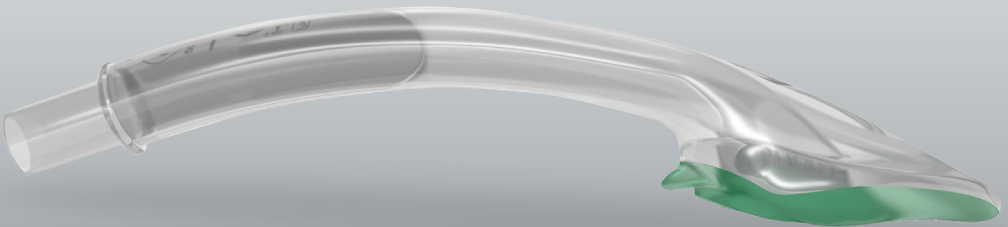




Resuscitation and Emergency Medicine

BIBLIOGRAPHY

Published studies, case reports and correspondence



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Introduction

The i-gel[®] is a second generation supraglottic airway, made of a medical grade thermoplastic elastomer, designed to create a non-inflatable anatomical seal of the pharyngeal, laryngeal and perilaryngeal structures. An integrated gastric channel provides an early warning of regurgitation, facilitates venting of gas from the stomach and allows for the passing of a gastric tube to empty the stomach contents. The device also includes a buccal cavity stabiliser to provide vertical strength during insertion and eliminate the potential for rotation.

The first study on i-gel[®] was conducted by Richard Levitan and his team at the University of Maryland Medical Center in Baltimore, USA. This landmark study on the positioning and mechanics of i-gel[®] in 65 non-embalmed cadavers, was initially presented as a free paper at the UK Difficult Airway Society meeting in Leicester in November 2004 and accepted for publication in *Anaesthesia* in April 2005. i-gel[®] was subsequently launched in January 2007 at the Association of Anaesthetists of Great Britain and Ireland Winter Meeting in London, UK.

The first independent clinical data on patients was a letter to the editor of *Resuscitation* from David Gabbott and Richard Beringer at Gloucester Royal Hospital in the UK. This correspondence, entitled, 'The i-gel[®] supraglottic airway: A potential role for resuscitation' reported initial findings on the use of i-gel[®] in 100 patients presenting for elective surgery under general anaesthesia.

Since the publication of this letter, i-gel[®] has been the subject of over 300 peer reviewed clinical studies, case reports and correspondence.

A bibliography including all known data on the device was first issued in 2011. Since then numerous additional studies have been published and this led to a new editions of the bibliography, updated to include all new data, being issued in 2014 and 2018.

As we often receive enquiries about clinical data specifically related to the use of the device in the emergency medicine setting and during resuscitation of patients in cardiac arrest, we felt there would be value in producing a more streamlined bibliography, focusing on this particular area of potential use.

The second edition of this Resuscitation and Emergency Medicine bibliography (after it was first published in 2014) includes general reviews regarding airway management for resuscitation, particularly those related to use of airway devices for out-of-hospital cardiac arrest (OHCA), as well as those studies specifically evaluating use of i-gel[®] in an emergency medicine or resuscitation setting.

There is also a section relating to use of cardiocerebral resuscitation (CCR) incorporating passive oxygenation (PO). Although these studies do not include i-gel[®], as the i-gel[®] O₂ incorporates a supplementary oxygen port which

can be used for the delivery of passive oxygenation, we thought they might be of interest. It should be noted that the 2015 European Resuscitation Council Guidelines for Resuscitation do not recommend passive oxygen delivery without ventilation for routine use during CPR¹.

Each study listed includes a brief summary description. These summaries are not intended to provide a comprehensive overview of the study concerned, only to assist the reader in deciding whether a particular paper is relevant to their area of interest, prior to obtaining a copy of the full document for review. The bibliography also provides an index by first author and journal title.

Titles are taken from the articles as they appear in their original form, spelling variations included, allowing you to make a perfectly accurate internet search should you wish to find out more.

Every attempt has been made to include all known data relevant to use of i-gel® in the emergency medicine and resuscitation setting, irrespective of outcome, so as to allow the reader every opportunity to obtain a balanced overview of the clinical data that exists for i-gel®. However, the nature of such a document is that it inevitably becomes out of date as soon as it is published, so we intend to issue updated versions at regular intervals.

In the meantime, you can keep up to date with all the latest clinical evidence through our online study database, which can be found at: <https://igevidence.intersurgical.com>. We will continue to publish new evidence as and when it becomes available.

Whilst every attempt has been made to provide accurate information, we apologise in advance for any errors or omissions and will be pleased to make any corrections brought to our notice in any following edition. We hope you find this bibliography interesting and useful.

Soar J, Nolan JP, Böttiger BW, Perkins GD, Lott C, Carli P, Pellis T, Sandroni C, Skrifvars MB, Smith GB, Sunde K, Deakin CD. European Resuscitation Council Guidelines for Resuscitation 2015: Section 3. Adult advanced life support. *Resuscitation*. 2015 Oct;95:100-47

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Clinical Adult

Effect of a Strategy of a Supraglottic Airway Device vs Tracheal Intubation During Out-of-Hospital Cardiac Arrest on Functional Outcome: The AIRWAYS-2 Randomised Clinical Trial

Benger JR, Kirby K, Black S, Brett SJ, Clout M, Lazaroo MJ, Nolan JP, Reeves BC, Robinson M, Scott LJ, Smartt H, South A, Stokes EA, Taylor J, Thomas M, Voss S, Wordsworth S, Rogers CA. JAMA. 2018 Aug 28; 320(8): 779-791

This cluster randomised clinical trial aimed to determine whether the i-gel® used for advanced airway management during non-traumatic out-of-hospital cardiac arrest could lead to a better outcome as compared to standard endotracheal intubation.

Results from 9,296 patients showed that no significant difference in functional outcome after an out of hospital cardiac arrest in adults between an i-gel® strategy and a tracheal intubation strategy. The secondary outcomes showed the i-gel treatment strategy was significantly more successful in achieving ventilation after two attempts.

Randomised comparison of the effectiveness of the laryngeal mask airway supreme, i-gel® and current practice in the initial airway management of out of hospital cardiac arrest: a feasibility study

Benger J, Coates D, Davies S, Greenwood R, Nolan J, Rhys M, Thomas M, Voss S. Br J Anaesth. 2016 Feb; 116(2): 262-8

Documentation of intended protocol for

future study into the effectiveness of i-gel® and LMA Supreme® for out-of-hospital cardiac arrest.

Higher insertion success with the i-gel® supraglottic airway in out-of-hospital cardiac arrest: A randomised controlled trial

Middleton PM, Simpson PM, Thomas RE, Bendall JC. Resuscitation 2014; 85(7): 893-7

Single-centre, prospective parallel-group randomised controlled trial (RCT) in subjects with an out-of-hospital cardiac arrest, with patients allocated to two groups: i-gel® and Portex® Soft Seal® Laryngeal Mask. Total of 51 patients were randomised with an average age of 65. i-gel® had a significantly higher success rate, resulting in a 58% greater likelihood of insertion.

Introduction of the i-gel® supraglottic airway device for prehospital airway management in a UK ambulance service

Duckett J, Fell P, Han K, Kimber C, Taylor C. Emerg Med J. 2014; 31(6): 505-7

Clinical review by North East Ambulance Service National Health Service Foundation Trust (NEAS) into the use of i-gel® as part of their advanced airway management techniques for cardiac arrests. Compared against endotracheal tube intubation, the two audits confirmed successful insertion of i-gel® at 94% and 92% respectively, against 90% and 86% for ET tube. Authors found i-gel® was also inserted more quickly and concluded that the device will 'emerge as the first choice of airway management device in prehospital cardiac arrests'.

Randomised comparison of the effectiveness of the laryngeal mask airway supreme, i-gel® and current practice in the initial airway management of prehospital cardiac arrest (REVIVE-Airways): a feasibility study research protocol

Benger J R, Voss S, Coates D, Greenwood R, Nolan J, Rawstorne S, Rhys M, Thomas M. BMJ Open 2013; 3: e002467

An investigative study into the proposal by JRCALC that supraglottic airway devices are safe and effective devices for use in OHCA. In the form of a cluster, randomised trial design, comparisons of LMA Supreme® and the i-gel® will be carried out against each other and current practices. Objectives will be success during initial airway management, ventilation success, whether other interventions are required, airway integrity on arrival at hospital, and numerous stages of patient survival.

Performance of the i-gel® during pre-hospital cardiopulmonary resuscitation

Häske D, Schempf B, Gaier G, Niederberger C. Resuscitation 2013; 84(9): 1229-32

This observational study of i-gel® use during CPR assessed ease of insertion, ventilation quality, leak and whether ventilation was possible without chest compression interruption. Insertions were attempted by 63 paramedics and seven emergency physicians in pre-hospital CPR, with an overall 90% first-attempt insertion success rate. Insertion was reported as easy in 80% of cases, with the same figure representing cases with no leak recorded. In 74% of cases, continuous chest compression was still possible. The authors say that, 'the i-gel® is an easy supraglottic device to insert and enables adequate ventilation during CPR'.

The effects of prewarming the i-gel® on fitting to laryngeal structure

Nishiyama T, Kohno Y, Kim HJ, Shin WJ, Yang HS. The American Journal Of Emergency Medicine 2012; 30(9): 1756-9

180 patients were randomised into two equal groups, one for insertion of i-gel® at room temperature, the other at 37 °C. Insertion time, number of insertion attempts, inspiratory and leak pressures, and leak fraction were compared. Report found no significant difference between the two groups.

Extraglottic airway devices for use in diving medicine - part 3: the i-gel®

Acott CJ. Diving and Hyperbaric Medicine 2008; 38(3): 124-7

This study looked at the use of i-gel® in airway management of a patient in a diving bell, or deck decompression chamber. The study highlighted the potential limitations of some supraglottic airways used in Hyperbaric Medicine, such as possible cuff expansion with a decrease in pressure on decompression and change in cuff volume due to gas diffusion as the gas mixtures change - problems not associated with i-gel®. It showed that, subjectively, there was no change in the consistency of the i-gel® at 203 and 283kPa pressure and that no bubbles were detected following decompression from 203, 283 or 608kPa. The i-gel® was also preferred by the Diver Medical Technicians (DMTs) to the alternative device included in the manikin section of the study because it 'lacked a cuff and was easier to insert from any position'.

Clinical Paediatric

Neonatal resuscitation using a laryngeal mask airway: a randomised trial in Uganda

Pejovic NJ, Trevisanuto D, Lubulwa C, Myrnerets Höök S, Cavallin F, Byamugisha J, Nankunda J, Tylleskär T. Arch Dis Child. 2018 Mar; 103(3): 255-260

This prospective RCT was carried out to compare the i-gel® and facemask (FM) during neonatal resuscitation in a low-resource setting. Time to spontaneous breathing (primary outcome), admission to the neonatal unit in the first 48 hours of life, hypoxic ischaemic encephalopathy, death and adverse effects (secondary outcomes) were evaluated in this study. Time to spontaneous breathing was shorter in the i-gel® group compared to the FM one. In addition, all resuscitations were successful in the i-gel® arm, whereas 11 patients treated with FM were passed onto the i-gel® due to unsatisfactory response. Therefore, the i-gel® was shown to be more effective than the FM in reducing the time to spontaneous breathing, but further larger studies are needed to validate these results.

Supraglottic airway devices during neonatal resuscitation: An historical perspective, systematic review and meta-analysis of available clinical trials

Schmolzer GM, Agarwal M, Kamlin CO, Davis PG. Resuscitation 2013; 84(6): 722-30

Review of available literature on the use of supraglottic airway devices during neonatal resuscitation. Current evidence suggests that resuscitation with a laryngeal mask is a 'feasible and safe alternative to mask ventilation in infants', however further randomised controlled trials are needed.

Anatomical and Cadaver

Evaluation of six different airway devices regarding regurgitation and pulmonary aspiration during cardio-pulmonary resuscitation (CPR) - A human cadaver pilot study

Piegeler T, Roessler B, Goliash G, Fischer H, Schlaepfer M, Lang S, Ruetzler K. Resuscitation. 2016 May; 102: 70-4

30 fresh human cadavers were randomly assigned to ventilation via one of six airway devices. Any pre-existing gastric contents were removed and 500ml methylene blue dye was instilled. The relevant airway device was then inserted and CPR was carried out for five minutes. Migration of the dye was then assessed by fiberoptic bronchoscopy: regurgitation was defined as dye in the oesophagus or pharynx and aspiration as dye below the vocal cords or ETT cuff.

A Comparison of Successful Eschmann Introducer Placement Through Four Supraglottic Airway Devices

Mitchell CA, Riddle ML, Pearson NM, Tauferner DH, Carl R. Annals Of Emergency Medicine 2010; 56(3): S25

Study to determine if a bougie could be successfully placed in a cadaver by emergency medicine providers using four supraglottic airway devices: LMA Supreme®, i-gel®, LMA® and KingLT®. Time to placement, confidence in the procedure and correct placement via direct laryngoscopy post-removal were recorded. No great significant differences in most areas, however i-gel® was much quicker than KingLT® to successfully insert, and generally outperformed it. LMA Supreme® and i-gel® are considered the better devices for such a procedure, although the authors concede that using a cadaver did inhibit the study.

Oesophageal seal of the novel supralaryngeal airway device i-gel® in comparison with the laryngeal mask airways Classic and ProSeal® using a cadaver model

Schmidbauer W, Bercker S, Volk T, Bogusch G, Mager G, Kerner T. Br J Anaesth 2009; 102(1): 135-9

The three supraglottic devices were inserted into eight unfixed cadaver models with exposed oesophagi, connected to a water column producing both a slow and fast oesophageal pressure increase. During a fast increase of oesophageal pressure (simulated vomiting procedure) with the oesophageal lumen of the i-gel® and pLMA open, the authors reported that ‘the entire oesophageal liquid was drained to the outside without any tracheal aspiration occurring.’

Initial anatomic investigations of the i-gel® airway: a novel supraglottic airway without inflatable cuff

Levitan RM, Kinkle WC. Anaesthesia 2005; 60(10): 1022-6

The first ever published study on i-gel® examined the positioning and mechanics in 65 non-embalmed cadavers, with 73 endoscopies, 16 neck dissections and six neck radiographs. The mean percentage of glottic opening score for the 73 insertions was 82%. In each of the neck dissections and radiographs the bowl of the device covered the laryngeal inlet. In their summary, the authors concluded that the i-gel® was consistently positioned over the laryngeal inlet and that the unique gel-like material of the device performed as intended, conforming to the perilaryngeal anatomy.

Manikin

Comparison of blind intubation with different supraglottic airway devices by inexperienced physicians in several airway scenarios: a manikin study

Bielski A, Smereka J, Madziala M, Golik D, Szarpak L. Eur J Pediatr. 2019 Mar 22

This manikin study aimed to compare the performance of several supraglottic airway devices (SADs) in different blind intubation scenarios performed by 116 inexperienced physicians. The devices used included i-gel[®], Air-Q[®] laryngeal airway and Ambu[®] AuraGain[™]. The three devices were tested on a paediatric manikin in three different scenarios, which included normal airway without chest compressions (A), normal airway with continuous chest compressions plus the CORPLUS CPR system (CCS) (B), and difficult airway with continuous chest compressions plus CCS (C). Parameters assessed in this investigation included first intubation success rate, median time to SAD placement, time to endotracheal intubation, as well as ease of intubation. Results have shown that the i-gel[®] performed better in every scenario and in all parameters tested as compared to the other devices. Therefore, these data demonstrated that the i-gel[®] is the most effective device for emergency blind intubation performed by inexperienced physicians in paediatric patients.

Comparison of blind intubation via supraglottic airway devices versus standard intubation during different airway emergency scenarios in inexperienced hand: Randomised, crossover manikin trial

Bielski A, Rivas E, Ruetzler K, Smereka J, Puslecki M, Dabrowski M, Ladny JR, Frass M, Robak O, Evrin T, Szarpak L. Medicine (Baltimore). 2018 Oct; 97(40): e12593.

This randomised study enrolled 134 physicians, skilled in endotracheal intubation but without prior experience with SADs, in order to evaluate the performance (successful patient intubation) of two devices such as the i-gel[®] and the Air-Q[®] in comparison to direct laryngoscopy. The participants were randomly assigned to three different scenarios, which included normal airway without chest compression (during intubation), normal airway with continuous chest compression and difficult airway with chest compression. In the first scenario, intubation success rate (first attempt) was 72% for endotracheal intubation, 75% for Air-Q[®] and 81% for the i-gel[®]. Time and ease of tracheal intubation were similar amongst all devices. In the second scenario success rate was 42% to the endotracheal intubation, 75% for Air-Q[®] and 80% for the i-gel[®]. Here the time for intubation was significantly higher in endotracheal intubation compared to the SADs. In the third scenario, success rate was 23% for the endotracheal intubation, 65% for the Air-Q[®] and 74% for the i-gel[®]. Both SADs had similar intubation times, which were significantly shorter in comparison to the endotracheal intubation. Thus, these findings demonstrated that SADs represent a superior alternative to endotracheal intubation when performing blind intubation in difficult scenarios.

How do different brands of size 1 laryngeal mask airway compare with face mask ventilation in a dedicated laryngeal mask airway teaching manikin?

Tracy MB, Priyadarshi A, Goel D, Lowe K, Huvanandana J, Hinder M. *Arch Dis Child Fetal Neonatal Ed.* 2018 May; 103(3): F271-F276

This manikin study assessed and compared the delivered ventilation of seven, size one LMA devices with two different face masks using self-inflating bags (SIBs). Forty participants carried out resuscitation on a specialised infant training manikin using the LMAs and the face masks in a random fashion. Findings have shown that the i-gel® had the highest peak inspiratory pressure and higher PEEP compared to the other devices. In addition, the i-gel® showed no insertion failures and all users described it as easy to use. Thus, these results indicate that the i-gel® may become the primary resuscitation device used for newborn resuscitation.

Tracheal intubation through i-gel® performed during simulated cardiopulmonary resuscitation

Wojewodzka-Zeleznikowicz M, Majer J. *Am J Emerg Med.* 2017 Jun; 35(6): 928-929

The objective of this study was to compare the efficacy of endotracheal intubation using the i-gel® as a guide for the ETT in a simulated resuscitation setting (MegaCode Kelly manikin). Twenty-seven nurses were enrolled in this study and received twenty minutes training using the i-gel® as a guide for the endotracheal tube. Intubation was evaluated in two scenarios: Scenario A (normal airway without chest compressions) and Scenario B (normal airway during continuous chest compressions). Findings demonstrated that intubation was 96.3%

effective in scenario A and 85% effective in scenario B. Average intubation time was 18.5 seconds in scenario A and 19 seconds in scenario B. Thus, chest compression may have a small effect on the effectiveness of the first intubation attempt, without affecting the intubation time.

Comparison of learning performance of 2 intubating laryngeal mask airways in novice: A randomised crossover manikin study

Liu ZJ, Yi J, Chen WY, Zhang XH, Huang YG. *Medicine (Baltimore).* 2017 May; 96(19): e6905

Forty-six doctors with no intubation experience were given twenty minutes of airway training and a short practice session with the i-gel® and Aura-i™. They were then asked to insert each device into a manikin in random order and to attempt intubation through each airway. Time to ventilation, first-attempt and overall intubation success, incidence of gastric inflation, ease of insertion, view of the vocal cords, and insertion score were all recorded and compared. Participants attempted the same tasks at a three-month follow-up session. First-attempt and overall success rates for intubation were high and comparable, with only one patient failing to intubate via the Aura-i™ at follow-up. Performance of the devices was generally comparable. Time to intubation was shorter with the i-gel® at both time points. Participants also reported that the i-gel® was easier to use. These results may be due to the lack of inflatable cuff.

Are nurses able to perform blind intubation? Randomised comparison of i-gel® and laryngeal mask airway

Ladny JR, Bielski K, Szarpak L, Cieciel M, Kanski R, Smereka J. Am J Emerg Med. 2017 May; 35(5): 786-787

The objective of this study was to determine the efficacy of blind intubation during CPR using either the i-gel® or the LMA on a Resusci Anne manikin (in a sniffing position). All participants attended a training session to learn the correct technique for airway control and tracheal intubation using SADs. Endotracheal intubation was carried out in two airway scenarios, normal airway at rest (A) and normal airway with continuous controlled chest compressions (B). Several parameters were assessed including time to intubation (primary outcome) and intubation success rate (secondary outcome). Findings showed that in scenario A the i-gel® scored a median time to intubate of 17.5 seconds and reached 100% intubation success rate, whereas the LMA achieved intubation in 20.5 seconds and 82.4% intubation success rate. Moreover, i-gel® was the fastest in scenario B and the LMA was the slowest in terms of time to intubation, and showed a significantly higher intubation success rate (94.1% vs 73.5%). The authors of this study stated that chest compressions do not have a major impact on the time for blind intubation but may negatively affect the efficacy of the first intubation attempt. i-gel® represents the best choice for blind intubation in both scenarios, but further clinical studies are needed to confirm these results.

Comparison of blind intubation through the i-gel® and the Air-Q® by novice physicians during cardiopulmonary resuscitation: A randomised, crossover, manikin trial

Szarpak L. Am J Emerg Med. 2017 Mar; 35(3): 509-510

This study set out to determine the efficacy of blind intubation by novice physicians using the i-gel® and the Air-Q® devices. Prior to the study, a training session focused on anatomy, physiology and pathophysiology of the airways as well as methods for airway control, was provided to all participants. The novice physicians were randomly assigned to either the i-gel® or the Air-Q®. Several parameters were assessed including time to intubation (primary outcome), time to secure the airway, efficacy of blind intubation and difficulty of the procedure (measured in visual-analogue scale or VAS). Results showed that the time for airway management was 6.5 seconds for the i-gel® and 11 seconds for the Air-Q®. Time to intubation was significantly shorter when using the i-gel® as compared to the Air-Q®. Moreover, the effectiveness of intubation was 90% for the i-gel® and 78% for the Air-Q®. i-gel® also had a lower VAS score, and the majority of the participants preferred it to the Air-Q®. Therefore, these results suggest that the i-gel® represents a better choice for blind intubation by novice physicians when performing CPR.

Competence in the use of supraglottic airways by Australian surf lifesavers for cardiac arrest ventilation in a manikin

Holbery-Morgan L, Angel C, Murphy M, Carew J, Douglas F, Murphy R, Hood N, Rechtman A, Scarff C, Simpson N, Stewardson A, Steinfort D, Radford S, Douglas N, Johnson D. Emerg Med Australas. 2017 Feb; 29(1): 63-68

The ability to train lifesavers to use supraglottic airway devices (SADs) compared to standard techniques for cardiac arrest ventilation (CPV) was assessed in this manikin study. 113 lifesavers were trained to use Laryngeal Mask Airway (LMA) and the i-gel® compared to standard devices, the Pocket Mask (PM) and Bag Valve Mask (BVM). Findings demonstrated that the median time to first effective ventilation was similar between the PM, BVM and i-gel® but longer for the LMA. Failed ventilation occurred more when using the i-gel® as compared to the PM and the LMA but less compared to the BVM. Hands-off time was comparable amongst the i-gel®, LMA and BVM but worse for the PM. Thus, based on these data, it appears that SADs may have limitations in terms of effective and reliable ventilation. However, large clinical studies are needed to validate these findings.

Comparison of the i-gel® and other supraglottic airways in adult manikin studies: Systematic review and meta-analysis

An J, Nam SB, Lee JS, Lee J, Yoo H, Lee HM, Kim MS. Medicine (Baltimore). 2017 Jan; 96(1): e5801

This meta-analysis evaluated the usefulness of i-gel® in the emergency setting compared to the classic cuffed SADs. The study carried out a search on multiple databases including PubMed, Cochrane Library and EMBASE.

Fourteen manikin RCTs were selected for this investigation. Results extrapolated from these studies showed that insertion with the i-gel® was significantly faster than the other SADs (LMA Classic®, Proseal®, and Unique; laryngeal tube, Combitube and EasyTube), but had similar insertion success rates when compared to the LMA Supreme®, Aura-i™ and Air-Q®. However, due to the heterogeneity of the results, further investigation is needed to better understand the differences between cuffed and uncuffed SADs in the emergency setting.

Pilot manikin study showed that a supraglottic airway device improved simulated neonatal ventilation in a low-resource setting

Pejovic NJ, Trevisanuto D, Nankunda J, Tylleskär T. Acta Paediatr. 2016 Dec; 105(12): 1440-1443

In this study the performance of the i-gel® was assessed and compared to a facemask for the management of neonatal (manikin) airways in a low-resource setting. Twenty-five hospital staff participants were enrolled to determine the efficiency of the i-gel® and in comparison to a facemask in a simulated neonatal resuscitation setting. A range of parameters was evaluated including the success rate, time of insertion and positive pressure ventilation (PPV). Results have shown that the i-gel® had a 100% success rate in all parameters, with a perceived efficiency significantly superior to the facemask. All participants were more satisfied with the i-gel® in terms of efficiency even though they had no prior experience with the device compared to the facemask. Thus, the i-gel® may represent a valuable tool for neonatal resuscitation in low-resource settings. However, further developments are needed to make this tool more affordable in order to become a real alternative.

Layperson mouth-to-mask ventilation using a modified i-gel® laryngeal mask after brief onsite instruction: a manikin-based feasibility trial

Schälte G, Bomhard LT, Rossaint R, Coburn M, Stoppe C, Zoremba N, Rieg A. *BMJ Open*. 2016 May 12; 6(5): e010770

A hundred participants were presented with a manikin and an airway management package containing a labelled i-gel® and a mouthpiece with a filter which connected to the i-gel® connector. They were given a sheet of instructions and told to attempt to ventilate the manikin. Time to ventilation, success rate, i-gel® position and direction, and participant age and first aid experience were recorded. Participants rated their success and the ease of use, stated whether they would use the device in an emergency, and stated whether they would feel comfortable performing ventilation with the device. Ninety-four patients felt that they were successful but only 79 actually were- though this is still a high success rate for a first attempt with minimal instruction. Nineteen patients did not place the i-gel® correctly, however five of these people could still perform ventilation. Younger participants were quicker to insert the i-gel®, but success rate was similar across ages. Participants who had done first-aid courses were quicker and more successful. 85% of patients felt that they were less reluctant to perform ventilation using this device.

Evaluation of the efficacy of six supraglottic devices for airway management in dark conditions: a crossover randomised simulation trial

Ohchi F, Komazawa N, Imagawa K, Okamoto K, Minami T. *J Anesth*. 2015 Dec; 29(6): 887-92

Fifteen novice doctors and seventeen with

>2 years experience were asked to insert each airway device into a manikin in random order. This was done in a windowless room with all the lights on and again with the lights switched off. Insertion time, insertion success, and participant's own perception of ease of use were all recorded. Ventilation success was lower in both groups when using the ProSeal® and cLMA in the dark. Insertion time for these devices was longer in the dark, an effect that was also seen in both groups. Both ProSeal® and cLMA were rated as more difficult to use in the dark compared with light conditions and with other devices. These results are thought to be due to the difference in design between these airways and the others used in the study, which are stiffer and anatomically shaped.

Performance of intubation with 4 different airway devices by unskilled rescuers: manikin study

Lee DW, Kang MJ, Kim YH, Lee JH, Cho KW, Kim YW, Cho JH, Kim YS, Hong CK, Hwang SY. *Am J Emerg Med*. 2015 May; 33(5): 691-6

This investigation was carried out to assess and compare the intubation performance of four airway devices such as Laryngeal Mask Airway, i-gel®, Pentax Airway Scope (AWS) and Macintosh laryngoscope (MCL). Thirty-eight unskilled rescuers executed intubation on a manikin during chest compressions in both normal (N) and difficult (D) airways scenarios. Several parameters were assessed including time to ventilation, intubation success rate and difficulty of intubation. Results showed that the i-gel® scored the best time to ventilation in both N and D scenarios, followed by the LMA, the AWS and the MCL. Moreover, intubation success rates were 100% for the i-gel® and the LMA in both scenarios, 97.4% (N) and 94.7% (D) for the AWS and 78.9% (N) and 47.4%

(D) the MCL. The i-gel® (1.0 and 2.0) also showed the best difficulty of intubation scores followed by the LMA (2.0 and 2.0), the AWS (3.0 and 3.0) and MCL (4.0 and 5.0). Therefore, data showed that the i-gel® is the best overall performing device, however clinical larger clinical studies are needed to confirm these findings.

Simulation analysis of three intubating supraglottic devices during infant chest compression

*Kohama H, Komazawa N, Ueki R, Kaminoh Y, Nishi S. *Pediatr Int.* 2015; 57(1): 180-2*

Twenty-two medical students placed all three airway devices in a manikin, both with and without chest compressions, in random order. Insertion time and ventilation success rate were recorded.

Comparison of positional shift of supraglottic devices resulting from chest compressions: simulation using a manikin and automated chest compression system

*Kitano M, Komazawa N, Fujiwara S, Minami T. *Acute Med Surg.* 2014 Oct 20; 2(2): 134-137*

This study set out to investigate the degree of supraglottic device displacement and the effect of Durapore tape fixation using a manikin with an advanced life support simulator during chest compressions. The positional shift of eight supraglottic devices (SADs) including the ProSeal®, i-gel®, Classic, Soft Seal®, Fastrack, Supreme, Ambu®-Aura-i™ and Air-Q® was assessed after five minutes of automated chest compressions. Findings demonstrated that the ProSeal® and the i-gel® had a significantly larger positional shift compared to the other SADs. On the other hand, the Air-Q® had a significantly smaller positional shift as compared to

the other devices. Moreover, tape fixation was able to provide a reduction in the positional shift in all SADs, with the ProSeal®, i-gel®, Classic, and Soft Seal® being significantly more stable. Thus, the Air-Q® is the most stable amongst the tested devices in this type of simulated scenario. However, clinical studies are required to validate these results.

Emergency airway management by paramedics: comparison between standard endotracheal intubation, laryngeal mask airway, and i-gel®

*Leventis C, Chalkias A, Sampanis M A, Foulidou X, Xanthos T. *Eur J Emerg Med.* 2014 Oct; 21(5): 371-3*

Study to investigate intubation skill levels of 72 paramedics using ETI, LMA and i-gel® in a manikin model. The success rate was higher, and the insertion time lower for those using i-gel®. There was a 'statistically significant association' between experience level and insertion time of LMA. Authors conclude that paramedics should 'lay greater emphasis on airway management using supraglottic devices, especially i-gel®'.

Is an i-gel® supraglottic airway useful for airway rescue in the community?

*Peutrell I, Jennison N. *British Journal of Midwifery* 2014 May; 22(5): 254-8*

Twenty midwives asked to manage newborn resuscitation scenarios on a manikin using two techniques: Bag valve mask with a Guedel, and a bag with an i-gel®. Time to first breath was quicker with i-gel®, no significant difference in duration of inflation breaths. Higher inflation pressures generated with i-gel®.

A randomised crossover comparison of manikin ventilation through Soft Seal[®], i-gel[®] and AuraOnce[™] supraglottic airway devices by surf lifeguards

Adelborg K, Al-Mashhadi RH, Nielsen LH, Dalgas C, Mortensen MB and Lofgren B. Anaesthesia. 2014 Apr; 69(4): 343-7

Forty lifeguards took part in this manikin study, where time to ventilation and proportion of successful ventilation (both with and without 'concurrent' chest compressions) were measured. Mean time to ventilate with i-gel[®] was 15.6 seconds, compared to 35.2 for Soft Seal[®] and 35.1 for AuraOnce[™]. Authors concluded that 'most lifeguards preferred the i-gel[®]'.

Comparison of blind intubation through the i-gel[®] and ILMA[®] Fastrach by nurses during cardiopulmonary resuscitation: a manikin study

Melissopoulou T, Stroumpoulis K, Sampanis MA, Vrachnis N, Papadopoulos G, Chalkias A, Xanthos T. Heart Lung. 2014 Mar-Apr; 43(2): 112-6

A group of 45 nurses inserted the i-gel[®] and ILMA[®] in a manikin with and without continuous chest compressions. ILMA[®] proved more successful than the i-gel[®], but continuation of compressions caused higher insertion times in both devices. Authors conclude that nursing staff can use both devices 'as conduits with comparable success rates, regardless of whether chest compressions are interrupted or not'.

Evaluation of chest compression effect on airway management with Air-Q[®], aura-i[®], i-gel[®], and Fastrack[®] intubating supraglottic devices by novice physicians: a randomised crossover simulation study

Komasawa N, Ueki R, Kaminoh Y, Nishi SI. J Anesth 2014; 28(5): 676-80

A group of 20 novice physicians inserted the named devices into manikins with or without chest compressions, whereupon insertion time and successful ventilation rate were measured. In cases of successful ventilation, blind tracheal intubation via the inserted device was performed. Chest compression did not significantly decrease ventilation success rates in each device, however insertion time with i-gel[®] did suffer, according to the authors.

The quality of cardiopulmonary resuscitation using supraglottic airways and intraosseous devices: a simulation trial

Reiter DA, Strother CG, Weingart SD. Resuscitation 2013; 84(1): 93-7

Emergency Medicine residents split into teams took part in two simulated ventricular fibrillation cardiac arrests using a high fidelity simulator, testing whether use of a laryngeal mask airway improved resuscitation results. Time to airway placement, duration and success rate of airway placement and percentage hands off time were among results measured. Authors conclude that use of a laryngeal mask and an IO device led to 'significantly faster establishment of an airway'.

A comparison of three supraglottic airway devices used by healthcare professionals during paediatric resuscitation simulation

Schunk D, Ritzka M, Graf B, Trabold B. Emerg Med J 2013; 30(9): 754-7

Sixty-six healthcare professionals of differing experience in paediatric airway management participated in a study comparing laryngeal masks, i-gel[®] and laryngeal tube. Separated into three groups and after brief training in each, the participants were asked to place the device. Positioning and time to insert were recorded. Results show that i-gel[®] is superior to both laryngeal mask and laryngeal tube under these circumstances.

Insertion of six different supraglottic airway devices whilst wearing chemical, biological, radiation, nuclear-personal protective equipment: a manikin study

Castle N, Pillay Y, Spencer N. Anaesthesia 2011; 66(11): 983-8

Six different supraglottic airway devices, including i-gel®, were tested by 58 paramedics for speed and ease of insertion in a manikin, whilst wearing either a standard uniform or chemical, biological, radiation, nuclear-person protective equipment (CBRN-PPE). During the latter test, i-gel® was the fastest of the six to insert with a mean insertion time of 19 seconds. Overall, the wearing of CBRN-PPE has a detrimental effect on insertion time of supraglottic airways.

Hands-off time during insertion of six airway devices during cardiopulmonary resuscitation: A randomised manikin trial

Ruetzler K, Gruber C, Nabecker S, Wohlfarth P, Priemayr A, Frass M, Kimberger O, Sessler D, Roessler B. Resuscitation 2011; 82(8): 1060-3

After an audio-visual lecture and practical demonstration, 40 voluntary emergency medical technicians with limited airway management experience were recruited to perform airway management with six devices, including the i-gel®, during sustained compressions on manikins. Hands-off time was significantly longer when inserting a traditional endotracheal tube, whereas the supraglottic devices were inserted successfully on each occasion.

Performance and skill retention of intubation by paramedics using seven different airway devices – a manikin study

Ruetzler K, Roessler B, Potura L, Priemayr A, Robak O, Schuster E, Frass M. Resuscitation 2011; 82 (5): 593-7

Forty-one paramedics with no previous experience watched a lecture and demonstration. They then attempted to insert each of six supraglottic airways and an ET tube into a manikin in random order. After three months, all participants were assessed again without receiving further training. All supraglottic airways except ProSeal® were more successful than the ET tube. i-gel®, Unique and LT-D had significantly faster times to insertion and ventilation than the other devices. There was no significant difference in success rates for supraglottic airways after three months, however, ET tube insertion rates decreased from 78% to 58% in that time.

Performance of supraglottic airway devices and 12 month skill retention: a randomised controlled study with manikins

Fischer H, Hochbrugger E, Fast A, Hager H, Steinlechner B, Koinig H, Eisenburger P, Frantal S, Greif R. Resuscitation 2011; 82(3): 326-31

This study compared the use of the i-gel®, Supreme, Unique and ProSeal® supraglottic airways and bag-valve mask ventilation. 267 third-year medical students were given standardised training before using all devices in random order on an airway training manikin. The number of attempts needed to secure the device, time to successful ventilation, tidal volume, ease of use and incidence of gastric inflation were all recorded. After 12 months, participants used the devices again without further training.

Airway management in simulated restricted access to a patient--can manikin-based studies provide relevant data?

Nakstad AR, Sandberg M. Scand J Trauma Resusc Emerg Med. 2011 13; 19: 36

Twenty anaesthesiologists from the Air Ambulance Department at Oslo University Hospital used i-gel[®], laryngeal tube LTSII[™] and Macintosh laryngoscopes in two scenarios with either unrestricted (scenario A) or restricted (scenario B) access to the cranial end of the manikin. Technique selected, success rates and time to completion were primary outcomes. Results showed that in scenario B, all physicians secured the airway on first attempt, compared to 80% for ETI, whilst also completing in a quicker time. Authors conclude that 'ETI was time consuming and had a low success rate'.

Assessment of the speed and ease of insertion of three supraglottic airway devices by paramedics: a manikin study

Castle N, Owen R, Hann M, Naidoo R, Reeves D. Emerg Med J 2010; 27(11): 860-3

In this study, 36 final-year paramedic students were randomised into one of six groups, each of which inserted three airway devices into a manikin in a different order. The devices used were the i-gel[®], the laryngeal mask airway and the Laryngeal Tube airway. The students were timed while performing each insertion and interviewed afterwards to determine which device they preferred and why. All insertions were successful on the first attempt. The i-gel[®] was significantly faster than its competitors with a mean insertion time of 12.3 seconds. Due to the speed and ease of insertion, 63% of students named the i-gel[®] as their preferred airway.

A comparison of the i-gel[®] supraglottic airway as a conduit for tracheal intubation with the intubating laryngeal mask airway: a manikin study

Michalek P, Donaldson W, Graham C, Hinds JD. Resuscitation 2010; 81(1): 74-7

A prospective study of 25 participants evaluating the success rate of blind intubation (using gum-elastic bougie, Aintree catheter and a tracheal tube) and fibrescope-guided tracheal intubation through the ILMA[®] and i-gel[®] on three different manikins. Success rate of fibrescope-guided technique was significantly higher than blind attempts with both devices. Results show that fiberoptic intubation through both devices in manikins is a highly successful technique.

Influence of airway management strategy on 'no-flow-time' in a standardized single rescuer manikin scenario (a comparison between LTS-D and i-gel[®])

Wiese CH, Bahr J, Popov AF, Hinz JM, Graf BM. Resuscitation 2009; 80(1): 100-3

Two hundred paramedics performed standardised simulated cardiac arrest management in a manikin, using either the LTS-D or an i-gel[®]. Both devices were comparable, with the LTS-D correctly positioned at the first attempt in 98% of cases, compared to 96% for the i-gel[®].

Effect of chest compressions on the time taken to insert airway devices in a manikin

Gatward JJ, Thomas MJC, Nolan JP, Cook TM. Br J Anaesth 2008; 100(3): 351-6

In this study, 40 volunteer doctors regularly involved in CPR, were timed inserting four different airway devices, including i-gel[®] and a tracheal tube, with and without stopping chest compressions. Comparison of the

speed of insertion of the different devices during CPR allowed ranking of the devices. The i-gel® was inserted approximately 50% faster than the other devices tested.

i-gel® insertion by novices in manikins and patients

Wharton NM, Gibbison B, Gabbott DA, Haslam GM, Muchatuta N, Cook TM. Anaesthesia 2008; 63(9): 991-5

This study evaluated the performance of i-gel® in manikins and anaesthetised patients when used by novices. The i-gel® was deployed with minimal evidence of patient trauma and 100% insertion success. In their summary, the authors concluded that, 'i-gel® is rapidly inserted in both manikins and patients by novice users and compares favourably to other supraglottic airways available. Further work determining safety and efficacy during cardio-pulmonary resuscitation is required.'

Cardiocerebral Resuscitation (CCR) and Passive Oxygenation

Oxygenation, Ventilation and Airway Management in Out-of-Hospital Cardiac Arrest: A Review

Henlin T, Michalek P, Tyll T, Hinds JD, Dobias M. Biomed Res Int; 2014: 376871. Epub 2014 Mar 3

A comprehensive review assessing the changing core protocols of treatment of out-of-hospital cardiac arrest (OHCA), covering basic life support (BLS), oxygenation, passive oxygenation, airway management strategies, intubation, use of supraglottic airways and post-return of spontaneous circulation (ROSC) care.

Use of cardiocerebral resuscitation or AHA/ERC 2005 Guidelines is associated with improved survival from out-of-hospital cardiac arrest: a systematic review and meta-analysis

Salmen M, Ewy G, Sasson C. BMJ Open 2012; 3: 2(5)

Collating data from 12 observational studies on the topic, covering both guidelines, the aim was to investigate the effect of both methods of treatment on cardiac arrest patients. Authors concluded that there is an 'association with improved survival' when cardiocerebral (CCR) protocols or 2005 Guidelines are compared with older versions, and that CCR appears to be a 'promising resuscitation protocol for Emergency Medical Services'.

Passive oxygen insufflation is superior to bag-valve-mask ventilation for witnessed ventricular fibrillation out-of-hospital cardiac arrest

Bobrow B J, Ewy G A, Clark L, Chikani V, Berg R A, Sanders A B, Vadeboncoeur T F, Hilwig R W, Kern K B. Ann Emerg Med 2009; 54(5): 656-62

Retrospective analysis of statewide out-of-hospital cardiac arrests on over 1000 patients receiving either passive ventilation or bag-valve-mask ventilation treatment by paramedics. Adjusted neurologically intact survival between ventilation techniques was the main results category compared. Passive ventilation proved more successful under the terms used.

Ventilation during resuscitation efforts for out-of-hospital primary cardiac arrest

Bobrow B J, Ewy G A. Curr Opin Crit Care 2009; 15(3): 228-33

A discussion on recent findings surrounding the role of ventilation during CPR during OHCA, focusing on whether passive oxygen insufflation is an optimal form of ventilation when compared to intubation and active assisted ventilation. The authors summarise and suggest that training prehospital medical providers to use passive insufflation may increase critical organ perfusion and therefore survival after OHCA.

Improved patient survival using a modified resuscitation protocol for out-of-hospital cardiac arrest

Garza A G, Gratton M C, Salomone J A, Lindholm D, McElroy J, Archer R. Circulation 2009; 119(19): 2597-605

A retrospective observational cohort study reviewing all adult primary ventricular fibrillation and pulseless ventricular tachycardia cardiac arrests before and

after protocol changes in the Emergency Medical System in Kansas City in the USA. Survival from out-of-hospital cardiac arrest of presumed cardiac origin improved from 7.5% to 13.9%, and survival to hospital discharge increased from an unadjusted rate of 22.4% to 43.9%. Authors confirm that the protocol changes optimising chest compressions with reduced disruptions improved return of spontaneous circulation and survival to discharge in their patients.

Cardiocerebral resuscitation improves neurologically intact survival of patients with out-of-hospital cardiac arrest

Kellum M J, Kennedy K W, Barney R, Keilhauer F A, Bellino M, Zuercher M, Ewy G. Ann Emerg Med 2008; 52(3): 244-52

The objective of this study was to compare a newly implemented protocol using the principles of cardiocerebral resuscitation against 2000 American Heart Association Guidelines for treatment of out-of-hospital cardiac arrest. Data was collected retrospectively from the two study groups, each spanning a three-year period. Cerebral performance category scores were used to define the neurological status of survivors, with '1' considered as 'intact' survival. Prior to the protocol change, 18 of 92 (20%) survived and 14 (15%) were intact. After the implementation, 42 of 89 (47%) survived and 35 (39%) were intact. Authors conclude that the implementation was associated with 'a dramatic improvement in neurologically intact survival.'

Efficacy of continuous insufflation of oxygen combined with active cardiac compression-decompression during out-of-hospital cardiorespiratory arrest

Saissy J-M, Boussignac G, Cheptel E, Rouvin B, Fontaine D, Bargues L, Levecque J-P, Michel A, Brochard L. Anesthesiology 2000; 92(6): 1523-30

Adult patients who had suffered nontraumatic OHCA with asystole were randomised into two groups: an IPPV group tracheally intubated with a standard tube and a continuous insufflation of air or oxygen (CIO) through microcannulas inserted into a modified endotracheal tube at a rate of 15l/min. Both groups underwent active cardiac compression-decompression with a device. Resuscitation continued for a maximum of 30 minutes, with blood gas analysis taken once stable spontaneous cardiac activity restored. Results for both groups were comparable. Arterial blood gas measure taken upon admission to hospital showed that partial pressure of arterial carbon dioxide was significantly lower in the CIO group, but pH was significantly higher. Authors conclude CIO is as effective as IPPV during OHCA.

Case Reports and Correspondence

i-gel® as alternative airway tool for difficult airway in severely injured patients

Häske D, Schempff B, Niederberger C, Gaier G. *Am J Emerg Med.* 2016 Feb; 34(2): 340.e1-4

This study described two cases in which the i-gel® was used in a prehospital setting as an alternative airway device in severely injured patients after failed intubation. In the first reported case, a 51-year-old male construction worker fell from a height of six meters onto a concrete floor. The first responders used the i-gel® to secure the patient's airways prior ventilation. Subsequently, during the resuscitation process, intubation was attempted twice without success. Therefore, i-gel® was used again, which allowed them to establish spontaneous circulation after 12 minutes of CPR. i-gel® was kept in place when the patient arrived in the emergency department, allowing ventilation prior to intubation. No evidence of iatrogenic injury from the airway management was reported. In the second reported case, a 20-year-old female cyclist was hit by a car and thrown onto the street. A rapid sequence induction was carried out to secure the airways via endotracheal intubation. The i-gel® was then placed on the first attempt, securing the patient airways after two failed endotracheal intubation attempts. The bronchoscopic control of the perilaryngeal structure showed no injury from the prehospital airway management. Thus, the authors of the study suggested that the i-gel® represents an appropriate primary airway management device, as well as a valuable rescue tool after failed intubation.

i-gel®: a new supraglottic device for effective resuscitation of a very low birthweight infant with Cornelia de Lange syndrome

Galderisi A, De Bernardo G, Lorenzon E, Trevisanuto D. *BMJ Case Rep.* 2015 Mar 25; 2015

This case report demonstrated the effectiveness of the i-gel® for the airway management of low birth weight infants in cases of resuscitation failure with facemask ventilation. In this instance, resuscitation of a male infant (36 + 3 weeks of gestation) with a birth weight of 1470 g (<3rd centile) and diagnosed with upper airway malformations (micrognathia and Cornelia Lange syndrome) was carried out with an i-gel® size-1 after facemask ventilation failure. The device was inserted at first attempt, allowing efficient ventilation, and oxygenation, which stabilised the patient. Therefore, the i-gel® should be present in the delivery room as it may be a life-saving tool in cases of facemask or tracheal intubation failure.

Supraglottic airway use by lifeguards

McKenna M, Davies M. *Anaesthesia* 2014; 69(8): 928

A response to the Adelborg et al study, questioning whether manikin simulation "adequately reproduces" the real-life anatomic difficulties experienced in drowning patients.

Should supraglottic airway devices be used by lifeguards at all?

Baker P, Webber J. Anaesthesia 2014; 69(8): 928-9

A further response to Adelborg et al, expressing concern at this being a manikin study, and suggesting that the “vital issue” is whether a device is “fit for purpose” in the case of a drowning patient.

A reply

Lofgren B, Adelborg K. Anaesthesia 2014; 69(8): 929-30

A response to the two concerns raised above, acknowledging that more studies are needed and that there is currently “insufficient evidence” to recommend any specific ventilation technique among lifeguards. They also reiterate their study conclusions.

Pre-hospital transient airway management using the i-gel® with sustained spontaneous breathing in different emergency situations

Tiesmeier J, Emmerich M. Minerva Anesthesiol 2013; 79(2): 212-3

Three case studies where an i-gel® was used in an emergency situation are presented on the back of the authors’ previous knowledge that this SAD has ‘advantageous characteristics’, including quick insertion time, good seal pressures and high success rates. Cases were: a ‘violent’ but sedated male patient; a 69-year-old patient suffering a cerebral seizure; and an unconscious and intoxicated patient found at home. Regurgitation and aspiration were not seen in any case. Authors conclude that, alongside other pre-clinical emergency situations, i-gel® can be used in cases of sustained spontaneous breathing, and ‘could be considered for extended use outside the hospital’.

i-gel® supraglottic airway use during hospital cardiopulmonary resuscitation

Larkin CB, d’Agapeyeff A, King BP, Gabbott DA. Resuscitation 2012; 83(6): E141

100 size 4 i-gel® airways were inserted in patients by a mixture of nurses, junior doctors and Resuscitation Officers, either before or after bag valve mask ventilation. 83/100 insertions were considered ‘Easy’ and 82/100 were inserted at the first attempt, with only one attempt resulting in complete failure. Presence of an audible leak and visible chest movement via synchronous and asynchronous ventilation were measured. 99% of users confirmed they would prefer to use i-gel® instead of an oropharyngeal airway. Authors confirm that, as a result of this test, i-gel® is their preferred supraglottic airway device of choice during the initial phase of CPR whilst the Resuscitation Team is summoned.

Supraglottic Airway Device preference and insertion speed in F1 doctors

Adlam M, Purnell D. Resuscitation 2012; 83(5): e129

Twenty-one Foundation Year One Trainees were asked to attempt to ventilate a manikin with either an LMA or i-gel®, of their own choosing. Results showed 71% chose to use an LMA, although on reflection 95% preferred the i-gel®. Speed of insertion was faster with i-gel®. Study supports use of i-gel® on resus trolleys for use by non-airway trained doctors.

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Failure to ventilate with supraglottic airways after drowning

Baker P A, Webber J B. Anaesth Intensive Care 2011; 39(4): 675-7

Reported failure of an i-gel® and an Ambu® AuraOnce™ to ventilate a drowning victim due to changes in lung physiology following inhalation of water requiring ventilation pressures up to 40cmH₂O. Authors say that supraglottic airways, thanks to rapid insertion, are recommended for resuscitation as they facilitate the continuation of cardiac compression, however low leak pressures may cause inadequate ventilation and entrainment of air into the stomach of drowning victims.

Passive oxygen insufflation is superior to bag-valve-mask ventilation for witnessed ventricular fibrillation out-of-hospital cardiac arrest

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increased from an unadjusted rate of 22.4% to 43.9%. Authors confirm that the protocol changes optimising chest compressions with reduced disruptions improved return of spontaneous circulation and survival to discharge in their patients.

Pre-hospital resuscitation using the i-gel®

Thomas M, Bengler J. Resuscitation 2009; 80(12): 1437

This correspondence article describes twelve attempts to ventilate patients in cardiac arrest using the i-gel®. The device could usually be inserted on the first attempt; however, on seven out of twelve occasions ventilation was then found to be inadequate. The i-gel®s were correctly positioned, but there were large leaks. The authors state that the reason for this is unclear, but that the device may be harder to position correctly when patients are not in the most appropriate position for insertion. An alternative explanation is that higher pressure is needed to ventilate the lungs after cardiac arrest, in which case other supraglottic airways should have the same problem.

i-gel® supraglottic airway for rescue airway management and as a conduit for tracheal intubation in a patient with acute respiratory failure®

Campbell J, Michalek P, Deighan M. Resuscitation 2009; 80(8): 963

Case of a 54-year-old male presented as emergency admission to ICU with pneumonia. With only grade 4 laryngoscopy view achieved, first a size 4 LMA Classic® was inserted, but was removed following lack of ventilation. i-gel® was inserted instead allowing for good ventilation. A 3mm fibroscope was passed easily through the i-gel®, which was then removed leaving a secure airway.

Evaluation of the i-gel® airway in 300 patients

Bamgbade OA, Macnab WR, Khalaf WM. Eur J Anaesthesiol 2008; 25(10): 865-6

This letter reported that first time insertion with i-gel® was achieved in <5 seconds in 290/300 patients. Three patients with difficult airway underwent successful fiberoptic endotracheal intubation through i-gel® and all patients underwent adequate pressure mode ventilation with airway pressures of 10-30cm H₂O initially and spontaneous breathing subsequently. In addition, lubricated gastric tubes were easily inserted through the gastric channel at the first attempt in all 80 cases where this was performed. The authors concluded that 'i-gel® is very suitable for peri-operative airway management, positive pressure ventilation and weaning from ventilation. It is also useful as an intubation aid and has a potential role in airway management during resuscitation. It is very easy to use, highly reliable and associated with minimal morbidity. The gastric channel separates the oesophagus

from the larynx and provides protection from aspiration. Further studies are required to compare i-gel® with other supraglottic devices.’

Cardiocerebral resuscitation improves neurologically intact survival of patients with out-of-hospital cardiac arrest

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The i-gel® supraglottic airway: A potential role for resuscitation?

Gabbott DA, Beringer R. Resuscitation 2007; 73(1): 161-162

A letter on initial findings following clinical use of i-gel® in 100 patients. In order to evaluate its potential use in a resuscitation setting, the investigators confined their use to a size four device. They used i-gel® on 100 patients undergoing elective surgery under general anaesthesia. The device was used

in patients with a weight range of 40-100kg. In 98/100 cases, the i-gel® was adequately positioned on the first or second attempt. The mean and median leak on sustained pressure was 24cm H₂O. Airway trauma, demonstrated by visible blood on the device on removal, was only detected on one occasion. There was one case of regurgitation. The gastric fluid was successfully vented through the oesophageal drainage port without any evidence of aspiration.

Reviews and Editorials

The i-gel® supraglottic airway and resuscitation - some initial thoughts

Soar J. Resuscitation 2007; 74(1): 197

This case report detailed use of a size four i-gel® during a cardiac arrest. The i-gel® was inserted in <10 seconds from opening the packet. The author was able to ventilate the patients lungs easily using a self-inflating bag-valve device connected to the i-gel®. The patients lungs were ventilated asynchronously during chest compressions with no leak. There was no evidence of aspiration. In addition, this case report confirmed the training of five non-anaesthetic trainee doctors to insert the i-gel® and ventilate an anaesthetised patient after minimal instruction. All these trainees rated i-gel® easier to insert than a laryngeal mask airway.

Airway management during cardiopulmonary resuscitation.

Bernhard M, Bengner JR. Curr Opin Crit Care. 2015 Jun; 21(3): 183-7

This review investigated the scientific evidence in regards to advanced airway management techniques during in and out of hospital CPR. Data obtained from in-hospital setting have demonstrated that the use of advanced techniques improved the quality of CPR. Failure to intubate was linked to a three minute delay in restoring spontaneous circulation. The use of the Glide Scope video laryngoscope was associated with a first-pass success rate of 93%. On the other hand, results from out-of-hospital setting showed that intubation is more effective compared with supraglottic devices, and advanced airway techniques did not show a better outcome compared to the standard ones. Moreover, findings from an observational study have demonstrated that the i-gel® delivers a 90% first-pass insertion success rate, and was easier to place compared to the Portex® Soft Seal® Laryngeal mask airway. Thus, further larger studies are needed to better understand the efficacy of advanced techniques and devices in comparison to the standard approaches.

Pre-hospital airway management: The data grows rapidly but controversy remains

Lockey D, Lossius HM. Resuscitation 2014; 85(7): 849-50

An editorial discussing three studies published in the same journal issue covering different aspects of emergency advanced airway management, both out of and inside the hospital.

Resuscitation highlights in 2013: Part 2

Nolan JP, Ornato JP, Parr MJA, Perkins GD, Soar J. Resuscitation 2014; 85(4): 437-43

Second of two editorials summarising key papers published in *Resuscitation* in 2013, covering advanced life support and post-resuscitation care, amongst other topics.

Which airway for cardiac arrest? Do supraglottic airway devices have a role?

Soar J. Resuscitation 2013; 84(9): 1163-4

An editorial on the controversy when deciding the timing of an airway, ventilation intervention, optimal technique and what different types of rescuer should do.

Supraglottic airway devices during neonatal resuscitation: An historical perspective, systematic review and meta-analysis of available clinical trials

Schmolzer GM, Agarwal M, Kamlin CO, Davis PG. Resuscitation 2013; 84(6): 722-30

Review of available literature on the use of supraglottic airway devices during neonatal resuscitation. Current evidence suggests that resuscitation with a laryngeal mask is a 'feasible and safe alternative to mask ventilation in infants', however further randomised controlled trials are needed.

Resuscitation highlights in 2012

Nolan JP, Ornato JP, Parr MJA, Perkins GD, Soar J. Resuscitation 2013; 84(2): 129-36

A summary of the key papers published across the full spectrum of cardiopulmonary resuscitation.

Resuscitation highlights in 2011

Nolan JP, Ornato JP, Parr MJA, Perkins GD, Soar J. Resuscitation 2012; 83(1): 1-6

The editorial team reports a substantial increase in the number of published studies in *Resuscitation* during 2010 - here is a summary of the key papers.

2009 in review

Nolan JP, Soar J, Parr MJA, Perkins GD. Resuscitation 2010; 81(1): 1-4

Focus on the key studies published in *Resuscitation* in 2009, including cardiac arrest prevention, basic life support and CPR quality.

Airway management for out-of-hospital cardiac arrest – more data required

Nolan JP, Lockey D. Resuscitation 2009; 80(12): 1333-4

This editorial discusses the options that are available for airway management when cardiac arrest occurs outside a hospital environment. It is stated that supraglottic airways are easier to insert than endotracheal tubes and have the added benefit of allowing chest compressions to continue while they are inserted. The article references i-gel® studies with both positive and negative outcomes. Overall, insertion time was quicker but ventilation was sometimes found to be inadequate. One study showed that the i-gel® had a higher leak pressure than the cLMA, however a German study found that the i-gel® produced a tight seal at 20cm H₂O in only around half of the patients involved. Most of the available i-gel® data comes from small studies. Randomised controlled trials are needed to confirm the performance of the i-gel® and other supraglottic airways during CPR.

Strategies to prevent unrecognised oesophageal intubation during out-of-hospital cardiac arrest

Nolan J. Resuscitation 2008; 76(1): 1-2

From the abstract: 'Tracheal intubation has long been regarded as a fundamental and essential component of advanced life support (ALS). It has been assumed that tracheal intubation improves the chances of surviving from cardiac arrest. There are no reliable data to support this belief and there are several reasons why attempted intubation can be harmful, particularly when undertaken by inexperienced individuals.'

Passive Oxygenation

Airway techniques and ventilation strategies

Nolan J P, Soar J Curr Opin Crit Care 2008; 14(3): 279-86

A review discussing the advantages and disadvantages of various methods of airway management during CPR, covering studies failing to show benefit of tracheal intubation, use of supraglottic airway devices, compression-only CPR and CCR. Authors conclude that supraglottic airways are a 'logical alternative' to tracheal intubation when CPR performed by those who are 'not highly skilled' at intubation.

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