



COLOR ATLAS OF
**FORENSIC
PATHOLOGY**

CARDIOVASCULAR DISEASE

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Version 2

CARDIOVASCULAR DISEASE

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

1. PULMONARY EMBOLISM



PULMONARY EMBOLISM

Pulmonary embolism (PE) is the blockage of the pulmonary vasculature by an embolus. A thrombus commences as a platelet aggregate. Then fibrin and red cells form a mesh until the lumen of the vein wall is occluded. This coralline thrombus then progresses as a propagated loose red fibrin clot containing many red cells. This is likely to extend up to the next large venous branch and it is possible for the clot to break off and embolize to the lung as a pulmonary embolus. More than 95% of all pulmonary emboli arise from thrombi within the large deep veins of the lower legs, typically originating in the popliteal vein and larger veins above it. Large or long thrombi can embolize to the main pulmonary artery trunk, the bifurcation or left or right pulmonary artery and produce massive pulmonary embolism. If total occlusion of the pulmonary arteries occurs, typically, from a large saddle embolus, acute cor pulmonale, shock or death due to acute right ventricular failure results.

The vast majority (60% to 80%) of emboli are clinically silent, and no more than one third is diagnosed before death. The minority (5%) are symptomatic with a sudden onset of unexplained dyspnoea which is the most common, and often, the only symptom of it. On examination there will be tachypnoea, localized pleural rub, and coarse crackles.

Embolization of medium sized pulmonary arteries by smaller thrombi usually do not produce any significant effect in otherwise healthy individuals due to compensation by bronchial arterial perfusion; however, they can produce haemorrhagic infarctions in those with already congested and compromised pulmonary perfusion, such as in congestive cardiac failure and mitral stenosis. Multiple recurrent pulmonary emboli cause increased breathlessness, often, over weeks or months due to recurrent emboli. About three fourths of all infarcts affect the lower lobes and more than half are multiple. Characteristically, they are wedge-shaped, with their base at the pleural surface and the apex pointing toward the hilus of the lung. Pleuritic chest pain and haemoptysis are present only when infarction has occurred. Since a saddle embolus causes a sudden death there is no time for morphologic alterations in the lung. However, when smaller emboli are impacted in medium-sized and small pulmonary arteries, alveolar haemorrhage may occur as a result of ischemic damage to the endothelial cells.

Risk factors for pulmonary embolism are obesity, immobility, pregnancy, oestrogen therapy, disorders of hypercoagulability, diseases like polycythaemia, inflammatory bowel disease, disseminated cancer, surgical procedures or trauma including multiple burns or fractures.

Autopsy data on the incidence of pulmonary embolism varies; ranging from 1% in the general hospitalized population, to 30% in persons dying after a predisposing factor of the patient to venous thrombosis in the legs. In a study done by Knight, more than three-quarters of the victims had predisposing factors but the remaining 20% were ambulant and apparently healthy.

Pulmonary infarcts typically are haemorrhagic, and appear as raised, red-blue areas in the early stages. The red cells begin to lyse within 48 hours, and the infarct becomes pale, eventually becoming red-brown as hemosiderin is produced. In time, fibrous replacement begins at the margins and converts the infarct into a scar. An ante-mortem embolus (especially if several days old) is firm. Although it may appear to be a cast of the large vessel in which it is impacted, it may often be unravelled to form a long length, that obviously originated in a leg vein. Post-mortem clots may be adherent to the ante-mortem embolus, and sometimes forms a sheath around it.

History

A 59-year-old male was treated in hospital for 12 days for a bowel obstruction and subsequent pneumonia. While going for a shower in hospital he fell and was declared deceased.

Internal examination

Cardiovascular System: The heart weighed 384 grams. Bilateral pulmonary arteries contained coiled thrombi which were approximately 2 mm in diameter. These were present in the main pulmonary arteries and their branches.

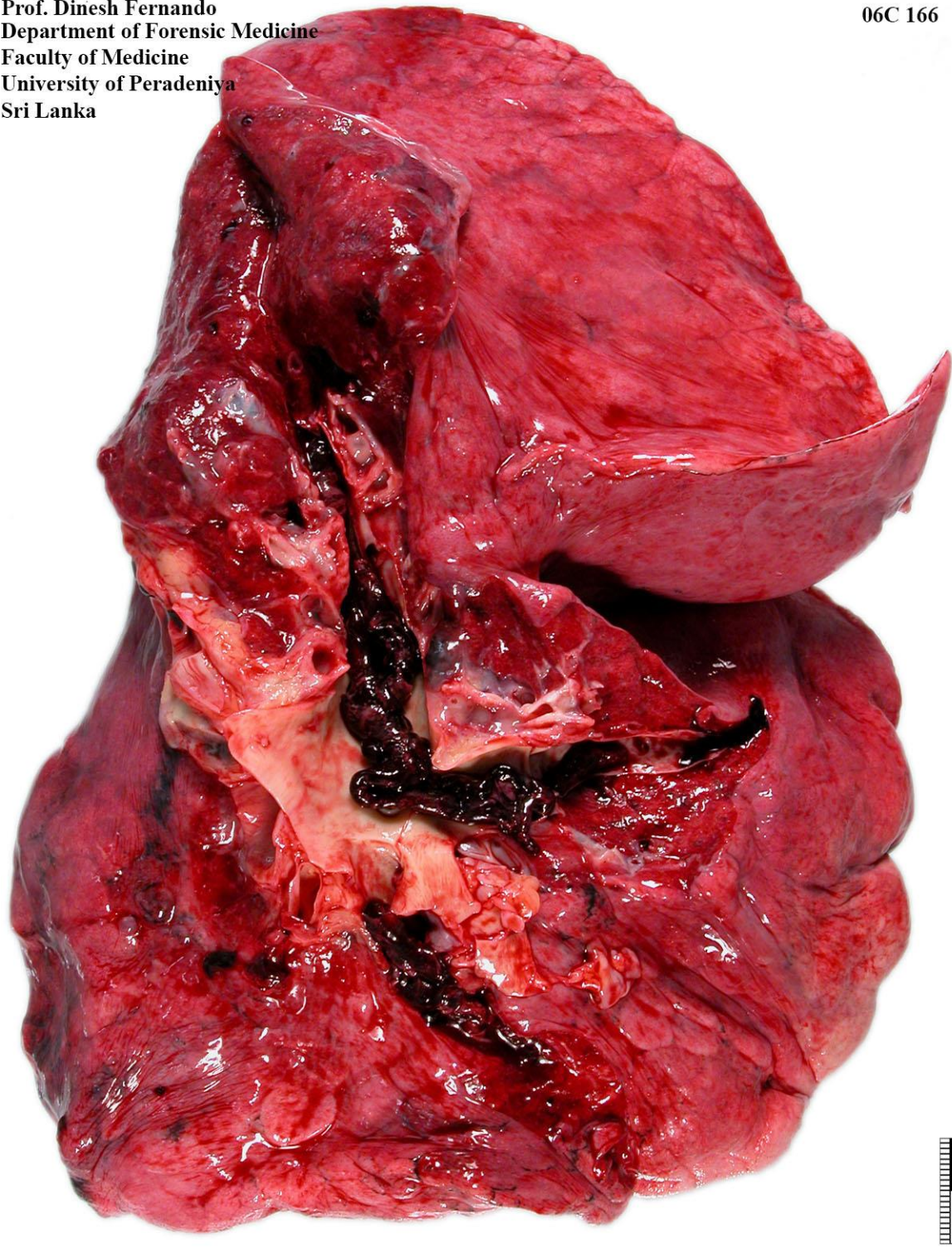
Respiratory system: The right and left lungs weighed 680 grams and 530 grams respectively. Sectioning of the lung revealed thrombi in the pulmonary arteries. The lower lobes of both lungs were solid to touch and friable.

Musculoskeletal System: Dissection of the left calf muscle revealed thrombi in the deep veins.



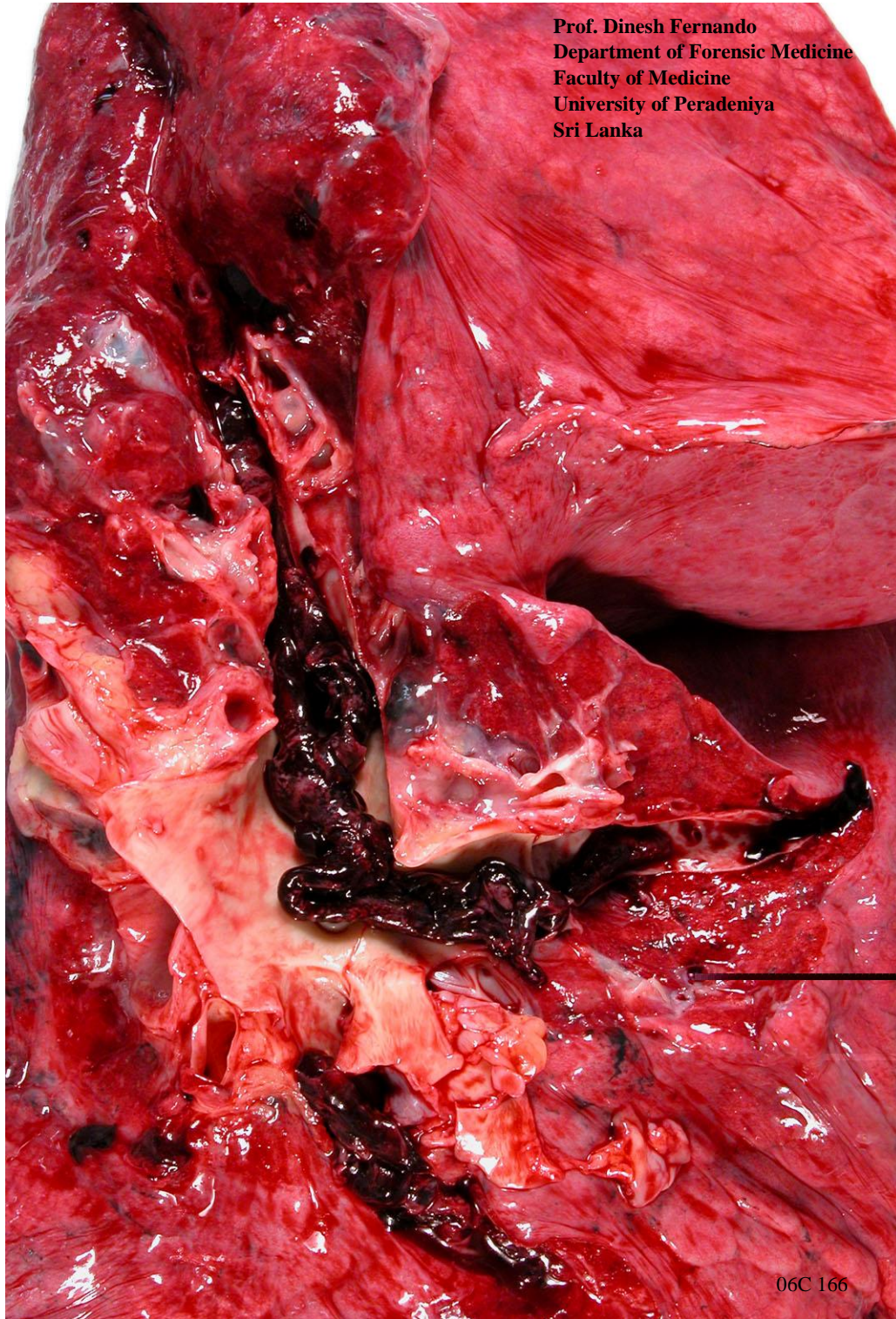
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(a)

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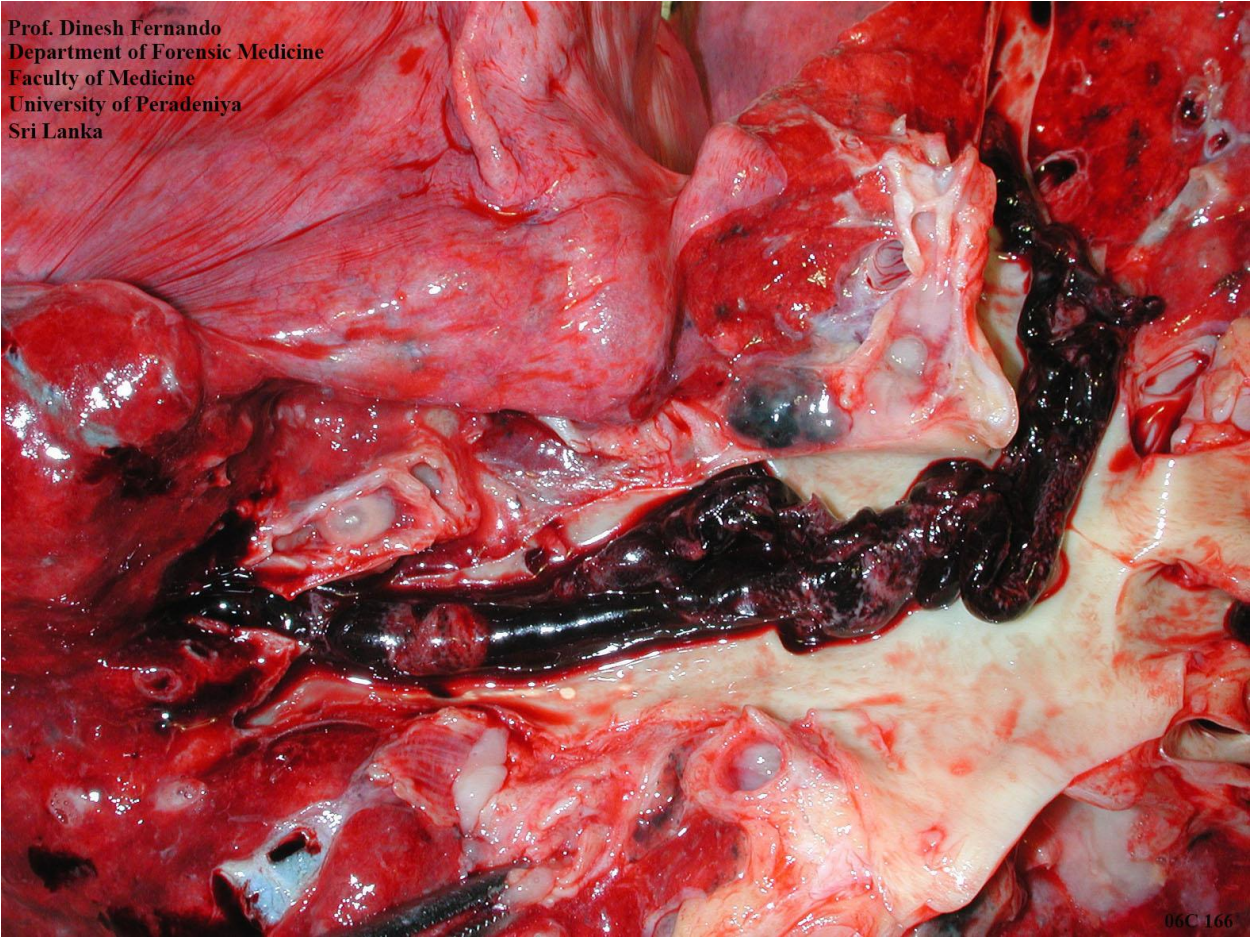


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(c)

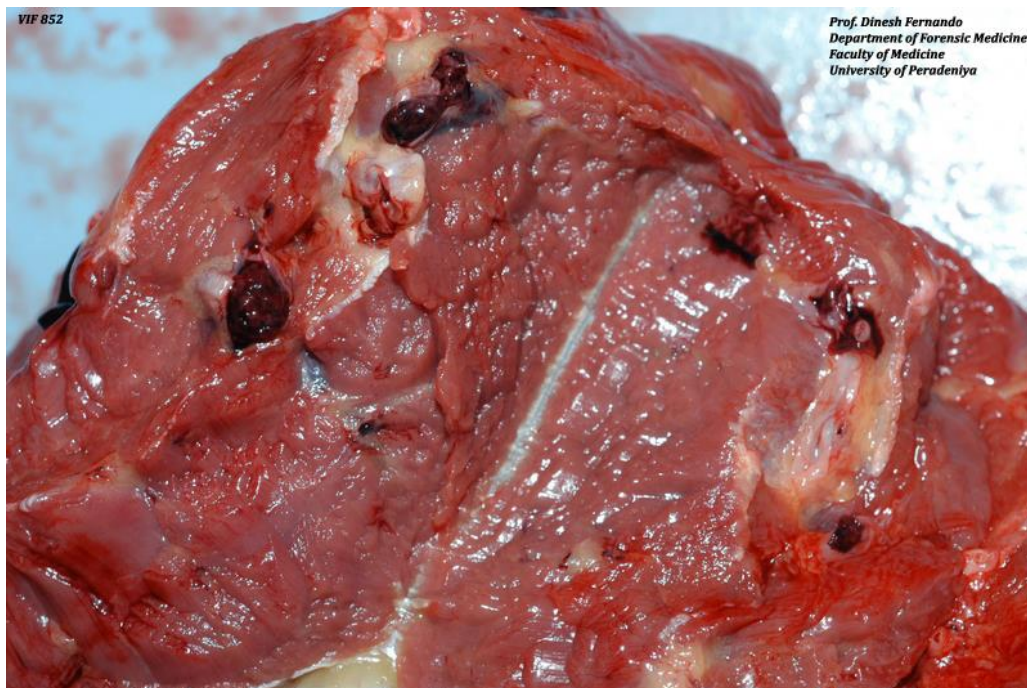
Figure 1(a, b, & c): Thromboembolus in the main pulmonary artery



(a)



(b)



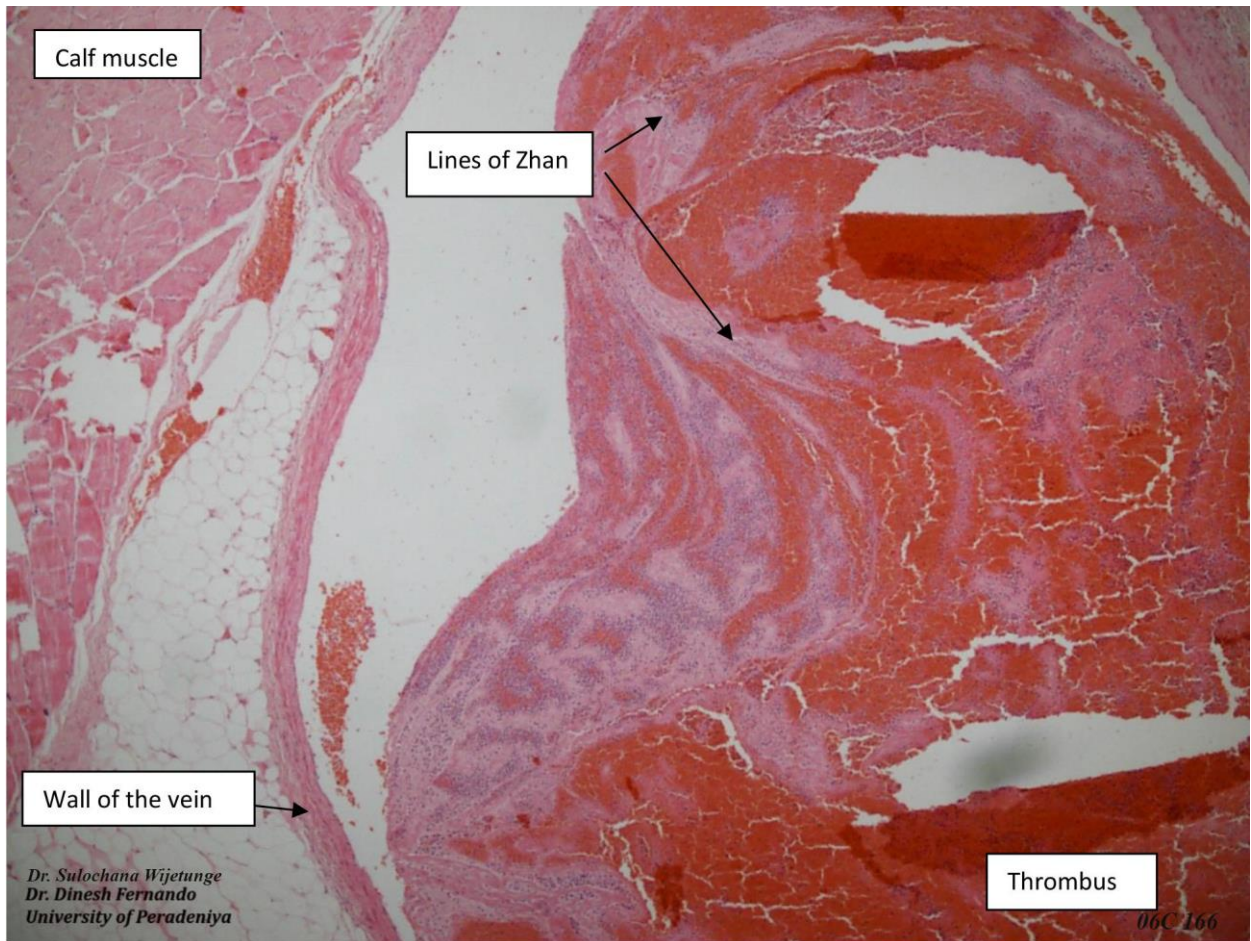
(c)

Figure 2 (a, b & c): Calf muscle sliced to show thrombi in deep veins

Microscopic Examination



(a)



(b)

Figure 3(a & b): Thrombosis of deep calf veins

- Lines of Zahn, pale pink areas composed of fibrin and platelets (bright pink areas are predominantly composed of red blood cells) are clearly seen in both thrombi. Lines of Zahn are useful to differentiate an ante mortem clot from a post mortem clot.
- These deep vein thrombi can get detached and embolize to the pulmonary circulation. Large or long thrombi can embolize to the main pulmonary artery trunk, the bifurcation or left or right pulmonary artery and produce massive pulmonary embolism., which leads to instantaneous death due to acute right ventricular failure.
- Embolization of medium sized pulmonary arteries by smaller thrombi usually do not produce any significant effect in otherwise healthy individuals due to compensation by bronchial arterial perfusion; however, they can produce haemorrhagic infarctions in those with already congested and compromised pulmonary perfusion, such as in congestive cardiac failure and mitral stenosis.

Cause of death

Pulmonary embolism due to deep vein thrombosis due to prolonged immobilization resulting from bowel obstruction and aspiration pneumonia

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