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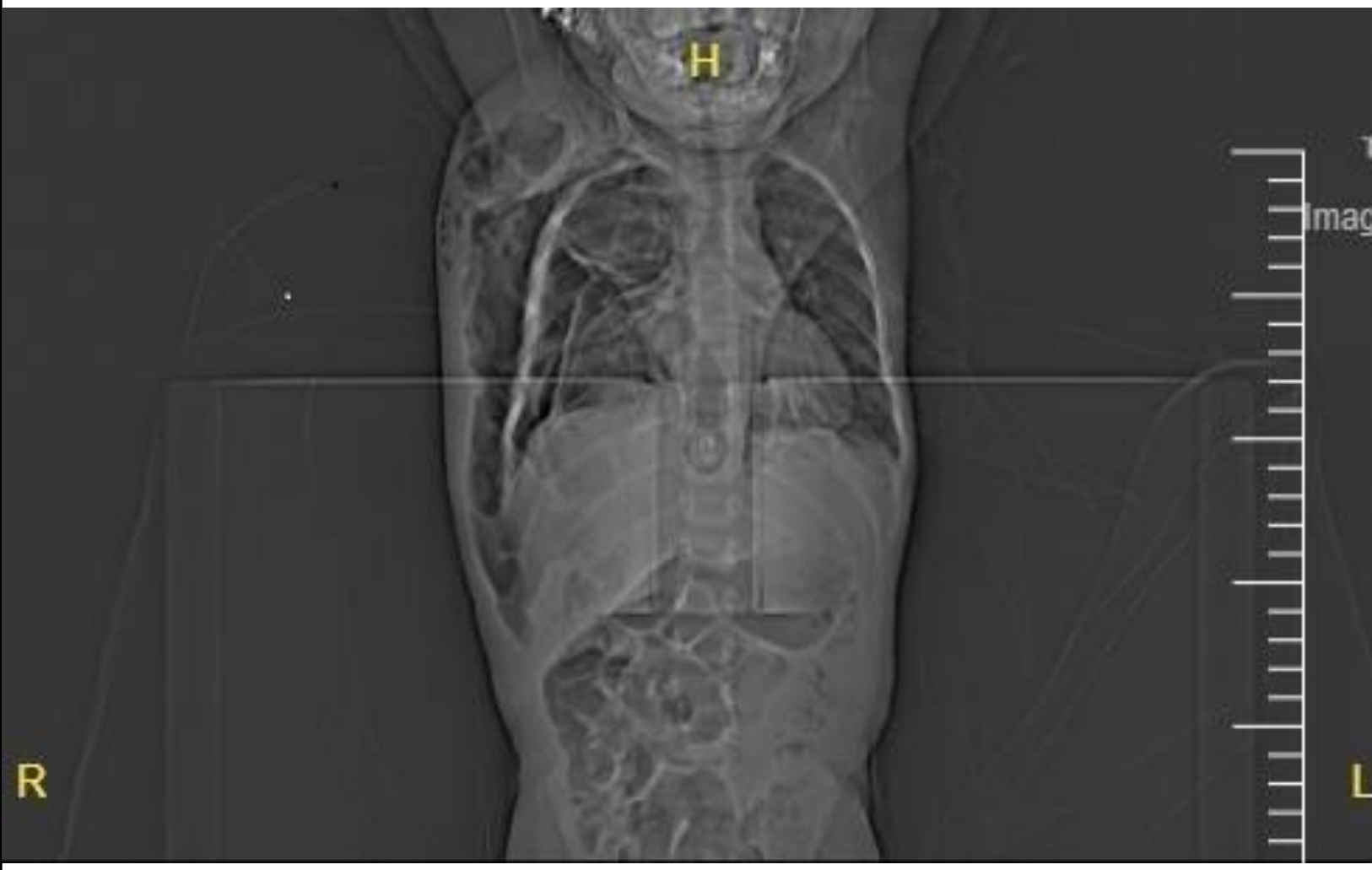

- **Determination of conditions that may prevent the effective use of blood in blood transfusion**
- **Colistin-daptomycin, colistin-linezolid, colistin-vancomycin combination effects on colistin in multi-resistant acinetobacter baumannii strains**
- **An uncommon complication in the drainage of a chest wall skin abscess: pneumothorax and subcutaneous emphysema**

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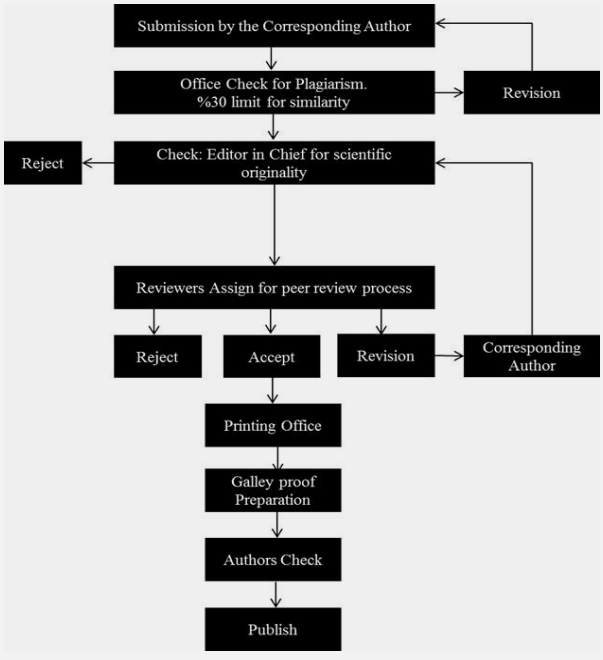

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Contents

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Case Report Doi: 10.17546/msd.390936

An uncommon complication in the drainage of a chest wall skin abscess: pneumothorax and subcutaneous emphysema

Mustafa Enes Demirel[1*], Shukri Said Mohamed[2], Ibrahim Hussein Ali[1], Abdishakur Mohamed Abdi[2], Naim Koku[2]

Abstract

Objective: Skin and soft tissue infections are frequent cases of emergency services. Treatment of these patients is usually performed ambulatory in the form of abscess drainage and oral antibiotic therapy.

In this article, it was aimed to draw attention to the fact that a rib fracture may be seen after an abscess drainage made by inexperienced persons and that might lead to presentation with more complicated situation.

Keywords: Child, subcutaneous abscess, abscess drainage, pneumothorax, emphysema

Introduction

Skin and soft tissue infections affecting the pediatric age group are often encountered in the Emergency Department (ED). A common cause of these infections is gram positive bacteria, especially Staphylococcus Aureus (1). When these infections become an abscess, there may be a need for intervention by a pediatric surgeon. The traditional treatment method for abscess is to make an incision of approximately 1-1.5cm in the skin, drain the abscess, apply irrigation to the abscess pouch and if necessary place a mesh in the pouch and follow up with antibiotic therapy (2, 3). The majority of patients applied with incision and drainage can be discharged on the same day with antibiotic therapy following the necessary procedures, but potential complications should always be kept in mind (4, 5). The pediatric age group in particular is more sensitive to the possibility of complications. Patients who develop complications must be followed up and hospitalized if necessary.

Unlike most cases, this report is of a female child who presented with respiratory problems and air leakage from the wound site which developed following abscess drainage. The aim of this case report was to draw attention to the uncommon complication of pneumothorax that could develop following abscess drainage (6, 7).

Case Presentation

A 2-year old girl was brought to the ED with the complaint of air leakage from the wound site following with abscess drainage. From the anamnesis it was learned that 10 days previously the patient had been taken to a doctor because of redness in the shoulder and high temperature. She had been discharged with antibiotics then as the redness increased and widespread swelling developed on the anterior of the right side of the chest, she was taken to a different hospital. As a result of pulmonary radiographs taken there, abscess drainage was applied at the level of the 8th-9th rib on the right side of the chest. The use of antibiotics and daily dressings were recommended and due to the subsequent development of air leaking from the site of the abscess drainage, the patient was brought to our hospital.

In the first examination, the patient was conscious and the general status was fair. The patient had tachypnea and respiratory problems, axillary temperature was 36.8°C, heartrate was 154/min, O2 saturation was 95%, blood glucose was 156 mg/dl and other laboratory test results were within normal limits. On auscultation, no respiratory sounds could be obtained in the right lung. On the anterior wall of the right thorax, there was widespread redness and increased temperature and there was widespread subcutaneous emphysema. When the abscess drainage dressing was removed, there was seen to be an air outlet from the wound site. Pneumothorax and subcutaneous emphysema were seen in the right hemi-thorax of the patient (Figure 1).

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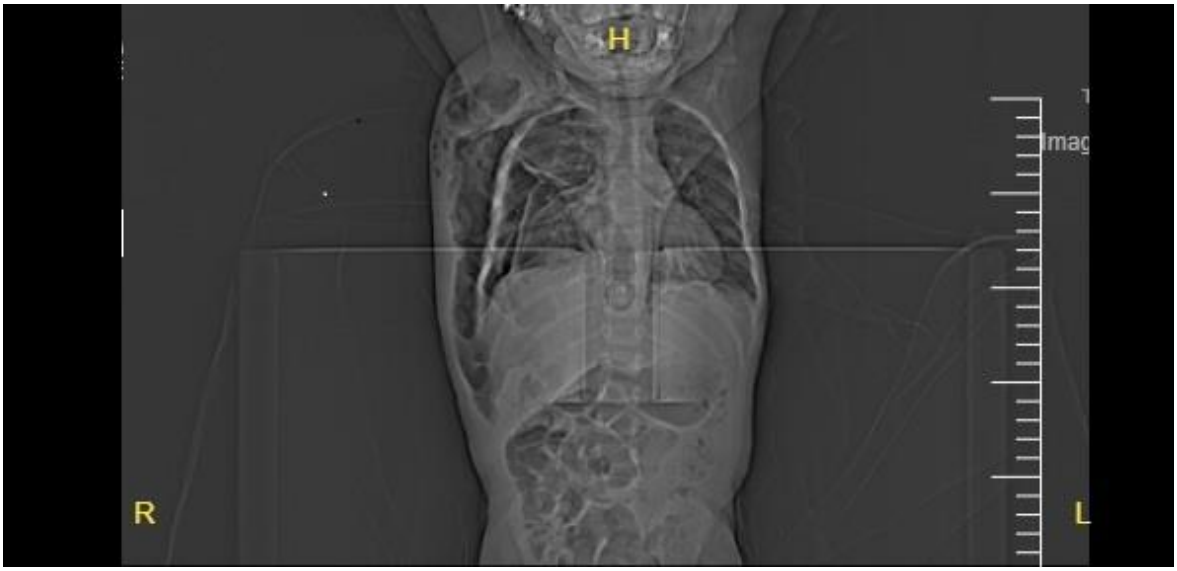

Figure 1.Pneumothorax and subcutaneous emphysema were seen in the right hemi-thorax

On the thorax tomography, pneumothorax, pleural effusion and rib fracture were reported on the right side. A pediatric surgical specialist was consulted and the patient was hospitalized with intravenous antibiotic therapy started of ceftriaxone (Unacefin® Yavuz Ilac San.Tic.A.S, Istanbul, Turkey) at a dose of 75 mg/kg/day. Under general anesthesia, the wound site was explored and the abscess pouch was irrigated A hemovac drain was placed subcutaneously and a thorax tube was attached to closed underwater drainage. Then vacuum-assisted closure (VAC) was applied for 3 days at 75mmHg pressure. On the 11th day after admittance, the thoracic drain was removed and on the 27th day, the patient was discharged with no complications.

Discussion

Skin and soft tissue infection is a problem often encountered by ED doctors and pediatric surgeons. Treatment includes making an incision of approximately 1 cm on the skin for drainage and irrigation of the abscess and when necessary the placement of a mesh, then follow-up with antibiotic therapy (2, 3). There are many references in literature stating that pediatric group patients can be discharged following the necessary skin incision and drainage of skin abscess (5).

Unlike many cases of abscess and emphysema seen following rib fracture, in the current case, rib fracture and pneumothorax were observed as a result of abscess drainage performed by inexperienced healthcare personnel (6, 7).

Conclusion

Abscess drainage of patients presenting at ED performed by experienced physicians provides a significant reduction in potential complications. The complications that developed in this patient show the necessity of a more careful approach, especially in pediatric patients.

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Colistin-daptomycin, colistin-linezolid, colistin-vancomycin combination effects on colistin in multi-resistant *Acinetobacter baumannii* strains

Arzu Irvem[*1]

Abstract

Objective: The most important problem in the treatment of nosocomial *Acinetobacter baumannii* (*A. baumannii*) infections which is increasingly seen in recent years is that almost all strains are resistant to many antibiotics, including carbapenems, and that the extinction of antibiotic options to be used in treatment. This leads the clinicians to new treatment options and suggests the use of combined antibiotics to achieve success in both the treatment of multi-drug-resistant *A. baumannii* (MDRAB) infections as well as to prevent resistance development. We investigated the in vitro activity of colistin in combination with vancomycin, linezolid or daptomycin against MDRAB to determine whether these combinations would be considered for clinical use. .

Methods: The fractional inhibitory concentration (FIC) index was used to determine the antibiotic combination effects and to evaluate the effect of antibiotic combinations on the bacteria.

Results: MIC values of colistin/vancomycin, colistin/linezolid, and colistin/daptomycin in 10 strains (33.3%) gave similar results. Twenty strains gave different MIC results according to antibiotics. The colistin/daptomycin antagonistic ratio was high when the colistin/vancomycin synergy ratio was high compared to the others.

Conclusion: Antibiotic combinations can be used as an alternative treatment approach in multi-drug resistant *A. baumannii* infections.

Keywords: *A. baumannii* , Colistin, Daptomycin, Linezolid, Vancomycin

Introduction

Recently, *A. baumannii* has emerged as one of the important nosocomial pathogens. Difficulties are encountered in the treatment of the infections caused by *A. baumannii* because the microorganism has an intrinsic resistance to many antibiotics and it has the potency of resistance to various classes of antibiotics. The most important problem in the treatment of nosocomial *A. baumannii* infections, which is increasingly seen in recent years, is that almost all strains are resistant to many antibiotics, including carbapenems, and that the extinction of antibiotic options to be used in treatment (1). This leads the clinicians to new treatment options and suggests the use of combined antibiotics to achieve success in both the treatment of multi-drug-resistant *A. baumannii* (MDRAB) infections as well as to prevent resistance development.

The outer membrane is an effective yet selective permeability barrier which distinguishes gram-negative bacteria from gram-positive bacteria (2).

The sensitivity profiles of bacteria to certain fluoroquinolones, β-lactam antibiotics, Erythromycin and even some of the more recent macrolides have been shown to alter by alterations in the composition and size of porins and/or the bacterial outer membrane (3).

At high concentrations colistin produces rapid bactericidal effects. It affects the bacterial outer membrane at lower concentrations and increases the permeability of gram-negative bacteria which facilitates the penetrative ability of other compounds that are usually excluded such as hydrophobic drugs; rifampicin, macrolides, and glycopeptides (including teicoplanin, telavancin, and daptomycin).

In this study, we investigated the in vitro activity of colistin in combination with vancomycin, linezolid or daptomycin against MDRAB to determine whether these combinations would be considered for clinical use.

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Material and method

Bacterial isolates: From 2016 to 2017 samples, total of 30 *A. baumannii* clinical isolates were selected from our hospitals. Identification of the clinical isolates was performed with Vitek MS system (bioMérieux, Marcy-l'Étoile, France). Susceptibility results were obtained using the Vitek®2 (bioMérieux) bacterial identification device per the manufacturer's instructions. Acinetobacter isolates resistant to three or more antibiotic groups were identified as MDRAB. Escherichia coli strain, ATCC 25922, was used as a control in each batch of tests.

E test and Combination method: Colistin minimum inhibitory concentration (MIC) values against *A. baumannii* clinical isolates were determined by the manufacturer's recommendation gradient diffusion method (E-test, bioMérieux, France) and evaluated according to CLSI recommendations. For colistin, ⩽2 mg/l was considered as susceptible, and ⩾4 mg/l was considered as resistant. Since vancomycin, daptomycin and linezolid are used in gram positives; there are no limit values (Table 1). FIC index was used to determine the antibiotic combination effects and to evaluate the effect of antibiotic combinations on the bacteria. To determine the FIC index by gradient diffusion method, the MIC values of A and B antibiotics in combination were recorded. To detect the combination MIC value, the strip B was first placed in the medium, and after waiting for one hour in the room temperature, the strip B was removed, and the strip A was placed in place so that the concentration lines completely overlapped. Following the 16-20 hour incubation period, the MIC numerical value of A was recorded in the presence of B at the cut-off point of the stripe edge of the inhibition zone diameter. The same procedure was repeated placing A before B. To determine the activity of the combination, the FIC index was calculated according to the following formula: MIC value of A in the presence of FIC A=B / A's MIC value alone MIC value of B in the presence of FIC B=A / B's MIC value alone Σ FIC index = FIC A + FIC B Effectiveness of the combinations If Σ FIC ⩽ 0.5; synergy, 0.5 < Σ FIC> 1 indicates partial synergy, Σ If FIC = 1; additive, 1 < Σ FIC> 4 is ineffective, If Σ FIC ⩾ 4 antagonism was assessed. 90 FIC values were calculated for the three antibiotic combinations tested in 30 MDRAB clinical isolates taken to this study. Ineffective, additive, antagonistic, synergistic and partial synergistic interactions were recorded.

Results

Ten of the 30 MDRAB strains taken into the study were isolated from wound samples, 5 were isolated from blood culture, 13 were isolated from lower respiratory tract sample, and 2 were isolated from urine.

Sequence of resistance rates in *A. baumannii* strains has been determined as; gentamicin;14/30, amikacin;21/30, netilmicin;15/30, tobramycin;11/30, imipenem;30/30, meropenem;30/30, ceftazidime;30/30, piperacillin/tazobactam;30/30, ciprofloxacin;30/30, trimethoprim sulfamethoxazole (SXT);26/30, tigecycline; 4/30. E test method did not detect a zone diameter in vancomycin, linezolid, and daptomycin. colistin E test zone diameter, colistin-vancomycin, colistin-linezolid, colistin-daptomycin combination zone diameters and FIC values are shown in the table 1.

Table 1: Minimum inhibitory concentration (µg/ml) range, MIC50 and MIC90 values.

Agent	MIC range	MIC_{50}	MIC_{90}
CT	0.019–256	0.25	0.75
VA	0.019-256	> 256	> 256
DAP	0.019-256	> 256	> 256
LZD	0.019-256	> 256	> 256

CT: Colistin, **VA:** Vancomycin, **LZD:** Linezolid, **DAP:** Daptomycin, **MIC50:** minimum inhibitory concentrations for 50% of the organisms, **MIC90**: minimum inhibitory concentrations for 90% of the organisms;

Discussion

Among the Acinetobacter species, *A. baumannii* is the most common genomic species which cause diseases in humans. This microorganism, which may colonize in the skin of healthy adults and hospital personnel may be a source of long-term hospital infections (4). The synergistic activity of the antibiotics administered in combination therapy is clinically important and in vitro synergy tests are guiding in this context. Therefore, the use of combined antibiotics is recommended to increase the success of treatment and to prevent or reduce the development of resistance. Many studies highlighted that in vitro synergy testing may be guiding in this context (5,6,7). Colistin-ampicillin sulbactam combination is one of the suggested combinations. The synergistic effect of this combination has been shown in many studies. Combinations of rifampicin-colistin, carbapenem-colistin, and tigecycline-colistin have been shown to be synergistic in; in vivo and in vitro studies (8,9). In addition to these commonly used antibiotics combinations with amikacin, phosphomycin, azithromycin, SXT and teicoplanin or vancomycin have been reported. Vidaillac et al (10) found that colistin-SXT combination showed a synergistic effect in colistin resistant *A.baumannii*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* strains in an in vivo study.

Table 2. Colistin-Daptomycin, Colistin-Linezolid, Colistin-Vancomycin combinations' effect and FIC volues.

Sample number	Colistin (MIC)	CT-VA (MIC)	CT-VA FIC	CT-LZD (MIC)	CT-LZD FIC	CT-DAP (MIC)	CT-DAP FIC
1	0.38	0.38	Additive	0.25	Partial synergy	0.38	Additive
2	0.38	0.125	Synergy	0.25	Partial synergy	0.38	Additive
3	1	0.125	Synergy	0.125	Synergy	0.19	Synergy
4	0.125	0.125	Additive	0.25	Ineffective	0.25	Ineffective
5	0.38	0.125	Synergy	0.19	Synergy	0.25	Partial synergy
6	0.25	0.38	Ineffective	0.5	Ineffective	0.5	Ineffective
7	0.38	0.19	Synergy	0.25	Partial synergy	0.125	Synergy
8	0.125	0.064	Synergy	0.25	Ineffective	0.5	Ineffective
9	0.19	0.125	Partial synergy	0.125	Partial synergy	0.125	Partial synergy
10	2	0.75	Synergy	0.25	Synergy	0.75	Synergy
11	0.5	0.125	Synergy	0.38	Partial synergy	0.25	Synergy
12	0.38	0.19	Synergy	0.75	Ineffective	0.25	Partial synergy
13	0.38	0.38	Additive	0.38	Additive	0.25	Partial synergy
14	0.125	0.5	Antagonistic	0.38	Ineffective	0.5	Antagonistic
15	0.125	0.125	Additive	0.125	Additive	0.094	Partial synergy
16	0.25	0.125	Synergy	0.125	Synergy	0.25	Additive
17	0.25	0.5	Ineffective	0.75	Ineffective	0.75	Ineffective
18	0.125	0.38	Ineffective	0.125	Additive	0.125	Additive
19	0.38	0.25	Partial synergy	0.5	Ineffective	0.75	Ineffective
20	0.25	0.75	Ineffective	0.5	Ineffective	0.75	Ineffective
21	0.094	0.75	Antagonistic	0.75	Antagonistic	1	Antagonistic
22	0.5	1	Ineffective	0.38	Partial synergy	0.75	Ineffective
23	0.125	0.25	Ineffective	0.38	Ineffective	0.25	Ineffective
24	0.125	0.38	Ineffective	0.016	Synergy	0.19	Ineffective
25	0.75	0.75	Additive	0.75	Additive	0.5	Partial synergy
26	0.25	0.38	Ineffective	0.75	Ineffective	0.5	Ineffective
27	12	12	Additive	12	Additive	12	Additive
28	0.38	1	Ineffective	0.25	Partial synergy	0.38	Additive
29	0.125	0.19	Ineffective	0.19	Ineffective	0.75	Antagonistic
30	0.25	0.25	Additive	0.19	Partial synergy	2	Antagonistic
Mean MIC Value	0.76	0.73		0.67		0.85	

Table 3. Colistin-Daptomycin, Colistin-Linezolid, Colistin-Vancomycin combinations' effect

	Synergy	Partial synergy	Additive	Ineffective	Antagonistic
CT -VA	9 (30%)	2 (6.6%)	7 (23.3%)	10 (33.3%)	2 (6.6%)
CT-LZD	5 (16.6%)	8 (26.6%)	5 (16.6%)	11 (36.6)	1 (3.3%)
CT-DAP	4 (13.3%)	6 (20%)	6 (20%)	10 (33.3%)	4 (13.3%)

Although colistin is used as a last resort in infections caused by MDRAB strains, there are concerns about toxicity potential and resistance formation. However, the action mechanism of colistin increases the likelihood of synergy with normally inactive compounds against gram negative organisms due to the impermeability of the bacterial outer membrane. Synergy studies with antibacterial agents against gram-positive microorganisms were tested in several studies. The efficacy of colistin/vancomycin was evaluated in the synergic studies in 5 epidemic strains and 34 MDRAB clinical isolates by microdilution and E test methods. For all strains, after exposure to 0.5 µg / ml colistin, significant synergies were demonstrated in at least one method with a reduction of vancomycin MIC> 256 µg / ml to ⩽48 µg / ml for all strains. This increases the likelihood that this combination will be clinically applicable to infections due to MDRAB; it can be administered at lower doses than the currently used doses (11). Although there is a strong interaction between vancomycin and colistin there is concern about the inherent toxicity of combining these agents in clinical practice. In a different study combination of colistin/teicoplanin has been assessed in vitro to determine whether this combination has similar antimicrobial activities because teicoplanin has less nephrotoxic potential than vancomycin. In the study, the combination of teicoplanin and colistin was bactericidal against all tested strains with the in vitro checkerboard method, FIC indices were found to be <0.5 and compatible with synergy. Using the E test method, the MIC value of teicoplanin was found to be lowered to ⩽ 2 mg / L from > 256 mg / L at MIC for colistin (12).

In a different study, four severe infections due to MDRAB were observed. All patients treated with the combination of colistin/vancomycin received a positive result in treatment. Most importantly, no significant adverse events related to the simultaneous administration of the colistin/vancomycin have been observed. In our in vitro experiments the synergistic effect of the colistin/vancomycin combination demonstrated bactericidal activity even at a vancomycin concentration of 16 mg / L reflecting the serum concentrations obtained in patients. In the Pediatric Intensive Care Unit an antimicrobial strategy based on the activity of colistin plus the absence of adverse effects has been found to be effective in life-threatening infections caused by MDRAB in vitro and in vivo. It has been shown that colistin/Vvancomycin combination has synergistic and bactericidal properties against carbapenem-resistant, colistin-sensitive *A. baumannii*, whereas meropenem addition did not increase the in vitro activity of colistin/vancomycin combination (13).

In a different study, vancomycin/colistin mean FIC was found as 0.08 and colistin/azithromycin mean FIC was found as 0.71 in 30 isolates.

Conclusion

These findings indicate that vancomycin-containing regimens may provide therapeutic benefit for MDRAB-associated infections; However, other methods should be used to confirm such a synergy. Also optimal combination therapy in severe infections should be considered in a prospective clinical trial (14). In a study, conducted in 2013 they found that combinations of colistin resistant *A. baumannii* strains isolated from patients previously treated with colistin were synergistic with vancomycin-colistin containing combinations in an in vivo study and in vivo larval experiments have reported that the combination regimen containing colistin-vancomycin-doripenem increases survival compared to monotherapy (15). In combination with linezolid/colistin, linezolid acts against broad spectrum gram positive bacteria by inhibiting the formation of the 70S initiation complex, possibly influencing the treatment of respiratory tract infections, because it reaches high concentrations in the epithelial lining fluid and blood. It is emphasized that especially in patients with renal dysfunction the combination of colistin and linezolid may be effective in the treatment of *A. baumannii* pneumonia and gram positive coinfection (3,16). In studies with daptomycin, synergy testing with 9 colistin-sensitive and 4 colistin-resistant isolates was conducted, and susceptible strains were considered as ineffective, and synergies were found in resistant strains (17). It has been concluded by studies on Galleria menolella larvae that the use of the combination of daptomycin/colistin is not effective in gram negative infections such as Klebsiella pneumoniae, E. coli, and Pseudomonas aeruginosa but may be beneficial in the treatment of *A. baumannii* (18,19).

When daptomycin was given with colistin in the treatment of Galleria mellonella larvae infected with lethal doses of *A. baumannii* this treatment resulted in significantly enhanced survival rates compared with colistin treatment alone (P<0.05). This work suggests that daptomycin/colistin combination is highly active against *A. baumannii* both in vitro and in a simple invertebrate model of infection (19). When investigating the synergistic interaction between the antibiotics forming the combination, interpretation of the combined interaction by evaluating the MIC values of the antibiotics one-by-one may lead to incorrect results. Sometimes synergistic interactions may occur even when one of the antibiotics used in combination is resistant. Even higher synergistic activity can be observed in combination with two resistant antibiotics (20). It would be better to interpret the antibiotics that make up the combination together since the opposite can also be observed. Although the strains collected in our study were taken from different patients at different times the high proportion of carbapenem resistant strains may be due to the clonal interrelated strains of isolated Acinetobacter species in our Intensive care unit. However, since we

can not do any molecular typing method, it is not possible to pinpoint this relationship. MIC values of vancomycin, linezolid, and daptomycin in 10 strains (33.3%) gave similar results. Twenty strains gave different MIC results according to antibiotics (Table 3). In other studies, for example, when the vancomycin MIC value is greater than 256 it is misleading to interpret MIC value by the combination test as a lower value because the effect of the colistin alone is ignored. Individual MIC values and synergy values were also evaluated in our study. The effect of antibiotics on colistin for gram positive factors was interpreted. The colistin/daptomycin antagonistic ratio was high when the colistin/vancomycin synergy ratio was high compared to the others (Table 3). There are few published articles on this subject. It is difficult to make generalizations because the combinational studies are formed with data that are worked with fewer strains. Antibiotic combinations can be used as an alternative treatment approach in multi-drug resistant *A. baumannii* infections. Althought, They are studies that should be planned according to the characteristics of the patient in the clinic and should be supported by prospective clinical or in vivo studies.

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Ethical issues: All Authors declare that Originality of research/article etc... and ethical approval of research, and responsibilities of research against local ethics commission are under the Authors responsibilities. The study was conducted due to defined rules by the Local Ethics Commission guidelines and audits.

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Determination of conditions that may prevent the effective use of blood in blood transfusion

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Abstract

Objective: This study was conducted to determine conditions that may prevent the effective use of blood in blood transfusion.

Methods: The study's universe consisted of transplanted and wasted blood and blood products (n=309) in a university research hospital orthopedics and traumatology, neurosurgery, pediatric hematology and pediatric intensive care clinics. Between 10.12.2014 and 20.04.2015, in the mentioned clinics, the data about blood waste and reasons was collected. The rates of use and waste of blood according to clinics, the rates of use and waste of blood according to the age of patients and the rates of use and waste of blood according to blood groups were analyzed by using independent t test.

Results: When the blood ratios used and wasted according to the clinics were examined, the mean blood amount used in the neonatal intensive care clinic was 27,79 ml, while the amount of blood wasted was 472,43ml (Due to 500 ml Blood bags). The mean amount of blood used in the pediatric hematology clinic was 189.62 ml, and the amount of blood wasted at the same clinic was 310.38 ml. When the reasons of blood waste were examined, it was concluded that the rate of not using pediatric blood bags was 40.1% and the rate of unnecessary request was 59.9%.

Conclusion: As a result, despite the fact that there is still not enough blood donations nowadays, it seems that blood is wasted because of preventable causes and not being used effectively.

Keywords: Blood transfusion, Blood waste

Introduction

Blood has been regarded as the basic symbol of health and life and has been known as “a unique means of treatment, whose source is human, and which has no other alternative to obtain” yet (1). Each of the individuals in society needs transfusion of blood and blood products for themselves, their families or their immediate surroundings at different times due to various diseases during their lifetime (1). The therapeutic use of blood, which is characterized as red liquid tissue circulation which performs many vital functions in multicellular organisms and circulates continuously in the cardiovascular system (2), is based on ancient histories. Blood transfusion studies, defined as the delivery of blood or blood products directly to the circulatory system of the individual (3, 4) started in the 15th century and still continue (5, 6). Today, studies on blood have reached to work on artificial and oxygen carriers. However, in this regard, a series of production has not yet been passed and these materials have not been used as a treatment option anywhere in the world (7, 8).

Because it cannot be produced in the laboratory environment, vital blood must be provided from healthy individuals (3). The increase in the average life span in most countries has increased the need for blood and blood products, the sole source of which is human, as a result, it has become important to provide blood (4). For this reason, blood services are carried out systematically in the world.

It has been reported that over 10 million blood donations have been made annually in the United States. In Germany, a total of 4.2 million units of blood are provided from the 3.6 million blood donors and 200 thousand blood donors volunteers.

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Approximately 4 million blood donations are collected each year in Japan. According to WHO data, 81 million blood donations per year are made in the world, 82,2% of them are taken from volunteer donors in developed countries and they are used by conducting all screening tests. Turkey is far behind in terms of blood donation compared to developed countries (4). As of the end of 2013, the Turkish Red Crescent has reached 1 million 640 thousand 881 units of blood donations (9, 10).

One of the main problems in health in our country is the lack of blood and blood products if needed and the inadequacy of voluntary blood donation. In developed countries, the proportion of blood donation to population is 5%, while in Turkey this rate is 1.5-2%. In our country, the fact that blood donation habits are not fully established constitutes a resource limitation in terms of blood and blood products (1).

Because blood transfusion therapy affects the lives of patients, careful applications is required. Nurses are responsible for ensuring the transfusion of blood and blood products in accordance with national and international standards and in a safe manner (11).

At this point, it is important for nurses to identify and manage individual-socio-economic resources in order to preserve, develop or improve health of the individual / family, alongside their roles as caregiver, decision maker, rehabilitator, educator and counselor; in this context, it is also necessary to ensure effective use of important resources such as blood, which does not have an alternative in patient treatment (12-14).

Material and method

Research Design

This research was planned and conducted in a descriptive research model.

The Universe of Research and Sampling

The study's universe consisted of transplanted and wasted blood and blood products in a university research hospital orthopedics and traumatology, neurosurgery, pediatric hematology and pediatric intensive care clinics. Since the research was planned with a cross-sectional method, no sampling method was used and the entire universe was sampled during the period of the research. All blood transfusions (309) performed at the clinics between the dates specified constituted the data of the study.

Data Collection Tools and Data Collection

All the clinics in the research hospital of university were visited before starting to research, and the clinics of Orthopedics and Traumatology, Neurosurgery, Pediatric Hematology and Pediatric Intensive Care Clinics in which the most frequent blood transfusion were made based on the past data were included in the study and the other clinics were excluded. Between 10.12.2014 and 20.04.2015, in the mentioned clinics, the data about blood waste and reasons was collected.

Blood waste and causes form consisting of 9 items investigating the material used, the clinic where the blood used, the amount of the blood used, wasted amount of blood and reasons of wasting etc. was prepared by the researcher in the light of the literature (2, 15).

Data Analysis

The coding and statistical analyzes of the data were performed using the Statistical Package for the Social Sciences for Windows (SPSS) 10.0 program. In the analysis of the data, number and percentage tests were used to assess data on blood transfusion and blood wasting reasons. The rates of use and waste of blood according to clinics, the rates of use and waste of blood according to the age of patients and the rates of use and waste of blood according to blood groups were analyzed by using independent t test. For statistical significance, $p<0.05$ value was accepted.

Ethical Principles of the Study

The information form containing the purpose and scope of the research was submitted to University Research Hospital Head Hospital and official permission was obtained. The study was approved by the appropriate ethics committee (2015/1) and was therefore carried out in accordance with the ethical standards set out in the Declarations of Helsinki. Oral approval was obtained from the patients to use their personal information in the research.

Limitations of the Study

Since the research is carried out on a single institution and the city there is a limitation on generalizability.

Results

According to the information about the blood products used (Table 1), it was found that the highest blood product used was erythrocyte (62.7%), the most used blood group was A Rh (+) (54%). Also, the highest number of transfused blood (49.6%) was found to be used in brain surgery.

When the amount of blood used according to age and weight in blood transfused individuals is examined (Table-2), the amount of blood transfusion applied to patients aged 40 years and over is higher than other age groups (32.8%) and those with a weight of 11 kg or more (66.3%) were found.

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Table 1. Information on Blood Product

Blood Transfusion Information	Number	Percentage*
Material Used		
Erythrocyte	194	62.7
Platelets	58	18.8
Plasma	54	17.5
Full Blood	3	1
Clinic in which the blood is used		
Brain surgeon	153	49,6
Newborn	103	33,3
Orthopedics	40	12,9
Pediatric Hematology	13	4,2
Blood Group Used		
A Rh +	167	54
A Rh-	39	12,6
0 Rh+	33	10,7
B Rh+	32	10,4
AB Rh+	23	7,4
B Rh-	7	2,3
AB Rh-	5	1,6
0 Rh-	3	1

* Percentage of line was taken

Table 2. Age and Weight Characteristics of Patients used Blood and Blood Products

Age of Patients used Blood and Blood Products	Number	%
0 years	58	18,8
1-19 years	65	21,1
20-39 years	84	27,3
40 and over	101	32,8
Weight of Patients Given Blood		
1-5 Kilo	104	33.7
6-10 Kilo	0	0
11 and up	205	66.3

Table 3. Information on the Average Blood Usage and Waste per Unit (500 ml Blood Bags) According to by Clinics

Clinics where blood is used	Used Blood Amount (ml) X ±SD	Wasted Blood Amount (ml) X ±SD
Newborn	27,79±36,2	472,43±36,1
Pediatric	189,62±78,4	310,38±78,4
Hematology	282,75±113,1	204,25±107,4
Orthopedics	246,47±148,0	252,22±148,6
Brain surgeon		

When the amount of blood used according to age and weight in blood transfused individuals is examined (Table 2), the amount of blood transfusion applied to patients aged 40 years and over is higher than other age groups (32.8%) and those with a weight of 11 kg or more (66.3%) were found.

When the blood ratios used and wasted according to the clinics were examined (Table 3), the mean blood amount used in the neonatal intensive care clinic was 27,79, while the amount of blood wasted was 472,43. The mean amount of blood used in the pediatric hematology clinic was 189.62, and the amount of blood wasted at the same clinic was 310,38.

When the blood mean values used and wasted according to blood groups were compared (Table-4), it was found that the highest average rate of use of blood and blood products was in the group of AB Rh (-) and the lowest average was in the group of A Rh (-); when the wasted blood amount means were compared, the highest mean was found in the group A Rh(-) and the lowest mean was in AB Rh(-).

When the reasons of blood waste were examined, it was concluded that the rate of not using pediatric blood bags was 40.1% and the rate of unnecessary request was 59.9%.

Table 4. Information on Blood Average Used and Wasted by Blood Groups

Blood Groups	Used Blood Amount (ml) X±SD	WastedBlood Amount (ml) X±SD
A Rh +	181,66±157,7	314,87±159,6
0 Rh+	136,73±148,0	360,24±151,4
B Rh+	222,19±154,7	277,81±154,8
AB Rh+	262,30±141,7	241,17±139,4
A Rh-	68,08±102,6	431,97±102,6
0 Rh-	300,00±104,4	200,00±104,4
B Rh-	161,43±162,6	324,29±171,7
AB Rh-	334,00±34,4	166,00±34,4

Table 5. Reasons for the Blood Waste

Reasons of Waste	Number	%
Not using pediatric blood bag	124	40,1
Unnecessary request	185	59,9

Discussion

Developing technology, changing living conditions, the emergence of different diseases, increased number of patients treated in surgical and trauma units has caused and increase in need for blood, whose sole source is human and which has no alternative despite all researches, therefore providing the necessary blood to meet this need has gained importance (16).

Since this has caused obtaining blood donations with the lowest risk (16), it has resulted in the regulation of campaigns to increase volunteer blood donation and the work in this area has accelerated. Accelerating blood donation studies have led academics in health care to conduct research that includes inaccurate information about blood donation, beliefs, attitudes and behaviors, and have provided training on informing the community correctly about blood donations in the light of the results of these researches (1, 16, 17). Another factor that is as important as blood donation to ensure this delicate balance between blood stocks supported by blood donation and blood demand, is the effective use of blood taken from the donor, prepared by passing through many procedures and tests. After the detailed literature search for our research, we found two studies on the effective use of blood in the World (18, 19). Although the belief and attitude researches in blood donation in our country were carried out, no research was conducted on the effective use of blood.

Of the 309 blood transfusions performed in the clinics where the research data were collected, 194 (62.7%) were found to be erythrocyte suspensions (Table 1). According to the results of a study by Portugal et al. (2014) in Brazil, "Transfusion Studies at the Neonatal Intensive Care Unit", 85% of premature babies are receiving at least one eirtrocy transfusion during their hospital stay (20). The fact that 33.3% of the transfusions we included in our study were done in the newborn clinic can be shown as the reason why the transfusion of erythrocyte suspension is so high.

Among the clinics within the scope of the study, it was the brain surgery clinic where the highest number of blood transfusions were made (49,6%) (Table-1). The high rate of trauma patient operations, the long duration of operations, and the high blood loss during the surgery can be the reason why the rate of blood transfusion in the clinic is so high.

When the blood group rates in the blood transfusion performed in the clinics are examined, it is seen that the A Rh (+) blood group has the highest blood transfusion ratio (Table 1). As a known fact, the most common group of blood is A Rh (+) in Turks According to the findings of Akin and Dostbil (2005) "Blood Group Studies in Turkey", A Rh + blood group is the most seen blood group in our country with 39.99% (21).

The ages of blood transfused patients are given in Table 2. According to the results obtained, it is seen that the age group with the highest blood transfusion is 40 years and over (32,8%).The necessity of surgical operations due to functional disorders in tissues and organs (2) due to age progression can be shown as a cause of blood transfusion in older age compared to early ages

When the use and waste averages of blood according to clinics are examined (Table-3), it is seen that the highest rate of use belongs orthopedics and traumatology clinics (282,75 ± 113,06). The high number of patients with trauma and the incidence of incisions covering large body surfaces frequently in surgical operations in this area can be attributed to the fact that the average blood usage is higher than the others in this clinic. On the other hand, the highest waste rate is found in the newborn clinic (472,43 ± 36,06). When the blood use and waste rates according to the average age of the patients were examined (Table 4), it was found that the highest average use was in the 20-39 age groups (277.38 ± 131.47) and the difference between the groups was significant ($p<0,001$). It is seen that the age group with the highest number of waste blood is 0- age group and the difference between the groups is significant ($p<0,001$).

Blood to be transfused is used as packed in average 500 cc with additives in the hospital study was conducted regardless of the clinical and necessity difference. The blood required for the treatment of a low birth weight baby does not often exceed a few cc, and the remaining amount of storage is sent to the disposal as storage conditions deteriorate and opened blood. The use of blood bags that do not contain the proper size and quantity in the clinics where the age and weight of the patients are low can be considered as a reason for the high rate of waste in clinics and small age groups.

According to the findings obtained, unnecessary demand (40.1%) and absence of pediatric bags (59.9%) are among the factors causing blood waste. According to the blood usage policy of the hospital, the nurses stated that the blood is prompted by the surgeon who will perform the surgery preoperatively in the clinics but most of the time the requested blood is kept waiting for more than 4 hours and is sent to the disposal when it is not needed in the operation. In the National Blood Center and Transfusion Course notes, Pelit (2009) noted that one of the most important tasks of the hospital transfusion team is the reduction of unnecessary blood use and the extermination of the blood, and this team's effective study will improve the quality of transfusion applications and decrease improper use, cost and complications (22). Cevizci et al. (2010) emphasized the importance of training of health staff and volunteers in order to ensure the blood balance that is stored and demanded and the effective use of the blood obtained (23).

In Iran, the study titled "Determination of Waste Rates and Reasons for Blood and Blood Products in Iran Hospital" has found a number of reasons for blood wastage, including not being used despite surgical or other clinic requests, filling the shelf life, hemolysis and various other causes. This data supports the results of our research (18).

Manmohan Singhal et al. conducted a study called "A Research Analysis on the Usage and Waste of Blood Components in the Blood Bank and the Blood

Component" and they have addressed to the use of more advanced materials to prevent blood waste (19). This finding supports the necessity of using a pediatric bag, one of the causes of blood waste resulting from our research (2013).

Conclusion

As a result, despite the fact that, there is still not enough blood donation nowadays, it seems that blood is wasted because of preventable causes and not being used effectively. Especially pediatric blood bag usage should be encourage for blood centers to pediatric patients. In addition that, there is not a blood donor data center for low rate blood group donors such as A Rh (-) in Turkey. Authorities should create a donor data center to respond demands for indicated low rate blood groups in this research.

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