

**BACTERIOLOGICAL AND PATHOLOGICAL STUDIES ON CONDEMNED LUNGS OF ONE HUMPED CAMELS (*CAMELEUS DROMEDARIUS*) SLAUGHTERED IN TAMBOUL AND NYALA ABATTOIRS, SUDAN**

By

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**ABSTRACT**

This study has been carried out in Central region of the Sudan (Tamboul abattoir) and Western region (Nyala abattoir) to investigate the condemnation causes of camel's lung. Two hundreds and six camel lungs are inspected at post-mortem in both areas (136 camels in Tamboul and 70 camels in Nyala abattoir). The survey has revealed different causes of camel's lung condemnation with slight variations between the two areas of survey.

The main causes of lung condemnation in Tamboul are found to be parasitic (Hydatidosis) 40.4%, pneumonia 19.1%, caseated nodules 8.8%, emphysema 6.6%, necrosis 5.9%, fibrosis 4.4%, abscess 2.9%, aspirated blood 2.2% and adhesions 1.5%. In Nyala the causes of condemnation are found to be, Hydatidosis 61.4%, pneumonia 31.4%, fibrosis 12.9%, abscess 8.5%, caseated nodules 5.7%, fibrosis 12.9% and emphysema 2.9%.

Grossly 35.7% of the total hydatidosis infection (98 lungs) is found to be associated with other pathological lesions. Pneumonic causes are detected as 32% of the total condemnations and the microorganisms involved are, *Staphylococcus spp.* 27.9%, *Corynebacterium spp.* 13.9%, *Streptococcus spp.* 13.9%, *Bacillus spp.* 12.8%, *Pneumococcus spp.* 11.8%, *Enterobacteria spp.* 9.6%, *Micrococcus spp.* 6.4%, *Haemophilus spp.* 2.1%, *Actinomyces spp.* 1.07%, *Pasteurella spp.* 1.07% and *Pseudomonas spp.* 1.07%.

The histopathology of pneumonic bacterial sections showed purulent bronchopneumonia, abscessation, haemorrhages, fibrinous pneumonia, granulomatous and interstitial pneumonias.

The mediastinal lymph node sections which stained with Ziehl Neelson stain revealed acid fast tubercle bacilli in one section.

## INTRODUCTION

Sudan is one of the largest camel populated countries in the world. Its population is about 3.2 millions (FAO, 2002). Sudan and Somalia have 70% of the total African camels and 55% of that of the world camel's population (Wilson, 1984). The camels were, and still are, valued as riding, baggage, draught animals, hair hides and as well as the best food providers in the arid areas (Sweet, 1965).

The remote breeding system of camels in the Sudan and elsewhere, considered to be one of the major constrains that facing diagnosis and investigation of camel's diseases and carry out the valuable information related to these animals. Camel respiratory infection had received a little attention in the Sudan. Some workers studied camel pneumonia in Sudan and other part of the world (Khan, 1970; McGrane and Higgins, 1985; Mustafa, 1992; Pavlik, *et. al.*, 2002; Nasr, 2003). Their studies stated the seasonality in the occurrence of camel pneumonia and established the many etiological agents responsible for the condition such as *Staphylococcus spp*, *Corynebacterium. Spp*, *Streptococcus spp*, *Klebsiella pneumoniae*, *Diplococcus pneumoniae*, *E .coli*, *Bacillus spp*, *Pasteurella spp*, *Haemophilus somnus* *Micrococcus spp*, *Actinomyces spp* and *Mycobacterium spp*. In recent years, camel's research received good attention not only in the Sudan but worldwide. This referred to the progressive importance of these animals uniquely adapted to harsh environmental conditions especially in the arid and semi arid areas, in addition to their propagated role in the national income. Therefore, this study was conducted in Central and Western region of the Sudan where the majority of camels were reared.

## MATERIALS AND METHODS

**Study Area:** Two hundreds and six slaughtered camel's lungs were examined at Western and Central region (seventy camels in Nyala abattoir, and 136 camels in Tamboul abattoir respectively). Hundred pneumonic lesions were subjected to the bacteriological and histopathological examination.

**Sampling and Examination:** For bacteriological investigations and histopathological techniques the methods described by (Cown and Steel 1993) and Bancroft (1996), were followed.

**RESULTS**

Post-mortem inspection revealed various causes of lungs condemnation in Tamboul and Nyala abattoirs. The morbidity of lung infection reached 72.8% of the total plugs. Ninety camels (66.1%) out of 136 showed lung lesions in Tamboul abattoir where 60 camels (85.7%) out of 70 in Nyala abattoir. Seventy samples from Tamboul and 30 samples from Nyala showed pneumonia. Fifty one percent of the total lesions showed bacterial growth; 41% from Tamboul and 10% from Nyala. Thirty eight percent showed negative bacteriological growth; 26% from Tamboul and 12% from Nyala. Eleven percent of the total samples were missed due to electrical shock. The total bacterial isolates were 93 (93%) from pneumonic lesions from both surveyed areas, 86.1% of these isolates were Gram-positive bacteria while 13.9% were Gram-negative bacteria. The Gram-positive bacteria isolated were, *Staphylococcus spp.* (27.9%), *Corynebacterium spp.* (13.9%), *Streptococcus spp.* (13.9%), *Bacillus spp.* (11.8%), *Pneumococcus spp.* (10.8%), *Micrococcus spp.* (6.4%) and *Actinomyces spp.* (1.07%). The Gram-negative bacteria were *Enterobacteria spp.* (9.7%), *Haemophilus spp.* (2.1%), *Pasteurella spp.* (1.07%) and (1.07%) were *Pseudomonas spp.* These organisms were isolated from different pneumonic lesions and different lobes distribution (Tables 1, 2). The isolated bacteria were identified using the routine biochemical analysis (Tables 3, 4, 5, 6).

**Gram Negative Bacteria:** The Gram negative isolates represented 13.9% of the isolated bacteria and they were found accompanying different stages of pneumonia. The organisms were identified as *Kelbsiella spp.* (2 isolates) 15.4%, *Haemophilus spp.* (2 isolates) 15.4%, *Pasteurella spp.* (one isolate) 7.7%, *Proteous spp.* (one isolate) 7.7%, *Pseudomonas spp.* (one isolate) 7.7%, non identified *Enterobacteria spp.* (3 isolates) 23.1% and non- identified Gram negative bacteria (3 isolates) 23.1%.

**Table (1): The distribution percent of the gross lesions among the different lobes**

Lesion (s)	Lobes		
	Cranial	Caudal	Accessory
Grey hepatization	77.7%	11.1%	11.1%
Congestion and haemorrhage	35.3%	35.3%	29.4
Pyogenic infections	50%	50%	-

**Table (2): The percentages of isolated bacteria and their correlation to different lesions:**

Organisms	Congestion and Red Hepatization	Grey Hepatization	Abscess	Caseated Nodules	Adhesions
<i>Staphylococcus</i> spp	8 (30.7%)	3 (11.5%)	8 (30.7%)	7 (26.9%)	-
<i>Streptococcus</i> spp	2 (15.4%)	2 (15.4%)	5 (38.5%)	3 (23%)	1 (7.6%)
<i>Micrococcus</i> spp	3 (43%)	-	1 (14%)	3 (43%)	-
<i>Pneumococcus</i> spp	8 (66.6%)	1 (8.3%)	1 (8.3%)	2 (16.6%)	-
<i>Corynebacterium</i> spp	7 (53.6%)	-	3 (23%)	2 (15.3%)	1 (7.7%)
<i>Actinomyces</i> spp	-	-	1 (100%)	-	-
<i>Haemophilus</i> spp	2 (100%)	-	-	-	-
<i>Pasteurella</i> spp	1 (100%)	-	-	-	-
<i>Enterobacteria</i> spp	6 (66.6%)	2 (22.2%)	1 (11.1%)	-	-
<i>Pseudomonas</i> spp	1(100%)	-	-	-	-

**Table (3): The Biochemical properties of Gram positive cocci isolated.**

The tests	<i>Staphylococcus</i>	<i>Micrococcus</i>	<i>Streptococcus</i>	<i>Pneumococcus</i>
Growth in air	+ ve	+ ve	+ve	+ ve
Anaerobic growth	+ ve	- ve	- ve	+ ve
Motility	- ve	- ve	- ve	- ve
Oxidase	- ve	+ ve	+ ve	+ ve
Catalase	+ ve	+ ve	+ ve	+ ve
Acid from glucose	+ ve	- ve	+ ve	- ve
O/F	F	O	F	O

V: variable +ve: Positive -ve: Negative O: Oxidative F: Fermentative

**Table (4): The Biochemical properties of Gram positive rods.**

Tests	<i>Corynebacterium</i>	<i>Actinomyces</i>	<i>Bacillus</i>
Growth in air	+ ve	-ve	+ ve
Anaerobic growth	+ ve	+ ve	V
Motility	- ve	- ve	V
Oxidase	- ve	- ve	+ ve
Catalase	+ ve	- ve	+ ve
Acid from glucose	- ve	+ve	V
O/F	F	F	F/O/-

V: variable +ve: Positive -ve: Negative O: Oxidative F: Fermentative

*Haemophilus* spp: *Haemophilus* spp morphologically is a Gram negative small rods or coccobacilli non motile and non spore forming organisms. In the blood agar incubated aerobically at 37°C the organism produced small discrete transparent colonies.

**Table (5): The Biochemical characterization of some Corynebacterium species.**

Test	<i>C. pseudotuberculosis</i>	<i>C. diphtheria</i>	<i>C. ulcerans</i>
Catalase	+ ve	+ ve	+ ve
Oxidase	- ve	- ve	- ve
O/F	F	F	F
Acid from: Glucose	+ ve	+ ve	+ ve
Lactose	+ ve	- ve	- ve
Maltose	+ ve	+ ve	+ ve
Manitol	- ve	- ve	- ve
Gelatin	- ve	- ve	+ ve
Urease	+ ve	- ve	+ ve
VP	- ve	- ve	- ve
Esculin	- ve	- ve	- ve
Salicin	- ve	- ve	- ve
Sucrose	+ ve	- ve	- ve
Starch	+ ve	+ ve	+ ve
Xylose	- ve	- ve	- ve

+ve: Positive -ve: Negative F: Fermentative

*Pasteurella* spp: The growth morphology of this organism in the blood agar, incubated aerobically at 37°C was round, non motile, mucoid colonies blackened the blood agar in the old cultures. The biochemical tests of *P. multocida*, *Haemophilus* spp and *Klebsiella* spp are shown in (Table 6).

**Table (6): The Biochemical properties of different Gram negative organisms.**

Tests	<i>Klebsiella</i>	<i>Haemophilus</i>	<i>Pasteurella</i>
Growth in air	+ ve	+ ve	+ ve
anaerobic growth	+ ve	+ ve	+ ve
Motility	- ve	- ve	- ve
Oxidase	- ve	+ ve	+ ve
Catalase	+ ve	- ve	+ ve
Glucose ferment	+ ve	+ ve	+ ve
O/F	F	F	F

+ve: Positive -ve: Negative F: Fermentative

**Histopathology:** Bacterial pneumonia was found to be responsible for 32% of lung condemnation causes and classified into suppurative, fibrinous and hemorrhagic pneumonia (Figs 1, 2, 3). Non-bacterial pneumonic sections showed congestions, hemorrhages, peribronchial fibrosis, thickening of alveolar wall and interstitial pneumonia. The inflammatory cells involved in these lesions were mainly mononuclear cells. An acid fast bacillus was demonstrated in mediastinal lymph node section stained with ZN stain, (Fig. 4).

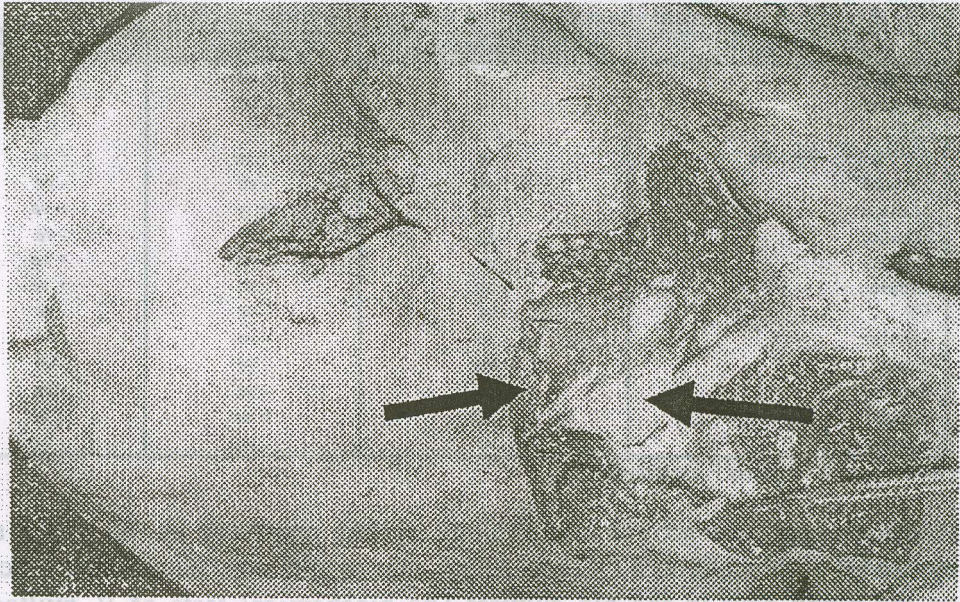


Fig. (1): Suppurative pneumonia (abscess)

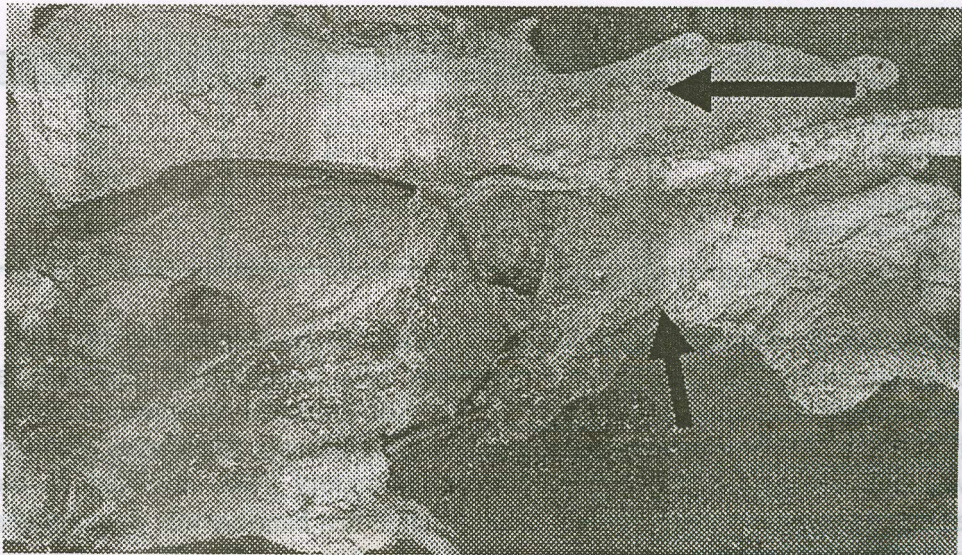
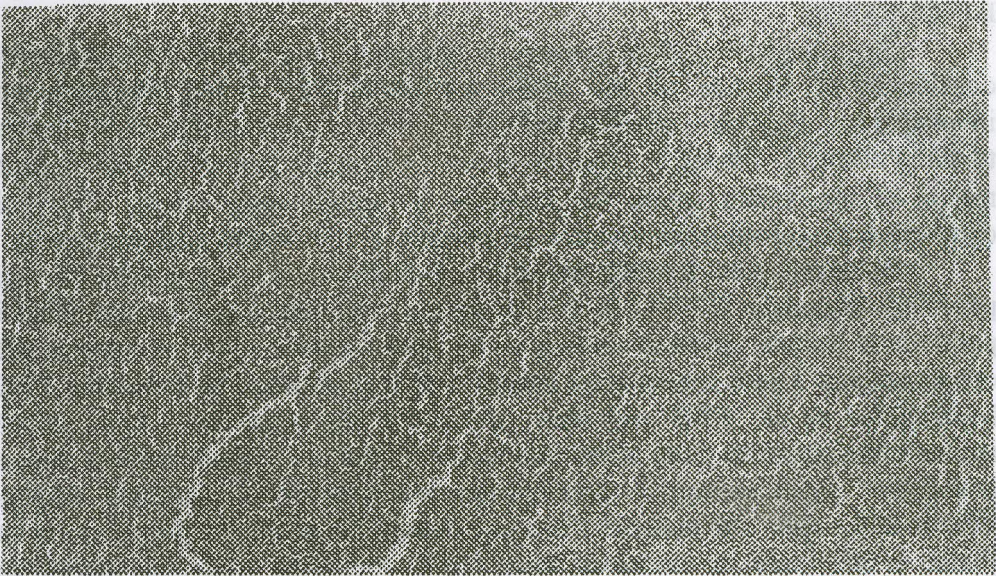
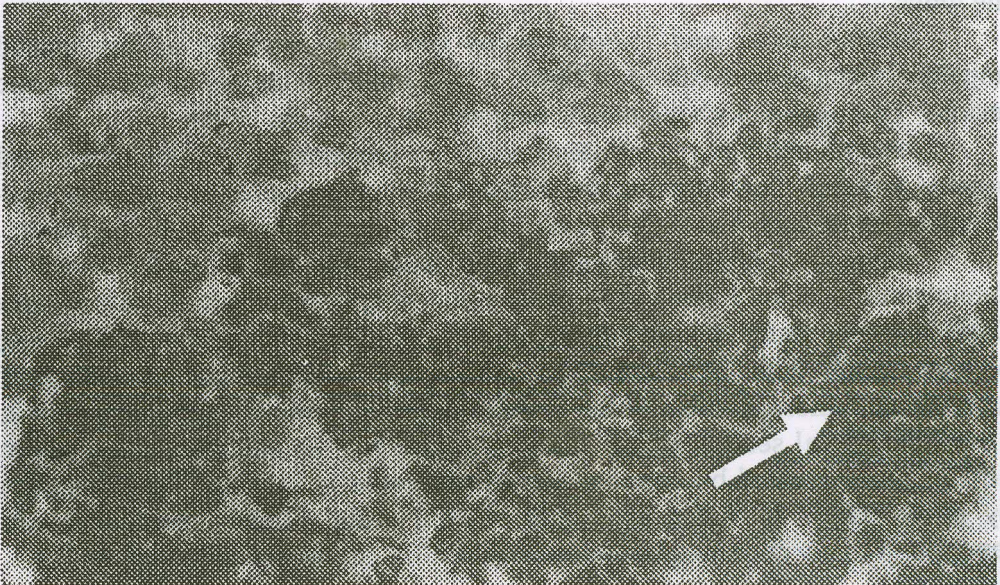


Fig (2): Fibrinous pneumonia in camel lung



**Fig. (3) Heamorrhagic pneumonia in lung**



**Fig. (4): Acid fast bacilli demonstrated in calcified mediastinal lymph node (arrow).**

**DISCUSSION**

The remote breeding system of camels in the Sudan and elsewhere, considered to be one of the major constrains that facing diagnosis and investigation of camel's diseases and carry out the valuable information related to these animals. Therefore, this study was conducted in Central and Western region of the Sudan where the majority of camels were reared. The main condemnation causes were found to be Hydatid cyst infection and pneumonia.

Bacteriological findings revealed that *Staphylococcus* spp were the most prevalent organism (27.9%) in this study the organism found incriminated in pneumonic lesions varied in severity and it often isolated in mixed cultures with other bacteria. These results were agreed with that obtained by (Mustafa, 1992; Mohammed *et al.*, 1993 and Nasr, 2003). On the other hand Nasr, (2003) isolated the organism from upper and lower respiratory tract of camels showed pneumonic signs at anti & post-mortem examination in Tamboul abattoir. *Micrococcus* spp. was isolated from pneumonic lungs for the first time in the Sudan in this study, nevertheless, Nasr, (2003) found the organisms incriminated in upper respiratory tract infection in camels but he failed to isolate it from the lungs.

*Streptococcus* and *Pneumococcus* spp. were reported as the second important pathogens involved in camel's lung infection mainly in the pyogenic lesions. This agreed with the results obtained by (Mustafa, 1992).

*Corynebacterium* spp isolates were found representing (13.9%) of the total bacteria isolated. The organism was isolated from pyogenic lesions, grey hepatization and adhesions. The matter, which indicated the virulence of the organism.

Attempts for *Mycobacterium* spp isolation was not succeeded However demonstration of acid fast rod in mediastinal lymph node section stained with Ziehl Neelson stain and accompanying of granulomatous lesion of the lung section stained with H&E from the same animal confirmed the occurrence of tuberculosis among camels in the Sudan. Demonstration of *Mycobacterium* in histopathological section in this study may give a great attention to the public health hazard created by consumption of raw camel's liver and lung practiced by many people in Sudan especially in rural areas. Camel tuberculosis was reported in many countries by (Khan *et al.*, 1970); (El Mossalami *et al.*, 1971).

Fig. (4): Acid fast bacilli demonstrated in calcified mediastinal lymph node (arrow)



Two Gram-negative isolates were diagnosed as *Haemophilus* spp, which associated with fibrinous pneumonia. The organism isolated from the upper respiratory tract infection of camels by (Nasr, 2003) but he was not succeeding to isolate the organism from lung parenchyma. His results confirmed the presence of the organism as upper respiratory tract flora and it may invade the lungs when the immunity of animal decline. *Pasteurella* spp were found as (1.07%) of the total bacteria isolated and (7.7%) of the Gram negative organisms. The organism was isolated from congested lesion showed sever hemorrhage and inflammation of the lung. Isolation of organism was reported by Mustafa, (1992); (Pavlik, *et al.*, 2002) reported tuberculosis in Bactrian camels (*Camelus ferus*) Europe. (McGrane and Higgins, 1985) described the lesions of TB in camels and they reported that the lungs were the most affected organs while, bronchial and mediastinal lymph nodes, pleura and liver also affected.

## CONCLUSION

- 1- Many causes are accounted for camel's lung condemnation in the two surveyed areas.
- 2- The parasitic causes mainly Hydatidiosis are more prevalent.
- 3- Bacterial causes of pneumonia paly a significant role in camel's lung condemnation.

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