IN VITRO EVALUATION OF EFFICACY OF SOME ANTIBIOTICS AGAINST S. AUREUS AND OTHER BACTERIAL MICROFLORA ISOLATED FROM SKIN WOUNDS AND ABSCESSES IN CAMEL

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ABSTRACT

Most of the Gram positive isolates were sensitive to amoxycillin, co-trimoxazole, trimethoprim, gentamicin, streptomycin, chloramphenicol, kanamycin, doxycycline hydrochloride, ciprofloxacin and neomycin. The intermediate zone of inhibition of Gram-positive isolates was recorded with erythromycin. A majority of these organisms were resistant to penicillin, ampicillin, bacitracin, lincomycin, sulphamethizole and sulphadiazine. Most of the Gram negative isolates were sensitive to ampicillin, chloramphenicol, gentamicin, norfloxacin, trimethoprim and ciprofloxacin. An intermediate response to tetracycline and kanamycin was recorded for these isolates and in general were resistant to sulphamethizol and polymyxin B.

It was recorded that the most effective drug for both Gram positive and Gram negative isolates were gentamicin, chloramphenicol, ciprofloxacin and trimethroprim. On the basis of antibiogram results it was deduced that furazolidone, chloramphenicol, gentamicin and cloxacillin can be used to contain the *S. aureus* infection in wounds and abscesses in camel. Gram positive organisms were resistant to ampicillin whereas this drug was able to inhibit the growth of most of the Gram negative bacteria. Sulphdiazine was found ineffective to most of the Gram positive and all of the Gram negative bacteria.

Key words: Abscesses, antibiogram, bacteria, camel, S.aureus, skin, wounds

The skin wounds, abscesses or similar lesions are a great problem in camel as these are difficult to treat medically. A wide range of bacteria have been found to be present in such lesions (Qureshi et al, 2002). Though the condition is not always fatal but its fast spread over the body surface makes difficult to manage this ailment and the camel becomes useless for any purpose. The in-practice antibiotic therapy also does not work satisfactorily and a range of antibiotics is tried in such cases by veterinarians. The emergence of drug resistance in micro-organisms gradually increases as a result of indiscriminate use of antibiotics or other chemotherapeutic agents posing a serious threat in circumventing these bacterial infections. Because of emergence of drug resistance there is constant change in the patterns of antibiotic susceptibility or resistance shown by these organisms towards different antibiotics.

The present article investigates efficacy of some of the antibiotics against bacteria with special

reference to *S.aureus* isolated from wounds and abscesses in skin of the camel. The knowledge of antibiotic sensitivity pattern against the bacterial isolates from skin wounds and abscesses would help in selection of suitable antibiotics for the effective care, management and containment of such infections in camels.

Materials and Methods

Collection of samples : A total of 70 pus samples from skin wounds and abscesses of male camels belonging to different owners in and around, Bikaner (Rajasthan) were collected from different sites on animal body for isolation of bacteria in pure cultures.

Isolation and identification : A total of 171 aerobic bacterial isolates were obtained which were identified up to species level (Qureshi *et al*, 2002).

Antibiogram study: The isolates obtained were subjected to antibiotic susceptibility tests as per the method described by Bauer *et al* (1966). Twenty two

different antibiotics were used for Gram positive and 14 for Gram negative isolates from the under mentioned list. The readymade antibiotic discs (Hi-Media Laboratories Limited, India) were used and the results were classified as sensitive, intermediate and resistant as per zone size interpretative chart supplied with discs. The following antibiotics discs were used :

(1)	Ampicillin (A)	10 mcg
(2)	Amoxycillin (Am)	30 mcg
(3)	Ciprofloxacillin (Cf)	5 mcg
(4)	Co-trimoxazole (Co)	25 mcg
(5)	Sulphadiazine (Sz)	100 mcg
(6)	Sulphamethizole (Sm)	300 mcg
(7)	Trimethoprim (Tr)	5 mcg
(8)	Cephalexin (Cp)	30 mcg
(9)	Furazolidone (Fr)	50 mcg
(10)	Streptomycin (S)	25 mcg
(11)	Chloramphenicol (C)	30 mcg
(12)	Gentamicin (G)	30 mcg
(13)	Neomycin (N)	30 mcg
(14)	Bacitracin (B)	10 units
(15)	Vancomycin (Va)	30 mcg
(16)	Erythromycin (E)	10 mcg
(17)	Lincomycin (L)	15 mcg
(18)	Cloxacillin (Cx)	10 mcg
(19)	Doxycycline HCl (Do)	30 mcg
(20)	Penicillin-G (P)	10 units
(21)	Kanamycin (K)	30 mcg
(22)	Tetracycline (T)	30 mcg
(23)	Norfloxacin (Nx)	10 mcg
(24)	Nalidixic acid (Na)	30 mcg
(25)	Polymixin B (Pb)	30 mcg

Results and Discussion

In the present study *S. aureus* was found associated with maximum wounds and abscesses and a total of 125 gm positive and 46 gram negative bacteria were isolated.

Antibiogram against S. aureus : All of the S. aureus isolates were found susceptible to furazolidone, chloramphenicol, gentamicin and cloxacillin, 97.5% to amoxycillin, ciprofloxacin, doxycycline hydrochloride and tetracycline, 95% to trimethoprim, 92.5% to vancomycin and 90% were susceptible to kanamycin. They were resistant to sulphadiazine, sulphamethizole, cephalexin, ampicillin and penicillin. The results are shown in table 1. Higher susceptibility of *S. aureus* to tetracycline was an interesting observation in the present investigation.

On the basis of antibiogram obtained it was deduced that furazolidone, chloramphenicol, gentamicin and cloxacillin antibiotics could be used to contain *S. aureus* infection in wounds and abscesses.

There are many antimicrobial susceptibility research reports published on pyogenic infections caused by S. aureus in canine, feline, horse, cattle and other animals but no could be traced on staphylococci isolated from wounds and abscesses in camel. Goel et al (1976) recorded inhibition of 80% or more of S. aureus with erythromycin and chloram-phenicol while penicillin, sulphadiazine failed to inhibit majority of S. aureus isolates. Reports of Love (1989) and, Woldehiwet and Jones (1990) sugge-sted that S. aureus was very susceptible to gentamicin, chloramphenicol, erythromycin, framycin, neomycin, lincomycin and ampicillin and very resistant to penicillin. Except ampicillin and erythromycin which were resistant and inter-mediate, respectively in the present study, our findings corroborated the above observations.

Sensitivity to chloramphenicol, doxycycline, gentamicin, novobiocin, vancomycin was recorded by Pereira and Siquiera-Jr (1995) and Prasad and Yadava (2000) for *S. aureus* isolated from cattle. They found these organisms resistant to penicillin followed by streptomycin, tetracycline, erythromycin, kanamycin and neomycin.

Kamboj *et al* (1995) found that staphylococci were sensitive to cephalexin followed by cloxacillin (93.59%), amoxycillin (91.13%), gentamicin, kanamycin, lincomycin and chloramphenicol (89.65%) each. Our observations were also in agreement with this report but contrarily reistance was recorded to cephalexin.

Nanu (1988) tested 37 coagulase positive staphylococci for drug sensitivity. All isolates were sensitive to chloramphenicol, whereas all were resistant to ampicillin, cephaloridine, carbenicillin and penicillin G.

Antibiogram against other isolates

Analysis of antibiogram revealed that a majority of the Gram positive organisms were sensitive

c		Response			
5. No.	Isolate (N)	Sensitive	Inter - mediate	Resistant	
1.	Staphylococcus aureus (40)	Am, Cf, Co, Tr, S, Fr, C, G, B, Va, L, Cx, Do, K, T	N,E	Sz, Sm, Cp, A, P	
2.	S. epidermidis (11)	Am, Cf, Co, Sz, Sm, Tr, S, Fr, C, G, N, Va, L, CX, Do, P, K, T	_	Ср, В, А, Е	
3.	S. intermedius (2)	Am, Cf, Co, Tr, Cp, S, Fr, C, G, N, A, E, L, Cx, DO, P, K	_	Sz, Sm, B, Va, T	
4.	S. saprophyticus (4)	Am, Cf, Co, Tr, Cp, S, Fr, G, N, Va, K, T	C, Do	Sz, Sm, B, A, E, L, Cx, P	
5.	S. caprae (4)	Am, Cf, Co, Tr, Cp, S, Fr, C, G, N, Cx, Do, K	-	SZ, Sm, B, Va, A, E, L, P, T	
6.	S. lugdunensis (2)	Am, Cf, Co, Tr, Cp, Fr, C, G, N, Va, Cx, Do	Е, К, Т	Sz, Sm, S, B, A, L, P	
7.	Micrococcus varians (10)	Am, Cf, Co, Tr, S, C, G, N, B, Va, L, Cx, Do, K,T	Е	Sz, Sm, Cp, Fr, A, P	
8.	M. luteus (21)	Am, Cf, Co, Sz, Sm, Tr, S, C, G, B, L, Cx, Do, P, K, T	N,Va,A, E	Cp, Fr	
9.	<i>Streptococcus faecalis</i> (1)	A, Cx	Am, B, E	Cf, Co, Sz, Sm, Tr, Cp, S, Fr, C G, N, Va, L, Do, P, K, T	
10.	Bacillus polymyxa (2)	All antibiotics used	_	-	
11.	B. licheniformis (4)	Am, Cf, Co, Sz, Sm, Tr, Cp, S, Fr, C, G, N, A, DO, K, T	В, Е	Va, L, Cx, P	
12.	B. subtilis (3)	Cf, Co, Tr, Cp, S, Fr, C, G, N, A, Do, K, T	Am, E	SZ, Sm, B, Va, L, Cx, P	
13.	Corynebacterium pyogenes (4)	Am, Cf, Sz, Tr, Cp, S, Fr, C, N, A, L, Cx, Do, P, K, T	G, B, E	Co, Sm, Va	
14.	C. bovis (12)	Am, Cf, Sz, Sm, Tr, Cp, S, Fr, C, N, A, Do, K	G, E, T	CO, B, Va, L, Cx, P	
15.	C. hoffmannii (3)	All antibiotics except B	В	_	
16.	Nocardia spp. (2)	Am, Cf, Co, Sz, Tr, Cp, S, C, G, N, A, Do, K, T	E, L	Sm, Fr, B, Va, Cx, P	

Table 1. Antibiogram of Gram positive isolates from camel skin wounds and abscesses.

N = Number of isolates

Table 2. Antibiogram of Gram negative isolates from camel skin wounds and abscesses.

S. No.	Isolato (NI)	Response			
	Isolate (IN)	Sensitive	Intermediate	Resistant	
1.	E. coli (3)	A, Cp, C, Nx, Tr, S, T, K, G, Fr	Cf	Sz, Na, Pb	
2.	Citrobacter koseri (4)	A, Cp, C, Nx, Na, Tr, K, Cf, G, Fr	S, T	Sz, Pb	
3.	Enterobacter aerogenes (2)	A, C, Nx, Na, Tr, K, Cf, G	S, T, Fr	Cp, Sz, Pb	
4.	Klebsiella oxytoca (3)	A, C, Na, Tr, S, T, K, G, Fr	Cp, Cf	SZ, Nx, Pb	
5.	K. pneumoniae (3)	A, Cp, Nx, Pb, Tr, S, K, Cf, G, Fr	C, Na, T	Sz	
6.	K. terrigena (8)	A, C, Nx, Na, Tr, Cf, G	Ср, S,T, К	SZ, Pb, Fr	
7.	Proteus vulgaris (6)	A, Cp, C, Nx, Na, Tr, S, T, Cf, G	K	SZ, Pb, Fr	
8.	Proteus mirabilis (3)	A, C, Nx, Na, Tr, S, T, Cf, G	Ср, К	SZ, Pb, Fr	
9.	Pseudomonas aeruginosa (3)	Pb, K, Cf, G	-	A, Cp, C, Sz, Nx, Na, Tr, S, T, Fr	
10.	Aeromonas liquefaciens (5)	Cp, Nx, Na, Tr, Cf, G	A, S, K	C, Sz, Pb, T, Fr	
11.	Alcaligenes faecalis (3)	A, Cp, C, Nx, Na, Pb, Tr, S, T, KCf, G, Fr	_	Sz	
12.	Bordetella parapertussis (3)	A, C, Nx, Na, Pb, Tr, S,T, KCf, G, Fr	_	Sz, Cp	

N = Number of isolates

to amoxycillin, co-trimoxazole, trimethoprim, gentamicin, streptomycin, chloramphenicol, kanamycin, doxycycline hydrochloride, ciprofloxacin and neomycin, and less sensitive to furazolidone, tetracycline, cloxacillin, vancomycin and cephalexin.

The most of the Gram positive bacteria (90%) were intermediate sensitive to erythromycin and resistant to penicillin, ampicillin, bacitracin, lincomycin, sulphamethizole and sulphadiazine. However, *Streptococcus faecalis* was sensitive to ampicillin and cloxacillin, intermediate to amoxycillin, bacitracin and erythromycin, and resistant to remaining all drugs used. Interesting results were obtained with *Bacillus polymyxa* and *Corynebacterium hoffmannii* (except against bacitracin) which were sensitive to all drugs used for Gram positive isolates.

Most of the Gram negative isolates were sensitive to ampicillin, chloramphenicol, norfloxacin, trimethoprim, ciprofloxacin and gentamicin and less sensitive to cephalexin, nalidixic acid, furazolidone and streptomycin. An intermediate response to tetracycline and kanamycin was recorded for these isolates. The Gram negative isolates, in general were resistant to sulphamethizole and polymyxin B. Exceptionally, *P. aeruginosa* was found resistant to all drugs used for Gram negative isolates but sensitive to polymyxin B, kanamycin, ciprofloxacin and gentamicin.

The antibiograms revealed that most effective drugs for both Gram positive and Gram negative isolates were gentamicin, chloramphenicol, ciprofloxacin and trimethroprim.

Antibiotic sensitivity against Gram positive and Gram negative organisms were carried out by Goel *et al* (1976) who concluded that erythromycin was most effective and penicillin was most resistant drugs against both Gram positive and Gram negative. These findings are in partial agreement with present study.

Many workers (Owens *et al*, 1975; Trishkina and Galushko, 1983; Prescott and Yielding, 1990; Ndung'U and Buoro, 1994) tested various organisms to antibiotic sensitivity. Most of the organisms were found sensitive to chloramphenicol, erythromycin, ampicillin, gentamicin, ciprofloxacin, enrofloxacin and norfloxacin.

Out of 63 staphylococcal isolates in the present study most were sensitive to amoxycillin, ciprofloxacin, co-trimoxazole, trimethoprim, cephalexin, furazolidone, gentamicin, neomycin, cloxacillin, vancomycin and kanamycin. The present findings are in agreement with previous findings of Woldehiwet and Jones (1990), Kamboj *et al* (1995) and Patel *et al* (1999).

Antibiogram of *Corynebacterium* isolates in present study indicated that cephalexin, sulphadiazine sulphamethizole, streptomycin, neomycin, ampicillin were most effective drugs followed by amoxycillin, ciprofloxacin, trimethoprim and kanamycin whereas resistant to co-trimoxazole, (except *C. hoffmannii*) and bacitracin. These findings are in agreement with previous findings of Abubakr *et al* (1999) and Ali (1999) who tested *Coryne-bacterium* spp. isolated from abscesses in camels. They found cephalexin as the most effective drug against corynebacteria.

Nocardia spp. was sensitive to ampicillin, sulphadiazine, trimethoprim, kanamycin, tetracycline, doxycycline, gentamicin, cephalexin, streptomycin, ciprofloxacin, amoxycillin, cotrimoxazole and neomycin whereas resistant to furazolidone, bacitracin, vancomycin, cloxacillin and penicillin and intermediate zones of inhibition were recorded with erythromycin and lincomycin. Previous findings of Hirsh and Jang (1999) supports the present results. They found *Nocardia nova* sensitive to ampicillin, kanamycin, tetracycline, doxycycline, trimethoprim, gentamicin, amoxycillin and cephalosporins.

The members of family *Enterobacteriaceae* were found sensitive to ampicillin, cephalexin, chloramphenicol, norfloxacin, trimethoprim, kanamycin, ciprofloxacin and gentamicin, whereas resistant to sulphadiazine and polymyxin B and intermediate to tetracycline and streptomycin. *E. coli* and Klebsiella strains were found sensitive to ampicillin, gentamicin, kanamycin, cephalosporins and polymyxinB by Nomura *et al* (1994) and *K. pneumoniae* was found sensitive to kanamycin, gentamicin, cephalosporins, neomycin, polymyxin B, tetracycline, streptomycin by Mraz *et al* (1981).

In present study all the *P. aeruginosa* isolates were found most sensitive to polymyxin B, kanamycin, ciprofloxacin and gentamicin whereas resistant to ampicillin, cephalexin, chloramphenicol, sulphdiazine, norfloxacin, trimethoprim nalidixic acid and tetracycline. These results are in agreement with previous reported of Sarma and Boro (1979) and Wolska *et al* (1999). All *Aeromonas liquefaciens* isolates tested for antibiotic sensitivity were sensitive to cephalexin, norfloxacin, nalidixic acid, trimethoprim, ciprofloxacin and gentamicin, whereas resistant to chloramphenicol, sulphadiazine, polymyxin B, tetracycline and furazolidone.

Among Gram negative bacteria *Alcaligenes faecalis* and *Bodetella parapertussis* were found sensitive to all used drugs except sulphadiazine and similar to findings of Speakman *et al* (2000) for *Bardetella bronchoseptica*.

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