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Aetiological Study on Pneumonia in Camel (*Camelus dromedarius*) and *in vitro* Antibacterial Sensitivity Pattern of the Isolates

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Abstract

A total of 514 samples including 196 nasal swabs, 148 tracheal swabs and 170 pneumonic lung tissues were collected: 460 isolates were identified. The isolates constituted 9 genera of bacteria with, 82.40 percent Gram positive organisms and 15 percent Gram negative organisms and mixed organisms as 2.6 percent. *Staph. aureus* and *Coryn. pyogenes* were the predominant isolates with frequency of 24.8 and 20.6 percent respectively. *Staph. aureus*, *Coryn. pyogenes*, *Strept*. pyogenes and *Klebsiella pneumoniae* showed high frequency of isolation from pneumonic lungs as compared with their isolation frequencies from nasal cavity and the trachea. In an *in vitro* antibiotic sensitivity tests, penicillin, ampicillin were the drugs of choice against Gram positive organisms. Gentamicin showed a marked inhibitory effect against both Gram positive and Gram negative bacteria.

Introduction

Complexity of the causative agent of pneumonia in farm animals has been stated (Magwood *et al*., 1969; Alley, 1975). The isolation of a variety of microorganisms from nasal cavity and pneumonic lung of camel was reported in a number of countries. In Egypt, Farrag *et al*. (1953) reported the isolation of eight genera of bacteria from camel pneumonic lungs. Ghawi (1978), El-Magawry *et al*. (1986) and Mahmoud *et al*. (1988) reported a variety of microorganisms from pneumonic lungs of camel. In India Arora and Kalra (1973) reported the isolation of *Klebsiella pneumoniae* and Diplococcus spp from pneumonic lungs. Chauhan *et al*. (1987) also reported the isolation of nine genera of bacteria from 219 nasal swabs taken from apparently healthy camel. In Somalia, Omar (1987) noticed the presence of five genera of bacteria in pneumonic lesions of slaughtered camels. In Iraq Al-Ani (1989) reported the presence of Pasteurella multocida, Pasteurella haemolytica, *E. coli*, Pseudomonas spp and *Corynebacterium pyogenes* in camel pneumonic lungs. In Sudan Shigidi (1973) studied the microflora of respiratory tract of camel, he reported the isolation of 6" genera of bacteria.

The lack of detailed information about pneumonia in camel in the Sudan, besides the indiscriminate use of antibiotic in the remote breeding area of camel, initiated the following investigation on the aetiology of pneumonia in camel and *in vitro* antibacterial sensitivity test for the isolated microorganisms.

Materials and Methods

The investigated camel were 196 animals. The camels were among those brought to the Veterinary Clinic, slaughter-houses and from field surveys. These were as follows:

Western region: 124 nasal swabs, 106 tracheal swabs and 106 lung tissues
Eastern region: 72 nasal swabs, 42 tracheal swabs and 42 lung tissues
Central region: 22 lung tissues

Nasal swabs were collected from camels with clinical signs of pneumonia. Lung tissues and tracheal swabs were collected from camels with clinical signs of pneumonia at antemortem examination and/or on the basis of gross pathological lesions at postmortem.

Nasal swabs, tracheal swabs and lung tissues were initially plated on sheep blood agar an MacConkey's agar (Oxide). Direct Gram stain was made to all samples collected. Cultured plates were incubated aerobically at 37°C for 24-48 hours before observed for the occurrence of visible growth. Isolated bacteria were identified according to the method of Cowman (1985).

Antibiotic sensitivity test was performed by two known conventional methods. The disc diffusion method was used in examination of the majority of isolated bacteria against seven antibiotic compounds. The broth dilution method was used to test representative isolates from pneumonic lungs against four antibiotics.

This study was continued for two consecutive years.

Results

Bacteriological findings: Out of 460 isolates there were 223 (48.5%) Gram positive cocci, 156 (33.9%) Gram positive rods, 69 (15%) Gram negative rods and in 12 samples (2.6%) mixed organisms were obtained. Nine genera of bacteria were isolated from the different parts of the respiratory tract of the affected camels. The frequency of isolation of

these bacteria in term of abundance were as follows: *Staph*. aureus 20.4 percent, *Coryn. pyogenes* 17.2 percent, Strept. *pyogenes* 11.3 percent, Bacillus spp 10.2 percent, non-coagulase positive Staph. 9.6 percent, *Klebsiella pneumoniae* 8.0 percent, *Diplococcus pneumoniae* 7.2 percent, *E. coli* 7 percent, *Diptheriods* 6.5 percent and mixed organisms 2.6 percent. From 170 pneumonic lung tissues, 165 isolates were identified with the following frequency. *Staph*. *aureus* 24.8 percent, *Coryn. pyogenes* 20.6 percent, *Strept*. *pyogenes* 14.6 percent, *Klebsiella pneumoniae* 10.9 percent, *Diplococcus pneumoniae* 6.6 percent, *E. coli* 6.6 percent, non-coagulase positive Staph. 6.5 percent, mixed organisms 6.05 percent and Diphtheroids 2.4 percent. From 196 nasal swabs., 168 isolates were identified with the following frequency: *Staph*. *aureus* 19.2 percent, *Coryne. pyogenes* 15.2 percent, non-coagulase positive. *Staph*. 13.1 percent, *Bacillus* spp. 12 percent, *Strept*. *pyogenes* 10.7 percent, Diphtheroids 8.3 percent, *E. coli* 7 percent, *Klebsiella pneumoniae* 6 percent, *Diplococcus pneumoniae* 6 percent and mixed isolates with 2.4 percent frequency. From 148 tracheal swabs 127 isolates were identified with the following frequency; *Staph*. *aureus* 16.5 percent, *Coryne. pyogenes* 15 percent, *Bacillus* spp. 12.6, non-coagulase positive *Staph*. 12.6 percent, *Diplococcus pneumoniae* 9.4 percent, Diptheriods 9.4 percent, *E. coil* 7.9 percent, *Strept*. *pyogenes* 7.9 percent, *Klebsiella pnetimoniae* 7 percent and mixed isolates of frequency of 1.6 percent (Table 1).

Table 2 shows the percentage of isolation of the same species within the different parts of the respiratory tract. The percentage of isolation of *Staph*. *aureus*, *Coryn*. *pyogenes* and *Strept*. *pyogenes* and *Klebsiella pneumoniae* from pneumonic tissue was the highest as compared with that from the nasal cavity and the trachea. In contrast the isolation of Bacillus spp, non-coagulase positive Staph. and Diphtheriod from pneumonic lung tissues was markedly less as compared to that isolated from the nasal cavity and the trachea. The isolation percentage of *E. coli* and *Diplococcus pneumoniae* was nearly similar from pneumonic lung tissues, nasal cavity and the trachea.

Antibacterial sensitivity: The majority of bacteria isolated from the different parts of the respiratory tracts were examined with the disc diffusion method. The results are shown in Table 3a. Out of 83 isolates of *Staph. aureus* 72 (86.7 percent) were sensitive to ampicillin, 83 (100%) sensitive to gentamicin and Cephaloridine, 60 (72.7%) sensitive to sulphatriad, 44 (53.1%) sensitive to tetracycline and 42 (50.7%) sensitive to streptomicin.

The sensitivity pattern of 64 isolates of *Coryn*. *pyogenes* was 93.7 percent, 71.8 percent and 56.2 percent to ampicillin, gentamicin and tetracycline respectively. Only 21.95 percent of the isolates were sensitive to streptomicin.

The percentage of sensitive isolates of *Strept*. *pyogenes* (24 isolates) was as follows: 83.3 percent to ampicillin, 100 percent to cephaloridine and gentamicin, 50 percent to tetracycline and 41, 7 percent to sulphatriad.

Out of 25 isolates of Klebsiella pneumoniae, 25 (100%) were sensitive to gentamicin, 22 (88%) sensitive to colistin, 8 (32%) sensitive to cephaloridine and 4 (16%) were sensitive to tetracycline.

The eighteen isolates of *Diplococcus pneumoniae* were 100 percent sensitive to ampicillin, cephaloridine, gentamicin and streptomicin, while the sensitivity to tetracycline was 77.7 percent.

Out of 16 isolates of *E. coil*, the percentage of sensitive isolates was 100 percent to gentamicin, 87.5 percent to cephaloridine, 75 percent to sulphatriad and colistin and 50 percent to tetracycline.

Table 3b demonstrates the results of the broth dilution method of 4 antibiotics against representative isolates from pneumonic lungs. The Gram positive organism, *Staph. aureus*, *Coryn*. *pyogenes*, *Strept*. *pyogenes* and *Diplococcus pneumoniae* were sensitive to penicillin at MIC ranging from 2-6 μg-ml. All 6 examined isolates showed moderate sensitivity to gentamicin (MIC = 6-8 μg/ml). The Gram positive organisms and E. coil were sensitive to moderately sensitive to oxytetracycline (MIC = 4-8 μg/ml). Streptomicin was the less effective antibiotics.

Discussion

Among the organisms isolated during this study Staphylococcus aureus and *Corynebacterium pyogehes* were the most predominant bacteria associated with camel pneumonia. Their isolation frequency was 24.8 percent and 20.6 percent respectively. The two organisms were found in pneumonic cases in other studies (Farrag *et al*., 1953; Ghawi, 1978; El-Magawry *et al*., 1986; Moallin and Zessin, 1990). *Streptococcus pyogenes* was also reported to occur in pneumonic camel by various authors, among these are Farrag *et al*. (1953), El-Magawry *et al*. (1986) and Mahmoud *et al*. (1988). The presence of Klebsiella penumoniae in pneumonic lung of camel was stated by Arora and Kalra (1973), Ghawi (1978) and Mahmoud *et al*. (1988). Arora and Kalra (1973) and Omar (1987) also isolated *Diplococcus pneumoniae* from camel pneumonia. The isolation of *E. coli* during the present investigation confirms the previous report of El-Magawry *et al*. (1986), Omar (1987), Mahmoud *et al*. (1988) and Al-Ani (1989). The occurrence of Bacillus spp and Diphtheroids in respiratory tract of camel was also demonstrated by Farrag *et al*. (1953) and Omar (1987).

The bacteria isolated during this study are comparable to those reported from the respiratory tract of apparently healthy camels (Shigidi, 1973; Chauhan *et al*. 1987). This may confirm the fact that the respiratory tract serves as a reservoir for a variety of microorganisms which under suitable predisposing conditions invade the different part of the tract and cause pathological lesions.

Table 1: Total number of isolated bacteria, frequency of isolation of each bacteria from the total isolates and whithin each part (%) of the respiratory tract

Types of bacteria	Nasal 196 samples	Trachea 148 samples	Lungs 170 sample	Total isolates	Frequency (%)
Staph. aureus	32 (19.2%)	21 (16.5%)	41 (24.8%)	94	20.4
Coryn. pyogenes	26 (15.2%)	19 (15.0%)	34 (20.6%)	79	17.2
Strept. pyogenes	16 (10.7%)	10 (07.9%)	24 (14.5%)	52	11.3
Bacillus sp.	20 (02.0%)	16 (12.6%)	11 (06.7%)	47	10.2
Non-coagulase *positive Staph.*	22 (13.1%)	16 (12.6%)	6 (03.6%)	44	9.6
Klebsilla pneumoniae	10 (06.0%)	9 (07.1%)	18 (10.9%)	37	8.0
Diplococcus pneumoniae	10 (06.0%)	12 (09.4%)	11 (06.7%)	33	7.2
E. coli	12 (07.1%)	10 (07.9%)	10 (06.2%)	32	7.0
Diphtheroids	14 (08.3%)	12 (09.4%)	4 (02.4%)	30	6.5
Mixed	4 (02.4%)	2 (01.6%)	6 (03.6%)	12	2.6
Total No. of isolates	168	127	165	460	

Table 2: Percentage of isolation of the same bacteria from different parts of respiratory tract

Types of bacteria	Lungs tissue	Nasal swabs	Trachea swabs
Staph. aureus	43.6	34.1	22.3
Coryn. pyogenes	43.0	22.9	24.1
Strept. pyogenes	46.2	34.6	19.2
Bacillus sp.	23.4	42.6	34.0
Non-coagulase *positive Staph.*	13.6	50.0	36.4
Klebsiella pneumoniae	48.6	27.0	24.4
Diplococcus pneumoniae	33.3	30.3	36.4
E. coil	31.3	37.4	31.3
Diphtheroids	13.3	46.7	40.0
Mixed	50.0	33.3	16.7

Table 3a: The results of the antibioic sensitivity test by the disc diffusion method

Bacterial species		Percentage of strains sensitive to antibacterial agents						
		AM	C	C	G	S	Su	T
Staphlococcus aureau	N = 83	86.7	100.0	0	100	50	72	53
Corynebacterium pyogenes	N = 64	93.8	0.0	0	71	21	0	56
Streptococcus pyogenes	N = 24	83.3	100.0	0	100	0	41	0
Diplococcus pneumoniae	N = 33	100.0	100.0	0	100	0	0	77
Klebsiella pneumoniae	N = 37	0.0	32.0	38	100	0	0	0
E. coil	N = 32	50.0	87.5	75	100	0	75	62

Table 3b: The results of the antibiotic sensitivity test by the broth dilution method

Bacterial species		Minimum inhibitory concentration (MIC) μg/ml			
		Penicillin	Gentamicin	Oxytetracycline 5%	Streptromicin
Staphlococcus aureau	N = 4	4	6	4	36
Corynebacterium pyogenes	N = 2	6	8	8	25
Streptococcus pyogenes	N = 3	2	6	8	50
Diplococcus pneumoniae	N = 2	2	6	4	8
Klebsiella pneumoniae	N = 2	75	6	18	20
E. coil	N = 2	50	6	4	25

The organisms *Staph. aureus*, *Conyn. pyogenes*, *Strept.* pyogenes and *Klebesiella penumoniae* were of the highest isolation frequency from pneumonic lung. These organisms these organisms. Cephaloridine and orytetracyline can also have been so often in association with the prominent pathological changes in camel pneumonic lung.

This complexity of the aetiology of pneumonia in camel is similar to the situation in other farm animals (Magwood *et al*., 1969; Alley, 1975).

The frequency of isolation of Gram positive organisms was 82.4 percent. These organisms showed more or less similar *in vitro* sensitivity to the antibacterial agents used. Penicillin, ampicillin and gentamicin were the drugs of choice against be used. Gentamicin was the most effective antibiotic against both Gram negative organisms isolated during this study (*Klebsiella pneumoniae* and *E. coli*). Colistin sulphate also possessed inhibitory effect against 'these two organisms. Oxytetracycline, sulphatriad and tetracycline were also effective against *E. coli*. In consideration of the most effective *in vitro* antibacterial reagent against all tested isolates, gentamicin should be the (drug of choice in controlling pneumonia in camel.

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