Journal of Microbiology Research 2014, 4(1): 14-17
DOI: 10.5923/j.microbiology.20140401.03

Original Anti-Microbial Treatment of Purulent-Inflammatory Lung Diseases in Patients Supported by Long-Term Artificial Ventilation of Lungs

F. G. Nazirov, R. A. Ibadov, Z. A. Shanieva*, A. Sh. Arifjanov, A. D. Eshonhodjaev, T. B. Ugarova, N. A. Strijkov, P. G. Komirenko

Republican Specialized Center of Surgery named after ac.V.Vahidov, Tashkent, Uzbekistan

Abstract We analysed the spectrum of microbial agents causing bronchial-pulmonary complications in 58 patients who underwent various surgical interventions and were supported by long-term artificial ventilation of lungs. "FarGALS", a medication with high antimicrobial activity developed and produced at V.Vakhidov Republican Specialised Centre of Surgery, was used for the first time in the nebuliser therapy. In comparison with other antimicrobial agents, the use of "FarGALS" has reduced complications of long-period artificial ventilation, justifying further investigations of this medication for the use in nebuliser therapy by intensive care units (ICU).

Keywords Anti-microbial Treatment, Intensive Care, Nebuliser Therapy

1. Introduction

With a duration of mechanical ventilation of lungs risk of pneumonia increases. Thus, according to an epidemiological study EPIC II (Russia), which included more than 14 thousand ICU patients have shown that every second patient have some signs of infection. In this case, 70% of patients the source of infection is the lungs.[2] Among the factors determining the etiological structure of bronchopulmonary complications, above all, should be made prior antimicrobial therapy and duration of mechanical ventilation[11]. Thus, according to Engelgart, only 20% of hospital-acquired pneumonia were of exogenous origin. An important role is played by translocation conditionally pathogenic bacteria in the gastrointestinal tract. At various critical conditions developed ischemia of the intestinal wall, broken motor and intestinal barrier function. In these conditions, the penetration of bacteria and their toxins in the portal and systemic circulation occurs. In addition, the observed retrograde colonization of the overlying parts of the intestinal tube. It is also submitted real that limfogematogen way of spreading bacteria from extrapulmonary sites of infection.

* Corresponding author:
zulya-shan@inbox.ru(Z. A. Shanieva)
Published online at http://journal.sapub.org/microbiology

It is conclusively proven, that early adequate empirical antibiotic therapy (EAT) for LAVL significantly reduces the risk of VAP and adverse outcome[3].

The important and urgent is the problem of prevention of scar stenosis of the trachea occurs after prolonged mechanical ventilation. Etiopathogenic found that as a result of ischemia tracheal mucosa in the area of localization inflatable cuff endotracheal tube developed granulation and cicatricial stricture[2]. Violation of purulent sputum expectoration of the tracheobronchial tree in the presence of tracheal stenosis worsens during the process, in the area of tracheal mucosal injury occurs pathological focus accession nosocomial infection.

The correct choice of empirical EAT scheme is crucial, but a variety of reasons of acute respiratory failure, the differences in the severity of the initial status of the patients, especially the earlier EAT most significantly affect the etiology of chronic inflammatory diseases of the lungs and makes it difficult, so the search for effective measures to prevent and treatment remains an urgent problem in modern resuscitation.

2. Objective

The aim of this study was to evaluate the effectiveness of the proposed algorithms predict, prophylaxis and treatment of bronchopulmonary complications in prolonged mechanical ventilation.

3. Materials and Methods (Experimental)

The material for the study is based on the results of bacteriological studies of crops from the trachea, throat, bronchial washings 58 operated patients who were on PIVL for 2010-2011-2012 (I-IX months.) years in the RSCS named after ac. V.Vahidov. The patients were divided into two groups: the main group included patients who used domestic product "FarGALS" (in 1:4 dilution) as inhalation therapy and bronchial lavage passed through the instrument channel fiberoptic (37 patients) in the control group included Patients treated by traditional methods (nebulizer with antibacterial drugs, bronchodilators and mucolytic - 21 patients). The mean age was 37,3 ± 12,6 years. The study included patients after various operations, the nature of which is presented in Table 1.

Species specificity of the isolated microorganisms were determined by conventional methods using identification media (production" HiMedia", India). Sensitivity of microorganisms to antibiotics: cephalosporins, aminoglycos ides, tetracyclines, fluoroquinolones, carbapenems, polymyxin B, and so on, as well as to antifungal drugs - were determined by the agar diffusion of the disks. Antimicrobial activity of biotech drugs, topical "FarGALS" against multiresistant hospital strains were determined by the agar diffusion. The results obtained, is to measure the diameters of the zones of inhibition of growth of test cultures around the wells. When zones up to 10 mm inclusive culture considered to be stable in zones 11-14 mm - moderately resistant, with zones of 15 mm and above - sensitive.

On pharmaceutical properties of drug belongs to antiseptic and healing wounds. "FarGALS" has a broad spectrum of antimicrobial action (active against gram-positive and gram-negative, aerobic and anaerobic, asporogenous and spore-forming bacteria, etc., fungi Candida, and Helicobacter pylori). Clinical studies have shown that the drug "FarGALS" can be used as an antimicrobial agent in the treatment of topically necrotic processes, has strong antibacterial and nekroliticheskim action speeds up cleaning of wounds and the appearance of granulation tissue, reduces contamination of tissues, provides faster healing has a strong local anti-inflammatory effect.

4. Results and Discussion

Total examined 340 samples of clinical material, of which 136 (40.0%) samples were identified different types of microorganisms (Table 2).

Table 1. The nature of surgical procedures performed in patients who were in the postoperative period for prolonged mechanical ventilation

Intervention type	Groups				Total	
	Main		Control			
	abs.	%	abs.	%	abs.	%
Mitral valve replacement	8	21,6%	6	28,4%	14	24,2%
Coronary artery bypass grafting	10	27,0%	5	24,0%	15	25,8%
Descending aorta prosthesis operation	4	10,8%	3	14,3%	7	12,0%
Miastenia gravis	2	5,4%	2	9,5%	4	7,0%
Lower lobectomy	4	10,8%	2	9,5%	6	10,3%
Jejunum resection complicated with peritonitis	9	24,3%	3	14,3%	12	20,7%
Total	37	100,0%	21	100,0%	58	100,0%

Table 2. The distribution of selected microorganisms, depending on the biomaterial

Causative agent	Biomaterial					
	Throat		Bronchial washings		Trachea	
	abs.	%	abs.	%	abs.	%
Acinetobacter spp.	3	2,2%	2	1,5%	21	15,4%
Esherichia coli	2	1,5%	3	2,2%	15	11,0%
Klebsiella pneumoniae	3	2,2%	1	0,7%	11	8,0%
Pseudomonas aeruginosa	2	1,5%	4	3,0%	11	8,0%
Staphylococcus aureus	4	3,0%	2	1,5%	5	3,6%
Staphylococcus spp.	4	3,0%	1	0,7%	7	5,0%
rp.p.Candida	19	14,0%	2	1,5%	14	10,3%

Analysis of research on different types of biomaterials inoculation revealed: in the study group (out of 88 positive samples) - throat - 21 (23.8%), bronchial washings - 9 (10.2%), trachea - 58 (66.0%) in the control group (out of 48 positive samples) - throat - 16 (33.3%), bronchial washings - 6 (12.5%), trachea - 26 (54.2%).

Of the isolates are most frequently encountered Candida spp. - 25,7%, Acinetobacter spp. - 19,0%, Esherichia coli-14,7%, Pseudomonas aeruginosa-12,5%, Klebsiella pneumoniae-11,0%, Staphylococcus spp.–8,8%, Staphylococcus aureus – 8,0%.

Antibiogram analysis of isolated cultures in patients on LAVL shows high resistance to a wide range of antibiotics, namely: Acinetobacter spp. - Highly resistant to all antibiotics except imipenem (0% resistant strains), polymyxin B (0% resistant strains) and tetracycline (7-15,4% of resistant strains). Esherichia coli - in its active against imipenem (10.5% of resistant strains), polymyxin B (10.5% of resistant strains), amikacin (31.5% of resistant strains) and cefoperazone/sulbactam (31.5% resistantstrains). Klebsiella pneumoniae was sensitive to imipenem (0% resistant strains), polymyxin (0% resistant strains), amikacin (0% resistant strains), ofloxacin (40.0% of resistant strains) and antibiotic – resistance cefoperazone / sulbactam (40.0% of resistant strains), piperacillin / tazobactam (40.0% of resistant strains). Staphylococcus aureus was sensitive to the III generation cephalosporins (cefotaxime, ceftriaxone, cefoperazone) and tetracyclines - 36.3% of resistant strains. To cefoperazone / sulbactam, and vancomycin-resistant strains were not. Staphylococcus spp. showed good sensitivity to a wide range of antibiotics.

Sensitivity analysis of fungi to antifungal r.Candida showed nitroksolin - 11.4% resistant strains, amphotericin B and fluconazole - 48.5% resistant strains, terbinafine - 51.4% of resistant strains. Analysis of the antimicrobial activity of the drug "FarGALS" against all tested crops (gram-positive organisms, gram-negative microorganisms, fungi), showed a high sensitivity (Table 3).

Thus, over the period studied, from the material of patients are on LAVL, the trend is the prevalence of gram-negative microorganisms planting and expanding the range allocated to crops, isolated cultures of gram-negative microorganisms are resistant to a broad range of antibiotics, clinical improvement when using "FarGALS" occurred after 2 - 3 days. The frequency of specific bronchopulmonary complications was lower in the group and not more than 8% against 23% in the control group. Terms of clinical recovery was 5-6 days, whereas in the traditional 8-10 days.

Table 3. Resistance level selected antimicrobial agents

Antibiotic/ micro-organism	Acinetobacter spp.	Escherichia coli	Klebsiella pneumoniae	Pseudomonas aeruginosa	Staphylococcus aureus	Staphylococcus spp.	rp.p.Candida
Amikacin	92,3%	31,5%	0,0%	23,5%	63,6%	16,6%	*
Gentamicin	77%	79,0%	100,0%	23,5%	63,6%	33,3%	*
Meropenem	0,0%	10,5%	0,0%	0,0%	-	-	*
Ofloxacin	92,3%	100,0%	40,0%	35,3%	63,6%	16,6%	*
Ciprofloxacin	100,0%	100,0%	100,0%	100,0%	72,7%	33,3%	*
Cefotaxime	100,0%	100,0%	100,0%	100,0%	36,3%	41,6%	*
Ceftazidime	100,0%	100,0%	100,0%	76,4%	100,0%	75,0%	*
Ceftriaxone	92,3%	100,0%	100,0%	100,0%	36,3%	16,6%	*
Cefoperazon	100,0%	100,0%	100,0%	100,0%	36,3%	25,0%	*
Cefoperazone / Sulbactam	61,5%	31,5%	40,0%	35,3%	0,0%	8,3%	*
Piperacillin / Tazobactam	92,3%	100,0%	40,0%	100,0%	-	-	*
Tetracycline	7,7%	100,0%	60,0%	100,0%	36,3%	33,3%	*
Doxycycline	15,4%	100,0%	100,0%	100,0%	36,3%	33,3%	*
Polymyxin	0,0%	10,5%	0,0%	0,0%	*	*	*
Vancomycin	*	*	*	*	0,0%	0,0%	*
Nitroxolin	*	*	*	*	*	*	11,4%
Terbinafine	*	*	*	*	*	*	51,4%
Amphotericin	*	*	*	*	*	*	48,5%
Fluconazole	*	*	*	*	*	*	48,5%
FarGALS	3,8%	5,2%	6,6%	0,0%	0,0%	0,0%	0,0%

Note: *-natural resistance

5. Conclusions

In patients on prolonged mechanical ventilation, the tendency of the prevalence of gram-negative microorganisms planting, and for the last two years, the array of multi-resistant flora released. Gram-negativemicroorgani sms isolated cultures are resistant to a broad range of antibiotics.

Analysis of the antimicrobial activity of the domestic drug "FarGALS" against all tested crops (gram-positive organisms, gram-negative microorganisms, fungi), shows a high sensitivity.

Inclusion in the complex post-operative prophylaxis and treatment of inflammatory lung disease in patients on prolonged mechanical ventilation drug "FarGALS" in the form of inhalation therapy and Fibro-broncho-kopic bronchial lavage reduces the incidence of early and late specific bronchopulmonary complications from 23% to 8%, achieve clinical improvement of the patients already at 2-3 days and shorten recovery period from 8-10 to 5-6 days.

High activity of the domestic drug "FarGALS" against multiresistant strains of causes feasibility of further study and application of patients are on LAVL.

REFERENCES

[1] Bazhenov L.G., Mustamov A.N. Ekubzhonov F.T, Bazhenov, S.S, Z.A Shanieva Antimicrobial activity of the new biotechnology drug "FarGALS" and the prospects for its clinical application / / Bulletin of the international scientific surgical association. 2008. Vol.3. Number 1. P. 23-25.

[2] Vyzhigin M.A. Gudowski L.M, V.D. Parshin, Rusakov M.A. Postresuscitation cicatricial stenosis of the trachea as a result of prolonged mechanical ventilation: the causes, prevention, and first aid / / anesthetic. and reanimatol. - M., 2004. - № 3. C-33-37.

[3] Protsenko D.N, Belotserkovsky B.Z Nosocomial pneumonia: Facts / / infection in surgery. Volume 7, Annex № 1, 2009, 6-10.

[4] Rudnov V.A. The problem of ventilator-associated pneumonia / / Universtitet practitioner. Medical Almanac. Antimicrobial treatment of severe infections in hospitals. Issue 2. 2009, 59-73. Boe J, Dennis JH, Oў Driscoll BR. European Respiratory Society Guidelines on the use of nebulizers. Eur Respir J 2001; 18: 228-42.

[5] Cook D. Ventilator-associated pneumonia: perspectives on the burden illness. Intensive Care Med 2000; 26(Suppl.1): 31-7.

[6] Frutos -Vivar F., Esteban A. When to wean from a ventilator: An evidence-based strategy. Clevelend Clinic Journal of Medicine. 2003. Vol. 70, N 5. P. 383-398.

[7] Gerald C. Smaldone, MD PhD, Lorraine Morra, BS. Under this protocol the OMRON Prototype nebulizer was tested. Budesonide output and particle size distribution of the Nebulizer was measured. Stony Brook Heath Science Center Stony Brook. New York 11794-8172. February 2003.

[8] Kollef M.H. Ventilator-associated pneumonia: the importance of initial empiric antibiotic selection. Infect Med 2000; 17:278-83.

[9] MacIntyre N. R., Cook D. J., Ely W. E., Epstein S. K., Fink J. B., Heffner J. E., Hess D., Hubmayer R. D., Scheinhorn D. J. Evidence-Based Guidelines for Weaning and Discontinuing Ventilatory Support. Chest. 2001. Vol. 120, N 6. P. 375-395.

[10] Skyler JS, Weinstock RS, Pascin P et al. Use of Inhaled Insulin in a Basal/Bolus Insulin Regimen in Type 1 Diabetic Subjects. Diabetes Care, 2005; 28 (7): 1630-5.

[11] Trouillet J.L., Chastre J., Vuagnant A. et al. Ventilator-associated pneumonia caused by potencially drug resistant bacteria. Am Rev Resp Crit Care Med 1998; 157:531 - 539. 3.