

# POST-TRAUMATIC BUCCAL INFECTION AND OSTEOMYELITIS ASSOCIATED WITH MANDIBULAR FRACTURES IN THE DROMEDARY CAMEL

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## ABSTRACT

Fifty nine camels with mandibular fractures were studied clinically, radiologically and microbiologically. It was demonstrated that males were more affected than females with an average age of 7 years. Unilateral and bilateral fractures with wounds and pus formation were diagnosed clinically and radiographically. Microbiological examination revealed *Proteus mirabilis* to be the most frequent isolate from injured sites followed by *Prot. vulgaris*, *Corynebacterium pseudotuberculosis*, *Arcanobacterium pyogenes*, *Micrococcus* spp. and *Staphylococcus aureus* together with other species. Of the fungi, *Candida krusei*, *Cryptococcus laurentii* and *Aspergillus penicillioides* were isolated.

From the buccal cavity of twenty-one normal camels, *Micrococcus* spp. was the predominant isolate followed by other bacterial and fungal species. Antibiogram studies of some of the isolates, showed varying degrees of susceptibility. The significance and implications of the isolates on post-traumatic osteomyelitis was discussed.

**Key words:** Buccal normal flora, camel, dromedary, mandibular fractures, osteomyelitis, Saudi Arabia

Accidental occurrence of fractures of the lower jaws in camels are frequent in the Eastern Province of Saudi Arabia. The fracture may be simple or compound (Gahlot, 2000; Ramadan, 2001), caused by violence or collision. Mandibular fractures in baby camels may be caused by accidental injury from the mother (Ramadan, 1994). Post-traumatic wounds are exposed to endogenous and exogenous infection that might further contribute tissue destruction. Fracture of the mandible may end up with osteomyelitis (Singh and Nigam, 1982; Ramadan and Abdin-Bey, 1990). The aetiology of post-traumatic osteomyelitis has not been studied fully in camels in Saudi Arabia.

Bacteria and fungi may reach the mandibular wound as commensals in the mouth or skin. Haematogenous spread from foci in the body is a possibility. An authenticated study regarding the

bacterial and fungal flora of the buccal cavity of the dromedary camel was lacking.

This paper deals with the study of bacterial isolates associated with jaw fractures at the time of fracture and several weeks postfracture, their antibiogram pattern and clinical comparison to microbes from the buccal cavity of normal camels.

## Materials and Methods

Fifty nine camels aged between 2 to 10 years with mandibular fractures, presented to surgery clinics at the Veterinary Teaching Hospital, King Faisal University (KFU) from September, 2000 to August, 2002 were investigated breed, sex and age wise. Sterile swabs taken from the buccal wounds of each animal, were streaked in duplicate on to 5% sheep blood agar and MacConkey

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agar (Oxoid). The fungal isolates were purified in Sabouraud's agar and nutrient agar (Oxoid). Biochemical tests for Gram positive bacteria were done as described by Koneman *et al* (1997) whereas the biochemical tests for Gram negative bacteria were done using API 20E and API 20 NE (bio Merieux, France). Fungi were identified on macro- and micro-morphology and conventional biochemical tests.

From another 21 healthy camels, swabs were taken from the buccal cavity and cultured as above.

A total of six isolates from the clinical cases were tested for antibiogram pattern. These were identified as *Proteus mirabilis*, *Staphylococcus aureus*, *Arcanobacterium pyogenes*, *Corynebacterium pseudotuberculosis*, *Pseudo-monas aeruginosa* and *Streptococcus pyogenes*.

Standard discs of 16 different antibacterial agents were used to test the isolates as described by Koneman *et al* (1997). The interpretation of results as susceptible (S), moderately susceptible

(MS) or resistant (R) was given according to the data given in laboratory manuals (Cheesbrough, 1993).

## Results

In present study out of 59 camels, 41 were male and 18 were females.

### Clinical and radiological findings

Over 90% of cases examined, the general health parameters (heart rate, respiratory rate and temperature) were within the normal value. Buccal haemorrhages and signs of pain were observed in 87% of the newly fractured camels (Fig 1). Variable evidence of emaciation was seen in comminuted fractures. In the unilateral fractures, the animals were able to close the mouth. The clinical and radiologic features of bilateral fractures were very characteristic. The fractures were situated in front of the first premolar and the lower jaw hanged downwardly. Wounds were found in the buccal cavity associated with saliva discharging from the

**Table 1.** Antibiogram of bacterial isolates recovered from fractured mandibles of dromedary camels.

Antibiotics	<i>Prot. mirabilis</i> (6)*			<i>Cory pseudo-tuberculosis</i> (6)			<i>Staph. aureus</i> (4)			<i>A. pyogenes</i> (4)			<i>Ps. aeruginosa</i> (3)			<i>St. pyogenes</i> (3)		
	S**	MS	R	S	MS	R	S	MS	R	S	MS	R	S	MS	R	S	MS	R
Amoxycillin	-	1	5	2	4	-	-	1	3	-	-	4	-	-	3	-	-	3
Ampicillin	4	1	1	2	-	4	2	-	2	-	-	4	-	-	3	-	-	3
Carbenicillin	4	2	-	4	-	2	3	1	-	-	2	2	1	2	-	3	-	-
Cloxacillin	-	-	6	2	-	4	3	1	-	-	2	2	1	1	1	-	-	3
Erythromycin	-	-	6	2	4	-	2	-	2	-	-	4	1	-	2	-	-	3
Flumequine	4	2	-	4	2	-	3	1	-	-	-	4	1	-	2	2	1	-
Gentamicin	-	2	4	5	1	-	2	1	1	3	1	-	-	1	2	1	2	-
Kanamycin	1	-	5	4	2	-	2	1	1	3	1	-	-	-	3	3	-	-
Neomycin	-	1	5	2	-	4	3	-	1	2	2	-	-	2	1	1	2	-
Nitrofurantoin	-	-	6	6	-	-	4	-	-	4	-	-	1	-	2	3	-	-
Novobiocin	-	2	4	2	-	4	4	-	-	1	2	1	-	-	3	-	1	2
Oxacillin	-	-	6	5	1	-	-	-	4	-	-	4	1	1	1	-	-	3
Oxytetracycline	-	-	6	2	-	4	-	-	4	-	-	4	-	-	3	-	-	3
Penicillin	-	-	6	1	1	4	2	1	1	-	-	4	-	-	3	-	-	3
Streptomycin	1	4	1	6	-	-	2	-	2	-	1	3	-	-	3	1	2	-
Sulphamethaoxazole trimethoprim	-	-	6	4	-	2	2	-	-	-	4	-	-	3	-	-	3	3

\* No. of tested isolates

\*\* S : Susceptible, MS : Moderately Susceptible, R : Resistant

corners of the mouth. In long standing cases, pus formation was evidenced.

Of 59 camels with fractured mandibles and bacteria and fungi were isolated in 54 animals. *Proteus mirabilis* was the most common pathogen isolated (10 times), followed by *Prot. vulgaris* (6 times), *Corynebacterium pseudo-tuberculosis* (6 times), *Arcanobacterium pyogenes* (5 times), *Micrococcus* spp (5 times), *Staphylococcus aureus* (4 times) and *Pseudomonas aeruginosa*, *Cory. bovis*, *Strepto-coccus pyogenes* and *bacillus* spp (3 times). The pathogens were isolated either alone or mixed with other bacteria.

The fungal isolates were *Candida krusei* (2 times), *Cryptococcus laurentii* and *As. penicillioides* (once). The older cases of mandibular fractures in camels revealed mixed bacterial and fungal infections as compared to freshly-fractured ones.

The organism isolated from the normal buccal cavity of 21 camels, were identified as *Micrococcus* spp., Coagulase negative *Staphylococci*, alpha haemolytic streptococci, *Bacillus* spp, *Corynebacterium* spp, *S.pneumoniae* and the yeasts, *C.kruseii*, *Rhodotorula* spp. and *Saccharomyces* spp. The antibiogram of the isoaltes is given in table 1. *Prot. mirabilis* was fully or moderately susceptible to ampicillin, carbenicillin, flumequine, novobiocin and streptomycin. *Cor. pseudotuberculosis* isolates were highly susceptible to nitrofurantoin and streptomycin. Isolates were highly susceptible to nitrofurantoin and streptomycin. Isolates identified as *Staph. aureus* were fully or moderately susceptible to carbenicillin, cloxacillin, flumequine, nitrofurantoin, novobiocin and sulphamethoxazole trimethoprim. *A. pyogenes* isolates were moderately susceptible to gentamicin, kanamycin, neomycin, nitro-furantoin and *Ps. aeruginosa* isolates, 33.3% were highly and 66.7% moderately susceptible to carbenicillin. *S.pyogenes* isolates were moderately susceptible to carbenicillin, flumequine, gentamicin, kanamycin, neomycin, nitrofurantoin and streptomycin.

## Discussion

Accidental fractures of the mandible of the dromedary camel appears to be frequent in Saudi Arabia (Ramadan, 1992; 2001). The present study, revealed that males were more affected than females, due to fighting during breeding season. The age of the majority of the affected animals

were 7 years and together with good general health condition, indicated that fractures were probably related to sexual maturity and vigorous body activity.

*Prot. mirabilis* was the most predominant microorganism isolated (15.6%) as pure or mixed infection. *Prot. mirabilis* is found in soil, water and faecal contaminated pastures and materials. *Cory. pseudotuberculosis* isolated is known to cause caseous lymphadenitis in sheep and goats and infections in camels have been reported (Carter and Cole, 1990). *Micrococcus* spp. predominantly isolated from normal buccal cavity, seemed to contaminate traumatic buccal wound in camels. Seventy five per cent of *Staph. aureus* isolates were from animals presented early. This pyogenic organism is present normally in the skin of man and animals (Koneman *et al*, 1997) and contamination of wounds after fracture could be possible. Other infective pyogenic bacteria as *Ps. aeruginosa*, *St. pyogenes*, *St. agalactiae*, *Cory. bovis* were recorded in varying numbers. Together with the other isolated species they are frank or opportunistic pathogens assisted by the tissue and bone destruction in the present cases. The fungal infection was recorded from older cases and occurred in mixed infection.

The infection of fractures in camels presented for medical treatment after 1-4 month post injury is possible. In another study, it was reported that post-traumatic osteomyelitis is secondary to exogenous bone infection (Hierholzer, 1973).

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