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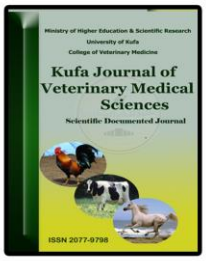

Ultrastructure Morphology of Camel Blood Cells

Karim A. Al-Jashamy Alaa A. Sawad

[1]Pathology Unite, Faculty of Medicine, SEGi University, Malaysia
[2]Department of Anatomy, College of Veterinary Medicine, University of Basra, Iraq
*Correspondence email: jashamy@yahoo.com.

Abstract

The main purpose of this study was to provide a basic cytology of camel blood by electron microscopy.Camel blood was collected, prepared, identified from two adult of one-humped female camels were clinically healthy. The fine structure of the red cells in camels was investigated and certain characteristic features were noted.The Scanning electron micrograph of camel erythrocytes showing elliptical shape and tropical waist (Tw) non-nucleated with 7.0±0.5 µm in diameter. The transmission of electron microscopy of camel erythrocytes showed elliptical shape and tropical waist (Tw), also a trilaminar of membranes (Me) of marginal band that a zone of high electron density. The area of (Me) showed structures are dense and the (Me) was contacted with individual microtubules (Mt). There are few intracellular organelles were observed with the occasional exception of number of mitochondria (Mi). The camel erythrocyte is trilaminar, the inner and outer membranes are of high electron density between which is a zone of lesser electron density. There are few intracellular organelles were observed with the occasional exception of number of mitochondria. The erythrocyte marginal band consisting of microtubules was observed.The fine structure of the camel monocytes showed revealed the presence of a few short cisternae of rough endoplasmic reticulum and various forms of vesicles associated with the Golgi complex were seen near the mitochondria, which are located adjacent to the main indentation in the nuclei. Membrane bound granules of different sizes and spherical or oval in shape, were observed, vacuoles of various forms, a well-defined Golgi complex, few rough endoplasmic reticulum and mitochondria were noticed randomly distributed in the cytoplasm.

Keywords: Electronic microscope, Morphology of Blood cells, Camel

Introduction

Camels (*Camelusdromedarius*) possess certain physiological, biochemical and pharmacological characteristics that distinguish them from other related ruminants. For instance, they have the exceptional ability to withstand considerable periods of dehydration (Johnson et al., 2011). It is known that camel erythrocytes are highly resistant

to osmotic haemolysis, being able to expand to 240% of their original volume without rupturing in hypotonic solutions (Perk, 1963)

Erythrocytes were non-nucleated, biconcave disks with few cytoplasmic organelles. Neutrophilshad numerous small specific granules(Mehrzad et al., 2014). Eosinophils contained specific granules with a dense matrix and a pale crystalloid body. Basophils revealed large round specific granules. Lymphocytes possessed scant cytoplasm with some mitochondria and azurophilic granules. Monocytes contained a large number of mitochondria, azurophilic granules and endoplasmic reticulum. Platelets were represented by anucleation and they had several different organelles in the cytoplasm. The structure of erythrocytes, neutrophils, basophils, lymphocytes, monocytes and platelets of macaques were similar to those of other mammals whereas eosinophils differed among several species. The ultrastructural morphology of blood cells have been documented in camels (Johnson et al., 1999). The main purpose of this study was to provide a basic cytology of camel blood by electron microscopy.

Materials and Method

Animals: Camel blood was collected, prepared, identified from two adult camels clinically healthy one-humped female camels (*Camelusdromedarius* age 4–6 years) used for this study. Five ml of blood samples were obtained via femoral venipuncture, during a brief period of anesthesia induced by ketamine hydrochoride (Calypsol®, Gedeon Richter Ltd).

Ultrastructural Specimen

Preparation: Blood samples were anticoagulated with EDTA and centrifuged at 2,000 rpm for 10 minutes and the plasma was removed. Blood specimens for SEM and EM immediately observation were first pre-fixed in 2.5 % glutaraldehyde buffer in 0.1 M phosphate buffer (PB) (pH=7.2) for 24 hours. After 15-30 minutes, the hardened buffy coat layer was collected with a wooden dowel, placed into fresh glutaraldehyde, cut into small pieces, prior to being washed three times with 0.1M PB, post-fixed with 1% osmium tetroxide in 0.1M PB, dehydrated in graduated concentrations of alcohol, and embedded in Spurrís resin. Ultrathin sections were cut using a diamond knife on an ultramicrotome, placed on a mesh grid, stained with uranyl acetate and lead citrate, before examined under TEM (JEM-2100, 120 KV, JEOL, Japan).

Scanning Electron Microscopy

After dehydration using increasing graded ethanol series, the blood cells were dried at room temperature and coated with platinum and gold with sputter coating (SC7620), the mounted specimens were then observed by scanning electron microscope (LEO 1450VP) at accelerating voltages of 20.0 kV. Each stage of centrifugation was (400×g, 5 min, 4°C).

Results

The fine structure of the red cells in camels was investigated and certain characteristic features were noted.Camel erythrocytes were non-nucleated, ellipticalshape with about 7.0±0.5µmin diameter (Fig. 1). The Scanning electron micrograph of camel erythrocytes showing elliptical shape and tropical waist (Tw) (Fig. 2a &b). The transmission of electron microscopy of camel erythrocytesshowed elliptical shape and tropical waist (Tw)and non-nucleated(Figs 3 a & b), also a trilaminar of membranes (Me) of marginal band that a zone of high electron density (Figure 3c). The area

of (Me) showed structures are dense and the (Me) was contacted with individual microtubules (Mt) (Fig 3c).There are few intracellular organelles were observed with the occasional exception of number of mitochondria (Mi). The fine structure of the camel monocytes showed revealed the presence of a few short cisternae of rough endoplasmic reticulum and various forms of vesicles associated with the Golgi complex were seen near the mitochondria, which are located adjacent to the main indentation in the nuclei. Membrane bound granules of different sizes and spherical or oval in shape, were observed, vacuoles of various forms, a well-defined Golgi complex, few rough endoplasmic reticulum and mitochondria were noticed randomly distributed in the cytoplasm (Fig. 3b).

Ultrastructurally, neutrophil had diameter of 11.0±1.5µm and their nuclei were divided into 2-5 lobes connected by a fine nuclear strand or filament, neutrophils contained numerous small round or oval specific granules and some mitochondria. Eosinophils had diameter of 11.0±1.3 µm and their nuclei were divided into 2-4 lobes. The specific granules of the eosinophil had a brighter purple-red color than those of the neutrophil, and might be superimposed on the nucleus. Electron micrographs of a basophil revealed large round homogenous matrix and electron-dense, membrane-bounded specific granules. Specific granules were 1.25±0.5 µm in diameter. Lymphocytes had 11.0±1.5 µmin diameterand their cytoplasm were transparent. The nucleus was round and large incomparison to the cell and it occupied most of it, the cytoplasm contained scant of some mitochondria and few azurophilic granules.

Discussion

In the camel, the nucleus is voided before the developing Marginal Bands (MBs) disintegrate, and indeed they may not disintegrate. The pointed ends seem to be pressure related, as the prolation increases by constriction of the cell affected by the elastic bands. The resulting erythrocyte is either a biscuitshaped ovoid or has a thin oval coin-like shape. It found that camels retain primitive or early developing Marginal Bands (MBs) of tubulin, arising from centrioles, and that these seem to constrain the erythrocyte's ellipsoid form (Charles, 2007). It is known that camel erythrocytes are highly resistant to osmotic haemolysis, being able to expand to 240% oftheir original volume without rupturing in hypotonic solutions (Perk, 1966). Camel erythrocytes are more resistant (or less susceptible) to osmotic haemolysis than cattle, sheep, goat, mouse, pig and human erythrocytes (Livine and Kuiper, 1973). This may be due partly to the shape of camel erythrocytes, which is oval rather than the circular discs seen with other mammalian erythrocytes (Jain and Keeton, 1974) and partly to the composition of the erythrocyte membrane(Livine and Kuiper, 1973).

Many workers have attempted to study the ability of camel erythrocytes to withstand the osmotic challenges associated with severe dehydration and rapid rehydration (Yagil et al., 1974) and the contribution of the erythrocyte and composition of its membrane to physiological adaptation to dehydration (Al-Qarawi and Mousa, 2004).The camel erythrocytes are more resistant to haemolysis (or less osmotically fragile. Erythrocytes of camels have also been shown to be more resistant to haemolysis (Johnson et al., 2011).

The fine structure of the camel monocytes showed the revealed presence of a few short cisternae of rough endoplasmic reticulum and various forms of vesicles associated with the Golgi complex which were seen near the mitochondria. The distribution of the cytoplasmic organelles seemed to be located adjacent to the main indentation in the nuclei. Camel monocytes were found to possess microvilli of varying length and number. The functional morphology of the above mentioned structures was discussed (Abdo et al., 1989).

There is little information on camel neutrophil's ultrastructure, however this study confirm and agree with pervious study that the evaluation of camel neutrophil's structure and ultrastructure is essential for innate immunobiology. The nuclei of healthy camel neutrophils were highly lobulated, predominantly ≥5 lobules, the surface of neutrophils contained many pseudopods, and the cytoplasm contained enormous high density granules with different sizes and forms, abundant mitochondria, rough endoplasmic reticulum, microtubules, phagolysosome, vacuoles, and Golgi apparatus (Mehrzad et al., 2014). In conclusion, ultrastructural study emphasizes the notion that camel blood cells are highly equipped with the cytoskeletal machinery for efficient organelle movement, phagocytosis, and microbicidal activities. The ultrastructural Erythrocytes features of camel have the exceptional ability to withstand considerable periods of dehydration and being able to expand more the original volume without rupturing in hypotonic conditions.

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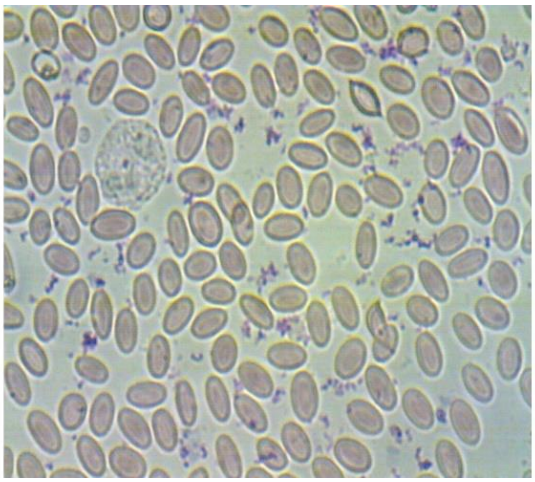

Fig. 1: Showing the Erythrocytes normal elliptical in shape and lake of central depression Giemsa stain X100

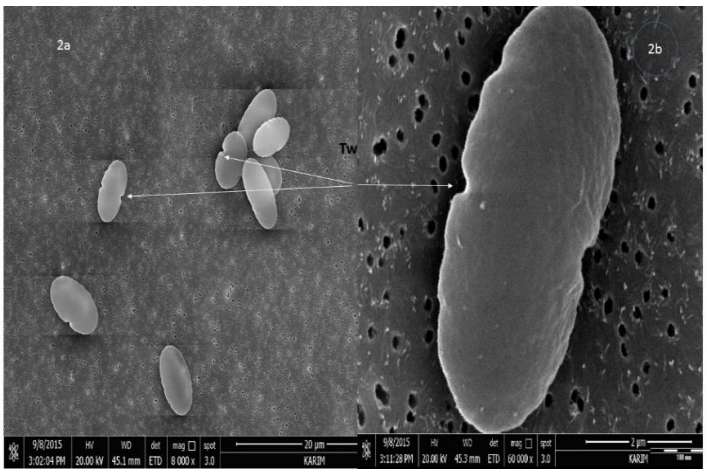

Fig. 2a &b). Scanning electron micrograph of Camel erythrocytes showing elliptical shape and tropical waist (Tw) arrows.

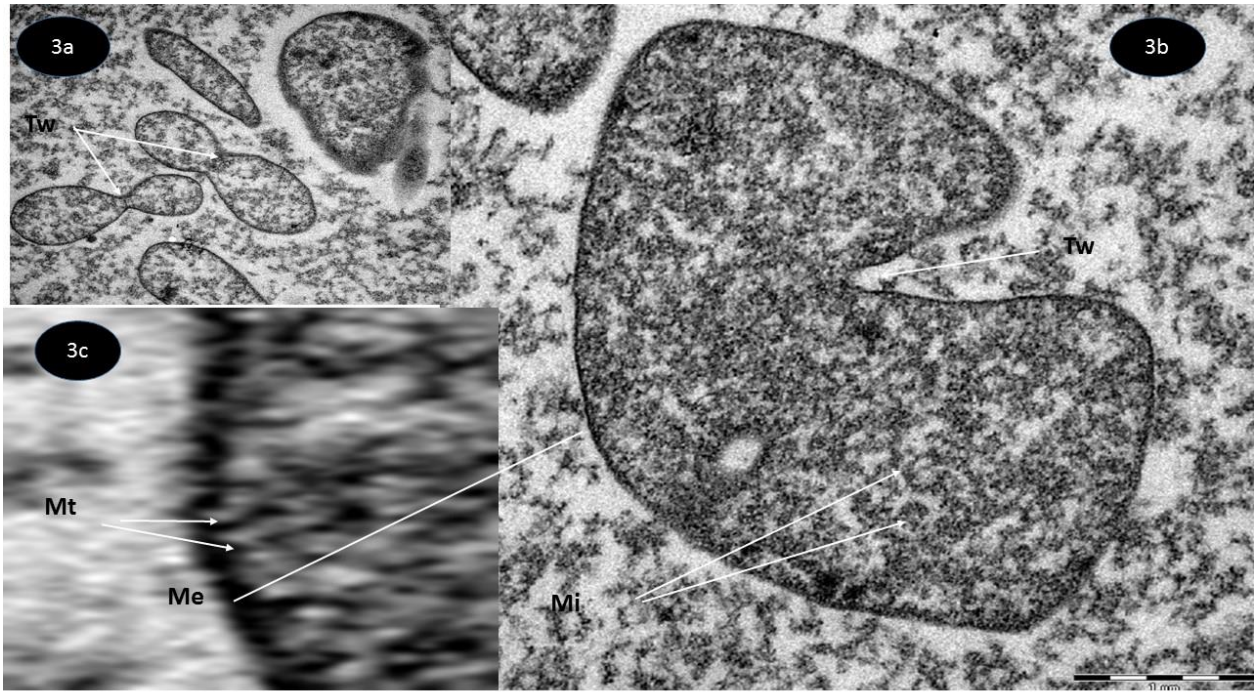

Fig. 3. Uranyl-acetate-stainedwhole mount of camel erythrocyte.The transmission of electron microscopy of camel erythrocytesshowed elliptical shape and tropical waist (3a &b). The (Me) is a continuous with mitochondria (Mi),and individual microtubules (Mt)densely of peripheral band and traversed by a network of irregularly stained dense enlargement material on inner side of (Me) (3c). Uranyl acetate staining.