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Clinical efficacy of psychiatric nursing-based vancomycin in the treatment of *Staphylococcus aureus* infectious skin diseases

Lina Zhang[1], Zhifeng Li[1], Xin Wang[1], Chao Lyu[1], Juan Shen[1] and Haitao Li[2]*
[1]Department of Dermatology, Affiliated Hospital of Hebei Engineering University, Handan, Hebei, China
[2]Medical College, Hebei University of Engineering, Handan, Hebei, China

Abstract: To study the clinical effect of psychiatric nursing-based vancomycin in patients with staphylococcus aureus infectious skin disease. A retrospective analysis was performed on 100 patients with staphylococcus aureus infectious skin disease admitted to our hospital from March 2019 to July 2020. Al patients received psychiatric nursing and were divided into control group (mupiroxine) and experimental group (vancomycin) according to the treatment mode, with 50 patients in each group. The effective rate of treatment, adverse reactions, disappearance time of dermatological clinical symptoms, and recurrence after one course of treatment were compared between the two groups. The effective rate of the experimental group was significantly higher than that of the control group (P<0.05).The incidence of adverse reactions and the disappearance time of clinical symptoms in the experimental group were significantly lower than those in the control group (P<0.05). After one course of treatment, the number of patients with recurrence in the experimental group was significantly lower than that in the control group (P<0.05). Vancomycin might be a boon for patients with staphylococcus aureus infectious skin diseases, with good effectiveness and safety profiles.

Keywords: Vancomycin, psychiatric nursing-based, *Staphylococcus aureus*, skin disease, clinical efficacy.

INTRODUCTION

Staphylococcus aureus, known as an infectious pathogen, can cause many skin clinical manifestations such as impetigo, folliculitis, furuncle, staphylococcal scalded skin syndrome, etc. (Navidinia *et al*., 2021; Prasad *et al*., 2021; Towell *et al*., 2021). The staphylococcus aureus skin infections peak in hot summer when excessive sweating on skin surface led by heat and humidity provides favorable condition for the infection and reproduction of bacteria. Skin, the organic tissue of human body massively exposed to external environments, is attached abundant of bacteria on its surface. The bacteria spread and multiply under appropriate conditions, leading to bacterial diseases and posing great threats to the health of patients (Doub, 2021; Muklewicz *et al*., 2021; Sader *et al*., 2021). Consequently, infected patients are in demand of in-time antibiotic treatment. Gentamicin, neomycin, chlortetracycline, penicillin, mupirocin, fusidic acid, vancomycin and quinolone are all common antibiotics, among which, mupirocin and fusidic acid are especially used against staphylococcus aureus skin infections (Cristinacce *et al*., 2021; Lin *et al*., 2021; Nakkam *et al*., 2021). However patients are prone to drug resistance with its widespread clinical use. Accordingly, this study was designed to further examine antibiotics therapy that suits for staphylococcus aureus skin infections, by enrolling patients either into a group receiving vancomycin or a group using mupirocin.

**Corresponding author:* e-mail: diyun84817962@163.com

MATERIALS AND METHODS

Patient selection and grouping

A retrospective analysis of 100 patients with *Staphylococcus aureus* skin infection admitted to our hospital from March 2019 to July 2020 was conducted. The participants were allocated into a control group and an experimental group according to different treatment measures, 50 cases in each group. Patients in the experimental group were aged from 23 to 58 years old, while the ages of patients in the control group were between 22 and 55 years old. The baseline information in the two groups were well balanced in the two groups in terms of gender, age and type of skin disease (P>0.05). See table 1.This study was reviewed and authorized by our hospital ethic committee (approval no. 2018/23-39).

Inclusion/Exclusion criteria

Inclusion criteria

(1) In line with the clinical symptoms of *Staphylococcus aureus* skin infection;
(2) Aged ≥ 18 years old
(3) With no other organic diseases, and normal functions of the heart, lung and kidney;
(4) No history of drug allergy, drug abuse and bad habits;
(5) This study was approved by the hospital ethics committee. All patients participated voluntarily with written informed consent obtained.

Exclusion criteria

(1) er bacterial infections;
(2) ergy to antibiotics;
(3) sence of congenital diseases.

Method

Mupirocin ointment (Manufacturer: SK&F; approval no: H10930064; Specification: 10g) was given for the control group; it was evenly applied to the infectious area on the skin surface, 3 times a day, avoiding contact with clothes. The effectiveness was then evaluated after one course of treatment, with 5-day a course.

Patients in the experimental group received 5mg/kg vancomycin hydrochloride (Manufacturer: Zhejiang Medicine CO., LTD Xinchang Pharmaceutical; approval No.H20033366; Specification: 0.5g) via intravenous injection at a speed of 10mg/min, with a maximum dose of 2g per day. Vancomycin was diluted in 100ml of 0.9% sodium chloride injection before use and 0.5g was instilled every 6 hours.

Indicators observation

The effective rate of treatment, adverse reactions, disappearance time of dermatological clinical symptoms, and recurrence after one course of treatment were compared between the two groups.

The efficacy is considered significantly effective if there are complete or general disappearance of clinical symptoms and no adverse reactions and drug resistance. The efficacy is considered effective if there are partial clinical manifestations with mild adverse reactions and no drug resistance. Otherwise it is considered if there are aggravated clinical manifestations with severe adverse reactions and drug resistance.

STATISTICAL ANALYSIS

All data analysis was performed with statistical software SPSS20.0 and the graphics were plotted by Graph Pad Prism 7 (Graph ad Software, San Diego, USA). Measurement data (x±s) were verified via t-test and the count data [n(%)] were processed using X^2 test. Significance was claimed at a *P* value of <0.05.

RESULTS

Comparison of the treatment effectiveness rate

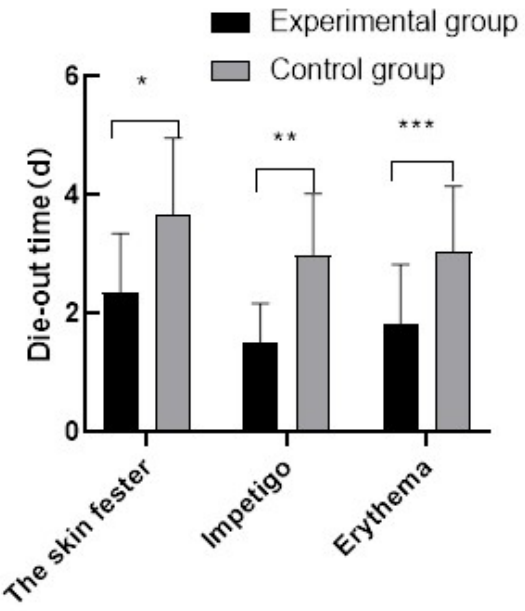
Table 2 shows that the experimental group obtained a significantly higher *treatment effectiveness* rate than the control group did (*P*<0.05).

Comparison of the concurrences of adverse reactions

The experimental group experienced milder *adverse reactions* during the treatment the control group in terms of body temperature increase, skin tenderness, skin redness and swelling (*P*<0.05) (table 3).

Comparison of the disappearance time of clinical symptoms

The experimental group spent significantly less time for the *disappearance* of skin symptoms including ulcer, impetigo and erythema than the control group (*P*<0.05) (fig. 1).



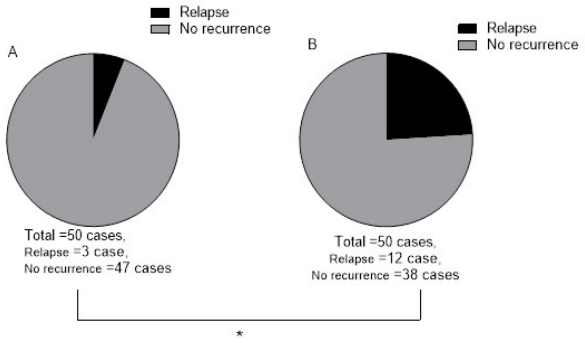
Note: The abscissas stand for symptoms of skin ulcer, impetigo and erythema from left to right. The ordinates represent die-out time measured by d.

*displays that the gap between the disappearance time of skin ulceration in the experimental group ((2.35±1.00) d) and the control group ((3.67±1.29) d) is of statistical significance (t=5.72, P<0.001).

**suggests the time period for impetigo die-out assessed in the experimental group ((1.51±0.66)d), is much shorter than that ((2.99±1.03)d) in the control group (t=8.55, P</0.001).

***means the time of erythema die-out assessed in the experimental group, which is ((1.81±1.02) d), is a lot shorter than that ((3.04±1.11) d) in the control group (t=5.77, P</0.001).

Fig. 1: Comparison of die-out time of clinical symptoms



Note: Pie chart A displays the number of relapsed patients in the experimental group and pie chart B shows the number of relapsed patients in the control group.

*Indicates the difference between the experimental group where 3 recurred cases were found and the control group which has 12 relapsed patients, is of statistical significance (X2=6.35, P=0.01).

Fig. 2: Comparison of recurrence after one course of treatment.

Table 1: Statistics of general data comparison (x±s)

Group		Experimental group	Control group	t/X2	P
Gender (Male/Female)		32/18	30/20	0.17	0.68
Age		39.63±5.24	39.25±5.37	0.36	0.72
Height (cm)		170.22±9.54	170.51±9.68	0.15	0.88
Weight (kg)		71.49±5.61	71.24±5.90	0.22	0.83
History of the disease (month)		2.08±0.54	2.17±0.50	0.86	0.39
History of smoking (years)		6.30±1.56	6.44±1.98	0.39	0.70
History of drinking (years)		10.20±2.21	10.08±2.06	0.28	0.78
Type of disease	Folliculitis	24	25	0.04	0.84
	Staphylococcal scalded skin syndrome	19	17	0.17	0.68
	Impetigo	7	8	0.08	0.78

Table 2: Comparison of the treatment effective rates

Group	Significant effects	Effective	Ineffective	Total effective rate (%)
Experimental group	33	11	6	88%
Control group	15	13	22	56%
X2				12.70
P				<0.001

Table 3: Comparison of the concurrence rates of adverse reactions

Group	Increase of body temperature	Tenderness	Redness and swelling	Total occurrence rate
Experimental group	0	1	3	8%
Control group	2	4	7	26%
X2				5.74
P				0.02

Comparison of recurrence after one course of treatment

Fig. 2 shows that the experimental group had a significantly lower number of relapsed cases than the control group after one course of treatment (P<0.05).

DISCUSSION

Staphylococcus aureus skin infection, a bacterial skin disease caused by staphylococcus aureus, can trigger a variety of skin clinical manifestations such as impetigo, folliculitis, furuncle, staphylococcal scalded skin syndrome and therefore results in adverse impacts on the daily life of the patients (Buchalter *et al*., 2021; Lodise *et al*., 2020; Yang *et al*., 2021). Currently antibiotic treatment is the mainstay for such bacterial skin diseases. However, the drug resistance rises from long-term use, and thereby reduces the therapeutic efficacy (Flannery *et al*., 2020; Wiggins and Chon, 2020; Zheng *et al*., 2020). Vancomycin, known as an antibiotic targeting on coccus, not only produces positive outcomes for treating staphylococcal infectious diseases accompanied by methicillin-resistance, but also is widely used in fighting other diseases like endocarditis and osteomyelitis (Sherri *et al*., 2020; Stocker *et al*., 2021). In general, a preferred way of vancomycin administration is intravenous injection under strict dosing so as to avoid adverse reactions caused by abusive injection within a short period of time. However, the management of the infusion speed merits attention, since too fast speed may give rise to hypotension, shock and even sudden cardiac death in severe circumstances (Babalola, 2020; Ye *et al*., 2020). Therefore, this study was aimed to evaluate the efficacy of vancomycin in treating staphylococcus aureus skin infections.

According to our results, the experimental group obtained higher treatment effectiveness rate than the control group, indicating that the use of vancomycin yielded considerable benefits, contributing to a higher therapeutic effective rate among patients with staphylococcus aureus skin infections. Additionally, the present study revealed that the experimental group was superior to the control group regarding adverse reactions control, disappearance time of clinical symptoms and the number of patients showing drug resistance after one course of treatment. A prior review found that after one course of treatment vancomycin treatment led to a decreased recurrence. Consistently, the previous study also revealed a good effectiveness profile of vancomycin in the treatment of age-related staphylococcus aureus pneumonia (WANG, 2020), in which vancomycin demonstrated a crucial role in improving efficacy and the course of medication, as

well as reducing adverse reactions. Taken together, those results have confirmed the rigorousness of this research.

CONCLUSION

In summary, the application of vancomycin might be an alternative for Staphylococcus aureus skin infection and hence is highly recommended in clinical settings with good safety and effectiveness profiles.

REFERENCES

Babalola OE (2020). Intravitreal linezolid in the management of vancomycin-resistant enterococcal endophthalmitis. *Am. J. Ophthalmol. Case Rep.*, **20**: 100974.

Buchalter DB, Teo GM, Kirby DJ, Schwarzkopf R, Aggarwal VK and Long WJ (2021). Does the organism profile of periprosthetic joint infections change with a topical vancomycin powder and dilute povidone-iodine lavage protocol? *J. Arthroplasty*, **36**(7S): S314-S319.

Cristinacce A, Wright JG, Macpherson M, Iaconis J and Das S (2021). Comparing probability of target attainment against *Staphylococcus aureus* for ceftaroline fosamil, vancomycin, daptomycin, linezolid, and ceftriaxone in complicated skin and soft tissue infection using pharmacokinetic/pharmacodynamic models. *Diagn Microbiol. Infect. Dis.*, **99**(4): 115292.

Doub JB (2021). A rare case of extensive *Staphylococcus aureus* sternoclavicular septic arthritis treated without surgical intervention. *IDCases*, **23**: e01023.

Flannery AH, Delozier NL, Effoe SA, Wallace KL, Cook AM and Burgess DS (2020). First-dose vancomycin pharmacokinetics versus empiric dosing on area-under-the-curve target attainment in critically ill patients. *Pharmacotherapy*, **40**(12): 1210-1218.

Lin SY, Shen LJ, Wu VC, Ko WJ, Wu CC and Wu FL (2021). Pharmacokinetics and dosing of vancomycin in patients undergoing sustained low efficiency daily diafiltration (SLEDD-f): A prospective study. *J. Formos Med. Assoc.*, **120**(1 Pt 3): 737-743.

Lodise TP, Hall RG 2nd and Scheetz MH (2020). Vancomycin area under the curve-guided dosing and monitoring: "Is the juice worth the squeeze"? *Pharmacotherapy*, **40**(12): 1176-1179.

Muklewicz JD, Steuber TD and Edwards JD (2021). Evaluation of area under the concentration-time curve-guided vancomycin dosing with or without piperacillin-tazobactam on the incidence of acute kidney injury. *Int. J. Antimicrob. Agents*, **57**(1): 106234.

Nakkam N, Gibson A, Mouhtouris E, Konvinse KC, Holmes NE, Chua KY, Deshpande P, Li D, Ostrov DA, Trubiano J and Phillips EJ (2021). Cross-reactivity between vancomycin, teicoplanin, and telavancin in patients with HLA-A *32:01-positive vancomycin-induced DRESS sharing an HLA class II haplotype. *J. Allergy Clin. Immunol.*, **147**(1): 403-405.

Navidinia M, Mohammadi A, Arjmand R, Dadashi M, Goudarzi M (2021). Molecular typing, biofilm formation and analysis of adhesion factors in *Staphylococcus aureus* strains isolated from urinary tract infections. *Gene Reports*, **22**: 101008.

Prasad JM, Negron O, Du X, Mullins ES, Palumbo JS, Gilbertie JM, Hook M, Grover SP, Pawlinski R, Mackman N, Degen JL and Flick MJ (2021). Host fibrinogen drives antimicrobial function in *Staphylococcus aureus* peritonitis through bacterial-mediated prothrombin activation. *Proc. Natl. Acad. Sci.* USA, **118**(1): e2009837118..

Sader HS, Carvalhaes CG, Streit JM, Arends SJR and Mendes RE (2021). Antimicrobial activity of dalbavancin against clinical isolates of coagulase-negative staphylococci from the USA and Europe stratified by species. *J. Glob Antimicrob. Resist*, **24**: 48-52.

Mendes RE, Castanheira M, Woosley LN, Stone GG, Bradford PA and Flamm RK (2017). Molecular β-lactamase characterization of aerobic gram-negative pathogens recovered from patients enrolled in the ceftazidime-avibactam phase 3 trials for complicated intra-abdominal infections, with efficacies analyzed against susceptible and resistant subsets. *Antimicrob. Agents Chemother.,* **61**(6): e02447-16.

Stocker SL, Carland JE, Reuter SE, Stacy AE, Schaffer AL, Stefani M, Lau C, Kirubakaran R, Yang JJ, Shen CFJ, Roberts DM, Marriott DJE, Day RO and Brett J (2021). Evaluation of a pilot vancomycin precision dosing advisory service on target exposure attainment using an interrupted time series analysis. *Clin. Pharmacol. Ther.*, **109**(1): 212-221.

Towell AM, Feuillie C, Vitry P, Da Costa TM, Mathelie-Guinlet M, Kezic S, Fleury OM, McAleer MA, Dufrêne YF, Irvine AD and Geoghegan JA (2021). Staphylococcus aureus binds to the N-terminal region of corneodesmosin to adhere to the stratum corneum in atopic dermatitis. *Proc. Natl. Acad. Sci. USA*, **118**(1): e2014444118.

Paul M, Bishara J, Yahav D, Goldberg E, Neuberger A, Ghanem-Zoubi N, Dickstein Y, Nseir W, Dan M and Leibovici L (2015). Trimethoprim-sulfamethoxazole versus vancomycin for severe infections caused by meticillin resistant *Staphylococcus aureus*: Randomised controlled trial. *BMJ.,* **350**: h2219.

Wiggins CJ and Chon SY (2020). Vancomycin-induced linear IgA bullous dermatosis. *Proc. (Bayl Univ Med Cent)*, **34**: 83-84.

Yang X, Xie B, Peng H, Shi G, Sreenivas B, Guo J, Wang C, He Y (2021). Eradicating intracellular MRSA via targeted delivery of lysostaphin and vancomycin with mannose-modified exosomes. *J. Control Release*, **329**: 454-467.

Ye C, Wang Z, Hu Y, Deng C, Liao L, Sun L, Wang C (2020). Systematic review and meta-analysis of the efficacy and safety of vancomycin combined with beta-

lactam antibiotics in the treatment of methicillin-resistant *Staphylococcus aureus* bloodstream infections. *J. Glob Antimicrob. Resist*, **23**: 303-310.

Zheng N, Gu Y, Hong Y, Sheng L, Chen L, Zhang F, Hou J, Zhang W, Zhang Z, Jia W and Li H (2020). Vancomycin pretreatment attenuates acetaminophen-induced liver injury through 2-hydroxybutyric acid. *J. Pharm. Anal.*, **10**(6): 560-570.