

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.

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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

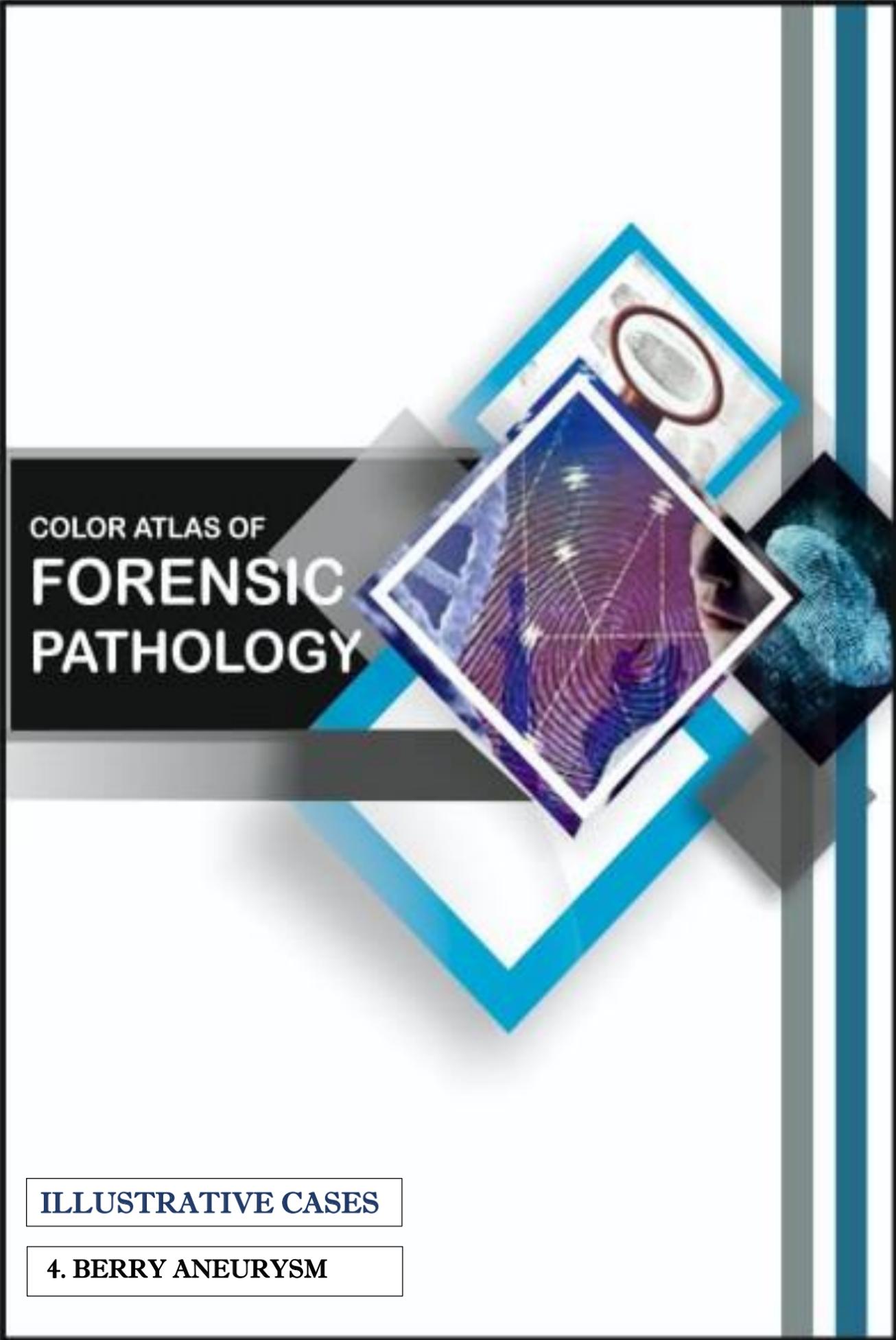
Forensic Medicine in Sri Lanka encompasses, both, examination of patients for medico-legal purposes and conducting autopsies in all unnatural deaths, in addition to those that the cause of death is not known. In the eyes of the justice system in Sri Lanka, all MBBS qualified medical officers are deemed 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 Wickramaratne 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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4. BERRY ANEURYSM



BERRY ANEURYSM

Berry aneurysms are the most common type of intracranial aneurysms and are the major cause of non-traumatic subarachnoid haemorrhage. Rupture of berry aneurysms is a relatively common cause of sudden collapse and rapid death. They are located at the branching points of cerebral arteries in the circle of Willis, with approximately 90% found in the anterior circulation. Of them, 40% are seen in anterior cerebral artery and anterior communicating artery and 25% each is seen in the internal carotid artery and middle cerebral artery. The balance 10% is seen in the vertebro basilar artery. Internal carotid artery aneurysms are mostly seen among females and anterior communicating artery aneurysms are more commonly seen in males. Chances of intra cranial haemorrhage is more in middle cerebral artery aneurysms and intra ventricular haemorrhage is more in anterior cerebral, anterior communicating and vertebro basilar artery aneurysms. The prevalence of aneurysms has been reported as 3 - 4% of all routine autopsies. Though they can be found at any age, they increase in frequency with age.

In early development, a defect in the formation of the media gives rise to a weakness of the vessel wall mainly at branching points. Persistence of incomplete involuted embryonic arteries with residual medial weakness is thought to be the reason for aneurysms which are away from the point of bifurcation. Aneurysms are thin walled protrusions of an artery. The muscular wall and internal elastic lamina are absent beyond the neck of an aneurysm. Therefore, the sac is lined only by thickened hyalinised intima, while the adventitia continues over the sac of the aneurysm.

The most common type of cerebral aneurysm is called a saccular, or berry aneurysm. It looks like a "berry" with a narrow stem. Two other types of cerebral aneurysms are fusiform and dissecting aneurysms. A fusiform aneurysm bulges out on all sides circumferentially. Fusiform aneurysms are generally associated with atherosclerosis. A dissecting aneurysm may result from a tear in the inner layer of the artery wall, causing blood to leak into the layers. This may cause a ballooning out on one side of the artery wall or it may block off or obstruct blood flow through the artery. Multiplicity of aneurysms is quite common (around 30%).

There are several risk factors for berry aneurysms; genetic factors like, positive family history, female gender, arterio-venous malformations, polycystic kidney disease, Ehlers-Danlos syndrome, bicuspid aortic valve etc and other factors like hypertension, cigarette smoking, heavy alcohol and caffeine intake. Atherosclerosis plays a secondary role which leads to focal destruction and weakening of the vessels walls.

A cause of medico-legal problems is the association of trauma and sub arachnoid haemorrhage (SAH), either from a ruptured pre-existing 'berry' aneurysm or a traumatic aneurysm occurring after blunt, penetrating or iatrogenic head trauma. Traumatic intracerebral aneurysms are rare. The reported incidence is less than 1 per cent, and they are more commonly seen in children. They are

caused by direct injury to the vessel wall or by acceleration induced shear forces and more than half of them are associated with skull fracture.

Berry aneurysms usually rupture at the apex. The haemorrhage occurs mainly into the subarachnoid space, while some may also occur into the substance of the brain. Minor leakage from the aneurysm may precede rupture. In such cases, the patient often complains of headache for days or weeks prior to rupture. Patients with spontaneous rupture of a berry aneurysm presents with a sudden excruciating headache which is often described as 'thunder clap headache' with neck stiffness and vomiting. Examination findings include meningism with focal neurological signs. Symptoms may resolve or may progress over hours or days to coma and death. Death is due to generalized vasospasm triggered by the subarachnoid haemorrhage, with resultant ischemic injury to the brain.

At autopsy, typically a fresh subarachnoid bleed with a ruptured aneurysm can be seen. The densest haemorrhage is seen over the base of the brain towards the ventral side, especially in the basal cisterns. Lesser amounts of blood is seen laterally and dorsally. Large pools of blood on the ventral surface of the brain often make it difficult to locate the aneurysm. Fresh bleed appears in bright red colour and if it lasts a week or so, a brownish tinge will appear as the haemoglobin undergoes changes.

History

A 48 year old male soldier was at home on leave and was last seen by his wife at 6.45 a.m. when she left for work. When she returned at 4.00 p.m. the same day, the diseased was found dead sitting at his computer table.

Internal examination

Central Nervous System

A thin SAH was seen over both convexities of the brain and predominantly in the base. A ruptured berry aneurysm measuring approximate 2-3 mm in diameter at the root of the right internal carotid artery was seen. A non-ruptured berry aneurysm was found at the basilar apex (bifurcation of the basilar artery).



Macroscopic examination

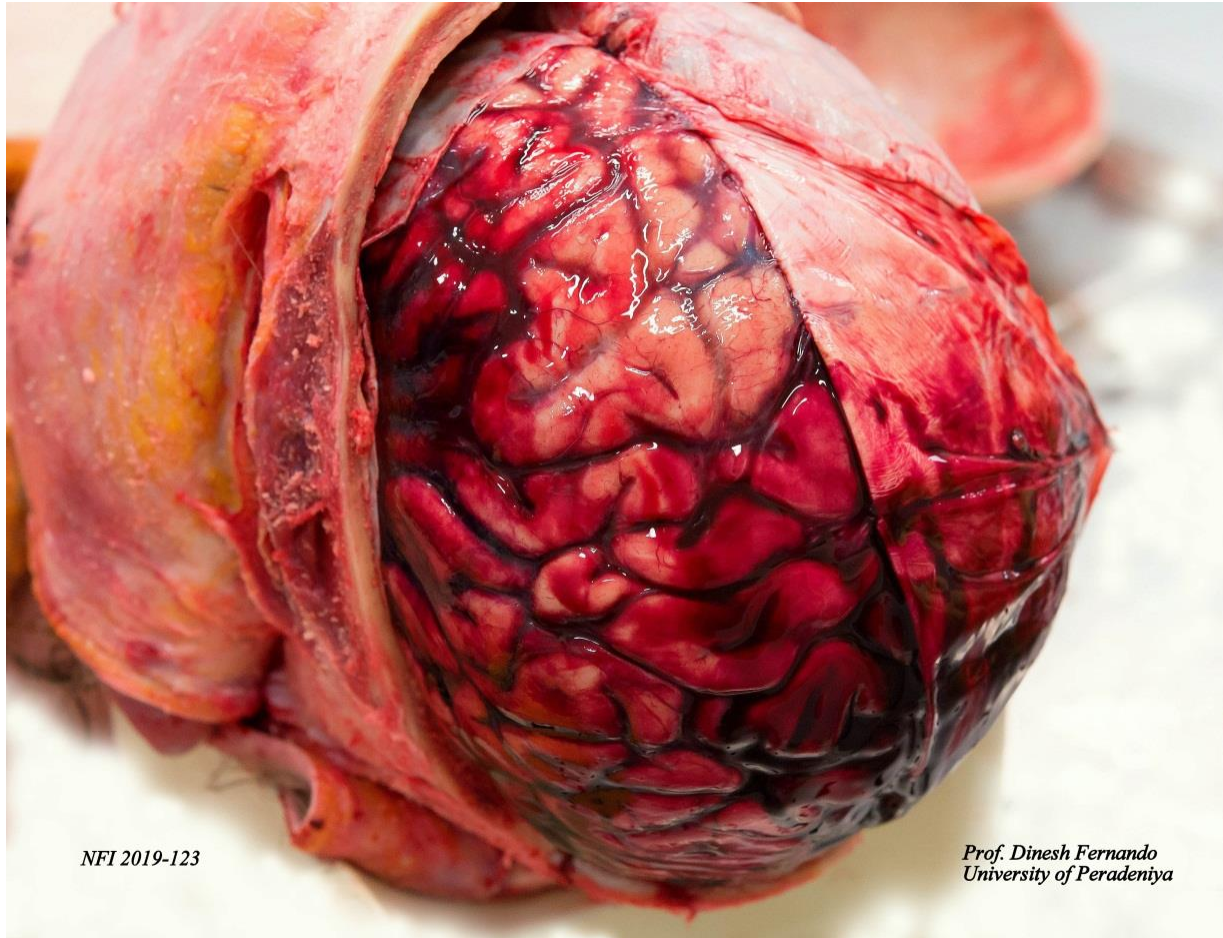


Figure 1: Sub arachnoid haemorrhage in an adult brain with part of the dura everted

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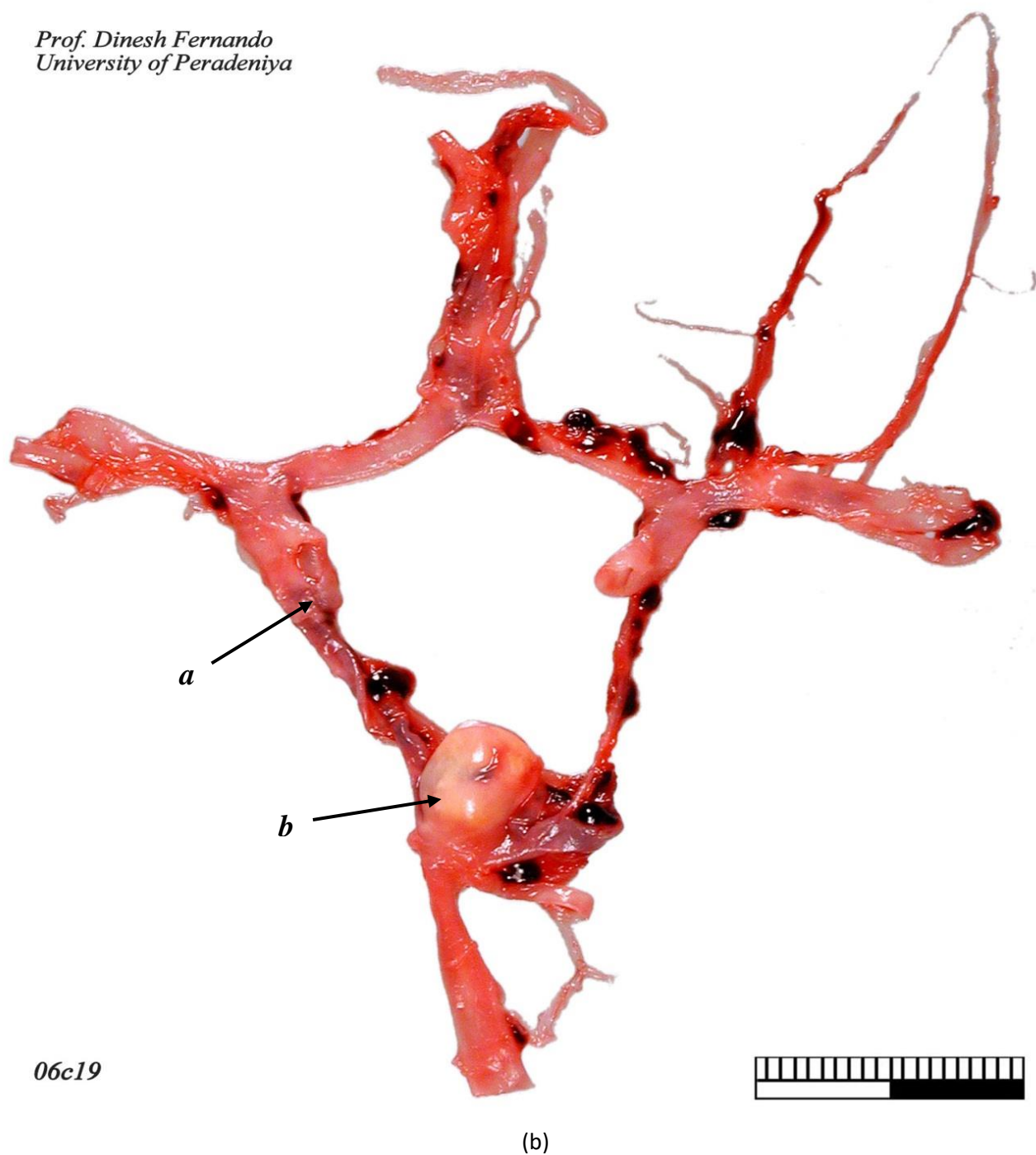


Figure 2: Sub arachnoid haemorrhage seen predominantly at the base of the brain



(a)

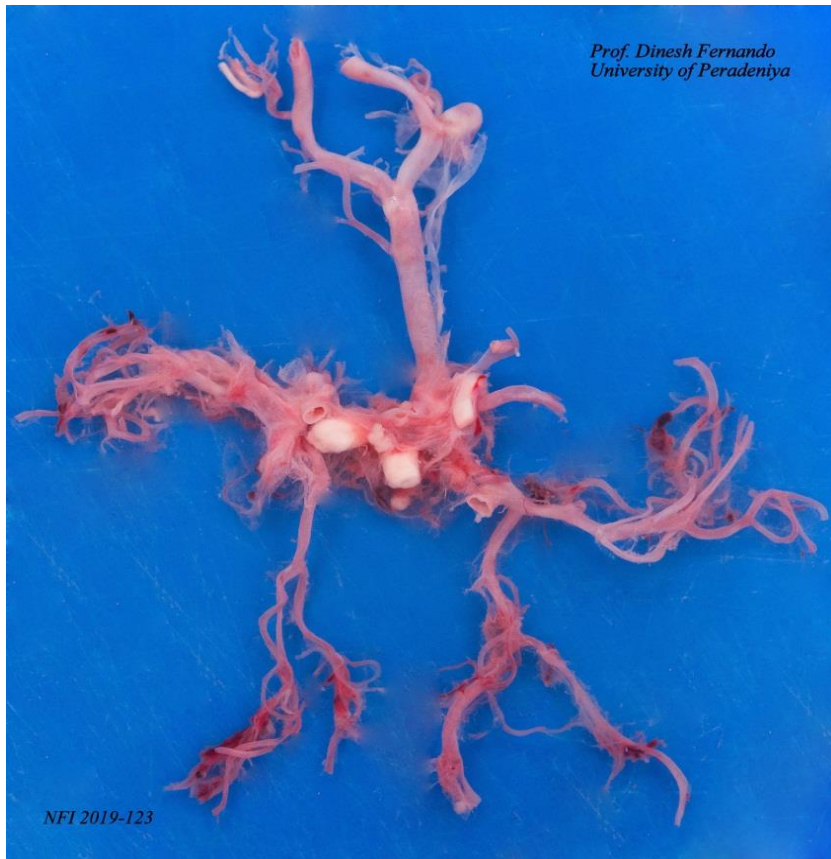
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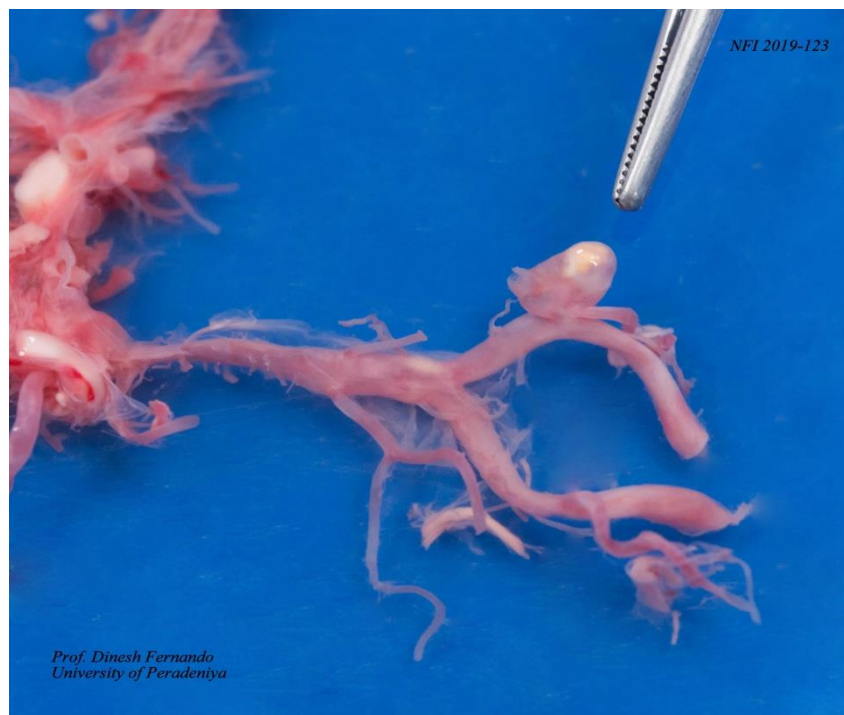
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(b)

Figure 3(a, b): Multiple aneurysms in the circle of Willis. Arrow 'a' root of the internal carotid artery and arrow 'b' bifurcation of the basilar artery (basilar apex)



(a)



(b)

Figure 4(a, b): A non-ruptured vertebral artery aneurysm, which is very rare, from another case

Microscopic Examination

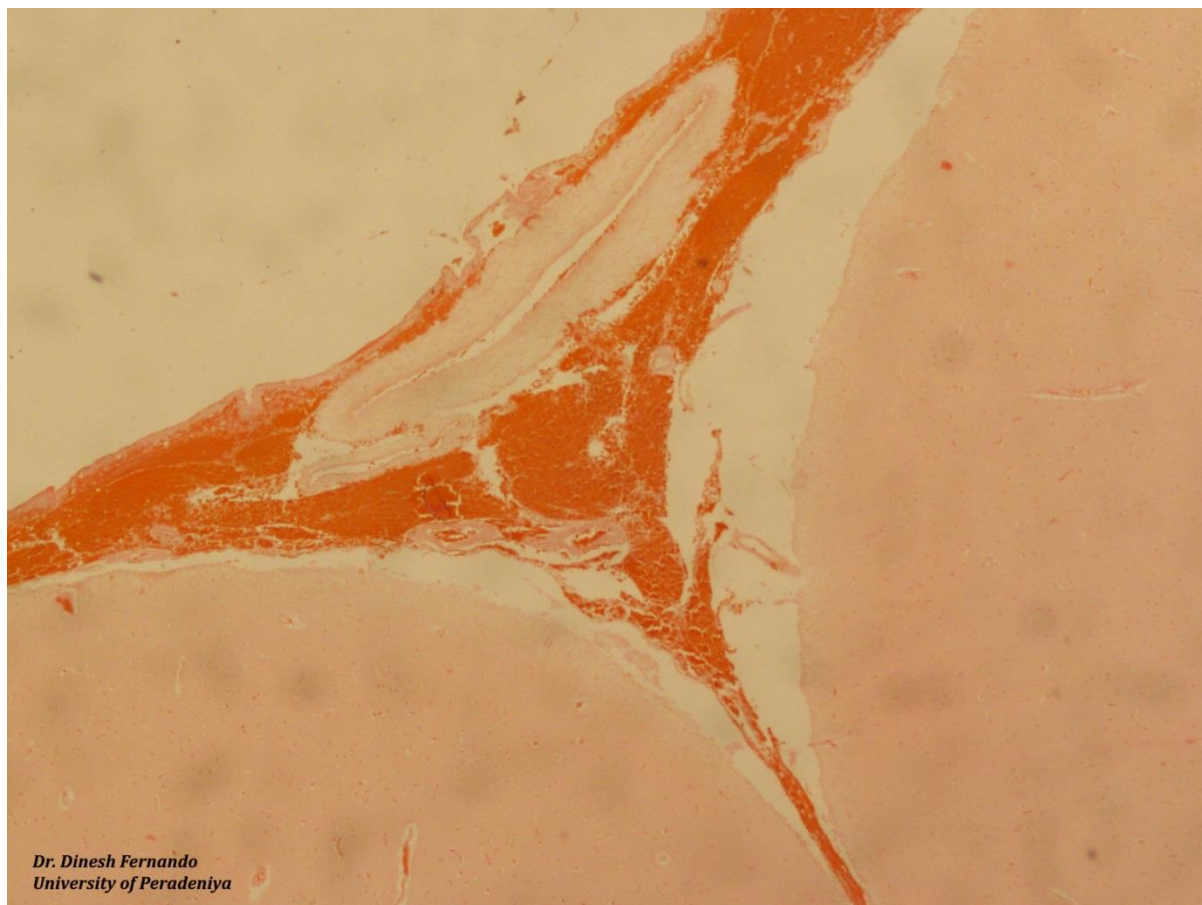


Figure 5: Sub Arachnoid Haemorrhage

Cause of death

Sub Arachnoid Haemorrhage due to ruptured berry aneurysm



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