COLOUR ATLAS OF FORENSIC TRAUMATOLOGY

COLOUR ATLAS OF FORENSIC TRAUMATOLOGY

Version 1

Traumatic Asphyxia

Prof. Dinesh Fernando
MBBS, MD (Forensic Medicine)
DLM, DMJ (Lond), FCFPSL
Dept. of Forensic Medicine

Dr. Sarangi Amarakoon
MBBS
Dept. of Forensic Medicine

Faculty of Medicine,
University of Peradeniya,
Sri Lanka

In case of any questions, comments, suggestions or errors, please mail the authors on dinesh.fernando@med.pdn.ac.lk or lakshaniamarakoon2015@gmail.com

ISBN: **978-624-96229-0-6**

Uploaded on 05/10/2023

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

MBBS, MD, FCCP, FCGP, DMJ (London), FRCP (London)

FRCP (Glasgow), FRCP (Edinburgh), FRCPath. (UK)

Senior Professor of Forensic Medicine, General Sir John Kotelawala Defence University, Ratmalana.

Emeritus Professor of Forensic Medicine and Toxicology, Faculty of Medicine, University of Colombo

About the authors.....

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. He was conferred a Fellowship by the College of Forensic Pathologists of Sri Lanka in 2021.

Dr. Shashika Weerasinghe was a Temporary Lecturer at the Department of Forensic Medicine. She obtained her MBBS in 2021 from the Faculty of Medicine & Allied Sciences, University of Rajarata.

Dr. Sarangi Amarakoon is a Temporary Research Assistant at the Department of Forensic Medicine. She obtained her MBBS in 2023 with Second class honours University of Peradeniya from the Faculty of Medicine, University of Peradeniya.

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, macro and micro images are from cases conducted by Prof. Dinesh Fernando. Ms. Chaya Wickramarathne did a yeomen service in the initial designing of lay out and formatting the booklet. The compilation of the case and photographs for publication was done by Dr. Shashika Weerasinghe. This is being continued by Dr. Sarangi Amarakoon.

The content herein may be used for academic purposes with due credit given.

Any clarifications, suggestions, comments or corrections are welcome.

COLOUR ATLAS OF

FORENSIC TRAUMATOLOGY

ILLUSTRATIVE CASES

Traumatic Asphyxia

Traumatic Asphyxia

Traumatic asphyxia is a form of mechanical asphyxia, in which respiration is prevented by the external pressure exerted on the chest and the abdomen. As opposed to other types of mechanical asphyxia that may cause obstruction of air entry into the lungs, traumatic asphyxia acts by restricting respiratory movements, and thus, preventing inspiration. It is also known as 'compression asphyxia', or 'crush asphyxia' since gross mechanical forces are the usual cause of the asphyxia.

Traumatic asphyxia is often accidental, but may, occasionally, be homicidal. It occurs when chest expansion and diaphragmatic lowering are prevented due to the compression of the chest and abdomen by a substance or an object. It may also occur when the body gets crushed in a crowd. Burial in the earth (eg: following the collapse of an excavation) or burial in grain, sand, or coal in industrial accidents are a few instances where traumatic asphyxia can occur. Similar restriction of chest movements can occur if the victim is pinned under a vehicle.

The characteristic features of traumatic asphyxia are cervico-facial congestion with swelling, subconjunctival haemorrhage, and cutaneous petechiae.

The autopsy findings seen in traumatic asphyxia include purple discolouration of the head neck and upper trunk (due to intense congestion), petechial haemorrhages of sclerae, conjunctivae, and periorbital area. The congestion extends to the level of the thoracic inlet but may extend below the clavicle down to the level of the third rib. There may be bleeding from the ears and nostrils. When the compression of the chest is due to a solid object, localized abrasions, and contusions can be present unrelated to the margin of congested area.

Upon internal examination, congestion of internal organs is less marked and there may be no evidence of trauma despite the heavy weight on the chest. However, the lungs are usually dark and heavy, associated with subpleural petechial haemorrhages. The right heart and all the veins above the atria are distended. Venous congestion is explained by the failure of pulmonary circulation due to the cessation of normal expansion and collapse of the pulmonary vasculature.

Compression of the upper abdomen and chest increases the intrathoracic pressure, obstructing the superior vena cava. As a result, the venules and capillaries distend and may lead to minute haemorrhages. When this pressure is released, the dilated veins do not regain the tone rapidly. The persistent bluish discolouration of the skin can be explained by the stasis of blood in these atonic vessels and this can be supported by the fact that this cutaneous discolouration blanches on pressure. If pressure is applied to the skin, the over-distension of the venules is prevented. Therefore, conjunctival haemorrhages are common since there is a relative lack of tissue support in the surrounding area. Retinal haemorrhages may also be seen.

History

A 56-year-old male was mowing the grass on his home property, when the tractor he was driving, overturned, causing him to be trapped underneath the vehicle. He was discovered face down and rigor mortis was well developed by that time.

External examination

Significant congestion was present on the right side of the forehead, around the eyelids, face, neck, both shoulders, and both axillae. Blotchy haemorrhages were present within the area of congestion. Large blotchy haemorrhages were seen in the sclera which were more on the right side.

Figure 1: Hypostasis with petechiae and ecchymosis over the right lateral aspect of the body

Figure 2: Significant congestion on the face and both shoulders with pale lower chest and abdomen

Figure 3: Congestion of the forehead and face excluding the left cheek

Figure 4: Congestion on the forehead, periorbital area, and right side of the face

Figure 5: Congestion of the left axilla

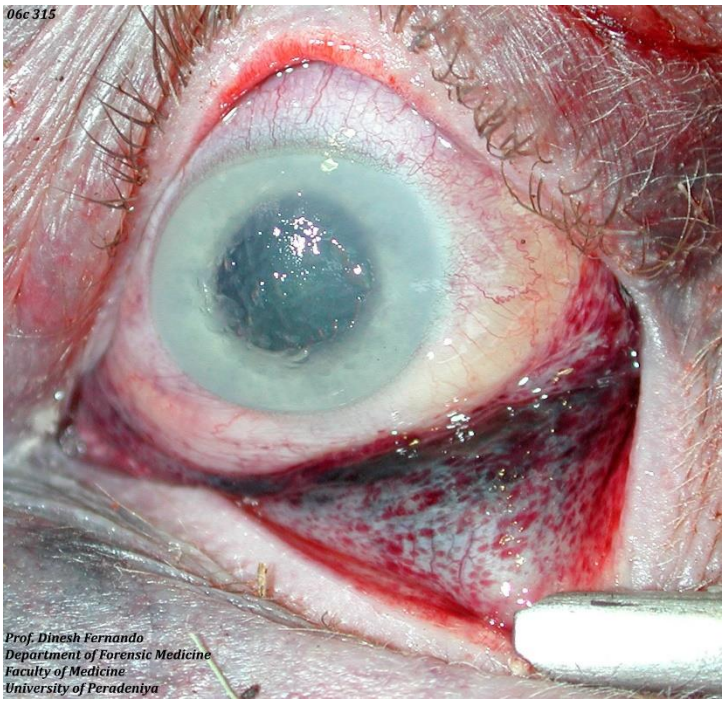

Figure 6: Congested conjunctiva with multiple petechial haemorrhages

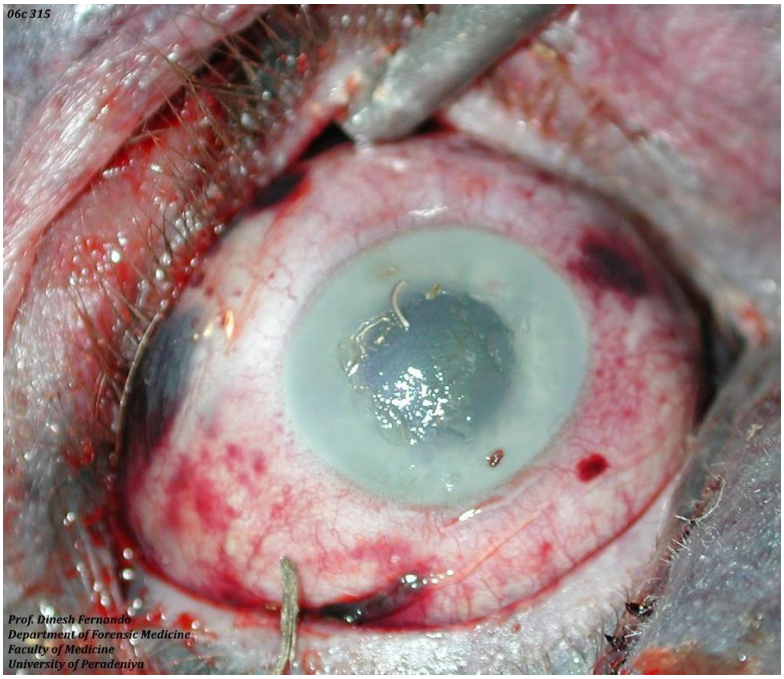

Figure 7: Large blotchy haemorrhages in the sclera

Figure 8: Blood-stained fluid in the nostril. Note the post-mortem insect bites in the left maxillary area

Figure 9: The tongue protruded and clamped between the teeth

Figure 10: Congested lower lips

Figure 11: Hypostasis on the right mid-upper arm and visible forearm; note the deep groove directed obliquely downwards and forwards with a lack of hypostasis above it, indicating pressure.

Figure 12: Right hand; note the marked bluish discolouration of the nail beds and two grooves on the pale thenar eminence

Internal Examination

Cardiovascular system: The pericardial surface was smooth and glistening. There were no petechial haemorrhages. The coronary arteries followed their usual courses and distributions and were a right-dominant circulation. The right coronary artery had concentric atheroma which caused approximately 50% occlusion of the lumen while the proximal left anterior descending coronary artery had eccentric atheroma which caused approximately 75% occlusion of the lumen. The left circumflex coronary artery had minimal atheroma.

Respiratory system: The pleural surfaces were smooth and glistening and petechial haemorrhages were present over both lungs. The pulmonary parenchyma manifested congestion.

Central Nervous System: The scalp was extremely congested throughout. The 1,600-gram brain had a congested external appearance. There were no contusions, either old or new, noted on the surface of the brain. There were no epidural, subdural or subarachnoid haemorrhages.

Musculoskeletal System:

1) The 2nd to 7th ribs were fractured anteriorly on the right and the 3rd to 6th ribs were fractured postero-laterally on the right.
2) The 3rd, 4th, 5th and 7th ribs were fractured laterally on the left and at the sterno-chondral junction of the 5th to 9th ribs.
3) There was no fracture of the right humerus.

Other findings of the internal examination were normal.

Figure 13: Severe congestion and blotchy haemorrhages on the inner aspect of the scalp

Examination of the scene

Figure 14: The victim trapped underneath the overturned tractor.

Figure 15: A close up of the part of the overturned tractor, crushing the victims' body

Figure 16: The overturned tractor and the area of grass that was mowed prior to the accident.

Cause of death

Chest injury (mechanical asphyxia). The autopsy findings are consistent with traumatic asphyxia due to being trapped under a tractor.

Bibliography

1. Di Maio DJ, Di Maio VJM. *Forensic Pathology.* 2nd ed. Boca Raton: CRC press; 2001
2. Saukko P, Knight B. Knight's forensic pathology. 4th ed. Boca Raton: CRC press; 2015
3. Colville-Ebeling B, Freeman M, Banner J. Autopsy practice in forensic pathology – Evidence-based or experience-based? A review of autopsies performed on victims of traumatic asphyxia in a mass disaster. *Journal of Forensic and Legal Medicine.* 2014; 22: 33-36.
4. Fred HL, Chandler FW. Traumatic Asphyxia. *American Journal of Medicine*. 1960; 29(3): 508–517.
5. James JP, Jones R, Karch SB, Manlove J. *Simpson's Forensic Medicine*. 13th ed. London: Hodder Arnold; 2011
6. Dolinak D, Matshes EW, Lew EO. *Forensic Pathology Principles and Practice*.1st ed. London: Elsevier Academic Press; 2005