

ORIGINAL RESEARCH

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Civilian vascular trauma, treatment and outcome at a level 1-trauma centre

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Abstract

Background: Outcomes after vascular injuries in wartime are well documented, but studies on vascular injuries in a civilian European populations are scarce.

Methods: A retrospective study on all adults admitted to a North-European level 1-trauma centre 2009–2018 with The Abbreviated Injury Scale-codes for non-iatrogenic vascular trauma (VT). Data were extracted from both national and regional trauma-registries, as well as patient charts. Patient demographics, mechanism, and location of vascular injury were registered as well as its treatment. Incidence and injury scores (ISS, NISS and TRISS) were calculated and overall survival (Kaplan–Meier) estimated.

Results: Of 4042 trauma-patients, 68 (1.7%) (median age 44 years, 76% males) sustained 81 vascular injuries (69 arterial; 12 venous); 46 blunt and 22 (32%) penetrating injuries. The total incidence of vascular injuries was 1.45/100,000 inhabitants and did not change over the study-period (95% confidence interval 1.13–1.82). The injuries were located in thorax (n = 17), neck (n = 16) and abdominal region (n = 15); most of the blunt injuries followed traffic (n = 31) or falling accidents (n = 10), and with 17 of the 22 penetrating injuries due to stabbing. The median ISS and NISS-scores were 22 and 33, with 50 (74%) and 55 (81%) patients having scores > 15, respectively. Forty-three (63%) patients had open surgical repair and 8 (12%) received endovascular treatment. Twenty-one patients died within 30-days (31%), 33% and 27% after blunt and penetrating injuries, respectively. Half of the patients that died within 24 h sustained aortic injury.

Conclusions: Traumatic vascular injuries are rare in civilian settings and are less than 2% of major trauma admissions. These patients are often seriously injured and their treatment can be challenging with high 30-day mortality.

Trial registration: Retrospectively registered.

Keywords: Vascular trauma, Injury score, Blunt, Penetrating, Scandinavian, Mortality, Treatment

Introduction

Trauma due to violence and injury kills nearly half a million people in Europe every year and many more are injured [1]. Even though progress has been made in pre-hospital care, injury prevention, automotive safety and emergency medical services, the proportion of deaths

occurring immediately after trauma still remains at 50–60% [2]. Injuries still account for 5.3% of all deaths in Europe and are a leading cause of death in people aged 15–29 years, according to the World Health Organization latest report [1]. In Norway approximately 6% of all deaths each year are injury-related [3]. Vascular injuries are common in severe trauma and may be responsible for up to 20% of trauma deaths [4, 5]. Vascular trauma (VT) has been well documented during wartime but epidemiological studies in civilian setting are scarce, both for blunt and penetrating vascular injuries [6–8]. Still the incidence of vascular trauma has been reported between

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Civilian Vascular Trauma

**Mark Creager, Joshua A.
Beckman, Joseph Loscalzo**



Civilian Vascular Trauma:

Civilian Vascular Trauma D. Preston Flanigan, James J. Schuler, Joseph P. Meyer, 1992 **Rich's Vascular Trauma E-Book** Todd E. Rasmussen, Nigel R M Tai, 2021-08-12 For more than 40 years Rich's Vascular Trauma has been surgeons' 1st reference for the diagnosis and treatment of vascular injury in both civilian and military settings across the globe. Published in association with the Society for Vascular Surgery (SVS), the fully updated 4th Edition reflects recent changes in vascular injury patterns, wounds, and trauma care, drawing from current research and a wide variety of peer-reviewed publications to keep you up to date with the latest evidence-based management strategies and techniques. Written and edited by vascular surgeons who are also trauma specialists, civilian and military experts who have proficiency in both open surgical and endovascular techniques, this must-have reference offers a global perspective on every aspect of the broad spectrum of vascular trauma. Covers all vascular surgery procedures required to stop hemorrhage and restore perfusion in vessels in the limbs, junctional areas, torso, and neck, including damage control techniques such as shunting and endovascular techniques such as REBOA and stenting. Addresses pre-hospital, emergency department, surgical, and endovascular stages of treatment in developed, austere, and deployed settings, including a rich section on vascular trauma in multiple international settings that provides important context for the global surgical community. Includes nine new chapters covering prehospital management, endovascular suites, stent grafts, selective aortic arch perfusion, extracorporeal systems, and gathering evidence in vascular trauma, and more. Presents surgical techniques in step-by-step, highly illustrated detail, as well as high-level strategic decision making such as the logistics of setting up an endovascular trauma service. Includes a new, rapidly digestible Tips and Tricks section summarizing how to execute essential vascular maneuvers and management steps to ensure that patients get the best outcomes. Emphasizes the current management of civilian vascular injuries while drawing upon the best available evidence, experience, and lessons learned from Afghanistan, Iraq, and the urban battlefield. Contains an innovative chapter on the systems approach and quality improvement in vascular trauma, offering information and tactics for all providers wishing to understand how clinical systems underpin patient outcome and recovery. Enhanced eBook version included with purchase. Your enhanced eBook allows you to access all of the text, figures, and references from the book on a variety of devices.

Rich's Vascular Trauma E-Book Todd E. Rasmussen, Nigel R M Tai, 2015-04-15 Published in association with the Society for Vascular Surgery (SVS), the newly updated edition of Rich's Vascular Trauma draws on civilian and military authorities from around the world to offer comprehensive and up-to-date coverage of the management of vascular injury. Anatomic patterns of vascular trauma, including extremity, torso, and cervical injury, are reviewed in detail, including the latest techniques to manage non-compressible torso hemorrhage. You'll have access to all of the current innovations across the broad spectrum of vascular trauma, presented in a well-organized fashion that allows you to quickly hone in on the most important issues in patient care and management. Emphasizes the current management of civilian vascular injuries with an

historical reflection of pioneering contributions from the battlefield Combines the largest existing database of military vascular trauma with the experience of one of the nation's premier civilian trauma centers Examines operative techniques and damage control for vascular traumas For the first time includes a novel International Perspectives section featuring fascinating accounts of vascular trauma from nine leading surgeons from five continents This section focuses on innovative surgical treatments tailored to locally developed pathways of care training solutions and regional injury patterns End to end coverage of all phases of acute vascular injury care including a new assessment of the implications of vascular trauma in the pre hospital setting i e point of injury and en route care Covers the emerging hot topics including endovascular procedures to manage trauma contemporary use of vascular shunts and a modern reappraisal of resuscitative endovascular balloon occlusion of the aorta for shock An innovative chapter on the systems approach and quality improvement in vascular trauma offering information and tactics for all providers wishing to understand how clinical systems underpin patient outcome and recovery from this challenging injury pattern A combined civilian and military authorship from internationally recognized authorities draws on the best available evidence experience and lessons learned from Afghanistan Iraq and the urban battlefield Expert Consult eBook version included with purchase This enhanced eBook experience allows you to search all of the text figures references and videos from the book on a variety of devices

Emergency Vascular and Endovascular Surgical Practice Aires Barros D'Sa, Anthony Chant, 2005-10-28 Emergency vascular and endovascular practice comprises almost half the workload undertaken by the majority of vascular surgeons Most vascular emergencies are characterised by the sudden occlusion rupture or injury of a blood vessel placing organ limb and life at risk An attitude of urgency and of good judgement both in diagnostic assessment and

Current Therapy of Trauma and Surgical Critical Care E-Book Juan A. Asensio, Donald D. Trunkey, 2008-04-03 Here's a unified evidence based approach to problems encountered in trauma and critical care surgical situations Comprehensive and concise it is ideal for a quick overview before entering the operating room or ICU or as a review for board certification or recertification Be prepared for the unexpected with practical concise coverage of major surgical problems in trauma and critical care Get expert practical and up to date guidance on ventilator management damage control noninvasive techniques imaging infection control dealing with mass casualties treating injuries induced by chemical and biological agents and much more Find the information you need quickly and easily through numerous illustrations key points boxes algorithms and tables

Vascular Trauma Norman M. Rich, Kenneth L. Mattox, Asher Hirshberg, 2004 Covers injuries to the upper and lower extremities as well as the internal organs discusses everything from initial care and diagnostic options through the management of specific injuries and special problems to dealing with complications describes the newest diagnostic modalities such as color flow Doppler and MR angiography as well as the latest interventional techniques and addresses specific challenges such as minimal vascular injuries endovascular grafts iatrogenic vascular trauma vascular trauma associated with illicit drug use and compartment syndromes

Operative Techniques in Trauma and Critical Care Amy J. Goldberg, Mary T. Hawn, 2023-03-13 With an emphasis on the hows and whys of contemporary surgery *Operative Techniques in Trauma and Critical Care* features concise bulleted text full color illustrations and intraoperative photographs to clarify exactly what to look for and how to proceed Drawn from the larger *Operative Techniques in Surgery* Second Edition this newly stand alone surgical atlas overseen by editor in chief Mary T Hawn and meticulously edited by Dr Amy J Goldberg focuses on the steps of each technique rapidly directing you to the information you need to choose the right approach for each patient perform it successfully and achieve the best possible results

Vascular Medicine: A Companion to Braunwald's Heart Disease E-Book Mark Creager, Joshua A. Beckman, Joseph Loscalzo, 2019-05-22 With authoritative coverage of everything from recent discoveries in the field of vascular biology to recent clinical trials and evidence based treatment strategies *Vascular Medicine* 3rd Edition is your go to resource for improving your patients cardiovascular health Part of the Braunwald family of renowned cardiology references this updated volume integrates a contemporary understanding of vascular biology with a thorough review of clinical vascular diseases making it an ideal reference for vascular medicine specialists general cardiologists interventional cardiologists vascular surgeons and interventional radiologists Incorporates technologic advances in vascular imaging including ultrasound MRI CTA and catheter based angiography along with more than 230 new figures providing an up to date and complete view of the vascular system and vascular diseases Covers novel antithrombotic therapies for peripheral artery disease and venous thromboembolism advances in endovascular interventions for aortic aneurysms and today's best surgical treatments for vascular diseases Includes seven new chapters Pathobiology of Aortic Aneurysms Pathobiology and Assessment of Cardiovascular Fibrosis Large Vessel Vasculitis Medium and Small Vessel Vasculitis Epidemiology and Prognosis of Venous Thromboembolic Disease Fibromuscular Dysplasia and Dermatologic Manifestations of Vascular Disease Discusses methods for aggressive patient management and disease prevention to ensure minimal risk of further cardiovascular problems Keeps you current with ACC AHA and ECC guidelines and the best ways to implement them in clinical practice Enhanced eBook version included with purchase which allows you to access all of the text figures and references from the book on a variety of devices

Rutherford's Vascular Surgery, 2-Volume Set Jack L. Cronenwett, K. Wayne Johnston, 2010-03-09 *Rutherford's Vascular Surgery* the most acclaimed comprehensive reference in its field presents definitive state of the art guidance on every aspect of vascular health care equipping you to make the best clinical decisions and optimize outcomes Extensively revised by many new international authors led by Drs Jack Cronenwett and K Wayne Johnston and now published in association with the Society for Vascular Surgery this 7th Edition provides the authoritative answers that surgeons interventionalists and vascular medicine specialists need to provide effective care for vascular surgery patients Consult this title on your favorite e reader with intuitive search tools and adjustable font sizes Elsevier eBooks provide instant portable access to your entire library no matter what device you're using or where you're located Get answers you can depend on

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Global Surgery Mark A. Hardy, Beth R. Hochman, 2023-07-24 Few books have been published to assist local and visiting clinicians in addressing opportunities to expand surgical care in low and middle income countries With contributions from international experts and surgical leaders this book serves as a valuable resource for local and visiting faculty trainees and students in their endeavors to deliver surgical services in existing facilities as well as to develop new infrastructures for specialized surgical care This book presents an anthology of important lessons gleaned from the experiences of participants in selected academic global surgery centers and existing partnerships all over the world Contributing authors summarize methods to build partnerships and expand capacity with a focus not only on how to but also on what worked what didn't work and what could be done differently They discuss specific examples ranging from implementing colon cancer screening to building a transplant program In addition several chapters describe approaches to diagnosis and management of specific surgical pathologies in limited resource environments as a complement to standard surgical texts in general surgery thoracic surgery neurosurgery urology obstetrics and gynecology orthopedics and surgery for contractures and burns Practical and user friendly Global Surgery encapsulates the increasing enthusiasm of young faculty trainees and medical students to improve access to surgical care in the world's low and middle income countries

Essential Practice of Surgery Jeffrey Norton, M. Li, R. Randal Bollinger, Alfred E. Chang, Stephen F. Lowry, Sean J. Mulvihill, Harvey I. Pass, Robert W. Thompson, 2006-05-11 A condensed version of the critically acclaimed Surgery Basic Science and Clinical Evidence Essential Practice of Surgery provides a state of the art evidence based approach to surgery for surgeons residents and medical students The book is divided into 8 comprehensive sections providing the most succinct coverage of critical topics Care of the Surgical Patient Gastrointestinal

Endocrine Surgery Vascular Surgery Cardiothoracic Surgery Transplantation Cancer and Associated Disciplines Over 250 illustrations and 340 tables including 62 evidence based tables complement the text Rutherford's Vascular Surgery and Endovascular Therapy, 2-Volume Set, E-Book Anton N. Sidawy, Bruce A. Perler, 2022-06-04 Encyclopedic definitive and state of the art in the field of vascular disease and its medical surgical and interventional management Rutherford's Vascular Surgery and Endovascular Therapy offers authoritative guidance from the most respected and innovative global thought leaders and clinical and basic science experts of our time The thoroughly revised 10th Edition published in association with the Society for Vascular Surgery and authored by multidisciplinary and international contributors is an outstanding reference for vascular surgeons vascular medicine specialists interventional radiologists and cardiologists and their trainees who depend upon Rutherford's in their practice Under the expert editorial guidance of Drs Anton N Sidawy and Bruce A Perler it is quite simply the most complete and most reliable resource available on the art and science of circulatory diseases Incorporates fundamental vascular biology diagnostic techniques and decision making as well as medical endovascular and surgical treatment of vascular disease Features numerous concise and comprehensive diagnostic and therapeutic algorithms vital to patient evaluation and management Covers all vascular imaging techniques offering a non invasive evaluation of both the morphology and hemodynamics of the vascular system Employs a full color layout images and online videos so readers can view clinical and physical findings and operative techniques more vividly Contains fully updated and more concise chapters with a focused format and summary for each that provides a quick access to key information ideal for consultation as well as daily practice Includes expanded coverage of the business of vascular surgery including a new section on the use of technology platforms and social media and new chapters on telemedicine the development and operation of outpatient dialysis centers and multispecialty cardiovascular centers vascular information on the internet and much more Provides new content on key topics such as endovascular treatment of complex aortic disease acute vascular occlusion in the pediatric population outpatient vascular care and anatomic surgical exposures for open surgical reconstructions Enhanced eBook version included with purchase Your enhanced eBook allows you to access all of the text figures and references from the book on a variety of devices Vascular Surgery, An Issue of Surgical Clinics, E-Book Ravi Veeraswamy, Dawn Coleman, 2023-07-18 In this issue guest editors bring their considerable expertise to this important topic Provides in depth reviews on the latest updates in the field providing actionable insights for clinical practice Presents the latest information on this timely focused topic under the leadership of experienced editors in the field Authors synthesize and distill the latest research and practice guidelines to create these timely topic based reviews The Evidence for Vascular Surgery; second edition Jonathan J Earnshaw, John A Murie, 2007-01-01 Winner of a HIGHLY COMMENDED AWARD in the Surgery category of the 2007 BMA Medical Book Competition The first edition published in 1999 was described as a longed for addition to the literature and as a text that cannot be compared with any other book on vascular surgery Lancet 2000 355 1918 At the time

it was different a book to help busy clinicians sift through surgical research and use it to make sensible decisions for their clinical practice The challenge for this second edition is to produce something better still The new edition is larger and more comprehensive thanks to valuable suggestions from colleagues and reviewers The text is as accessible as possible with short chapters recommendations for management comprehensive referencing and full colour illustration It belongs on the shelf or in the briefcase of everyone who has to treat patients with vascular disease **Cumulated Index Medicus** ,1975

Vascular Surgery Christos D. Liapis,Klaus Balzer,Fabrizio Benedetti-Valentini,Jose Fernandes e Fernandes,2007-03-31 This practical guide is devoted to vascular diseases as dealt with by vascular surgeons It is written with the collaboration of other specialists attending to vascular diseases The book provides a concise overview of the current level and standards of care of vascular diseases in the European Union and fills the need of vascular specialists who prepare for the U E M S exam The text is well structured and contains practical guidelines The readership that will benefit most will be trainees and practitioners in vascular surgery angiology and also practicing physicians However the book will also be valuable to physicians of other specialties Iatrogenic Vascular Injuries Sven-Erik Bergentz,David Bergqvist,2012-12-06 This small but information packed book is the first to focus exclusively on iatrogenic vascular injuries It is a timely first for the scope and magnitude of this subject have reached almost epidemic proportions recently as a result of exponential increases in the use of invasive diagnostic and therapeutic procedures by almost every medical and surgical speciality The data on vascular trauma from civilian experiences are becoming dominated by injuries of iatrogenic cause Even were it not for medical legal liability the importance of prompt recognition and correct treatment of injuries that we ourselves cause is obvious as is the need for preventive measures to be clearly identified and adopted This book serves these needs well through a nicely balanced focus on prevention on the one hand with its comprehensive review of epidemiology and etiology and on management on the other with its practical comments on diagnosis treatment and outcome The organization of this book makes it very usable After chapters on both arterial and venous catheterization injuries there follows a thorough analysis of injuries associated with percutaneous transluminal angioplasty and other endovascular procedures Then after a chapter on noninvasive vascular injuries there follows a series of chapters dealing with vascular injuries associated with the practice of specific specialties radiation therapy orthopedics neurosurgery especially lumbar disc surgery gynecology head and neck surgery urology adult general surgery and pediatric surgery **Vascular Injuries in Surgical Practice** Fred S. Bongard,1991 *Anatomy & Physiology with Brief Atlas of the Human Body and Quick Guide to the Language of Science and Medicine - E-Book* Kevin T. Patton, Frank B. Bell, Terry Thompson, Pegg L. Williamson, 2022-03-21 A P may be complicated but learning it doesn't have to be Anatomy Physiology 11th Edition uses a clear easy to read approach to tell the story of the human body's structure and function Color coded illustrations case studies and Clear View of the Human Body transparencies help you see the Big Picture of A P To jump start learning each unit begins by reviewing what you have

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