

A Comparison of Three Different Methods of Fixation in the Management of Thoracolumbar Fractures

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Abstract

Introduction

Management of thoracolumbar fractures remains controversial in the literature. The primary aims of this study were to assess different levels of fixation with respect to radiological outcomes in terms of fracture reduction and future loss of correction.

Methods

This is a single center, retrospective study. Fifty-five patients presenting with thoracolumbar fractures between January 2012 and December 2015 were analyzed in the study. The levels of fixation were divided in 3 groups, 1 vertebra above and 1 below the fracture (1/1), 2 above and 2 below (2/2), and 2 above and 1 below (2/1).

Results

The most common mechanism was high fall injury and the most common vertebra L1. Burst fractures were the ones with the highest incidence. The 2/2 fixation achieved the best reduction of the fracture but with no statistical significance. The correction is maintained better by the 2/2 fixation but there is no statistical difference compared to the other fixations. Insertion of screws at the fracture level did not improve outcomes.

Conclusion

The data of this study identified a trend towards better radiological outcomes for fracture reduction and maintenance of the correction in the 2/2 fixations. However these results are not statistically significant. Future multicenter prospective clinical trials are needed in order to agree on the ideal management and method of fixation for thoracolumbar fractures.

KEYWORD: THORACOLUMBAR, SPINE, FRACTURES, FIXATION, SURGERY
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Introduction

The majority of vertebral fractures in the axial skeleton occur in the thoracolumbar spine.¹ The thoracolumbar area is the transition of the rigid thoracic spine into the mobile lumbar spine and it is considered biomechanically the weakest part of the spine. This characteristic makes it vulnerable to increased stresses and injuries.^{2,3} Thoracolumbar injuries are usually the result of high energy trauma like motor vehicle accidents or falls from a height.¹

Numerous thoracolumbar fracture classifications have been proposed that aim to help in diagnosis,

guide treatment and help with communication.

Amongst the most significant are the ones proposed by Dennis, Magerl, the Thoracolumbar Injury Classification System (TLICS) by Vaccaro and the AOSpine Thoracolumbar spine injury classification system by Vaccaro.⁴⁻⁷ The Denis classification system introduced a modern concept on spinal stability, the 3-column theory. CT and MRI scans later revealed a more complex stability mechanism and rendered the Denis Classification as an incomplete model however it is still thought to have some use in modern practice. The latest AOSpine Thoracolumbar spine injury classification system (Table 1) combines the strengths of the Magerl and TLICS in terms of mor-

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Management of Thoracolumbar Fractures Charles A. Reitman, 2004 The newest addition to the AAOS Monograph series this title offers orthopaedic surgeons detailed information and instruction relating to thoracolumbar fractures

Rockwood and Green's Fractures in Adults Charles A. Rockwood, Robert W. Bucholz, Charles M. Court-Brown, James D. Heckman, Paul Tornetta, 2010 In its thoroughly revised updated Seventh Edition Rockwood and Green's Fractures in Adults offers a complete print and multimedia package the established gold standard two volume reference on fractures and access to an integrated content website More than 80 of the world's foremost authorities provide comprehensive coverage of all bone and joint injuries thoroughly discuss alternative methods for treating each injury and present their own preferred methods This edition has 33 new contributors and new chapters on principles of nerve injury and complex regional pain syndrome psychological aspects of trauma gunshot and wartime injuries principles of mangled extremity management amputations limb salvage reconstruction principles of post traumatic infections principles of nonunions and principles of malunions A companion website contains the fully searchable text an image bank and videos of 25 surgical procedures

Advancing the understanding of surgical management for degenerative spine conditions Lingxiao Chen, Shiqing Feng, Wei Zeng, Hengxing Zhou, 2023-02-08 Contemporary Surgical Management of Fractures and Complications Asif Ilyas, Saqib Rehman, 2013-03-31 This two volume set is a complete guide to the surgical management of fractures and complications Volume one discusses the upper extremity and spine and Volume two examines the pelvis and lower extremity Each chapter discusses a different type of fracture providing a step by step guide through history clinical presentation diagnostic testing imaging treatment and complications Written by a recognised US author and editor team this comprehensive manual features 2000 colour illustrations including numerous fluoroscopic images as well as a selection of case studies Key Features Two volume set providing complete guidance to surgical management of fractures and complications Numerous different types of fracture discussed with practical procedural approach Authored by US specialists **AAOS Atlas of Orthoses and Assistive Devices** John D. Hsu, John W. Michael, John R. Fisk, American Academy of Orthopaedic Surgeons, 2008-01-01 With new coverage of postpolio syndrome cranial orthoses and now incorporating the perspectives of renowned physiatrists this is a one stop rehabilitation resource Tips and Pearls in every chapter and a new 2 color format make accessing information a snap Incorporates chapters on the Orthotic Prescription Strength and Materials and the Normal and Pathologic Gait help you understand your role in the rehabilitative process Carries the authority and approval of AAOS the preeminent orthopaedic professional society Contains new chapters on Orthoses for Persons with Postpolio Paralysis Orthoses for Persons with Postpolio Syndromes and Cranial Orthoses Incorporates evidence based recommendations into the chapters on spinal upper and lower limb orthoses to help you select the most proven approach for your patients *ISCoS Textbook on Comprehensive management of Spinal Cord Injuries* Harvinder Singh Chhabra, 2015-01-01 SCI needs management by a team

comprising of doctors physiotherapists occupational therapists nurses vocational counsellor psychologist assistive technologist orthotist and social worker Since the available textbooks did not address the requirements of all disciplines the need for the proposed textbook was reinforced **The Spine: Medical & Surgical Management** Alexander

Vaccaro, 2019-04-30 The Spine Medical and Surgical Conditions is a complete two volume evidence based study edited by an internationally recognised team of spine surgeons based in the USA China Canada Germany Japan Brazil Egypt and India The two volumes are divided into 137 chapters across fourteen sections The first section covers general topics in spinal medicine including anatomy biomechanics physical and neurological examination interventional diagnostics and therapeutics and anaesthesia This is followed by sections on the development of the spine metabolic disorders and bone grafting Subsequent sections focus on surgery for particular parts of the spine including cervical lumbar and thoracic as well as sections on spinal cord injuries and motor preservation Later sections in the book provide information on the spine in paediatrics adult deformity tumours vascular malformations and infections complications of spinal surgery and a final section on minimally invasive techniques Enhanced by 1500 full colour images The Spine Medical and Surgical Conditions is also made available online complete with text images and video with each physical copy Key Points Comprehensive two volume guide to spinal medicine Covers anatomy biomechanics examination diagnostics therapeutics anaesthesia surgery and complications

Enhanced by 1500 full colour images Includes access to online version with complete text images and video Spinal Cord Medicine, Third Edition Steven Kirshblum, Vernon W. Lin, 2018-12-28 In this comprehensive clinically directed reference for the diagnosis and treatment of persons with spinal cord injury and related disorders editors of the two leading texts on spinal cord injury SCI medicine have joined together to develop a singular premier resource for professionals in the field Spinal Cord Medicine Third Edition draws on the expertise of seasoned editors and experienced chapter authors to produce one collaborative volume with the most up to date medical clinical and rehabilitative knowledge in spinal cord injury management across the spectrum of care This jointly configured third edition builds on the foundation of both prior texts to reflect the breadth and depth of the specialty Containing 60 state of the art chapters the book is divided into sections covering introduction and assessment acute injury management and surgical considerations medical management neurological and musculoskeletal care rehabilitation recent research advances system based practice and special topics New and expanded content focuses on the significant changes in the epidemiology of traumatic injury the classification of SCI and the latest medical treatments of multiple medical complications In addition chapters discuss new surgical considerations in acute and chronic SCI and the many advances in technology that impact rehabilitation and patients overall quality of life With chapters authored by respected leaders in spinal cord medicine including those experienced in spinal cord injury medicine physical medicine and rehabilitation neurology neurosurgery therapists and researchers this third edition goes beyond either of the prior volumes to combine the best of both and create a new unified reference that defines the current standard of care for

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Campbell's Operative Orthopaedics E-Book Frederick M. Azar, S. Terry Canale, James H. Beaty, 2016-11-01 Unrivalled in scope and depth Campbell's Operative Orthopaedics continues to be the most widely used resource in orthopaedic surgery relied on for years by surgeons across the globe It provides trusted guidance on when and how to perform every state of the art procedure that's worth using with updates to the new edition including hundreds of new techniques illustrations and digital diagnostic images to keep you abreast of the latest innovations Each chapter follows

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Rockwood and Green's Fractures in Adults Paul Tornetta III, William M. Ricci, Robert F. Ostrum, Michael D. McKee, Benjamin J. Ollivere, Victor A. de Ridder, 2024-08-15 Since its first edition over 60 years ago Rockwood and Green s Fractures in Adults has been the go to reference for treating a wide range of fractures in adult patients The landmark two volume tenth edition continues this tradition with two new international editors a refreshed mix of contributors and revised content throughout bringing you fully up to date with today s techniques and technologies for treating fractures in orthopaedics Drs Paul Tornetta III William M Ricci Robert F Ostrum Michael D McKee Benjamin J Ollivere and Victor A de Ridder lead a team of experts who ensure that the most up to date information is presented in a comprehensive yet easy to digest manner

Mastering Orthopaedic Techniques Spine Surgery Bhavuk Garg, Rajesh Malhotra, 2012-05-15 Part of the well known Mastering Orthopaedic Techniques series this book is a step by step guide to spine surgery for orthopaedic surgeons Presented in an atlas format this reference covers both basic and advanced spinal surgical procedures including minimally invasive correction growing rod technique injection techniques and cervical disk replacement With contributions from internationally recognised orthopaedic specialists this comprehensive reference includes more than 400 detailed images and illustrations

Rockwood and Green's Fractures in Adults Robert W. Bucholz, 2012-03-29 In its thoroughly revised updated Seventh Edition Rockwood and Green s Fractures in Adults offers a complete print and multimedia package the established gold standard two volume reference on fractures and access to an integrated content website More than 80 of the world s foremost authorities provide comprehensive coverage of all bone and joint injuries thoroughly discuss alternative methods for treating each injury and present their own preferred methods This edition has 33 new contributors and new chapters on principles of nerve injury and

complex regional pain syndrome psychological aspects of trauma gunshot and wartime injuries principles of mangled extremity management amputations limb salvage reconstruction principles of post traumatic infections principles of nonunions and principles of malunions

Evidence-based Orthopaedics James Gardner Wright, 2009 Dr James Wright Associate Editor for the Journal of Bone and Joint Surgery presents this landmark publication and novel approach to orthopaedic problems and solutions This new evidence based reference examines clinical options and discusses relevant research evidence to provide you with expert recommendations for best practice The consistent chapter format and featured summary tables provide at a glance access to the evidence based literature and clinical options Leading authorities contribute their expertise so you can apply the most effective clinical solutions to the persistent questions you encounter in your practice You can even access the fully searchable and regularly updated text online The result is an outstanding resource in clinical orthopaedics as well as a valuable framework for translating evidence into practice Features the completely searchable text online via www.expertconsult.com with periodic updates to available evidence alerting you to changing evidence and guidelines Covers common and controversial clinical problems that address the full range of nagging questions in your practice such as the best treatment for displaced fractures of the distal radius or which DVT prophylaxis to use in joint replacement surgery Provides a consistent chapter format that presents clinical questions with evidence based graded recommendations for each treatment to help you make the best informed decisions Includes abundant summary tables that synthesize available literature and recommended clinical approaches for information at a glance Your purchase entitles you to access the website until the next edition is published or until the current edition is no longer offered for sale by Elsevier whichever occurs first If the next edition is published less than one year after your purchase you will be entitled to online access for one year from your date of purchase Elsevier reserves the right to offer a suitable replacement product such as a downloadable or CD ROM based electronic version should online access be discontinued

Fractures of the Cervical, Thoracic, and Lumbar Spine Alexander R. Vaccaro, 2002-09-26 This reference focuses on individualized spinal injury assessments immobilization techniques nonoperative and operative indications operative fixation strategies and prognoses Containing over 1900 references Fractures of the Cervical Thoracic and Lumbar Spine is an invaluable resource for orthopedic spinal and trauma surgeons neurosurgeon

Acute Care Neurosurgery by Case Management P. B. Raksin, 2022-09-01 This book reviews the common clinical scenarios that might trigger emergent consultation for neurosurgical intervention with attention to key components of the clinical interview and exam optimal diagnostic evaluation indications for and the goals of operative intervention perioperative considerations and strategies for complication mitigation This is not a surgical atlas but rather a road map for the journey to the operating room door The intent is to establish a systematic evidence based action plan for the patient presenting in neurologic crisis Each chapter opens with a relevant case vignette and then unfolds through uniform sections to tell the story of how one might approach the disease entity in question

from initial request for consultation to definitive management highlighting steps of the decision making process What are the highest yield questions to ask during a focused interview What are the most pertinent objective exam findings What is the proper differential diagnosis What is the most appropriate and efficient plan for diagnostic evaluation with respect to laboratories and imaging Does this patient have an indication for emergent or urgent neurosurgical intervention If so what is the goal of that intervention What are the most common potential complications of the proposed procedure and what steps might be taken to mitigate those risks Each chapter is punctuated by 3 5 teaching pearls summarizing these key elements The overall goal is to create a framework for assessment that might be applied in the emergency department the trauma bay or the ICU when a neurologic emergency arises The scope of the text encompasses not only cranial and spinal trauma but also entities such as shunt failure stroke aneurysmal subarachnoid hemorrhage pituitary apoplexy cauda equina syndrome and central nervous system infection that might require time sensitive intervention An additional section addresses issues requiring emergent neurosurgical response in the ICU setting including sudden neurologic worsening status epilepticus and abnormal clotting coagulopathy The text will not only serve as a valuable resource for those preparing to take the oral board exam but will also provide a targeted refresher for clinicians taking general neurosurgical call in the community as well as an educational reference for mid level practitioners and those in training who are serving as first responders on behalf of a neurosurgical service

Rothman-Simeone The Spine E-Book Steven R. Garfin, Frank J. Eismont, Gordon R. Bell, Christopher M. Bono, Jeffrey S. Fischgrund, 2017-09-11 Get comprehensive practical coverage of both surgical and non surgical treatment approaches from the world's most trusted authorities in spine surgery and care Rothman Simeone and Herkowitz's The Spine 7th Edition edited by Drs Steven R Garfin Frank J Eismont Gordon R Bell Jeffrey S Fischgrund and Christopher M Bono presents state of the art techniques helping you apply today's newest developments in your practice Highlights critical information through the use of pearls pitfalls and key points throughout the text as well as more than 2 300 full color photographs and illustrations Offers a newly revised streamlined format that makes it easier than ever to find the information you need Contains new chapters on the clinical relevance of finite element modeling and SI joint surgery Includes an expanded section on minimally invasive spine surgery including recent developments and future directions Provides the latest evidence based research from high quality studies including new randomized controlled trials for lumbar stenosis surgery fusion and injections Presents the knowledge and expertise of new international contributors as well as new editorial leadership from Dr Steven Garfin Expert Consult™ eBook version included with purchase This enhanced eBook experience allows you to search all of the text figures and references from the book on a variety of devices

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aspects of the specialty general topics general orthopaedics trauma regional orthopaedics neoplasia and miscellaneous topics and recent advances Questions on bone and joint disorders and paediatric orthopaedics are also included Figures and flowcharts help explain anatomy and algorithms and approaches to treatment methods Also included with this edition is online access to video lectures notes and self assessment The previous edition 9789389587098 published in 2019

Benzel's Spine Surgery E-Book Michael P. Steinmetz, Sigurd H. Berven, Edward C. Benzel, 2021-05-18 Written and edited by world renowned experts in the field Benzel's Spine Surgery Techniques Complication Avoidance and Management 5th Edition provides expert step by step guidance on the evaluation and management of disorders of the spine This definitive two volume work explores the full spectrum of techniques used in spine surgery giving you the tools you need to hone your skills and increase your knowledge in this challenging area Clearly organized and extensively revised throughout it features contributions from both neurosurgeons and orthopaedic surgeons to present a truly comprehensive approach to spine disease Offers a thorough overview of the effective management of patients with spinal disorders including fundamental principles biomechanics applied anatomy instrumentation pathophysiology of spinal disorders surgical techniques motion preservation strategies non surgical management and complication avoidance and management as well as controversies Focuses on both pathophysiology and surgical treatment of spine disease with an increased emphasis on minimally invasive surgery Contains new features such as key points boxes at the beginning of chapters and algorithms to help streamline the decision making process Covers today's hot topics in spine surgery such as health economics artificial intelligence predictive analytics new less invasive techniques including endoscopic spine surgery and the future of spine surgery Provides expert coverage of key topics including biomechanics of motion preservation techniques spinal injuries in sports biologics in spine fusion surgery anterior sub axial cervical fixation and fusion techniques complex lumbosacropelvic fixation techniques and many more Features more than 1 500 high quality illustrations as well as new procedural videos on en bloc spondylectomy minimally invasive endoscopic posterior cervical foraminotomy cervical total disc replacement minimally invasive lumbar decompression of stenosis and more 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 *The Evidence for Neurosurgery* Zoher Ghogawala,, Ajit A Krishnaney,, Michael P Steinmetz,, H Hunt Batjer,, Edward C Benzel, 2012-10-01 This textbook aims to examine some of the most controversial areas of neurological surgery by applying the current evidence to illuminate our understanding of the pathophysiology of each disease and the outcomes from surgical and non surgical treatments The Evidence for Neurosurgery is a textbook that will challenge current dogmas in many instances provide an organized framework for understanding where current evidence can be applied clinically and illustrate where gaps in the evidence exist and how these deficiencies may be filled in the future In the first chapter Clinical Evidence the reader will gain an understanding of the levels of clinical evidence and will learn what types of study designs are appropriate and in which

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web summary in this chapter we talked about feature selection methods how to distinguish between useful features and features that are not likely to be helpful in prediction we talked about dimensionality reduction and we learned how to perform pca in scikit learn

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a net ionic equation is the most accurate representation of the actual chemical process that occurs writing these equations requires a familiarity with solubility rules acid base reactivity

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apr 25 2017 this is understood when you consider the two chemicals appear unchanged before and after the reaction therefore the net ionic equation is $2\text{Cl}^- + 2\text{Ag}^+$

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ions that remain essentially unchanged during a reaction are called spectator ions this means you can ignore them when you

write the ionic equation you only need to model how the solid

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the first step to writing a net ionic equation is balancing the chemical equation present let s use the reaction between sodium chloride and silver nitrate as an example next we write the

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highlights learning objectives by the end of this section you will be able to derive chemical equations from narrative descriptions of chemical reactions write and balance chemical

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the net ionic equation is the chemical equation that shows only those elements compounds and ions that are directly involved in the chemical reaction notice that in writing the net ionic

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what remains when the spectator ions are removed is called the net ionic equation which represents the actual chemical change occurring between the ionic compounds cl aq

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this net ionic equation indicates that solid silver chloride may be produced from dissolved chloride and silver i ions regardless of the source of these ions these molecular and

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write the overall chemical equation the complete ionic equation and the net ionic equation for the reaction of aqueous silver fluoride with aqueous sodium phosphate to give solid silver

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the complete ionic equation for this reaction is as follows equation 4 13 2ag aq 2f aq 2nh₄ aq cr₂o₇²⁻ aq ag₂cr₂o₇ s 2nh₄ aq 2f aq because two nh₄ aq

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