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Clinical paper

Effectiveness of Intubating Laryngeal Mask Airway in managing out-of-hospital cardiac arrest by non-physicians

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Abstract

Aim of the study: The role of supraglottic devices in airway management in out-of-hospital cardiac arrest (OHCA) remains controversial. The aim of this study was to evaluate the feasibility and effectiveness of intubation through the Intubating Laryngeal Mask Airway (ILMA) when used by prehospital emergency nurses in the setting of OHCA.

Methods: We conducted a prospective, observational trial during 12 years by the Fire Department and prehospital emergency service of the health district of Strasbourg, France. The primary outcome was the success rate of ventilation after intubation through the ILMA, while the secondary outcomes were the success rate of ventilation after insertion of the ILMA and complications related to ILMA placement and intubation. Factors associated with successful intubation were also studied.

Results: During the study period, 1464 ILMA placements were attempted by emergency nurses during OHCA. Ventilation was possible in 1250 patients (85.38%) after ILMA placement and in 1078 patients (73.63%) after intubation. Regurgitation of gastric contents occurred in 237 (16.18%) patients, mostly during basic life support. Two factors were predictive of a successful tracheal intubation: the performance of the Chandy maneuver OR = 2.91 (CI: 2.07–3.97) and the number of attempts at intubation OR = 1.95 (CI: 1.43–2.61). Conversely, the number of attempts at ILMA insertion was predictive of an intubation failure OR = 0.11 (CI: 0.07–0.17).

Conclusion: The success rate of intubation through the ILMA was high. After ILMA placement, ventilation was possible in 1250 patients (85.38%) and in 1078 patients (73.63%) after intubation.

Keywords: Out-of-hospital cardiac arrest, Emergency medical services, Airway management, Endotracheal intubation, Supraglottic airway devices, Paramedics

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Introduction

In case of an out-of-hospital cardiac arrest (OHCA), the European Resuscitation Council[1] and American Heart Association[2] recommend the endotracheal intubation (ETI) for securing the airways, but it should be attempted only if the healthcare provider is properly trained and has regular, ongoing experience with the technique. In the absence of personal skills in ETI, a supraglottic airway device (SGA) or a bag mask ventilation (BMV) are two acceptable alternatives. The optimal airway management in this setting remains controversial.[1] A multicenter randomized clinical trial comparing BMV versus ETI in 2043 patients with OHCA[3] came to a non-conclusive result.

The ETI is considered the optimal method of managing the airway during OHCA.[4] There is evidence that, without adequate training and experience, the incidence of complications, such as oesophageal intubation (2.4–17% in studies involving paramedics)[5–9] and dislodgement is unacceptably high. Prolonged attempts at ETI are harmful, the interruption of chest compressions will compromise coronary and cerebral perfusion. In a study of prehospital intubation by paramedics during 100 OHCA the total duration of the interruptions in CPR associated with ETI attempts was 110 s and in 25% of cases the interruptions were more than 3 min.[10] Intubation success rates correlate with the intubation experience attained by paramedics.[11] The intubation failure rate is 50% in prehospital systems with providers who do not perform intubation frequently.[12–13] Tracheal intubation is a difficult skill to acquire and maintain. Anaesthesia residents required about 125 intubations in the operating room setting before they were able to achieve an intubation success rate of 95%.[14]

Although BMV appears to be easier to perform,[15] it may be difficult to ensure and the risk of regurgitation and pulmonary aspiration is higher.[16]

There are published studies on the use of SGA devices during CPR, but none of these studies have been powered adequately to enable survival to be studied as a primary endpoint.[17] The SGA devices are easier to use and, unlike ETI, can be inserted without interrupting chest compressions. Moreover, the learning curve for the insertion of the intubating laryngeal mask is reported to be shorter.[18] The Intubating Laryngeal Mask Airway (ILMA, Fastrach™) is a device to be used in management of difficult airway. Investigations of the ILMA in the prehospital setting when used by paramedics are scarce.[19–21]

The aim of this study was to evaluate the effectiveness and feasibility of intubation through the ILMA when used by the non physicians during OHCA.

Methods

We conducted a prospective, observational trial between 1 January 2006 and 31 December 2017 by the Fire Department (FD) and prehospital Emergency Department (ED) of the health district of Strasbourg, Bas-Rhin, France.

Ethics

This study was approved by the Institutional Research Ethics Board of the University of Strasbourg. The Ethics Committee waived the need for informed consent because the study was not randomized and assessed a device routinely used in the practice of the Emergency Service.

Organisation of prehospital emergency care

Bas-Rhin counted 1,116,658 people in 2015, according to INSEE[22] in 4755 km^2 with a density of 236.47 inhabitants per km^2, which is twice the French average. The department has 5 hospitals with an ED and 8 mobile emergency medical teams (Service d'Aide Médicale Urgente: SMUR).

In case of OHCA, a primary care ambulance with a team of three emergency medical technicians (EMT) firemen on board, a SMUR consisting of an EMT, a nurse and a physician, are available for prehospital patients. Additionally, a FD nurse is available when the location of the intervention is in rural areas of the district because the response time of SMUR is more than ten minutes.

Protocol for airway management

This study included all consecutive OHCA patients for whom a FD nurse used an ILMA for securing the airways in the frame of the predefined standardized protocol for which they were trained.

1. The primary care fireman team is responsible for conducting basic life support (BLS) according to international guidelines including chest compressions, BMV and defibrillation if necessary.
2. Upon arrival of the FD nurse on the scene, he/she is in charge of airway management and drugs administration. As per protocol, the nurse has to insert ILMA, unless the patient has trismus or a small mouth opening and then try to ventilate through the ILMA. The size of the ILMA is chosen according to the recommendations of the manufacturer. Sedatives and neuromuscular blocking agents are not administrated (patients in cardiac arrest). A proper lubrication of the lumen of the ILMA was emphasized to facilitate the passage of the tracheal tube (TT). The FD nurse can use the Chandy maneuver to facilitate the ventilation and/or TT insertion.
3. If the placement of the ILMA is not successful, the FD nurse has to remove it and to resume the bag-mask ventilation.
4. When ventilation through ILMA is effective, a wire reinforced TT is inserted through the ILMA. To confirm the tracheal intubation, clinical criteria were used (observing bilateral chest expansion, auscultation using a stethoscope).
5. If the tracheal intubation through the ILMA is not possible or ventilation through TT proves ineffective, the nurse has to remove the TT and continue to ventilate the patient through the ILMA until the arrival of the medical team.
6. Peripheral intravenous catheter insertion and drugs administration follow airway control.

ILMA insertion training course

Participants were trained to insert the ILMA, which consisted of a 20 min video didactic presentation followed by the practice on a mannequin (Resusci-Anne Sim, Laerdal Medical, Stavanger, Norway). Three successful insertions of an ILMA size 5 and performance of blind tracheal intubation with a wire reinforced TT size 7 were required to pass the course.

A refresher session had to be attended by all nurses every year. Proficiency using the ILMA was tested after both the initial training and refresher sessions.

Our choice is based on evidence-based education from literature. Several studies have demonstrated that simulation-based education allows transfer of learnt skills from the simulated environment to the clinical setting, both for procedural skills and non-technical skills.

Collecting data

Data recorded were the date and time of the OHCA, the pattern, the departure and arrival time of the FD nurse, location of the intervention, the characteristics of the patient, presence and timing of regurgitation, ILMA and TT size, the quality of the ventilation through the ILMA and after intubation, number of attempts at ILMA and TT insertions and the difficulties encountered.

Outcomes

1. The primary outcome was the success rate of intubation through the ILMA when used by the non physicians in OHCA.
2. The secondary outcomes were the success rate of ventilation after insertion of the ILMA and complications related to ILMA placement and intubation.

Factors associated with successful intubation were also studied.

Statistical analysis

The data were analyzed according to the Bayesian paradigm. Categorical data are described as frequency (%). Count data are described after categorization but were used as count in the subsequent modeling.

A sample of 1450, approximately the expected sample size, would provide us with a power of 89% to detect an OR of 1.4 for a binary predictor and a power of more than 93% to detect an OR of 1.2 for a continuous predictor under the assumption that, in both situations, the success rate in the reference group was 50%. This value (50%) was chosen because it maximizes the variance and gives thus a conservative estimation of the power.

The primary and secondary outcomes were each modeled with a multiple logistic regression. The selection of the final model was based on a stepwise descending selection based on DIC combined with the clinical relevance of the variable to include or to exclude. For this outcomes analyses, the priors were defined before the study and were based on a generic prior stating that the OR is a priori in the interval [1/150–150]. A random effect was included to take account of the nurse cluster effect, each nurse in this study being implied for one or several cases. The OR are provided with their point estimate and 95% posterior credibility interval and the probability that the OR is larger than 1 or in a prespecified range of values. A large (near 1) or a small (near 0) probability both suggest an effect.

We remind that the Bayesian paradigm does not use the (frequentist) p-value and that the probability of exceeding, for a parameter of interest, a given threshold must not be confused with a p-value.

Missing data were replaced using multiple imputation. For count data, the missing data were imputed as drawn from a Poisson distribution in which the lambda parameter was equal to the mean of the observed data. For categorical data, a Dirichlet distribution was used for which the observed distribution of the non-missing data was used as parameters.

A burn-in of 5000 iterations, followed by 100,000 iteration was used for each analysis. Convergence of the McMC sample chain was checked graphically. Convergence was observed in each case. All computations were done with R 3.2.2 and JAGS statistical softwares with all the required additional packages (R Core Team (2016). R: A Language and environment for statistical computing. R foundation for Statistical Computing. Vienna, Austria, 2014. URL: https://www.R-project.org/).

Results

Patients and operators demographics

One hundred and sixty two nurses completed the training course and provided cares to 1464 patients during the study period (Fig. 1). In 210 cases, ventilation was ineffective and in 4 cases we have incomplete data. In the other 1250 cases, the ventilation through the ILMA was effective. From these 1250 cases (we excluded 56 cases: 2 ROSC and 54 dead pronounced) in 1294 cases the nurses tried to introduce the tracheal tube.

The number of male patients was twice as large as the number of females with a sex ratio of 1.86. The average age of patients was 67.59 years (SD 16.77). More than 50% of patients were older than 70 (Table 1).

A total of 952 (65%) interventions were performed during the day (between 7 a.m. and 7 p.m.) and 492 (34%) at night (between 7 p.m. and 7 a.m.). The median response time from the call to the arrival of the FD nurse on scene was 11.9 min (SD 5.86), with a median of 11 min.

On average, the FD nurses performed 9 interventions, with a minimum of 1 and a maximum of 141. The women FD nurses performed a total of 801 interventions (8 interventions on average) and the men performed 657 interventions (10 interventions on average). Women FD nurses outnumbered men, with a sex ratio male/female = 0.64. Half of the FD nurses (women and men) completed more than 4 interventions (Table 2).

On average, a FD nurse received 5.39 training sessions (SD 3.25). Half of the interventions concerned FD nurses who had received 5 training sessions. In 35 cases (2.39%) intubation was considered difficult.

Primary outcome

The intubation success rate was 73.63% (1078 of 1464 cases). We counted 321 failures of intubation (210 failures of ILMA insertion and 111 failures of ventilation through the TT). After intubation, the ventilation was effective in 1020 (69.67%) cases after the first attempt whereas only in 50 (3.41%) cases after the second attempt.

Secondary outcomes

After the ILMA placement, ventilation was effective in 1250 cases (85.38%). After placement of the ILMA, there were minimal leaks in 375 cases (25.61%), major leaks in 124 cases (8.46%), obstruction in 79 cases (5.39%) and in 7 cases (0.47%) ventilation was impossible. After insertion of the ILMA, the ventilation was effective in 1172 (80.05%) cases after first attempt, whereas in only 70 (4.78%) cases after the second attempt (Tables 3 and 4).

Regurgitation of gastric contents occurred in 237 cases (16.18%), in 187 cases (12.77%) before the use of the ILMA, in 25 cases (1.7%) during the ILMA placement, and in 25 cases (1.7%) after the ILMA placement.

Regarding the experience of the FD nurse and the number of training session, we observed that the success rate remained constant over time. The experience of the FD nurses refers to the

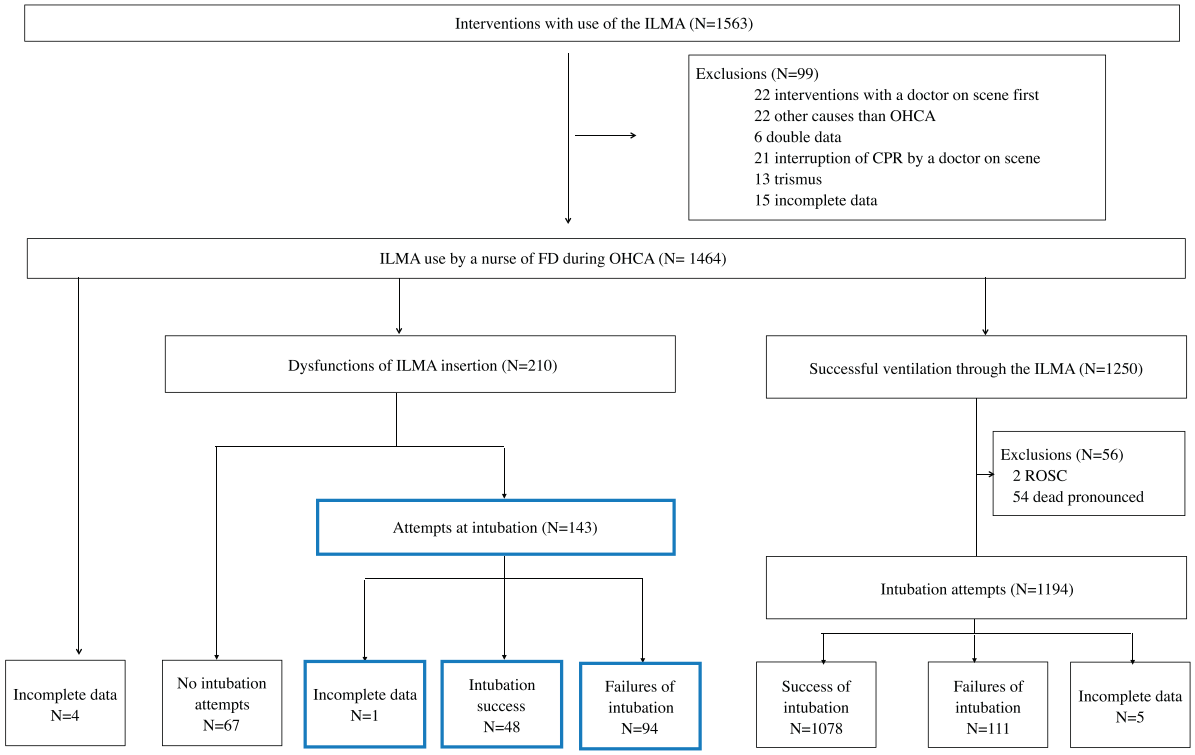

Fig. 1 – Flow chart (out-of-hospital cardiac arrest).
ILMA: Intubating Laryngeal Mask Airway; OHCA: out-of-hospital cardiac arrest; CPR: Cardio Pulmonary Resuscitation; FD: Fire Department; ROSC: Return of Successful Circulation; deviation from the protocol.

number of uses of the ILMA in emergency situations before the current intervention. As far as the number of attempts at ILMA is concerned, the OR is less than 1, which means that the more the FD nurse tried to introduce the mask, the less he/she succeeded. On the second attempt, the success rate decreases by 20 times.

After univariate analysis, six variables were introduced in a multivariate analysis. Table 5 summarizes the odds ratio (OR) for each variable used in the statistical analysis. In multivariable analysis, two factors were predictive of a successful tracheal intubation: the performance of the Chandy maneuver OR = 2.91 (CI:2.07–3.97) and

Table 1 – Characteristics of the study population.

N	N	%
Patient's gender	1464	100
Male	947	64.68
Female	509	34.76
Not recorded	8	0.54
Patient's age	1464	100
<18 years	11	0.75
19–49 years	189	12.90
50–74 years	637	43.51
≥75 years	610	41.66
Not recorded	17	1.16
Location of the intervention	1464	100
Patients's home	1138	77.73
Public place	181	12.36
Patients's workplace	9	0.61
Other	129	8.81
Not recorded	7	0.47
Start time of the intervention	1464	100
Day (7 a.m–7 p.m.)	952	65.02
Night (7 p.m–7 a.m.)	492	33.60
Not recorded	20	1.36

Table 2 – Characteristics of the FD nurses.

	N	%
Gender of the FD nurses	162	100
Female	95	58.64
Male	61	37.65
Not recorded	6	3.70
Number of interventions according to the gender of the FD nurses	1464	100
Female	801	54.71
Male	657	44.87
Not recorded	6	0.40
Number of interventions according to the number of training sessions	1464	100
1–4	712	48.63
5–10	623	42.55
>10	129	8.81
Not recorded	0	0.00

FD: Fire Department.

Table 3 – Quality of the ventilation after the insertion of the ILMA.

	Total		Success		Failure		Not recorded
	N	%	N	%	N	%	N
Total	1464	100	1250	85.38	210	14.34	4
Patient's age							
<18 years	11	0.75	9	0.61	2	0.13	0
19-49 years	189	12.90	167	11.40	21	1.43	1
50-74 years	637	43.51	545	37.22	91	6.21	1
≥75 years	610	41.66	515	35.17	93	6.35	2
Not recorded	17	1.16	14	0.95	3	0.20	0
Number of interventions according to the gender of the FD nurses							
Female FD nurses	801	54.71	679	46.37	118	8.06	4
Male FD nurses	657	44.87	566	38.66	91	6.21	0
Not recorded	6	0.40	5	0.34	1	0.06	0
Number of uses of the ILMA in emergency situations							
<5	458	31.28	377	25.75	78	5.32	3
5–10	339	23.15	283	19.33	56	3.82	0
>10	666	45.49	589	40.23	76	5.19	1
Not recorded	1	0.06	1	0.06	0	0.00	0
Number of interventions according to the number of training sessions							
1	182	12.43	145	9.90	37	2.52	0
2	202	13.79	162	11.06	40	2.73	0
3	186	12.70	156	10.65	30	2.04	0
4	142	9.69	120	8.19	19	1.29	3
≥5	752	51.36	667	45.56	84	5.73	1
Not recorded	0	0.00	0	0.00	0	0.00	0
The location of the intervention							
Patient's home	1138	77.73	965	65.91	172	11.74	1
Public place	181	12.36	155	10.58	24	1.63	2
Patient's workplace	9	0.61	8	0.54	0	0.00	1
Other	129	8.81	116	7.92	13	0.88	0
Not recorded	7	0.47	6	0.40	1	0.06	0
Start time of the intervention							
Day (7 a.m-7 p.m)	952	65.02	810	55.32	140	9.56	2
Night (7 p.m-7 a.m)	492	33.60	427	29.16	63	4.30	2
Not recorded	20	1.36	13	0.88	7	0.47	0
Number of attempts to introduce the ILMA							
1	1285	87.77	1172	80.05	112	7.65	1
2	158	10.79	70	4.78	86	5.87	2
3	14	0.95	5	0.34	8	0.54	1
4	2	0.13	1	0.06	1	0.06	0
5	1	0.06	0	0.00	1	0.06	0
Not recorded	4	0.27	2	0.13	2	0.13	0
Difficult intubation criteria							
Yes	35	2.39	21	1.43	14	0.95	0
No	1425	97.33	1225	83.67	196	13.38	4
Not recorded	4	0.27	4	0.27	0	0.00	0

FD: Fire Department; ILMA: Intubating Laryngeal Mask Airway.

the number of attempts at intubation OR = 1.95 (CI:1.43–2.61). Conversely, the number of attempts at ILMA insertion was predictive of an intubation failure OR = 0.11 (CI:0.07–0.17). Effectively, we have 20 times less chances to succeed at intubation on the second attempts at ILMA insertion than the first.

Discussion

This study demonstrates that, used by a trained FD nurse, the use of the ILMA is feasible and allows effective airway management during

Table 4 – Distribution of ventilation after intubation.

	Total		Success		Failure*		No CPR**	Not recorded
	N	%	N	%	N	%	N	N
Total	1464	100	1078	73.63	321	21.92	56	9
Patient's age								
<18 years	11	0.75	7	0.47	2	0.13	1	1
19–49 years	189	12.90	143	9.76	34	2.32	9	3
50–74 years	637	43.51	461	31.48	152	10.38	23	1
≥75 years	610	41.66	457	31.21	129	8.81	20	4
Not recorded	17	1.16	10	0.68	4	0.27	3	0
Gender of the FD nurses								
Female	801	54.71	567	38.72	186	12.70	39	2
Male	657	44.87	509	34.76	132	9.01	16	7
Not recorded	6	0.40	2	0.13	3	0.20	1	0
Number of uses of the ILMA in emergency situations								
<5	458	31.28	307	20.96	121	8.26	25	5
5–10	339	23.15	244	16.66	82	5.60	12	1
>10	666	45.49	527	35.99	118	8.06	18	3
Not recorded	1	0.06	0	0.00	0	0.00	1	0
Number of training sessions								
1	182	12.43	119	8.12	54	3.68	9	0
2	202	13.79	142	9.69	54	3.68	6	0
3	186	12.70	132	9.01	44	3.00	9	1
4	142	9.69	106	7.24	29	1.98	3	4
≥5	752	51.36	579	39.54	140	9.56	29	4
Not recorded	0	0.00	0	0.00	0	0.00	0	0
The location of the intervention								
Patient's home	1138	77.73	828	56.55	261	17.82	45	4
Public place, workplace	190	12.97	140	9.56	37	2.52	8	5
Other	129	8.81	104	7.10	22	1.50	3	0
Not recorded	7	0.47	6	0.40	1	0.06	0	0
Start time of the intervention								
Day	952	65.02	695	47.47	222	15.16	30	5
Night	492	33.60	372	25.40	90	6.14	26	4
Not recorded	20	1.36	11	0.75	9	0.61	0	0
Difficult intubation criteria								
No	1425	97.33	1060	72.40	301	20.56	55	9
Yes	35	2.39	15	1.02	19	1.29	1	0
Not recorded	4	0.27	3	0.20	1	0.06	0	0
Number of attempts to introduce the ILMA								
1	1285	87.77	1025	70.01	204	13.93	51	5
2	158	10.79	49	3.34	102	6.96	4	3
3	14	0.95	4	0.27	9	0.61	0	1
4	2	0.13	0	0	2	0.13	0	0
≥5	1	0.06	0	0	1	0.06	0	0
Not recorded	4	0.27	0	0	3	0.20	1	0
The performance of the Chandy maneuver								
Yes	276	18.85	186	12.70	87	5.94	2	1
No	1090	74.45	882	60.24	184	12.5	22	2
Not recorded	98	6.69	10	0.68	50	3.41	32	6
Number of attempts at intubation								
0	109	7.44	0	0.00	52	3.55	56	1
1	1186	81.01	1020	69.67	163	11.13	0	3
2	124	8.46	50	3.41	72	4.91	0	2
3	19	1.29	5	0.34	14	0.95	0	0
4	0	0.00	0	0.00	0	0.00	0	0
5	1	0.06	0	0.00	1	0.06	0	0

Table 4 *(continued)*

	Total		Success		Failure*		No CPR**	Not recorded
	N	%	N	%	N	%	N	N
Not recorded	25	1.70	3	0.20	19	1.29	0	3

* 210 failures because the ventilation through the ILMA was ineffective and 111 because the ventilation through the tracheal tube was ineffective.
** After the insertion of the ILMA, but before the insertion of the tracheal tube, a doctor was on scene and he stop the cardio pulmonary resuscitation (CPR).

Table 5 – Univariate and multivariate analysis.

	Univariate			Multivariate			Target range
	OR	CI (95%)	Pr(OR)	OR	CI (95%)	Pr(OR)	
Patients's age							
<18 years	1.29	0.22–5.06	0.09				0.9–1.1
19–45 years							
50–74 years	0.86	0.56–1.23	0.26				0.9–1.1
≥75 years	0.99	0.65–1.43	0.38				0.9–1.1
Gender of the FD nurses	0.81	0.58–1.10	0.18				0.9–1.1
Start time of the intervention: day/night	0.93	0.70–1.22	1.00				0.7–0.9
Intervention's place							
Patient's home							
Public place	0.78	0.46–1.26	0.12				0.5–1
Patient's workplace	3.70	0.50–16.31	0.08				0.5–1
Duration of the intervention	0.99	0.97–1.01	1.00	0.99	0.97–1.01	1.00	0.9–1.1
Number of training sessions	1.02	0.98–1.06	0.87	1.01	0.96–1.06	0.67	1–2
Number of sitting in emergency	1.00	0.99–1.00	0.67	0.99	0.98–1.00	0.31	1–2
The performance of Chandy manoeuver	2.23	1.56–3.10	0.01	2.91	2.07–3.97	0.01	1–2
Number of attempts at ILMA	0.13	0.09–0.18	0.00	0.11	0.07–0.17	0.00	1–1.5
Number of attempts at intubation	1.25	0.95–1.64	0.92	1.95	1.43–2.61	0.59	1–2

OR = odds ratio, CI = credibility interval, Pr (OR) = probability that odds ratios are in a target range, ILMA = Intubating Laryngeal Mask Airway, FD = Fire Department.

OHCA. The characteristics of the study population are similar to the French population suffering of OHCA.[23]

The number of intubations considered difficult is smaller in our study.[24–29] The rate of difficult intubations in the paramedic based systems is between 13% and 26%.[30] A French work found the same result in a series of 355 intubations in prehospital settings.[31]

Previously reported success rate of ETI through the ILMA performed by the novice healthcare providers range from 43% to 97%.[32–35] The observed success rate for the insertion of ILMA in this study is similar to that reported previously in studies conducted in the operating room or in the prehospital settings.[6,36,37] English literature shows quite different results, but most studies have been done on mannequins, cadavers or on patients in the operating room. Keller et al. found that ventilation was satisfactory in 92% of cases and moderate to satisfactory in 89% of cases. Major leaks were recorded in 58% of cases.[38] Very few studies have analyzed the insertion of ILMA in prehospital care.[39] In our study, major leaks were twenty times less present than in the literature. Of note, in these 8 cases the attempt were not performed according to the recommandations.

The ILMA insertion failures are due to the presence of significant bleeding in the upper airway, the corpulence of the patient, anatomical abnormalities (head or neck cancer, hanged, severe head trauma or significant swelling of the tongue). In some situations, inserting the ILMA was possible and ventilation was ample, but intubation was unsuccessful. This is mainly due to the occurence of regurgitation, either before or during insertion of the ILMA. Other causes of obstruction founded were insufficient lubrication (6 cases), foreign bodies in the mouth (18 cases).

The most common complication was regurgitation which occurred most often after the beginning of resuscitation. Occurence of regurgitation after starting CPR due to the increased intrathoracic pressure during CPR and the fact that patients in prehospital settings are considered full stomach patients. The incidence of regurgitation in this study was lower compared with the results reported in historical data.[40]

In 143 cases, a deviation from the protocol was observed. Despite occurence of major leaks after ILMA insertion, the nurses introduced the TT and in 48 cases (33.56%) the ventilation after intubation was effective. In this study all 210 cases of failure of ventilation after ILMA insertion were considered as failure of the intubation.

This seems surprising, but only two factors were predictive of a successful intubation: the performance of the Chandy maneuver and the number of attempts at intubation. Conversely, the number of attempts at ILMA insertion was predictive of a failure of intubation. The sitting of Chandy maneuver facilitate the intubation. We can say that the success rate decreases abruptly after the first attempts at ILMA insertion, by about 20 times on the second attempt.

No factors related to the patient (age, gender, anatomy), intervention (when and where), FD nurses (number of training sessions, experience) significantly influence success of intubation through the ILMA. Usability of ILMA explains this fact. The ILMA is an easy device, with a fast learning curve although of the extra hospital difficult settings. The incurvation radius of ILMA, its stiffness and the ability to apply vertical traction force on the handle of the device probably contribute to the high success rate of placement.

This study has several limitations such as: (1) the goal of the study was limited to the assessment of feasibility and effectiveness of airway control whereas patient survival rate was not evaluated, (2) only clinical criteria were used to judge the success of the ventilation. Capnography, not available at the beginning of this study, was not used as a judgment criteria (3) the success rate of intubation was calculated only for patients in OHCA, (4) this study is an observational study. To account for potential confounding factors, multivariate analyses were used.

Future research could compare the impact of ILMA with traditional airway management for OHCA patients in a large randomized controlled trial.

Conclusion

In conclusion, the use of ILMA is feasible and allows effective airway management when performed by trained non medical healthcare professionals during OHCA. In these prospective series of 1464 OHCA, the success rate at ventilation through the ILMA was 85.38%. Among these 1464 cases, 73.63% could be properly ventilated after tracheal intubation through the ILMA. The most common complication was regurgitation, which was found in 16.18% of cases, mostly during BLS. Two factors were predictive of a successful tracheal intubation: the performance of the Chandy maneuver and the number of attempts at intubation. Conversely, the number of attempts at ILMA insertion was predictive of an intubation failure.

Conflict of interest

None.

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