Asynchronies bibliography

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HAMILTON MEDICAL

Intelligent Ventilation since 1983

Asynchronies during mechanical ventilation are associated with mortality

Blanch L, Villagra A, Sales B, Montanya J, Lucangelo U, Luján M, García-Esquirol O, Chacón E, Estruga A, Oliva JC, Hernández-Abadia A, Albaiceta GM, Fernández-Mondejar E, Fernández R, Lopez-Aguilar J, Villar J, Murias G, Kacmarek RM

Intensive Care Med. 2015 Apr;41(4):633-41
PMID 25693449 , **http://www.ncbi.nlm.nih.gov/pubmed/25693449**

Design	Prospective, noninterventional observational study
Patients	50 patients admitted to intensive care unit beds equipped with Better CareTM software throughout mechanical ventilation
Objectives	This study aimed to assess the prevalence and time course of asynchronies during mechanical ventilation (MV).
Main Results	Asynchronies were detected in all patients and in all ventilation modes. The median asynchrony index (AI) was 3.41 % [IQR 1.95-5.77]; the most common asynchrony overall and in each mode was ineffective inspiratory efforts durng expiration (IEE) [2.38 % (IQR 1.36-3.61)]. Asynchronies were less frequent from 12 pm to 6 am [1.69 % (IQR 0.47-4.78)]. In the hours where more than 90% of breaths were machine-triggered, the median AI decreased, but asynchronies were still present. When we compared patients with AI > 10 vs AI ≤ 10 %, we found similar reintubation and tracheostomy rates, but higher ICU and hospital mortality, as well as a trend towards a longer duration of MV in patients with an AI above the cutoff.
Conclusion	Asynchronies are common throughout MV, occurring in all MV modes and more frequently during the daytime. Further studies should determine whether asynchronies are a marker for, or a cause of mortality.

Patient-ventilator asynchrony during assisted mechanical ventilation

Thille AW, Rodriguez P, Cabello B, Lellouche F, Brochard L
Intensive Care Med. 2006 Oct;32(10):1515-22
PMID 16896854, **http://www.ncbi.nlm.nih.gov/pubmed/16896854**

Patients	62 consecutive patients requiring mechanical ventilation for more than 24 h were included prospectively as soon as they triggered all ventilator breaths: assist-control ventilation (ACV) in 11 and pressure-support ventilation (PSV) in 51
Objectives	The incidence, pathophysiology, and consequences of patient-ventilator asynchrony are poorly known. We assessed the incidence of patient-ventilator asynchrony during assisted mechanical ventilation and we identified associated factors.
Main Results	Fifteen patients (24%) had an asynchrony index greater than 10% of respiratory efforts. Ineffective triggering and double-triggering were the two main asynchrony patterns. Asynchrony existed during both ACV and PSV, with a median number of episodes per patient of 72 (range 13-215) vs. 16 (4-47) in 30 min, respectively (p=0.04). Double-triggering was more common during ACV than during PSV, but no difference was found for ineffective triggering. Ineffective triggering was associated with a less sensitive inspiratory trigger, higher level of pressure support (15 cmH(2)O, IQR 12-16, vs. 17.5, IQR 16-20), higher tidal volume, and higher pH. A high incidence of asynchrony was also associated with a longer duration of mechanical ventilation (7.5 days, IQR 3-20, vs. 25.5, IQR 9.5-42.5).
Conclusion	One-fourth of patients exhibit a high incidence of asynchrony during assisted ventilation. Such a high incidence is associated with a prolonged duration of mechanical ventilation. Patients with frequent ineffective triggering may receive excessive levels of ventilatory support.

Bedside waveforms interpretation as a tool to identify patient-ventilator asynchronies

Georgopoulos D1, Prinianakis G, Kondili E
Intensive Care Med. 2006 Jan;32(1):34-47
PMID 16283171, **http://www.ncbi.nlm.nih.gov/pubmed/16283171**

Objectives	This review discusses the basic waveforms during assisted mechanical ventilation and how their interpretation may influence the management of ventilated patients. The discussion is limited on waveform eye interpretation of the signals without using any intervention which may interrupt the process of mechanical ventilation.
Main Results	Flow, volume, and airway pressure may be used to (a) identify the mode of ventilator assistance, triggering delay, ineffective efforts, and autotriggering, (b) estimate qualitatively patient's respiratory efforts, and (c) recognize delayed and premature opening of exhalation valve. These signals may also serve as a tool for gross estimation of respiratory system mechanics and monitor the effects of disease progression and various therapeutic interventions.
Conclusion	Flow, volume, and airway pressure waveforms are valuable real-time tools in identifying various aspects of patient-ventilator interaction.

Patient-ventilator trigger asynchrony in prolonged mechanical ventilation

Chao DC, Scheinhorn DJ, Stearn-Hassenpflug M
Chest. 1997 Dec;112(6):1592-9
PMID 9404759, **http://www.ncbi.nlm.nih.gov/pubmed/9404759**

Design	Descriptive and prospective cohort study
Patients	Two hundred consecutive ventilator-dependent patients, transferred to Barlow Respiratory Hospital over an 18-month period for attempted weaning from PMV
Objectives	The objective of this study was to investigate patient-ventilator trigger asynchrony (TA), its prevalence, physiologic basis, and clinical implications in patients requiring prolonged mechanical ventilation (PMV).
Main Results	Of the 200 patients screened, 26 were excluded and 19 were found to have TA. Patients with TA were older, carried the diagnosis of COPD more frequently, and had more severe hypercapnia than their counterparts without TA. Only 3 of 19 patients (16%), all with intermittent TA, were weaned from mechanical ventilation after 70, 72, and 108 days, respectively. This is in contrast to a weaning success rate of 57%, with a median (range) time to wean of 33 (3 to 182) days in patients without TA. Observation of uncoupling of accessory respiratory muscle movement and onset of machine breaths was accurate in identifying patients with TA, which was confirmed in all seven patients consenting to Peso monitoring. TA appeared to result from high auto-PEEP and severe pump failure. Adjusting trigger sensitivity and application of flow triggering were unsuccessful in eliminating TA; external PEEP improved but rarely led to elimination of TA that was transient in duration. Reduction of ventilator support in PS mode, with resultant increased respiratory pump output and lower tidal volumes, uniformly succeeded in eliminating TA. However, this approach imposed a fatiguing load on the respiratory muscles and was poorly tolerated.
Conclusion	TA can easily be identified clinically; when it occurs patients in a stable condition with PMV, it is associated with poor outcomes.

Observational study of patient-ventilator asynchrony and relationship to sedation level

de Wit M, Pedram S, Best AM, Epstein SK
J Crit Care. 2009 Mar;24(1):74-80
PMID 19272542 , **http://www.ncbi.nlm.nih.gov/pubmed/19272542**

Design	Observational Study
Objectives	Clinicians frequently administer sedation to facilitate mechanical ventilation. The purpose of this study was to examine the relationship between sedation level and patient-ventilator asynchrony.
Main Results	Twenty medical ICU patients underwent 35 observations. Ineffective triggering was seen in 17 of 20 patients and was the most frequent asynchrony (88% of all asynchronous breaths), being observed in 9% +/- 12% of breaths. Deeper levels of sedation were associated with increasing ITI (awake, yes 2% vs no 11%; P < .05; CAM-ICU, coma [15%] vs delirium [5%] vs no delirium [2%]; P < .05; RASS, 0, 0% vs -5, 15%; P < .05). Diagnosis of chronic obstructive pulmonary disease, sedative type or dose, mechanical ventilation mode, and trigger method had no effect on ITI.
Conclusion	Asynchrony is common, and deeper sedation level is a predictor of ineffective triggering.

Clusters of ineffective efforts during mechanical ventilation: impact on outcome

Vaporidi K, Babalis D, Chytas A, Lilitsis E, Kondili E, Amargianitakis V, Chouvarda I, Maglaveras N, Georgopoulos D

Intensive Care Med. 2017 Feb;43(2):184-191
PMID 27778044, **http://www.ncbi.nlm.nih.gov/pubmed/27778044**

Design	Observational study
Objectives	The aim of this study was to investigate the role of ineffective efforts (IEs), specifically clusters of IEs, during mechanical ventilation on the outcome of critically ill patients.
Main Results	The analysis included 2931 h of assisted ventilation and 4,456,537 breaths. Neither the IEs index (IEs as a percentage of total breaths) in general nor a value above 10 % was correlated with patient outcome. Overall, IEs events were identified in 38 % of patients. In multivariate analysis, the presence of events in the 1st day group (n = 79) was associated with the risk of being on mechanical ventilation ≥8 days after first recording [odds ratio 6.4, 95 % confidence interval (1.1-38.30)] and hospital mortality [20 (2.3-175)]. Analysis of the data for all patients revealed similarly increased risks for prolonged ventilation [3.4 (1.1-10.7)] and mortality [4.9 (1.3-18)].
Conclusion	Clusters of IEs are often present in mechanically ventilated critically ill patients and are associated with prolonged mechanical ventilation and increased mortality. Studies to find ways of improving patient-ventilator interaction are warranted.

Ability of ICU Health-Care Professionals to Identify Patient-Ventilator Asynchrony Using Waveform Analysis

Ramirez II, Arellano DH, Adasme RS, Landeros JM, Salinas FA, Vargas AG, Vasquez FJ, Lobos IA, Oyarzun ML, Restrepo RD
Respir Care. 2017 Feb;62(2):144-149
PMID 28108684, **http://www.ncbi.nlm.nih.gov/pubmed/28108684**

Design	Observational study
Main Results	A total of 366 health-care professionals (HCPs) were evaluated. Statistically significant differences were found when HCPs with and without prior training in mechanical ventilation (trained vs non-trained HCPs) were compared according to the number of asynchronies detected correctly. Of the HCPs who identified 3 asynchronies, 63 [81%] were trained vs 15 [19%] non-trained, P < .001; 2 asynchronies, 72 [65%] trained vs 39 [35%] non-trained, P = .034; 1 asynchrony, 55 [47%] trained vs 61 [53%] non-trained, P = .02; 0 asynchronies, 17 [28%] trained vs 44 [72%] non-trained, P < .001). HCPs who had prior training in mechanical ventilation also increased, nearly four-fold, their odds of identifying ≥2 asynchronies correctly (odds ratio 3.67, 95% CI 1.93-6.96, P < .001). However, neither years of experience nor profession were associated with the ability of HCPs to identify asynchrony.
Conclusion	HCPs who have specific training in mechanical ventilation increase their ability to identify asynchrony using waveform analysis. Neither experience nor profession proved to be a relevant factor to identify asynchrony correctly using waveform analysis.

Cycling-off guided by real time waveform analysis (IntelliSync+): pilot study on next generation PSV

Mojoli F, Orlando A, Bianchi I, Torriglia F, Bianzina S, Pozzi M, Iotti G.A, Braschi A, PLUG Working Group
PMID 55555555, **http://www.ncbi.nlm.nih.gov/pubmed/55555555**

Design	Pilot study

Promoting Patient-Ventilator Synchrony

Thille AW, Brochard L
PMID 77777777, **http://www.ncbi.nlm.nih.gov/pubmed/77777777**

Automatic Detection of Patients' Spontaneous Activity During Pressure Support Ventilation

G. Matrone, F. Mojoli, A. Orlando, A. Braschi, G. Magenes
Article · January 2010 with 14 reads https://doi.org/10.1007/978-3-642-13039-7_120
PMID na, **http://www.ncbi.nlm.nih.gov/pubmed/na**

Patients	Data presented in this paper refers to a set of signals recorded from 6 ICU patients, including 6445 respiratory acts
Objectives	The occurrence of significant patient-ventilator asynchronies in assisted ventilation modes is a significant problem in clinical practice. To address this problem, an original software tool has been developed that is described here. This tool implements a new automatic technique to identify the beginning and end of the patient's respiratory effort, events that are sometimes missed or detected with a significant delay by the ventilator.
Main Results	The tool proved to outperform the machine in increasing the amount of respiratory acts assisted without significant delay from 22% to 70%.
Conclusion	The tool presented here is the first step in the development of a hardware-software device to be directly interfaced with the ventilator, to serve as a monitoring aid for the clinician and possibly to directly drive the device's activity.
Comment	P.D. Bamidis and N. Pallikarakis (Eds.): MEDICON 2010, IFMBE Proceedings 29, pp. 479–482, 2010. www.springerlink.com