Vol 11 No 1, p 67-71

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

S. Qureshi and A.K. Kataria
Department of Veterinary Microbiology, College of Veterinary and Animal Science, Bikaner (INDIA)

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

SEND REPRINT REQUEST TO S. QURESHI

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, chloram-phenicol, 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

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

S. No.	Isolate (N)	Response		
		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	–	Cp, B, A, E
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	E, K, T	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	E	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.	*Streptococcus faecalis* (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	B, E	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	B	–
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

N = Number of isolates

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

S. No.	Isolate (N)	Response		
		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	Cp, S,T, K	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	Cp, K	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, co-trimoxazole 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*.

References

Abubakr MI, Nayel MN and Fadlalla ME (1999). Corynebacterium abscesses in camels in Bahrain. Journal of Camel Practice and Research 6(1):107-109.

Ali HS (1999). Clinico-bacteriological and therapeutic studies on Corynebacterium pseudotuberculosis infection in camel in Assiut governorate-Egypt. Assiut Veterinary Medical Journal 42(83):228-238 (Cited from Vet. Bull. 70 : Abst. 4442).

Bauer AW, Kirby WM, Sherris JC and Turck M (1966). Antibiotic susceptibility testing by a standardised single disc method. American Journal of Clinical Pathology 45: 493-496.

Goel YP, Kulshrestha CM and Pathak RC (1976). *In vitro* antibiotic spectrum of some pathogenic bacteria. Indian Veterinary Journal 53:382-382.

Hirsh DC and Jang SS (1999). Antimicrobial susceptibility of Nocardia nova isolated from five cats with nocardiosis. Journal of American Veterinary Medical Association 215:815-817.

Kamboj DS, Singh KB, Sharma DK, Nauriyal DC and Baxi KK (1995). Characterisation and antimicrobial profile of bacterial isolates from Canine bacterial dermatitis. Indian Veterinary Journal 2:671-674.

Love DN (1989). Antimicrobial susceptibility of staphylococci isoalted from dogs. Australian Veterinary Practice 19: 196-200.

Mraz O, Vymola F and Vrbova E (1981). Sensitivity of herd strains of Klebsiella pneumoniae to antibiotics and its trend. Acta Veterinaria Brno 50:201-205 (Cited from Veterinary Bulletin 53:2267).

Nanu E (1988). Bacteriological quality of pork products with special reference to staphylococcal enterotoxins. Ph.D. submitted to Birsa Agri. Univ., Ranchi, Bihar, India.

Ndung'U PT and Buoro IBJ (1994). Survey of bacterial diseases and antibiotic resistance in the small animal clinic. Israel Journal of Veterinary Medicine 49:115-119.

Nomura T, Usami Y, Kikuchi N, Takahashi T, Hiramune T and Yanagawa R (1994). Antibiotic susceptibility of Klebsiella and E. coli strains isolated from milk of cow affected with clinical mastitis. J. Rokuno Gakuen University, Natural Science, 19:169-172 (Cited from Veterinary Bulletin, 65: Abst. 7281).

Owens DRMS, Wagner JE and Addison BJBS (1975). Antibiograms of pathogenic bacteria isolated from laboratory animals. Journal of American Veteriary Medical Association 167:605-609.

Patel A, Lloyd DH and Lamport AI (1999). Antimicrobial resistance of feline staphylococci in Southeastern England. In Special issue on antibiotics. Veterinary Dermatology, 10: 257-261. (Cited from Veterinary Bulletin 69: Abst. 7968).

Pereira MSV and Siquiera-Jr JP (1995). Antimicrobial drug resistance in *S. aureus* isolated from cattle in Brazil. Letters in Applied Microbiology 20:391-395.

Prasad C and Yadava R (2000). Prevalence of S. aureus in Chevon and its antibiogram. Indian Veterinary Medical Journal 24:203-206.

Prescott JF and Yielding KM (1990). *In vitro* susceptibility of selected veterinary bacterial pathogens to ciprofloxacin, enrofloxacin and norfloxacin. Canadian Journal of Veterinary Research 54:195-97.

Qureshi S, Kataria AK and Gahlot TK (2002). Bacterial microflora associated with wounds and abscesses on camel (*Camelus dromedaries*) skin. Journal of Camel Practice and Research 9(2):129-134.

Sarma G and Boro BR (1979). Antibiotic resistance pattern of pathogenic bacteria isolated from clinical materials of animals. Indian Veterinary Journal 56:356-359.

Speakman AJ, Dawson S, Corkill JE, Binns SH, Hort CA and Gaskell RM (2000). Antibiotic susceptibility of canine Bardetella bronchoseptica isolates. Veterinary Microbiology 71:193-200.

Trishkina ET and Galushko LKH (1983). Sensitivity to antibiotics of pathogenic micro-organisms harboured by sheep. Veterinariya, Moscow, USSR, 9:70-72.

Woldehiwet Z and Jones JJ (1990). Species distribution of coagulase positive staphylococci isolated from dogs. Veterinary Record 126:485.

Wolska K, Jakubezak A, Anusz Z and Bukowski K (1999). Susceptibility of *Pseudomonas aeruginosa* strains to antibiotics and chemotherapy. Medyeyno Waterynaryjna, 55:812-817. (Cited from Veterinary Bulletin 70: Abst. 2373).