# Thoracic Surgery: Surgical Management of Chest Injuries



VOLUME 7

INTERNATIONAL TRENDS IN GENERAL THORACIC SURGERY

Watts R. Webb Augustin Besson

# INTERNATIONAL TRENDS IN GENERAL THORACIC VOLUME 7 SURGERY

# NOT FOR RESALE

## THORACIC SURGERY: SURGICAL MANAGEMENT OF CHEST INJURIES



Edited by

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with 324 illustrations





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Invited comment: Late sequelae of thoracic injuries

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Invited comment: Airway trauma: tracheobronchial trauma

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Invited comment: Myocardial contusion

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Monitoring for thoracic surgery

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Invited comment: Tracheobronchial aspiration

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Invited comment: Barotrauma

#### DANIEL BENCHIMOL, M.D.

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Invited comment: Esophageal injuries

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Emergency room organization and equipment: a concept

Invited comment: Diaphragmatic injuries

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Invited comment: Acute thoracic compression syndrome—"traumatic asphyxia"

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Invited comment: Airway trauma: tracheobronchial trauma

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The case of war or civil catastrophe

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Tracheobronchial aspiration

#### MAURICE CARA, M.D.

Professor of Anesthesiology, Department of Anesthesiology, Hopital Necker, Paris, France Invited comment: Structural and organizational criteria for the accident and emergency department: the house officer

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Prevention of chest trauma

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Air embolism in thoracic trauma

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Invited comment: Tracheal reconstruction with personal techniques

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War wounds of the chest

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Clinical Professor, Department of Surgery, Laval University, Sainte-Foy, Quebec, Canada Late sequelae of thoracic injuries

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Late sequelae of thoracic injuries

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Radiology of mediastinal injuries

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Intrathoracic gas collections

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Invited comment: Causes of early death in thoracic trauma

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Radiologic assessment

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Myocardial contusion

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Penetrating wounds

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Diaphragmatic injuries

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Thoracic Surgeon, Thoracic Surgery Service, La Fe University Hospital, Valencia, Spain Controversial aspects of surgical fixation for traumatic flail chest

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Particularities of thoracic trauma in children

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Management of pain associated with thoracic cage injuries

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Thoracic injuries: ventilation

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Causes of early death in thoracic trauma

Intrathoracic fluid effusions

Acute thoracic compression syndrome—"traumatic asphyxia"

#### PETER GOLDSTRAW, M.B., F.R.C.S.

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Invited comment: Physiotherapy in the posttraumatic period

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Invited comment: Thoracic vascular injury

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Diaphragmatic injuries

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Airway trauma: laryngotracheal trauma

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Tracheobronchial aspiration

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Tracheotomy and cricothyroidotomy

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Epidemiology according to age

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Penetrating wounds

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Management of pain associated with thoracic cage injuries

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Invited comment: Radiology of mediastinal injuries

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Invited comment: Late sequelae of thoracic injuries

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Invited comment: Surgical indications in trauma

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War wounds of the chest

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Invited comment: The case of war or civil catastrophe

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Invited comment: Iatrogenic chest injuries

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Barotrauma

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Surgical indications in trauma, Part 2, Early operation in thoracic trauma

#### MARVIN S. KOGUTT, M.D.

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Invited comment: Air embolism in thoracic trauma

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Invited comment: Emergency room organization and equipment: a concept

#### MARIUS LACHERETZ, M.D.

Professeur, Department Chirurgie Pediatrique, Universite de Droit et de la, Sante, Lille, France Particularities of thoracic trauma in children

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Biomechanics of impact injury

#### ROBERT C. MACKERSIE, M.D., F.A.C.S.

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Invited comment: Management of pain associated with thoracic cage injuries

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Airway trauma: laryngotracheal trauma

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Thoracic vascular injury

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Physiotherapy in the posttraumatic period

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Chest wall fractures

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Heart and pericardium injuries

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Kinematics of chest trauma

Emergency medical services—the flying ambulance

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Postgraduate Professor ISAPS (IPRS); Former Associate Professor, Department of Plastic and Reconstructive Surgery and ENT, University Hospital, Lausanne, Switzerland

Tracheal reconstruction with personal techniques

#### ROBERT H. MILLER, M.D., F.A.C.S.

Professor and Chairman, Department of Otolaryngology, Head and Neck Surgery, Tulane University School of Medicine, New Orleans, Louisiana

Invited comment: Airway trauma: laryngotracheal trauma

#### KENNETH L.G. MILLS, M.D., F.R.C.S.

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Structural and organizational criteria for the accident and emergency department: the house of-

Associations of injuries and their management

#### K. MOGHISSI, B.Sc., M.D., F.R.C.S.(Ed.), F.R.C.S.(Eng.)

Consultant Cardiothoracic Surgeon, Humberside Cardiothoracic Surgical Centre, Castle Hill Hospital, Hull, England

Invited comment: Emergency medical services—the flying ambulance

#### PETER V. MOULDER, M.D.

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Posttraumatic and postoperative empyema

#### KLAUS-MICHAEL MÜLLER, M.D.

Universitats-Professor and Institutsdirektor, Institut fur Pathologie a.d. Berufsgenossenschaftlichen Krankenanstalten Bergmannsheil Bochum, Universitatsklinik, Ruhr-Universitat, Bochum, Federal Republic of Germany

Invited comment: Pathology of the acute posttraumatic lung failure

#### EDWARD R. MUNNELL, M.D., F.A.C.S.

Clinical Professor of Surgery, Department of Surgery, Section of Thoracic and Cardiovascular Surgery, University of Oklahoma Health Science Center, Oklahoma City, Oklahoma

Chest drainage in the traumatized patient

#### HEINZ NEEF, M.D., D.Sc.

Professor of Surgery, Department of Thoracic Surgery, Martin-Luther-University, Halle-Wittenberg, Federal Republic of Germany

Invited comment: Posttraumatic and postoperative empyema

#### WILLIAM M. NOVICK, M.D.

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Chest wall fractures

#### TIMOTHY P. O'DWYER, M.B., F.R.C.S.

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Tracheotomy and cricothyroidotomy

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Titular Professor of Surgery, Head of Thoracic Surgery Service, Department of Thoracic Surgery Service, La Fe University Hospital, Valencia, Spain

Controversial aspects of surgical fixation for traumatic flail chest

#### CH. PEILLON, M.D.

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Invited comment: Controversial aspects of surgical fixation for traumatic flail chest

#### MICHAIL PERELMAN, M.D.

Professor of Surgery, Academician of the U.S.S.R. Academy of Medical Science, Chair of Phthisiopulmonology, All Union Centre of Surgery, First Moscow Medical Institute, Moscow, U.S.S.R.

Invited comment: Airway trauma: tracheobronchial trauma

#### JEAN PETIT, M.D.

Department of Anesthesiology and Critical Care, University of Rouen, Rouen, France Invited comment: Controversial aspects of surgical fixation for traumatic flail chest

#### SERGE POMERLEAU, M.D.

Resident, Division of Thoracic Surgery, Hopital Laval, Laval University, Sainte-Foy, Quebec, Canada

Late sequelae of thoracic injuries

#### ZENO POPOVICI, M.D.

Lecturer, Bucharest University, High School of Medicine; Romania Emergency Hospital, 2nd Surgical Clinic, Bucharest, Romania; Chief of Surgery, County Hospital, Sibiu, Romania

Invited comment: Diaphragmatic injuries Esophageal injuries

#### LOUIS S. PROD'HOM, M.D., Dr. méd.

Professeur, Directeur General, Centre hospitalier universitaire vaudois, Lausanne, Switzerland Emergency room organization and equipment: a concept

#### JACQUES QUESNEL, M.D.

Professeur, Chef de service d'Anesthesie-Reanimation, Faculte de Medecine Caen, Centre hospitalo-univeersitaire de Caen, Caen, France

Invited comment: Airway trauma: tracheobronchial trauma

#### MAX L. RAMENOFSKY, M.D.

Professor of Surgery and Pediatrics, Chief, Division of Pediatric Surgery, Department of Pediatric Surgery, University of South Alabama, Mobile, Alabama

Invited comment: Particularities of thoracic trauma in children

#### CARL E. RAVIN, M.D.

Professor and Chairman, Department of Radiology, Duke University Medical Center, Durham, North Carolina

Invited comment: Radiologic assessment

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Agrege and Privat-docent, Department of Anesthesiology, Centre hospitalier universitaire vaudois, Lausanne, Switzerland

Invited comment: Tracheotomy and cricothyroidotomy

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Pathology of acute posttraumatic lung failure

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Particularities of thoracic trauma in children

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Perforating wounds

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Invited comment: Esophageal injuries

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Lung injuries

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Invited comment: War wounds of the chest

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Invited comment: Chest wall fractures

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Resident, Department of General Surgery, Laval University, Sainte Foy, Quebec, Canada Late sequelae of thoracic injuries

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Pathology of acute posttraumatic lung failure

#### PIERRE A. SCHNYDER, M.D.

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Radiologic assessment

#### STEVEN R. SHACKFORD, M.D., F.A.C.S.

Chairman and Professor, Department of Surgery, University of Vermont, Burlington, Vermont Invited comment: Management of pain associated with thoracic cage injuries

#### G. TOM SHIRES, M.D.

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Invited comment: Emergency medical services—the flying ambulance

#### WILLIAM J. SIBBALD, M.D., F.R.C.P.(C), F.A.C.P.

Coordinator, Program in Critical Care, The University of Western Ontario; Coordinator, The Richard Ivey Critical Care Trauma Centre, Victoria Hospital, London, Ontario, Canada

Invited comment: Myocardial contusion

#### WILLIAM H. SNYDER, III, M.D.

Professor of Surgery, University of Texas, Health Science Center at Dallas, Dallas, Texas Invited comment: Association of injuries and their management

#### RONALD D. STEWART, B.A., B.Sc., M.D., F.A.C.E.P., F.R.C.P.C., D.Sc.(hon)

Chief, Department of Emergency Medicine, Sunnybrook Medical Centre/University of Toronto; Professor of Surgery and Anaesthesia, University of Toronto, Toronto, Ontario, Canada

Airway control and intubation in thoracic trauma Comment and clarification

#### RENÉ E. STOPPA, M.D.

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Invited comment: Laparotomy

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Invited comment: Intrathoracic fluid effusions

#### PETER M. SUTER, M.D., F.C.C.P.

Professor and Chief, Division of Surgical Intensive Care, Department of Anesthesia, University Hospital, Geneva, Switzerland

Invited comment: Airway control and intubation in thoracic trauma

#### JOHN E. SUTTON, Jr., M.D.

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Thoracic injuries: ventilation

#### PANAGIOTIS N. SYMBAS, M.D.

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Median sternotomy or thoracotomy

#### GYÖZÖ J. SZABÓ, M.D.

Chief Surgeon, Department of Thoracic Surgery, Postgraduate Medical School, National Institute of Traumatology, Budapest, Hungary

Invited comment: Iatrogenic chest injuries

#### VICENTE TARRAZONA, M.D.

Thoracic Surgeon Consultant, Thoracic Surgery Service, La Fe University Hospital, Valencia, Spain

Controversial aspects of surgical fixation for traumatic flail chest

#### JACQUES TESTART, M.D.

Professeur de Clinique Chirurgicale, Hopital Charles Nicolle, Rouen, France

Invited comment: Controversial aspects of surgical fixation for traumatic flail chest

#### ERWIN R. THAL, M.D.

Professor, Department of Surgery, University of Texas Southwestern Medical Center at Dallas, Dallas, Texas

Invited comment: Structural and organizational criteria for the accident and emergency department: the house officer

#### GREGORY A. TIMBERLAKE, M.D.

Associate Professor and Director, Jon Michael Moore Trauma Center, Department of Surgery, West Virginia University School of Medicine, Morgantown, West Virginia

Invited comment: Diaphragmatic injuries

#### DONALD D. TRUNKEY, M.D.

Professor and Chairman, Department of Surgery, Oregon Health Sciences University, Portland, Oregon

Invited comment: Prevention of chest trauma

#### SIEGFRIED J. TUENGERTHAL, M.D.

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Iatrogenic chest injuries

#### MICHAEL K. URBAN, M.D., Ph.D.

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Monitoring for thoracic surgery

#### HAROLD C. URSCHEL, Jr., M.D.

Professor of Thoracic and Cardiovascular Surgery, Department of Thoracic and Cardiovascular Surgery, Baylor University Medical Center, Dallas, Texas

Invited comment: Median sternotomy or thoracotomy

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Airway trauma: tracheobronchial trauma

#### DATLA G.K. VARMA, M.D.

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Radiology of mediastinal injuries

#### J.F. VELLY, M.D.

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Invited comment: Chest drainage in the traumatized patient

#### DAVID C. VIANO, Ph.D.

Principal Research Scientist, Department of Biomedical Science, General Motors Research Laboratories, General Motors Technical Center, Warren, Michigan

Biomechanics of impact injury

#### Ph. VICHARD, M.D.

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Invited comment: Laparotomy

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Myocardial contusion

#### GUY VOORDECKER, M.D.

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Invited comment: Acute thoracic compression syndrome—"traumatic asphyxia"

#### ROBERT B. WAGNER, M.D., F.A.C.S.

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Invited comment: Lung injuries

#### DEIRDRE C.T. WATSON, M.D., F.R.C.S.

Consultant Thoracic Surgeon, Regional Department of Thoracic Surgery, East Birmingham Hospital, Birmingham, England

Invited comment: Intrathoracic gas collections

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Adult respiratory distress syndrome: clinical facets Surgical indications in trauma, Part 3, Late operation in thoracic trauma

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Airway trauma: tracheobronchial trauma

#### GLENN J.R. WHITMAN, M.D.

Assistant Professor and Chief, Department of Cardiothoracic Surgery, University of Colorado Health and Science Center, Denver, Colorado

Invited comment: Causes of early death in thoracic trauma

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Iatrogenic chest injuries

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Surgical indications in trauma, Part I, Immediate (resuscitative) thoracotomy for trauma

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Invited comment: Monitoring for thoracic surgery

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Emergency room organization and equipment: a concept

We would like to dedicate this volume to the residents, registrars, and fellows who are at the front line in management of trauma victims at all hours of the day and night.

Their dedication and thoughtful care of the patients according to established and newly evolving concepts have made possible the experience, and through this, the principles described in this book.