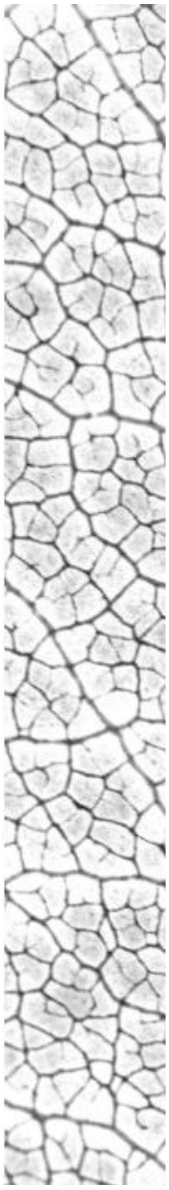

EurAsian Journal of BioSciences
Eurasia J Biosci 14, 435-439 (2020)

Electron microscopic changes in mitochondria in central nervous system of neurotoxicity of TOCP (tri ortho cresyl phosphate) in adult hen

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Abstract

The study aimed to investigate neurotoxicity of TOCP (tri ortho cresyl phosphate) of acute single dose for 21 days and sub chronic of daily doses of 90 days. All of the following mitochondria of cerebellum and midbrain, and also mitochondria of axoplasm of myelinated nerve fibers of sciatic nerve and spinal cord, showed that treatment related changes of neurotoxicity of TOCP characterized by dark stained, lamellated degenerate mitochondria. This indicated that mitochondria can be affected by the neurotoxicity of TOCP resulting in degeneration. Electron microscopic study of nervous system demonstrates very strong evidence of degeneration of mitochondria in myelinated axon. Further than presence of degenerate mitochondria even in the cytoplasm of neuron TOCP ultra-structurally showed degenerate myelin as lamellated body formation with auto phagocytosis of degeneration myelin by oligo dendrocytes. Mitochondria in axoplasm of myelinated axon in association with degenerate myelin. Morphologically degenerate mitochondria showed loss of formation of lamellated degenerate mitochondria, it neurons there was complete loss of the neuronal morphology of mitochondria, in severe cases the degeneration of mitochondria associated with calcium deposits. The presence of degeneration of mitochondria in association with neurotoxicity of TOCP indicated the serious of the damage which was caused by the TOCP.

Keywords: mitochondria, electron microscope, hen

Abd Alsamada MA, Hadi AE, Hasan MA (2020) Electron microscopic changes in mitochondria in central nervous system of neurotoxicity of TOCP (tri ortho cresyl phosphate) in adult hen. Eurasia J Biosci 14: 435-439.

INTRODUCTION

Studied the sub chronic ninety days delayed neurotoxicity of tri ortho cresyl phosphate (TOCP) of spinal cord adult hen by orall gavage. AL-sereah and Majeed (2014a) and Majeed and AL-sereah (2014) did teasing of acute neurotoxicity of tri ortho cresyl phosphate (TOCP) in sciatic nerve of adult hen. AL-sereah and Majeed (2014b) studied of acute delayed neurotoxicity of tri ortho cresyl phosphate (TOCP) of spinal cord light microscope of adult hen. Majeed et al. (2014a) studied the ultrastructural study of pineal gland in ageing sprague dawley rat. Majeed et al. (2014b) did electron microscopic study of acute neurotoxicity of TOCP (tri ortho cresyl phosphate) of sciatic nerve of adult hen (Akpan et al 2017).

Richardson et al. (1979) study the subcellular distribution of marker enzymes and of neurotoxic esterase in adult hen brain. Carrington and Abou-Donia (1985) studied neurotoxic estrase and acetylcholine estrase. Bischoff (1970) did ultrastructural study of TOCP in chicken. Abou-Donia et al. (1988) did cytoskeletal changes dueto organophosphorus and hexacarbon compound in relation to neurotoxicity. Abou-Donia and Lapadula (1988) analysed of the pathogenesis of organophosphorus compound induced delayed neurotoxicity. Abou-Donia and Lapadula, (1990) study the cytoskeletal protien and axonal neuropathy. Cavanagh (1964) study the neuropathological changes experimental animals and humen.

The aim of this study was investigating the neuropathological changes in various areas in the brain of hen (Classen et al. 1996, Reza et al 2018).

MATERIALS AND METHODS

A total of 120 hens were studied divided into 40 hens of 2 groups of 20 each untreated control and 20 treated with single dose of 500 mg/kg of corn oil for 21 days, and the second study of 80 hens of 4 groups, untreated control and treated 1.25, 2.5 and 5 mg/kg orally for 90

Received: August 2019
Accepted: December 2019
Printed: March 2020

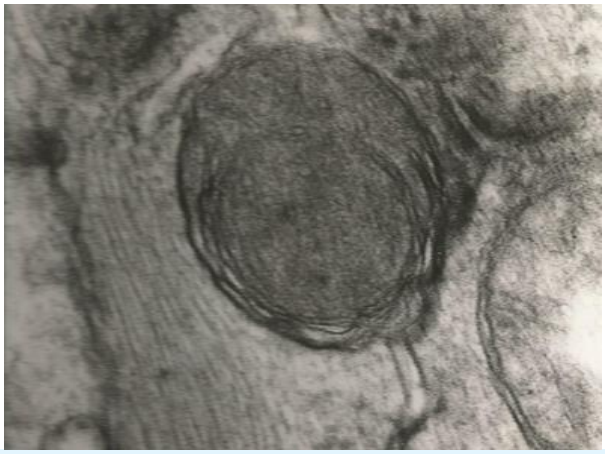

Fig. 1. Dendrite with multi-layered outer membrane of mitochondria (EM 30000X)

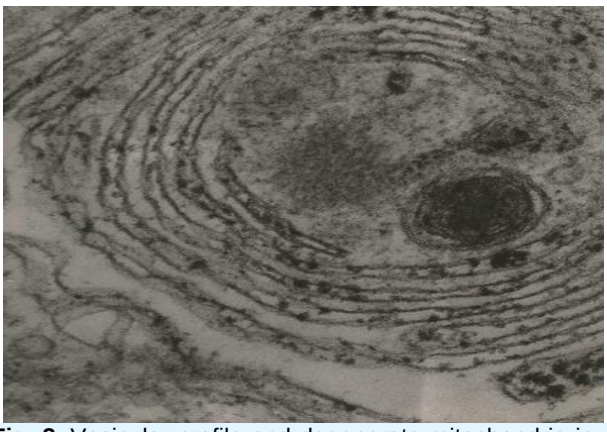

Fig. 2. Vesicular profile and degenerate mitochondria in a pre-synaptic process (EM 20000X)

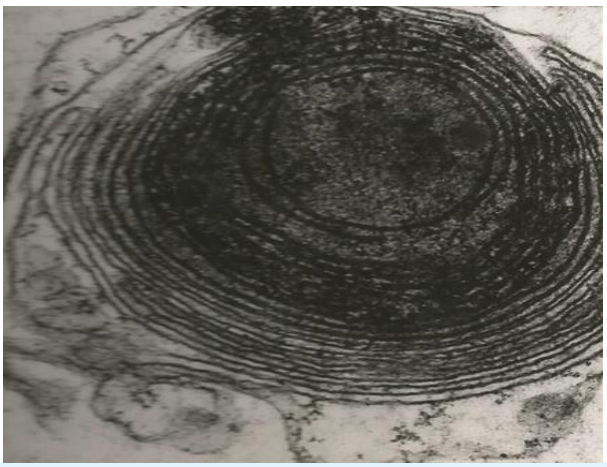

Fig. 3. Pre-synaptic process, note a multilamellar inclusion body (EM 40000X)

days. section of sciatic nerve, spinal cord, cerebullum and midbrain were fixed in glutaraldehyde then resin plastic blocks were made and cut by ultra- microtome at 1ug stained with toluidine blue for orientation, and selection of the right part for electron microscopy, then Copper grads were made and staind with uranyl lead acetate electron microscope.

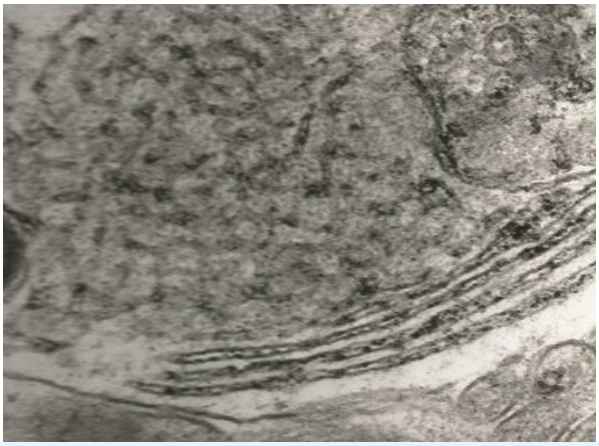

Fig. 4. Axon terminal with vesicular profile and multi layered outer membrane (EM 25000X)

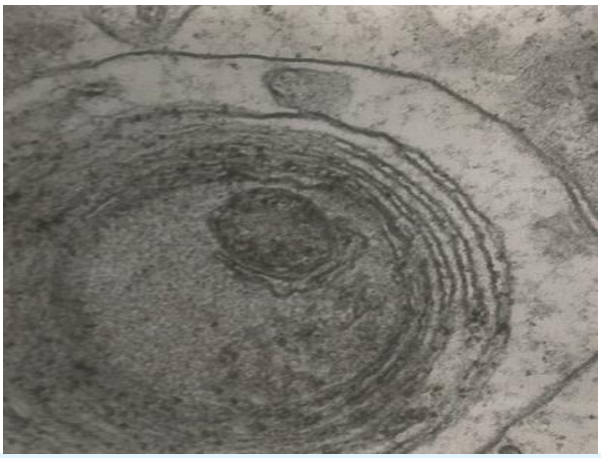

Fig. 5. Multilamellar body enclosing degenerate mitochondria in axon terminal (EM 20000X)

RESULTS

The result study of neurotoxicity of axoplasm myelinated nerve fiber of sciatic nerve and spinal cord and synapses of cerebullum and midbrain in all of the those mitochondria showed evidence of treatment related changes due to neurrotoxicity of TOCP characterised by degenerate mitochondria with dark stained lamellated structure with loss of cristae (**Figs. 1**-**4**). In some degenerate mitochondria of synapses showed evidence of severe degeneration and even mirization (**Figs. 6** and **7**) and enclosed by fibrelar process as lamellated membrance inclosing the changing synapses (**Figs. 8**-**10**).

DISCUSSION

This study showed evidence of recovery of peripheral neuropathy of the sciatic nerve, which was so prominent in case of acute single dose of neurotoxicity of TOCP and while the peripheral neuropathy of the sciatic nerve was reduced there was progressive increase in severity of the central nervous system neuropathy of the spinal cord with increase in incidence

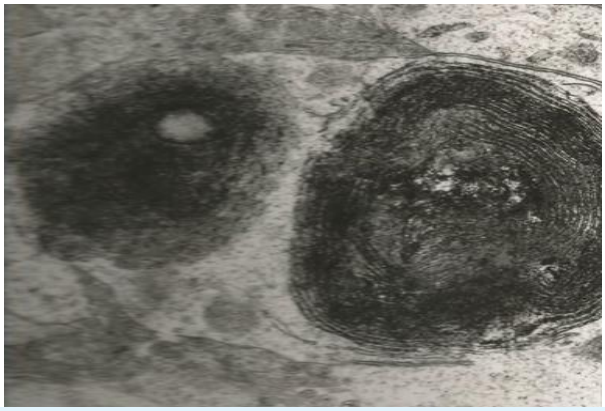

Fig. 6. Pre-synaptic process with two degenerate dark stained mitochondria, note the various lamellation of the mitochondria outer membrane (EM 30000X)

Fig. 7. Multilamellar inclusion body enclosing structure less degenerate organelles in axon terminal (EM 40000X)

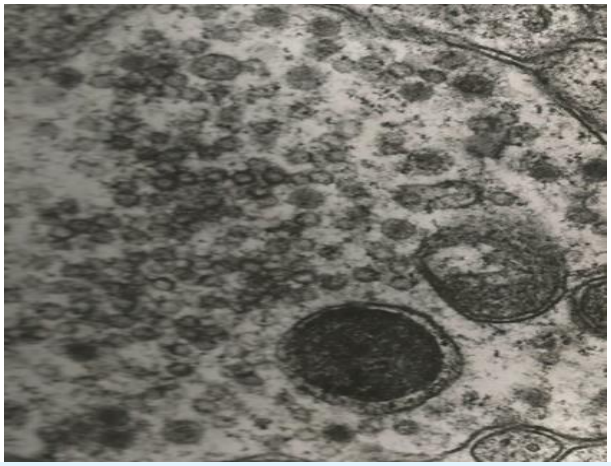

Fig. 8. Pre-synaptic process with dark stained degenerate mitochondria, adjacent to normal mitochondria (EM 15000)

and number of degenerate vacuolated nerve fibers associated with clumps of degenerate myelin in contrast to the lesion of the acute single dose of delayed neurotoxicity in which the severity of the central neuropathy in spinal cord was quite less than the peripheral neuropathy of sciatic nerve (AL-sereah and Majeed 2014a). The present study concentrated on electron microscopic changes in the mitochondria

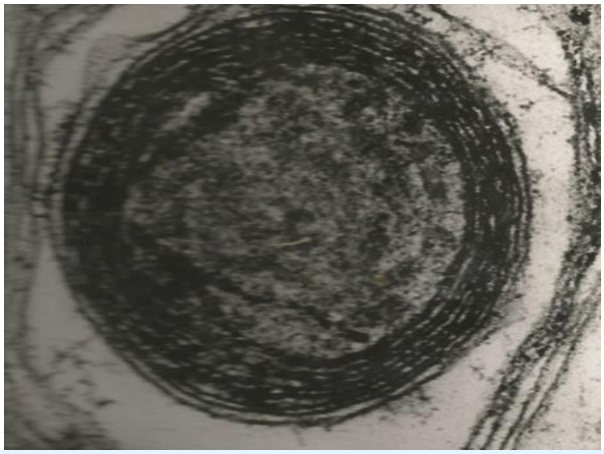

Fig. 9. Pre-synaptic process, with multilamellar dark stained inclusion which enclose degenerate mitochondria (EM 49000X)

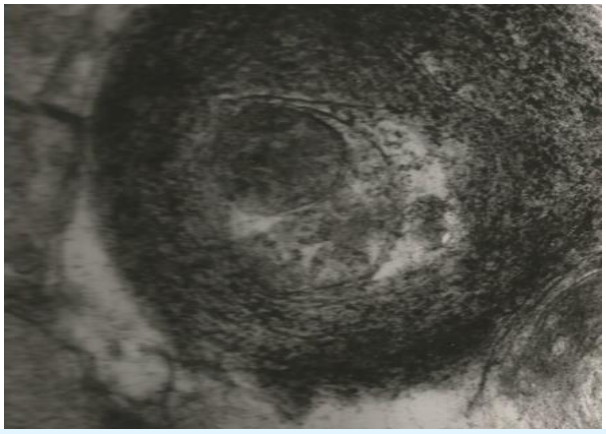

Fig. 10. Pre-synaptic process with dark stained multilamellar inclusion bodies enclosing remnants of degenerate mitochondria (EM 45000X)

induced by neurotoxicity of TOCP. Majeed and AL-sereah (2014) showed that sciatic of control untreated birds within normal limits with presence Ranvier node and normal myelin sheath while those hens given single dose of tri ortho cresyl phosphate (TOCP) as 500 mg/kg orally showed varying degree of fragmented degenerate myelin with area of demyelination. The severity of fragmentation and demyelination of sciatic nerve correspond with varying degree of ataxia, in coordination and paralysis clinically appearing in the treated hens. The present research topic did electron microsopic study on mitochondria in central nervous system of adult hen induced by TOCP. AL-sereah and Majeed (2014b) did acute delayed neurotoxicity of spinal cord of adult hens treated with TOCP (tri ortho cresyl phosphate) as positive control for organophosphorus, histopathology of light microscopy of Toluidine blue stains showed occasional nerve fibers with partial demyelination also nerve fibers with clumps or masses of degenerate myelin. The present paper studied the electron microscopic changes in the mitochondria of the nervous system of adult hen dueto neurotoxicity of TOCP in acute study. Majeed et al. (2014a) reported electron

microscopic study was done on young and old rats males and females showed presence of synapsis with dark core vesicles and numerous number of mitochondria, the presence of synapsis indicate electro chemical activity with possibility of active neurotransmitters. The present research did electron microscopic study on changes in mitochondria from various areas by neurotoxicity of TOCP in acute study (Majeed et al. 2014b). The result electron microscopy of sciatic nerve showed degeneration of myelin in myelinated nerve fibers characterized by vacculation of myelin, clumping of myelin, spheroid body formation of myelin, lamellated body of degenerate myelin, exoplasm showed increased of neurofilament also present of dark stained lamellated degenerate mitochondria. The present study was concentrated on electron microscopic changes in mitochondria of central nervous system induced by neurotoxicity of TOCP in adult hen. Richardson et al. (1979) investigated the subcellular enzymic changes due to neurotoxicity in adult hen brain. The present study concentrated on electron microscopic changes induced by neurotoxicity of TOCP in the nervous system of adult hen mainly on mitochondria. Carrington and Abou-Donia (1985) concentrated on enzymic changes due to neurotoxicity. The present research paper did electron microscopic study for changes induced by TOCP in adult hen mainly on mitochondria. Bischoff (1970) studied the ultrastructural changes due to neurotoxicity of TOCP. The present paper also did electron microscopic study on changes in the mitochondria associated with neurotoxicity of TOCP in adult hen. Abou-Donia et al. (1988) study the cytoskeletal protein associated with neurotoxicity with organophosphorus and hexacarbon compound. The present study did electron microscopic investigation on changes in the mitochondria related to neurotoxicity of TOCP. Abou-Donia and Lapadula (1988) investigated molecular pathogenesis of organophosphorus in relation to neurotoxicity. The present study did electron microscopic research observation on changes in mitochondria affected by neurotoxicity of TOCP. Abou-Donia and Lapadula (1990) studied the cytosceletal and axonal neuropathy. The present study was done on base of electron microscopy and found the changes in the cynpses which related to neurotoxicity of TOCP. Cavanagh (1964) studied neuropathological changes induced experimentally and these reported in human. The present research paper concentrate on the electron microscopic changes in mitochondria in adult hen related to neurotoxicity of TOCP. Classen et al. (1996) studied the neuropathological changes in various areas in the brain of hens. The present study was done on electron microscopic changes on mitochondria from various areas of peripheral and central nervous system to study the changes of mitochondria on base of electron microscope induced by neurotoxicity of TOCP.

CONCLUSION

Electron microscopic study was the only way to give inside changes of mitochondria in the central nervous system of neurotoxicity of TOCP in adult hen.

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