INTELLiVENT-ASV

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HAMILTON MEDICAL

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Automated closed-loop FiO2 titration increases the percentage of time spent in optimal zones of oxygen saturation in pediatric patients-A randomized crossover clinical trial

Soydan E, Ceylan G, Topal S, Hepduman P, Atakul G, Colak M, Sandal O, Sari F, Karaarslan U, Novotni D, Schultz MJ, Agin H

Front Med (Lausanne). 2022 Aug 25;9:969218
PMID 36091711, **http://www.ncbi.nlm.nih.gov/pubmed/36091711**

Design	Randomized crossover clinical trial comparing Adaptive Support Ventilation (ASV) 1.1 with use of a closed-loop oxygen system vs. ASV 1.1 with manual oxygen titrations
Patients	30 children with a median age of 21 (11–48) months; including 12 (40%) with pediatric ARDS
Objectives	Compare automated ventilation with closed-loop control of oxygen to automated ventilation with manual titrations of oxygen with respect to the time spent in predefined SpO2 zones in pediatric critically ill patients
Main Results	The percentage of time spent in optimal SpO2 zones increased with use of the closed-loop oxygen control vs. manual oxygen control [96.1 (93.7–98.6) vs. 78.4 (51.3–94.8); P < 0.001]. The percentage of time spent in acceptable, suboptimal, and unacceptable zones decreased. Findings were similar with the use of closed-loop oxygen control compared to manual titration in patients with ARDS. The total number of closed-loop oxygen changes per patient was 52 (11.8–67) vs. manual changes 1 (0–2), (P < 0.001).
Conclusion	In critically ill pediatric patients, use of closed-loop control of oxygen titration increased the percentage of time spent within optimal SpO2 zones, and increased the total number of oxygen changes per patient

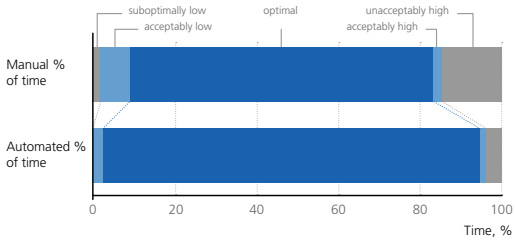

Figure 1: Percentage of time spent in unacceptably high/low, acceptably high/low, and optimal SpO2 zones. For illustrative purposes, the width of each bar represents the mean percentage of time spent

Fully automated postoperative ventilation in cardiac surgery patients: a randomised clinical trial

De Bie AJR, Neto AS, van Meenen DM, Bouwman AR, Roos AN, Lameijer JR, Korsten EHM, Schultz MJ, Bindels AJGH

Br J Anaesth . 2020 Nov;125(5):739-749
PMID 32739044, **http://www.ncbi.nlm.nih.gov/pubmed/32739044**

Design	Single-centre study, randomized controlled trial
Patients	220 patients at the end of cardiac surgery
Objectives	Compare automated and conventional ventilation regarding the proportion of postoperative ventilation time characterised by exposure to predefined optimal, acceptable, and critical (injurious) ventilatory parameters in the first three postoperative hours
Main Results	Subjects randomised to automated ventilation spent a 29.7% higher mean proportion of postoperative ventilation time receiving optimal postoperative ventilation. Automated ventilation reduced the proportion of postoperative ventilation time that subjects were exposed to injurious ventilatory settings by 2.5%. Severe hypoxaemia was less likely in subjects randomised to automated ventilation (risk ratio: 0.26 [0.22-0.31]). Subjects resumed spontaneous breathing more rapidly when randomised to automated ventilation (hazard ratio: 1.38 [1.05-1.83]).
Conclusion	Fully automated ventilation in patients after cardiac surgery optimised lung-protective ventilation, with fewer episodes of severe hypoxaemia and an accelerated resumption of spontaneous breathing

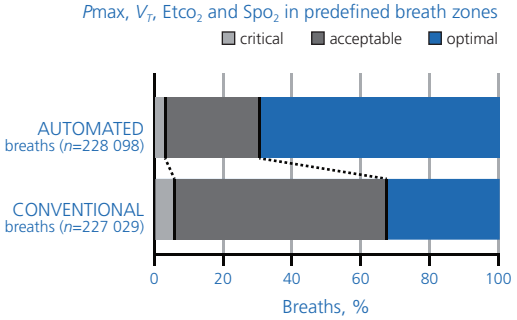

Figure 2: Patients spent more time in optimal and acceptable ranges

Closed loop ventilation mode in Intensive Care Unit: a randomized controlled clinical trial comparing the numbers of manual ventilator setting changes

Arnal JM, Garnero A, Novotni D, Corno G, Donati SY, Demory D, Quintana G, Ducros L, Laubscher T, Durand-Gasselin J

Minerva Anestesiologica 2018 January;84(1):58-67
PMID 28679200, **http://www.ncbi.nlm.nih.gov/pubmed/28679200**

Design	Randomized controlled study; INTELLiVENT-ASV versus conventional modes (VAC + PSV)
Patients	60 ICU patients with an expected duration of mechanical ventilation of at least 48 hours
Objectives	Compare the number of manual ventilator setting changes, the number of arterial blood gas analyses, the sedation dose and the user acceptance
Main Results	The number of manual ventilator setting changes per 24h per subject was lower in INTELLiVENT-ASV when compared to the conventional ventilation group (5 [4-7] versus 10 [7-17]; p<0.001). The number of arterial blood gas analyses and the sedation doses were not significantly different between the groups. Nurses and physicians reported that INTELLiVENT-ASV was significantly easier to use than conventional ventilation.
Conclusion	INTELLiVENT-ASV reduces the number of manual ventilator setting changes with the same number of arterial blood gas analyses and sedation dose, and is easier to use for the caregivers when compared to conventional ventilation modes

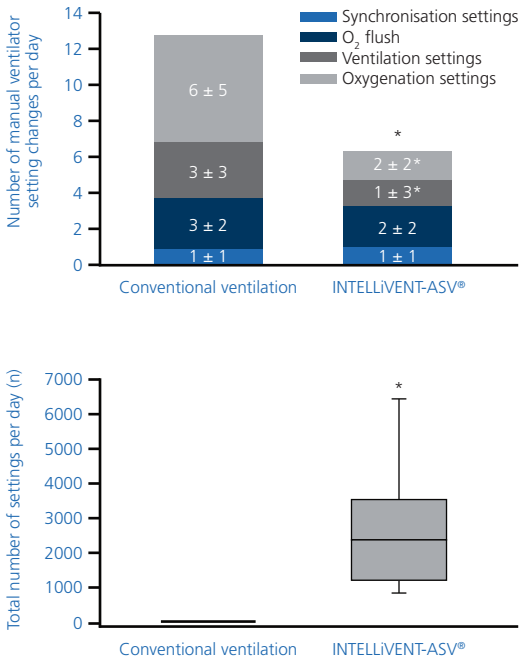

Figure 3: Number of manual ventilator setting changes and total number of ventilator setting changes per day, according to study group

Automated weaning from mechanical ventilation after off-pump coronary artery bypass grafting

Fot EV, Izotova NN, Yudina AS, Smetkin AA, Kuzkov VV, Kirov MY.
Front Med (Lausanne). 2017 Mar 21;4:31
PMID 28377920, **http://www.ncbi.nlm.nih.gov/pubmed/28377920**

Design	Randomized controlled study; INTELLiVENT-ASV with Quick Wean function versus protocolized weaning (SIMV + PSV)
Patients	40 patients after off-pump coronary artery bypass grafting
Objectives	Compare duration of mechanical ventilation and assess safety
Main Results	INTELLiVENT-ASV required a change in settings in 2 patients vs. 7 (5-9) adjustments per patient in the protocolized weaning group. Incidence and duration of unacceptable ventilation were reduced in the INTELLiVENT-ASV group. The FiO2 during spontaneous breathing trials was significantly lower in the INTELLiVENT-ASV group: 30 (30-35) vs. 40 (40-45)% in the protocolized weaning group. The time until tracheal extubation did not differ between the INTELLiVENT-ASV and the protocolized weaning groups: 193 (115-309) and 197 (158-253) minutes, respectively.
Conclusion	INTELLiVENT-ASV provides postoperative ventilation in a more protective way, reduces the workload on medical staff, and does not prolong the duration of weaning

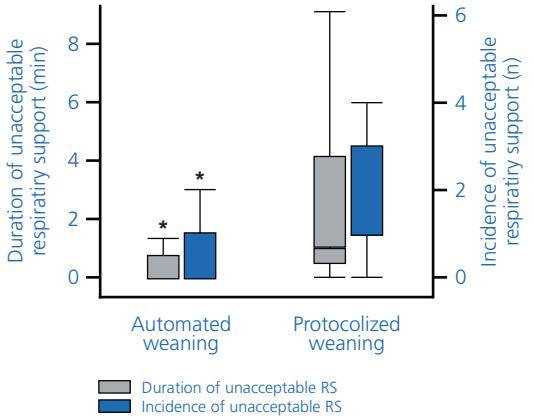

Figure 4: Incidence and duration of unacceptable ventilation were reduced in the INTELLiVENT-ASV group

Closed-loop ventilation mode (IntelliVent-ASV) in intensive care unit: a randomized trial of ventilation delivered

Bialais E, Wittebole X, Vignaux L, Roeseler J, Wysocki M, Meyer J, Reychler G, Novotni D, Sottiaux T, Laterre PF, Hantson P

Minerva Anestesiol. 2016 Jun;82(6):657-68
PMID 26957117, **http://www.ncbi.nlm.nih.gov/pubmed/26957117**

Design	Randomized controlled study, INTELLiVENT-ASV versus VPC and PSV
Patients	80 ICU patients ventilated for at least 48 h
Objectives	Compare safety, efficacy, and workload
Main Results	Ventilation parameters were similar in both groups except for PEEP (7 ±4 cmH2O vs. 6 ±3 cmH2O with INTELLiVENT-ASV and conventional ventilation, respectively, p = 0.028) and PetCO2 (36 ±7 mmHg with INTELLiVENT-ASV vs. 40 ±8 mmHg with conventional ventilation, p = 0.041). Safety was similar for INTELLiVENT-ASV and conventional ventilation for all parameters with the exception of Pmax. Efficacy was comparable for the two ventilation strategies for all parameters except SpO2 and Vt, which were more often optimal with INTELLiVENT-ASV (p = 0.005, p = 0.016, respectively). INTELLiVENT-ASV required fewer manual adjustments than conventional ventilation (p < 0.001) for a higher total number of adjustments (p < 0.001).
Conclusion	INTELLiVENT-ASV required fewer manual adjustments than conventional ventilation while delivering safe and effective ventilation

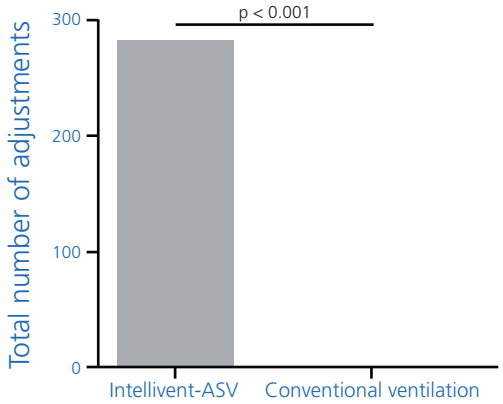

Figure 5: Total number of adjustments including automatic adjustments is higher with INTELLiVENT-ASV

Evaluation of fully automated ventilation: a randomized controlled study in post-cardiac surgery patients

Lellouche F, Bouchard PA, Simard S, L'Her E, Wysocki M
Intensive Care Med. 2013 Mar;39(3):463-71
PMID 23338569, **http://www.ncbi.nlm.nih.gov/pubmed/23338569**

Design	Randomized controlled study, INTELLiVENT-ASV versus VC + PSV
Patients	60 post-cardiac surgery patients
Objectives	Measure the duration of ventilation within a "not acceptable" range of tidal volumes
Main Results	The percentage of time within the predefined zones of optimal, acceptable, and not acceptable ventilation were 12%, 81%, and 7% with PV; and 89.5%, 10%, and 0.5% with INTELLiVENT-ASV ($p < 0.001$). 148 interventions during PV and 5 interventions with INTELLiVENT-ASV ($p < 0.001$).
Conclusion	INTELLiVENT-ASV was safe, reduced the number of interventions, and provided more time in the optimal zone and less time in the not-acceptable zone, in hemodynamically stable patients after cardiac surgery

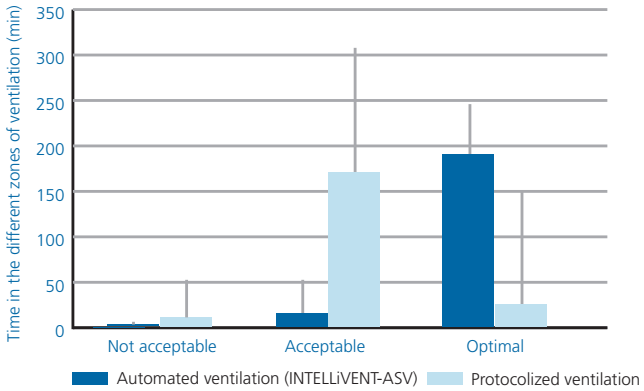

Figure 6: INTELLiVENT-ASV delivered more optimal ventilation than protocolized ventilation. Prococolized ventilation delivered acceptable ventilation.

Closed-Loop Versus Conventional Mechanical Ventilation in COVID-19 ARDS

Wendel Garcia PD, Hofmaenner DA, Brugger SD, Acevedo CT, Bartussek J, Camen G, Bader PR, Bruellmann G, Kattner J, Ganter C, Schuepbach RA, Buehler PK
J Intensive Care Med. 2021 Oct;36(10):1184-1193
PMID 34098803, **http://www.ncbi.nlm.nih.gov/pubmed/34098803**

Design	Prospective study: INTELLiVENT-ASV or conventional ventilation
Patients	40 critically ill, mechanically ventilated COVID-19 ARDS patients: 23 patients in INTELLiVENT-ASV group and 17 patients in conventional ventilation group
Objectives	Compare the percentage of lung-protective ventilation (defined as the combined target of Vt < 8 ml/kgPBW, dynamic ΔP < 15 cmH2O, Ppeak < 30 cmH2O, SpO2 ≥ 88% and dynamic mechanical power < 17 J/min) in INTELLiVENT-ASV versus conventional ventilation, assessed minute-by-minute during the initial seven days and the overall ventilation time
Main Results	1,048,630 min (728 d) of cumulative mechanical ventilation. During the initial 7 days, patients in the INTELLiVENT-ASV group were ventilated lung-protectively for 65% of the time versus 38% in the conventional group (P < 0.001), and for 45% versus 33% of the overall mechanical ventilation time (P < 0.001). In patients ventilated in the conventional group, 7 [3–12] manual changes were required each day to adapt mechanical ventilator settings, as opposed to 4 [2–7] in the INTELLiVENT-ASV group (P = 0.02). In comparison, the automated algorithm in the INTELLiVENT-ASV group adapted the ventilator settings every 2.8 [2.3–3.6] min.
Conclusion	INTELLiVENT-ASV was associated with a higher degree of lung-protective ventilation than was conventional mechanical ventilation.

Airway and transpulmonary driving pressures and mechanical powers selected by INTELLiVENT-ASV in passive, mechanically ventilated ICU patients

Arnal JM, Saoli M, Garnero A
Heart Lung. 2020 Jul-Aug;49(4):427-434
PMID 31733881, **http://www.ncbi.nlm.nih.gov/pubmed/31733881**

Design	Prospective observational study
Patients	255 adult ICU patients
Objectives	Investigate driving pressure (ΔP) and mechanical power (MP) (and also transpulmonary ΔP (ΔPL) and MP (MPL) for a subgroup of patients) delivered by INTELLiVENT-ASV
Main Results	98 patients were classified as normal-lung, 28 as COPD, and 129 as ARDS patients. The median ΔP was 8 (7-10), 10 (8-12), and 9 (8-11) cmH2O for normal-lung, COPD, and ARDS patients, respectively. The median MP was 9.1 (4.9 - 13.5), 11.8 (8.6 - 16.5), and 8.8 (5.6 - 13.8) J/min for normal-lung, COPD, and ARDS patients, respectively. For the 19 patients managed with transpulmonary pressure, ΔPL was 6 (4-7) cmH2O and MPL was 3.6 (3.1 - 4.4) J/min.
Conclusion	INTELLiVENT-ASV selected ΔP and MP considered in safe ranges for lung protection. In a subgroup of ARDS patients, the combination of a recruitment strategy and INTELLiVENT-ASV resulted in an apparently safe ΔPL and MPL.

Automated vs. conventional ventilation in the ICU: a randomized controlled crossover trial comparing blood oxygen saturation during daily nursing procedures (I-NURSING)

Chelly J, Mazerand S, Jochmans S, Weyer CM, Pourcine F, Ellrodt O, Thieulot- Rolin N, Serbource-Goguel J, Sy O, Vong LVP, Monchi M

Crit Care. 2020 Jul 22;24(1):453
PMID 32698860, **http://www.ncbi.nlm.nih.gov/pubmed/32698860**

Design	Prospective randomized controlled crossover trial
Patients	265 patients with FiO2 ≤ 60% and without prone positioning or neuromuscular blocking agents underwent two nursing procedures on the same day using automated (INTELLiVENT-ASV®) and conventional ventilation (VC, BiPAP, or PS) in a randomized order
Objectives	Compare SpO2 during nursing procedures performed on patients mechanically ventilated in automated and conventional ventilation modes (AV and CV, respectively)
Main Results	The percentage of time spent with SpO2 in the acceptable range was longer in the automated period than in the conventional period. Automated ventilation was associated with a higher number of nursing procedures carried out with SpO2 in the acceptable and a lower incidence of blood oxygen desaturation ≤ 85%.
Conclusion	Automated ventilation appears to reduce the incidence and severity of blood oxygen desaturation during nursing procedures in comparison to CV.

A prospective comparison of the efficacy and safety of fully closed-loop control ventilation (Intellivent-ASV) with conventional ASV and SIMV modes

Abutbul A, Sviri S, Zbedat W, Linton DM, van Heerden PV
S Afr J Crit Care. 2014 Aug;30(1):28-32

Design	Prospective crossover study
Patients	20 ICU patients ventilated at least 24h
Objectives	Compares the efficacy of INTELLiVENT-ASV, ASV, and SIMV on ventilation and oxygenation parameters, blood gases, and hemodynamic status
Main Results	INTELLiVENT-ASV automatically selected higher PEEP (7.6 ±5 cmH2O) than the physician in ASV (5.1 ±2 cmH2O) and SIMV (5.2 ± 2cmH2O), lower FiO2 (35 ±70 %) than ASV (41±60%) and SIMV (41 ±60%). There was no difference in RR, Vt , MV, Pinsp, PO2, and hemodynamic status. In ASV, PCO2 levels were lower than in INTELLiVENT-ASV and SIMV.
Conclusion	INTELLiVENT-ASV provides better oxygenation efficiency than ASV and SIMV
Comment	Same PO2 with lower FiO2 implies better ventilation/perfusion ratio due to higher PEEP, without hemodynamic consequences

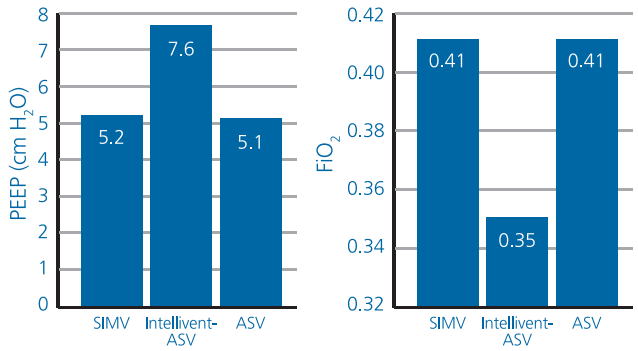

Figure 7: INTELLiVENT-ASV automatically selected higher PEEP and lower FiO2 than physicians in ASV and SIMV

Fully automated closed-loop ventilation is safe and effective in post-cardiac surgery patients

Beijers AJ, Roos AN, Bindels AJ
Intensive Care Med. 2014 May;40(5):752-3
PMID 24577110, **http://www.ncbi.nlm.nih.gov/pubmed/24577110**

Design	Prospective comparative non inferiority pilot study
Patients	128 low risk post cardiac surgery patients
Objectives	Compare safety and efficacy between INTELLiVENT-ASV, ASV, and conventional ventilation (PCV and PS)
Main Results	No ventilation-related safety issues. The number of interactions was lower in the INTELLiVENT-ASV group compared to the other groups. Duration of mechanical ventilation, reintubations, and desaturations were not different.
Conclusion	INTELLiVENT-ASV was safe and efficient in post cardiac surgery and required less interactions than conventional modes.

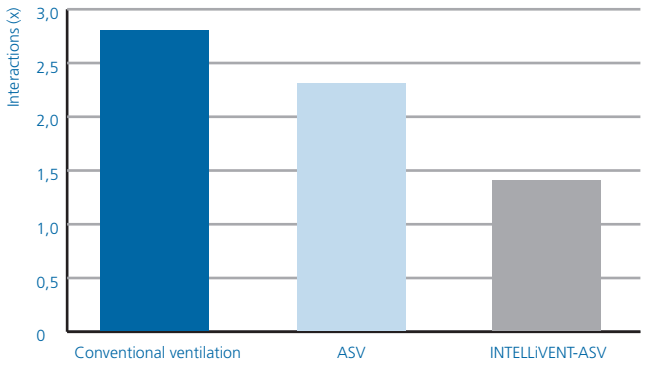

Figure 8: INTELLiVENT-ASV needed fewer manual settings than either ASV or conventional ventilation

Prospective randomized crossover study of a new closed-loop control system versus pressure support during weaning from mechanical ventilation

Clavieras N, Wysocki M, Coisel Y, Galia F, Conseil M, Chanques G, Jung B, Arnal JM, Matecki S, Molinari N, Jaber S

Anesthesiology. 2013 Sep;119(3):631-41
PMID 23619172 , **http://www.ncbi.nlm.nih.gov/pubmed/23619172**

Design	Prospective, randomized, single-blind crossover study. Two periods of 24 h, randomly PSV or INTELLiVENT-ASV
Patients	14 patients during the weaning phase
Objectives	Evaluate oxygenation and variability in the ventilatory parameters
Main Results	The PaO2/ FiO2 ratio improved significantly from 245 ± 75 at baseline to 294 ±123 after 24 h of INTELLiVENT-ASV. The coefficient of variation of inspiratory pressure and positive end-expiratory pressure were significantly higher with INTELLiVENT-ASV, 16 [11-21] and 15 [7-23]%, compared with 6 [5-7] and 7 [5-10]% in PSV. Inspiratory pressure, positive end-expiratory pressure, and FiO2 changes were adjusted significantly more often with INTELLiVENT-ASV compared with PSV.
Conclusion	INTELLiVENT-ASV improved oxygenation with more variability than PSV, mainly in Pinsp, PEEP, and FiO2

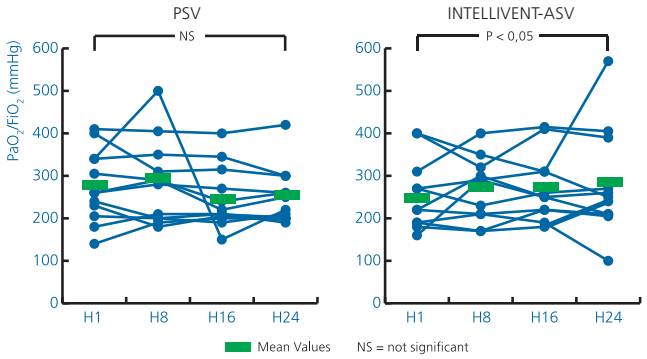

Figure 9: INTELLiVENT-ASV improved oxygenation in actively breathing ICU patients.

Feasibility study on full closed-loop control ventilation (INTELLiVENT-ASV) in ICU patients with acute respiratory failure: a prospective observational comparative study

Arnal JM, Garnero A, Novotni D, Demory D, Ducros L, Berric A, Donati SY, Corno G, Jaber S, Durand-Gasselin J
Crit Care. 2013 Sep 11;17(5):R196
PMID 24025234, **http://www.ncbi.nlm.nih.gov/pubmed/24025234**

Design	Prospective observational comparative feasability study
Patients	100 unselected ICU patients
Objectives	Compare oxygenation and ventilation settings automatically selected by INTELLiVENT-ASV in 3 lung conditions: normal lungs, ARDS, and COPD, in passive and active patients
Main Results	No safety issues. Fully automated ventilation was used for 95% of the total ventilation time. In passive patients, Vt was significantly different between normal lung, ARDS, and COPD patients, 8.1 (7.3-8.9) ml/kg PBW; 7.5 (6.9-7.9) ml/kg PBW; 9.9 (8.3-11.1) ml/kg PBW, respectively. In passive ARDS patients, FiO2 and PEEP were statistically higher than passive normal lung (35 (33-47)% versus 30 (30-31)%, and 11 (8-13) cmH2O versus 5 (5-6) cmH2O, respectively. The ventilation controller was deactivated in 2 patients for 1 day (increased CO2 gradient). PEEP and FiO2 controllers were deactivated for 1 day in 7 patients because of poor SpO2 quality (5 shocks, 1 therapeutic hypothermia, 1 severe chronic arterial disease). The PEEP controller was deactivated in 3 patients (1 COPD, 1 pneumothorax, and 1 ARDS). The FiO2 controller was deactivated in one COPD patient (hyperoxia).
Conclusion	INTELLiVENT-ASV was safely used in unselected ventilated ICU patients. Automatically selected oxygenation and ventilation settings were different according to the lung condition.

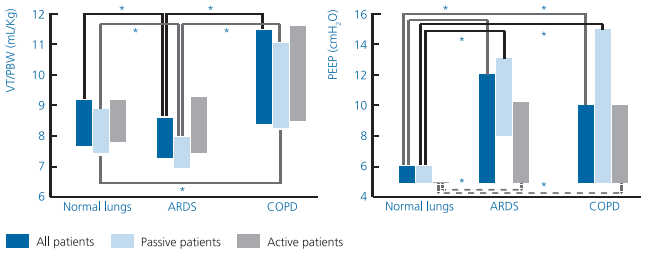

Figure 10: The ventilation parameter Vt was different according to lung condition in the passive patient subgroup. It was not significantly different in the active patient subgroup, as ventilation drive controlled volume and the respiratory rate. The oxygenation parameter PEEP was different according to lung condition in all patients (active and passive).

Safety and efficacy of a fully closed-loop control ventilation (INTELLiVENT-ASV) in sedated ICU patients with acute respiratory failure: a prospective randomized crossover study

Arnal JM, Wysocki M, Novotni D, Demory D, Lopez R, Donati S, Granier I, Corno G, Durand-Gasselin J
Intensive Care Med. 2012 May;38(5):781-7
PMID 22460854, **http://www.ncbi.nlm.nih.gov/pubmed/22460854**

Design	Prospective randomized crossover comparative study. Two periods of 2 h randomly ASV or INTELLiVENT-ASV
Patients	50 sedated ICU patients with ARDS
Objectives	Assess the safety and efficacy of INTELLiVENT-ASV in passive patients
Main Results	No safety issue. MV and Vt decreased from 7.6 (6.5-9.5) to 6.8 (6.0-8.0) l/min and from 8.3 (7.8-9.0) to 8.1 (7.7-8.6) ml/kg PBW during INTELLiVENT-ASV as compared to ASV. Pplat and FiO2 decreased from 24 (20-29) to 20 (19-25) cmH2O and from 40 (30-50) to 30 (30-39)% during INTELLiVENT-ASV as compared to ASV. RR, Pinsp, and PEEP decreased during INTELLiVENT-ASV as compared to ASV. Respiratory mechanics and blood gases were not different except for PaCO2, which was higher during INTELLiVENT-ASV.
Conclusion	INTELLiVENT-ASV was safe in passive patients with acute respiratory failure

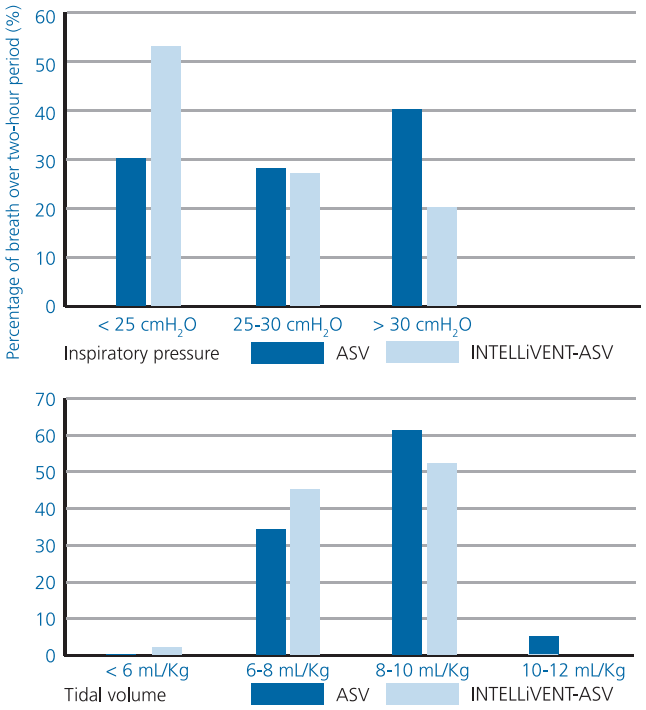

Figure 11: INTELLiVENT-ASV decreased Pinsp and Vt compared with ASV

Effect of INTELLiVENT-ASV versus Conventional Ventilation on Ventilation Intensity in Patients with COVID-19 ARDS-An Observational Study

Buiteman-Kruizinga L, Mkadmi H, Serpa Neto A, Kruizinga M, Botta M, Schultz M, Paulus F, van der Heiden P
J Clin Med. 2021 Nov 19;10(22):5409
PMID 34830691, **http://www.ncbi.nlm.nih.gov/pubmed/34830691**

Design	Retrospective study
Patients	51 COVID-19 ARDS patients
Objectives	Compare the intensity of ventilation (driving pressure [ΔP] and mechanical power [MP]) in INTELLiVENT-ASV versus conventional ventilation in COVID-19 ARDS patients
Main Results	Compared to conventional ventilation, INTELLiVENT-ASV delivered ventilation with lower ΔP and less MP: 1 hour before conversion, conventional ventilation delivered ΔP = 13 cmH2O and MP = 24.8 J/min, whereas 1 hour after conversion to INTELLiVENT-ASV, ΔP was 11 cmH2O and MP was 18.8 J/min.
Conclusion	Conversion from conventional ventilation to INTELLiVENT-ASV resulted in a lower intensity of ventilation

Predictive factors for successful INTELLiVENT-ASV® use: a retrospective observational study

Katayama S, Tonai K, Shima J, Koyama K, Nunomiya S
BMC Anesthesiol. 2020 Apr 25;20(1):94
PMID 32334537, **http://www.ncbi.nlm.nih.gov/pubmed/32334537**

Design	Single-center, retrospective observational study
Patients	189 adult ICU patients categorized into the " INTELLiVENT-ASV success" group and " INTELLiVENT-ASV failure" group
Objectives	Report the initial three years of experience using INTELLiVENT-ASV, the clinical conditions; and the technical and organizational factors associated with its use
Main Results	135 patients (71.4%) were categorized into the INTELLiVENT-ASV success group. In the INTELLiVENT-ASV success group, the reasons for ICU admission included post-elective surgery (94.1%), post-emergent surgery (81.5%), and other medical reasons (55.6%). INTELLiVENT-ASV failure was associated with a low P/F ratio and high APACHE II score. The main reasons for not using INTELLiVENT-ASV included strong inspiratory effort and asynchrony.
Conclusion	Most of the ventilated patients could be managed successfully with INTELLiVENT-ASV. During the implementation of INTELLiVENT-ASV, the most severe patients should be excluded until the team is experienced in using it

A rational framework for selecting modes of ventilation

Mireles-Cabodevila E, Hatipo□lu U, Chatburn RL
Respir Care. 2013 Feb;58(2):348-66 Erratum in Respir Care. 2013 Apr;58(4):e51
PMID 22710796, **http://www.ncbi.nlm.nih.gov/pubmed/22710796**

Design	Review
Patients	All ICU patients
Objectives	Describe and compare ventilatory modes
Main Results	INTELLiVENT-ASV is PC-IMV(OI,OI) [order- family(genus, species)]: pressure control, intermittent mandatory ventilation, optimal intelligence for the primary and secondary breaths targeting schemes.
Conclusion	INTELLiVENT-ASV is first among all modes in terms of safety (ventilation and oxygenation optimization), comfort, and weaning

Accuracy of two pulse-oximetry measurements for INTELLiVENT-ASV in mechanically ventilated patients: a prospective observational study

Katayama S, Shima J, Tonai K, Koyama K, Nunomiya S
Sci Rep. 2021 Apr 26;11(1):9001
PMID 33903716, **http://www.ncbi.nlm.nih.gov/pubmed/33903716**

Design	Prospective observational study
Patients	100 mechanically ventilated patients and 1,497 arterial blood gas results
Objectives	Evaluate the accuracy of SpO2 measurements from a Nihon Kohden and a Masimo monitor compared to actual SaO2
Main Results	The Nihon Kohden SpO2 measurements were less biased than Masimo measurements. Nihon Kohden and Masimo SpO2 measurements were not significantly different in the "SaO2 < 94%" group. In the "94% ≤ SaO2 < 98%" and "SaO2 ≥ 98%" groups, there were significant differences between the Nihon Kohden and Masimo SpO2 measurements.
Conclusion	When using automatic control of oxygenation with INTELLiVENT-ASV in mechanically ventilated patients, the Nihon Kohden SpO2 sensor is preferable

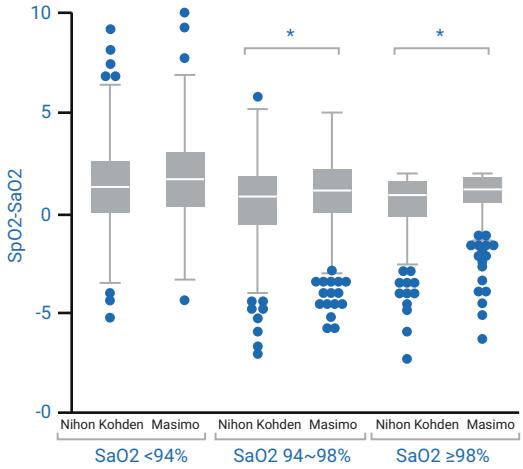

Figure 12: Differences in the pulse oximeters' SpO2 measurements among SaO2 categories

Adaptive support ventilation with and without end-tidal CO2 closed loop control versus conventional ventilation

Sulemanji DS, Marchese A, Wysocki M, Kacmarek RM
Intensive Care Med. 2013 Apr;39(4):703-10
PMID 23151992, **http://www.ncbi.nlm.nih.gov/pubmed/23151992**

Design	Comparative Simulation study
Patients	Lungs model
Objectives	Compare PC, VC, ASV and ASV with ventilation controller in 4 clinical scenarios : Normal lung, COPD, ARDS and brain injury; with 2 points of interest : capnia and Pplat
Main Results	Ventilation parameters in normal lungs, brain injury, and COPD were similar for all modes. In ARDS, capnia was higher in ASV with the ventilation controller than in other modes, Pplat in ASV and ASV with ventilation controller were lower than in VC.
Conclusion	PC, VC, ASV, and ASV with ventilation controller performed similarly in most cases. In ARDS patients, ASV with ventilation controller delivered safer ventilation.

A pilot prospective study on closed loop controlled ventilation and oxygenation in ventilated children during the weaning phase.

Jouvet P, Eddington A, Payen V, Bordessoule A, Emeriaud G, Gasco RL, Wysocki M
Crit Care. 2012 May 16;16(3):R85
PMID 22591622, **http://www.ncbi.nlm.nih.gov/pubmed/22591622**

Design	Prospective observational safety study 5 periods : PSV, ASV, ASV with ventilation controller, INTELLiVENT-ASV, PSV.
Patients	15 childrens, more than 7 Kg during the weaning phase
Objectives	Assess the safety by the percentage of time in normal ventilation
Main Results	No adverse events. Vt, RR, Pinsp, and MV were equivalent for all modalities. The percentage of time in normal ventilation were equivalent for all modalities. The PEEP controller needs further investigation.
Conclusion	ASV with ventilation controller and INTELLiVENT-ASV were safe and kept children under normal ventilation most of the time
Comment	The large ranges of normal ventilation in pediatric patients were probably responsible for the similarity between the groups.

Additional files

Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and acute respiratory distress syndrome

The Acute Respiratory Distress Syndrome Network
N Engl J Med. 2000 May 4;342(18):1301-8
PMID 10793162, **http://www.ncbi.nlm.nih.gov/pubmed/10793162**

Design	Multicenter randomized controlled study lower Vt (6 ml/Kg) et Pplat (30 cmH2O) versus traditionnal Vt (12 mL/Kg) et Pplat (50 cmH2O)
Patients	861 patients with ARDS
Objectives	Compare protective ventilation and traditional ventilation on clinical outcomes
Main Results	Mortality was lower in the lower Vt group than in the group treated with traditional tidal volumes (31.0 % vs. 39.8 %), and the number of days without ventilator during the first 28 days was greater in this group (12 ±11 vs. 10 ±11)
Conclusion	The "ARDSNet table" supports the way in which the oxygenation controller increases PEEP and FiO2

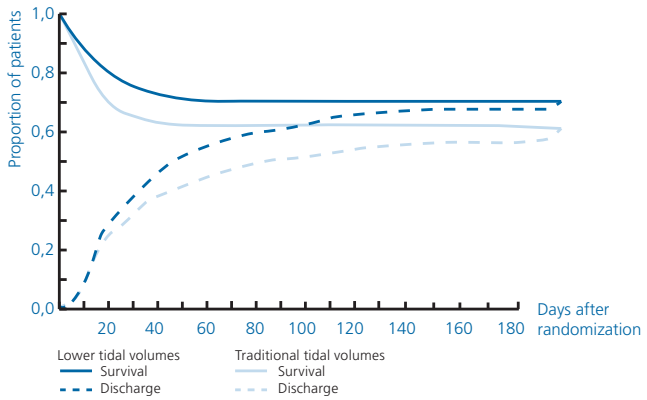

Figure 13: Probability of survival and of discharge were higher in the lower Vt group than in the traditional Vt group.

Effectiveness, safety and efficacy of INTELLiVENT-ASV, a closed-loop ventilation mode for use in ICU patients - a systematic review

Botta M, Wenstedt EFE, Tsonas AM, Buiteman-Kruizinga LA, van Meenen DMP, Korsten HHM, Horn J, Paulus F, Bindels AGJH, Schultz MJ, De Bie AJR
Expert Rev Respir Med. 2021 Jul 31:1-11
PMID 34047244, **http://www.ncbi.nlm.nih.gov/pubmed/34047244**

Design	Systematic review
Main Results	Studies suggest INTELLiVENT-ASV to be an effective automated mode with regard to the titrations of tidal volume, airway pressure, and oxygen
Conclusion	INTELLiVENT-ASV is as safe as conventional modes and as effective in terms of ventilation and oxygenation. Future studies are needed to test its efficacy

Higher versus lower positive end-expiratory pressures in patients with acute respiratory distress syndrome

Brower RG, Lanken PN, MacIntyre N, Matthay MA, Morris A, Ancukiewicz M, Schoenfeld D, Thompson BT; National Heart, Lung, and Blood Institute ARDS Clinical Trials Network
N Engl J Med. 2004 Jul 22;351(4):327-36
PMID 15269312, **http://www.ncbi.nlm.nih.gov/pubmed/15269312**

Design	Randomized controlled study lower versus higher PEEP levels, according to different tables of predetermined combinations of PEEP and FiO2
Patients	549 patients with ARDS
Objectives	Compare the effects of higher and lower PEEP levels on clinical outcomes
Main Results	PEEP was 8 cmH2O in the lower-PEEP group and 13 cmH2O in the higher-PEEP group. Hospital deaths were 24.9% and 27.5%, respectively. From day 1 to day 28, breathing was unassisted for a mean of 14.5 ±10.4 days in the lower-PEEP group and 13.8 ±10.6 days in the higher-PEEP group.
Conclusion	This study supports the high PEEP-FiO2 table used by the oxygenation controller for decreasing treatment
Comment	PEEP was not set according to recruitability. However, a high PEEP in patients with low potential of recruitability has a negative effect, and low PEEP in patients with high potemtial of recruitability is harmful.

Conservative oxygen therapy in mechanically ventilated patients: a pilot before-and-after trial

Suzuki S, Eastwood GM, Glassford NJ, Peck L, Young H, Garcia-Alvarez M, Schneider AG, Bellomo R
Crit Care Med. 2014 Jun;42(6):1414-22
PMID 24561566, **http://www.ncbi.nlm.nih.gov/pubmed/24561566**

Design	Before-After study
Patients	108 ICU patients ventilated for more than 48h
Objectives	Compare 2 oxygenation goals: prescribed by clinician and SpO2 = 90-92%
Main Results	During period with "SpO2 = 90-92%", the SpO2, PaO2, and FiO2 were lower than during "prescribed goal" (95.5%, 83 torr and, 0.27 versus 98.4%, 107 torr, and 0.40, respectively). "SpO2 = 90-92%", decreased the total amount of oxygen delivered by two thirds (16 L vs 5 L; $p < 0.001$). The PaO2/FIO2 ratio was similar during the 2 periods. There were no difference in biochemical or clinical outcomes
Conclusion	Oxygenation goal "SpO2 = 90-92%" in mechanically ventilated ICU patients was feasible and safe, and decrease the oxygen consumption.

Automated weaning from mechanical ventilation: Results of a Bayesian network meta-analysis

Neuschwander A, Chhor V, Yavchitz A, Resche-Rigon M, Pirracchio R
J Crit Care. 2021 Feb;61:191-198
PMID 33181416, **http://www.ncbi.nlm.nih.gov/pubmed/33181416**

Design	Bayesian network Meta-Analysis
Patients	26 trials, 2,097 patients
Objectives	Compare the automated modes for MV weaning in critically ill and post-operative adult patients
Main Results	663 articles were screened and 26 trials (2,097patients) were included in the final analysis. All automated modes included in the study (ASV, INTELLiVENT-ASV, Smartcare, Automode, PAV and MRV) outperformed standard-of-care; but no automated mode reduced the duration of mechanical ventilation weaning in comparison to others in the network meta-analysis.
Conclusion	Compared to standard weaning practice, all automated modes reduced the duration of MV weaning in critically ill and post-operative adult patients, but no difference was observed among automated modes.

The dawn of physiological closed-loop ventilation-a review

Platen PV, Pomprapa A, Lachmann B, Leonhardt S
Crit Care. 2020 Mar 29;24(1):121
PMID 32223754, **http://www.ncbi.nlm.nih.gov/pubmed/32223754**

Design	Review
Conclusion	This review shows the evolution of the physiological closed-loop control of mechanical ventilation

Optimal duration of a sustained inflation recruitment maneuver in ARDS patients

Arnal JM, Paquet J, Wysocki M, Demory D, Donati S, Granier I, Corno G, Durand-Gasselin J
Intensive Care Med. 2011 Oct;37(10):1588-94
PMID 21858522, **http://www.ncbi.nlm.nih.gov/pubmed/21858522**

Design	Prospective study
Patients	50 patients with ARDS
Objectives	Measure the dynamics of recruitment and the hemodynamic status during a sustained inflation recruitment maneuver
Main Results	Time constant was 2.3 ±1.3 s = most of recruitment occured in the first 10 s. Hemodynamic status was maintained for 10 s then decreased significantly.
Conclusion	In early-onset ARDS patients, a sustained inflation RM for 10 s was sufficient and safe. Supports the method used for automatic recruitment maneuver

Higher vs lower positive end-expiratory pressure in patients with acute lung injury and acute respiratory distress syndrome: systematic review and meta-analysis

Briel M, Meade M, Mercat A, Brower RG, Talmor D, Walter SD, Slutsky AS, Pullenayegum E, Zhou Q, Cook D, Brochard L, Richard JC, Lamontagne F, BhatnagarN, Stewart TE, Guyatt G
JAMA. 2010 Mar 3;303(9):865-73
PMID 20197533, **http://www.ncbi.nlm.nih.gov/pubmed/20197533**

Design	Meta-Analysis
Patients	2299 patients with ARDS 3 trials
Objectives	Evaluate the association of higher vs lower PEEP with patient outcomes
Main Results	Mortality was 32.9% in patients assigned to the higher PEEP group and 35.2% in the lower PEEP group (adjusted relative risk = 0.94; 95% confidence interval [CI], 0.86-1.04)
Conclusion	Higher levels of PEEP were associated with improved survival in ARDS patients. This open-lung concept supports the way in which the oxygenation controller decreases PEEP and FiO2

BTS guideline for emergency oxygen use in adult patients

O'Driscoll BR, Howard LS, Davison AG; British Thoracic Society
Thorax. 2008 Oct;63 Suppl 6:vi1-68
PMID 18838559, **http://www.ncbi.nlm.nih.gov/pubmed/18838559**

Design	Guidelines
Patients	Critically ill patients
Objectives	Summarize the oxygen prescription
Conclusion	Target saturation 94-98% Except for patients with chronic hypercapnia 88-92% Supports the SpO2 target used by the oxygenation controller

Low mortality rate in adult respiratory distress syndrome using low-volume, pressure-limited ventilation with permissive hypercapnia: a prospective study

Hickling KG, Walsh J, Henderson S, Jackson R
Crit Care Med. 1994 Oct;22(10):1568-78
PMID 7924367, **http://www.ncbi.nlm.nih.gov/pubmed/7924367**

Design	Prospective descriptive study of ventilation management with limitation of peak inspiratory pressure and the use of low tidal volumes
Patients	53 severe ARDS patients
Objectives	Evaluate the outcomes in patients with severe adult respiratory distress syndrome who are managed with reduction of regional lung overdistention and permissive hypercapnia
Main Results	The mean maximum PaCO2 was 66.5 mmHg (range 38 to 158 mmHg) and the mean arterial pH was 7.23 (range 6.79 to 7.45). The hospital mortality rate was significantly lower than that predicted by the APACHE II scores (26.4% vs. 53.3%, p = .004), even after correcting the latter for the effect of hypercapnic acidosis (26.4% vs. 51.1%). Mortality increased with the number of organ failures: 43% in patients with ≥ 4 failures, 20.5% with ≤ 3 failures, and 6.6% with only respiratory failure.
Conclusion	Supports the permissive hypercapnia concept used by the ventilation controller when Pinsp is above 25 cmH2O

Bench-to-bedside review: hypercapnic acidosis in lung injury: from 'permissive' to 'therapeutic'

Ijland MM, Heunks LM, van der Hoeven JG
Crit Care. 2010;14(6):237
PMID 21067531, **http://www.ncbi.nlm.nih.gov/pubmed/21067531**

Design	Review
Conclusion	Explains the physiopathology and benefits of permissive hypercapnia

The work of breathing

OTIS AB
Physiol Rev. 1954 Jul;34(3):449-58
PMID 13185751, **http://www.ncbi.nlm.nih.gov/pubmed/13185751**

Design	Physiological study
Conclusion	Supports the ASV principle of selecting a Vt-RR combination according to the least work of breathing principle

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