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Pneumonia nosocomial e ventilação mecânica não invasiva:  
um estudo de coorte

Dissertação apresentada à Faculdade de Medicina  
da Universidade de São Paulo para obtenção do  
título de Mestre em Ciências

Área de Concentração: Movimento, Postura  
e Ação Humana

Orientadora: Profa. Dra. Carolina Fu

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## DEDICATÓRIA

*As duas mulheres da minha vida: minha esposa e minha filha !*

*Com vocês me sinto feliz!*

*Com vocês me sinto amado!*

*Com vocês me sinto realizado!*

*Somos uma família completa!*

*Amo vocês para sempre!*

*“Dias melhores virão!*

*Dias melhores pra sempre!”*

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## LISTA DE ABREVIATURAS

VNI	Ventilação Não Invasiva
VMI	Ventilação Mecânica Invasiva
IrPA	Insuficiência Respiratória Aguda
PAV	Pneumonia Associada a Ventilação Mecânica
PNN	Pneumonia Nosocomial
UTI	Unidade de Terapia Intensiva
DPOC	Doença Pulmonar Obstrutiva Crônica
EAP	Edema Agudo de Pulmão
SDRA	Síndrome do Desconforto Respiratório Agudo
RNC	Rebaixamento do Nível de Consciência
IAM	Infarto Agudo do Miocárdio
PCR	Parada Cárdio-Respiratória
VILI	Lesão Pulmonar Induzida pela Ventilação Mecânica
AIDS	Síndrome da Imuno Deficiência Adquirida
SAPS II	Simplified Acute Physiology Score
CDC	Centers for Disease Control and Prevention

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## RESUMO

BERNARDES SRN. *Pneumonia nosocomial e ventilação não-invasiva: um estudo de coorte*. [dissertação]. São Paulo: Faculdade de Medicina, Universidade de São Paulo; 2010. 89 p.

**INTRODUÇÃO:** A Ventilação Mecânica Não Invasiva (VNI) é um suporte ventilatório muito utilizado em pacientes críticos. Estudos mostram redução da morbidade entre os pacientes nas Unidades de Terapia Intensiva (UTIs) além de menor taxa de pneumonia nosocomial (PNN) em comparação aos pacientes que usam Ventilação Mecânica Invasiva (VMI). **OBJETIVO:** Verificar taxa de PNN, fatores de risco e mortalidade em pacientes que usaram VNI. **MÉTODO:** Foi realizado um estudo observacional entre maio e dezembro de 2007 em todos os pacientes que usaram VNI em 11 UTIs de um hospital universitário terciário. Após instalação da VNI, os pacientes eram observados durante o período de internação nas UTIs e os dados referentes a presença de PNN, dados clínicos, demográficos e fatores de risco para foram coletados diariamente. **RESULTADO:** VNI foi usada em 407 indivíduos durante o estudo, porém foram excluídos 28 indivíduos por diagnóstico prévio de pneumonia comunitária no momento de internação nas UTIs, portanto 379 foram incluídos no estudo. A incidência de PNN ocorreu em 22 pacientes (5,8%), e desta amostra 14 pacientes eram do sexo masculino (63,6%), com média de idade de 56 anos, score de gravidade (SAPS II) com média de 37,6 e 11 pacientes estavam internados em UTIs cirúrgicas. Os principais motivos para instalação da VNI foram: Insuficiência respiratória pós – extubação (45%), insuficiência respiratória aguda (27%), como recurso da fisioterapia (14%) e como VNI profilática (9%). A média do tempo de uso de VNI foi de 8,95 dias e a taxa de mortalidade foi de 2,3 %. Os seguintes fatores foram associados a PNN: necessidade de aspiração traqueal em 14 pacientes (8,5 %,  $p < 0,05$ ) e uso de sedação prolongada em 19 pacientes (8,2%,  $p < 0,05$ ). Dos pacientes que desenvolveram PNN, 13 (7,2%) tinham idade avançada (>65 anos de idade). **CONCLUSÃO:** Em nosso estudo, a PNN em pacientes com VNI teve maior prevalência no sexo masculino, em pacientes internados em unidade cirúrgicas e os fatores de risco associados foram sedação prolongada e necessidade de aspiração traqueal.

**DESCRITORES:** Pneumonia associada à ventilação mecânica, pneumonia, infecção hospitalar, respiração com pressão positiva intermitente, estudos de coorte.

## **ABSTRACT**

Bernardes SRN. *Nosocomial pneumonia and non invasive ventilation: an observational study*. [dissertation]. São Paulo: "Faculdade de Medicina, Universidade de São Paulo"; 2010. 89 p.

**INTRODUCTION:** Noninvasive ventilation (NIV) has become an integral part of ventilatory support to critically ill patients. Studies shows that Noninvasive ventilation (NIV) reduce morbidity among patients in intensive care units (ICUs) and had significantly lower rates of nosocomial pneumonia(NP) than patients who received invasive mechanical ventilation.

**OBJECTIVE:** To verify the rates of NP, risk factors and mortality in not selected patients that used NIV in the ICUs.**METHOD:** We conducted a prospective observational study between May and December 2007, of all adult patients receiving NIV at 11 ICUs. After the installation of NIV, the patients were observed during the internation period. It was collected daily data refered to the presence of PNN, clinical data, demographic and presence of risk factors to develop PNN in this population.

**RESULTS:** NIV was used to manage 407 patients over the study period, but were excluded 28 patients already present diagnosed of community acquired pneumonia at the ICU admission, so 379 individuals were included. The incidence of NP occurred in 22 patients (5,8%), in this sample 14 patients were male (63,6%), mean age 56 years, the severity score (SAPS II) with an average of 37,6 and 11 patients were hospitalized in surgical ICUs.

The main reasons to installation of NIV were: Acute respiratory failure in Pos – extubation (45%), acute respiratory failure (27%), as a chest therapy resource (14%) and as profilatic NIV (9%). The average duration of use of NIV was 8.95 days and the mortality rate was 2.3%.The following factors were associated to NP: need of tracheal aspiration in 14 patients (8,5%,  $p < 0,05$ ) and use of prolonged sedation in 19 patients (8,2%,  $p < 0,05$ ). From the patients that developed NP 13 (7,2%) had advanced age (>65 years old).**CONCLUSION:** In our study, the NP in patients with NIV had higher prevalence in males, in patients in surgical unit and the risk factors were prolonged sedation and need for tracheal aspiration.

**DESCRIPTORS:** Pneumonia associated ventilation, pneumonia, nosocomial pneumonia, intermittent positive pressure ventilation, cohort studies.

## **1 INTRODUÇÃO**

## **1 INTRODUÇÃO**

A ventilação mecânica não invasiva (VNI) tem sido usada com sucesso no tratamento da insuficiência respiratória aguda (IRpA)<sup>1</sup>, prevenindo a intubação oro traqueal e evitando secundariamente as complicações da ventilação mecânica invasiva (VMI)<sup>2</sup>.

As complicações observadas nos pacientes com IRpA tratados com VNI são menores em relação aos pacientes ventilados de forma invasiva<sup>3</sup>. Dentre as complicações associadas à VMI podemos citar a Pneumonia Associada à Ventilação Mecânica (PAV) que é uma forma de Pneumonia Nosocomial (PNN)<sup>4</sup>.

As duas condições acima são relatadas como a maior causa de mortalidade e morbidade na unidade de terapia intensiva (UTI)<sup>5</sup>, sendo que a PNN é definida como uma infecção pulmonar desenvolvida após 48 horas da admissão no hospital, cujos sinais clínicos que preenchem os critérios para o seu diagnóstico são febre, leucocitose, alteração de secreção e infiltrado pulmonar<sup>6</sup>. Já a PAV se desenvolve em pacientes que estão em ventilação mecânica por um tempo mínimo de 48 horas<sup>5</sup>.

Estratégias são descritas na prevenção da PNN e PAV, sendo que as principais são: uso de protocolos que facilitem e aceleram o processo de desmame<sup>7</sup>, aspiração subglótica<sup>8</sup>, utilização de decúbito horizontal elevado<sup>9,10</sup>, programa de higienização oral<sup>11,12</sup>, uso de dispositivo de troca de calor e umidade<sup>13,14</sup>, higienização das mãos<sup>15</sup> e utilização da VNI<sup>16-23</sup>.

Estudos envolvendo VNI em pacientes com doença pulmonar obstrutiva crônica (DPOC)<sup>24</sup>, edema agudo de pulmão (EAP)<sup>16, 17</sup>, insuficiência respiratória pós-extubação<sup>25-27</sup>, pacientes imunodeprimidos<sup>28,29</sup>, e transplantados<sup>30,31</sup>, apontam taxas de

PNN associada ao uso da VNI com valores variando de 0% até 41% entre estes pacientes.

Estudos que apontam e descrevem a prática clínica de utilização da VNI e que relacionam os seus fatores de risco para desenvolver PNN em pacientes de diversas etiologias são escassos.

Mediante o exposto acima, o objetivo deste estudo é de observar na prática clínica a incidência de PNN, fatores de risco e complicações entre pacientes clínicos e cirúrgicos que fizeram uso de VNI nas UTIs de um hospital universitário e de alta complexidade de São Paulo.



**2 OBJETIVOS**

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## **2 OBJETIVOS**

Os objetivos deste estudo são de observar na prática clínica a incidência de PNN, taxa de sobrevida, fatores de risco e complicações entre pacientes clínicos e cirúrgicos que fizeram uso de VNI nas UTIs de um hospital universitário e de alta complexidade de São Paulo.



### **3 REVISÃO DA LITERATURA**

#### **3.1 - Ventilação mecânica não invasiva- VNI**

##### **3.1.1 – Definição**

A ventilação mecânica não invasiva (VNI), que é a forma de suporte ventilatório mecânico onde a oferta da pressão positiva é realizada através de máscaras faciais ou nasais<sup>32</sup>, tem sido usada no tratamento de pacientes com insuficiência respiratória aguda (IRpA) e crônica agudizada<sup>1</sup>. Este tipo de suporte ventilatório deve ser considerado medida inicial na terapêutica de pacientes sobre condições críticas com prejuízo na função respiratória.

Em situações específicas, como por exemplo, na exacerbação da doença pulmonar obstrutiva crônica (DPOC) sua utilização é benéfica e já consagrada através de diversos estudos<sup>33-35</sup>. Tais benefícios resultam em menores taxas de mortalidade, menores complicações e menores taxa de intubação oro-traqueal<sup>36</sup>.

##### **3.1.2 - Objetivos da VNI**

A VNI tem o objetivo de corrigir os mecanismos fisiopatológicos da IrpA ou seja, assegurar a adequada troca gasosa pulmonar e normalizar o trabalho da respiração<sup>36</sup> evitando conseqüentemente a intubação oro-traqueal e complicações associadas à VMI<sup>2,3</sup>.

### **3.1.3 - Indicações e contra-indicações**

A técnica é indicada para o tratamento da insuficiência respiratória aguda (IRpA)<sup>1,32,36-39</sup> como por exemplo, edema agudo de pulmão (EAP)<sup>40-43</sup> doença pulmonar obstrutiva crônica (DPOC)<sup>32-34</sup>, síndrome do desconforto respiratório aguda (SDRA)<sup>44</sup>, insuficiência respiratória crônica como a hipoventilação noturna<sup>45</sup>, doenças neuromusculares<sup>46</sup> e também como auxiliar no processo de desmame ventilatório<sup>25-27</sup>.

Em relação às contra indicações, podemos citar as absolutas que são: rebaixamento do nível de consciência (RNC), agitação severa, hipersecreção, vômitos incontrolados, hemoptise e epistaxe maciça, pós-operatório de esofagectomia, infarto agudo do miocárdio (IAM), parada cardíaco-respiratória (PCR), necessidade imediata de intubação endotraqueal, apnéia, obstrução de via aérea alta e trauma facial<sup>47</sup>.

As contra-indicações relativas variam de acordo com a indicação e adequada seleção do paciente. São elas: ligeira diminuição do nível de consciência, insuficiência respiratória severa progressiva, suspeita de isquemia aguda coronariana, instabilidade hemodinâmica e gravidez<sup>47</sup>.

### **3.1.4 Complicações**

#### **3.1.4.1 Complicações relacionadas com a interface**

Lesões cutâneas podem ocorrer devido a fragilidade da pele ou infecção, que são tratados com medicação tópica anti-bacteriana. Uma das mais sérias complicações

relacionadas com a interface é a úlcera nasal. Este tipo de complicação comumente ocorre em pacientes que permanecem por longos períodos sob o uso da VNI<sup>51</sup>.

Alterações na anatomia da face comumente observada na população idosa e a indevida proteção ao redor do osso nasal que está em contato direto com a máscara facial são fatores que prédispõem a formação de úlceras nasais<sup>48</sup>.

Devido à necessidade de fixação da interface no rosto do paciente para a oferta do suporte ventilatório, alguns pacientes podem sentir a sensação de claustrofobia. A escolha correta da interface, da modalidade e do aparelho mais adequado para a oferta do suporte ventilatório não-invasivo em cada situação em específico contribuem para uma menor sensação de claustrofobia<sup>48</sup>.

Máscaras oro-nasais têm maior probabilidade de causar claustrofobia. Capacetes e máscaras faciais totais (*full-face*) podem evitar a claustrofobia, presumivelmente porque não impedem a visão do paciente e não permitem o contato próximo os olhos ou osso nasal<sup>48</sup>.

#### **3.1.4.2 Complicações relacionadas com a oferta do fluxo e pressão inspiratória**

Complicações relacionadas à pressão incluem desconforto, dor na cavidade auricular e aerofagia com insuflação gástrica.

A aerofagia é uma complicação freqüentemente observada nos pacientes sob VNI com boa tolerância<sup>49</sup>. Todas as complicações são atenuadas pela diminuição da pressão ou otimização dos parâmetros do aparelho de VNI. Nenhum estudo revelou uma pressão alvo ideal, ou um valor de pressão inspiratória máxima com base na tolerância e conforto adequado.

O mais grave efeito de pressão pode ser pneumotórax e pneumoencefalo, que tenham sido comunicados informalmente, mas são raros<sup>50,51</sup>.

As complicações relacionadas ao fluxo são semelhantes. Os sintomas incluem secreta nasal, congestão ou obstrução nasal. O uso de descongestionantes nasais pode corrigir ou amenizar o problema<sup>48</sup>.

O fluxo de ar que escapa ao redor da máscara irrita a mucosa conjuntival, ocasiona a irritação ocular e conjuntivite, fator este que também está associado a uma má adaptação da interface no paciente<sup>48</sup>.

Estas complicações são amenizadas com atenção aos escapes de ar e adequada umidificação aquecida prevenindo a sensação de secreta e irritação ocular<sup>52-54</sup>.

#### **3.1.4.3 Bronco-aspiração**

A bronco-aspiração é a complicação potencialmente mais grave da VNI, e deve ser evitada com a correta seleção do paciente que vai receber a técnica. Por precaução, com o início do uso da técnica de VNI, clínicos cautelosos consideram a colocação de sonda nasogástrica como fator preventivo no caso de bronco-aspiração durante a aplicação da VNI<sup>48</sup>.

A hipersecreção pulmonar é também uma preocupação, corrigida com umidificação/hidratação e fisioterapia respiratória. Em última análise, nem a incidência verdadeira desta complicação nem a utilidade das intervenções sugeridas acima são conhecidas ou bem documentadas<sup>48</sup>.

#### 3.1.4.4 Complicações hemodinâmicas

Uma rara, mas grave complicação da VNI que pode ocorrer em pacientes com comprometimento do débito cardíaco<sup>48</sup>.

A pressão positiva aplicada na via aérea durante a VNI aumenta a pressão intratorácica, aumenta a pressão ventricular esquerda e a pós-carga e reduz a pré-carga, que pode causar hipotensão em um paciente com prejuízo na função cardíaca.

Confalonieri et al<sup>55</sup> usaram ecocardiografia para avaliar os efeitos hemodinâmicos agudos no início da VNI em 16 pacientes com DPOC e IrPA. Em 4 pacientes (21%) VNI reduziu o débito cardíaco em 15%.

Este estudo enfatiza a necessidade de estar ciente das potenciais alterações da pressão arterial em pacientes com comprometimento do estado cardíaco e / ou hipovolemia<sup>55</sup>.

#### 3.1.5 Vantagens

Por se tratar de uma técnica onde o suporte ventilatório é ofertado através de máscaras oro-faciais, seu uso pode ser ofertado de forma intermitente, garantindo também a manutenção da deglutição e fala.

Observa-se, menor risco de trauma às vias aéreas superiores (lesão de cordas vocais, lesão traqueal, traqueomalácia) e menor risco para lesões inerentes ao uso do ventilador mecânico, como por exemplo a lesão pulmonar induzida pela ventilação mecânica (VILI), volutrauma, barotrauma<sup>59</sup> e menores taxas de pneumonia associada a ventilação mecânica (PAV) e pneumonia nosocomial (PNN),<sup>16,17,20-24,60,61</sup>.



A menor necessidade de uso de sedativos é outra vantagem observada nos pacientes tratados com VNI, contribuindo desta forma para uma boa resposta frente a terapia.

### **3.1.6 Desvantagens**

A utilização da VNI nas UTIs implica em treinamento, educação e formação ampla da equipe multidisciplinar que atende aos pacientes em IrPA<sup>56</sup>.

As primeiras horas de VNI estão associados com um aumento carga de trabalho nos cuidados a estes pacientes que exige protocolos específicos, incluindo o acompanhamento destes pacientes com VNI com maior atenção e tempo dispendido<sup>56-58</sup>.

## **3.2 Pneumonia nosocomial (PNN) e Pneumonia Associada a Ventilação Mecânica (PAV)**

### **3.2.1 Definição**

A PNN e PAV são relatadas como a maior causa de mortalidade e morbidade na unidade de terapia intensiva (UTI)<sup>62</sup>.

A PNN é definida como uma infecção pulmonar desenvolvida após 48 horas da admissão no hospital e os sinais clínicos que preenchem os critérios para o seu diagnóstico são febre, leucocitose, alteração de secreção e infiltrado pulmonar<sup>6</sup>.

A PAV se desenvolve em pacientes que intubados ou traqueostomizados sob suporte ventilatório invasivo por um tempo mínimo de 48 horas. Ocorre comumente em pacientes internados em UTIs e esta associado a uma significativa morbidade e mortalidade<sup>5,63</sup>.

#### **3.2.2 Fatores de risco para desenvolver PNN**

O uso de VMI e intubação traqueal são os principais fatores associados à PNN além de presença de cateteres venosos e urinários, idade maior ou igual a 60 anos, obesidade, doença cardíaca ou pulmonar crônica, insuficiência renal, malignidade, baixa imunidade (AIDS, câncer), diabetes mellitus, cirurgia prévia, SDRA, trauma crânio-encefálico, sonda naso gástrica, Glasgow menor que 9, uso de relaxantes musculares, tabagismo, decúbito horizontal e uso prévio de sedação<sup>5</sup>.

#### **3.2.3 Prevenção de PNN e PAV**

Estratégias são descritas na prevenção da PNN e PAV, sendo que as principais são: uso de protocolos que facilitem e aceleram o processo de desmame<sup>64</sup>, aspiração subglótica<sup>8</sup>, utilização de decúbito horizontal elevado<sup>9,10</sup> programa de higienização oral<sup>11,12</sup>,

uso de dispositivo de troca de calor e umidade<sup>13,14</sup>, higienização das mãos<sup>15</sup> e utilização da VNI<sup>16-23</sup>.

A presença do tubo oro-traqueal é uma fator de risco para desenvolver PNN em pacientes intubados<sup>21</sup>. Diversos estudos apontam menores taxas de PNN na população que foi tratada com VNI<sup>16-23</sup>.

Guerin et al<sup>22</sup> observaram o impacto da VNI sobre a PNN e VAP nos pacientes que utilizaram esta técnica na UTI, verificando-se menor incidência de PNN no grupo que utilizou somente VNI.

Nourdine et al<sup>23</sup> também obtiveram resultados semelhantes aos citados acima, observando menor incidência de PNN no grupo que foi ventilado de forma não-invasiva.

O sucesso e falência da VNI foi o motivo do estudo de Demoule et al em pacientes com IrPA e Insuficiência respiratória crônica agudizada. Neste estudo verificou-se que os pacientes com Insuficiência respiratória crônica agudizada tratados com VNI tiveram menor taxa PNN, em comparação com o grupo que foi tratado com VMI<sup>65</sup>.

A utilização da VNI em pacientes com DPOC<sup>24,32-34</sup>, EAP<sup>39-42</sup>, insuficiência respiratória pós-extubação<sup>25-27</sup>, pacientes imunodeprimidos<sup>28,29</sup>, e transplantados<sup>30,31</sup>, apontam taxas de PNN associada ao uso da VNI com valores variando de 0% até 41% entre estes pacientes.

Estudos que apontam e descrevem a prática clínica de utilização da VNI e que relacionam os seus fatores de risco para desenvolver PNN em pacientes de diversas etiologias são escassos.

Mediante o exposto acima, o objetivo deste estudo é de observar na prática clínica a incidência de PNN, taxa de sobrevida, fatores de risco e complicações entre pacientes clínicos e cirúrgicos que fizeram uso de VNI nas UTIs de um hospital universitário e de alta complexidade de São Paulo.



## **4 MÉTODO**

### **4.1 Tipo de estudo**

Trata-se de um estudo de coorte prospectivo de pacientes internados em UTI que fizeram o uso de VNI durante sua internação.

### **4.2 Local**

O estudo foi realizado nas unidades de terapia intensiva do Instituto Central do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (ICHC-FMUSP), no período de maio até dezembro de 2007. Foram incluídas no estudo todas as unidades de terapia intensiva do ICHC-FMUSP, totalizando 11 unidades.

### **4.3 Amostra**

Participaram do estudo pacientes com idade igual ou superior a 18 anos, admitidos de forma consecutiva nas unidades de terapia intensiva, submetidos à VNI durante a internação.

#### **4.4 Critérios de exclusão**

Foram excluídos do estudo pacientes traqueostomizados previamente ao uso de VNI, pacientes com diagnóstico de pneumonia comunitária prévia e provenientes de outros serviços sem data do início da VNI especificada.

Os pacientes que preencheram os critérios de inclusão foram observados diariamente até o óbito ou sua saída da UTI.

#### **4.5 Procedimento**

As UTIs foram visitadas diariamente pelos pesquisadores e a coleta foi realizada através dos dados prospectivos obtidos nos prontuários de cada paciente.

Não foi realizado nenhum tipo de intervenção no paciente pelos pesquisadores no momento da coleta e todas as decisões sobre o uso da VNI foram tomadas pela equipe de assistência das unidades estudada.

#### **4.6 Variáveis estudadas**

As variáveis foram selecionadas através da revisão da literatura relevante e para a coleta de dados foi elaborado um questionário padronizado (anexo 1) contendo as variáveis do estudo.

As seguintes variáveis foram coletadas:

#### 1-Variáveis independentes ou preditoras:

Dados demográficos, local de origem do paciente, tipo do paciente (clínico ou cirúrgico), internação prévia na UTI, tratamento prévio com VMI ou VNI e escore de gravidade: Simplified Acute Physiology Score (SAPS II) das primeiras 24 h de internação na UTI foram anotados.

Sobre a utilização da VNI, foram coletados os seguintes dados: data de início, complicações, motivo da instalação, indicação, tempo e total de dias de uso, tipo de VNI e interface utilizada.

Os dados referentes à PNN obedeceram os critérios de diagnósticos pré-estabelecidos pelo Centers for Disease Control and Prevention (CDC). Os fatores de risco para desenvolver PNN também foram observados.

#### 2- Variáveis dependentes ou de desfecho:

Taxa de pneumonia com o uso da VNI, taxa de mortalidade,

### **4.7 Análise Estatística**

A elaboração do banco de dados foi realizada através de planilha eletrônica. As análises iniciais foram realizadas com o pacote estatístico Epi Info versão 6.04 (Centers for Disease Control and Prevention – CDC) e a análise multivariada através do programa SPSS V 12.0 for Windows (SPSS Inc 1998-2003).

Foi feita uma análise descritiva da população estudada. As variáveis quantitativas foram expressas como média (desvio padrão) ou mediana (intervalo interquartil), quando mais apropriado. As variáveis categóricas foram apresentadas como proporção com intervalo de confiança de 95%.

Na análise univariada, as associações entre as variáveis categóricas foram analisadas o teste Qui-quadrado. Os dados contínuos foram comparados com o teste *t* de Student.

A análise multivariada foi feita mediante o modelo de regressão logística, para verificar a atuação conjunta dos possíveis fatores de risco. Foram incluídas no modelo as variáveis que mostraram associações com a PNN ( $p < 0,05$ ). Permaneceram no modelo as variáveis independentes que mantiveram associação com a PNN após o ajuste ( $p \leq 0,05$ ), de acordo com o teste de Wald. Foi utilizado o método *enter* com a introdução ou não de variáveis no modelo, de acordo com o nível significância preestabelecido.

Todos os testes foram bicaudais, considerando-se significativo um  $p \leq 0,05$ .





## 5 RESULTADOS

De 1 de maio até 31 de dezembro de 2007 XX pacientes foram internados nas 11 UTIs do complexo hospitalar, sendo que 407 pacientes preencheram os critérios de inclusão e foram observados.

Do total de pacientes observados, 28 pacientes foram excluídos, por preencherem os critérios de exclusão, pois que internaram com história prévia de pneumonia comunitária. Participaram ativamente do estudo 379 (figura 1)

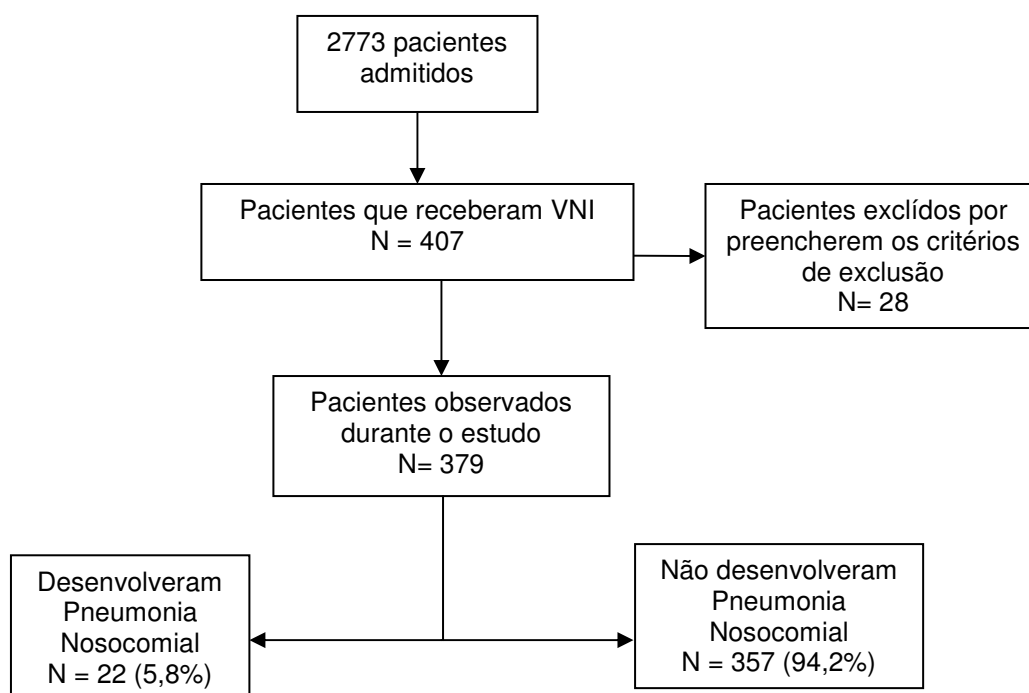


Figura 1 – Fluxograma dos pacientes que participaram do estudo

A média de idade dos pacientes foi de 56 anos e 55% eram do sexo masculino. No momento de internação 57% desta amostra apresentava perfil clínico e escore de gravidade (SAPS II) de 36.

O estudo foi realizado em 11 UTIs do complexo hospitalar e a tabela 01 apresenta o número de pacientes admitidos por UTI, e respectivamente o número de pacientes que utilizaram VNI e desenvolveram PNN. No período avaliado, a maior frequência de uso da VNI foi na UTI de Cirurgia Geral e do Aparelho Digestório (94 pacientes) e na UTI de emergências clínicas (62 pacientes).

Do total dos pacientes observados, 22 (5,8%) desenvolveram PNN associado ao uso de VNI e a maior incidência foi na UTI de Anestesia, totalizando 15,4% do total que desenvolveu PNN.

**Tabela 1** – Número de pacientes que desenvolveram PNN distribuídos pelas UTIs

TIPO DE UTI	PNN n (%)	Sem PNN n (%)	Total
<b>UTIs Cirúrgicas</b>			
UTI da Anestesia	8 (15)	44 (85)	52
UTI da Cirurgia Geral e Cirurgia do Aparelho Digestório	2 (2)	92 (98)	94
UTI de emergências cirúrgicas e trauma	1 (2)	38 (98)	39
Total de pacientes	11	174	185
<b>UTIs clínicas</b>			
UTI de Queimados	0 (0)	2 (100)	2
UTI da Hematologia	1 (17)	5(83)	6
UTI da Nefrologia	1 (4)	23 (96)	24
UTI da Clínica Médica e Choque	2 (5)	33 (94)	35
UTI Respiratória	1 (5)	19 (95)	20
UTI da Neurologia	1 (7%)	14 (93)	15
UTI das moléstias infecciosas e tétano	1 (3)	29 (97)	30
UTI de emergências clínicas	4 (7)	58 (93)	62
Total de pacientes	11	183	194

**Tabela 02** – Características demográficas dos pacientes que desenvolveram e não desenvolveram PNN

Características	PNN	Sem PNN	Valor de P (<0,05)
Idade média (SD)	62, (19,11)	56 (2)	0,163
Gênero, n (%)	Masc 14 (7)	Masc 195 (93)	
SAPS II	37	35	0,619
UTI com fisioterapia 24 Hrs, n (%)	15 (7)	196 (93)	0,313
Dias de VNI (SD)	9 (5,25)	5 (3,89)	0,000001
<b>Principal tipo de admissão – n (%)</b>			0,989
Clínica	13 (59)	206 (57)	
Cirúrgica	5 (23)	77 (21)	
Cirurgia de urgência	4 (18)	74(20)	
<b>Tipo de saída da UTI – n (%)</b>			0,158
Alta	9(41)	206(58)	
Transferência	7(32)	60(17)	
Óbito	6(27)	91(25)	

A idade média dos pacientes que desenvolveram PNN foi de 62 anos, 14 pacientes (6,7%) pertenciam ao sexo masculino, 5,9% tinham perfil clínico e o SAPS II no momento de internação na UTI era de 37 conforme tabela 02, onde estão apresentados dados demográficos comparativos entre a população que desenvolveu e não desenvolveu PNN durante o estudo.

Na tabela 03 estão apresentados os dados referentes ao motivo da instalação da VNI e a principal causa foi por insuficiência respiratória aguda pós extubação (179 pacientes) e destes, 10 pacientes desenvolveram PNN, que representa 45,5% do total que adquiriu a infecção.

**Tabela 03** – Motivo da instalação da VNI nos pacientes com PNN

Motivo da instalação da VNI, n (%)	PNN	Sem PNN	Total
DPOC descompensada	0	9 (2)	9
Asma	0	1(0,4)	1
Depressão do SNC	0	3 (0,8)	3
Doença neuromuscular	0	4 (1)	4
IrPA	6 (27)	92 (25)	98
IrPA Pós-extubação	10 (4)	159 (45)	169
Outra doença respiratória crônica descompensada	1 (5)	3 (1)	4
VMNI profilática	2 (9)	14 (4)	16
Recurso da fisioterapia respiratória	3 (14)	69 (19)	72
Ignorado	0	1 (0,4)	1
Outros	0	2 (0,6)	2
<b>TOTAL</b>	<b>22 (100)</b>	<b>357(100)</b>	<b>379</b>

A maior frequência de uso da VNI, foi nas UTIs com fisioterapia 24 horas com 211 pacientes, e a incidência de PNN também foi maior com 15 pacientes (tabela 04).

**Tabela 04** – Comparação entre UTIs com fisioterapia 24 e 12 horas

Tipo de UTI, n (%)	PNN	Sem PNN	TOTAL
UTI com Assistência 24 horas (%)	15 (68)	196 (55)	211 (100)
UTI com Assistência 12 horas (%)	7 (32)	161 (45)	168 (100)

Quanto aos dados referentes aos fatores de risco foi observado que o uso de sedação prévia apresentou taxa de frequência de 14(63%) e a necessidade de aspiração traqueal, 19(84%), com significância estatística com valor de  $p=0,042$  e  $p=0,009$  respectivamente (tabela 05).

**Tabela 05** – Fatores de risco para desenvolver pneumonia nosocomial na população estudada

Fatores de risco, n (%)	PNN	Sem PNN	P Value (< 0,05)
Idade avançada	13 (59)	167 (47)	0,183
Uso prévio de sedação	14 (64)	151 (42)	0,042*
Doença cardíaca ou pulmonar crônica	13 (59)	191 (53)	0,388
IRpA*	4(18)	97(27)	0,256
Malignidade	1 (4)	63 (18)	0,087
Diabete mellitus	6 (27)	80(22)	0,383
Uso prévio de VMI†	6 (27)	67 (19)	0,233
Cirurgia prévia	12 (54)	199 (56)	0,541
SDRA‡	1 (4)	5 (1)	0,303
TCE§	1 (4)	23 (6)	0,586
SNG	18 (82)	252 (71)	0,190
Cateteres invasivos	21 (95)	336 (94)	0,630
Necessidade de aspiração	19 (86)	214 (60)	0,009*
Glasgow < 9	6 (27)	115(3)	0,412
Uso de relaxantes musculares	2 (9)	58 (16)	0,281
Tabagismo	5 (23)	59 (17)	0,307
Decúbito horizontal	4 (18)	76(21)	0,488
Imunossupressão	1 (4)	46 (13)	0,215

\* IRpA: insuficiência respiratória aguda, † VMI: ventilação mecânica invasiva, ‡ SDRA: síndrome do desconforto respiratório agudo, § TCE: traumatismo crânio encefálico, || SNG : sonda naso gástrica.

A idade avançada, presença de doença cardíaca ou pulmonar crônica, o uso de cateteres e sonda nasogástrica apresentaram taxa alta em quase todos os pacientes que desenvolveram PNN, respectivamente em 13(59%), 13(59%), 21 (95%) e 18 (82%) indivíduos em relação ao total de 22 indivíduos, porém não foram estatisticamente significantes.



## 6 DISCUSSÃO

O estudo descreve a utilização da VNI na prática clínica além dos fatores de risco para desenvolver PNN entre uma população de pacientes clínicos e cirúrgicos durante sua internação nas UTIs em um hospital terciário de alta complexidade.

Como observado nos resultados, dos 379 pacientes estudados, 22(5,8%) desenvolveram PNN associada ao uso da VNI, taxa menor em relação ao estudo observacional multicêntrico apresentado por Carlucci et al (2001), realizado em 42 UTIs com 108 pacientes em uso de VNI, que foi de aproximadamente de 10%<sup>20</sup>.

O perfil demográfico dos indivíduos em nosso estudo mostrou que 63% foi do sexo masculino, com média de idade de 62 anos. Este dado tem sido identificado como um fator de risco que aumenta a incidência de PAV. Outros estudos<sup>66-68</sup> mostram que o sexo masculino está associado a uma condição de imunossupressão em situações de cirurgia ou pós trauma, aumentando o risco de infecções. Isto deve ocorrer, pois como já documentado em estudos prévios com animais, altos níveis de testosterona e baixos níveis de estradiol devem ser responsáveis pela imunossupressão pós trauma<sup>69</sup>. Desta maneira, observamos que o sexo feminino possui maior proteção hormonal e melhor resposta imune em comparação com o sexo masculino<sup>70,71</sup>.

Em relação ao valor do SAPS II<sup>72</sup>, a média foi de 37, valor semelhante ao estudo de Carlucci et al (2001)<sup>20</sup> mas, maior que apresentado em outro estudo prévio realizado por Guerin et al (1997)<sup>22</sup>, onde a média foi de 11,7.

A diferença entre os valores de SAPS II encontrados no nosso estudo em relação ao estudo citado anteriormente, pode ter relação com a característica da

nossa instituição, pois trata-se de um hospital tipo terciário, o que envolve internações de diversas naturezas e gravidades.

Em relação ao tipo de admissão, 13 pacientes (59,1%) tinham perfil clínico, porém estavam internados em unidades do tipo cirúrgica. Ainda nesta amostra, 10 indivíduos (45,5%) tiveram como principal motivo da instalação da VNI a IRpA pós-extubação.

Neste caso, a intubação prévia predispôs o indivíduo a adquirir infecções respiratórias, pois com a presença de prótese oro-traqueal, perde-se o mecanismo reflexo de proteção das vias aéreas, favorecendo o acúmulo de secreções supra-*cuff* e perda das barreiras fisiológicas de proteção da via aérea<sup>72</sup>. Em nosso estudo, o tempo de VMI destes pacientes foi de 10 dias em média, o que pode ter favorecido a instalação da PNN.

Em relação ao tempo de uso, os pacientes que desenvolveram PNN utilizaram VNI por tempo maior (8,95 dias) em relação aos pacientes que não desenvolveram PNN (4,57 dias). O resultado é esperado, pois com a instalação da PNN, a função respiratória fica comprometida pela produção de secreção, aumento da resistência das vias aéreas, redução dos volumes e capacidades e conseqüente piora da troca gasosa. Conforme apresentado no estudo de Guérin (1997)<sup>22</sup>, os pacientes que desenvolveram PNN também tiveram tempo de VNI maior em relação ao grupo que não desenvolveu.

Os dados referentes à presença de sondas e cateteres, não apresentaram significância estatística, porém dos 22 pacientes que desenvolveram PNN, 18 utilizaram sonda nasogástrica e 21 cateteres invasivos. Sabe-se que a presença destes fatores predispõe ao desenvolvimento de infecções<sup>73</sup> e seus cuidados devem ser abordados de forma cuidadosa para prevenção de PNN.



A idade avançada e presença de doença pulmonar e cardíaca crônica, apesar de não mostrarem relevância estatística, são fatores que merecem destaque, pois são situações clínicas muito comuns em ambiente de UTI e na presença destas condições deve-se também ter cautela em relação ao desenvolvimento de PNN.

O uso prévio de sedação prolongada foi um fator com relevância estatística, onde 14 (63,3%) dos pacientes receberam sedação.

O uso de drogas sedativas ou bloqueadores musculares estão associados à PNN, assim como foi observado por outros pesquisadores<sup>75</sup>. O uso de tal terapêutica diminui o reflexo de tosse, diminui o clearance das secreções traqueais e diminuição da motilidade gástrica<sup>66</sup>, além de aumentar o tempo de permanência na ventilação mecânica<sup>76</sup>.

A necessidade de aspiração foi mais um fator relevante. Em nosso estudo, 19 pacientes do total que desenvolveu PNN fizeram parte desta amostra. A remoção da secreção traqueal através da técnica de aspiração tem sido tradicionalmente usada para prevenir pneumonia. Porém as sondas de aspiração podem introduzir microorganismos no trato respiratório inferior do paciente o que pode levar a PNN<sup>77</sup>. O acúmulo de secreção nas vias aéreas ocasionado pelo reflexo de tosse diminuído seja por dor ou presença de anestesia também pode ser um fator associado a PNN. Sendo assim esses pacientes serão submetidos a um maior número de aspirações das vias aéreas.

Outro dado que merece destaque é em relação à assistência de fisioterapia por 24 horas. Neste trabalho, o número de pacientes que desenvolveu PNN, em sua maioria, estava internado em unidades que tinham fisioterapia ininterrupta.

Isto pode ser justificado pelo perfil dos pacientes internados nestas unidades, pois foram pacientes de perfil cirúrgico que sofreram mais intervenções e foram mais manipulados.

## **7 CONCLUSÃO**

## 7 CONCLUSÃO

Em nosso estudo, a PNN em pacientes com VNI teve maior prevalência no sexo masculino, em pacientes internados em unidade cirúrgicas e os fatores de risco associados foram sedação prolongada e necessidade de aspiração traqueal.

Foram encontradas limitações no estudo, frente a ausência de protocolos específicos para o uso da VNI e a prevenção da PNN neste grupo de pacientes.

Estudos estratificando os diversos tipos de pacientes com a indicação para uso da VNI associando fatores de risco seriam necessários no futuro como o objetivo de prevenir a PNN.



## 8. ANEXOS

## 8 1 - Anexo 1 – CAPPESQ



## APROVAÇÃO

A Comissão de Ética para Análise de Projetos de Pesquisa - CAPPesq da Diretoria Clínica do Hospital das Clínicas e da Faculdade de Medicina da Universidade de São Paulo, em sessão de 12/09/2007, **APROVOU** o Protocolo de Pesquisa nº **0328/07**, intitulado: **"PNEUMONIA NOSOCOMIAL E VENTILAÇÃO NÃO INVASIVA: UM ESTUDO DE COORTE"**, apresentado pelo Departamento de **FISIOTERAPIA, FONOAUDIOLOGIA E TERAPIA OCUPACIONAL**, inclusive o Termo de Consentimento Livre e Esclarecido.

Cabe ao pesquisador elaborar e apresentar à CAPPesq, os relatórios parciais e final sobre a pesquisa (Resolução do Conselho Nacional de Saúde nº 196, de 10/10/1996, inciso IX.2, letra "c").

Pesquisador (a) Responsável: **Profa. Dra. Carolina Fu**

Pesquisador (a) Executante: **Sidnei Ricardo Nobre Bernardes**

CAPPesq, 14 de Setembro de 2007

Prof. Dr. Eduardo Massad  
**Presidente da Comissão  
de Ética para Análise de  
Projetos de Pesquisa**

## 8 2 - Anexo 2 – Questionário padronizado para coleta de dados

**Ventilação não-invasiva: estudo de coorte prospectivo**

<b>ETIQUETA</b> <b>INTERNAÇÃO NO HC</b> / / <b>(NOME, DATA DE NASCIMENTO, RGHC)</b>	<b>INTERNAÇÃO NA UTI:</b> / / <b>HORA:</b> <b>INTERNAÇÃO PRÉVIA NA UTI:</b> (1) Sim (2) Não <b>DATA</b> / / <b>TRATAMENTO PRÉVIO COM VMI:</b> (1) sim (2) não <b>DATA</b> <b>TRATAMENTO PRÉVIO COM VNI:</b> (1) sim (2) não <b>DATA</b> <b>USO DE VNI DOMICILIAR</b> (1) Sim (2) Não <b>PROCEDÊNCIA:</b> (1) PS (2) ENF (3) Outra UTI (4) Outro hospital (5) Centro Cirurgico
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**SEXO:** (1) Masculino (2) Feminino

**UTI:** (1) Anest (2) Cirurg (9ª) (3) Quei (4) Hem (5) Nef (6) CM (7) Pne (8) Neu (9) MI (10) PSTR (11) PSCI

**UTI COM FISIO RESPIRATÓRIA 24HS:** 1. SIM ( ) 2. NÃO ( )

**SAPS II nas primeiras 24 horas após internação**

Idade (anos)					0 <40	7 40 - 59	12 60 - 69	15 70 - 74	16 75 - 79	18 > = 80
<b>FC (BPM)</b>			11 < 40	2 40 - 69	0 70 - 119	4 120 - 159	7 > = 160			
<b>PAS (mmHg)</b>			13 <70	5 70 - 99	0 100 - 199	2 > = 200				
<b>T (°C)</b>					0 < 39	3 > = 39				
<b>Em VM PaO2/FiO2</b>		11 <100	9 100 - 199	6 > = 200	0 Sem VM					
<b>Diurese (ml/Dia)</b>			11 <500	4 500 - 999	0 > = 1000					
<b>Uréia (mg/ml)</b>					0 < 28	6 28 - 83	10 > = 84			
<b>Leucócitos (0³/mm)</b>				12 <1,0	0 1,0 - 19,9	3 > = 20				
<b>K+ (mEq/L)</b>				3 < 3,0	0 3,0 - 4,9	3 > = 5,0				
<b>Na+ (mEq/L)</b>				5 < 125	0 125 - 144	1 > = 145				
<b>HCO3- (mEq/L)</b>			6 < 15	3 15 - 19	0 > = 20					
<b>BT (mg/Dl)</b>					0 < 4,0	4 4,0 - 5,9	9 > = 6,0			
<b>Glasgow</b>	26 <6	13 6 - 8	7 9 - 10	5 11 - 13	0 14 - 15					
<b>Doença Crônica</b>						9 CA Metast.	10 CA Hemat.	17 AIDS		
<b>Admissão</b>					0 Cirurgia Eletiva	6 Clínico	8 Cirurgia de urgência			

**PONTUAÇÃO:** \_\_\_\_\_

DATA DE INICIO DA VNI: / /	PERÍODO: (1) MANHA (2) TARDE (3) NOITE
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**MOTIVO DA INSTALAÇÃO DA VENTILAÇÃO MECÂNICA NÃO INVASIVA:**

<p><b>1. DPOC DESCOMPENSADA</b> (paciente com diagnóstico de DPOC [enfisema, bronquite crônica, fibrose cística], conhecido ou altamente provável, baseado na história, exame físico e RX de tórax, em descompensação, necessitando VM): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>2. ASMA</b> (crise asmática) : 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>3. ALTERAÇÃO DO NÍVEL DE CONSCIÊNCIA</b> ( devido a evento neurológico primário [AVC, infecções, overdose de drogas] ou metabólico [encefalopatia hepática, encefalopatia urêmica, coma mixematoso]): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>4. DOENÇA NEUROMUSCULAR</b> ( insuficiência respiratória devido a comprometimento primário do SNP [trauma raquimedular, tétano, esclerose lateral, amiotrófica, síndrome de Guillain-Barré, miastenia gravis, botulismo, intoxicação por organofosforados] ou de massa muscular [distrofia muscular, distúrbios hidroeletrólíticos]): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5. INSUFICIÊNCIA RESPIRATÓRIA AGUDA</b></p> <p><b>5.1 LPA</b> (PaO<sub>2</sub> / FIO<sub>2</sub> ≤ 300 + RX infiltrado bilateral difuso, compatível com edema pulmonar + Pcap ≤ 18 ou sem sinais clínicos e/ou ecocardiográficos de hipertensão atrial esquerda): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5.2 SDR</b> (PaO<sub>2</sub> / FIO<sub>2</sub> ≤ 200 + RX infiltrado bilateral difuso, compatível com edema pulmonar + Pcap ≤ 18 ou sem sinais clínicos e/ou ecocardiográficos de hipertensão atrial esquerda): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5.3 EDEMA AGUDO DE PULMÃO/ INSUFICIÊNCIA CARDÍACA CONGESTIVA:</b> 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5.4 PNEUMONIA</b> (novo ou progressivo infiltrado ao RX de tórax + febre ou hipotermia + leucocitose ou leucopenia + secreção traqueal purulenta + terapia antimicrobiana instituída pelo médico assistente): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5.5 TRAUMA</b> (VM iniciada devido a trauma cranioencefálico, torácico, abdominal ou outro): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5.6 APNEIA OU DISFUNÇÃO DE VAS</b> (obstrução das vias aéreas superiores): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5.7 OUTRA</b> ( outra causa de insuficiência respiratória aguda, não mencionada: atelectasia, derrame pleural, etc): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>5.8 IGNORADO:</b> 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>6. PÓS- EXTUBAÇÃO*</b> : SEGUIR ORIENTAÇÕES DO QUADRO “** PÓS-EXTUBAÇÃO”</p> <p><b>6.1 Insuficiência respiratória</b> (extubação seguido de insuficiência respiratória em até 48 horas): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>6.2 Desmame precoce:</b> 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>6.3 Profilático:</b> 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>7. OUTRA DOENÇA RESPIRATÓRIA CRÔNICA DESCOMPENSADA</b> ( doenças intersticiais pulmonares crônicas, etc): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>8. VNI “PROFILÁTICA”:</b> (Hipervolemia, queimados, etc): 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>9. RECURSO DA FISIOTERAPIA RESPIRATÓRIA:</b> 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>10. IGNORADO:</b> 1. <b>Sim</b>    2. <b>Não</b></p>
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**\* PÓS - EXTUBAÇÃO**

<p><b>MOTIVO DA INTUBAÇÃO:</b></p> <p>1. DPOC DESCOMPENSADA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>2. ASMA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>3. ALTERAÇÃO DO NÍVEL DE CONSCIÊNCIA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>4. DOENÇA NEUROMUSCULAR: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5. INSUFICIÊNCIA RESPIRATÓRIA AGUDA</p> <p>5.1 LPA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5.2 SDR: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5.3 EDEMA AGUDO DE PULMÃO/ INSUFICIÊNCIA CARDÍACA CONGESTIVA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5.4 PNEUMONIA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5.5 TRAUMA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5.6 DISFUNÇÃO DE VAS: 1. <b>Sim</b>    2. <b>Não</b></p>	<p>5.7 FALÊNCIA PÓS-EXTUBAÇÃO: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5.8 OUTRA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>5.9 IGNORADO</p> <p>6. OUTRA DOENÇA RESPIRATÓRIA CRÔNICA DESCOMPENSADA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>7. PARADA CÁRDIO-RESPIRATÓRIA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>8. INSTABILIDADE HEMODINÂMICA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>9. CIRURGIA: 1. <b>Sim</b>    2. <b>Não</b></p> <p>10. OUTROS: 1. <b>Sim</b>    2. <b>Não</b></p> <p>11. IGNORADO : 1. <b>Sim</b>    2. <b>Não</b></p> <p><b>DATA DA INTUBAÇÃO PRÉVIA A VNI:</b> / /    <b>HORA:</b></p>
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DATA DA EXTUBAÇÃO: / /    HORA:
FORMA DE EXTUBAÇÃO: 1. PROGRAMADA    2. ACIDENTAL



PARÂMETROS VENTILATÓRIOS NO D1 DE VNI - DATA / /								
BIPA P	EPAP		CPAP	CPAP (cmH <sub>2</sub> O)		VM	PEEP (cmH <sub>2</sub> O)	
	IPAP			FR			PS (cmH <sub>2</sub> O)	
	O <sub>2</sub>						FiO <sub>2</sub>	
	FR						FR	
PARÂMETROS VENTILATÓRIOS NO DF DE VNI - DATA / /								
BIPA P	EPAP		CPAP	CPAP (cmH <sub>2</sub> O)		VM	PEEP (cmH <sub>2</sub> O)	
	IPAP			FR			PS (cmH <sub>2</sub> O)	
	O <sub>2</sub>						FiO <sub>2</sub>	
	FR						FR	

Para o preenchimento dos quadros abaixo, **TEMPO DE VNI**, seguir gabarito:

\* Tipo de máscara: (1) FACIAL (2) NASAL (3) TOTAL FACE

\*\* Tipo de VNI: (1) BIPAP VISION (2) BIPAP ST/D 30 (3) CPAP Gerador de fluxo (4) VENTILADOR MECÂNICO (5) OUTROS

TEMPO DE VNI								
DATA	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
Tempo (min)								
*Tipo máscara								
**Tipo VNI								

TEMPO DE VNI								
DATA	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
Tempo (min)								
*Tipo máscara								
** Tipo VNI								

TEMPO DE VNI								
DATA	/ /	/ /	/ /	/ /	/ /	/ /	/ /	/ /
Tempo (min)								
*Tipo máscara								
** Tipo de VNI								

TOATAL DE DIAS DE VNI:	TOTAL DE HORAS DE VNI:	MÉDIA DE HORAS DE VNI/DIA:
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GASOMETRIA 24 ANTES DO INICIO DA VNI					GASOMETRIA AÓS O ULTIMO DIA DE USO DA VNI				
Ph	PaO <sub>2</sub>	PaCO <sub>2</sub>	HCO <sub>3</sub>	BE	Ph	PaO <sub>2</sub>	PaCO <sub>2</sub>	HCO <sub>3</sub>	BE

## TOSSE 24 HRS APÓS INÍCIO DA VNI

TOSSE 1: (1) EFICAZ (2) INEFICAZ  
 TOSSE 2: (1) PRODUTIVA (2) SECA ASPIRAÇÃO NASOTRAQUEAL: (1) Sim (2) Não  
 QUANTIDADE DE SECREÇÃO: (1) Pequena (2) Média (3) Grande (4) Ausente

INTOLERÂNCIA À VNI DURANTE O USO : (1) Sim (2) Não

VAZAMENTO DE AR DA VNI COMPROMETE A TERAPIA: (1) Sim (2) Não

DIETA DURANTE A VNI NAS 1<sup>AS</sup> 24 HORAS: (1) Sim (2) Não

VIA DE ADMINISTRAÇÃO DA DIETA DURANTE A VNI : (1) ORAL (2) POR SONDA (3) JEJUM

## COMPLICAÇÕES DA VNI

(1) LESÃO CUTÂNEA	(5) HIPOTENSÃO (PAS < 90 mmHg)
(2) DISTENSÃO GÁSTRICA	(6) OUTRAS
(3) IRRITAÇÃO OCULAR	(7) NENHUMA
(4) VÔMITOS / ASPIRAÇÃO	

## DADOS RELACIONADOS COM PNEUMONIA NOSOCOMIAL

# Para o preenchimento dos “DADOS RELACIONADOS COM PNEUMONIA NOSOCOMIAL”, observar o uso de VNI nos pacientes com mais de 48 horas da data da internação.

# Observar 02 ou mais critérios diagnósticos (critérios clínicos e biológicos) para Pneumonia nosocomial, com confirmação do diagnóstico através do exame radiológico (ITEM 9) por médico assistente à unidade.

DATA													
1. Febre (> 37,5 <sup>o</sup> )													
2. Alteração da secreção traqueal *													
3. Estertores pulmonares													
4. Cultura de escarro positiva													
5. Leucositose (> 11000)													
6. Cultura de secreção traqueal positiva													
7. Cultura de líquido pleural													
8. Hemocultura positiva													
9. Novo infiltrado radiológico													

#Alteração da secreção pulmonar: > 100 cm cúbicos de produção diária de secreção. Observar alterações na viscosidade (secreção viscosa) e cor da secreção (coloração esverdeada e/ou amarelada) ITEM 6 é obrigatório para fechar o diagnóstico de Pneumonia nosocomial

<b>PNEUMONIA NOSOCOMIAL</b>	1 – SIM ( )	2 – NÃO ( )
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## FATORES DE RISCO PARA DESENVOLVER PNEUMONIA NOSOCOMIAL

1. IDADE AVANÇADA (>= 60) ANOS)	(1)SIM	(2)NÃO
2. USO PRÉVIO DE SEDAÇÃO PROLONGADA (acima de 48 hs)	(1)SIM	(2)NÃO
3. DOENÇAS CARDÍACAS OU PULMONAR CRÔNICA	(1)SIM	(2)NÃO
4. INSUFICIÊNCIA RENAL	(1)SIM	(2)NÃO
5. MALIGNIDADE	(1)SIM	(2)NÃO
6. DIABETES MELLITUS	(1)SIM	(2)NÃO
7. USO PRÉVIO DE VNI	(1)SIM	(2)NÃO
8. CIRURGIA PRÉVIA (ABDOMINAL / TORÁCICA / OUTRAS)	(1)SIM	(2)NÃO
9. SDRA	(1)SIM	(2)NÃO
10. TRAUMA CRÂNIO-ENCEFÁLICO	(1)SIM	(2)NÃO
11. SONDA NASO-GÁSTRICA	(1)SIM	(2)NÃO
12. CATÉTERES INVASIVOS	(1)SIM	(2)NÃO
13. NECESSIDADE DE ASPIRAÇÃO	(1)SIM	(2)NÃO
14. ESCALA DE GLASGOW < 9	(1)SIM	(2)NÃO
15. USO DE RELAXANTES MUSCULARES	(1)SIM	(2)NÃO
16. TABAGISMO	(1)SIM	(2)NÃO
17. DECÚBITO HORIZONTAL	(1)SIM	(2)NÃO
18. IMUNOSSUPRESSÃO	(1)SIM	(2)NÃO

## INTUBAÇÃO APÓS O USO DE VNI:

(1) SIM	DATA: / /
(2) NÃO	HORA: / /

## CAUSA DA INTUBAÇÃO

(1) INSUFICIÊNCIA RESPIRATÓRIA AGUDA	(5) OBSTRUÇÃO DE VIA AÉREA
(2) REBAIXAMENTO DO NÍVEL DE CONSCIÊNCIA	(6) INTOLERÂNCIA
(3) INSTABILIDADE HEMODINÂMICA	(7) OUTRA CAUSA
(4) INABILIDADE DE ELIMINAR SECREÇÕES	(8) IGNORADO

TRAQUEOSTOMIA: (1) SIM (2) NÃO DATA: / /

SAÍDA DA UTI: / / TIPO DE SAÍDA DA UTI: (1) ALTA (2) ÓBITO (3) TRANSFERÊNCIA

RESULTADO DA VNI: (1) SUCESSO (2) FALÊNCIA (necessidade de iot ou a dependência de VNI após 72 horas do início da VNI)

SEGUNDO EVENTO: (1)SIM (2) NAO (instalação de VNI após extubação em pct com uso de VNI pré IOT)

### 8.3 - Anexo 3 – Normas da Revista

RESPIRATORY CARE Manuscript Preparation Guide, Revised 1/08

#### **Editorial Policies for Authors**

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The first figure in a report of a clinical trial must contain a flow diagram that shows the phases of the trial, including enrollment, patient allocation, follow-up, and analysis. All studies that include human subjects must indicate in the Methods section that approval was received from the appropriate local institutional review board(s), and/or that the procedures were conducted in accordance with the ethical standards of the World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects (<http://www.w.net/e/policy/b3.htm>).

All authors are responsible for ensuring that the manuscript also complies with the provisions of the Health Insurance Portability and Accountability Act (HIPAA), available at <http://www.h.gov/ocr/hipaa>, which applies to information in any part of the report that could identify a patient. You must provide written consent from the patient, next of kin, or guardian for any photograph, illustration, or description in which an individual could be identified. All studies involving animals must indicate in the Methods section that approval was received from the local institutional review board(s), or that the research was conducted in accordance with a national guideline (eg, Public Health Service Policy on Humane Care and Use of Laboratory Animals (<http://grants.nih.gov/grants/olaw/references/phspol.htm>)).

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**ABSTRACT**

**Introduction:** Noninvasive ventilation (NIV) has become an integral part of ventilatory support to critically ill patients. Many studies have shown that NIV reduces morbidity and the rate of nosocomial pneumonia (NP), when compared to patients who received invasive mechanical ventilation.

**Objective:** To verify the rates of NP, risk factors and mortality in not selected patients that used NIV at intensive care units (ICU). **Method:** A prospective cohort study of consecutively admitted patients in 11 ICUs of a large, public, university-affiliated hospital. Over a 9 months period, we studied all patients with age  $\geq 18$  years, submitted to NIV during ICU stay. The following data were collected daily: NIV characteristics, medical and demographic data, NP rate and risk factors associated to NP, and ICU outcomes. **Results:** NIV was used to manage 407 patients over the study period. The study population included 379 patients. NP occurred in 22 patients (5.8%), The main reasons to installation of NIV were: post extubation (45%), acute respiratory failure (27%), as a chest therapy resource (14%) and as prophylactic NIV (9%). The mean duration of use of NIV was 9 days and the mortality rate was 2.3%. The following factors were associated to NP: need of tracheal aspiration ( $p < 0,05$ ) and use of prolonged sedation ( $p < 0.05$ ). From the patients that developed NP, 13 (7%) were elderly ( $>65$  years old). **Conclusion:** In our study, the NP in patients with NIV had higher prevalence in males, in patients in surgical unit and the risk factors were prolonged sedation and need for tracheal aspiration.

Key words: Noninvasive ventilation, nosocomial pneumonia, cohort studies

## 1 – INTRODUCTION

Non-invasive mechanical ventilation (NIV) has been successfully used for treating acute respiratory failure (ARF)<sup>1</sup>, preventing orotracheal intubation, and also preventing the complications of invasive mechanical ventilation (IMV)<sup>2</sup>.

The complications observed among ARF patients treated with NIV are smaller than those of patients using invasive ventilation<sup>3</sup>. Among the complications associated to IMV, we can mention ventilator-associated pneumonia (VAP), which is a type of nosocomial pneumonia. (NP)<sup>4</sup>.

Both conditions above are reported as the major cause of mortality and morbidity at ICUs<sup>5</sup>. NP is defined as a pulmonary infection developed 48 hours after hospital admission. Its clinical signs, which are the criteria for diagnosis, are fever, leukocytosis, secretion alteration, and pulmonary infiltrate<sup>6</sup>. On the other hand, VAP is developed in patients who have been under mechanical ventilation treatment for at least 48 hours<sup>5</sup>.

Several strategies are described for preventing NP and VAP. The main ones are: use of protocols to facilitate and accelerate the weaning process<sup>7</sup>, subglottic suction<sup>8</sup>, use of head-elevated supine position<sup>9</sup>, mouth hygienization program<sup>11,12</sup>, use of heat and moisture exchangers<sup>13, 14</sup>, hand hygienization<sup>15</sup>, and use of NIV<sup>16-23</sup>.

Studies regarding NIV among patients with chronic obstructive pulmonary disease (COPD)<sup>24</sup>, acute pulmonary edema (APE)<sup>16, 17</sup>, post-extubation respiratory failure<sup>25, 26</sup>; and immunodepressed<sup>27, 28</sup> and transplanted<sup>29, 30</sup> patients show NIV-associated NP values ranging between 0 to 41% among these patients.

There is a paucity of studies describing the clinical use of NIV and relating its NP risk factors among patients with different etiologies.

Therefore, this study aims at observing NP occurrence, risk factors and complications in clinical practice among clinical and surgery patients who made use of NIV at the ICUs of a tertiary hospital.

## **METHODS**

This a prospective cohort study of patients consecutively admitted to 11 ICUs of a university tertiary hospital. Between May 1st and December 31st, 2007, all the ICU patients over 18 years old who underwent NIV treatment were studied. The exclusion criteria concerned patients who had been tracheostomized before the use of NIV, present diagnosed of community acquired pneumonia at the ICU admission, and patients whose data were incomplete during collection.

NIV is defined as a ventilation support method with positive pressure, in which no tracheal prosthesis is employed (orotracheal and nasotracheal tube, or tracheostomy cannula) and the connection between ventilator and patient is made through a facial or nasal mask<sup>31</sup>.

The patients meeting the inclusion criteria were observed daily until their death or ICU discharge. The researchers carried out the data collection through a form specially developed for this study. These researchers had been trained for three months before gathering the data. The form was tested and revised in the same period. The units were visited daily by the researchers. The prospective data were obtained from medical records and from the medical, physiotherapy and nursing teams caring for the patients at the moment the data were collected. All the decisions about the use of NIV were made by the healthcare teams at the study units. No intervention whatsoever concerning the patients was made by the research team.

The variables studied were selected through review of relevant literature. These included the following information: demographic data, patient's place of origin; previous ICU hospitalization; previous NIV or MV treatment; home use of NIV; Simplified Acute Physiology Score (SAPS II)<sup>32</sup> of the first 24 hours of ICU hospitalization; characteristics of NIV (reason for installing NIV, continuous length of time and total length of time of NIV use, type of NIV, final ventilation parameters of NIV, type of mask, tolerance to NIV, and complications associated to NIV); risk factors to develop nosocomial pneumonia and presence or not of this condition (in compliance with the *CDC-Centers for disease control and prevention* criteria<sup>6</sup>). The results were: Rate of pneumonia with the use of NIV and mortality rate.

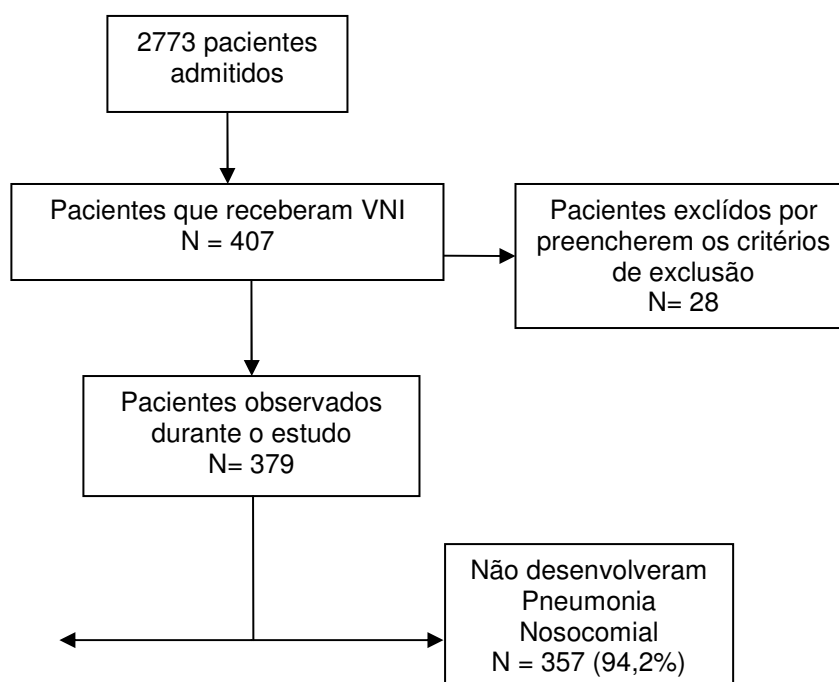
### **3.1 ANALYSIS OF THE DATA**

Databank creation and analysis were performed with the statistical package Epi Info version 6.04 (Centers for Disease Control and prevention – CDC). A descriptive analysis of the study population was carried out. The quantitative variables were expressed as mean (standard deviation) or median (interquartile range), when more appropriate. Categorical variables were presented as proportion with 95% confidence interval.

In univariate analysis, associations between the categorical variables were analyzed through chi-square test or Fisher's Exact test. Continuous data were compared through Student's *t*-test or the non-parametric equivalent. All the tests were two-tailed with significance level  $p \leq 0,05$ .

## 4 - RESULTS

Between May 01 2007 and December 31 2007, 2773 patients were hospitalized at the 11 study ICUs. During this period, 407 patients used NIV. Three hundred seventy-nine (379) of these were included. The other 28 were excluded because they had been hospitalized with a diagnosis of community-acquired pneumonia. (figure 1).



**Figure 1.** Flowchart of the study population

The demographic data of the study population were: The mean age of patients was 56, and 55% were male. At the moment of hospitalization, 57% of this sample was made of clinical patients, with Simplified Acute Physiology Score (SAPS II) 36.

Table 1 shows patient distribution at the ICUs, according to NP development or not.

Table 1 – Distribution of patients according to nosocomial pneumonia rate and intensive care unit categories.

ICU* types, n (%)	NP*	Non-NP	Total
<b>Surgical ICU</b>			
Anesthesia ICUs	8 (15)	44 (85)	52
General Surgery and Digestive Tract Surgery	2 (2)	92 (98)	94
Surgical emergencies and trauma	1 (3)	38 (97)	39
Total patients	11	174	185
<b>Medical ICU</b>			
Burns	0 (0)	2 (100)	2
Hematology	1 (17)	5(83)	6
Nephrology	1 (4)	23 (96)	24
Medical and Shock	2 (5)	33 (95)	35
Respiratory	1 (5)	19 (95)	20
Neurology	1 (7)	14 (94)	15
Infectious diseases	1 (3)	29 (97)	30
Emergency	4 (7)	58 (93)	62
Total patients	11	183	194

\* ICU: intensive care unit

During the study period, the ICUs that used NIV most were: Digestive System General Surgery ICU (94 patients) and Clinical Emergency ICU (62 patients).

A total of 22 patients (5.8%) developed NP from the use of NIV. The post-anesthesia ICU showed the highest incidence: 8 patients.

Among the population that developed NP, the average age of patients was 70 years, 14 patients (7%) were male; there were 13 hospitalizations of clinical patients (59%); and SAPS II at the moment of ICU hospitalization was 37, as seen in table 2. This table also shows comparative demographic data between the population that developed NP during the study and the one that didn't.

**Table 02** - Demographic characteristics of patients who developed and not developed nosocomial pneumonia

Characteristics	NP* (n = 22)	Non-NP (n = 357)	P Value (< 0,05)
SAPS II <sup>†</sup> , mean (SD)	37 (13)	35 (14)	0,619
ICU <sup>‡</sup> /Physical therapy 24h, n (%)	15 (7)	196 (93)	0,313
Days of NIV (SD)	9 (5)	5 (3)	0,000001
Age, mean (SD)	70 (21)	63 (20)	0,163
Gender, n (%)	Male 14 (7)	Male 195 (93)	
<b>Main type of admission, n (%)</b>			0,989
Medical	13 (59)	206 (58)	
Surgical	5 (23)	77 (94)	
Emergency surgery	4 (18)	74(95)	
<b>ICU outcome, n (%)</b>			0,158
Discharge	9(41)	206(58)	
Transfer	7(32)	60(17)	
Death	6(27)	91(25)	

\*NP: nosocomial pneumonia, † SAPS: Simplified Acute physiology Score, ‡ ICU: intensive care unit,

Table 3 shows the data concerning the reasons for installing NIV, among which the main cause was post-extubation acute respiratory failure (179 patients). Among these, 10 patients developed NP, which represents 45% of all the ones who acquired this infection.

Table 03 - Reason for the NIV installation in patients with nosocomial pneumonia

Reason for NIV* installation, n (%)	NP (n = 22)	Non-NP (n = 357)	TOTAL
Descompensated COPD <sup>†</sup>	0	9 (2)	9
Asthma	0	1(0,4)	1
Depression of CNS <sup>‡</sup>	0	3 (0,8)	3
Neuromuscular Disease	0	4 (1)	4
ARF <sup>§</sup>	6 (27)	92 (25)	98
ARF Pós-extubation	10 (45)	159 (45)	169
Another decompensated chronic respiratory disease	1 (5)	3 (1)	4
NIV profilatic	2 (9)	14 (4)	16
Resource of physical therapy	3 (14)	69 (19)	72
Ignored	0	1 (0,4)	1
Others	0	2 (0,6)	2
<b>TOTAL</b>	<b>22 (100)</b>	<b>357 (100)</b>	<b>379</b>

\*NIV: noninvasive ventilation, †COPD: chronic obstructive pulmonary disease, ‡CNS: central nervous system, §ARF: acute respiratory failure

NIV use was most frequent at ICUs with 24-hour physiotherapy services: 211 patients. NP incidence was also higher among this population, totalizing 15 patients, as seen in Table 4.

Table 04 - Comparison between ICU therapy with 24 and 12 hours

ICU* therapy assistance, n (%)	NP <sup>†</sup>	Non NP	TOTAL
ICU with assistance 24 hours	15 (68)	196 (55)	211 (100)
ICU with assistance 12 hours	7 (32)	161 (45)	168 (100)

\*ICU: intensive care unit, †NP:nosocomial pneumonia

Table 5 shows the data concerning risk factors. The use of previous sedation showed frequency rate 14 (63%), whereas the need of tracheal aspiration, 19 (84%). These factors presented statistical significance  $p=0.042$  and  $p=0.009$ , respectively.

**Table 05** – Risk factors for developing NP in the study population

Risk factor, n (%)	NP*	Non NP	P Value (< 0,05)
Advanced age	13 (59)	167 (47)	0,183
Previous use of sedation	14 (64)	151 (42)	0,042*
Heart disease or lung disease	13 (59)	191 (53)	0,388
ARF	4(18)	97(27)	0,256
Malignancy	1 (4)	63 (18)	0,087
Diabetes Mellitus	6 (27)	80(22)	0,383
Previous use of NIV	6 (27)	67 (19)	0,233
Previous surgery	12 (54)	199 (56)	0,541
ARDS	1 (4)	5 (1)	0,303
Brain damage	1 (4)	23 (6)	0,586
Naso gastric tube	18 (82)	252 (71)	0,190
Invasive catethers	21 (95)	336 (94)	0,630
Need aspiration	19 (86)	214 (60)	0,009*
Glasgow Coma Score< 9	6 (27)	115(3)	0,412
Use of muscle relaxants	2 (9)	58 (16)	0,281
Smoke	5 (23)	59 (17)	0,307
Supine	4 (18)	76(21)	0,488
Imunosuppression	1 (4)	46 (13)	0,215

\*NP: nosocomial pneumonia

## 5 - DISCUSSION

This study describes the use of NIV in clinical practice as well as risk factors for developing NP among a population of clinical and surgery patients during their stay at the ICUs of a high complexity tertiary hospital.

As observed in the results, 22 (5.8%) of the 379 study patients developed NIV-associated NP, which is lower in comparison to the approximately 10% (ten percent) of the multicenter observational study presented by Carlucci et al (2001)<sup>20</sup>, carried out at 42 ICUs with 108 patients using NIV.

The demographic profile of the individuals in our study showed that 63% were male, and the mean age was 62 years. These data have been identified as risk factors that increase VAP incidence. Other studies<sup>33-35</sup> show that the male gender is associated to an immunosuppression condition in surgery or post-trauma situations, which increases the risk of infections.

This may occur because, as already reported in studies previously carried out with animals, high levels of testosterone and low levels of stradiol must be



responsible for post-traumatic immunosuppression<sup>36</sup>. Thus, we observed that females have more hormonal protection and better immune response in comparison to males<sup>37,38</sup>.

As far as SAPS II is concerned, the mean was 37, similar to the one in the study by Carlucci et al (2001)<sup>20</sup>, but higher than what had been presented in the study carried out by Guerin et al (1997)<sup>22</sup>, in which the mean was 11.7. The difference between the SAPS II values found in our study and in the previous studies may be related to the characteristics of our hospital, since it was a tertiary type hospital, involving hospitalizations of different natures and seriousness.

Another point to consider is the evolution of equipment and knowledge, which allows better application of NIV in patients with more serious conditions<sup>20</sup>.

Concerning the type of admission, 13 patients (59%) presented a clinical profile, but they were hospitalized in mixed-type units (units with healthcare services for clinical and surgery patients). Still in this sample, for 10 individuals (45%) the main reason for installing NIV was ARF post-extubation.

In these cases, the previous intubation predisposed the individual to acquiring respiratory infections. In the presence of orotracheal prosthesis, the airway protection mechanism is lost, which favors the accumulation of supra-cuff secretions and loss of the physiological barriers protecting the airways<sup>39</sup>. In our study, NIV use length among these patients was 10 days on average, which may have favored NP incidence.

Regarding length of use, the patients who developed NP used NIV for a longer time (9 days) than the patients who did not develop NP (5 days). This result is expected because when NP takes place, the respiratory function is compromised by secretion production, increase in airway resistance, reduction of volumes and

capacities, and consequent worsening of gas exchange. As presented in the study by Guérin (1997)<sup>22</sup>, the patients who developed NP also had longer NIV time than those who didn't.

The data concerning the presence of tubes and catheters, did not present statistical significance. Nevertheless, of the 22 patients who developed NP, 18 used nasogastric tubes and 21 received invasive catheters.

It is a known fact that these factors predispose individuals to develop infections<sup>40</sup>. Therefore, their condition should be carefully dealt with so as to prevent NP incidence.

Although advanced age and presence of chronic pulmonary and cardiac disease do not show statistical relevance, they are factors that need to be highlighted. These are clinical situations very common in ICU environments. In face of these conditions, one should also be careful about NP development.

Previous use of prolonged sedation was a factor with statistical relevance. Fourteen (63%) of the study patients received sedation.

The use of sedative drugs or muscular blockers is associated to NP, as observed by other researchers<sup>41</sup>. Using these therapies reduces cough reflex, tracheal secretion clearance, and gastric motility<sup>33</sup>, besides increasing the length of stay under mechanical ventilation<sup>42</sup>.

The need of aspiration was another relevant factor. In our study, 19 of those patients who developed NP were part of this sample.

Removing tracheal secretion through the aspiration technique has been traditionally used to prevent pneumonia. However, the aspiration tubes may introduce microorganisms in the patient's lower respiratory tract, which may lead to NP. The accumulation of secretion in the airways caused by decreased cough reflex,

either because of pain or anesthesia, can also be a factor associated to NP. Therefore, these patients will undergo a bigger number of airway aspirations.

Another fact that deserves attention concerns the 24-hour physiotherapy. In this study, most patients (15) who developed NP were hospitalized at ICUs that offered uninterrupted physiotherapy.

This can be explained by the profile of the patients at these units: the surgery patients were the ones undergoing more interventions and handling. The presence of a qualified physiotherapist specialized in respiratory physiotherapy is a positive point in caring for this type of patient.

These professionals should correctly indicate or not the use of non-invasive ventilation support because they are the ones who directly deal with this equipment and know the best method and interface for the patient in that particular situation.

## **6 - CONCLUSION**

In our study, NP among NIV patients had higher prevalence among male patients hospitalized at surgery units. The associated risk factors were prolonged sedation and the need of tracheal aspiration.

The study faced limitations: the absence of specific protocols for using NIV and preventing NP in this group of patients.

Further studies stratifying the several types of patients indicated for NIV use associated to risk factors are still necessary in order to prevent NP.

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