

# Use of cricoid pressure in rapid sequence induction: time for a rethink?

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Rapid sequence induction is a form of induction of anaesthesia, using an intravenous induction agent and muscle relaxant, application of cricoid pressure and placement of an endotracheal tube to maintain the airway. It is used when patients are at potential risk of aspiration, such as for emergency surgery.

The technique was initially described by Stept and Safar in 1970 as a means of reducing the risk of aspiration during induction.<sup>1</sup> The relationship between aspiration of gastric contents and respiratory distress was first described by Mendelson in 1946, who observed asthma-like symptoms in obstetric patients who had aspirated during an anaesthetic.<sup>1,2</sup> His subsequent experiments in rabbits showed that acidic liquid caused damage to lung tissue and that this damage was related to the volume and pH of the liquid aspirated.<sup>2</sup> Sellick went on to suggest that cricoid pressure could control passive regurgitation of gastric contents, preventing aspiration.<sup>2</sup>

## CURRENT GUIDELINES

The current Difficult Airway Society guidelines recommend cricoid pressure in rapid sequence induction.<sup>3</sup> The recommended technique includes preoxygenation followed by cricoid pressure applied with a force of 10N while the patient is conscious. The force of the cricoid pressure is to be increased to 30N after administration of an induction agent and muscle relaxant, most commonly thiopental and suxamethonium, when the patient becomes unconscious.<sup>3</sup> This is followed by direct laryngoscopy and the insertion of an endotracheal tube, after which cricoid pressure is released.<sup>3</sup>

The use of cricoid pressure in rapid sequence induction is also recommended by the Royal College of Anaesthetists. Their 2011 National Audit Project 4 on airway management showed that aspiration remained the single most common cause of anaesthesia related death, although it acknowledged that there needed to be further research to understand the efficacy of cricoid pressure in preventing this.<sup>4</sup> However, over half of all cases of aspiration reported to the audit occurred during maintenance or emergence from anaesthesia, as opposed to intubation, suggesting other factors may contribute more significantly to aspiration than lack of cricoid pressure.<sup>5</sup> Similarly, the Difficult Airway Society note the lack of high grade evidence for their recommendation and recommend that cricoid pressure should be removed if intubation becomes difficult; acknowledging that the application of cricoid pressure may make laryngoscopy more challenging.<sup>3</sup>

## VARIATIONS IN PRACTICE

Although the use of cricoid pressure in rapid sequence induction is in national guidelines and commonly practiced in the United Kingdom (UK), its use is not as prevalent internationally. A survey comparing practice in the UK with that in Austria and Switzerland suggested that 96%

of anaesthetists in the UK use cricoid pressure during rapid sequence induction, compared to 52% in Austria and 30% in Switzerland.<sup>6</sup> However, despite comparatively lower use of cricoid pressure in Europe, rates of aspiration are not significantly higher in these countries than in the UK; practitioners in France rarely use cricoid pressure but France has a significantly below average rate of aspiration.<sup>7</sup>

## EVIDENCE FOR EFFECTIVENESS AT PREVENTING REGURGITATION

Early studies on cricoid pressure provided only low grade evidence. The experiments by Mendelson were conducted on rabbits using acidic liquid to show that the presence of acid in the lungs was damaging and that this damage increased with a greater volume and more acidic liquid.<sup>2</sup> The original studies by Sellick were neither standardised nor randomised and were observational studies using only 26 patients.<sup>8,9</sup> Moreover, in Sellick's study three patients aspirated; over 10% of the number of participants, which is the highest incidence of aspiration in any study regardless of use of cricoid pressure.<sup>8</sup>

Although aspiration remains the greatest cause of anaesthesia related death, the absolute risk of aspiration is very small, at 1 in every 2000-3000 procedures, although this rises to 1 in 800 in emergency surgery.<sup>1,10</sup> Therefore, studies would need to have a very large sample size in order to ascertain any attributable risk reduction.<sup>5,10</sup> It is also difficult to conduct standardised and randomised studies in patients in emergency situations, which is when rapid sequence induction is commonly used.

A Cochrane review examined the evidence for cricoid pressure using randomised controlled trials, but only one single trial fit their inclusion criteria and even this did not have any clinically relevant results.<sup>9</sup>

A more recent randomised controlled trial looked at the effect of cricoid pressure compared to a sham procedure, with anaesthetists blinded to which was being applied. The sham procedure was shown to be not inferior to cricoid pressure in preventing aspiration; and secondary outcomes such as rate of pneumonia, length of stay and mortality were not significantly different in the two study groups.<sup>11</sup> It further identified potential difficulties associated with cricoid pressure and found there was a significantly longer intubation time and poorer laryngoscopy view in the group who had cricoid pressure.<sup>11</sup> This is the only randomised controlled trial to date to report clinically relevant results about cricoid pressure in rapid sequence induction and would suggest that cricoid pressure is not effective in preventing aspiration and has the potential to make intubation more difficult. Whilst this study was done on patients in theatre, it acknowledges that rapid sequence induction in a non-theatre setting may carry different risks and that further work is needed in alternative settings as well as in high risk groups such as pregnant women.<sup>11</sup>

## POTENTIAL PROBLEMS WITH USE OF CRICOID PRESSURE

While the use of cricoid pressure became prevalent as it seemed a logical and simple manoeuvre to prevent aspiration which could cause little harm, there is now debate about its safety. The risks of failed intubation, hypoxia and cardiovascular compromise as well as awareness during anaesthesia are known to be higher in rapid sequence induction and some of this may be related to the use of cricoid pressure.<sup>1</sup> There is also a small risk of oesophageal trauma; and repeated intubation attempts have the potential to cause trauma to the airway.<sup>1</sup>

There is some evidence that application of cricoid pressure lowers the power of the lower oesophageal sphincter, which impairs its function in preventing regurgitation.<sup>3, 9</sup> A further study showed that in 62.5% of cases there is incomplete occlusion of the oesophageal lumen and lateral deviation of the oesophagus, meaning application of cricoid pressure does not necessarily form a complete barrier in the oesophagus to prevent regurgitation.<sup>12</sup> CT and MRI scans also suggest the oesophagus lies lateral to the vertebral body in approximately 50% of patients and so in these patients cricoid pressure is unlikely to have any benefit as the oesophageal lumen would not be occluded.<sup>13</sup> However an alternative study showed that 30N of cricoid pressure generated enough pressure on the upper oesophageal sphincter to prevent regurgitation; although this study measured pressure on the upper oesophageal sphincter as opposed to patient outcomes and so the benefit remains theoretical.<sup>14</sup> Other studies have observed aspiration regardless of application of cricoid pressure, suggesting that its use may not confer any additional benefit.<sup>9, 13</sup>

If done correctly, cricoid pressure should not make intubation more difficult and could even improve the view on direct laryngoscopy.<sup>15, 16</sup> In part, more difficult intubation with use of cricoid pressure may be a result of the fact that cricoid pressure is frequently applied incorrectly and requires regular training to enable correct use of pressure.<sup>7, 13, 17</sup> It is thought that up to 47% of practitioners apply too little pressure, 28% apply too much pressure and 85% never objectively measure the force they are applying.<sup>13, 18</sup> Moreover, it has been shown that the skill is only retained for four weeks after simulated training.<sup>17</sup>

## CONCLUSION

The use of cricoid pressure became prevalent after low grade observational studies and there is little evidence of the benefit of its use in rapid sequence induction. The original studies are not necessarily applicable to modern day anaesthetics. There is limited high grade evidence, and most recent literature suggests there is potential harm by prolonging the time to intubation. However, aspiration remains the single most common cause of anaesthesia related death and reducing this risk is paramount. The only clinically relevant randomised controlled trial suggests there is no benefit in using cricoid pressure and further similar studies may be required to corroborate these results.

In practice, most clinicians will await the publication of further research and national guidelines. However, there should be a low threshold for removing cricoid pressure in difficult or prolonged intubation attempts.

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