Appendix 1: Delphi survey on the criteria of switching between non-invasive ventilation and spontaneous breathing

Introduction

Although there is a general consensus on when to initiate non-invasive ventilation in patients with hypercapnic acute respiratory failure, there are no precise and validated international guidelines to manage changes between periods of NIV and spontaneous breathing. As a result, switching from NIV to SB may be variable between study centers, and consequently, the determination of the ventilator-free days biased in the High-Flow ACRF study. We thus aimed to assess the agreement on the criteria proposed by the principal investigator of the High Flow ACRF study (JDR).

Methods

A Delphi survey technique was used to develop consensus. The experts selected for this study were expected to be the potential users of the criteria; therefore, the invited experts consisted of the co-investigators of the High Flow ACRF study. Invitations to participate were sent by email providing a link to the online survey. Individual responses from panel members were confidential and all panel members' details were anonymized.

Instructions and how consensus would be achieved were provided on the introductory page of the questionnaire. Each participant was requested to state his agreement on a five point scale (1= disagree, 2= somewhat disagree, 3= neither agree nor disagree, 4 = somewhat agree, 5= agree). There was an option for free comments at the end of each statement, to offer clarification or further information.

Statements included in round 1 were drafted by JDR and CG. The survey included 5 main statements and 2 to 4 sub statements. Two main statements pertained to the switch criteria (from NIV to SB, and from SB to NIV) and 3 main statements pertained to the definitions used in the switch criteria (improvement in clinical signs of moderate to severe respiratory distress; worsening in clinical signs of moderate to severe respiratory distress; no correction or impairment of hypercapnic respiratory acidosis on arterial blood gas). The scoring of each sub statement was requested only when the main statement was rated <4.

For the first round, the survey was sent to the 27 experts panel members who independently rated agreement for each statement. Participants who completed round 1 where further invited to complete round 2. Only statements with low agreement (i.e. that were not accepted in the first round) and therefore needed further consideration in a subsequent round were recirculated to the panelists. These statements were accompanied by comments that were made during round 1, the individual respondents rating and the median rating from the entire panel.

Commensurate with the objectives of the Delphi study, and in keeping with prior studies within the literature, consensus was set a priori at 80% of the respondents scoring each main statement 4 or 5. The a priori number of rounds to terminate the Delphi process was 2. The first and second tour questionnaires were sent by email to the panel members in March and April 2017, respectively. Up to 2 reminders were sent by email to non-respondents for each round.

Study data were collected by an electronic questionnaire and managed using a software developed in house. The questionnaire was piloted for content and format by two clinicians not participating into the Delphi study. Data generated by electronic survey was exported to SAS for analysis.

The percentage of respondents scoring an item 4 or 5 as well as the mean, median, and range score were calculated for each main statement, and sub statement if the main statement did not reach consensus.

Results

Data collection was completed between Mars and April 2017. All selected experts agreed to participate (n=27). Two questionnaires iterations were completed with 92.6 % (25 of 27) participation in the first iteration and 100 % participation in the second iteration (25 of 25, 2 members dropped out). The results of the Delphi survey incorporate the consensus opinion of the 25 members who completed both questionnaires. For the first round, the survey was sent to the 27 experts panel members who independently rated agreement for each statement. Four of five main statements achieved consensus at the first tour (Table 1). For the second round, the only one statement not attaining the a priori defined threshold for agreement (80%) was sent to all the panelists (Table 2). Seventy-two percent (18/25) of the panelists agreed on these statements at the second tour, thereby failing to reach consensus (Table 3). Based on the comments of the panelists, two related sub statements were reformulated and circulated by email. Panelists were asked to email back if they still did not agree.

Conclusion

Consensus was reached for 4 main statements, and 72 % of the panelists agreed on the fifth which was then reformulated, providing reassurance of the acceptability and applicability of the study protocol criteria by the study centers.

Table 1. Delphi results regarding the agreement on the main statements, round 1 (n=25). Bolded statements refer to the switch criteria.

No of main statement	Statements	Agreement	Range	Rating, mean (median)
1	**In the High Flow ACRF study, switch from non-invasive ventilation to spontaneous breathing will be required if one or more of the following criteria is met :**	68	1-5	3.8 (4)
	A. Improvement in clinical signs of moderate to severe respiratory distress i.e. one or more of the following criteria :			
	1) Dyspnea (decrease of at least 2 points in the VAS) 2) Respiratory rate ≤ 25/min 3) Use of accessory respiratory muscles (from severe to moderate, or moderate to absent) 4) Paradoxical abdominal motion (yes/no) 5) Regression of signs of respiratory encephalopathy (sleepiness and/or asterixis and/or confusion) (yes/no)			
	B. Stabilization or correction of hypercapnic respiratory acidosis on ABG i.e. pH≥7.30 and decrease in PaCO2 of at least 20% as compared to baseline value (inclusion)			
	C. Stabilization or correction of hypoxemia: 90% ≤SpO2≤ 94% and/or PaO2 ≥ 60 mmHg (8 kPa) with FiO2 ≤0.5 under NIV			
	D. Intolerance to NIV (agitation and/or mask removal, and/or patient's wish to interrupt session before).			
2	In the High Flow ACRF study, improvement in clinical signs of moderate to severe respiratory distress will be defined by one or more of the following criteria :	84	2-5	4.4 (5)
	A. Dyspnoea (decrease of at least 2 points in the visual analog scale)			
	B. Respiratory rate ≤ 25/min			
	C. Use of accessory respiratory muscles (from severe to moderate, or moderate to absent)			

	D. Paradoxical abdominal motion (yes/no)			
	E. Signs of respiratory encephalopathy (sleepiness and/or asterixis and/or confusion) (yes/no)			
3	**In the High Flow ACRF study, switch from spontaneous breathing to non-invasive ventilation will be required if one of the following criteria, at least, is met**	80	2-5	4.4 (5)
	A. Worsening in clinical signs of moderate to severe respiratory distress, i.e. one or more of the following criteria:			
	1) Dyspnea (increase of at least 2 points in the VAS scale) 2) Respiratory rate > 25/min 3) Use of accessory respiratory muscles (from absent to moderate, or moderate to severe) 4) Paradoxical abdominal motion (yes/no) 5) Signs of respiratory encephalopathy (sleepiness and/or asterixis and/or confusion) (yes/no)			
	B. No correction or impairment of hypercapnic respiratory acidosis on ABG, i.e. one of the following criteria:			
	1) pH < 7.30 and/or increase in PaCO2of at least 20% as compared to value under NIV 2) No correction or impairment of hypoxemia: SpO2 < 90% and/or PaO2 < 60 mmHg (8 kPa) with standard O2≥5 l/min or FiO2 ≥ 0.5 with HFHO			
4	In the High Flow ACRF study, worsening in clinical signs of moderate to severe respiratory distress will be defined by one or more of the following criteria :	92	1-5	4.4 (5)
	A. Dyspnea (increase of at least 2 points in the VAS scale)			
	B. Respiratory rate > 25/min			
	C. Use of accessory respiratory muscles (from absent to moderate, or moderate to severe)			
	D. Paradoxical abdominal motion (yes/no)			
	E. Signs of respiratory encephalopathy (sleepiness and/or asterixis and/or confusion) (yes/no)			
5	In the High Flow ACRF study no correction or impairment of hypercapnic	88	2-5	4.4 (5)

	respiratory acidosis on ABG will be defined by one of the following criteria			
	A. pH < 7.30 and/or increase in PaCO2 of at least 20% as compared to value under NIV :			
	B. No correction or impairment of hypoxemia: SpO2 < 90% and/or PaO2 < 60 mmHg (8 kPa) with standard O2 ≥ 5 l/min or FiO2 ≥0.5 with HFHO			

Table 2. Delphi results regarding the agreement on the sub-statements of the main statement not attaining agreement in round 1 (n=8).

No	Statements	Agreement	Range	Rating, mean (median)
1	**In the High Flow ACRF study, switch from non-invasive ventilation to spontaneous breathing will be required if one or more of the following criteria is met :**			
	A. Improvement in clinical signs of moderate to severe respiratory distress i.e. one or more of the following criteria :	75	2-5	4 (4)
	1) Dyspnea (decrease of at least 2 points in the VAS) 2) Respiratory rate≤ 25/min 3) Use of accessory respiratory muscles (from severe to moderate, or moderate to absent) 4) Paradoxical abdominal motion (yes/no) 5) Regression of signs of respiratory encephalopathy (sleepiness and/or asterixis and/or confusion) (yes/no)			
	B. Stabilization or correction of hypercapnic respiratory acidosis on ABG i.e. pH≥7.30 and decrease in PaCO2 of at least 20% as compared to baseline value (inclusion)	50	1-5	3.4 (3.5)
	C. Stabilization or correction of hypoxemia: 90% ≤SpO2 ≤94% and/or PaO2≥60 mmHg (8 kPa) with FiO2 ≤0.5 under NIV	50	1-5	3.5 (3.5)
	D. Intolerance to NIV (agitation and/or mask removal, and/or patient's wish to interrupt session before).	87	3-5	4.4 (4.5)

Table 3. Delphi results of the second round regarding the agreement on the sub-statements of the main statement not attaining agreement in round1 (n=7)

No	Statements	Agreement	Range	Rating, mean (median)
1	**In the High Flow ACRF study, switch from non-invasive ventilation to spontaneous breathing will be required if one or more of the following criteria is met* :**	72	2-5	4 (3.7)
	A. Improvement in clinical signs of moderate to severe respiratory distress i.e. one or more of the following criteria :	43	2-5	3.4(3)
	1) Dyspnea (decrease of at least 2 points in the VAS) 2) Respiratory rate≤25/min 3) Use of accessory respiratory muscles (from severe to moderate, or moderate to absent) 4) Paradoxical abdominal motion (yes/no) 5) Regression of signs of respiratory encephalopathy (sleepiness and/or asterixis and/or confusion) (yes/no)			
	B. Stabilization or correction of hypercapnic respiratory acidosis on ABG i.e. pH≥7.30 and decrease in PaCO2 of at least 20%** as compared to baseline value (inclusion)	72	1-5	3.7 (4)
	C. Stabilization or correction of hypoxemia: 90% ≤SpO2 ≤ 94% ***and/or PaO2 ≥ 60 mmHg (8 kPa) with FiO2≤ 0.5 under NIV	43	1-5	3.3 (3)
	D. Intolerance to NIV (agitation and/or mask removal, and/or patient's wish to interrupt session before).	100	4-5	4.7 (5)

* at least 2 criteria following round 2

** 10 % was proposed following round 2

*** 88%≤ SpO2≤ 92%** following round 2