VENTILATION ASSOCIATED PNEUMONIA IN LOW BIRTH WEIGHT NEWBORNS

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Abstract: *Ventilation associated pneumonia (VAP) is a nosocomial pneumonia occurring after 48 hours of mechanical ventilation. VAP incidence is between 5-40%. We aimed to identify the risk factors associated with VAP in premature infants below 32 weeks gestation and to implement a project to improve medical care. The study was conducted over a period of 20 months in a NICU and included 105 newborns. Diagnostic criteria were clinical, bacteriological and radiological. The incidence of VAP in 2009 was 30% and 23% in 2010. There were 6 deaths in 2009 and 2 deaths in 2010. The need for another intubation was the most important risk factor for VAP. The most common organism isolated in cultures from the endotracheal tube was Klebsiella spp. The new preventive strategies reduced the incidence and morbidity of VAP. Prospective studies are needed to confirm these results.*

Cuvinte cheie: *pneumonie, ventilaţie mecanică, prematur*

Rezumat: *Pneumonia asociată ventilaţiei mecanice (VAP) este o pneumonie nosocomială ce apare după 48 ore de la instituirea ventilaţiei mecanice. Incidenţa VAP este între 5-40%. Ne-am propus identificarea factorilor de risc pentru VAP la prematurul sub 32 săptămâni şi implementarea unui proiect de îmbunătăţire a îngrijirii medicale. Studiul s-a realizat pe o perioadă de 20 luni într-o secţie de TI neonatală, pe 105 nou-născuţi. Criteriile de diagnostic au fost clinice, bacteriologice şi radiologice. Incidenţa VAP în 2009 a fost de 30%, iar în 2010 de 23 %. Au fost notate 6 decese în 2009 şi 2 decese în 2010. Reintubarea a fost cel mai important factor de risc pentru VAP. Cel mai frecvent microorganism izolat în culturile prelevate din sonda endotraheală a fost Klebsiella Spp. Folosirea strategiilor de prevenţie aplicate de noi la pacienţii luaţi în studiu au redus incidenţa şi morbiditatea VAP. Sunt necesare studii prospective pentru confirmarea rezultatelor.*

INTRODUCTION

Ventilation associated pneumonia (VAP) is a nosocomial pneumonia occurring after 48 hours of mechanical ventilation. VAP is the second leading cause of nosocomial infection in NICU. It increases morbidity and mortality in critically ill newborns, especially in those with extremely low birth weight or low birth weight (ELBW, LBW) and is responsible for increasing the average length of hospitalization in the NICU from 18.5 to 24 days. The incidence of VAP is between 5-40%. (1-4) (Table 1)

Table 1 VAP incidence

Author	Incidence	Year of publication
Tejada	22%	2001
Adams	23%	2002
Anucha	30%	2003
Brady	29%	2005
Calaghan	20,5%	2007
Larsen	23,8%	2005
Patra	30,5%	2006
Dollinger	39,6%	2007
Tripathi	34%	2009

Langer divided VAP into two entities:

- VAP with early onset (within 2-5 days after initiation of mechanical ventilation) - caused by endogenous bacteria
- VAP with late onset (after 5 days of mechanical ventilation) - caused by resistant organisms secondary to aspiration of gastric and pharynx secretions: Staphylococcus aureus, Pseudomonas. (5,6)

The main sources of infection come from patients or staff and the environment:

- patient/staff: pharynx, nostrils, hands.
- environment: ventilation circuit, aspiration system, humidifying fluid, bed/incubator, air conditioning, floors, clothes, medicines, disinfectants containers, drug trolleys, the door handle, stethoscope. (5,6)

Prevention of VAP is very important and can be achieved by relatively simple means: hand washing(5), patient positioning at 30-35º(7), rigorous oral care(8,9), closed system aspiration, pharyngeal aspiration, sterilizing the equipment or using disposable equipment(10), aggressive removal of endotracheal tube, oxygen weaning protocol.

There is evidence that prolonged intubation is a factor that significantly increases the risk of VAP in NICU.

It was demonstrated that the use of oxygen with FiO_2 above 60%, even for a short time, produces secondary lesions and increases the risk of VAP and sepsis.

OBJECTIVE

Our aim was to identify risk factors for VAP in preterms with gestational age below 32 weeks and implement a project to improve medical care (5 levels of care).

MATERIAL AND METHOD

We conducted a retrospective observational study (12 months) and a prospective observational one (8 months) on the

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incidence of VAP from 01/01/2009 to 08/31/2010) in the NICU of "Dr. D. Popescu" Emergency Hospital no. 5, Timisoara, a 3rd level regional centre. Our department has 12 beds. Enrolled patients were infants aged below 32 weeks of gestation, mechanically ventilated for over 48 hours in SIMV/CMV/ACV modes.

The patients were orotracheally intubated and a gastric tube was also placed. The tubes were changed only if they were blocked by secretions or incorrectly positioned (visualized on radiography). Each patient had its own ventilation circuit and continuous aspiration system. No H2 blockers were used in the cases studied and also no local topical antibiotic prophylaxis was used.

Diagnostic criteria were clinical, bacteriological and radiological. Clinically we observed the increasing demand for oxygen, ventilation parameters, sleep apnoea, hypo/ hyperthermia, tachypnea, intercostal retractions, purulent endotracheal secretions, stetacustic lung changes.

Bacteriological cultures were taken from the endotracheal tube, throat, nose and blood, and quantitative measurements were done. We also monitored the reactive C protein, and leukocyte counts.

Risk factors for the occurrence of VAP were the duration of ventilation, the gestational age below 28 weeks, repeated intubation, repeated endotracheal aspiration, severe bronchodysplasia, sedation with Fentanyl, and gastric tube insertion.

For the second group (01.01.2010-08.31.2010) we applied interventions to improve the quality of medical care consisting in:

1. washing hands and using individual disinfectants for each incubator;
2. newborn positioning at 30-35º
3. oral care at every 3 hours using colostrum / mother milk
4. aspiration of secretions in a closed system, changed every 48 hours and cleaned with sterile saline (fig. 1)
5. changing ventilator circuits every 48 hours.

To verify our hypothesis we calculated event rates in experimental and control group, relative risk and relative probability of the event (odds ratio- OR) that identifies the effectiveness of the intervention.

RESULTS

From 01/01/2009 to 08/31/2010, 105 newborns with gestational age below 32 weeks were enrolled in the study, mechanical ventilated over 48 hours, of which 68 newborn babies in 2009 and 37 in 2010.

Of these, 20 babies have developed VAP in 2009 and 9 in 2010. The incidence of VAP in 2009 was 30% (Table 2) and 23% in 2010 (Table 3).

Table no. 2. VAP incidence in 2009

Age	Total	VAP	Incidence
□28w	14	9	64%
28-30w	31	7	23%
31-32w	23	4	17%
Total	68	20	30%

Table no. 3. VAP incidence in 2010

Age	Total	VAP	Incidence
□28w	14	9	64%
28-30w	31	7	23%
31-32w	23	4	17%
Total	68	20	30%

We noted 6 deaths in 2009 and 2 deaths in 2010. Risk factors for VAP have been systematized in Table 5, the most important being repeated intubation (OR 4.3, p = 0.05). Positive blood cultures, positive reactive C protein, leukocyte counts, umbilical vein catheterization and asphyxia at birth weren't risk factors for VAP in the study groups.

Table no. 4. VAP risk factors

Risk factor	Odd ratio	Confidence interval	*p*
Duration of ventilation	2,10	1,02-4,23	0,021
Gestational age < 28 weeks	3,15	1,05-10,34	0,032
Repeated intubation	4,3	1,85-13,41	0,05
Repeated dezobstruction	3,5	1,6-6,4	0,012
Severe BPD	3,65	1,0-10,6	0,03
Fentanyl sedation	3,8	1,8-8,5	0,01
Insertion of gastric tube	3,01	1,3-8,5	0,01

#bronchopulmomary dysplasia

The most common organism isolated in the cultures taken from the endotracheal tube was Klebsiella spp. (6 cases), followed by Serratia Marcenses (5 cases), E. coli (4 cases). Other organisms involved were represented by Acinetobacter baumanii (2), Staphylococcus aureus (2), Staphylococcus coagulase negative (2), Pseudomonas aeruginosa (1), Enterobacter (2) and associations (5).

DISCUSSIONS

The incidence of VAP in our study is comparable with other studies. We believe that variations can be explained by: difficulty in establishing a positive diagnosis, how and when cultures were taken, interpretation of results, performing qualitative, not quantitative cultures, the use of bronchoalveolar lavage versus fibrooptic fibroscopy, showing a 95% sensitivity and specificity in the diagnosis of VAP.

We observed that the implementation of the five steps preventive project decreased the incidence of VAP by 7%. However, birth weight and gestational age below 28 weeks increased the incidence of VAP in our study up to 65%. Factors that increase the risk of VAP in newborns are represented by: the severity of respiratory distress, number of days of intubation (the risk increases after 72 hours), number of repeated intubations, delayed enteral feeding. Incriminated etiologic agents were both gram negative and gram positive, with clear predominance of the former.

Limitations of our study were: the fact that VAP is difficult to define, especially in low birth weight newborns, lack of guidelines and protocols for prevention and surveillance, and difficulty in interpreting bacteriological cultures.

CONCLUSIONS

Our analysis confirms the importance of knowing the causes of VAP.

Using new prevention strategies reduced the incidence of VAP and decreased morbidity of the disease in our department. However prospective studies are needed to confirm these results.

Figure no. 1 Reprezentarea măsurilor de creștere a calității actelor medicale

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