CONCLUSIONS

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1. The most important and significant data in our study in predicting weaning outcome of COPD patients from mechanical ventilator were integrative weaning index(IWI), rapid shallow breathing index(RSBI), glascow coma score(GCS), heart rate and presence of abnormal value of resistance. GCS had the best specificity ,positive predictive value and accuracy, while presence of abnormal resistance had the best sensitivity and negative predictive value.

2. There were other data in our study that may predict weaning of COPD patients from mechanical ventilator although they were statistically non significant as they should be studied on larger number of patients. They were presence of structural brain damage, presence of electrolyte disturbance especially hypophosphatemia, presence of taking sedation prior to weaning, presence of acid base disturbance, presence of ischaemic heart disease, presence of heart failure, presence of atrial fibrillation and BMI.

3. Haemoglobin level, systolic blood pressure, respiratory rate, tidal volume, static compliance, maximum inspiratory pressure, P0.1 were poor predictors of weaning outcome of COPD patients from mechanical ventilator in our study.

4. PaO2, HI, PaCO2 could not accurately predict weaning outcome of COPD patients from MV.

5. Non invasive PSV gave more than 50% chance of weaning of COPD patients from MV and it can also shorten the duration of weaning from mechanical ventilator.

LIMITATIONS OF THE STUDY

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1. Lack of continuous ECG monitoring to detect the exact time of occurrence of ischaemic changes to the heart whether at the time of mechanical ventilation, during weaning process or at the time of extubation.

2. Although static compliance can be measured during weaning from mechanical ventilation, it was not an easy task to be performed during the weaning process, because the patient's inspiratory effort during the assisted breath could interfere with the inspiratory plateau pressure measurement. Also it was difficult to give the patient a muscle relaxant or strong sedative during the course of weaning. In our study we minimized this limitation by observing the digital display of the pressure-time inspiratory plateau curve thus avoiding respiratory cycles that revealed clear inspiratory efforts of the patients and sometimes by giving a short acting sedative like propofol.

3. Static compliance could not be measured directly by the ventilator in all cases so, if it could not be measured directly it was calculated using this equation: Cst = VT / (inspiratory plateau pressure – positive end expiratory pressure).

4. We tested the effect of acid base disturbance in general on weaning outcome of patients with COPD from mechanical ventilator without specifying the effect a certain type of acid base disturbance on weaning outcome.

RECOMMENDATION

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1. There were data in our study that may predict weaning of COPD patients from mechanical ventilator although they were statistically non significant as they should be studied on larger number of patients. They were presence of structural brain damage, presence of electrolyte disturbance especially hypophosphatemia, presence of taking sedation prior to weaning, presence of acid base disturbance, presence of ischaemic heart disease, presence of heart failure, presence of atrial fibrillation and BMI. So, we recommend studying these data on larger number of patients in further studies.

2. We recommend studying the effect of certain value of abnormal resistance on weaning outcome of patients with COPD from mechanical ventilator as we have examined in our study the effect of abnormal value of resistance in general (without specifying the value)on weaning outcome of COPD patients from mechanical ventilator.

3. We recommend also studying the effect of a specific subtype of acid base disturbance (metabolic or respiratory, acidosis or alkalosis) on weaning outcome of patients with COPD from mechanical ventilator as we tried in our study to detect the effect of acid base disturbance in general on weaning outcome of patients with COPD from mechanical ventilator.

4. It is advisable to study the effect of certain type alone of heart failure whether it is left sided heart failure, right sided heart failure or diastolic dysfunction on weaning outcome of patients with COPD from mechanical ventilator.

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PROTOCOL

COMPARISON BETWEEN PREDICTORS OF WEANING FROM MECHANICAL VENTILATOR IN COPD PATIENTS AND THE EFFECT OF USAGE OF CPAP IN DIFFICULT WEANING PATIENTS

مقارنة بين قياسات التنبؤ بالفطام من جهاز التهوية الميكانيكية فى مرضى الأنسداد الرئوى المزمن وتأثير استخدام الضغط الهوائى الموجب المستمر فى مرضى الفطام الصعب

Protocol of thesis submitted,	خطة بحث مقدمة
To the faculty of medicine,	لكلية الطب
Alexandria university,	جامعة الاسكندرية
In partial fulfillment of the	ايفاءا جزئيا
requirements of the degree of	لشروط الحصول على درجة الماجستير
master of critical care.	في الطب الحرج

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INTRODUCTION

Mechanical ventilation(MV) is the defining event of intensive care unit management. Although it is a life saving intervention in many diseases, a major goal of critical care clinicians should be to liberate patients from MV as early as possible to avoid the multitude of complications and risks associated with prolonged unnecessary MV including ventilator induced lung injury, ventilator associated pneumonia, increased length of ICU and hospital stay and cost of care delivery. [1, 2]

Weaning decisions based only on expert clinical judgment are not always correct. Premature discontinuation places severe stress on the respiratory and cardiovascular systems, while unnecessary delays can lead to diaphragmatic atrophy so several predictors of weaning are therefore used to aid decision-making. [3]

According to the American college of chest physicians, society of critical care medicine and the American association of respiratory care the weaning indices that have some predictive capacity are: [4]

1)Tidal volume: Spontaneous tidal volumes greater than 5 ml/kg have been considered as good predictors of weaning outcome. [5]

2)Maximal inspiratory pressure(P_{Imax}): it is commonly used to test respiratory muscle strength. The proximal end of the endotracheal tube is occluded for 20 to 25 seconds with a one-way valve that allows the patient to exhale but not to inhale. This procedure leads to increasing inspiratory effort and P_{Imax} measuredtowards the end of the occlusion period. Several early studies have shown that $P_{Imax} \leq -30$ cmH_2O has a high predictive value for weaning. [6]

3)Breathing frequency (f): Tachypnea (f ≥ 30–35 breaths/minute) is a sensitive marker of respiratory distress but can prolong intubation when used as an exclusive criterion. [7]

4)$P_{0.1}/P_{Imax}$: The airway occlusion pressure ($P_{0.1}$) is the pressure measured at the airway opening 0.1 second after inspiring against an occluded airway. The $P_{0.1}$ is effort independent and correlates well with central respiratory drive. When combined with the maximal inspiratory pressure P_{Imax}, the $P_{0.1}/P_{Imax}$ ratio at a value of <0.3 has been found to be a good early predictor of weaning success.[8]

5)Oxygenation: Arterial oxygen saturation (SaO_2) ≥ 90% with a fraction of inspired oxygen $FiO_2 \leq 0.4$ associated with successful weaning. [9]

6)Minute ventilation (V_E) : V_E < 10 l/minute is associated with weaning success. Studies showed that V_E values > 15–20 l/minute are helpful in identifying patients who are unlikely to be liberated from mechanical ventilation. [10]

7)Rapid shallow breathing index: It is the ratio of breathing frequency to tidal volume obtained during the first 1 minute of a T-piece trial. At a threshold value of ≤ 105 breaths/minute/liter, RSBI was a significantly better predictor of weaning outcomes than other 'classic' and commonly used parameters.[11],[12]

AIM OF THE STUDY

To compare between different weaning parameters in combination of the general condition of the COPD patients as predictors of weaning and to study the effect of usage of CPAP in difficult weaning patients.

PATIENTS

The study will be conducted on 100 COPD patients admitted to Alexandria main university hospital who are mechanically ventilated for more than 24 hours and will be considered candidates for weaning judged by the physician in charge.

Inclusion criteria: Mechanically ventilated for at least 24 hours and the cause of mechanical ventilation has been resolved judged by the physician in charge.

Exclusion criteria: Patients younger than 18 years, patients on vasopressors, patients with toxicological diseases.

Informed consent will be taken from every patient included in the study whenever possible or from patient's next of kin. All selected patients fulfilling the inclusion criteria will be subjected to full history (including age, sex and preexisting underlying disease), full clinical examination and Laboratory investigations will be done on admission .

METHODS

The following values will be measured in all COPD patients candidate for weaning:

1.frequency.

2.tidal volume.

3.rapid shallow breathing index.

4.maximum inspiratory pressure: will be measured on volume control ventilation while the patient fully sedated and during inspiratory pause.A value less than 25cmH2Ois considered one of predictors of weaning success.

5.P0.1: will be measured on volume control ventilation while the patient is fully sedated and during first 0.1 second of patient inspiration.

6.compliance: will be measured while patient on volume control ventilation, fully sedated and inspiratory pause for 0.5 to 1 S, Cst = VT / (inspiratory plateau pressure – positive end expiratory pressure).[14,15]

7.PaO2: will be measured using arterial blood gas analysis.

8.PaCO2: will be measured using arterial blood gas analysis.

9.PEEP.

10.hypoxic index: will be measured by dividing PaO2 by FiO2.

11.haemoglobin level: should be more than 9 g/dl.

12.integrative weaning index(IWI): will be calculated by this equation:IWI=CstxSaO2/RSBI.(Cst:static compliance,SaO2:saturation of O2in arterial blood,RSBI:rapid shallow breathing index).A value of more than 25ml/cmH2O breaths/minute/liter is a good predictor of weaning outcome.

These parameters will be considered with neurological status(structural brain damage or electrolyte disturbances),respiratory status(myopathy, neuropathy,change in compliance or resistance or V/Q mismatch),metabolic status(nutrition and acid base status)and cardiovascular status(prescence of ischemic heart disease arrythmias or heart failure).In addition vital signs of the patient will be measured(BP,temperature.respiratory rate and heart rate).

Then patient will be discontinued from MV by the physician in charge through a T-piece trial for 2 hours and if spontaneous breathing trial succeeded then success of weaning will be determined by the ability to breath normally apart from MV for 48 hours [16]. The decision to return to MV will be made by the physician in charge (who will be completely blind to the study).[17]

According to the success of the weaning trial patients are classified into 2 groups:

GROUP 1 : failure of weaning group.

GROUP 2 : success of weaning group.

The study will also include the effect of usage of CPAP in difficult weaning patients.

Different weaning parameters (frequency,TV,RSBI,Pmax, minute ventilation,P0.1,compliance,Pmax,minute ventilation,P0.1,compliance, PaO2,PaCO2,PEEP,hypoxic index)in association with the general condition of the patient(neurologically,respiratory, cardiovascular and metabolic)and vital signs will be collected.

Patients will be divided into 2groups:group1:who succeeded in the trial of weaning(sustained ability to breath apart from mechanical ventilator for 48 hours after successful spontaneous breathing trial for 2 hours using T-piece) and group2:who failed in the trial of weaning and all weaning parameters,general condition and vital signs of the patient will be compaired to determine specificity, sensitivity,positive and negative predictive values and accuracy of each of them.

The study will also include the effect of usage of CPAP in difficult weaning patients.

RESULTS

The results will be reported,interpreted and analysed to fulfill the aim of the research.

DISCUSSION

The results of this study will be interpreted and compared with other studies.

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ARABIC SUMMARY

الملخص العربى

الفطام من التهوية الميكانيكية يمكن تعريفها بأنها عملية سحب دعم التنفس الصناعي فجأة أو تدريجيا. مرض الانسداد الرئوي المزمن هو مرض يمكن الوقاية منه وعلاجه مع بعض الآثار الهامة خارج الرئة التي يمكن أن تسهم في شدة المرض في عدد من المرضي. يتميز عنصرها الرئوي بالحد من تدفق الهواء الذي لا يمكن عكسه بشكل كامل .الحد من تدفق الهواء عادة ما يكون تقدميا ومصحوبا باستجابة التهابية غير طبيعية من الرئة إلى الجزيئات السامة أو الغازات .

في دراستنا قارنا بين مؤشرات الفطام المختلفة بالاضافة الي الحالة العامة لمرضى السدة الرئوية المزمنة (العصبية والايونية والجهاز التنفسي والقلب والأوعية الدموية والوضع الحمضي القاعدي ومؤشر كتلة الجسم) كمتنبآت للفطام ودرسنا تأثير استخدام التهوية بدعم الضغط غير الغازي في مرضى الفطام الصعب .

وقد أجريت الدراسة على ١٠٠ مريض من مرضي السدة الرئوية المزمنة تم قبولهم إلى المستشفى الجامعي الرئيسي بالإسكندرية الذين استوفوا معايير الاشتمال والاقصاء، و تم وضعهم علي جهاز التهوية الميكانيكية لأكثر من ٢٤ ساعة وتم اعتبارهم مرشحين للفطام من قبل الطبيب المختص .تعرض كل المرضى المختارين والذين حققوا معايير الاشتمال الي اخذ التاريخ المرضي كاملا(بما في ذلك السن والجنس والأمراض الكامنةسابقة الوجود)، والفحص السريري الكامل والفحوصات المختبرية أجريت عند الحجز ويوميا .

تم قياس القيم التالية في جميع مرضى الانسداد الرئوي المزمن المرشحين للفطام :العلامات الحيوية(ضغط الدم الانقباضي والانبساطي،الحرارة،معدل التنفس،معدل ضربات القلب)، الحجم المدي(TV) ، مؤشر التنفس السريع الضحل(RSBI)، الضغط الشهيقي الاقصي(MIP)، الضغط الشهيقي في اول١٠٠مللي ثانية(P0.1)، والامتثال، الضغط الشرياني للاكسجين(PaO2)، الضغط الشرياني لثاني اكسيد الكربون(PaCO2)، النهاية الايجابية للضغط الزفيري(PEEP)، مؤشرنقص الاكسجين(HI)، ومؤشر الفطام التكاملي(IWI)و النسبة بين الضغط الشهيقي في اول١٠٠مللي ثانية و الضغط الشهيقي الاقصي(P0.1/MIP ratio).

واعتبرت هذه المؤشرات مع الحالة العصبية والايونية (وجود تلف هيكلي في المخ، ووجود اضطرابات بالايونات الكهربائية، مقياس جلاسكو للغيبوبة (GCS)،وجود أخذ المهدئات أو المنومات قبل محاولة الفطام)، وحالة الجهاز التنفسي (وجود قيمة غير طبيعية للامتثال أو المقاومة و التدرج الأكسجيني الشرياني الحويصلي -PAO2)) (PaO2، والوضع الحمضي القاعدي ومؤشر كتلة الجسم (مؤشر كتلة الجسم ووجود اضطراب حمضي قاعدي) وحالة القلب والأوعية الدموية (مرض نقص تروية القلب، اضطراب بضربات القلب أو فشل عضلة القلب ومستوى الهيموجلوبين) .

وفقا لنجاح محاولة فطام المرضى تم تصنيفهم إلى مجموعتين :المجموعة ١ :مجموعة فشلت في محاولة الفطام والمجموعة ٢ نجحت في محاولة الفطام.(نجاح الفطام تقرر من القدرة على التنفس بشكل طبيعي بعيدا عن جهاز التهوية الميكانيكية لمدة ٤٨ ساعة).ثم تمت مقارنة كل هذه المؤشرات الفطامية بالإضافة إلى المؤشرات التي تعكس الحالة العصبية والايونية والجهاز التنفسي والوضع الحمضي القاعدي ومؤشر كتلة الجسم وحالة القلب والأوعية الدموية للمريض إلى جانب العلامات الحيوية للمريض وفقا لخصوصيتها، وحساسيتها، والقيم التنبؤية الإيجابية والسلبية ودقتها للكشف عن قدراتهم كمتنبآت للفطام من جهاز التهوية الميكانيكية .شملت الدراسة أيضا تأثير استخدام التهوية بدعم الضغط الغير الغازي في مرضى الفطام صعب.

وجدنا أن:

١. كانت أهم البيانات واكثرها مغزاة في دراستنا في توقع نتائج الفطام من التهوية الميكانيكية في مرضى الانسداد الرئوي المزمن هي مؤشر الفطام التكاملي (IWI)،مؤشر التنفس السريع الضحل (RSBI)، ومقياس جلاسكو للغيبوبة (GCS)ومعدل ضربات القلب و وجود قيمة غير طبيعية من المقاومة .كان مقياس جلاسكو للغيبوبة (GCS)الأفضل في الخصوصية والقيمة التنبؤية الإيجابية والدقة، في حين أن وجود المقاومة غير طبيعية الأفضل في الحساسية والقيمة التنبؤية السلبية .

٢ . كانت هناك بيانات أخرى في دراستنا التي يمكنها التنبؤ بالفطام في مرضى السدة الرئوية المزمنة من جهاز التهوية الميكانيكية على الرغم من أنها كانت إحصائيا غير هامة لانها ينبغي دراستها على عدد أكبر من المرضى . وهم وجود تلف هيكلي في المخ، ووجود اضطرابات بالايونات الكهربائية خاصة نقص فوسفات الدم، ووجود أخذ مهدئات قبل الفطام، ووجود اضطراب حمضي قاعدي، ووجود مرض نقص تروية القلب ، ووجود فشل في عضلة القلب، ووجود الذبذبة الاذينية ومؤشر كتلة الجسم.

٣. كان مستوى الهيموغلوبين و ضغط الدم الانقباضي ومعدل التنفس والحجم المدي والامتثال الثابت و الضغط الشهيقي الاقصي و الضغط الشهيقي في اول١٠٠مللي ثانية مؤشرا فقيرا للفطام في مرضى الانسداد الرئوي المزمن من جهاز التهوية الميكانيكية في دراستنا .

٤. الضغط الشرياني للاكسجين(PaO2)، الضغط الشرياني لثاني اكسيد الكربون (PaCO2)و مؤشر نقص الكسجين (HI)لا يمكنهم التنبؤ بدقة الفطام في مرضى الانسداد الرئوي المزمن من جهاز التهويم الميكانيكية.

٥. التهوية بدعم الضغط أعطى أكثر من ٥٠٪ فرصة للفطام في مرضى السدة الرئوية المزمنة من جهاز التهوية الميكانيكية ويمكن ان ينقص من مدة الفطام من جهاز التهوية الميكانيكية.

الملخص العربى

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مقارنة بين قياسات التنبؤ بالفطام من جهاز التهوية الميكانيكية فى مرضى الانسداد الرئوى المزمن وتأثير استخدام الضغط الهوائى الموجب المستمر فى مرضى الفطام الصعب

رسالة مقدمة

لقسم الطب الحرج ـ كلية الطب ـ جامعة الإسكندرية
ضمن متطلبات درجة

الماجستير

فى

الطب الحرج

مقدمة من

خالد بهاء الدين محمد دسوقي الطويلة

بكالوريوس الطب والجراحة :الإسكندرية، ٢٠٠٨
كلية الطب
جامعة الإسكندرية

٢٠١٥