SVU-IJVS-7(4)-11-16 Print ISSN: 2535-1826 Online ISSN: 2535-1877

Short Communications Open Access

Coli Septicemia in Adult Racing Dromedary Camels

Mahmoud S. El-Neweshy [1, 2]*, Julanda H. Al Mawly[2], Hossam G Tohamy[3], Haytham Ali [4, 5], Abdulrahman A. Alkheraif[6] and Mohie A. M. Haridy [6, 7]*,

[1]*Department of Pathology, Faculty of Veterinary Medicine, Kafrelsheikh University, 33516 Kafrelsheikh, Egypt*
[2]*Central Laboratory for Animal Health, Ministry of Agriculture and Fisheries, Muscat Sultanate of Oman*
[3]*Department of Pathology, Faculty of Veterinary Medicine, Alexandria University, Alexandria, Egypt*
[4]*Department of Pathology, Faculty of Veterinary Medicine, Zagazig University, Zagazig, 44511, Egypt*
[5]*Department of Animal and Veterinary Sciences, College of Agricultural and Marine Sciences, Sultan Qaboos University, Muscat, Sultanate of Oman.*
[6]*Department of Pathology and Laboratory Diagnosis, College of Veterinary Medicine, Qassim University, P.O. Box 6622, Buraidah, 51452, Saudi Arabia*
[7]*Department of Pathology and Clinical Pathology, Faculty of Veterinary Medicine, South Valley University, Qena, 83523, Egypt*

***Correspondence to:** mohieharidy@svu.edu.eg, mahmoud.neweshy@vet.kfs.edu.eg, m.haridy@qu.edu.sa

Submit Date: 2024-07-12 , Revise Date: 2024-09-30 , Accept Date:2024-10-03
https://doi.org/10.21608/svu.2024.303548.1330

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ABSTRACT

In the Gulf area, the racing camel is a very valuable animal. *Escherichia coli* (*E. coli*) septicemia has been reported in young camelids (*Camelus dromedarius*) 2 to 4 weeks old causing 30% morbidity and 100% case fatality. Infection occurred after exhaustion, poor nutrition, inadequate colostrum intake, and an unhygienic (sewage-contaminated) environment. This study investigated the cause of a septicemic condition with high mortality (58.3%) among racing dromedary camels (2.5- 5 years old) in Oman. Hematology revealed leukocytosis with neutrophilia, marked lymphopenia, and deranged hepatic, renal, and muscle biochemical profiles. Clinical signs were high fever with lymphadenopathy. The pathological examination revealed inflammation of the lung, trachea, abomasum, kidney, heart, and liver with considerable parenchymal necrosis and hemorrhages. Multidrug-resistant *E. coli* was isolated from the tissues of all dead cases. This is the first report about *E. coli* septicemia in adult dromedary camels. The multidrug resistance nature of the bacterial isolates is a significant clinical and health challenge.

Keywords: *E. coli*; Septicemia; Camel; Histopathology; β-lactamase

INTRODUCTION

Escherichia coli (*E. coli*) septicemia has been reported in young camelids **(***Camelus dromedarius***)** 2 to 4 weeks old (Wernery and Kaaden, 2002, Khalafalla and Hussein, 2021, Wernery and Kaaden, 1995). The reported morbidity and mortality rates in dromedary calves were 30% and 100%; respectively (Schwartz and Dioli, 1992). The unsanitary or crowded conditions in the breeding herd along with inadequate intake of colostrum can

increase of the risk of coli septicemia (Wernery and Kaaden, 2002, Ghorbani et al., 2016). The affected camel calves suffer from weight loss, profuse diarrhea, and abdominal distension. The recorded lesions were lymphadenopathy, necrotic gastroenteritis, abscess formation, and meningitis (Haenichen and Wiesner, 1995, Bornstein et al., 2000). There is no report on coli septicemia in adult camels.

MATERIAL AND METHODS

In August 2019, high mortality among racing dromedary camels was reported in Al Batinah North Governorate (Northern Oman). Out of 92, twelve diseased camels (2.5-5 years old) exhibited fever (41°C), congested mucous membranes, enlargement of superficial lymph nodes, abdominal colic, and foamy nasal discharges. Seven of the reported cases have died within two days. Animals were injected with broad-spectrum antibiotics (Terramycin/LA®, Zoetis) and a Non-steroidal anti-inflammatory drug (Finadyne® MSD), but the mortalities persisted. Camels had a history of the annual treatment with anti-trypanosomal drugs and vaccination against hemorrhagic septicemia and enterotoxaemia. The feed of the camels was a mix of green grass, oats, dates, and barley. Lab works were done in the Central Laboratory for Animal Health (Ministry of Agriculture, Fisheries and Water Resources, Oman) to investigate the cause of death. Ethical research guidance of the study was approved by the Central Laboratory for Animal Health (Approval No. CLAH-023/2019)

Ten blood samples were collected from diseased and critically ill cases before death. Hematology was performed using an automated cell counter (Vet Auto Hematology Analyzer®, model BC 2800, Mindray). The following indices were measured (RBC count, hemoglobin, hematocrit, and total and deferential leucocytic count). Serum chemistry was measured using an automated chemistry analyzer (Mindray BS-200E Chemistry Analyzer with Mindray reagents). Following the manufacturer's instructions, the following parameters were evaluated: total protein, albumin, aspartate aminotransferase (AST), creatine kinase (CK), and blood urea nitrogen (BUN).

Dead dromedaries were subjected to necropsy within 6-8 hours after death and gross lesions were recorded. Specimens were taken from the lungs, kidney, forestomach, intestine, spleen, prescapular and mesenteric lymph nodes, and heart and fixed in 10% buffered formalin for subsequent histopathology. Forty-eight hours later, the fixed tissue specimens were processed using the paraffin-embedded technique (Culling (2013). Briefly, 5-µm thick sections were obtained from paraffin blocks, and stained with hematoxylin and eosin (H&E). Parts of the lungs, liver, and spleen were collected under sterile conditions and

transported immediately in a dry ice container for bacteriological examination. In the same day, the tissue specimens were inoculated aerobically on blood agar (Oxoid CM 271, with 5% defibrinated sheep blood). The direct cultures on blood agar were examined after overnight incubation at 37°C and re-incubated for an additional 24 hours. The isolates were identified by the VITEK® 2 system (bioMérieux, USA). The antibiogram analysis was performed using the VITEK® 2 AST 239 card and VITEK® 2 GN ID (bioMérieux cards) which was complemented with the diffusion disk method. The interpretation of the antibiogram was performed according to the criteria of CLSI (Clinical and Laboratory Standards Institute) for *Enterobacteriaceae* (Hsueh et al., 2010). Thin blood smears were prepared, stained with Giemsa-stain, and examined microscopically with light microscopy for blood parasites investigation according to Hoare (1972).

RESULTS

The morbidity and mortality rates of the current disease were 13% (12 out of 92) and 58.3% (7 out of 12), respectively. Most cases (70.8%) showed leukocytosis 30.9 + 3.6 x 10^3 /µl (normal range 16.7± 2.8 x 10^3/µl) with neutrophilia 9.8 ± 1.0 x 10^3 /µl (70%) (normal range 5.93 ± 1.1 x 10^3 /µl (43.7%) and marked lymphopenia 3.18 ± 0.9 x 10^3/µl (22.9%) (normal range 5.9 ± 2.4 ×103 (42%). Hypoproteinemia, total protein 4.4 g/dl (reference range 7.9 ± 0.4 g/dl), and increased CK 313.5± 97 iu/l (reference range 127.8 ±87 iu/l) , AST 522.7.(reference range 88.8±70.03 IU/l, and BUN 173.6 mg/dl (normal value 17 ± 10.0 mg/dl) were reported in 83.3% of the examined cases.

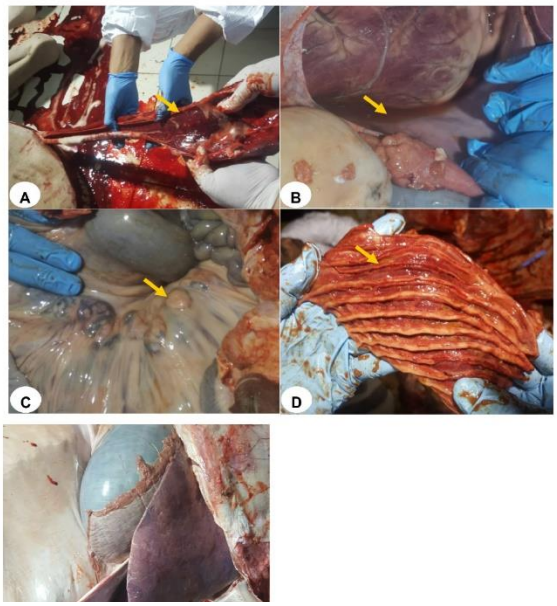

Fig. (1): The gross lesions of coli septicemia in an adult dromedary camel (4 year-old) revealed severely congested trachea with edema (A), hydropericardium (B), necrotic mesenteric lymph node (C), inflamed abomasum (D), and pulmonary edema (E). The arrows point to the lesions.

Upon necropsy (Fig. 1), all superficial lymph nodes were swollen. The trachea was severely congested and filled with edema. Lungs were wet and heavy. There was mild to moderate hydrothorax, hydropericardium, and hydroperitoneum. The mesenteric lymph nodes were swollen and greyish-white. The liver, kidneys, and spleen were congested and swollen. Reddish hyperemic discoloration of the left-sided endocardium was observed. The abomasal mucosa were reddish and swollen.

Histopathologically (Fig. 2), the main findings were lymphadenitis with necrosis of the lymphoid follicles, acute tubular necrosis, tracheitis, and pulmonary edema. In addition, there were abomasitis and multifocal hepatic necrosis. Furthermore, there were striking hemorrhages in the renal parenchyma and subendocardium of the left chambers. The main features observed were discrete polymorph nuclear neutrophil infiltration in all examined tissues.

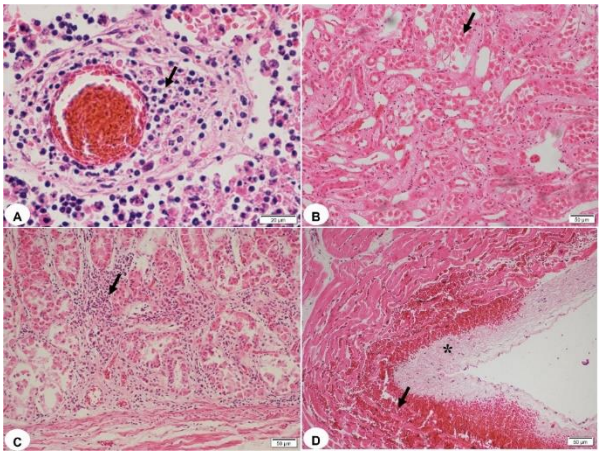

Fig. (2): The histopathology of E. coli septicemia in adult dromedary camel showing diffuse destruction of the lymphoid follicles in the lymph node (A), acute renal tubular necrosis (B), abomasitis with leucocytic infiltration in the mucosal and submucosa

The *E. coli* was isolated in pure cultures from all lungs, liver, and spleen samples. The isolates exhibited a high rate of resistance in vitro to ampicillin, trimethoprim-sulfamethoxazole (85.7%) and flumequine (71.4%), and streptomycin (57.1%). All isolates were resistant in vitro to tetracycline, cefoperazone, cefquinome, cephalexin, and cefalotin (100%). The isolates were highly susceptible in vitro to imipenem, marbofloxacin, ciprofloxacin, enrofloxacin, gentamicin, neomycin, ticarcillin/clavulanic acid, and florfenicol. The parasitological examination revealed no affections among the current cases.

DISCUSSION

Clinical signs and pathological findings of current cases resemble the commonly observed conditions in neonatal bovine and camelidae colisepticemia during their first week of life (Bornstein et al., 2000, Lotfollahzadeh, 2015, Wernery and Kaaden, 2002, Khalafalla and Hussein, 2021). *E coli* is the most common pathogen responsible for bloodstream infection (Ma et al., 2017). Recently, some camel-keeping people perform blood transfusion procedures in between racing camels to increase their activity in the race. This procedure is done without veterinary supervision, which is considered a prerequisite to bloodstream infections.

The clinicopathological findings of hypoproteinemia, increased AST, BUN and CK are due to bacterial toxins and inflammation and cell damage of parenchymatous organs (Jesse et al., 2016, Ballou et al., 2011).

Herein, the bacteriological and antibiogram findings revealed the isolation of extended-spectrum β-lactamase (ESBL)-producing *E. coli* from the liver, lung, and spleen. The bacterial isolates were resistant to

multiple classes of antimicrobial drugs. After the culture and sensitivity test, the diseased camels were successfully treated with an I/M injection of marbofloxacin (Marbocyl 10%®, Vetoquinol, France), at 1 ml/50 kg body weight for three successive days. Recent studies focused on camels as potential reservoirs of ESBL-producing bacteria, which are considered a potential hazard to human health (Fadlelmula et al., 2016, Carvalho et al., 2020, Nüesch-Inderbinen et al., 2020, El-Ghareeb et al., 2020). A high presence rate of ESBL-producing *E. coli* (ESBL-EC) in camels in KSA as well as multidrug resistant strains and E. coli ST131 clone in human and camel isolates indicated camels are potential reservoirs for resistant *E. coli* strains that contributing to the increase in antimicrobial resistance in KSA (Fadlelmula et al., 2016). This is the first report on the septicemic *E. coli* infection among adult camels.

COMPLIANCE WITH ETHICAL STANDARDS

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

DATA AVAILABILITY

The current study has no associated data

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