes	1. Intraocular pressure, mean arterial pressure, heart rate measured before induction, immediately after induction and every minute after intubation for 5 mins 2. Intubating conditions 60s after muscle relaxant. Reported as a score (1 - 4) described in Methods section. Clinical variables included jaw relaxation, vocal cord movement, diaphragm movement
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted January 1999. Univeristy of Malaya, Kuala Lumpur, Malaysia
Funding and declarations	Funding source: Organon Teknika (Malaysia) supplied rocuronium. Kemajuan Abadi Optomedic (Malaysia) supplied Keeler Pulsair air pulse tonometer Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Chiu 1999 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	"randomized, double-blind, controlled study", but does not elaborate
Allocation concealment (selection bias)	Low risk	"drugs were administered ...by one anaesthetist (CYW) who was unaware of the drugs administered"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"the intubating anesthetist were not allowed to observe injection of the neuromuscular blocking drug or the presence of any fasciculations, by standing initially with their back to the patient. They were then asked to turn round to face the patient, 45 s after injection of either succinylcholine or rocuronium; by then the fasciculations had subsided"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Chung 2001

Methods	RCT Simulated RSI N = 84
Participants	ASA I - II Adult Elective OR Mean age 45.8
Interventions	1. Rocuronium 0.6 mg/kg and then thiopental 5 mg/kg (n = 28)* 2. Thiopental 5 mg/kg and then succinylcholine 1 mg/kg (n = 29) 3. Thiopental 5 mg/kg and then rocuronium 0.6 mg/kg (n = 27) Sequence with: fentanyl 2 mcg/kg, lidocaine 20 mg
Outcomes	1. Intubating conditions 60s after muscle relaxant. Reported as excellent, good and poor from a score (0 - 9) (from Cooper et al) based on 3 variables (ease of laryngoscopy, condition of vocal cords, response to intubation) and defined in a table 2. Apnea time before laryngoscopy 3. Intubation time 4. Total apnoea time
Adverse events	5 participants in Group 1 and 1 in Group 2 had pain in injection. 3 in Group 1 had diminished breathing during induction. 1 in Group 1 had mild desaturation

Chung 2001 (*Continued*)

Time & Place	Study dates not reported. Article accepted September 2000. Changhua Christian Hospital, Changhau, Taiwan	
Funding and declarations	Funding source: none declared Declarations of interest: none declared	
Notes	Efficacy analysis	
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"patients were randomly allocated", but did not elaborate
Allocation concealment (selection bias)	High risk	Not mentioned
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Not mentioned
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants accounted for, 6/90 participants excluded due to "invisible vocal cords after several attempts"
Selective reporting (reporting bias)	Low risk	All outcomes reported

Cooper 1992

Methods	RCT Modified RSI N = 80
Participants	ASA I - II 18 - 65 years Elective OR Mean age 34.5 Mean weight 66.3 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 40) 2. Succinylcholine 1 mg/kg (n = 40) Premedication: temazepam 10 - 20 mg po Sequence with: fentanyl 1 - 3 mcg/kg, thiopentone 3 - 5 mg/kg

Cooper 1992 (*Continued*)

Outcomes	1. Intubating conditions 60 and 90s after muscle relaxant. Reported as excellent, good and poor from a score (0 - 9) based on 3 variables (jaw relaxation, vocal cords, response to intubation), defined in table
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted March 1992. Queen's University, Belfast, Britain
Funding and declarations	Funding source: rocuronium supplied by Organon Teknika, Belgium Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"patients were allocated randomly"
Allocation concealment (selection bias)	Unclear risk	"patients were allocated randomly"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment on blinding
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

De Almeida 2009

Methods	Controlled Trial Simulated RSI N = 80
Participants	ASA I - III Elective bariatric surgery Morbidly obese participants BMI $\geq$ 40 18 - 65 yrs Mean age 39 Mean weight 128 kg

De Almeida 2009 (*Continued*)

Interventions	1. Succinylcholine 1 mg/kg ideal body weight (n = 20)* 2. Succinylcholine 1 mg/kg total body weight (n = 20) 3. Rocuronium 0.6 mg/kg ideal body weight (n = 20)* 4. Rocuronium 0.6 mg/kg total body weight (n = 20) Premedication: midazolam 7.5 mg Sequence with: propofol 2 mg/kg, fentanyl 2 mcg/kg
Outcomes	Intubation conditions 60s after intubation. Reported as excellent, good, poor based on 5 variables (laryngoscopy, vocal cord position, vocal cord movement, reaction to tube insertion, limb movement with tube insertion) described in a table
Adverse events	None reported.
Time & Place	March 2005 to March 2007. Federal University of Santa Catarina, Santa Catarina, Brazil
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Paper written in Spanish.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	No mention of randomization
Allocation concealment (selection bias)	High risk	No comment made
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No description or comment on blinding
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Dubois 1995

Methods	RCT Modified RSI N = 24
Participants	ASA I - II 18 - 65 years Elective OR Baseline information not provided (told groups tested and no difference)
Interventions	1. Rocuronium 0.6 mg/kg (n = 12) 2. Succinylcholine 1 mg/kg (n = 12) Premedication: midazolam 2 - 5 mg iv and/or droperidol 1.25 - 5mg iv Sequence with: fentanyl 1 - 10 mcg/kg, thiopentone 3 - 5 mg/kg
Outcomes	1. Intubating conditions after 80% first twitch depression of TOF. Reported as excellent good, poor and inadequate based 3 variables (jaw relaxation, vocal cord movement, diaphragm) described in Methods section 2. Heart rate and blood pressure 2. Onset time of muscle relaxant
Adverse events	5 participants had fasciculations. 2 had skin rash and one experienced hypersalivation
Time & Place	Study dates not reported. Article accepted March 1994. Georgetown University Medical Center, Washington, DC, USA.
Funding and declarations	Funding source: Support of Clinical Project Director Organon Inc Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Randomly assigned via computer generation
Allocation concealment (selection bias)	Low risk	"either R or S in a coded syringe prepared by the pharmacist was given"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"the investigator intubator was blinded to the muscle relaxant randomization scheme and not in the operating room for drug administration"

Dubois 1995 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Unclear risk	"The other 6 patients were dropped because of incomplete data retrieval". Did not say why data were missing
Selective reporting (reporting bias)	Unclear risk	Outcomes for excluded participants not reported

Giudice 1998

Methods	RCT Modified RSI N = 40
Participants	ASA I - II Age 18 - 56 Mean age uncertain but told groups homogeneous Mean weight also homogeneous
Interventions	1. Rocuronium 0.3 mg/kg (n = 10)* 2. Rocuronium 0.6 mg/kg (n = 10) 3. Rocuronium 0.9 mg/kg (n = 10) 4. Succinylcholine 1 mg/kg (n = 10) Premedication: lorazepam 1 mg po 1 hour prior, atropine 0.08 mg/kg few minutes prior Sequence with: fentanyl prn, propofol 1.5 mg/kg
Outcomes	1. Intubating conditions when T1 of TOF $\leq$ 5%. Reported as a score (0 - 6). Variables not presented for score assessment 2. Recovery of T1 to 25% 3. Intubating time 4. Recovery time
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted August 1998. Italy
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Italian

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"patients were randomly allocated into four groups"
Allocation concealment (selection bias)	High risk	Not mentioned

Giudice 1998 (*Continued*)

Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Iqbal 2013

Methods	RCT Simulated RSI N = 60
Participants	ASA I - II Adult elective surgery Age 20 - 60 yrs
Interventions	1. Rocuronium 0.9 mg/kg (n = 30) 2. Succinylcholine 1.5 mg/kg (n = 30) Sequence with: thiopental 5 mg/kg No premeds
Outcomes	Intubating conditions 60s after induction drugs. Reported as excellent, good, poor and not possible based on 3 variables (jaw relaxation, vocal cords and response to tube) from modification of Goldberg et and Krieg et al
Adverse events	None reported.
Time & Place	January to August 2009. Civil Hospital Karachi, Karachi, Pakistan
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomized", did not elaborate

Iqbal 2013 (*Continued*)

Allocation concealment (selection bias)	Low risk	"double-blind manner"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"endotracheal intubation was done blinded by standing with the back to the patient."
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Koroglu 2002

Methods	RCT Simulated RSI N = 80
Participants	ASA I - II Adult women Pregnant
Interventions	1. Rocuronium 0.6 mg/kg and propofol 2 mg/kg (n = 20) 2. Succinylcholine 1.5 mg/kg and propofol 2 mg/kg (n = 20) 3. Rocuronium 0.6 mg/kg and thiopentone 5 mg/kg (n = 20) 4. Succinylcholine 1.5 mg/kg and thiopentone 5 mg/kg (n = 20)
Outcomes	1. Intubations conditions. Started intubation 20s after muscle relaxant, intubated according to clinical conditions. Reported as excellent, good, poor based on 3 variables (jaw relaxation, vocal cord movement, reaction to tube) and score (0 - 9) from Cooper et al 2. Time to intubations 3. Neuromuscular conduction in musculus adductor pollicis by TOF 3. Umbilical arterial and venous blood gas values
Adverse events	None reported.
Time & Place	Study dates not reported. Article published 2002. Dokuz Eylul University, Turkey
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis In Turkish

Koroglu 2002 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	High risk	"patients were numbered according to their order of arrival to the surgery"
Allocation concealment (selection bias)	High risk	No comment made
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment made
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	All cases were accounted for
Selective reporting (reporting bias)	Low risk	All outcomes reported

Kulkarni 2010

Methods	RCT Modified RSI N = 300
Participants	ASA I - II Elective cleft palate repair OR Age 1 - 10 Mean age 4 Mean weight 17 kg Mallampati I - II
Interventions	1. Succinylcholine 1.5 mg/kg (n = 100) 2. Rocuronium 0.6 mg/kg (n = 100) 3. Rocuronium 0.9 mg/kg (n = 100) Premedication: glycopyrrolate 0.004 mg/kg IM, midazolam 0.05 mg/kg IM, ketamine 5 mg/kg IM for younger children, tramadol 1 mg/kg iv Sequence with: thiopental 6 - 8 mg/kg
Outcomes	1. Intubation conditions at 60s after muscle relaxant. Reported as excellent, good, poor, inadequate according to intubation scoring system as per Mangorian et al. Based on 3 clinical variables: jaw relaxation, vocal cord movement and diaphragmatic movements 2. Intubation time 3. Duration of muscle relaxation with TOF monitoring 4. Clinical recovery

Kulkarni 2010 (*Continued*)

Adverse events	Tachycardia in all three groups (58-66%)
Time & Place	October 2003 to September 2008. Lotus Hospital & Research Center, Kolhapur, Maharashtra, India
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	used oral RAE tubes

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomly divided in three groups"
Allocation concealment (selection bias)	High risk	No comment made
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment made
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases presented
Selective reporting (reporting bias)	Low risk	All outcomes reported

Kwon 2013

Methods	RCT Modified RSI N = 40
Participants	ASA I - II Elective OR Mean age 43 Mean weight 61 kg
Interventions	1. Succinylcholine 1.5 mg/kg (n = 20) 2. Rocuronium 0.6 mg/kg (n = 20) Sequence with: lidocaine 60 mg, fentanyl 1.5 mcg/kg, propofol 1.5 mg/kg

Kwon 2013 (*Continued*)

Outcomes	1. Intubating conditions (with loss of consciousness for rocuronium group and 60s after succinylcholine). Reported as excellent, acceptable and poor based on a score. Variables included: mandibular relaxation, resistance to blade insertion, vocal cord position and movement, limb response, coughing 2. Timing of events 3. Complications of intubation: awareness, respiratory difficulty postoperatively
Adverse events	3 participants who received rocuronium complained of injection pain
Time & Place	Study dates were not reported. Article accepted September 2012 Dankook University, Cheonan, Korea
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"patients were randomly assigned"
Allocation concealment (selection bias)	Low risk	"tracheal intubation were performed...by an experienced anesthesiologist who was blinded to the anesthetic drug"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No blinding mentioned
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases were reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Lam 2000

Methods	RCT Modified RSI N = 30

Lam 2000 (*Continued*)

Participants	ASA I - II 18 - 65 years Elective OR
Interventions	1. Rocuronium 0.6 mg/kg (n = 15) 2. Succinylcholine 1 mg/kg (n = 15) Premedication: midazolam 2 mg Sequence with: fentanyl 2 mcg/kg, propofol 2.5 mg/kg
Outcomes	1. Intubating conditions 60s after muscle relaxant. Intubation conditions were reported by the same blinded individual as excellent, good, poor and inadequate based on jaw relaxation, vocal cord position and movement, and diaphragm movement 2. Onset muscle relaxation with TOF 3. Offset muscle relaxation with TOF
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted August 2000. University of Washington, Seattle, USA
Funding and declarations	Funding source: Organon West Orange, New Jersey Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer generated
Allocation concealment (selection bias)	Low risk	Intubator unaware of drug
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	"there were no attempts made to blind the individual"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data set
Selective reporting (reporting bias)	Low risk	All outcomes reported

Larsen 2005

Methods	RCT Simulated RSI N = 209
Participants	ASA I - III > 17 years Emergency OR
Interventions	1. Rocuronium 0.6 mg/kg (n = 102) 2. Succinylcholine 1 mg/kg (n = 107) Premedication: i.m morphine 30 mins prior Sequence with: alfentanil 10 - 20 ug/kg, propofol 2 - 3 mg/kg
Outcomes	1. Intubating conditions 60s after muscle relaxant by senior anaesthesiologist. Intubations not achieved in 30s were recorded as failed. Reported as excellent, good, poor and first attempt failed. Based on 5 variables: ease of laryngoscopy, position of vocal cords, movement of vocal cords, movement of limbs and coughing during tracheal intubation 2. Heart rate and blood pressure
Adverse events	1 participant in Group 2 had atrial fibrillation requiring treatment verapamil and sotalol. Hypotension requiring treatment with ephedrine occurred in 18 Group2 and 17 Group 1. Five participants in Grp 2 and 2 in Group1 reported postoperative muscle pain
Time & Place	Study dates not reported. Article accepted June 2005. University of Copenhagen, Glostrup, Denmark
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sealed envelopes
Allocation concealment (selection bias)	Low risk	The participant was allocated by the concealed envelope method
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"anaesthesiologist (a senior member of the study group) blinded to the muscle relaxant and concealed in a room next to the operation theatre until 40 secs after its administration, hereby preventing him from seeing fasci-

Larsen 2005 (*Continued*)

		culations after succinylcholine"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases accounted for
Selective reporting (reporting bias)	Low risk	All outcomes reported

Latorre 1996

Methods	RCT Modified RSI N = 40
Participants	ASA I - III Age 18-62, mean 44.5 Mean weight 73.5 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 20) 2. Succinylcholine 1 mg/kg (n = 20) Sequence with: fentanyl 2 - 3 mcg/kg, propofol 1.5 - 2.0 mg/kg
Outcomes	1. Intubating conditions 60s after muscle relaxant. Reported as score based on clinical variables: laryngoscopy, vocal cord movement and coughing 2. Onset time 3. Clinical duration of muscle block with EMG recordings on adductor pollicis 4. % blocked at time of intubation 5. Heart rate, blood pressure and arterial oxygen saturation
Adverse events	None reported.
Time & Place	Study dates not reported. University of Johannes-Gutenberg, Mainz, Germany
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	In German

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"patients were allocated randomly"
Allocation concealment (selection bias)	Low risk	Examiner did not know which drug was injected

Latorre 1996 (*Continued*)

Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases accounted for
Selective reporting (reporting bias)	Low risk	All outcomes reported

Le Corre 1999

Methods	RCT Modified RSI N = 150
Participants	ASA I - II 18 - 75 years Elective OR Mean age 47.5 Mean weight 61.5 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 30) 2. Succinylcholine 1 mg/kg (n = 30) 3. Atracurium 0.5 mg/kg (n = 30)* 4. Mivacurium 0.2 mg/kg (n = 30)* 5. Vecuronium 0.08 mg/kg (n = 30)* Premedication: alprazolam 0.5 mg/kg po Sequence with: fentanyl 3 mcg/kg, propofol 2.5 mg/kg
Outcomes	1. Time to complete disappearance of response to orbicularis oculi after TOF stimulation 2. Intubation conditions reported as excellent, good, poor and impossible. Scale variables were vocal cord movement and ease of laryngoscopy
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted June 1999. Jean Bernard Hospital, Poitiers, France
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis
Risk of bias	

Le Corre 1999 (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"random allocation"
Allocation concealment (selection bias)	Low risk	"intubation was performed by another physician unaware of muscle relaxant injected"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"onset time of neuromuscular blockade ...was estimated by a blinded physician who was not involved in the intubating procedure. When the orbicularis oculi was completely blocked, intubation was performed by another physician "
Incomplete outcome data (attrition bias) All outcomes	High risk	Participants were excluded from the final analysis in 2 cases: 1) when the vocal cords were not completely visualized during the laryngoscopy and 2) when onset time was longer than 300s In participants not fully paralysed after 300s after the administration of the muscle relaxant, intubation was performed after giving a supplemental dose of muscle relaxant
Selective reporting (reporting bias)	Unclear risk	due to incomplete outcome data, difficult to assess.

Magorian 1993

Methods	RCT Modified RSI N = 50
Participants	ASA I III 18 - 70 years uncertain location Mean age 36 Mean weight 68 kg Mallampati 1 or 2 airway and no contraindication to RSI
Interventions	1. Rocuronium 0.6 mg/kg (n = 10) 2. Rocuronium 0.9 mg/kg (n = 10) 3. Rocuronium 1.2 mg/kg (n = 10) 4. Vecuronium 0.1 mg/kg (n = 10)* 5. Succinylcholine 1 mg/kg (n = 10) Premedication: midazolam 0.02-0.05 mg/kg

Magorian 1993 (*Continued*)

	Sequence with: fentanyl (?dose), thiopental 2 - 7 mg/kg
Outcomes	1. Ablation of T1 (onset) 2. Return of T1 to 25% of duration 3. Intubation conditions 60s after muscle relaxant. Reported as excellent, good, poor, inadequate based on jaw relaxation, vocal cord movement and diaphragm movement 4. Presence of fasciculations
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted June 1993 University of California, San Franscisco, USA.
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"randomly designated"
Allocation concealment (selection bias)	Low risk	"intubation of trachea was attempted by a clinician who was blinded to the muscle relaxant administered"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	"Intubating conditions were judged by each clinician, and the presence or absence of fasciculations was noted"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Malik 2004

Methods	RCT Simulated RSI N = 60

Malik 2004 (*Continued*)

Participants	ASA I - II 20 - 50 years Elective non-ophthalmic surgery
Interventions	1. Rocuronium 0.9 mg/kg (n = 30) 2. Succinylcholine 1.5mg/kg (n = 30) Sequence with an opiate and thiopental
Outcomes	1. Intubation conditions 60s after muscle relaxants. Reported as excellent, adequate and poor as per Abbott and Samuel. Variables included jaw relaxation, vocal cord position and cough reflex 2. Heart rate and blood pressure before, just after and 1,3, 5 mins after intubation 3. Intraocular pressure
Adverse events	None reported.
Time & Place	Study dates not reported. Article published 2004. Rohtak, India
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomly allocated"
Allocation concealment (selection bias)	High risk	No comment made
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment made
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Marsch 2011

Methods	RCT Simulated RSI N = 401
Participants	Emergency ICU Age ≥ 18 yrs Mean age 62 Mean weight 73 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 201) 2. Succinylcholine 1 mg/kg (n = 200) Sequence with: fentanyl 1 mcg/kg, propofol 1 mg/kg or etomidate 0.2 mg/kg
Outcomes	1. Incidence of desaturation ≥ 5% by pulse oximetry 2. Duration of intubation sequence 3. Incidence of failed first intubation 4. Intubation conditions after fasciculations stopped or 60s from muscle relaxant injection. Reported as excellent, good and poor based on a score from 6 clinical variables (laryngoscopy, vocal cords position, vocal cord movement and intubation response with regard to coughing and limb movement) 5. Haemodynamic consequences
Adverse events	None reported
Time & Place	August 2006 to June 2010 University Hospital of Basel, Basel, Switzerland.
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Stratified randomization by gender was used to ensure a similar distribution of gender in both groups
Allocation concealment (selection bias)	Low risk	Using sealed envelopes, participants were randomly allocated by the study physician
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessor was unblinded

Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases accounted for
Selective reporting (reporting bias)	Low risk	All outcomes reported

Mazurek 1998

Methods	RCT Simulated RSI N = 26
Participants	ASA I - III 2 - 15 years Emergency OR Mean age 6.6 Mean weight 28 kg
Interventions	1. Rocuronium 1.2 mg/kg (n = 13) 2. Succinylcholine 1.5 mg/kg (n = 13) Sequence with: atropine 0.01 mg/kg, thiopental 5 mg/kg
Outcomes	1. Onset and quality of muscle paralysis with TOF 2. Intubation conditions 30s after muscle relaxant. Reported excellent, good, fair and poor from a score based on jaw relaxation, vocal cords and response to tube 3. Onset of apnoea
Adverse events	Precipitation of thiopental and rocuronium during induction in one case
Time & Place	Study dates not reported. Article accepted for publication September 1998 Chicago, USA.
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Participants were randomized using a random numbers table
Allocation concealment (selection bias)	Low risk	"all investigators except the one designated to dispense the study drug were blinded to choice of muscle relaxant"

Mazurek 1998 (*Continued*)

Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"The investigators performed the laryngoscopies but were blinded to the relaxant by standing with their back to the patient during the induction so that they could not detect fasciculations."
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data
Selective reporting (reporting bias)	Low risk	All outcomes reported

McCourt 1998

Methods	RCT Simulated RSI N = 318
Participants	ASA I - IV 18 - 75 years Emergency and elective participants in OR Mean age 41.5 Mean weight 71 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 61) 2. Rocuronium 1.0 mg/kg (n = 130) 3. Succinylcholine 1 mg/kg (n = 127) Sequence with: fentanyl 1 - 2 mcg/kg, thiopentone 5 mg/kg
Outcomes	1. Intubation conditions 60s after muscle relaxant. Reported as excellent, good and poor after Viby-Mogensen et al. Based on conditions for laryngoscopy, vocal cords and reaction to intubation presented in a table
Adverse events	Erythema occurred in 6 participants who received succinlycholine and 17 who received rocuronium. Bronchospasm occurred once in Group 2
Time & Place	The Queen's University of Belfast, the Helsinki University Central Hospital UK
Funding and declarations	Funding source: Organon Teknika Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

McCourt 1998 (*Continued*)

Random sequence generation (selection bias)	Low risk	Computer-generated randomizations
Allocation concealment (selection bias)	Low risk	Intubator unaware of drug given
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"intubation were carried out by an assessor, blinded to the treatment administered, 50s after the end of injection of the neuro-muscular blocking drug This assessor was not present in the room until about 45s after the neuromuscular blocking drug had been given."
Incomplete outcome data (attrition bias) All outcomes	Low risk	Incomplete data were accounted for and well explained
Selective reporting (reporting bias)	Low risk	All outcomes reported

Mencke 2005

Methods	RCT Simulated RSI N = 120
Participants	ASA I - II Adults Mean age 49.8 Mean weight 75 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 30 men) 2. Rocuronium 0.6 mg/kg (n = 30 women) 3. Succinylcholine 1.0 mg/kg (n = 30 men) 4. Succinylcholine 1.0 mg/kg (n = 30 women) Premed: midazolam 7.5 mg Sequence with: thiopental 5 mg/kg, fentanyl 3 mcg/kg
Outcomes	1. Intubation conditions 60s after muscle relaxant. Reported as excellent, good and poor based on laryngoscopy, vocal cord position and reaction to tube 2. Intubation times
Adverse events	None reported.
Time & Place	Study dates not reported. University of Rostock, Rostock, Germany

Mencke 2005 (*Continued*)

Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	In German. Data aggregated for groups 1 & 2 and groups 3 & 4

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computerized randomization
Allocation concealment (selection bias)	Low risk	Intubation performed by blind operator
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Mencke 2006

Methods	RCT Simulated RSI N = 150
Participants	ASA I - II 18 - 77 years Uncertain location
Interventions	1. Rocuronium 0.6 mg/kg (n = 76) 2. Succinylcholine 1.0 mg/kg (n = 74) Sequence with: fentanyl 3 mcg/kg, thiopental 5.0 mg/kg
Outcomes	1. Intubation conditions 50s after muscle relaxant by experienced anaesthesiologist. Reported as excellent, good and poor based on laryngoscopy, vocal cord movement and position and reaction to tube insertion or cuff inflation 2. Intubation time 3. Adverse outcomes: Postoperative hoarseness, sore throat, vocal cord injuries
Adverse events	Thoroughly reported as one of the primary outcomes.

Mencke 2006 (*Continued*)

Time & Place	Study dates not reported. Article accepted September 2005. University of Rostock, Rostock, Germany
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Random number draws
Allocation concealment (selection bias)	Low risk	"syringes were prepared by an independent investigator"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"To prevent the anesthesiologist who performed the tracheal intubation from noting succinylcholine-induced muscle fasciculations, he was called to enter the study room after 40s"
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Mitra 2001

Methods	RCT Modified RSI N = 40
Participants	ASA I - II Adult, mean age 40 Mean weight 59.6 kg Elective OR Mallampati 1 or 2 airways
Interventions	1. Rocuronium 0.6 mg/kg (n = 20) 2. Succinylcholine 1.5 mg/kg (n = 20) Premedication: diazepam 5 mg Sequence with: morphine 1 mg/kg, propofol 2.0 mg/kg

Mitra 2001 (*Continued*)

Outcomes	1. Intraocular pressure 2. Intubating conditions 60s after muscle relaxant. Reported as excellent, good, poor and inadequate
Adverse events	None reported.
Time & Place	Study dates not reported. Government Medical College and Hospital, Chandigarh, India
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomized"
Allocation concealment (selection bias)	Low risk	"all drugs administered into ...infusion by one anaesthetist who was unaware of drug administered"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"he intubating anaesthetist were not allowed to observe the injection of the neuromuscular blocking drug or the presence of fasciculation by making them stand with their back to the patient for 45 s after injection of the drug"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Naguib 1994

Methods	RCT Modified RSI N = 70
Participants	ASA I - II Elective OR

Naguib 1994 (*Continued*)

	Mean age 33.5 Mean weight 68.4 kg
Interventions	1. Mivacurium 0.15 mg/kg (n = 10)* 2. Mivacurium 0.015mg/kg then 0.135mg/kg 3 mins later (n = 10)* 3. Rocuronium 0.6 mg/kg (n = 10) 4. Rocuronium 0.06 mg/kg then 0.54mg/kg 3 mins later (n = 10) 5. Mivacurium 0.015 mg/kg then Rocuronium 0.54 mg/kg (n = 10)* 6. Rocuronium 0.06 mg/kg then mivacurium 0.135 mg/kg (n = 10) 7. Succinylcholine 1.0 mg/kg (n = 10) Sequence with: incremental doses of fentanyl, midazolam 0.03 mg/kg, thiopentone 5 - 7 mg/kg
Outcomes	1. Onset time after priming of muscle blockade with TOF 2. Intubation conditions with different priming sequences 30s after thiopentone dose. Reported as excellent, good or poor based on jaw relaxation, vocal cord movement and diaphragm movement 3. Recovery of twitch height to 10% of control
Adverse events	None reported
Time & Place	Study dates not reported. Article accepted April 1994. King Khalid University Hospital, Riyadh, Sadui Arabia
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"patients were randomly assigned to seven groups"
Allocation concealment (selection bias)	Low risk	Tracheal intubation was performed after complete neuromuscular block by an experienced anaesthetist who was not involved in the study and was not aware of the muscle relaxant used
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No comment on blinding

Naguib 1994 (*Continued*)

Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Naguib 1997

Methods	RCT Simulated RSI N = 60
Participants	ASA I 3 - 10 years weight 12 - 40 kg Elective OR Mean Age 5.0 Mean weight 20.1 kg
Interventions	1. Succinylcholine 1 mg/kg (n = 10) 2. Mivacurium 0.2 mg/kg (n = 10)* 3. Rocuronium 0.6 mg/kg (n = 10) 4. Rocuronium 0.9 mg/kg (n = 10) 5. Mivacurium 0.2 mg/kg + rocuronium 0.3 mg/kg (n = 10)* 6. Mivacurium 0.1 mg/kg + rocuronium 0.45 mg/kg (n = 10)* Premedication: trimeprazine 2 mg/kg po Sequence with: fentanyl 2 mcg/kg, propofol 2 mg/kg
Outcomes	1. Intubation conditions 60s after muscle relaxant. Reported as excellent, good and poor based on jaw relaxation, vocal cord movement and diaphragm movement. 2. TOF at 60s 3. Pharmacodynamic study (not used)
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted May 1997. King Khalid University Hospital, Riyadh, Sadui Arabia
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Naguib 1997 (*Continued*)

Random sequence generation (selection bias)	Unclear risk	"allocated randomly"
Allocation concealment (selection bias)	Low risk	To maintain blinding, participants who received a single neuromuscular blocking drug had a simultaneous injection of placebo. 60s after the end of injection the trachea was intubated in all participants by the same anaesthetist who was unaware of the participant's grouping
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No mention of blinding muscle relaxant used
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Nelson 1997

Methods	RCT Modified RSI N = 42
Participants	ASA I - II 25 - 77 years Elective OR Mean age 50 Mean weight 73.5 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 20) 2. Succinylcholine 1 mg/kg (n = 22) Premedication: midazolam 0.02 - 0.03 mg/kg Sequence with: fentanyl 2 - 3 mcg/kg, thiopental 4 - 5 mg/kg
Outcomes	1. Onset time of neuromuscular blocker 2. Intubation conditions 60s after injection of blinded syringe. Reported as excellent, good, fair or poor based on jaw relaxation, vocal cord movement and cough response
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted January 1997. The Bowman Gray School of Medicine, Winston-Salem, USA

Nelson 1997 (*Continued*)

Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Patients were randomly assigned, via computer-generated random numbers table"
Allocation concealment (selection bias)	Low risk	Used blinded syringes
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Laryngoscopy and intubation began 60s after the injection of the contents of the final blinded syringe by an anaesthetist unaware of the treatment group. This individual was not allowed to look at or touch the participant during the period of time in which fasciculations would occur, nor was he or she allowed to look at the polygraph tracing
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Did not explain why 2 participants were excluded from rocuronium group

Patel 1995

Methods	RCT Modified RSI N = 22
Participants	Uncertain ASA Adult participants Emergency OR Mean age 44.2 Mean weight 74.7 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 7) 2. Rocuronium 0.9 mg/kg (n = 8) 3. Succinylcholine 1 mg/kg (n = 7) Sequence with: fentanyl (?dose), thiopental (?dose)
Outcomes	1. Intubation conditions after visual loss of orbicularis oculi TOF or after 90s. Reported as excellent, good, fair based on jaw relaxation, vocal cord position and coughing

Patel 1995 (*Continued*)

Adverse events	None reported.
Time & Place	Study dates not reported. MetroHealth Medical Center, Cleveland, USA
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis Abstract only

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomized"
Allocation concealment (selection bias)	Low risk	Anaesthesiologist was blinded to relaxant
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment on blinding effects of drugs
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Pühringer 1992

Methods	RCT Modified RSI N = 30
Participants	ASA I - II 18 - 65 years Elective OR Mean age 28.9 Mean weight 66.1 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 20) 2. Succinylcholine 1 mg/kg (n = 10) Premedication: meperidine 1 mg/kg, atropine 0.01 mg/kg

Pühringer 1992 (*Continued*)

	Sequence with: afentanyl 25 mcg/kg, propofol up to 2.5 mg/kg
Outcomes	1. Intubation conditions 60s after muscle relaxant. Reported as excellent, good, poor and inadequate based on jaw relaxation, vocal cord position and reaction to intubation
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted February 1992. Univeristy of Innsbruck, Innsbruck, Austria
Funding and declarations	Funding source: grant from Organon Teknika Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomization table
Allocation concealment (selection bias)	Low risk	"Unaware of the muscle relaxant used"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"This person was unaware of the twitch response at the time of laryngoscopy, unaware of the muscle relaxant used"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Singh 2011

Methods	RCT Modified RSI N = 90
Participants	ASA I - II Major elective surgery in OR 20 - 60 years Mean age 38 Mean weight 53 kg

Singh 2011 (*Continued*)

Interventions	1. Succinylcholine 1.5 mg/kg (n = 30) 2. Rocuronium 0.6 mg/kg (n = 30) 3. Vecuronium 0.08 mg/kg (n = 30)* Sequence with propofol 2 - 2.5 mg/kg
Outcomes	1. Intubation conditions were assessed as per Cooper et al. Reported as excellent, good, fair and poor from a score of 0 - 9 2. Intubation time
Adverse events	None reported
Time & Place	Study dates not reported. Regional Institute of Medical Sciences, Imphal, India
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Using computer generated randomization"
Allocation concealment (selection bias)	High risk	No comment made
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Once the control response had been noted, the neuromuscular blocking agent was injected and the endotracheal intubation was carried out by the same person (unblinded)
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Sluga 2005

Methods	RCT Simulated RSI N = 180
Participants	ASA I - IV 18 years or older Emergency OR
Interventions	1. Rocuronium 0.6 mg/kg (n = 90) 2. Succinylcholine 1 mg/kg (n = 90)
Outcomes	1. Intubation conditions. Reported as excellent, good and poor based on a score that was evaluated from laryngoscopy, vocal cords and response to intubation 2. Intubation time
Adverse events	5 failure to intubate on first attempt. Desaturations in 5 of 90 in Group 2 and 9 of 90 in Group 1
Time & Place	Study dates not reported. Article accepted April 2005. Krankenhaus Thusis, Switzerland
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	ITT analysis Exact numbers for intubating conditions provided by authors

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sealed envelopes
Allocation concealment (selection bias)	Low risk	"Patients were randomly allocated (sealed envelopes)"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	The staff anaesthesiologist was not blinded to the neuromuscular blocking drug used, and the management of difficulties and complications, if any, was left to his discretion
Incomplete outcome data (attrition bias) All outcomes	Low risk	Adequately described
Selective reporting (reporting bias)	Low risk	All outcomes reported

Sorensen 2012

Methods	RCT Modified RSI N = 55
Participants	Elective surgery 18 - 60 years Mean age 51 Mean weight 78 kg
Interventions	1. Succinylcholine 1 mg/kg (n = 26) 2. Rocuronium 1 mg/kg (n = 29) Sequence with alfentanil 0.01 mg/kg, propofol 2 mg/kg
Outcomes	1. Time from correct placement of endotracheal tube to spontaneous ventilation 2. Duration of action of neuromuscular blocking agent measured on TOF-WatchSx 3. Intubation difficulty scale 4. Intubation conditions 55s after muscle relaxant administration. Reported as excellent, good and fair
Adverse events	Tachycardia above 100 beats per minute
Time & Place	Study dates not reported. Copenhagen University Hospital, Copenhagen, Denmark
Funding and declarations	Funding source: funding supported by Tryg Foundation, Lyngy Denmark Declarations of interest: none declared
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Computer- generated list
Allocation concealment (selection bias)	Low risk	Opaque envelopes
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The investigator (in all cases, an anaesthesiology consultant) was blinded by only being allowed to enter the operating theatre after correct placement of the tracheal tube had been verified. The personnel doing the statistical evaluations were blinded to the allocation by being presented the allocation list without the key. After statistical evaluation, an abstract and a conclusion were written in 2

		copies, 1 for each allocation possibility
Incomplete outcome data (attrition bias) All outcomes	Low risk	Adequate description of excluded participants
Selective reporting (reporting bias)	Low risk	All outcomes reported

Sparr 1996a

Methods	RCT Simulated RSI N = 50
Participants	ASA I - II 18 - 65 years Elective OR Mean age 31 Mean weight 75.5 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 25) 2. Succinylcholine 1 mg/kg (n = 25) Sequence with: thiopentone 6 mg/kg
Outcomes	1. Intubating conditions 45s after administration of muscle relaxant. Reported as excellent, good, fair and poor according to a scoring condition as per Cooper et al. Clinical variables include ease of laryngoscopy, aspect of vocal cords and response of diaphragm 2. Presences of fasciculations 3. Intubation time
Adverse events	One case of bronchospasm and 2 cases of ventricular ectopic beast in Group 2. One case of desaturation in Group 1
Time & Place	Study dates not reported. Article accepted September 1995 University of Innsbruck, Innsbruck, Austria
Funding and declarations	Funding source: supported by Organon Teknika NV, Belgium. Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	Randomly allocated

Sparr 1996a (*Continued*)

Allocation concealment (selection bias)	Low risk	"The intubator was blinded to the muscle relaxant administered"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	" Forty seconds after the administration of the muscle relaxant, the intubator was called to enter the study room. ..The occurrence of muscle fasciculations or body movements was noted by both the intubator and the anaesthetist"
Incomplete outcome data (attrition bias) All outcomes	Low risk	Accounted for excluded participants
Selective reporting (reporting bias)	Low risk	All outcomes reported

Sparr 1996b

Methods	RCT Simulated RSI N = 150
Participants	ASA I - II 18 - 65 years Elective OR Mean age 34 Mean weight 69 kg
Interventions	1. Rocuronium 0.6 + thiopentone 5 mg/kg (n = 25) 2. Rocuronium 0.6 mg/kg + propofol 2.5 mg/kg (n = 25)* 3. Rocuronium 0.6 mg/kg + thiopentone 5 mg/kg + alfentanyl 20mcg/kg (n = 25)* 4. Rocuronium 0.6 mg/kg + propofol 2.5 mg/kg + alfentanyl 20mcg/kg (n = 25)* 5. Succinylcholine 1 mg/kg + thiopentone 5 mg/kg (n = 50) Sequence with: as above
Outcomes	1. Intubating conditions 45s after muscle relaxant administration. Reported as per Cooper et al as excellent, good, fair and poor based on scores evaluating jaw relaxation, vocal cords and response to intubation 2. Intubating time 3. Fasciculations
Adverse events	Nonre reported
Time & Place	Study dates not reported. Article accepted April 1996 University of Innsbruck, Innsbruck, Austria

Sparr 1996b (*Continued*)

Funding and declarations	Funding source: supported by Oganon GmbH, Division of Organon Teknika, Vienna, Austria Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"allocated randomly"
Allocation concealment (selection bias)	Low risk	"Intubator was blinded to the treatment each patient received"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"In order to prevent the intubator from noting …. muscle fasciculations…. called to enter the study room 40s after the administration of the blocker"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases accounted for
Selective reporting (reporting bias)	Low risk	All outcomes reported

Stevens 1996

Methods	Modified RCT N RSI N = 70
Participants	ASA I - II 18 - 65 years Elective OR Mean age 37.6 Mean weight 73.9 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 30) 2. Succinylcholine 1 mg/kg (n = 10) 3. Mivacurium 0.15mg/kg and rocuronium 0.6mg/kg (n = 30)* Premedication: midazolam 0.02 - 0.05 mg/kg iv Sequence with: fentanyl 3 mcg/kg, thiopental up to 7 mg/kg

Stevens 1996 (*Continued*)

Outcomes	1. Onset time of neuromuscular blocker 2. Duration of neuromuscular blocker 3. Intubation conditions
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted November 1995. University of Texas Health Science Center, Texas, USA
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Envelopes
Allocation concealment (selection bias)	Low risk	"previously prepared envelopes containing cards assigning patients to one of the three groups"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	"Presence or absence of fasciculations was noted. Laryngoscopy was begun with a Miller 2 blade 45 seconds later, and intubation was completed within 15 seconds. The same experienced anesthesiologist, who was unaware of the status of T , performed and graded all the intubations in the investigation"
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Stoddart 1998

Methods	RCT Modified RSI N = 60

Stoddart 1998 (*Continued*)

Participants	Uncertain ASA 3 - 15 years Elective OR for tonsillectomy Mean Age 7.5 Mean weight 26.9 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 30) 2. Succinylcholine 1 mg/kg (n = 30) Premedication: paracetamol 20 mg/kg po Sequence with: propofol 3 - 4 mg/kg
Outcomes	1. Intubation conditions 1 min after muscle relaxant. Reported as excellent, good, fair or poor based on scores evaluating jaw relaxation, vocal cords and response to intubation 2. Duration of neuromuscular blocker 3. Onset time of neuromuscular blocker
Adverse events	None reported.
Time & Place	Study dates not reported. Bristol Hospital for Sick Children, Bristol, UK
Funding and declarations	Funding source: rocuronium and TOF guard device was provided by Organon Teknika Ltd, Cambridge UK Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	Sealed envelopes
Allocation concealment (selection bias)	Low risk	Sealed envelopes
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	Blinded to identity of relaxant but not fasciculations
Incomplete outcome data (attrition bias) All outcomes	Low risk	All cases reported
Selective reporting (reporting bias)	Low risk	All outcomes reported

Tang 1996

Methods	RCT Modified RSI N = 100
Participants	Uncertain ASA All women getting elective laparoscopic surgery Mean Age 29.4 Mean weight 70.0 kg
Interventions	1. Succinylcholine 1 mg/kg + rocuronium boluses (n = 23) 2. Succinylcholine 1mg/kg + mivacurium boluses(n = 25) 3. Mivacurium 0.2 mg/kg (n = 25)* 4. Rocuronium 0.6 mg/kg (n = 27) Sequence with: fentanyl 1.5 mcg/kg, thiopental 4 mg/kg Premedication: midazolam 2 mg iv
Outcomes	1. Intubating conditions 90s after dose of muscle relaxant. Reported using a 3-point scale: excellent, good and poor based on jaw relaxation and movement of vocal cords 2. Neuromuscular effects
Adverse events	1 in Group 1 and 6 in Group 4 had upper body erythema not requiring treatment. 16% in Group 1+ 2 developed postoperative myalgias
Time & Place	Study dates not reported. Article accepted January 1996. University of Texas Southwestern Medical Center, Dallas, USA
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomly assigned"
Allocation concealment (selection bias)	High risk	No comment made
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"laryngoscopy was performed by an anesthesiologist who was unaware of the twitch response"

Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Tripathi 2010

Methods	RCT Modified RSI N = 100
Participants	ASA I - II Elective OR 20 - 60 yrs Mean age 37 Mean weight 51 kg
Interventions	1. Rocuronium 0.9 mg/kg (n = 50) 2. Succinylcholine 1.5 mg/kg (n = 50) Premedication: glycopyrrolate 0.004 mg/kg iv, ranitidine 50 mg iv, tramadol 1mg/kg iv, midazolam 0.015 mg/kg iv Sequence with thiopental
Outcomes	1. Onset time of neuromuscular blockade 2. Intubation conditions reported as excellent, good, fair and poor. Scores were based on jaw relaxation, vocal cord motion and response to intubation 3. Haemodynamics 4. Complications at time of intubation
Adverse events	Both groups demonstrated an increase in blood pressure, heart rate, arrhythmias and laryngospasm. No significant difference between the two groups
Time & Place	Study dates not reported. Government Medical College, Bhavnagar, Gujarat, India
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"sealed envelope"

Tripathi 2010 (*Continued*)

Allocation concealment (selection bias)	Low risk	"opening sealed envelope"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No mention of blinding to fasciculations
Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Tryba 1994

Methods	RCT Simulated RSI N = 80
Participants	ASA I - III Adult participants Elective OR Mean age 31.7 Mean weight 74.5 kg
Interventions	1. Rocuronium 0.6 mg/kg prior to induction agent (n = 20) 2. Rocuronium 0.6 mg/kg following induction agent (true RSI) (n = 20) 3. Rocuronium 0.56 mg/kg prior to induction agent after rocuronium primer 0.04 mg/kg (n = 20) 4. Succinylcholine 1.5 mg/kg (with rocuronium primer 0.04 mg/kg) (n = 20) Premedication: lormethazepam 2 - 3 mg po and clorazepate 0.4 mg/kg po Sequence with: fentanyl 2 mcg/kg, thiopental 6 mg/kg
Outcomes	1. Intubating conditions 30s after 3rd dose of muscle relaxant. Reported as scores according to scoring system of Damaoal et al and modified by Krieg et al. Factors evaluated include laryngoscopy, severity of coughing and movement of vocal cords
Adverse events	1 case of severe coughing in Group 1 and 5 in Group 2.
Time & Place	Study dates not reported. University Hospital Bergmannsheil, Bochum, Germany
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	ITT analysis

Tryba 1994 (*Continued*)

Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Prospective randomized double blind"
Allocation concealment (selection bias)	Low risk	"The investigator preparing the syringes was not involved with the induction"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No blinding of fasciculations
Incomplete outcome data (attrition bias) All outcomes	Low risk	Complete data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Turan 1999

Methods	RCT Modified RSI N = 40
Participants	Uncertain ASA Adult participants Uncertain type of OR Mean age 36.3 years Mean weight 74.5 kg
Interventions	1. Rocuronium 1.2 mg/kg (n = 20) 2. Succinylcholine 1.0 mg/kg (n = 20) Sequence with: thiopentone 6 mg/kg
Outcomes	1. Intubation conditions 45s after muscle relaxant reported as excellent, good, poor and inadequate. Evaluated based on Magorian et all and Dubois et all based on jaw relaxation, vocal cords and diaphragm movement 2. SBP
Adverse events	None reported
Time & Place	Study dates not reported. Turkey

Turan 1999 (*Continued*)

Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	ITT analysis In Turkish

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	"divided into two groups randomly"
Allocation concealment (selection bias)	High risk	No comment
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No comment
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Türkmen 2004

Methods	RCT Modified RSI Adult elective surgery N = 60
Participants	ASA I - II Age 19 - 73 years (Baseline demographics table unavailable)
Interventions	1. Mivacurium 0.25 mg/kg (n = 20)* 2. Rocuronium 0.6 mg/kg (n = 20) 3. Succinylcholine 1 mg/kg (n = 20) Premedication: Midazolam 10 mg im Sequence with: fentanyl 2 mg/kg, propofol 2 mg/kg
Outcomes	1. Intubation conditions after full relaxation as measured by TOF monitoring. Reported as excellent, good and bad 2. Haemodaynamics

Türkmen 2004 (*Continued*)

Adverse events	None reported.
Time & Place	Study dates not reported. Istanbul Hospital, Istanbul, Turkey
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	In Turksih Only data for excellent intubation conditions were available (paper missing tables)

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"randomized"'
Allocation concealment (selection bias)	Low risk	"intubation was performed by an anesthesiologist who do not know muscle relaxant used"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No comment made
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Tables unavailable

Vinik 1999

Methods	RCT Modified RSI N = 45
Participants	ASA I - III 18 - 65 years Elective OR for eye surgery Mean age 41.4 Mean weight 74.5 kg
Interventions	1. Rocuronium 0.6 mg/kg (n = 15) 2. Succinylcholine 1 - 1.5 mg/kg (n = 15) 3. Atracurium 0.5 mg/kg (n = 15)*

Vinik 1999 (*Continued*)

	Sequence with: alfentanyl 0.025 mg/kg, propofol 1.5 mg/kg, midazolam 0.025 mg/kg
Outcomes	1. Intraocular pressure 2. Intubating conditions 60s after muscle relaxant administration. Reported as excellent, good, poor and inadequate based on jaw relaxation, vocal cord movement and diaphragm movement
Adverse events	None reported.
Time & Place	Study dates not reported. Article accepted December 1998 Eye Foundation Hospital, Birmingham, USA
Funding and declarations	Funding source: supported by a grant from Organon, Inc. West Orange NJ Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	"Randomized"
Allocation concealment (selection bias)	High risk	"Open-label"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	High risk	No attempt at blinding made
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Weiss 1997

Methods	RCT Simulated RSI N = 45
Participants	ASA I - II 18 - 65 years Elective OR Mean age 36.7

Weiss 1997 (*Continued*)

	Mean weight 73.2 kg
Interventions	1. Rocuronium 0.7 mg/kg (n = 15) 2. Rocuronium 0.9 mg/kg (n = 16) 3. Succinylcholine 1.5 mg/kg (n = 14) Sequence with: fentanyl 2 mcg/kg, thiopental 4 - 5 mg/kg
Outcomes	1. Intubating conditions 60s after muscle relaxation. Reported as excellent, good, poor or impossible based on ease of laryngoscopy, vocal cords and response to intubation
Adverse events	None reported.
Time & Place	Study dates not reported. Accepted March 1997. Robert Wood Johnson Medical School at Camden, Camden, USA
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"patients were randomly assigned, via computer-generated random numbers table"
Allocation concealment (selection bias)	Low risk	"Both the patient and the anesthesiologist intubating the patient were blinded to the muscle relaxant used"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	"anesthesiologist performing the intubation was out of the OR during the induction to avoid witnessing the fasciculations from succinylcholine."
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data
Selective reporting (reporting bias)	Low risk	All outcomes reported

Yorukoglu 2003

Methods	RCT Modified RSI N = 125
Participants	ASA I - II Adult elective OR Excluded expected difficult intubations
Interventions	1. Succinylcholine 1 mg/kg intubated 60s(n = 25) 2. Rocuronium 0.6 mg/kg intubated 60s (n = 25) 3. Rocuronium 0.6 mg/kg intubated 60s with lidocaine 1.5mg/kg (n = 25)* 4. Rocuronium 0.6 mg/kg intubated 90s (n = 25)* 5. Rocuronium 0.6 mg/kg intubated 90s with lidocaine 1.5mg/kg (n = 25)* Premedication: atropine 0.5 mg/kg, pethidine 50 mg im Sequence with: alfentanyl 10 mcg/kg, propofol 2 mg/kg
Outcomes	1. Intubating conditions 60 or 90s after end of muscle relaxant injection. Reported as excellent, good, poor and inadequate as per Goldberg et al, based on vocal cords and coughing 2. Haemodynamic changes
Adverse events	None reported
Time & Place	Study dates not reported. Article accepted November 2002 University of Ankara, Ankara, Turkey
Funding and declarations	Funding source: none declared Declarations of interest: none declared
Notes	Efficacy analysis

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	"Patients were randomly allocated into five groups using a computer-generated table of random numbers"
Allocation concealment (selection bias)	Low risk	"patients and the intubating anesthetist were blinded to the study solutions administered"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Participant asleep and personnel performance does not affect intubating conditions
Blinding of outcome assessment (detection bias) All outcomes	Low risk	60 or 90secs after the end of the muscle relaxant injection, the intubating anaesthesist was called to enter the study room and the intubating anaesthesist was in-

Yorukoglu 2003 (*Continued*)

		structed by an assistant to start laryngoscopy
Incomplete outcome data (attrition bias) All outcomes	Low risk	125 participants were enrolled and all completed the study
Selective reporting (reporting bias)	Low risk	All outcomes reported

* Not used in analysis
ASA status: American Society of Anesthesia score I - IV, determined by health (decreased health as score increases)
BMI: Body mass index, kg/m²
EMG: electromyogram
i.m: intramuscular
IOP: Intraocular pressure
ITT: Intention-to-treat
iv: intravenous
N: number
OR: operating room
po: per os
R: rocuronium
RAE: name of endotracheal tube
RCT: randomized controlled trial
RSI: rapid sequence induction
S: succinylcholine
s: seconds
SBP: systolic blood pressure
T_1 : first twitch of train of four
TOF: train-of-four

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Dobson 1999	Only looked at rocuronium with propofol versus rocuronium with thiopental without comparing to succinylcholine
Dubois 1992	No comparison with succinylcholine
Hemmerling 2000	No outcome of intubation conditions
Huizinga 1992	The control group used not only succinylcholine but also gallamine in the sequence which cannot be controlled for when combining studies
Lam 1997	Abstract data only. Unclear what intubation scores were based on results given

(*Continued*)

Martin 1998	No comparison of single intubating dose of rocuronium versus succinylcholine. Study looks at priming dose of non-depolarizing muscle relaxants with succinylcholine only
Misiolek 2009	Used double lumen tubes
Naguib 1994b	No comparison with succinylcholine
Ortiz-Gómez 2005	RCT but intubation condition data is presented in graphic form only and cannot be reliably extracted
Robertson 2004	No outcome of intubation conditions
Stourac 2013	Conference abstract only, no data could be abstracted
Vianna 1997	Does not document intubation scores in paper
Vincent 1996	Abstract only. Unable to obtain document from North American source. Will reconsider if able to obtain in future
Woolf 1997	Did not record intubating conditions, measures other parameters only

RCT = randomized controlled trial
RSI: rapid sequence intubation

DATA AND ANALYSES

Comparison 1. Rocuronium any dose versus succinylcholine

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation conditions	50	4151	Risk Ratio (M-H, Random, 95% CI)	0.86 [0.81, 0.92]
1.1 Simulated RSI	23	2535	Risk Ratio (M-H, Random, 95% CI)	0.80 [0.72, 0.89]
1.2 Modified RSI	25	1468	Risk Ratio (M-H, Random, 95% CI)	0.92 [0.85, 0.99]
1.3 Mixed simulated and modified RSI	2	148	Risk Ratio (M-H, Random, 95% CI)	0.59 [0.33, 1.08]
2 Acceptable versus suboptimal intubation conditions	48	3992	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.95, 0.99]
2.1 Simulated RSI	22	2416	Risk Ratio (M-H, Random, 95% CI)	0.94 [0.90, 0.98]
2.2 Modified RSI	24	1428	Risk Ratio (M-H, Random, 95% CI)	1.00 [0.99, 1.01]
2.3 Mixed simulated and modified RSI	2	148	Risk Ratio (M-H, Random, 95% CI)	0.82 [0.66, 1.01]

Comparison 2. Rocuronium specific dose versus succinylcholine

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation conditions	50	4352	Risk Ratio (M-H, Random, 95% CI)	0.86 [0.81, 0.92]
1.1 Rocuronium 0.6 - 0.7mg/kg	39	2808	Risk Ratio (M-H, Random, 95% CI)	0.80 [0.72, 0.88]
1.2 Rocuronium 0.9 - 1.0mg/kg	16	1458	Risk Ratio (M-H, Random, 95% CI)	0.95 [0.89, 1.00]
1.3 Rocuronium 1.2 mg/kg	3	86	Risk Ratio (M-H, Random, 95% CI)	0.93 [0.75, 1.15]
2 Acceptable versus suboptimal intubation conditions	48	4193	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.96, 0.99]
2.1 Rocuronium 0.6 - 0.7mg/kg	38	2768	Risk Ratio (M-H, Random, 95% CI)	0.96 [0.93, 0.99]
2.2 Rocuronium 0.9 - 1.0mg/kg	15	1339	Risk Ratio (M-H, Random, 95% CI)	1.00 [0.98, 1.01]
2.3 Rocuronium 1.2 mg/kg	3	86	Risk Ratio (M-H, Random, 95% CI)	1.0 [0.92, 1.08]

Comparison 3. Rocuronium versus succinylcholine for induction agent

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation conditions	49	3750	Risk Ratio (M-H, Random, 95% CI)	0.85 [0.80, 0.91]
1.1 Propofol	22	1448	Risk Ratio (M-H, Random, 95% CI)	0.92 [0.84, 1.01]
1.2 Thiopental	28	2302	Risk Ratio (M-H, Random, 95% CI)	0.81 [0.73, 0.88]
2 Acceptable versus suboptimal intubation conditions	47	3591	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.95, 1.00]
2.1 Propofol	21	1408	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.97, 1.01]
2.2 Thiopental	27	2183	Risk Ratio (M-H, Random, 95% CI)	0.96 [0.92, 0.99]

Comparison 4. Rocuronium versus succinylcholine with narcotic

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation outcomes	34	2292	Risk Ratio (M-H, Random, 95% CI)	0.85 [0.78, 0.93]
1.1 Propofol Induction	17	992	Risk Ratio (M-H, Random, 95% CI)	0.89 [0.78, 1.01]
1.2 Thiopental Induction	17	1300	Risk Ratio (M-H, Random, 95% CI)	0.82 [0.73, 0.92]
2 Acceptable versus suboptimal intubation conditions	32	2193	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.94, 1.00]
2.1 Propofol Induction	16	952	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.96, 1.02]
2.2 Thiopental Induction	16	1241	Risk Ratio (M-H, Random, 95% CI)	0.95 [0.90, 1.00]

Comparison 5. Rocuronium versus succinylcholine without narcotic

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation conditions	15	1428	Risk Ratio (M-H, Random, 95% CI)	0.85 [0.76, 0.95]
1.1 Propofol Induction	4	426	Risk Ratio (M-H, Random, 95% CI)	0.95 [0.85, 1.06]
1.2 Thiopental Induction	12	1002	Risk Ratio (M-H, Random, 95% CI)	0.80 [0.69, 0.94]
2 Acceptable versus suboptimal intubation conditions	14	1368	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.95, 1.01]
2.1 Propofol Induction	4	426	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.94, 1.02]
2.2 Thiopental Induction	11	942	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.94, 1.02]

Comparison 6. Comparison of children and adults

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation conditions	50	4151	Risk Ratio (M-H, Random, 95% CI)	0.86 [0.80, 0.91]
1.1 Adults	45	3615	Risk Ratio (M-H, Random, 95% CI)	0.85 [0.80, 0.92]
1.2 Children	5	536	Risk Ratio (M-H, Random, 95% CI)	0.86 [0.70, 1.06]
2 Acceptable versus suboptimal intubation conditions	48	3992	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.95, 0.99]
2.1 Adults	43	3456	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.95, 0.99]
2.2 Children	5	536	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.97, 1.02]

Comparison 7. Rocuronium versus succinylcholine in emergency intubation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation conditions	5	1073	Risk Ratio (M-H, Random, 95% CI)	0.84 [0.73, 0.98]
2 Acceptable versus suboptimal intubation conditions	5	1073	Risk Ratio (M-H, Random, 95% CI)	0.98 [0.96, 1.01]

Comparison 8. Rocuronium versus succinylcholine by blinding of outcome assessment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Excellent versus other intubation conditions	50	4151	Risk Ratio (M-H, Random, 95% CI)	0.86 [0.81, 0.92]
1.1 Low Risk	21	1880	Risk Ratio (M-H, Random, 95% CI)	0.83 [0.75, 0.92]
1.2 Unclear Risk	4	229	Risk Ratio (M-H, Random, 95% CI)	0.93 [0.72, 1.18]
1.3 High Risk	25	2042	Risk Ratio (M-H, Random, 95% CI)	0.88 [0.80, 0.96]
2 Acceptable versus suboptimal intubation conditions	48	3992	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.95, 0.99]
2.1 Low Risk	23	1970	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.94, 1.00]
2.2 Unclear Risk	3	110	Risk Ratio (M-H, Random, 95% CI)	0.99 [0.92, 1.07]
2.3 High Risk	22	1912	Risk Ratio (M-H, Random, 95% CI)	0.97 [0.94, 1.00]

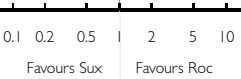
Analysis 1.1. Comparison 1 Rocuronium any dose versus succinylcholine, Outcome 1 Excellent versus other intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 1 Rocuronium any dose versus succinylcholine

Outcome: 1 Excellent versus other intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Simulated RSI					
Abu-Halaweh 2007	20/60	32/60		1.4 %	0.63 [0.41, 0.96]
Alanoglu 2006	57/60	54/59		3.2 %	1.04 [0.94, 1.14]
Andrews 1999	88/133	103/139		2.9 %	0.89 [0.76, 1.04]
Belyamani 2008	2/20	5/20		0.2 %	0.40 [0.09, 1.83]
Chiu 1999	13/15	14/15		2.3 %	0.93 [0.73, 1.18]
Chung 2001	20/29	19/27		1.7 %	0.98 [0.69, 1.38]
De Almeida 2009	19/20	15/20		2.1 %	1.27 [0.96, 1.66]
Iqbal 2013	25/30	29/30		2.8 %	0.86 [0.72, 1.03]
Koroglu 2002	22/30	28/35		2.1 %	0.92 [0.70, 1.20]
Larsen 2005	52/102	67/107		2.3 %	0.81 [0.64, 1.04]
Malik 2004	28/30	30/30		3.2 %	0.93 [0.83, 1.05]
Marsch 2011	109/201	102/200		2.7 %	1.06 [0.88, 1.28]
Mazurek 1998	7/13	10/13		0.9 %	0.70 [0.39, 1.26]
McCourt 1998	85/130	101/127		2.9 %	0.82 [0.71, 0.96]
Mencke 2005	13/60	34/60		1.0 %	0.38 [0.23, 0.65]
Mencke 2006	16/76	42/74		1.2 %	0.37 [0.23, 0.60]
Naguib 1997	17/20	9/10		2.1 %	0.94 [0.72, 1.25]
Sluga 2005	50/90	69/90		2.5 %	0.72 [0.58, 0.90]
Sparr 1996a	15/25	23/25		1.8 %	0.65 [0.46, 0.92]
Sparr 1996b	10/25	45/50		1.1 %	0.44 [0.27, 0.72]
Tryba 1994	48/60	16/20		2.3 %	1.00 [0.78, 1.29]
Weiss 1997	15/31	13/14		1.5 %	0.52 [0.35, 0.77]
Yorukoglu 2003	12/25	23/25		1.4 %	0.52 [0.34, 0.80]
Subtotal (95% CI)	**1285**	**1250**		**45.6 %**	**0.80 [0.72, 0.89]**



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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Total events: 743 (Rocuronium), 883 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.04; Chi^2 = 96.83, df = 22 (P<0.00001); I^2 =77%					
Test for overall effect: Z = 4.00 (P = 0.000063)					
2 Modified RSI					
Alvarez Rios1997	18/20	19/20		2.8 %	0.95 [0.79, 1.13]
Cheng 2002	67/80	37/40		3.1 %	0.91 [0.79, 1.03]
Cooper 1992	30/40	39/40		2.7 %	0.77 [0.64, 0.93]
Dubois 1995	9/12	9/12		1.2 %	1.00 [0.63, 1.59]
Giudice 1998	13/20	6/10		0.9 %	1.08 [0.59, 1.97]
Kulkarni 2010	122/200	90/100		3.1 %	0.68 [0.60, 0.77]
Kwon 2013	5/20	11/20		0.5 %	0.45 [0.19, 1.07]
Lam 2000	7/15	11/15		0.8 %	0.64 [0.34, 1.18]
Latorre 1996	9/20	12/20		0.8 %	0.75 [0.41, 1.37]
Le Corre 1999	28/30	26/30		2.8 %	1.08 [0.91, 1.28]
Magorian 1993	25/30	8/10		1.7 %	1.04 [0.73, 1.48]
Mitra 2001	18/20	20/20		2.8 %	0.90 [0.76, 1.07]
Naguib 1994	13/20	8/10		1.3 %	0.81 [0.52, 1.27]
Nelson 1997	18/20	22/22		2.8 %	0.90 [0.76, 1.07]
Patel 1995	11/15	7/7		1.7 %	0.77 [0.54, 1.09]
Pühringer 1992	17/20	8/10		1.7 %	1.06 [0.74, 1.52]
Singh 2011	23/30	25/30		2.3 %	0.92 [0.71, 1.19]
Sorensen 2012	27/29	20/26		2.4 %	1.21 [0.96, 1.53]
Stevens 1996	11/30	8/10		0.9 %	0.46 [0.26, 0.80]
Stoddart 1998	27/30	25/30		2.6 %	1.08 [0.88, 1.32]
Tang 1996	24/27	42/48		2.8 %	1.02 [0.86, 1.21]
Tripathi 2010	47/50	49/50		3.3 %	0.96 [0.89, 1.04]
Turan 1999	17/20	17/20		2.2 %	1.00 [0.77, 1.30]
Türkmen 2004	19/20	19/20		3.0 %	1.00 [0.87, 1.15]
Vinik 1999	11/15	11/15		1.3 %	1.00 [0.65, 1.54]
Subtotal (95% CI)	**833**	**635**		**51.4 %**	**0.92 [0.85, 0.99]**
Total events: 616 (Rocuronium), 549 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.02; Chi^2 = 60.54, df = 24 (P = 0.00005); I^2 =60%					
Test for overall effect: Z = 2.26 (P = 0.024)					

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
3 Mixed simulated and modified RSI					
Abdulatif 1996	6/24	15/24		0.6 %	0.40 [0.19, 0.85]
Ali 2008	32/50	44/50		2.4 %	0.73 [0.58, 0.92]
Subtotal (95% CI)	**74**	**74**		**3.0 %**	**0.59 [0.33, 1.08]**
Total events: 38 (Rocuronium), 59 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.13$; $Chi^2 = 2.57$, df = 1 (P = 0.11); $I^2 = 61\%$					
Test for overall effect: Z = 1.70 (P = 0.090)					
Total (95% CI)	**2192**	**1959**		**100.0 %**	**0.86 [0.81, 0.92]**
Total events: 1397 (Rocuronium), 1491 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 175.80$, df = 49 (P<0.00001); $I^2 = 72\%$					
Test for overall effect: Z = 4.68 (P < 0.00001)					
Test for subgroup differences: $Chi^2 = 5.82$, df = 2 (P = 0.05), $I^2 = 66\%$					

Analysis 1.2. Comparison 1 Rocuronium any dose versus succinylcholine, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 1 Rocuronium any dose versus succinylcholine

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Simulated RSI					
Abu-Halaweh 2007	57/60	58/60		3.0 %	0.98 [0.91, 1.06]
Andrews 1999	124/133	135/139		3.6 %	0.96 [0.91, 1.01]
Belyamani 2008	8/20	13/20		0.1 %	0.62 [0.33, 1.15]
Chiu 1999	15/15	15/15		2.0 %	1.00 [0.88, 1.13]
Chung 2001	26/29	27/27		1.7 %	0.90 [0.78, 1.03]
De Almeida 2009	20/20	19/20		1.8 %	1.05 [0.92, 1.20]
Iqbal 2013	20/30	30/30		0.7 %	0.67 [0.52, 0.87]
Koroglu 2002	28/30	32/35		1.7 %	1.02 [0.89, 1.17]
Larsen 2005	98/102	100/107		3.3 %	1.03 [0.96, 1.10]
Malik 2004	30/30	30/30		3.3 %	1.00 [0.94, 1.07]
Marsch 2011	187/201	194/200		3.8 %	0.96 [0.92, 1.00]
Mazurek 1998	12/13	12/13		0.9 %	1.00 [0.80, 1.25]
McCourt 1998	125/130	123/127		3.7 %	0.99 [0.95, 1.04]
Mencke 2005	38/60	51/60		0.9 %	0.75 [0.60, 0.93]
Mencke 2006	45/76	66/74		1.0 %	0.66 [0.54, 0.81]
Naguib 1997	20/20	10/10		1.6 %	1.00 [0.86, 1.16]
Sluga 2005	78/90	83/90		2.4 %	0.94 [0.85, 1.04]
Sparr 1996a	24/25	25/25		2.2 %	0.96 [0.86, 1.07]
Sparr 1996b	20/25	50/50		1.0 %	0.80 [0.65, 0.97]
Tryba 1994	53/60	20/20		2.1 %	0.90 [0.80, 1.01]
Weiss 1997	21/31	13/14		0.6 %	0.73 [0.55, 0.97]
Yorukoglu 2003	24/25	25/25		2.2 %	0.96 [0.86, 1.07]
Subtotal (95% CI)	**1225**	**1191**		**43.8 %**	**0.94 [0.90, 0.98]**
Total events: 1073 (Rocuronium), 1131 (Succinylcholine)					

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Heterogeneity: Tau^2 = 0.01; Chi^2 = 69.18, df = 21 (P<0.00001); I^2 =70%					
Test for overall effect: Z = 2.88 (P = 0.0039)					
2 Modified RSI					
Alvarez Rios1997	20/20	20/20		2.6 %	1.00 [0.91, 1.10]
Cheng 2002	75/80	40/40		3.2 %	0.94 [0.88, 1.01]
Cooper 1992	39/40	40/40		3.2 %	0.98 [0.91, 1.04]
Dubois 1995	12/12	11/12		0.9 %	1.09 [0.87, 1.36]
Giudice 1998	20/20	10/10		1.6 %	1.00 [0.86, 1.16]
Kulkarni 2010	200/200	100/100		4.3 %	1.00 [0.98, 1.02]
Kwon 2013	17/20	18/20		0.8 %	0.94 [0.75, 1.19]
Lam 2000	13/15	15/15		0.8 %	0.87 [0.69, 1.09]
Latorre 1996	18/20	18/20		1.0 %	1.00 [0.81, 1.23]
Le Corre 1999	30/30	30/30		3.3 %	1.00 [0.94, 1.07]
Magorian 1993	30/30	10/10		1.8 %	1.00 [0.87, 1.15]
Mitra 2001	20/20	20/20		2.6 %	1.00 [0.91, 1.10]
Naguib 1994	20/20	10/10		1.6 %	1.00 [0.86, 1.16]
Nelson 1997	20/20	22/22		2.7 %	1.00 [0.91, 1.09]
Patel 1995	14/15	7/7		0.8 %	0.97 [0.76, 1.23]
Pühringer 1992	20/20	9/10		0.8 %	1.13 [0.89, 1.44]
Singh 2011	29/30	30/30		2.6 %	0.97 [0.88, 1.06]
Sorensen 2012	29/29	26/26		3.2 %	1.00 [0.93, 1.07]
Stevens 1996	29/30	10/10		1.5 %	1.00 [0.86, 1.16]
Stoddart 1998	30/30	30/30		3.3 %	1.00 [0.94, 1.07]
Tang 1996	27/27	47/48		3.1 %	1.01 [0.94, 1.09]
Tripathi 2010	50/50	50/50		3.9 %	1.00 [0.96, 1.04]
Turan 1999	20/20	20/20		2.6 %	1.00 [0.91, 1.10]
Vinik 1999	14/15	14/15		1.1 %	1.00 [0.83, 1.21]
Subtotal (95% CI)	**813**	**615**		**53.2 %**	**1.00 [0.99, 1.01]**
Total events: 796 (Rocuronium), 607 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.0; Chi^2 = 7.68, df = 23 (P = 1.00); I^2 =0.0%					
Test for overall effect: Z = 0.46 (P = 0.64)					
3 Mixed simulated and modified RSI					
Abdulatif 1996	17/24	24/24		0.7 %	0.71 [0.55, 0.93]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Ali 2008	44/50	50/50		2.3 %	0.88 [0.79, 0.98]
Subtotal (95% CI)	**74**	**74**		**2.9 %**	**0.82 [0.66, 1.01]**
Total events: 61 (Rocuronium), 74 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.02; Chi^2 = 2.52, df = 1 (P = 0.11); I^2 =60%					
Test for overall effect: Z = 1.83 (P = 0.068)					
Total (95% CI)	**2112**	**1880**		**100.0 %**	**0.97 [0.95, 0.99]**
Total events: 1930 (Rocuronium), 1812 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 146.90, df = 47 (P<0.00001); I^2 =68%					
Test for overall effect: Z = 2.69 (P = 0.0072)					
Test for subgroup differences: Chi^2 = 10.07, df = 2 (P = 0.01), I^2 =80%					

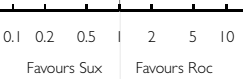
Analysis 2.1. Comparison 2 Rocuronium specific dose versus succinylcholine, Outcome 1 Excellent versus other intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 2 Rocuronium specific dose versus succinylcholine

Outcome: 1 Excellent versus other intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Rocuronium 0.6 - 0.7mg/kg					
Abdulatif 1996	6/24	15/24		0.6 %	0.40 [0.19, 0.85]
Ali 2008	32/50	44/50		2.2 %	0.73 [0.58, 0.92]
Alvarez Rios1997	18/20	19/20		2.4 %	0.95 [0.79, 1.13]
Belyamani 2008	2/20	5/20		0.2 %	0.40 [0.09, 1.83]
Cheng 2002	29/40	37/40		2.3 %	0.78 [0.64, 0.97]
Chung 2001	20/29	19/27		1.6 %	0.98 [0.69, 1.38]
Cooper 1992	30/40	39/40		2.4 %	0.77 [0.64, 0.93]
De Almeida 2009	19/20	15/20		1.9 %	1.27 [0.96, 1.66]
Dubois 1995	9/12	9/12		1.2 %	1.00 [0.63, 1.59]
Giudice 1998	5/10	6/10		0.5 %	0.83 [0.37, 1.85]
Koroglu 2002	21/30	28/35		1.9 %	0.88 [0.66, 1.17]
Kulkarni 2010	40/100	90/100		2.1 %	0.44 [0.35, 0.57]
Kwon 2013	5/20	11/20		0.5 %	0.45 [0.19, 1.07]
Lam 2000	7/15	11/15		0.8 %	0.64 [0.34, 1.18]
Larsen 2005	52/102	67/107		2.1 %	0.81 [0.64, 1.04]
Latorre 1996	9/20	12/20		0.8 %	0.75 [0.41, 1.37]
Le Corre 1999	28/30	26/30		2.5 %	1.08 [0.91, 1.28]
Magorian 1993	10/10	8/10		1.6 %	1.24 [0.87, 1.75]
Marsch 2011	109/201	102/200		2.4 %	1.06 [0.88, 1.28]
Mencke 2005	13/60	34/60		1.0 %	0.38 [0.23, 0.65]
Mencke 2006	16/76	42/74		1.1 %	0.37 [0.23, 0.60]
Mitra 2001	18/20	20/20		2.5 %	0.90 [0.76, 1.07]
Naguib 1994	13/20	8/10		1.2 %	0.81 [0.52, 1.27]
Naguib 1997	7/10	9/10		1.2 %	0.78 [0.49, 1.23]



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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Nelson 1997	18/20	22/22		2.5 %	0.90 [0.76, 1.07]
Patel 1995	4/7	7/7		0.8 %	0.60 [0.32, 1.13]
Pühringer 1992	17/20	8/10		1.5 %	1.06 [0.74, 1.52]
Singh 2011	23/30	25/30		2.0 %	0.92 [0.71, 1.19]
Sluga 2005	50/90	69/90		2.2 %	0.72 [0.58, 0.90]
Sparr 1996a	15/25	23/25		1.6 %	0.65 [0.46, 0.92]
Sparr 1996b	10/25	45/50		1.1 %	0.44 [0.27, 0.72]
Stevens 1996	11/30	8/10		0.9 %	0.46 [0.26, 0.80]
Stoddart 1998	27/30	25/30		2.3 %	1.08 [0.88, 1.32]
Tang 1996	24/27	42/48		2.5 %	1.02 [0.86, 1.21]
Tryba 1994	48/60	16/20		2.0 %	1.00 [0.78, 1.29]
Türkmen 2004	19/20	19/20		2.6 %	1.00 [0.87, 1.15]
Vinik 1999	11/15	11/15		1.3 %	1.00 [0.65, 1.54]
Weiss 1997	3/15	13/14		0.3 %	0.22 [0.08, 0.60]
Yorukoglu 2003	12/25	23/25		1.3 %	0.52 [0.34, 0.80]
Subtotal (95% CI)	**1418**	**1390**	♦	**61.8 %**	**0.80 [0.72, 0.88]**
Total events: 810 (Rocuronium), 1032 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.07$; $Chi^2 = 167.59$, df = 38 ($P<0.00001$); $I^2 = 77\%$					
Test for overall effect: $Z = 4.46$ ($P < 0.00001$)					
2 Rocuronium 0.9 - 1.0mg/kg					
Abu-Halaweh 2007	20/60	32/60		1.3 %	0.63 [0.41, 0.96]
Alanoglu 2006	57/60	54/59		2.8 %	1.04 [0.94, 1.14]
Andrews 1999	88/133	103/139		2.5 %	0.89 [0.76, 1.04]
Cheng 2002	38/40	37/40		2.7 %	1.03 [0.92, 1.15]
Chiu 1999	13/15	14/15		2.1 %	0.93 [0.73, 1.18]
Giudice 1998	8/10	6/10		0.8 %	1.33 [0.74, 2.41]
Iqbal 2013	25/30	29/30		2.5 %	0.86 [0.72, 1.03]
Kulkarni 2010	82/100	90/100		2.7 %	0.91 [0.81, 1.02]
Magorian 1993	8/10	8/10		1.2 %	1.00 [0.65, 1.55]
Malik 2004	28/30	30/30		2.7 %	0.93 [0.83, 1.05]
McCourt 1998	85/130	101/127		2.6 %	0.82 [0.71, 0.96]
Naguib 1997	10/10	9/10		2.0 %	1.11 [0.85, 1.44]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Patel 1995	7/8	7/7		1.6 %	0.89 [0.63, 1.25]
Sorensen 2012	27/29	20/26		2.1 %	1.21 [0.96, 1.53]
Tripathi 2010	47/50	49/50		2.9 %	0.96 [0.89, 1.04]
Weiss 1997	12/16	13/14		1.7 %	0.81 [0.59, 1.11]
Subtotal (95% CI)	**731**	**727**		**34.3 %**	**0.95 [0.89, 1.00]**
Total events: 555 (Rocuronium), 602 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 27.02$, df = 15 (P = 0.03); $I^2 = 44\%$					
Test for overall effect: Z = 1.82 (P = 0.069)					
3 Rocuronium 1.2 mg/kg					
Magorian 1993	7/10	8/10		1.0 %	0.88 [0.53, 1.46]
Mazurek 1998	7/13	10/13		0.9 %	0.70 [0.39, 1.26]
Turan 1999	17/20	17/20		2.0 %	1.00 [0.77, 1.30]
Subtotal (95% CI)	**43**	**43**		**3.9 %**	**0.93 [0.75, 1.15]**
Total events: 31 (Rocuronium), 35 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 1.46$, df = 2 (P = 0.48); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.66 (P = 0.51)					
Total (95% CI)	**2192**	**2160**		**100.0 %**	**0.86 [0.81, 0.92]**
Total events: 1396 (Rocuronium), 1669 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.04$; $Chi^2 = 222.44$, df = 57 (P<0.00001); $I^2 = 74\%$					
Test for overall effect: Z = 4.64 (P < 0.00001)					
Test for subgroup differences: $Chi^2 = 8.71$, df = 2 (P = 0.01), $I^2 = 77\%$					

Analysis 2.2. Comparison 2 Rocuronium specific dose versus succinylcholine, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 2 Rocuronium specific dose versus succinylcholine

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Rocuronium 0.6 - 0.7mg/kg					
Abdulatif 1996	17/24	24/24		0.5 %	0.71 [0.55, 0.93]
Ali 2008	44/50	50/50		1.9 %	0.88 [0.79, 0.98]
Alvarez Rios1997	20/20	20/20		2.2 %	1.00 [0.91, 1.10]
Belyamani 2008	8/20	13/20		0.1 %	0.62 [0.33, 1.15]
Cheng 2002	36/40	40/40		1.8 %	0.90 [0.81, 1.01]
Chung 2001	26/29	27/27		1.4 %	0.90 [0.78, 1.03]
Cooper 1992	39/40	40/40		2.9 %	0.98 [0.91, 1.04]
De Almeida 2009	20/20	19/20		1.4 %	1.05 [0.92, 1.20]
Dubois 1995	12/12	11/12		0.6 %	1.09 [0.87, 1.36]
Giudice 1998	10/10	10/10		0.9 %	1.00 [0.83, 1.20]
Koroglu 2002	28/30	32/35		1.4 %	1.02 [0.89, 1.17]
Kulkarni 2010	100/100	100/100		4.5 %	1.00 [0.98, 1.02]
Kwon 2013	17/20	18/20		0.6 %	0.94 [0.75, 1.19]
Lam 2000	13/15	15/15		0.6 %	0.87 [0.69, 1.09]
Larsen 2005	98/102	100/107		3.1 %	1.03 [0.96, 1.10]
Latorre 1996	18/20	18/20		0.7 %	1.00 [0.81, 1.23]
Le Corre 1999	30/30	30/30		3.1 %	1.00 [0.94, 1.07]
Magorian 1993	10/10	10/10		0.9 %	1.00 [0.83, 1.20]
Marsch 2011	187/201	194/200		3.7 %	0.96 [0.92, 1.00]
Mencke 2005	38/60	51/60		0.7 %	0.75 [0.60, 0.93]
Mencke 2006	45/76	66/74		0.8 %	0.66 [0.54, 0.81]
Mitra 2001	20/20	20/20		2.2 %	1.00 [0.91, 1.10]
Naguib 1994	20/20	10/10		1.3 %	1.00 [0.86, 1.16]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Naguib 1997	10/10	10/10		0.9 %	1.00 [0.83, 1.20]
Nelson 1997	20/20	22/22		2.3 %	1.00 [0.91, 1.09]
Patel 1995	6/7	7/7		0.3 %	0.87 [0.59, 1.26]
Pühringer 1992	20/20	9/10		0.6 %	1.13 [0.89, 1.44]
Singh 2011	29/30	30/30		2.3 %	0.97 [0.88, 1.06]
Sluga 2005	78/90	83/90		2.1 %	0.94 [0.85, 1.04]
Sparr 1996a	24/25	25/25		1.9 %	0.96 [0.86, 1.07]
Sparr 1996b	20/25	50/50		0.8 %	0.80 [0.65, 0.97]
Stevens 1996	29/30	10/10		1.2 %	1.00 [0.86, 1.16]
Stoddart 1998	30/30	30/30		3.1 %	1.00 [0.94, 1.07]
Tang 1996	27/27	47/48		2.9 %	1.01 [0.94, 1.09]
Tryba 1994	53/60	20/20		1.8 %	0.90 [0.80, 1.01]
Vinik 1999	14/15	14/15		0.8 %	1.00 [0.83, 1.21]
Weiss 1997	7/15	13/14		0.1 %	0.50 [0.29, 0.88]
Yorukoglu 2003	24/25	25/25		1.9 %	0.96 [0.86, 1.07]
Subtotal (95% CI)	**1398**	**1370**	◆	**60.3 %**	**0.96 [0.93, 0.99]**
Total events: 1247 (Rocuronium), 1313 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.01; Chi^2 = 130.83, df = 37 (P<0.00001); I^2 =72%					
Test for overall effect: Z = 2.57 (P = 0.010)					
2 Rocuronium 0.9 - 1.0mg/kg					
Abu-Halaweh 2007	57/60	58/60		2.8 %	0.98 [0.91, 1.06]
Andrews 1999	124/133	135/139		3.4 %	0.96 [0.91, 1.01]
Cheng 2002	39/40	40/40		2.9 %	0.98 [0.91, 1.04]
Chiu 1999	15/15	15/15		1.6 %	1.00 [0.88, 1.13]
Giudice 1998	10/10	10/10		0.9 %	1.00 [0.83, 1.20]
Iqbal 2013	30/30	30/30		3.1 %	1.00 [0.94, 1.07]
Kulkarni 2010	100/100	100/100		4.5 %	1.00 [0.98, 1.02]
Magorian 1993	10/10	10/10		0.9 %	1.00 [0.83, 1.20]
Malik 2004	30/30	30/30		3.1 %	1.00 [0.94, 1.07]
McCourt 1998	125/130	123/127		3.7 %	0.99 [0.95, 1.04]
Naguib 1997	10/10	10/10		0.9 %	1.00 [0.83, 1.20]
Patel 1995	8/8	7/7		0.6 %	1.00 [0.79, 1.27]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Sorensen 2012	29/29	26/26		2.9 %	1.00 [0.93, 1.07]
Tripathi 2010	50/50	50/50		3.9 %	1.00 [0.96, 1.04]
Weiss 1997	14/16	13/14		0.6 %	0.94 [0.74, 1.19]
Subtotal (95% CI)	**671**	**668**		**35.9 %**	**1.00 [0.98, 1.01]**
Total events: 651 (Rocuronium), 657 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 4.30$, df = 14 (P = 0.99); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.72 (P = 0.47)					
3 Rocuronium 1.2 mg/kg					
Magorian 1993	10/10	10/10		0.9 %	1.00 [0.83, 1.20]
Mazurek 1998	12/13	12/13		0.7 %	1.00 [0.80, 1.25]
Turan 1999	20/20	20/20		2.2 %	1.00 [0.91, 1.10]
Subtotal (95% CI)	**43**	**43**		**3.8 %**	**1.00 [0.92, 1.08]**
Total events: 42 (Rocuronium), 42 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 0.0$, df = 2 (P = 1.00); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.0 (P = 1.0)					
Total (95% CI)	**2112**	**2081**		**100.0 %**	**0.98 [0.96, 0.99]**
Total events: 1940 (Rocuronium), 2012 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 136.21$, df = 55 (P<0.00001); $I^2 = 60\%$					
Test for overall effect: Z = 2.49 (P = 0.013)					
Test for subgroup differences: $Chi^2 = 4.45$, df = 2 (P = 0.11), $I^2 = 55\%$					

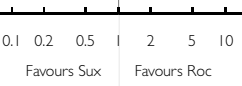
Analysis 3.1. Comparison 3 Rocuronium versus succinylcholine for induction agent, Outcome 1 Excellent versus other intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 3 Rocuronium versus succinylcholine for induction agent

Outcome: 1 Excellent versus other intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Propofol					
Abdulatif 1996	6/24	15/24		0.6 %	0.40 [0.19, 0.85]
Andrews 1999	88/133	103/139		2.9 %	0.89 [0.76, 1.04]
Belyamani 2008	2/20	5/20		0.2 %	0.40 [0.09, 1.83]
Chiu 1999	13/15	14/15		2.4 %	0.93 [0.73, 1.18]
De Almeida 2009	19/20	15/20		2.2 %	1.27 [0.96, 1.66]
Giudice 1998	13/20	6/10		0.9 %	1.08 [0.59, 1.97]
Koroglu 2002	11/15	15/19		1.6 %	0.93 [0.63, 1.36]
Kwon 2013	5/20	11/20		0.5 %	0.45 [0.19, 1.07]
Lam 2000	7/15	11/15		0.9 %	0.64 [0.34, 1.18]
Larsen 2005	52/102	67/107		2.4 %	0.81 [0.64, 1.04]
Latorre 1996	9/20	12/20		0.9 %	0.75 [0.41, 1.37]
Le Corre 1999	28/30	26/30		2.8 %	1.08 [0.91, 1.28]
Mitra 2001	18/20	20/20		2.8 %	0.90 [0.76, 1.07]
Naguib 1997	17/20	9/10		2.2 %	0.94 [0.72, 1.25]
Pühringer 1992	17/20	8/10		1.7 %	1.06 [0.74, 1.52]
Singh 2011	23/30	25/30		2.3 %	0.92 [0.71, 1.19]
Sluga 2005	50/90	69/90		2.5 %	0.72 [0.58, 0.90]
Sorensen 2012	27/29	20/26		2.4 %	1.21 [0.96, 1.53]
Stoddart 1998	27/30	25/30		2.6 %	1.08 [0.88, 1.32]
Türkmen 2004	19/20	19/20		3.0 %	1.00 [0.87, 1.15]
Vinik 1999	11/15	11/15		1.4 %	1.00 [0.65, 1.54]
Yorukoglu 2003	12/25	23/25		1.4 %	0.52 [0.34, 0.80]
Subtotal (95% CI)	**733**	**715**		**40.7 %**	**0.92 [0.84, 1.01]**
Total events: 474 (Rocuronium), 529 (Succinylcholine)					



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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Heterogeneity: Tau^2 = 0.02; Chi^2 = 50.38, df = 21 (P = 0.00032); I^2 =58%					
Test for overall effect: Z = 1.75 (P = 0.081)					
2 Thiopental					
Abu-Halaweh 2007	20/60	32/60		1.4 %	0.63 [0.41, 0.96]
Alanoglu 2006	57/60	54/59		3.2 %	1.04 [0.94, 1.14]
Ali 2008	32/50	44/50		2.4 %	0.73 [0.58, 0.92]
Alvarez Rios1997	18/20	19/20		2.8 %	0.95 [0.79, 1.13]
Cheng 2002	67/80	37/40		3.1 %	0.91 [0.79, 1.03]
Chung 2001	20/29	19/27		1.8 %	0.98 [0.69, 1.38]
Cooper 1992	30/40	39/40		2.7 %	0.77 [0.64, 0.93]
Dubois 1995	9/12	9/12		1.3 %	1.00 [0.63, 1.59]
Iqbal 2013	25/30	29/30		2.8 %	0.86 [0.72, 1.03]
Koroglu 2002	10/15	13/16		1.4 %	0.82 [0.53, 1.26]
Kulkarni 2010	122/200	90/100		3.1 %	0.68 [0.60, 0.77]
Magorian 1993	25/30	8/10		1.8 %	1.04 [0.73, 1.48]
Malik 2004	28/30	30/30		3.1 %	0.93 [0.83, 1.05]
Mazurek 1998	7/13	10/13		0.9 %	0.70 [0.39, 1.26]
McCourt 1998	85/130	101/127		2.9 %	0.82 [0.71, 0.96]
Mencke 2005	13/60	34/60		1.1 %	0.38 [0.23, 0.65]
Mencke 2006	16/76	42/74		1.2 %	0.37 [0.23, 0.60]
Naguib 1994	13/20	8/10		1.4 %	0.81 [0.52, 1.27]
Nelson 1997	18/20	22/22		2.8 %	0.90 [0.76, 1.07]
Patel 1995	11/15	7/7		1.7 %	0.77 [0.54, 1.09]
Sparr 1996a	15/25	23/25		1.8 %	0.65 [0.46, 0.92]
Sparr 1996b	10/25	45/50		1.2 %	0.44 [0.27, 0.72]
Stevens 1996	11/30	8/10		1.0 %	0.46 [0.26, 0.80]
Tang 1996	24/27	42/48		2.8 %	1.02 [0.86, 1.21]
Tripathi 2010	47/50	49/50		3.3 %	0.96 [0.89, 1.04]
Tryba 1994	48/60	16/20		2.3 %	1.00 [0.78, 1.29]
Turan 1999	17/20	17/20		2.3 %	1.00 [0.77, 1.30]
Weiss 1997	15/31	13/14		1.6 %	0.52 [0.35, 0.77]
Subtotal (95% CI)	**1258**	**1044**		**59.3 %**	**0.81 [0.73, 0.88]**

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Total events: 813 (Rocuronium), 860 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.04; Chi^2 = 141.66, df = 27 (P<0.00001); I^2 =81%					
Test for overall effect: Z = 4.54 (P < 0.00001)					
Total (95% CI)	**1991**	**1759**	♦	**100.0 %**	**0.85 [0.80, 0.91]**
Total events: 1287 (Rocuronium), 1389 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.03; Chi^2 = 186.12, df = 49 (P<0.00001); I^2 =74%					
Test for overall effect: Z = 4.75 (P < 0.00001)					
Test for subgroup differences: Chi^2 = 3.76, df = 1 (P = 0.05), I^2 =73%					

Analysis 3.2. Comparison 3 Rocuronium versus succinylcholine for induction agent, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 3 Rocuronium versus succinylcholine for induction agent

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Propofol					
Abdulatif 1996	17/24	24/24		0.6 %	0.71 [0.55, 0.93]
Andrews 1999	124/133	135/139		3.7 %	0.96 [0.91, 1.01]
Belyamani 2008	8/20	13/20		0.1 %	0.62 [0.33, 1.15]
Chiu 1999	15/15	15/15		1.9 %	1.00 [0.88, 1.13]
De Almeida 2009	20/20	19/20		1.7 %	1.05 [0.92, 1.20]
Giudice 1998	20/20	10/10		1.6 %	1.00 [0.86, 1.16]
Koroglu 2002	15/15	17/19		1.1 %	1.11 [0.92, 1.34]
Kwon 2013	17/20	18/20		0.8 %	0.94 [0.75, 1.19]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Lam 2000	13/15	15/15		0.8 %	0.87 [0.69, 1.09]
Larsen 2005	98/102	100/107		3.4 %	1.03 [0.96, 1.10]
Latorre 1996	18/20	18/20		0.9 %	1.00 [0.81, 1.23]
Le Corre 1999	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Mitra 2001	20/20	20/20		2.6 %	1.00 [0.91, 1.10]
Naguib 1997	20/20	10/10		1.6 %	1.00 [0.86, 1.16]
Pühringer 1992	20/20	9/10		0.7 %	1.13 [0.89, 1.44]
Singh 2011	29/30	30/30		2.7 %	0.97 [0.88, 1.06]
Sluga 2005	78/90	83/90		2.4 %	0.94 [0.85, 1.04]
Sorensen 2012	29/29	26/26		3.2 %	1.00 [0.93, 1.07]
Stoddart 1998	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Vinik 1999	14/15	14/15		1.1 %	1.00 [0.83, 1.21]
Yorukoglu 2003	24/25	25/25		2.2 %	0.96 [0.86, 1.07]
Subtotal (95% CI)	**713**	**695**		**40.1 %**	**0.99 [0.97, 1.01]**
Total events: 659 (Rocuronium), 661 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 20.36$, df = 20 (P = 0.44); $I^2 = 2\%$					
Test for overall effect: Z = 0.97 (P = 0.33)					
2 Thiopental					
Abu-Halaweh 2007	57/60	58/60		3.1 %	0.98 [0.91, 1.06]
Ali 2008	44/50	50/50		2.3 %	0.88 [0.79, 0.98]
Alvarez Rios1997	20/20	20/20		2.6 %	1.00 [0.91, 1.10]
Cheng 2002	75/80	40/40		3.3 %	0.94 [0.88, 1.01]
Chung 2001	26/29	27/27		1.7 %	0.90 [0.78, 1.03]
Cooper 1992	39/40	40/40		3.3 %	0.98 [0.91, 1.04]
Dubois 1995	12/12	11/12		0.8 %	1.09 [0.87, 1.36]
Iqbal 2013	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Koroglu 2002	13/15	15/16		0.8 %	0.92 [0.73, 1.17]
Kulkarni 2010	200/200	100/100		4.6 %	1.00 [0.98, 1.02]
Magorian 1993	30/30	10/10		1.7 %	1.00 [0.87, 1.15]
Malik 2004	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Mazurek 1998	12/13	12/13		0.8 %	1.00 [0.80, 1.25]
McCourt 1998	125/130	123/127		3.9 %	0.99 [0.95, 1.04]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Mencke 2005	38/60	51/60		0.9 %	0.75 [0.60, 0.93]
Mencke 2006	45/76	66/74		1.0 %	0.66 [0.54, 0.81]
Naguib 1994	20/20	10/10		1.6 %	1.00 [0.86, 1.16]
Nelson 1997	20/20	22/22		2.7 %	1.00 [0.91, 1.09]
Patel 1995	14/15	7/7		0.7 %	0.97 [0.76, 1.23]
Sparr 1996a	24/25	25/25		2.2 %	0.96 [0.86, 1.07]
Sparr 1996b	20/25	50/50		1.0 %	0.80 [0.65, 0.97]
Stevens 1996	29/30	10/10		1.5 %	1.00 [0.86, 1.16]
Tang 1996	27/27	47/48		3.2 %	1.01 [0.94, 1.09]
Tripathi 2010	50/50	50/50		4.1 %	1.00 [0.96, 1.04]
Tryba 1994	53/60	20/20		2.1 %	0.90 [0.80, 1.01]
Turan 1999	20/20	20/20		2.6 %	1.00 [0.91, 1.10]
Weiss 1997	21/31	13/14		0.6 %	0.73 [0.55, 0.97]
Subtotal (95% CI)	**1198**	**985**		**59.9 %**	**0.96 [0.92, 0.99]**
Total events: 1094 (Rocuronium), 957 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.01; Chi^2 = 141.60, df = 26 (P<0.00001); I^2 =82%					
Test for overall effect: Z = 2.28 (P = 0.022)					
Total (95% CI)	**1911**	**1680**		**100.0 %**	**0.97 [0.95, 1.00]**
Total events: 1753 (Rocuronium), 1618 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 129.50, df = 47 (P<0.00001); I^2 =64%					
Test for overall effect: Z = 2.35 (P = 0.019)					
Test for subgroup differences: Chi^2 = 2.11, df = 1 (P = 0.15), I^2 =53%					

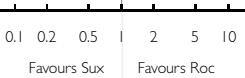
Analysis 4.1. Comparison 4 Rocuronium versus succinylcholine with narcotic, Outcome 1 Excellent versus other intubation outcomes.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 4 Rocuronium versus succinylcholine with narcotic

Outcome: 1 Excellent versus other intubation outcomes

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Propofol Induction					
Abdulatif 1996	6/24	15/24		1.0 %	0.40 [0.19, 0.85]
Belyamani 2008	2/20	5/20		0.3 %	0.40 [0.09, 1.83]
Chiu 1999	13/15	14/15		3.6 %	0.93 [0.73, 1.18]
De Almeida 2009	19/20	15/20		3.3 %	1.27 [0.96, 1.66]
Kwon 2013	5/20	11/20		0.8 %	0.45 [0.19, 1.07]
Lam 2000	7/15	11/15		1.4 %	0.64 [0.34, 1.18]
Larsen 2005	52/102	67/107		3.6 %	0.81 [0.64, 1.04]
Latorre 1996	9/20	12/20		1.4 %	0.75 [0.41, 1.37]
Le Corre 1999	28/30	26/30		4.2 %	1.08 [0.91, 1.28]
Mitra 2001	18/20	20/20		4.2 %	0.90 [0.76, 1.07]
Naguib 1997	17/20	9/10		3.3 %	0.94 [0.72, 1.25]
Pühringer 1992	17/20	8/10		2.6 %	1.06 [0.74, 1.52]
Sluga 2005	50/90	69/90		3.8 %	0.72 [0.58, 0.90]
Sorensen 2012	27/29	20/26		3.7 %	1.21 [0.96, 1.53]
Türkmen 2004	19/20	19/20		4.4 %	1.00 [0.87, 1.15]
Vinik 1999	11/15	11/15		2.2 %	1.00 [0.65, 1.54]
Yorukoglu 2003	12/25	23/25		2.2 %	0.52 [0.34, 0.80]
Subtotal (95% CI)	**505**	**487**		**46.0 %**	**0.89 [0.78, 1.01]**
Total events: 312 (Rocuronium), 355 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.04$; $Chi^2 = 52.14$, df = 16 (P = 0.00001); $I^2 = 69\%$					
Test for overall effect: Z = 1.76 (P = 0.079)					
2 Thiopental Induction					
Alanoglu 2006	29/30	29/29		4.8 %	0.97 [0.88, 1.06]
Cheng 2002	67/80	37/40		4.5 %	0.91 [0.79, 1.03]
Chung 2001	20/29	19/27		2.7 %	0.98 [0.69, 1.38]



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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Cooper 1992	30/40	39/40		4.1 %	0.77 [0.64, 0.93]
Dubois 1995	9/12	9/12		2.0 %	1.00 [0.63, 1.59]
Magorian 1993	25/30	8/10		2.7 %	1.04 [0.73, 1.48]
Malik 2004	28/30	30/30		4.6 %	0.93 [0.83, 1.05]
McCourt 1998	85/130	101/127		4.3 %	0.82 [0.71, 0.96]
Mencke 2005	13/60	34/60		1.7 %	0.38 [0.23, 0.65]
Mencke 2006	16/76	42/74		1.9 %	0.37 [0.23, 0.60]
Naguib 1994	13/20	8/10		2.1 %	0.81 [0.52, 1.27]
Nelson 1997	18/20	22/22		4.2 %	0.90 [0.76, 1.07]
Patel 1995	11/15	7/7		2.7 %	0.77 [0.54, 1.09]
Stevens 1996	11/30	8/10		1.6 %	0.46 [0.26, 0.80]
Tang 1996	24/27	42/48		4.2 %	1.02 [0.86, 1.21]
Tryba 1994	48/60	16/20		3.5 %	1.00 [0.78, 1.29]
Weiss 1997	15/31	13/14		2.4 %	0.52 [0.35, 0.77]
Subtotal (95% CI)	**720**	**580**		**54.0 %**	**0.82 [0.73, 0.92]**
Total events: 462 (Rocuronium), 464 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.04; Chi^2 = 74.88, df = 16 (P<0.00001); I^2 =79%					
Test for overall effect: Z = 3.33 (P = 0.00087)					
Total (95% CI)	**1225**	**1067**		**100.0 %**	**0.85 [0.78, 0.93]**
Total events: 774 (Rocuronium), 819 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.04; Chi^2 = 125.79, df = 33 (P<0.00001); I^2 =74%					
Test for overall effect: Z = 3.67 (P = 0.00024)					
Test for subgroup differences: Chi^2 = 0.81, df = 1 (P = 0.37), I^2 =0.0%					

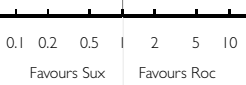
Analysis 4.2. Comparison 4 Rocuronium versus succinylcholine with narcotic, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 4 Rocuronium versus succinylcholine with narcotic

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Propofol Induction					
Abdulatif 1996	17/24	24/24		1.2 %	0.71 [0.55, 0.93]
Belyamani 2008	8/20	13/20		0.3 %	0.62 [0.33, 1.15]
Chiu 1999	15/15	15/15		3.3 %	1.00 [0.88, 1.13]
De Almeida 2009	20/20	19/20		3.0 %	1.05 [0.92, 1.20]
Kwon 2013	17/20	18/20		1.4 %	0.94 [0.75, 1.19]
Lam 2000	13/15	15/15		1.5 %	0.87 [0.69, 1.09]
Larsen 2005	98/102	100/107		5.3 %	1.03 [0.96, 1.10]
Latorre 1996	18/20	18/20		1.8 %	1.00 [0.81, 1.23]
Le Corre 1999	30/30	30/30		5.3 %	1.00 [0.94, 1.07]
Mitra 2001	20/20	20/20		4.2 %	1.00 [0.91, 1.10]
Naguib 1997	20/20	10/10		2.8 %	1.00 [0.86, 1.16]
Pühringer 1992	20/20	9/10		1.4 %	1.13 [0.89, 1.44]
Sluga 2005	78/90	83/90		4.0 %	0.94 [0.85, 1.04]
Sorensen 2012	29/29	26/26		5.1 %	1.00 [0.93, 1.07]
Vinik 1999	14/15	14/15		2.0 %	1.00 [0.83, 1.21]
Yorukoglu 2003	24/25	25/25		3.8 %	0.96 [0.86, 1.07]
Subtotal (95% CI)	**485**	**467**		**46.5 %**	**0.99 [0.96, 1.02]**
Total events: 441 (Rocuronium), 439 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 18.52$, df = 15 (P = 0.24); $I^2 = 19\%$					
Test for overall effect: Z = 0.57 (P = 0.57)					
2 Thiopental Induction					
Cheng 2002	75/80	40/40		5.2 %	0.94 [0.88, 1.01]
Chung 2001	26/29	27/27		3.0 %	0.90 [0.78, 1.03]
Cooper 1992	39/40	40/40		5.1 %	0.98 [0.91, 1.04]
Dubois 1995	12/12	11/12		1.6 %	1.09 [0.87, 1.36]



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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Magorian 1993	30/30	10/10		3.0 %	1.00 [0.87, 1.15]
Malik 2004	30/30	30/30		5.3 %	1.00 [0.94, 1.07]
McCourt 1998	125/130	123/127		5.9 %	0.99 [0.95, 1.04]
Mencke 2005	38/60	51/60		1.6 %	0.75 [0.60, 0.93]
Mencke 2006	45/76	66/74		1.8 %	0.66 [0.54, 0.81]
Naguib 1994	20/20	10/10		2.8 %	1.00 [0.86, 1.16]
Nelson 1997	20/20	22/22		4.4 %	1.00 [0.91, 1.09]
Patel 1995	14/15	7/7		1.4 %	0.97 [0.76, 1.23]
Stevens 1996	29/30	10/10		2.7 %	1.00 [0.86, 1.16]
Tang 1996	27/27	47/48		5.1 %	1.01 [0.94, 1.09]
Tryba 1994	53/60	20/20		3.6 %	0.90 [0.80, 1.01]
Weiss 1997	21/31	13/14		1.1 %	0.73 [0.55, 0.97]
Subtotal (95% CI)	**690**	**551**		**53.5 %**	**0.95 [0.90, 1.00]**
Total events: 604 (Rocuronium), 527 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.01; Chi^2 = 60.88, df = 15 (P<0.00001); I^2 =75%					
Test for overall effect: Z = 2.01 (P = 0.045)					
Total (95% CI)	**1175**	**1018**		**100.0 %**	**0.97 [0.94, 1.00]**
Total events: 1045 (Rocuronium), 966 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 74.70, df = 31 (P = 0.00002); I^2 =59%					
Test for overall effect: Z = 2.05 (P = 0.040)					
Test for subgroup differences: Chi^2 = 1.97, df = 1 (P = 0.16), I^2 =49%					

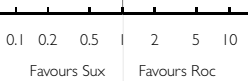
Analysis 5.1. Comparison 5 Rocuronium versus succinylcholine without narcotic, Outcome 1 Excellent versus other intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 5 Rocuronium versus succinylcholine without narcotic

Outcome: 1 Excellent versus other intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Propofol Induction					
Andrews 1999	88/133	103/139		8.2 %	0.89 [0.76, 1.04]
Koroglu 2002	11/15	15/19		4.5 %	0.93 [0.63, 1.36]
Singh 2011	23/30	25/30		6.4 %	0.92 [0.71, 1.19]
Stoddart 1998	27/30	25/30		7.4 %	1.08 [0.88, 1.32]
Subtotal (95% CI)	**208**	**218**		**26.5 %**	**0.95 [0.85, 1.06]**
Total events: 149 (Rocuronium), 168 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.0$; $Chi^2 = 2.45$, df = 3 (P = 0.48); $I^2 = 0.0\%$					
Test for overall effect: Z = 0.94 (P = 0.35)					
2 Thiopental Induction					
Abu-Halaweh 2007	20/60	32/60		3.9 %	0.63 [0.41, 0.96]
Alanoglu 2006	28/30	25/30		7.7 %	1.12 [0.93, 1.35]
Ali 2008	32/50	44/50		6.8 %	0.73 [0.58, 0.92]
Alvarez Rios1997	18/20	19/20		7.8 %	0.95 [0.79, 1.13]
Iqbal 2013	25/30	29/30		7.9 %	0.86 [0.72, 1.03]
Koroglu 2002	10/15	13/16		3.9 %	0.82 [0.53, 1.26]
Kulkarni 2010	122/200	90/100		8.7 %	0.68 [0.60, 0.77]
Mazurek 1998	7/13	10/13		2.6 %	0.70 [0.39, 1.26]
Sparr 1996a	15/25	23/25		5.1 %	0.65 [0.46, 0.92]
Sparr 1996b	10/25	45/50		3.3 %	0.44 [0.27, 0.72]
Tripathi 2010	47/50	49/50		9.3 %	0.96 [0.89, 1.04]
Turan 1999	17/20	17/20		6.3 %	1.00 [0.77, 1.30]
Subtotal (95% CI)	**538**	**464**		**73.5 %**	**0.80 [0.69, 0.94]**
Total events: 351 (Rocuronium), 396 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.05$; $Chi^2 = 68.25$, df = 11 (P<0.00001); $I^2 = 84\%$					
Test for overall effect: Z = 2.77 (P = 0.0056)					
Total (95% CI)	**746**	**682**		**100.0 %**	**0.85 [0.76, 0.95]**
Total events: 500 (Rocuronium), 564 (Succinylcholine)					



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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Heterogeneity: Tau^2 = 0.03; Chi^2 = 62.14, df = 15 (P<0.00001); I^2 =76%					
Test for overall effect: Z = 2.91 (P = 0.0036)					
Test for subgroup differences: Chi^2 = 3.05, df = 1 (P = 0.08), I^2 =67%					

Analysis 5.2. Comparison 5 Rocuronium versus succinylcholine without narcotic, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 5 Rocuronium versus succinylcholine without narcotic

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Propofol Induction					
Andrews 1999	124/133	135/139		10.5 %	0.96 [0.91, 1.01]
Koroglu 2002	15/15	17/19		2.0 %	1.11 [0.92, 1.34]
Singh 2011	29/30	30/30		6.1 %	0.97 [0.88, 1.06]
Stoddart 1998	30/30	30/30		9.1 %	1.00 [0.94, 1.07]
Subtotal (95% CI)	**208**	**218**		**27.8 %**	**0.98 [0.94, 1.02]**
Total events: 198 (Rocuronium), 212 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.0; Chi^2 = 2.66, df = 3 (P = 0.45); I^2 =0.0%					
Test for overall effect: Z = 1.09 (P = 0.27)					
2 Thiopental Induction					
Abu-Halaweh 2007	57/60	58/60		7.8 %	0.98 [0.91, 1.06]
Ali 2008	44/50	50/50		4.9 %	0.88 [0.79, 0.98]
Alvarez Rios1997	20/20	20/20		5.9 %	1.00 [0.91, 1.10]
Iqbal 2013	30/30	30/30		9.1 %	1.00 [0.94, 1.07]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Koroglu 2002	13/15	15/16		1.3 %	0.92 [0.73, 1.17]
Kulkarni 2010	200/200	100/100		16.3 %	1.00 [0.98, 1.02]
Mazurek 1998	12/13	12/13		1.5 %	1.00 [0.80, 1.25]
Sparr 1996a	24/25	25/25		4.8 %	0.96 [0.86, 1.07]
Sparr 1996b	20/25	50/50		1.8 %	0.80 [0.65, 0.97]
Tripathi 2010	50/50	50/50		13.0 %	1.00 [0.96, 1.04]
Turan 1999	20/20	20/20		5.9 %	1.00 [0.91, 1.10]
Subtotal (95% CI)	**508**	**434**		**72.2 %**	**0.98 [0.94, 1.02]**
Total events: 490 (Rocuronium), 430 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 33.73, df = 10 (P = 0.00021); I^2 =70%					
Test for overall effect: Z = 1.19 (P = 0.23)					
Total (95% CI)	**716**	**652**		**100.0 %**	**0.98 [0.95, 1.01]**
Total events: 688 (Rocuronium), 642 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 30.90, df = 14 (P = 0.01); I^2 =55%					
Test for overall effect: Z = 1.31 (P = 0.19)					
Test for subgroup differences: Chi^2 = 0.02, df = 1 (P = 0.88), I^2 =0.0%					

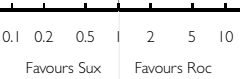
Analysis 6.1. Comparison 6 Comparison of children and adults, Outcome 1 Excellent versus other intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 6 Comparison of children and adults

Outcome: 1 Excellent versus other intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Adults					
Abdulatif 1996	6/24	15/24		0.6 %	0.40 [0.19, 0.85]
Abu-Halaweh 2007	20/60	32/60		1.4 %	0.63 [0.41, 0.96]
Alanoglu 2006	57/60	54/59		3.2 %	1.04 [0.94, 1.14]
Ali 2008	32/50	44/50		2.4 %	0.73 [0.58, 0.92]
Alvarez Rios1997	18/20	19/20		2.8 %	0.95 [0.79, 1.13]
Andrews 1999	88/133	103/139		2.9 %	0.89 [0.76, 1.04]
Belyamani 2008	2/20	5/20		0.2 %	0.40 [0.09, 1.83]
Chiu 1999	13/15	14/15		2.3 %	0.93 [0.73, 1.18]
Chung 2001	20/29	19/27		1.7 %	0.98 [0.69, 1.38]
Cooper 1992	30/40	39/40		2.7 %	0.77 [0.64, 0.93]
De Almeida 2009	19/20	15/20		2.1 %	1.27 [0.96, 1.66]
Dubois 1995	9/12	9/12		1.2 %	1.00 [0.63, 1.59]
Giudice 1998	13/20	6/10		0.9 %	1.08 [0.59, 1.97]
Iqbal 2013	25/30	29/30		2.8 %	0.86 [0.72, 1.03]
Koroglu 2002	21/30	28/35		2.1 %	0.88 [0.66, 1.17]
Kwon 2013	5/20	11/20		0.5 %	0.45 [0.19, 1.07]
Lam 2000	7/15	11/15		0.8 %	0.64 [0.34, 1.18]
Larsen 2005	52/107	67/102		2.3 %	0.74 [0.58, 0.94]
Latorre 1996	9/20	12/20		0.9 %	0.75 [0.41, 1.37]
Le Corre 1999	28/30	26/30		2.8 %	1.08 [0.91, 1.28]
Magorian 1993	25/30	8/10		1.7 %	1.04 [0.73, 1.48]
Malik 2004	28/30	30/30		3.1 %	0.93 [0.83, 1.05]
Marsch 2011	109/201	102/200		2.7 %	1.06 [0.88, 1.28]
McCourt 1998	85/130	101/127		2.9 %	0.82 [0.71, 0.96]



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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Mencke 2005	13/60	34/60		1.0 %	0.38 [0.23, 0.65]
Mencke 2006	16/76	42/74		1.2 %	0.37 [0.23, 0.60]
Mitra 2001	18/20	20/20		2.8 %	0.90 [0.76, 1.07]
Naguib 1994	13/20	8/10		1.3 %	0.81 [0.52, 1.27]
Nelson 1997	18/20	22/22		2.8 %	0.90 [0.76, 1.07]
Patel 1995	11/15	7/7		1.7 %	0.77 [0.54, 1.09]
Pühringer 1992	17/20	8/10		1.7 %	1.06 [0.74, 1.52]
Singh 2011	23/30	25/30		2.3 %	0.92 [0.71, 1.19]
Sluga 2005	50/90	69/90		2.5 %	0.72 [0.58, 0.90]
Sorensen 2012	27/29	20/26		2.4 %	1.21 [0.96, 1.53]
Sparr 1996a	15/25	23/25		1.8 %	0.65 [0.46, 0.92]
Sparr 1996b	10/25	45/50		1.2 %	0.44 [0.27, 0.72]
Stevens 1996	11/30	8/10		0.9 %	0.46 [0.26, 0.80]
Tang 1996	24/27	42/48		2.8 %	1.02 [0.86, 1.21]
Tripathi 2010	47/50	49/50		3.3 %	0.96 [0.89, 1.04]
Tryba 1994	48/60	16/20		2.3 %	1.00 [0.78, 1.29]
Turan 1999	17/20	17/20		2.2 %	1.00 [0.77, 1.30]
Türkmen 2004	19/20	19/20		3.0 %	1.00 [0.87, 1.15]
Vinik 1999	11/15	11/15		1.4 %	1.00 [0.65, 1.54]
Weiss 1997	15/31	13/14		1.5 %	0.52 [0.35, 0.77]
Yorukoglu 2003	12/25	23/25		1.4 %	0.52 [0.34, 0.80]
Subtotal (95% CI)	**1854**	**1761**		**88.3 %**	**0.85 [0.80, 0.92]**
Total events: 1156 (Rocuronium), 1320 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.03; Chi^2 = 155.95, df = 44 (P<0.00001); I^2 =72%					
Test for overall effect: Z = 4.49 (P < 0.00001)					
2 Children					
Cheng 2002	67/80	37/40		3.0 %	0.91 [0.79, 1.03]
Kulkarni 2010	122/200	90/100		3.1 %	0.68 [0.60, 0.77]
Mazurek 1998	7/13	10/13		0.9 %	0.70 [0.39, 1.26]
Naguib 1997	17/20	9/10		2.1 %	0.94 [0.72, 1.25]
Stoddart 1998	27/30	25/30		2.6 %	1.08 [0.88, 1.32]
Subtotal (95% CI)	**343**	**193**		**11.7 %**	**0.86 [0.70, 1.06]**
Total events: 240 (Rocuronium), 171 (Succinylcholine)					

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Heterogeneity: Tau^2 = 0.04; Chi^2 = 20.66, df = 4 (P = 0.00037); I^2 =81%					
Test for overall effect: Z = 1.41 (P = 0.16)					
Total (95% CI)	**2197**	**1954**	♦	**100.0 %**	**0.86 [0.80, 0.91]**
Total events: 1396 (Rocuronium), 1491 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.03; Chi^2 = 180.11, df = 49 (P<0.00001); I^2 =73%					
Test for overall effect: Z = 4.75 (P < 0.00001)					
Test for subgroup differences: Chi^2 = 0.01, df = 1 (P = 0.93), I^2 =0.0%					

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Favours Sux Favours Roc

Analysis 6.2. Comparison 6 Comparison of children and adults, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 6 Comparison of children and adults

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Adults					
Abdulatif 1996	17/24	24/24		0.6 %	0.71 [0.55, 0.93]
Abu-Halaweh 2007	57/60	58/60		3.0 %	0.98 [0.91, 1.06]
Ali 2008	44/50	50/50		2.1 %	0.88 [0.79, 0.98]
Alvarez Rios1997	20/20	20/20		2.5 %	1.00 [0.91, 1.10]
Andrews 1999	124/133	135/139		3.7 %	0.96 [0.91, 1.01]
Belyamani 2008	8/20	13/20		0.1 %	0.62 [0.33, 1.15]
Chiu 1999	15/15	15/15		1.8 %	1.00 [0.88, 1.13]
Chung 2001	26/29	27/27		1.6 %	0.90 [0.78, 1.03]
Cooper 1992	39/40	40/40		3.2 %	0.98 [0.91, 1.04]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
De Almeida 2009	20/20	19/20		1.6 %	1.05 [0.92, 1.20]
Dubois 1995	12/12	11/12		0.8 %	1.09 [0.87, 1.36]
Giudice 1998	20/20	10/10		1.5 %	1.00 [0.86, 1.16]
Iqbal 2013	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Koroglu 2002	28/30	32/35		1.6 %	1.02 [0.89, 1.17]
Kwon 2013	17/20	18/20		0.7 %	0.94 [0.75, 1.19]
Lam 2000	13/15	15/15		0.7 %	0.87 [0.69, 1.09]
Larsen 2005	98/102	100/107		3.4 %	1.03 [0.96, 1.10]
Latorre 1996	18/20	18/20		0.9 %	1.00 [0.81, 1.23]
Le Corre 1999	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Magorian 1993	30/30	10/10		1.6 %	1.00 [0.87, 1.15]
Malik 2004	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Marsch 2011	187/201	194/200		4.0 %	0.96 [0.92, 1.00]
McCourt 1998	125/130	123/127		3.9 %	0.99 [0.95, 1.04]
Mencke 2005	38/60	51/60		0.8 %	0.75 [0.60, 0.93]
Mencke 2006	45/76	66/74		0.9 %	0.66 [0.54, 0.81]
Mitra 2001	20/20	20/20		2.5 %	1.00 [0.91, 1.10]
Naguib 1994	20/20	10/10		1.5 %	1.00 [0.86, 1.16]
Nelson 1997	20/20	22/22		2.6 %	1.00 [0.91, 1.09]
Patel 1995	14/15	7/7		0.7 %	0.97 [0.76, 1.23]
Pühringer 1992	20/20	9/10		0.7 %	1.13 [0.89, 1.44]
Singh 2011	29/30	30/30		2.5 %	0.97 [0.88, 1.06]
Sluga 2005	78/90	83/90		2.3 %	0.94 [0.85, 1.04]
Sorensen 2012	29/29	26/26		3.2 %	1.00 [0.93, 1.07]
Sparr 1996a	24/25	25/25		2.1 %	0.96 [0.86, 1.07]
Sparr 1996b	20/25	50/50		0.9 %	0.80 [0.65, 0.97]
Stevens 1996	29/30	10/10		1.4 %	1.00 [0.86, 1.16]
Tang 1996	27/27	47/48		3.1 %	1.01 [0.94, 1.09]
Tripathi 2010	50/50	50/50		4.1 %	1.00 [0.96, 1.04]
Tryba 1994	53/60	20/20		2.0 %	0.90 [0.80, 1.01]
Turan 1999	20/20	20/20		2.5 %	1.00 [0.91, 1.10]

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Vinik 1999	14/15	14/15		1.0 %	1.00 [0.83, 1.21]
Weiss 1997	21/31	13/14		0.5 %	0.73 [0.55, 0.97]
Yorukoglu 2003	24/25	25/25		2.1 %	0.96 [0.86, 1.07]
Subtotal (95% CI)	**1769**	**1687**		**86.5 %**	**0.97 [0.95, 0.99]**
Total events: 1603 (Rocuronium), 1620 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 87.00, df = 42 (P = 0.00006); I^2 =52%					
Test for overall effect: Z = 2.50 (P = 0.012)					
2 Children					
Cheng 2002	75/80	40/40		3.2 %	0.94 [0.88, 1.01]
Kulkarni 2010	200/200	100/100		4.7 %	1.00 [0.98, 1.02]
Mazurek 1998	12/13	12/13		0.8 %	1.00 [0.80, 1.25]
Naguib 1997	20/20	10/10		1.5 %	1.00 [0.86, 1.16]
Stoddart 1998	30/30	30/30		3.4 %	1.00 [0.94, 1.07]
Subtotal (95% CI)	**343**	**193**		**13.5 %**	**0.99 [0.97, 1.02]**
Total events: 337 (Rocuronium), 192 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 4.46, df = 4 (P = 0.35); I^2 =10%					
Test for overall effect: Z = 0.51 (P = 0.61)					
Total (95% CI)	**2112**	**1880**		**100.0 %**	**0.97 [0.95, 0.99]**
Total events: 1940 (Rocuronium), 1812 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 124.57, df = 47 (P<0.00001); I^2 =62%					
Test for overall effect: Z = 2.49 (P = 0.013)					
Test for subgroup differences: Chi^2 = 1.92, df = 1 (P = 0.17), I^2 =48%					

Analysis 7.1. Comparison 7 Rocuronium versus succinylcholine in emergency intubation, Outcome 1 Excellent versus other intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 7 Rocuronium versus succinylcholine in emergency intubation

Outcome: 1 Excellent versus other intubation conditions

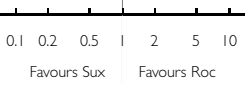
Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Larsen 2005	52/102	67/107		19.7 %	0.81 [0.64, 1.04]
Marsch 2011	109/201	102/200		24.8 %	1.06 [0.88, 1.28]
Mazurek 1998	7/13	10/13		5.6 %	0.70 [0.39, 1.26]
McCourt 1998	85/130	101/127		28.3 %	0.82 [0.71, 0.96]
Sluga 2005	50/90	69/90		21.7 %	0.72 [0.58, 0.90]
Total (95% CI)	**536**	**537**		**100.0 %**	**0.84 [0.73, 0.98]**

Total events: 303 (Rocuronium), 349 (Succinylcholine)

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 8.52$, df = 4 (P = 0.07); $I^2 = 53\%$

Test for overall effect: Z = 2.25 (P = 0.025)

Test for subgroup differences: Not applicable



Analysis 7.2. Comparison 7 Rocuronium versus succinylcholine in emergency intubation, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 7 Rocuronium versus succinylcholine in emergency intubation

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Larsen 2005	98/102	100/107		19.0 %	1.03 [0.96, 1.10]
Marsch 2011	187/201	194/200		37.0 %	0.96 [0.92, 1.00]
Mazurek 1998	12/13	12/13		1.6 %	1.00 [0.80, 1.25]
McCourt 1998	125/130	123/127		34.7 %	0.99 [0.95, 1.04]
Sluga 2005	78/90	83/90		7.7 %	0.94 [0.85, 1.04]
Total (95% CI)	**536**	**537**		**100.0 %**	**0.98 [0.96, 1.01]**

Total events: 500 (Rocuronium), 512 (Succinylcholine)

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 4.11$, df = 4 (P = 0.39); $I^2 = 3\%$

Test for overall effect: Z = 1.22 (P = 0.22)

Test for subgroup differences: Not applicable

Analysis 8.1. Comparison 8 Rocuronium versus succinylcholine by blinding of outcome assessment, Outcome 1 Excellent versus other intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 8 Rocuronium versus succinylcholine by blinding of outcome assessment

Outcome: 1 Excellent versus other intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Low Risk					
Abu-Halaweh 2007	20/60	32/60		1.3 %	0.63 [0.41, 0.96]
Ali 2008	32/50	44/50		2.4 %	0.73 [0.58, 0.92]
Andrews 1999	88/133	103/139		2.9 %	0.89 [0.76, 1.04]
Belyamani 2008	2/20	5/20		0.2 %	0.40 [0.09, 1.83]
Cheng 2002	67/80	37/40		3.0 %	0.91 [0.79, 1.03]
Chiu 1999	13/15	14/15		2.3 %	0.93 [0.73, 1.18]
Dubois 1995	9/12	9/12		1.2 %	1.00 [0.63, 1.59]
Iqbal 2013	25/30	29/30		2.7 %	0.86 [0.72, 1.03]
Larsen 2005	52/102	67/107		2.3 %	0.81 [0.64, 1.04]
Le Corre 1999	28/30	26/30		2.8 %	1.08 [0.91, 1.28]
Mazurek 1998	7/13	10/13		0.9 %	0.70 [0.39, 1.26]
McCourt 1998	85/130	101/127		2.9 %	0.82 [0.71, 0.96]
Mencke 2006	16/76	42/74		1.2 %	0.37 [0.23, 0.60]
Mitra 2001	18/20	20/20		2.8 %	0.90 [0.76, 1.07]
Nelson 1997	18/20	22/22		2.8 %	0.90 [0.76, 1.07]
Pühringer 1992	17/20	8/10		1.6 %	1.06 [0.74, 1.52]
Sorensen 2012	27/29	20/26		2.4 %	1.21 [0.96, 1.53]
Sparr 1996b	10/25	45/50		1.1 %	0.44 [0.27, 0.72]
Tang 1996	24/27	42/48		2.8 %	1.02 [0.86, 1.21]
Weiss 1997	15/31	13/14		1.5 %	0.52 [0.35, 0.77]
Yorukoglu 2003	12/25	23/25		1.4 %	0.52 [0.34, 0.80]
Subtotal (95% CI)	**948**	**932**		**42.3 %**	**0.83 [0.75, 0.92]**
Total events: 585 (Rocuronium), 712 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 72.82$, df = 20 ($P<0.00001$); $I^2 = 73\%$					
Test for overall effect: Z = 3.61 (P = 0.00030)					

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
2 Unclear Risk					
Alanoglu 2006	57/60	54/59		3.2 %	1.04 [0.94, 1.14]
Kwon 2013	5/20	11/20		0.5 %	0.45 [0.19, 1.07]
Naguib 1994	13/20	8/10		1.3 %	0.81 [0.52, 1.27]
Turan 1999	17/20	17/20		2.2 %	1.00 [0.77, 1.30]
Subtotal (95% CI)	**120**	**109**		**7.1 %**	**0.93 [0.72, 1.18]**
Total events: 92 (Rocuronium), 90 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.03; Chi^2 = 7.71, df = 3 (P = 0.05); I^2 =61%					
Test for overall effect: Z = 0.61 (P = 0.54)					
3 High Risk					
Abdulatif 1996	6/24	15/24		0.6 %	0.40 [0.19, 0.85]
Alvarez Rios1997	18/20	19/20		2.7 %	0.95 [0.79, 1.13]
Chung 2001	20/29	19/27		1.7 %	0.98 [0.69, 1.38]
Cooper 1992	30/40	39/40		2.7 %	0.77 [0.64, 0.93]
De Almeida 2009	19/20	15/20		2.1 %	1.27 [0.96, 1.66]
Giudice 1998	13/20	6/10		0.8 %	1.08 [0.59, 1.97]
Koroglu 2002	22/30	28/35		2.1 %	0.92 [0.70, 1.20]
Kulkarni 2010	122/200	90/100		3.0 %	0.68 [0.60, 0.77]
Lam 2000	7/15	11/15		0.8 %	0.64 [0.34, 1.18]
Latorre 1996	9/20	12/20		0.8 %	0.75 [0.41, 1.37]
Magorian 1993	25/30	8/10		1.7 %	1.04 [0.73, 1.48]
Malik 2004	28/30	30/30		3.1 %	0.93 [0.83, 1.05]
Marsch 2011	109/201	102/200		2.7 %	1.06 [0.88, 1.28]
Mencke 2005	13/60	34/60		1.0 %	0.38 [0.23, 0.65]
Naguib 1997	17/20	9/10		2.1 %	0.94 [0.72, 1.25]
Patel 1995	11/15	7/7		1.7 %	0.77 [0.54, 1.09]
Singh 2011	23/30	25/30		2.2 %	0.92 [0.71, 1.19]
Sluga 2005	50/90	69/90		2.5 %	0.72 [0.58, 0.90]
Sparr 1996a	15/25	23/25		1.7 %	0.65 [0.46, 0.92]
Stevens 1996	11/30	8/10		0.9 %	0.46 [0.26, 0.80]
Stoddart 1998	27/30	25/30		2.6 %	1.08 [0.88, 1.32]
Tripathi 2010	47/50	49/50		3.3 %	0.96 [0.89, 1.04]
Tryba 1994	48/60	16/20		2.2 %	1.00 [0.78, 1.29]

(*Continued* . . .)

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Türkmen 2004	19/20	19/20		2.9 %	1.00 [0.87, 1.15]
Vinik 1999	14/15	14/15		2.6 %	1.00 [0.83, 1.21]
Subtotal (95% CI)	**1124**	**918**		**50.6 %**	**0.88 [0.80, 0.96]**
Total events: 723 (Rocuronium), 692 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 83.89$, df = 24 ($P<0.00001$); $I^2 = 71\%$					
Test for overall effect: Z = 2.96 (P = 0.0031)					
Total (95% CI)	**2192**	**1959**		**100.0 %**	**0.86 [0.81, 0.92]**
Total events: 1400 (Rocuronium), 1494 (Succinylcholine)					
Heterogeneity: $Tau^2 = 0.03$; $Chi^2 = 178.44$, df = 49 ($P<0.00001$); $I^2 = 73\%$					
Test for overall effect: Z = 4.65 (P < 0.00001)					
Test for subgroup differences: $Chi^2 = 1.08$, df = 2 (P = 0.58), $I^2 = 0.0\%$					

Analysis 8.2. Comparison 8 Rocuronium versus succinylcholine by blinding of outcome assessment, Outcome 2 Acceptable versus suboptimal intubation conditions.

Review: Rocuronium versus succinylcholine for rapid sequence induction intubation

Comparison: 8 Rocuronium versus succinylcholine by blinding of outcome assessment

Outcome: 2 Acceptable versus suboptimal intubation conditions

Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
1 Low Risk					
Abu-Halaweh 2007	57/60	58/60		3.1 %	0.98 [0.91, 1.06]
Ali 2008	44/50	50/50		2.2 %	0.88 [0.79, 0.98]
Andrews 1999	124/133	135/139		3.9 %	0.96 [0.91, 1.01]
Belyamani 2008	8/20	13/20		0.1 %	0.62 [0.33, 1.15]
Cheng 2002	75/80	40/40		3.4 %	0.94 [0.88, 1.01]
Chiu 1999	15/15	15/15		1.8 %	1.00 [0.88, 1.13]
Dubois 1995	12/12	11/12		0.7 %	1.09 [0.87, 1.36]
Iqbal 2013	20/30	3/30		0.0 %	6.67 [2.21, 20.09]
Larsen 2005	98/102	100/107		3.5 %	1.03 [0.96, 1.10]
Le Corre 1999	30/30	30/30		3.5 %	1.00 [0.94, 1.07]
Mazurek 1998	12/13	12/13		0.7 %	1.00 [0.80, 1.25]
McCourt 1998	125/130	123/127		4.2 %	0.99 [0.95, 1.04]
Mencke 2006	45/76	66/74		0.9 %	0.66 [0.54, 0.81]
Mitra 2001	20/20	20/20		2.5 %	1.00 [0.91, 1.10]
Nelson 1997	20/20	22/22		2.6 %	1.00 [0.91, 1.09]
Pühringer 1992	20/20	9/10		0.6 %	1.13 [0.89, 1.44]
Sorensen 2012	29/29	26/26		3.3 %	1.00 [0.93, 1.07]
Sparr 1996a	24/25	25/25		2.1 %	0.96 [0.86, 1.07]
Sparr 1996b	20/25	50/50		0.9 %	0.80 [0.65, 0.97]
Stevens 1996	29/30	10/10		1.4 %	1.00 [0.86, 1.16]
Tang 1996	27/27	47/48		3.3 %	1.01 [0.94, 1.09]
Weiss 1997	21/31	13/14		0.5 %	0.73 [0.55, 0.97]
Yorukoglu 2003	24/25	25/25		2.1 %	0.96 [0.86, 1.07]

(*Continued* . . .)

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Subtotal (95% CI)	**1003**	**967**		**47.7 %**	**0.97 [0.94, 1.00]**
Total events: 899 (Rocuronium), 903 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 52.53, df = 22 (P = 0.00026); I^2 =58%					
Test for overall effect: Z = 1.72 (P = 0.085)					
2 Unclear Risk					
Kwon 2013	17/20	18/20		0.7 %	0.94 [0.75, 1.19]
Naguib 1994	20/20	10/10		1.5 %	1.00 [0.86, 1.16]
Turan 1999	20/20	20/20		2.5 %	1.00 [0.91, 1.10]
Subtotal (95% CI)	**60**	**50**		**4.7 %**	**0.99 [0.92, 1.07]**
Total events: 57 (Rocuronium), 48 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.33, df = 2 (P = 0.85); I^2 =0.0%					
Test for overall effect: Z = 0.15 (P = 0.88)					
3 High Risk					
Abdulatif 1996	17/24	24/24		0.6 %	0.71 [0.55, 0.93]
Alvarez Rios1997	20/20	20/20		2.5 %	1.00 [0.91, 1.10]
Chung 2001	26/29	27/27		1.6 %	0.90 [0.78, 1.03]
Cooper 1992	39/40	40/40		3.4 %	0.98 [0.91, 1.04]
De Almeida 2009	20/20	19/20		1.6 %	1.05 [0.92, 1.20]
Giudice 1998	20/20	10/10		1.5 %	1.00 [0.86, 1.16]
Koroglu 2002	28/30	32/35		1.6 %	1.02 [0.89, 1.17]
Kulkarni 2010	200/200	100/100		5.2 %	1.00 [0.98, 1.02]
Lam 2000	13/15	15/15		0.7 %	0.87 [0.69, 1.09]
Latorre 1996	18/20	18/20		0.8 %	1.00 [0.81, 1.23]
Magorian 1993	30/30	10/10		1.6 %	1.00 [0.87, 1.15]
Malik 2004	30/30	30/30		3.5 %	1.00 [0.94, 1.07]
Marsch 2011	187/201	194/200		4.3 %	0.96 [0.92, 1.00]
Mencke 2005	38/60	51/60		0.8 %	0.75 [0.60, 0.93]
Naguib 1997	20/20	10/10		1.5 %	1.00 [0.86, 1.16]
Patel 1995	14/15	7/7		0.7 %	0.97 [0.76, 1.23]
Singh 2011	29/30	30/30		2.6 %	0.97 [0.88, 1.06]
Sluga 2005	78/90	83/90		2.4 %	0.94 [0.85, 1.04]
Stoddart 1998	30/30	30/30		3.5 %	1.00 [0.94, 1.07]
Tripathi 2010	50/50	50/50		4.5 %	1.00 [0.96, 1.04]
Tryba 1994	53/60	20/20		2.0 %	0.90 [0.80, 1.01]

(*Continued* . . .)

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Study or subgroup	Rocuronium n/N	Succinylcholine n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Vinik 1999	14/15	14/15		1.0 %	1.00 [0.83, 1.21]
Subtotal (95% CI)	**1049**	**863**		**47.7 %**	**0.97 [0.94, 1.00]**
Total events: 974 (Rocuronium), 834 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 64.60, df = 21 (P<0.00001); I^2 =67%					
Test for overall effect: Z = 1.74 (P = 0.082)					
Total (95% CI)	**2112**	**1880**		**100.0 %**	**0.97 [0.95, 0.99]**
Total events: 1930 (Rocuronium), 1785 (Succinylcholine)					
Heterogeneity: Tau^2 = 0.00; Chi^2 = 110.42, df = 47 (P<0.00001); I^2 =57%					
Test for overall effect: Z = 2.50 (P = 0.012)					
Test for subgroup differences: Chi^2 = 0.34, df = 2 (P = 0.85), I^2 =0.0%					

ADDITIONAL TABLES

Table 1. Intubating conditions

Score	Ease of laryngoscopy	Vocal cords	Intubation response
1. Excellent	Good	Open	None
2. Good	Fair	Open	Diaphragmatic movement
3. Poor	Difficult	Movement	Moderate coughing
4. Impossible	Poor	Closed	Severe coughing or bucking

APPENDICES

Appendix 1. MEDLINE (via OVID) (1966 to February 14 2015)

1. succinylcholine/ or succinylcholine.mp. or suxamethonium.mp. or succinyldicholine.mp. or anectine.mp. or quelicin.mp. or sucostrin.mp. or celocurine.mp. or deliclin.mp. or listenon.mp. or lysthenon.mp. or myorelaxin.mp. or succicuran.mp.
2. rocuronium.af. or zemuron.mp. or org 9426.mp.
3. neuromuscular blocker/ or neuromuscular block$.mp. or rapid sequence induction.mp. or rsi.mp. or intubat$.mp. or anesthesia/ or anesthesia.mp.
4. 1 and 2 and 3

Appendix 2. EMBASE (via OVID) (1988 to February 14 2015)

1. succinylcholine/ or suxamethonium iodide/ or succinylcholine.mp. or suxamethonium.mp. or succinyldicholine.mp. or anectine.mp. or quelicin.mp. or sucostrin.mp. or celocurine.mp. or deliclin.mp. or listenon.mp. or lysthenon.mp. or myorelaxin.mp. or succicuran.mp.
2. rocuronium/ or rocuronium.af. or zemuron.mp. or org 9426.mp.
3 neuromuscular blocking agent/ or neuromuscular block$.mp. or rapid sequence induction.mp. or rsi.mp. or intubat$.mp. or general anesthesia/ or intubation/ or endotracheal intubation/ or rapid sequence induction.mp. or rsi.mp.
4. 1 and 2 and 3
5. (randomized-controlled-trial/ or randomization/ or controlled-study/ or multicenter-study/ or phase-3-clinical-trial/ or phase-4-clinical-trial/ or double-blind-procedure/ or single-blind-procedure/ or (random* or cross?over* or factorial* or placebo* or volunteer*).mp. or ((singl* or doubl* or trebl* or tripl*) adj3 (blind* or mask*)).ti,ab.) not (animals not (humans and animals)).sh.
6. 4 and 5

Appendix 3. CENTRAL, the Cochrane Library (February 2015 Issue 2)

#1 MeSH descriptor Succinylcholine explode all trees
#2 succinylcholin* or suxamethonium or succinyldicholin* or anectine or quelicin or sucostrin or celocurine or deliclin or listenon or lysthenon or myorelaxin or succicuran
#3 (#1 OR #2)
#4 rocuronium or zemuron
#5 org 9426
#6 (ROCURONIUM) or (ROCURONIUM-INDUCED)
#7 (#4 OR #5 OR #6)
#8 MeSH descriptor Neuromuscular Blocking Agents explode all trees
#9 MeSH descriptor Neuromuscular Blockade explode all trees
#10 neuromuscular near block
#11 (#8 OR #9 OR #10)
#12 (#3 AND #7 AND #11)

WHAT'S NEW

Last assessed as up-to-date: 14 February 2015.

Date	Event	Description
15 October 2015	New citation required but conclusions have not changed	New authors (DT, EN) joined the team. Conclusions for the study were not changed with inclusion of new citations. Methods now include a 'Risk of bias' table, 'Summary of findings' table and GRADE assessment
15 October 2015	New search has been performed	We ran the search to Week 2 of February 2015. We identified 13 new trials , of which 11 were incorporated into the meta-analysis. Two trials awaiting translation from the previous update were translated and included in this review

HISTORY

Protocol first published: Issue 4, 2000

Review first published: Issue 1, 2003

Date	Event	Description
20 August 2007	New citation required and conclusions have changed	Substantive amendment. We reran our searches until June 2007. We found 18 new studies and included 11. The conclusions changed
19 August 2007	New search has been performed	The review is substantially updated

CONTRIBUTIONS OF AUTHORS

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Conceiving the review: JJP

Co-ordinating the review: JJP

Undertaking manual searches: JJP, VM EN

Screening search results: JJP, JL, VM, EN, DT

Organizing retrieval of papers: JJP, VM, EN, DT

Screening retrieved papers against inclusion criteria: JJP, JL, VM, EN, DT

Appraising quality of papers: JJP, JL, VM, EN, DT

Abstracting data from papers: JJP, JL, VM, EN, DT

Data management for the review: JJP, DT

Entering data into Review Manager: JJP, VM, EN, DT

Analysis of Data: JJP, JL, VS, GW, DT

Interpretation of data: JJP, VS, GW, DT

Statistical analysis: JJP, GW, DT

Writing the review: JJP, JL, VM, GW, DT

Securing funding for the review: JJP

Guarantor for the review (one author): JJP

Responsible for reading and checking review before submission: JJP, DT

DECLARATIONS OF INTEREST

Diem TT Tran: none known

Ethan K Newton: none known

Victoria AH Mount: none known

Jacques S Lee: none known

George A Wells: none known

Jeffrey J Perry: none known

SOURCES OF SUPPORT

Internal sources

- No sources of support supplied

External sources

- Canadian Association of Emergency Physicians, Canada.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We added a subgroup analysis based on detection bias after the meta-analysis was performed, to try to identify a source for the high statistical heterogeneity.

NOTES

August 2015: Methods now include a 'Risk of bias' table, a 'Summary of findings' table and GRADE assessment.

INDEX TERMS

Medical Subject Headings (MeSH)

Androstanols [*administration & dosage]; Intubation, Intratracheal [*methods]; Neuromuscular Depolarizing Agents [*administration & dosage; adverse effects]; Neuromuscular Nondepolarizing Agents [*administration & dosage; adverse effects]; Propofol [administration & dosage]; Randomized Controlled Trials as Topic; Succinylcholine [*administration & dosage; adverse effects]

MeSH check words

Humans