



COLOR ATLAS OF
**FORENSIC
PATHOLOGY**

BRAIN AND SPINAL CORD

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Version 1

BRAIN AND SPINAL CORD

ILLUSTRATIVE CASES

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FOREWORD

The greatest pleasure I experience as a teacher, is to see my students excel in their chosen careers and perform even better than myself. The series of e-booklets prepared to better equip medical officers to handle common conditions likely to be encountered in their day to day forensic practice by Professor Dinesh Fernando, is a good example of one of my students doing better than me!

Dinesh is the son of Emeritus Professor of Community Medicine, Former Head, Department of Community Medicine, Former Dean, Faculty of Medicine and Vice Chancellor of the University of Peradeniya, Malcolm Fernando, who was an illustrious medical academic. Following his father's footsteps, he joined the University of Peradeniya in 2003.

Dinesh was one of my post graduate trainees at the Department of Forensic Medicine and Toxicology, Faculty of Medicine, Colombo, and obtained the doctorate in Forensic Medicine in 2003. He underwent post-doctoral training at the Victorian Institute of Forensic Medicine, Melbourne, Australia, with my colleague and contemporary at Guy's Hospital Medical School, University of London, Professor Stephen Cordner. During this period, he served as the honorary forensic pathologist of the Disaster Victim Identification team in Phuket, Thailand following the tsunami, and was awarded an operations medal by the Australian Federal Police.

He has edited, and contributed chapters to, 'Lecture Notes in Forensic Medicine' authored by the former Chief Judicial Medical Officer, Colombo, Dr. L.B.L. de Alwis and contributed to 'Notes on Forensic Medicine and Medical Law' by Dr. Hemamal Jayawardena. He is the editor of the Sri Lanka Journal of Forensic Medicine, Science and Law. Continuing his writing capabilities, he has compiled an important and unique set of e-booklets which will be a great asset to undergraduate and post-graduate students of Forensic Medicine, and also to our colleagues. Its succinct descriptions of complicated medico-legal issues and clear and educational photographs are excellent. It makes it easy for the students to assimilate the theoretical knowledge of each topic as they have been augmented with histories, examination findings, macroscopic and microscopic photographs of actual cases. In some areas, photographs from multiple cases have been included, so that the students can better appreciate the subtle differences that would be encountered in their practice.

I sincerely thank my ever so grateful student Dinesh, for giving me this great honour and privilege to write the foreword.

Professor Ravindra Fernando

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About the authors.....

Dr. Sulochana Wijetunge is a Senior Lecturer serving at the Department of Pathology, Faculty of Medicine, University of Peradeniya and Teaching Hospital, Peradeniya. She obtained her undergraduate education at the Faculty of Medicine, University of Colombo, and her postgraduate training from Postgraduate Institute of Medicine, University of Colombo, Sri Lanka. International exposure includes training at the University of Southern California, USA and Royal Marsden NHS Foundation Trust, UK. She has 17 years of experience in undergraduate teaching and 12 years of experience as a board certified histopathologist and a post graduate trainer. She has an interest in forensic histopathology and trains the forensic medicine postgraduate students in Pathology.

Dr. Dinesh Fernando is a merit Professor in Forensic Medicine at the Faculty of Medicine, University of Peradeniya and honorary Judicial Medical Officer, Teaching Hospital Peradeniya. He obtained his MBBS in 1994 with Second class honours from the North Colombo Medical College, Sri Lanka, and was board certified as a specialist in Forensic Medicine in 2004. He obtained the postgraduate Diploma in Medical Jurisprudence in Pathology from London in 2005, and possesses a certificate of eligibility for specialist registration by the General Medical Council, UK. He underwent post-doctoral training at the Victorian Institute of Forensic Medicine, Melbourne, Australia. He has also worked at the Wellington hospital, New Zealand, as a locum Forensic Pathologist and as an Honorary Clinical Senior Lecturer at the Wellington School of Medicine and Health Sciences, University of Otago, New Zealand. He was invited to visit and share experiences by the Netherlands Forensic Institute in 2019.

PREFACE

Forensic Medicine in Sri Lanka encompasses, both, examination of patients for medico-legal purposes and conducting autopsies in all unnatural deaths, in addition to those that the cause of death is not known. In the eyes of the justice system in Sri Lanka, all MBBS qualified medical officers are deemed to be competent to conduct, report and give evidence on medico-legal examinations of patients and autopsies conducted by them, as an expert witness. However, during their undergraduate training, they may not get the opportunity to assist, nor observe, a sufficient variety of representative of cases that may be encountered in the future.

Therefore, a series of e-booklets has been prepared to better equip medical officers to handle common conditions that are likely to be encountered in day to day forensic practice. The case histories and macro images are from cases conducted by Prof. Dinesh Fernando, while the microscopic images are from the collections of, either, Prof. Dinesh Fernando or Dr. Sulochana Wijetunge. The selection, photography, reporting of all microscopic images and the short introductions of the pathology of each condition was done by Dr. Sulochana Wijetunge. Most of the macro images used were taken by Louise Goossens – a medical photographer par excellence.

Dr. Madhawa Rajapakshe contributed immensely in preparing the photographs for publication. Ms. Chaya Wickramarathne did a yeomen service in design, lay out and formatting the booklet. If not for the many hours she spent in discussing with the two authors, and editing these cases over several months, these booklets would not have seen the light of day. This is being continued by Ms. Isuruni Thilakarathne.

The content herein may be used for academic purposes with due credit given. Any clarifications, suggestions, comments or corrections are welcome.

Prof. Dinesh Fernando
Dr. Sulochana Wijetunge



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ILLUSTRATIVE CASES

2. SCALDS IN A PERSON WITH ALZHEIMER'S DISEASE



SCALDS IN A PERSON WITH ALZHEIMER'S DISEASE

Alzheimer's disease (AD) is the commonest cause of dementia in the elderly. It is a neurodegenerative disease caused by the accumulation of the proteins, beta amyloid and tau, in specific regions of the brain. This leads to insidious impairment of higher cognitive functions, which manifests as progressive memory impairment, deficit in visuo spatial orientation, language and personality over time. Grossly the brain shows a variable degree of cortical atrophy with widening of the cerebral sulci. Two pathological hallmarks of AD seen mainly in the end stage of the illness are neuritic (senile) plaques and neurofibrillary tangles. Both plaques and tangles contribute to progressive neural dysfunction with an initiation of an inflammatory response from microglia and astrocytes.

'Scald' is a feature of superficial (first degree) burns mostly due to tissue damage from hot liquids, usually by hot water. Erythema and blistering are the general features of scalds, but charring of the skin is also found when the liquid is extremely hot, such as with molten metal. Scalding burns generally occur on exposed skin, as even one layer of clothing can be sufficient to protect the body.

History

A 79-year-old-female in an advanced stage of Alzheimer's disease had filled a bath tub full of very hot water and got into it. She was unable to get out on her own due to having several hip replacement surgeries. When her husband heard her crying for help, he saw that she was sitting in the bath tub with both her legs draped over the sides of it.

External Examination

Approximately 50 % of the body surface area had scalds. It involved the entirety of the upper and lower back and both buttocks. The lateral aspects of the chest with extension to the anterior aspect of the chest, abdomen and upper thigh were scalded as was the entire posterior aspect of left upper limb and posteromedial aspect of right upper limb.



Figure 1: Scalds involving entire posterior aspect of the body. Note sharp margin on thigh



Figure 2: Scalds involving lateral aspect of the body. Note sparing of axilla



Figure 3: Scald of upper limb and wrist. Note sharp margin and sparing of axilla



Figure 4: Note circular burn due to splashing on the outer aspect of the left arm



Figure 5: Displaced water extending over the anterior aspect of the body. Note the sharp margins and erythematous base

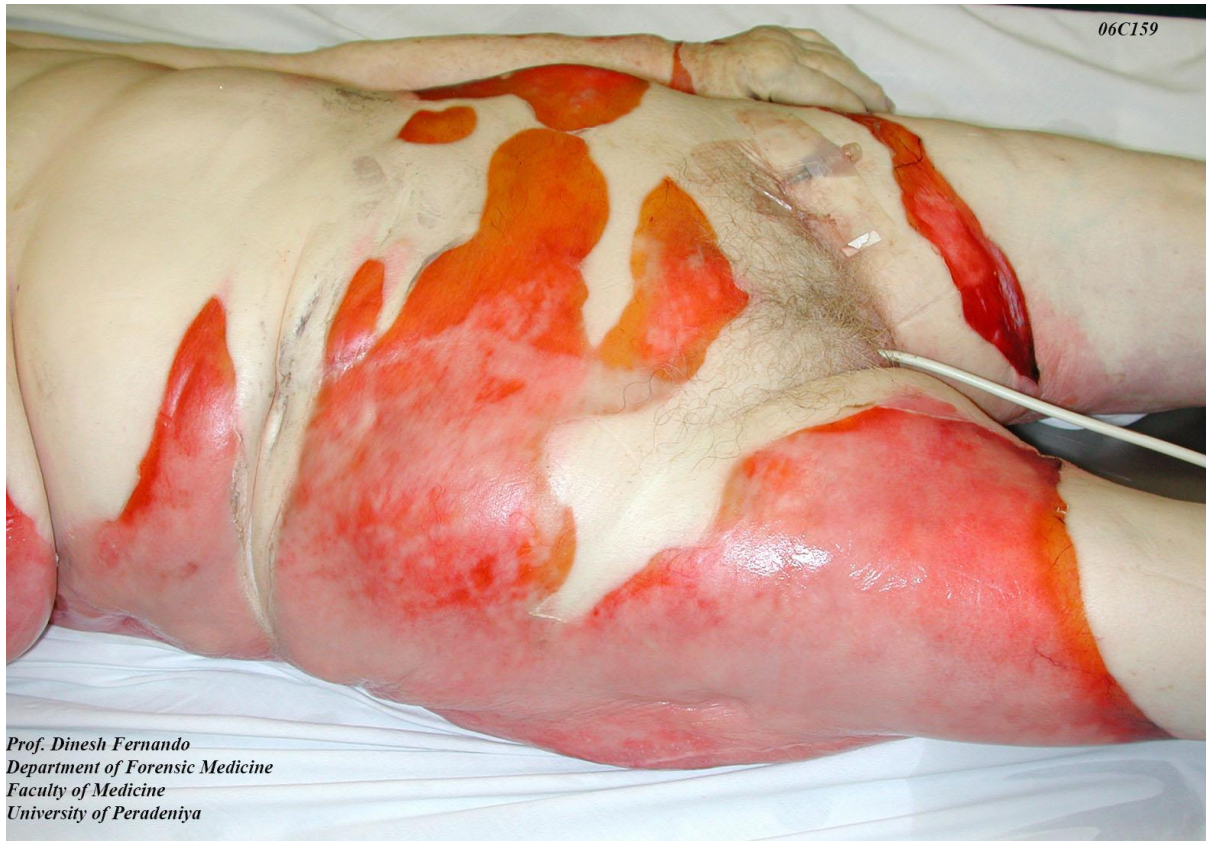
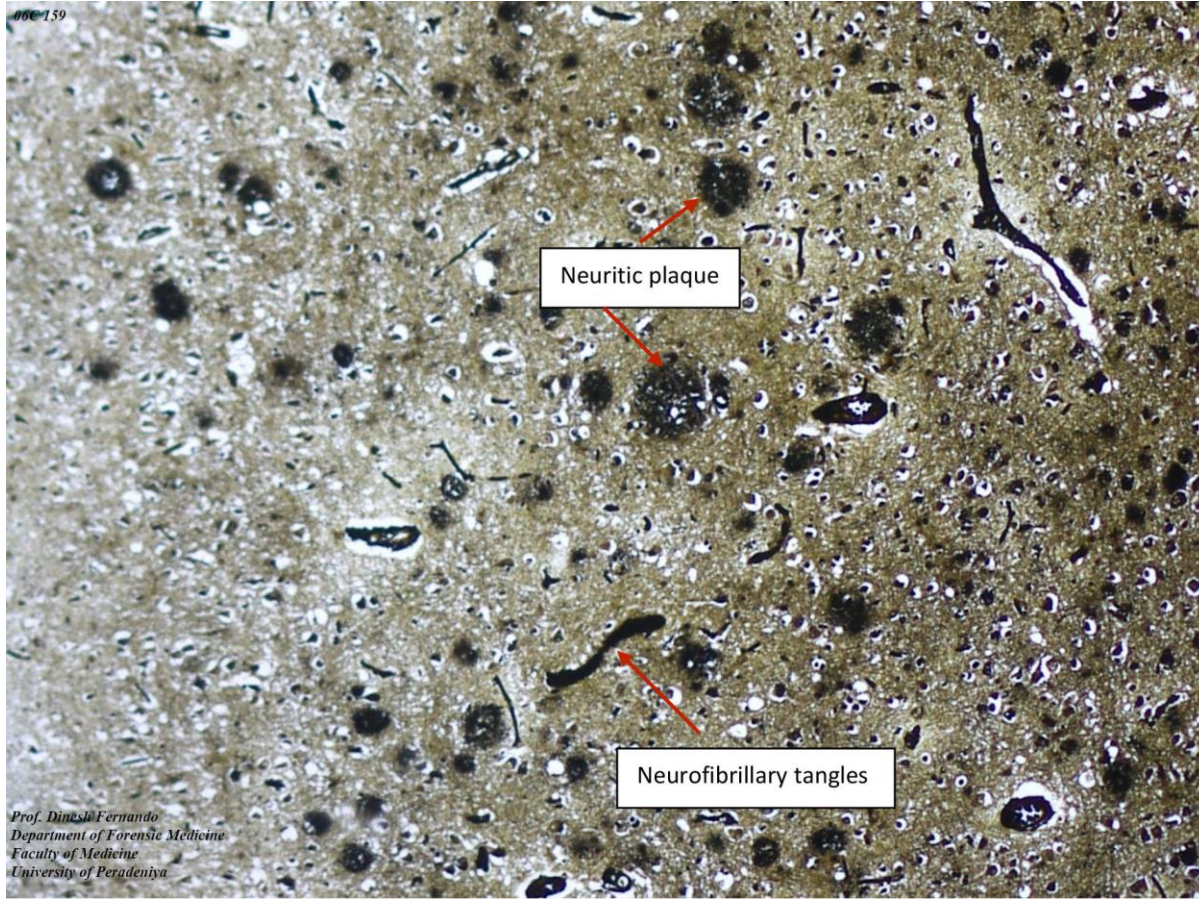
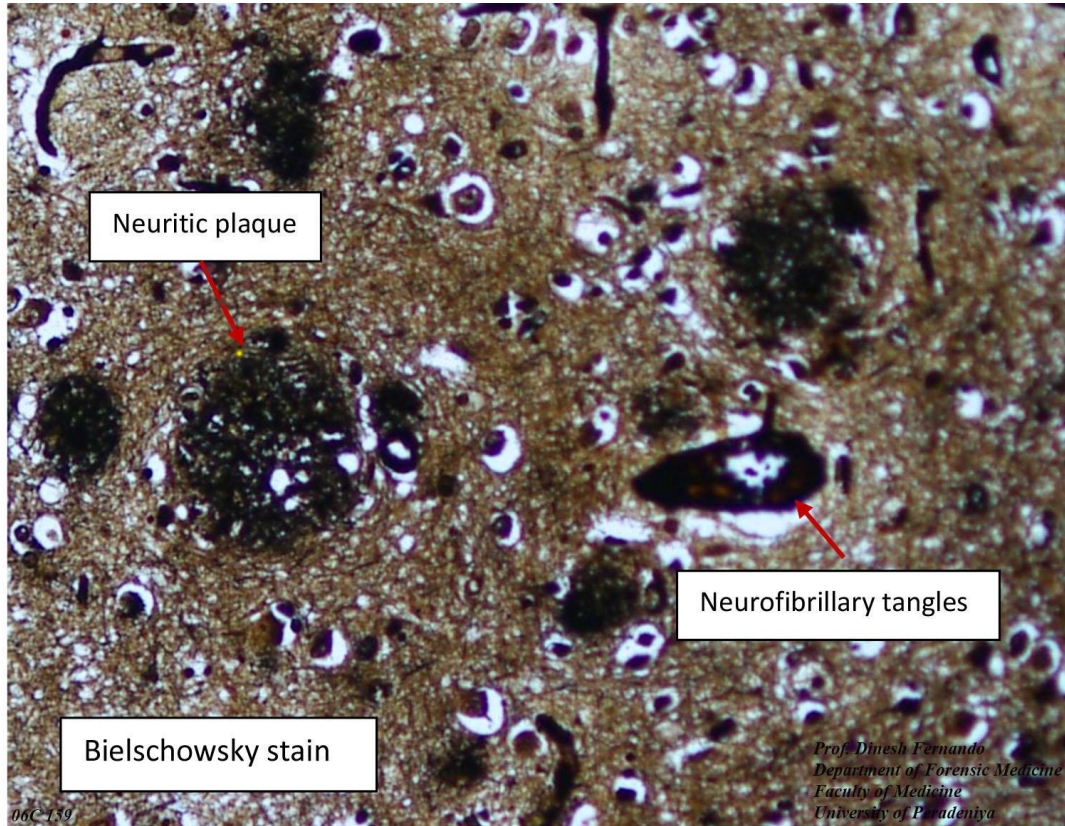


Figure 6: Note sparing of skin folds and inguinal region due to flexion of hip



Microscopic Examination





(b)

Figure 7(a, & b): Neurofibrillary tangles and neuritic plaques (Bielschowsky stain)

- Demonstration of neurofibrillary tangles and neuritic plaques in brain sections are required for confirmation of Alzheimer's disease at autopsy. Although these structures can be seen with routine haematoxylin and eosin stain, they are clearly demonstrated with Bielschowsky stain (a silver stain).
- Neurofibrillary tangles and neuritic plaques can also be seen as a senile change and in other degenerative diseases of the brain; however, these are characteristic features of Alzheimer's disease.

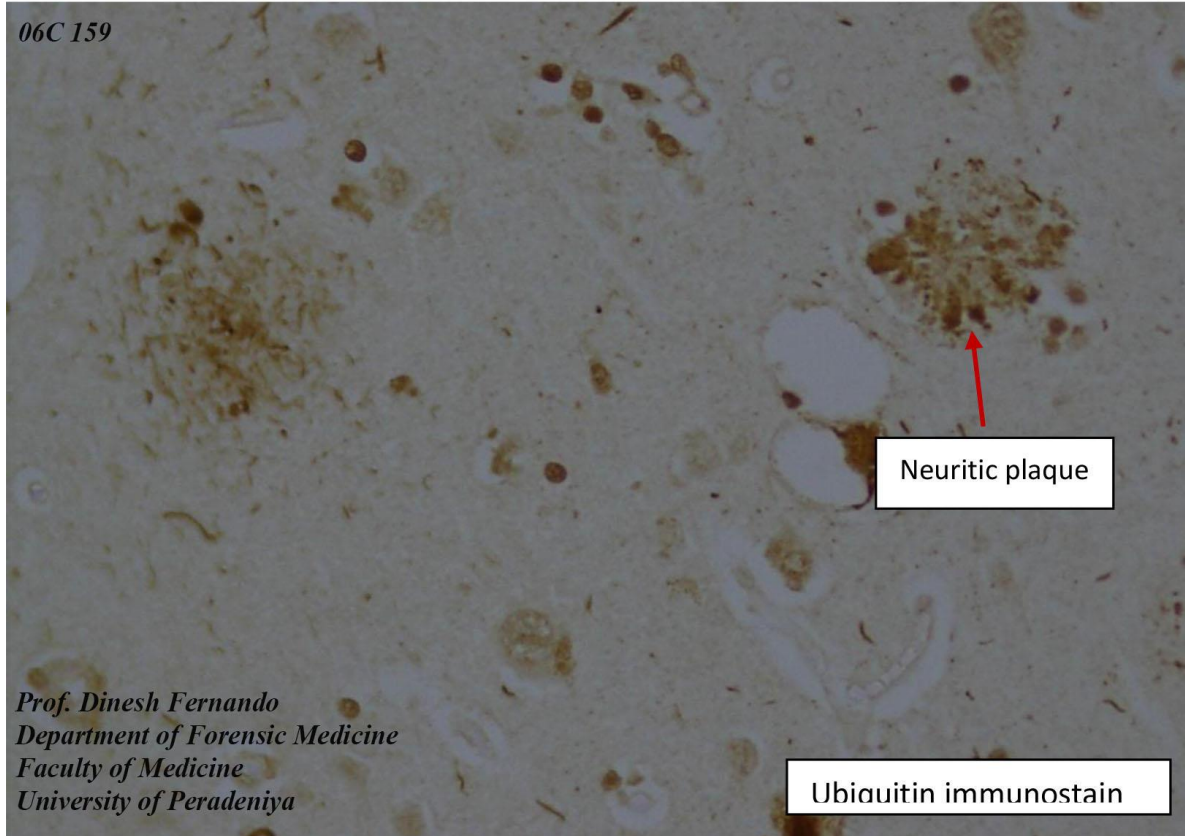


Figure 8: Neuritic plaque Stained with Ubiquitin immunostain

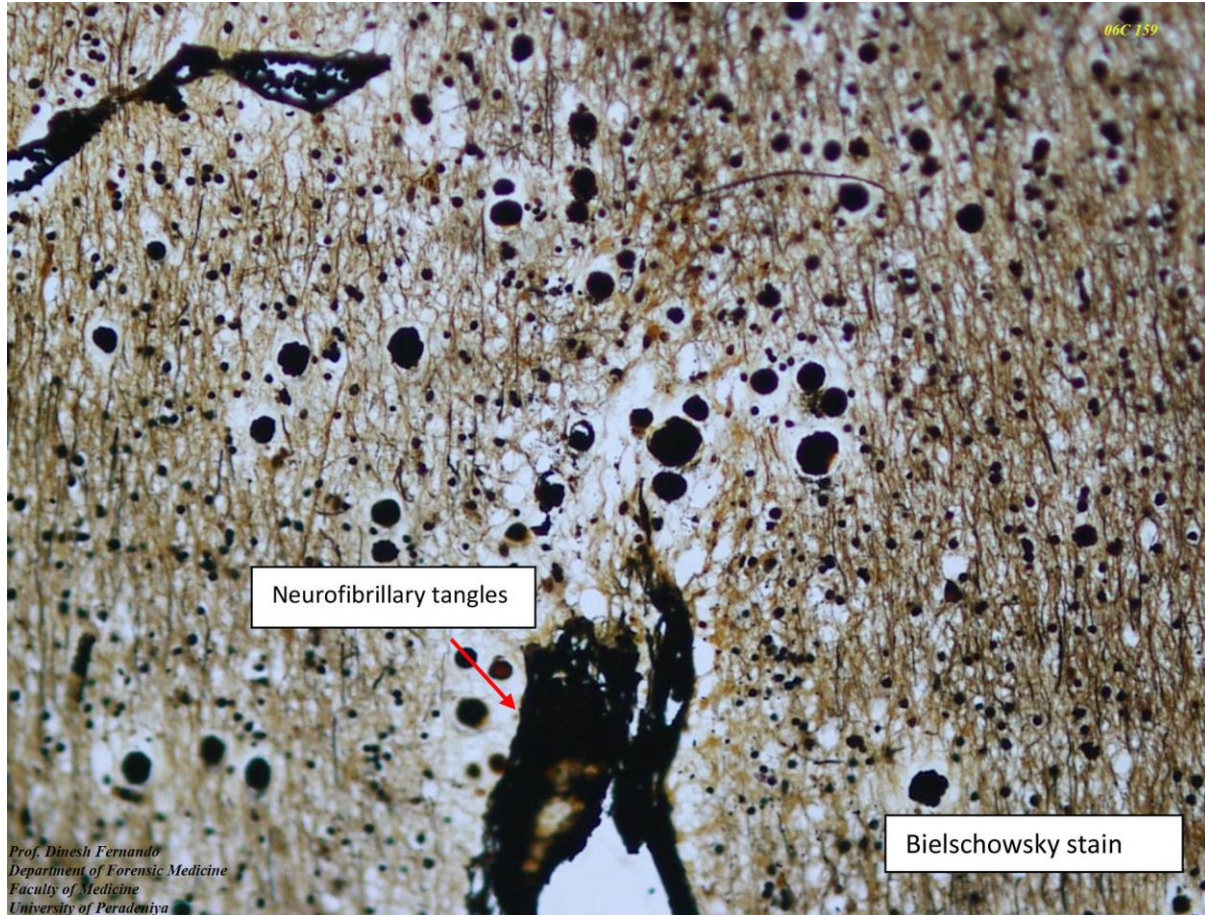


Figure 9: Neuritic plaques are degenerated neural structures deposited around small amyloid deposits.

- Neurofibrillary tangles are formed by accumulation of abnormally processed tau proteins inside neurons. The affected neurons eventually die and the insoluble proteins persist.



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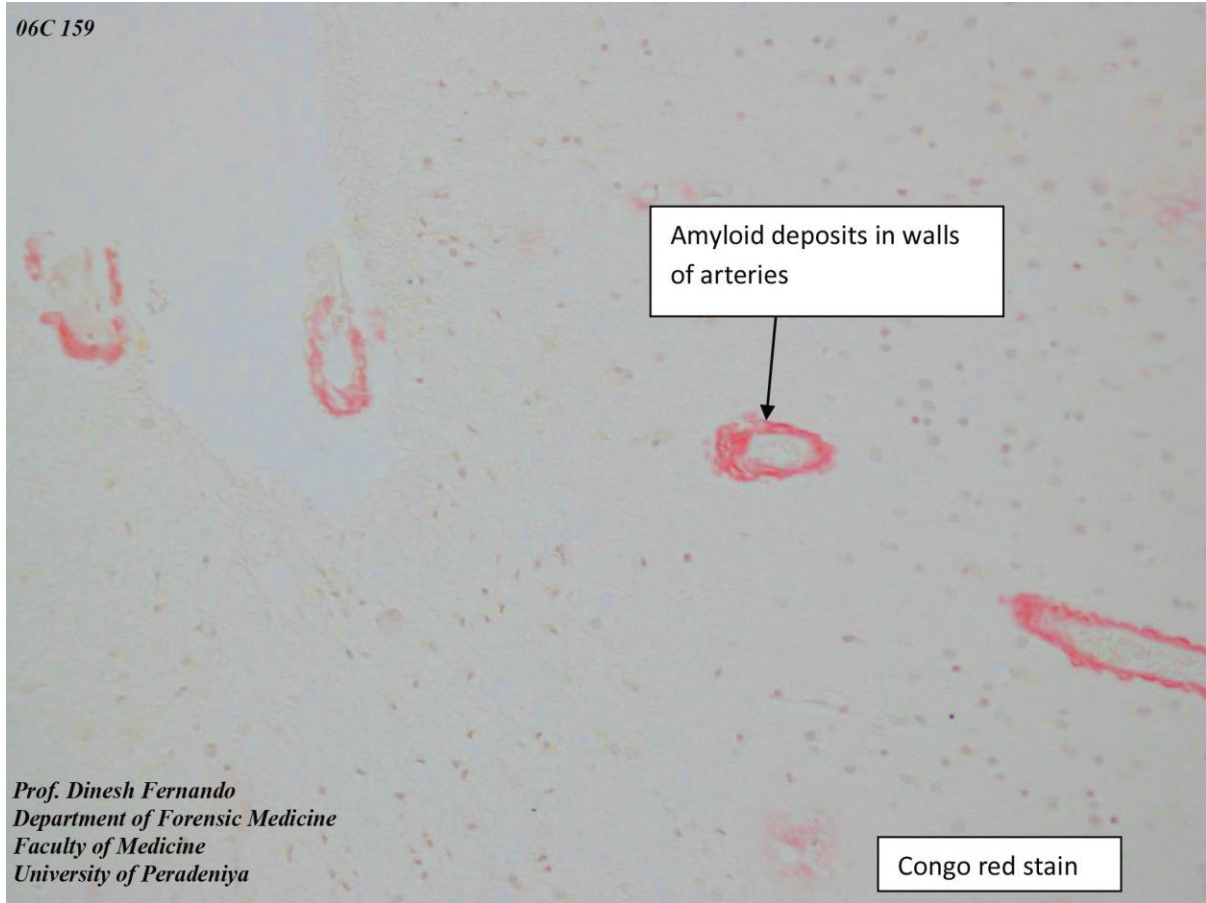


Figure 10: Amyloid deposits in walls of arteries stained with Congo red stain

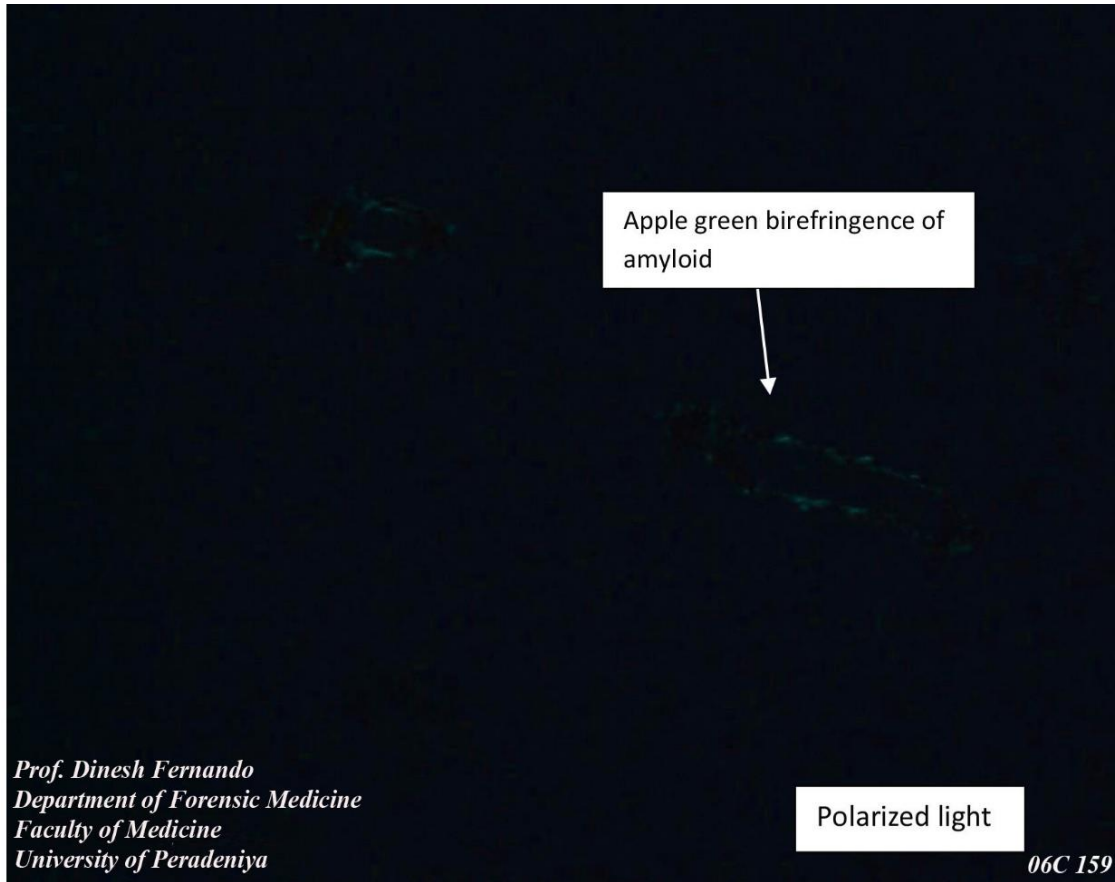


Figure 11: Amyloid angiopathy visualized under polarized light

- Amyloid angiopathy is also a common finding in Alzheimer's disease.
- Amyloid deposits in the vessel walls can be demonstrated by Congo red stained sections visualized under polarized stain. Amyloid shows an apple green birefringence with polarized light.

Cause of death

Scalds involving over 50 % of the body in a person with advanced Alzheimer's disease



Bibliography

1. Di Maio DJ, Di Maio VJM. *Forensic pathology*. 2nd ed. Boca Raton: CRC press; 2001.
2. Kumar A, Abbas AK, Aster JC. *Robbins basic pathology*. 9th ed. Philadelphia: An Imprint of Elsevier; 2013.
3. Kumar P, Clark ML. *Kumar & Clark's Clinical Medicine*. 8th ed. Edinburgh: Elsevier Health Sciences; 2012.
4. Saukko P, Knight B. *Knight's forensic pathology*. 4th ed. Boca Raton: CRC press; 2015.