

WHEN TO TRANSFER TO A TRAUMA CENTER?

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WCLA Medical Seminar 2016

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It was an honor and pleasure to present at the Workers' Compensation Lawyers Association Annual Medical Seminar. Your commitment and dedication to continuing education is commendable. I hope you found the lecture to be both educational and thought provoking. Please feel free to contact me for further discussion or assistance at mljdoc@aol.com or 847-324-3965.



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DISCLOSURES

- The 17th Annual Chicago Trauma Symposium
- The Foundation for Education and Musculoskeletal Research (FEMR)

When to Transfer?

- Not a simple decision
- Financial implications
- Legal ramifications
- No clear guidelines
- Level I Trauma Center
 - 24hr in-house general surgery (trauma trained)
 - Ortho, neurosurgery, anesthesia, emergency medicine, plastic surgery, oral and maxillofacial, pediatric, and critical care (trauma trained)

When to Transfer?

- So just transfer the tough cases, right?
- How do we define tough?
- What is your understanding or perception of tough?
- Perception becomes your reality
 - Why was this case transferred?
 - Why wasn't the other case transferred?
 - I have yet to make sense of all the political, economic, legal, and human forces exerted on this most important decision
- The Mother test!
 - What would you have done for your Mom

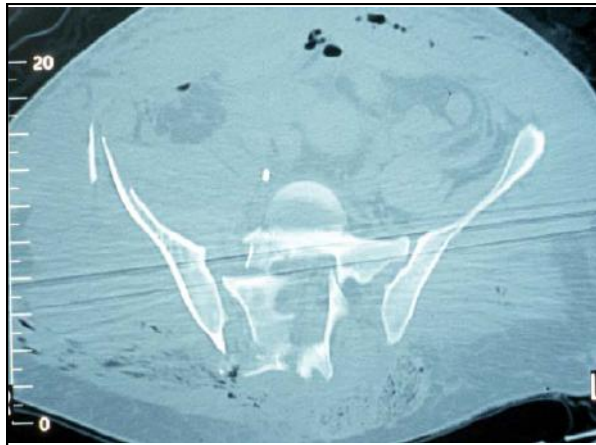
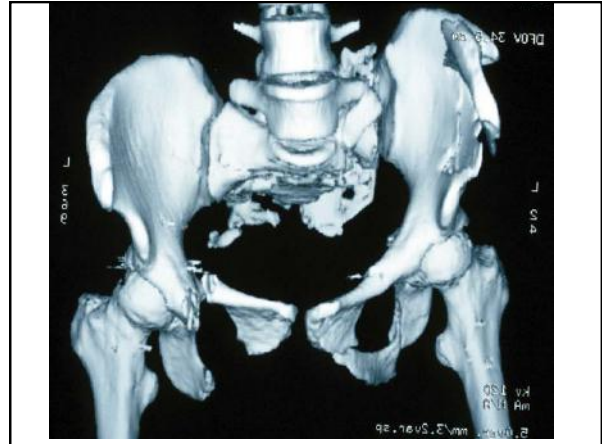
When to Transfer?

- How am I going to teach this?
- The history of human communication is story telling
 - Ancient Camp Fires
 - Show and Tell
- These are my stories
 - Pelvic Fractures
 - Mangled Extremities
- These are the extremes
 - You decide how far you will standardly deviate from these extremes before transfer to a Trauma Center

WHAT IS HIGH ENERGY?

• THE ENERGY DISSIPATED IN THE PATIENT IS PROPORTIONAL TO THE MASS AND THE SQUARE OF THE VELOCITY

$$KE = \frac{1}{2} mv^2$$
$$F = ma$$



HIGH ENERGY PELVIC FRACTURES

- ASSOCIATED INJURIES
 - AORTIC RUPTURE 8 TIMES MORE LIKELY – COMPARED TO NON-PELVIC BLUNT TRAUMA

PELVIC-ASSOCIATED INJURIES

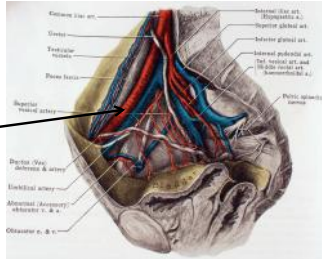
- HEMORRHAGE 75%
- UROGENITAL 12%
- LUMBOSACRAL PLEXUS 8%

HIGH ENERGY PELVIC FRACTURES

- MORTALITY RATE 15-25%
- OTHER ASSOCIATED MUSCULOSKELETAL INJURIES 60-80%

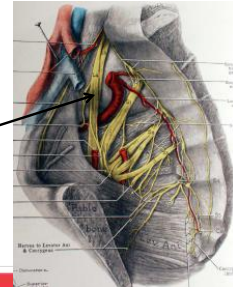
PELVIS

- Several Structures of Consequence Pass Through the Pelvis
 - Vascular
 - Neurologic
 - Genitourinary
 - Gastrointestinal



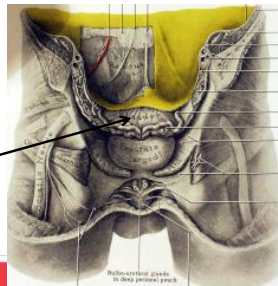
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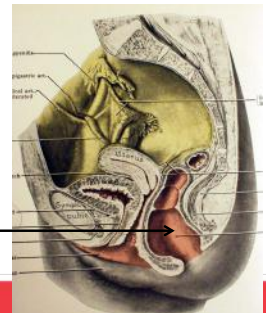
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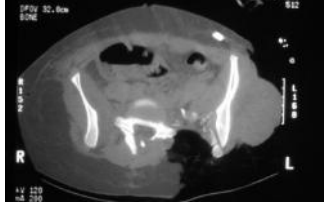
PELVIS

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THEREFORE

- Injuries to the Pelvic Ring may Result in Significant Consequences:
 - Death
 - Disability

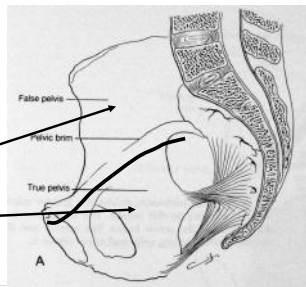


CAUSES OF DISABILITY

- Persistent Pain
 - Malunion
 - Nonunion
- Deformity
 - Pelvic Obliquity
 - Malrotation
 - Leg Length Discrepancy

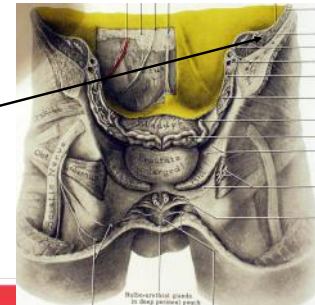
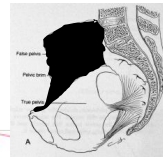
BONY PELVIS

- The Pelvic Brim Divides The Pelvic Basin Into Two Sections
 - False Pelvis
 - Above
 - True Pelvis
 - Below



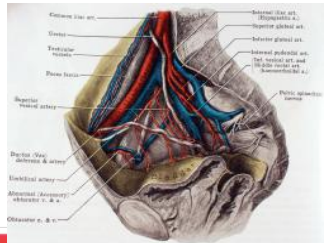
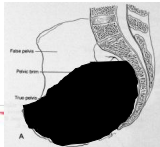
FALSE PELVIS

- Sacral Ala
- Iliac Fossa
 - Covered by Iliacus Muscle



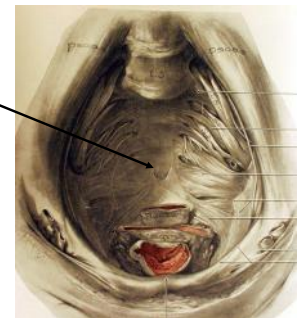
TRUE PELVIS

- Deep Basin Below Pelvic Brim
- Pubis, Ischium, and Small Triangular Portion of Ilium



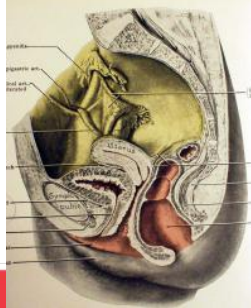
PELVIC DIAPHRAGM

- Like a Trampoline

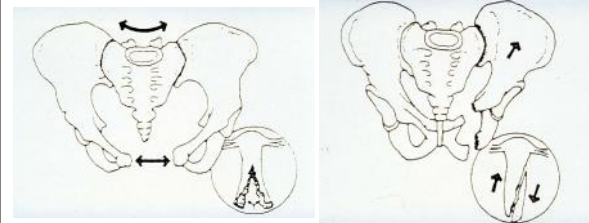


PELVIC DIAPHRAGM

- Coccygeal and Levator Ani Muscles
- Traversed by Three Major Structures
 - Urethra
 - Rectum
 - Vagina



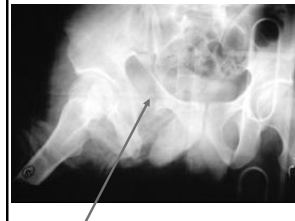
DISRUPTED PELVIC DIAPHRAGM



PELVIC DIAPHRAGM Female: Recto-Vaginal Trauma

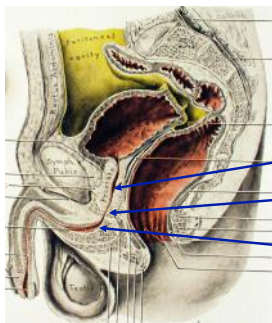


PELVIC DIAPHRAGM Male: Genitourinary Trauma



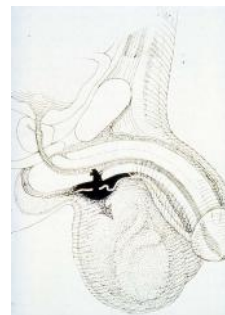
External Rotation-Abduction "Tractor-Pull"

URETHRAL INJURY



Prostate
Pelvic Floor
Bulbous Portion
Urethra

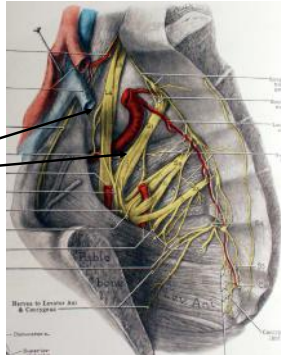
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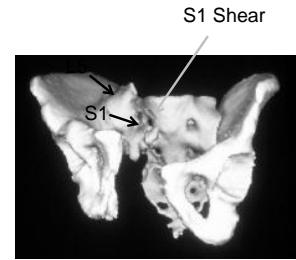
LUMBOSACRAL PLEXUS

- Anterior Rami of T12 through S4

- L4 through S1 Most Important Clinically



LUMBOSACRAL PLEXUS

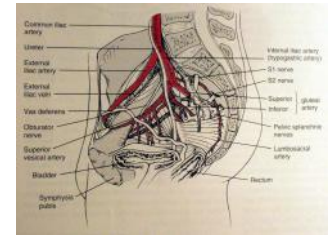


LUMBOSACRAL PLEXUS



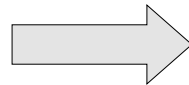
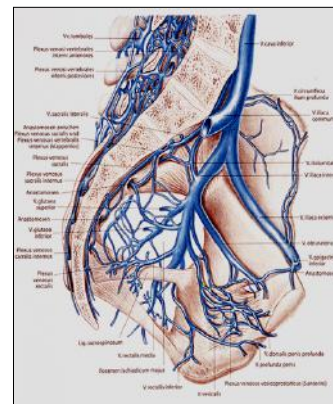
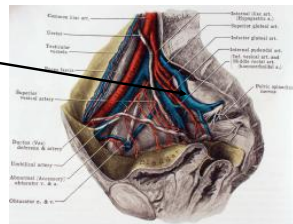
BLOOD VESSELS

- Massive Hemorrhage is the Major Complication of Pelvic Disruptions



PELVIC VEINS

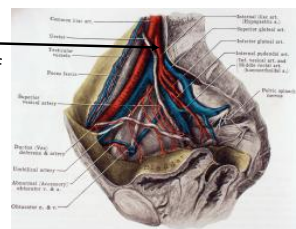
- Large Thin Walled Posterior Venous Plexus
 - Most Drain Into the Internal Iliac Vein
- Bleeding Often Venous





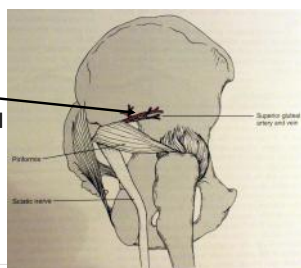
PELVIC ARTERIES

- The Internal Iliac Artery is the Vessel of Major Importance in Pelvic Trauma



PELVIC ARTERIES

- The Superior Gluteal Artery is the Largest Branch of the Internal Iliac Artery



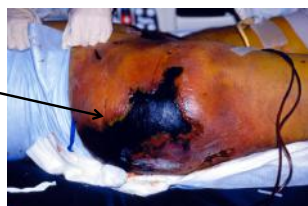
PHYSICAL EXAM

- Deformity
- Leg Length Discrepancies



PHYSICAL EXAM

- Soft Tissues



PHYSICAL EXAM

Manual Stability Assessment – no!

- Warm em' up
 - Fill em' up
 - Wrap em' up
- CT scan
- Donut of death

RADIOGRAPHIC INSTABILITY

- Plain Radiographs



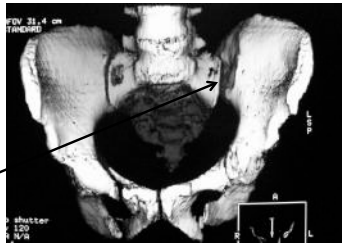
RADIOGRAPHIC INSTABILITY

- Computed Tomography



RADIOGRAPHIC INSTABILITY

- Computed Tomography



SURGICAL INDICATIONS

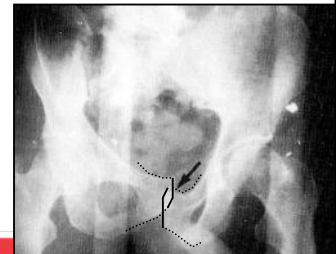
ROTATIONAL DEFORMITY

- Locked Pubic Symphysis



ROTATIONAL DEFORMITY

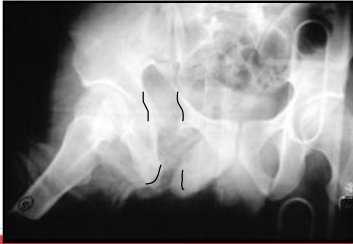
- Locked Pubic Symphysis



PUBIC RAMI FRACTURES

INDICATIONS RAMI FRACTURES

- Injury to Femoral Neurovascular Structure.
- Tilt Fracture
 - Dyspareunia in females



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INDICATIONS RAMI FRACTURES

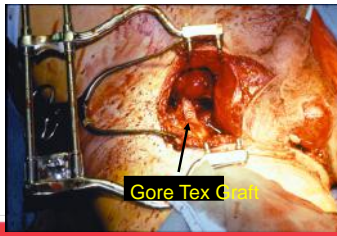
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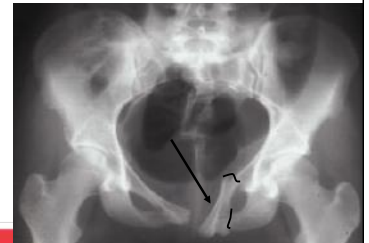
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PUBIC RAMI FRACTURES

INDICATIONS RAMI FRACTURES

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SURGICAL INDICATIONS Uniplanar Instability

- Rotationally Unstable Pelvic Fracture
 - Pubic Symphysis Widening of Greater than 2.5 cm



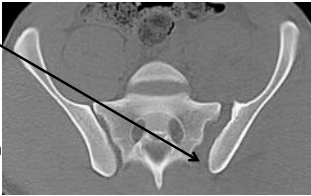
SURGICAL INDICATIONS Multi-planar Instability

- Unstable Posterior Pelvic Ring
 - SI Joint Dislocation
 - SI Joint Fracture-Dislocation
 - Unstable Sacral Fractures
 - Unstable Posterior Iliac Wing Fractures




SURGICAL INDICATIONS
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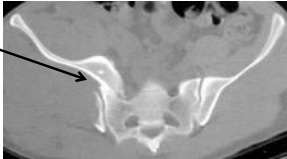
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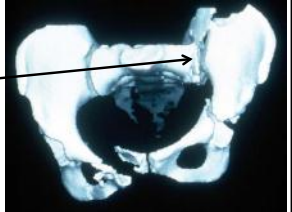
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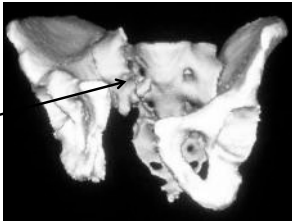
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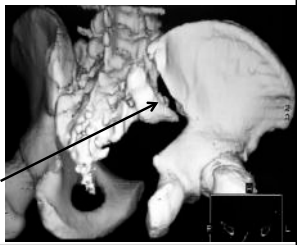
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MANGLED EXTREMITY

HISTORICAL PERSPECTIVE

- IMMEDIATE AMPUTATION AFTER “COMPOUND” FRACTURE INDICATED:
 - MAIN BLOOD VESSELS DAMAGED
 - MAIN NERVES SEVERELY DAMAGED
 - EXTENSIVE DAMAGE TO SOFT PARTS

(Stimson, 1883)

HISTORICAL PERSPECTIVE

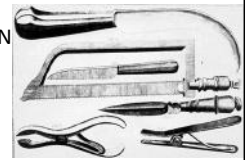
– “WHEN THE BONE IS LITERALLY SMASHED OVER A GREAT EXTENT AND THE NEIGHBORING JOINTS ARE INVOLVED”

(Stimson, 1883)

HISTORICAL PERSPECTIVE

- DURING THE AMERICAN CIVIL WAR OVER 20,000 AMPUTATION WERE PERFORMED

(Hunter, 1983)



HISTORICAL PERSPECTIVE

- PROGRESS HAS BEEN MADE



HISTORICAL PERSPECTIVE

- AMERICAN WAR AMPUTATION RATES FOLLOWING ARTERIAL REPAIR

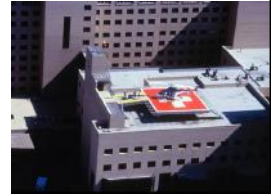


HISTORICAL PERSPECTIVE

- AMPUTATION RATES FOLLOWING ARTERIAL REPAIR:
 - WORLD WAR II 36% (*DeBakey, 1946*)
 - KOREAN WAR 13% (*Hughes, 1958*)
 - VIETNAM WAR 8% (*Heaton, 1966*)

HISTORICAL PERSPECTIVE

- CIVILIAN PRACTICE
 - RAPID TRANSPORTATION AND RESUSCITATION
 - IMPROVED WOUND CARE
 - ANTIBIOTICS



HISTORICAL PERSPECTIVE

- NEW FIXATION METHODS



HISTORICAL PERSPECTIVE

- ADVANCES IN PLASTIC SURGERY
 - FREE TISSUE TRANSFER
- IMPROVED VASCULAR REPAIR TECHNIQUES

HISTORICAL PERSPECTIVE

“YOUNG TRAUMA SURGEONS BEGAN TO BELIEVE THAT ANY AMOUNT OF DAMAGE COULD BE REPAIRED, AND RECONSTRUCTION WAS ATTEMPTED IN VIRTUALLY ALL CASES”
(Hansen, 1988)



HISTORICAL PERSPECTIVE

- PROLONGED ATTEMPTS AT RECONSTRUCTION
- 2-3 YEARS OF HOSPITALIZATIONS
- MULTIPLE SURGERIES
- INFECTIONS AND NONUNIONS
- INEVITABLE AMPUTATIONS

HISTORICAL PERSPECTIVE

“MANY PATIENTS LOST THEIR JOBS, FAMILIES, SAVINGS, AND, MOST IMPORTANTLY, THEIR SELF-IMAGE AND SELF-RESPECT”

(Hansen, 1988)

LITERATURE REVIEW

Gustilo et. al., 1984

- PROTOTYPE OF MASSIVE LOWER EXTREM TRAUMA IS THE **OPEN TIBIA FRACTURE**
 - TYPE IIIA
 - TYPE IIIB
 - TYPE IIIC



LITERATURE REVIEW

- **TYPE IIIA** OPEN TIBIA FRACTURE
 - EXTENSIVE LACERATIONS OR FLAPS, BUT ADEQUATE SOFT-TISSUE COVERAGE OF BONE
 - HIGH ENERGY FRACTURES REGARDLESS OF WOUND SIZE

(Gustilo et. al., 1984)



LITERATURE REVIEW

- **TYPE IIIB** OPEN TIBIA FRACTURES
 - EXTENSIVE SOFT-TISSUE LOSS WITH PERIOSTEAL STRIPPING AND EXPOSED BONE
 - MASSIVE CONTAMINATION IS COMMON

(Gustilo et. al., 1984)



LITERATURE REVIEW

- **TYPE IIIIC OPEN TIBIA FRACTURES**
 - FRACTURES WITH ASSOCIATED ARTERIAL INJURY REQUIRING REPAIR

(Gustilo et. al., 1984)



LITERATURE REVIEW

- **RETROSPECTIVE REVIEW OF 62 TYPE-III OPEN TIBIA FRACTURES**
 - DEMONSTRATED THE PROGNOSTIC VALUE OF GUSTILO'S SUBCLASSIFICATION OF TYPE III INJURIES

(Caudle and Stern, 1987)

LITERATURE REVIEW

- **TYPE IIIA TIBIA FRXS**
 - LOWEST COMPLICATION RATES
 - 27% NONUNIONS
 - NO DEEP INFECTIONS
 - NO SECONDARY AMPUTATIONS

(Caudle and Stern, 1987)

LITERATURE REVIEW

- **TYPE IIIB OPEN TIBIA FRXS**
 - HIGHER COMPLICATION RATES
 - 43% NONUNIONS
 - 29% DEEP INFECTIONS
 - 17% SECONDARY AMPUTATIONS

(Caudle and Stern, 1987)

LITERATURE REVIEW

- TYPE IIIC OPEN TIBIA FRXS
 - DISASTROUS COMPLICATION RATES
 - 100% NONUNION RATE
 - 78% AMPUTATION RATE (EARLY OR LATE)
 - 2 PATIENTS WHO AVOIDED AMPUTATION
 - ONE HAD CHRONIC OSTEOMYELITIS
 - ONE HAD SEVERE PAIN AND EQUINIS AND WAS REQUESTING AMPUTATION

LITERATURE REVIEW

- TYPE IIIC INJURIES
 - CLEARLY MOST PROBLEMATIC
 - DECISION TO SALVAGE OR AMPUTATE REQUIRES URGENT CONSIDERATION

LITERATURE REVIEW

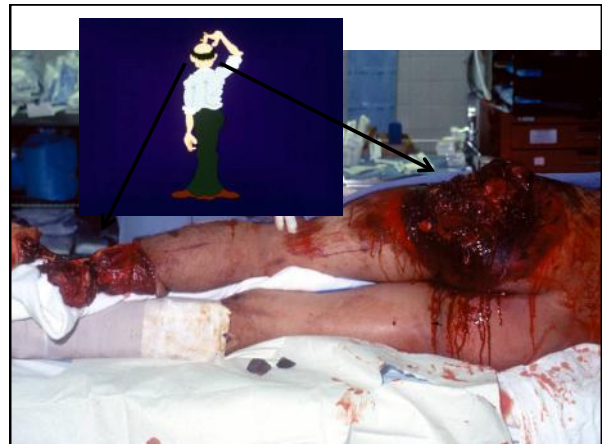
- TYPE IIIC INJURIES
 - VARIABLES THAT DETERMINE SUCCESS OR FAILURE?

PREDICTING LIMB SALVAGEABILITY

- LIMB SALVAGE SCORING
 - OBJECTIVE CRITERIA AND INJURY GRADING
 - SKIN, NERVE, VESSEL, MUSCLE, BONE
 - ISS, LAG TIME, AGE, PREEXISTING DISEASE, SHOCK
 - WARM ISCHEMIA TIME

LIMB SALVAGE SCORES

- CURRENTLY NO PREDICTIVE SCALE ADEQUATELY TESTED PROSPECTIVELY THAT CAN BE USED WITH CONFIDENCE IN AMPUTATION DECISION MAKING



DECISION MAKING

- COMMONSENSE
- PERSONALITY OF INJURY
 - THE PATIENT
 - THE INJURED LIMB
 - THE HEALTHCARE ENVIRONMENT

(Hunter, 1992)

DECISION MAKING

- PATIENT FACTORS
 - AGE
 - UNDERLYING DISEASE
 - MULTI-SYSTEM INJURIES AND SHOCK
 - WORK AND RECREATIONAL ACTIVITIES

DECISION MAKING

- THE INJURED LIMB
 - MECHANISM OF INJURY
 - DAMAGE BONE, SKIN, MUSCLE, NERVE, VESSEL
 - INJURY TO IPSILATERAL FOOT
 - WARM ISCHEMIA TIME



DECISION MAKING

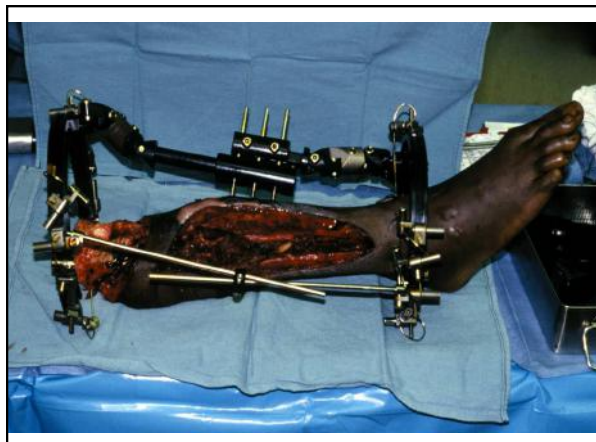
- HEALTHCARE ENVIRONMENT
 - FACILITIES FOR SURGERY AND REHAB AVAILABLE?
 - SOCIO-ECONOMIC COST TO THE PATIENT, FAMILY, AND SOCIETY

ECONOMIC

- PRIMARY AMPUTATION INSTEAD OF LIMB SALVAGE IN GRADE IIIC INJURIES WOULD SAVE US **100-200 MILLION DOLLARS** PER YEAR IN US ALONE

(Hansen, 1989)





PRIMARY AMPUTATION

- ABSOLUTE INDICATIONS
 - COMPLETE AMPUTATION
 - IRREPARABLE SCIATIC OR POSTERIOR TIBIAL NERVE INJURY WITH A GRADE IIIC TIBIA FRACTURE (may be changing?)
 - ISCHEMIA TIME > 6-8 HRS

(Hunter, 1992)



PRIMARY AMPUTATION

- ABSOLUTE INDICATIONS
 - ASSOCIATED LIFE THREATENING INJURIES WITH PROLONGED SHOCK, DIC, OR ARDS
 - A CADAVERIC FOOT AT INITIAL EXAM

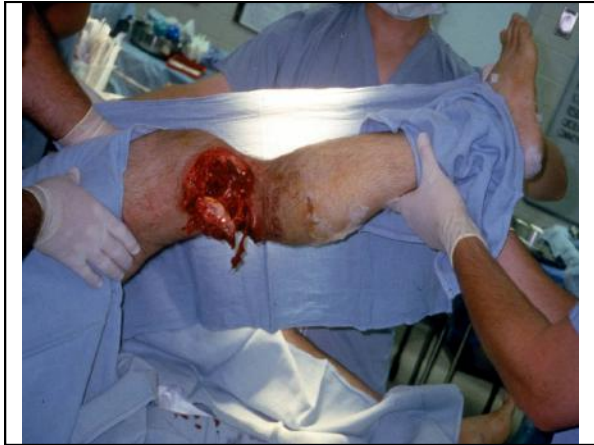
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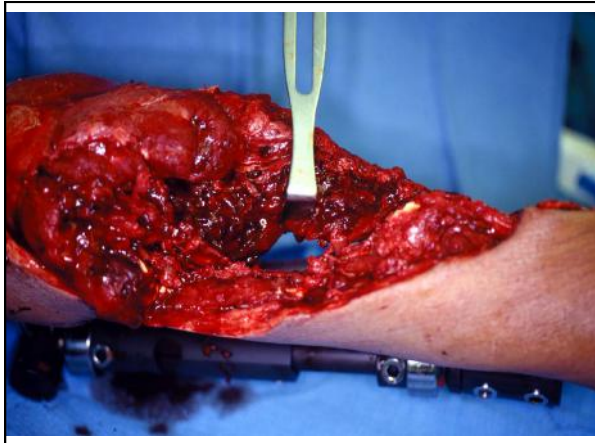
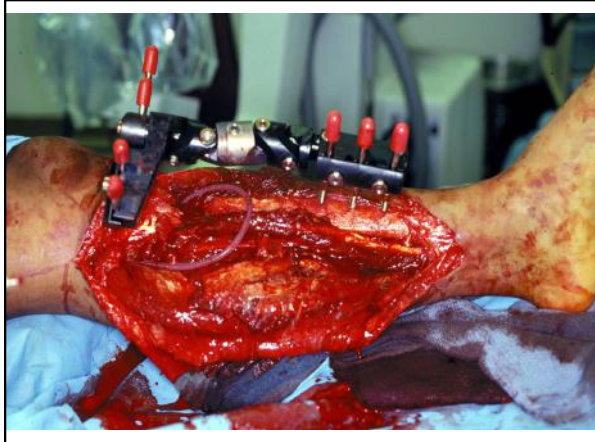


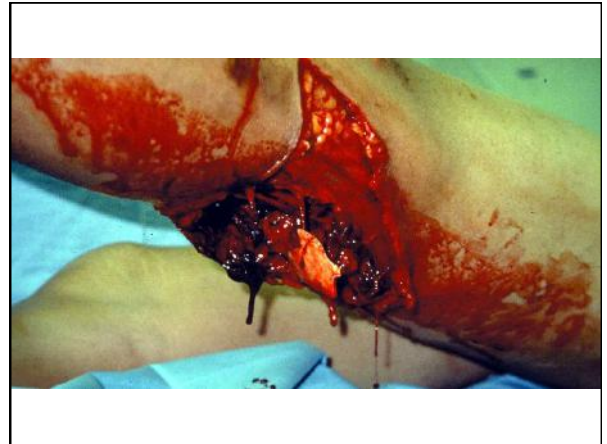
PRIMARY AMPUTATION

- RELATIVE INDICATIONS
 - GRADE IIIC INJURIES OF TIBIA/FIBULA
 - CRUSH OF LOWER LIMB AND IPSILATERAL FOOT
 - SIGNIFICANT BONE LOSS OR ASSOCIATED SEVERE DAMAGE TO KNEE OR ANKLE

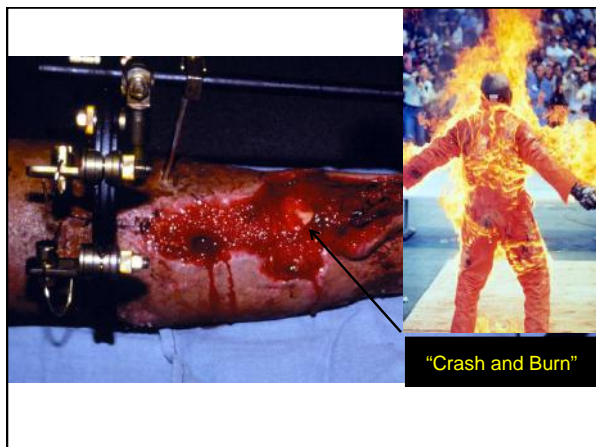
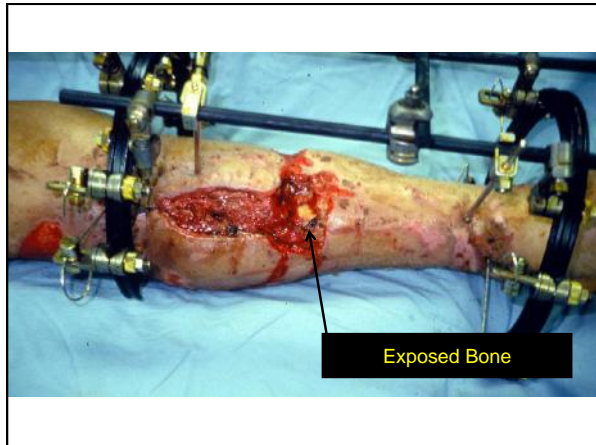
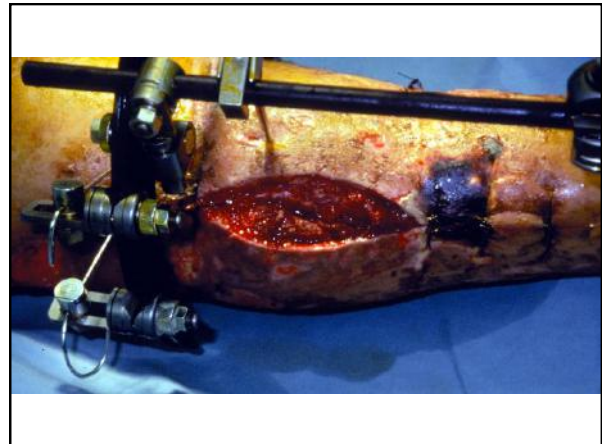
(Hunter, 1992)











SUMMARY

- PHOTOGRAPH LIMB AT TIME OF INJURY
- DOCUMENT FULLY ALL OPERATIVE FINDINGS RELATED TO LIMB AND GENERAL STATUS OF PATIENT
- SECOND OPINION (DIRECTLY OR INDIRECTLY)

SUMMARY

- CLINICAL JUDGMENT
- COMMON SENSE
- PREDICTIVE INDICES AVAILABLE IN RECENT LITERATURE
- BE PREPARED TO MAKE A **CLEAR RECOMMENDATION**

WHEN TO TRANSFER?

- These are my stories
 - Pelvic Fractures
 - Mangled Extremities
- These cases are the extremes
 - You decide how far you will standardly deviate from these extremes before transfer to a Trauma Center



Treatment Options for your Hip Pain

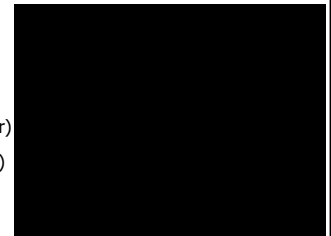
Matthew L. Jimenez, MD
Illinois Bone and Joint Institute

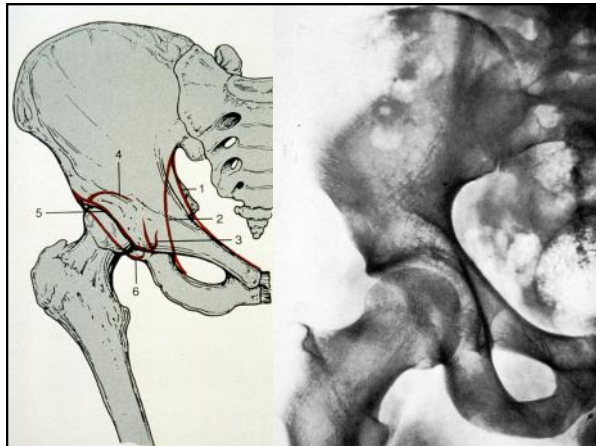
143

How your hip works

Anatomy of the hip

- Ball-and-socket joint
- Ball (femoral head) at the end of the leg bone (femur)
- Hip socket (or acetabulum) holds the ball





What's causing your pain?

It's estimated 70 million people in the U.S. have some form of arthritis.¹ Osteoarthritis is one of the most common types.

Osteoarthritis

- Wear and tear that deteriorates the "cushion" in your joints
- A degenerative condition—it won't get better and may get worse

Rheumatoid arthritis

- An autoimmune disease that attacks the lining of joints, causing swelling and possibly throbbing and deformity

1. Landers, S. Another reason to exercise for those with arthritis. American Medical Association website, 2005. Available at: <http://www.ama-assn.org/amednews/2005/05/02/hlsc0502.htm>.

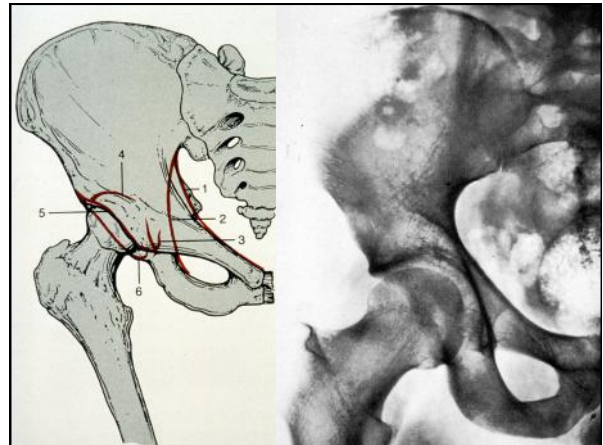
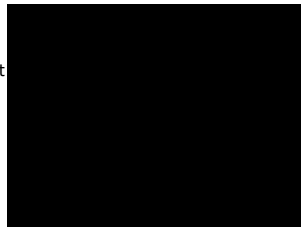
What's causing your pain?

Healthy hip

•The end of each bone in the joint is covered with cartilage, acting as a cushion so the joint functions without pain

Diseased hip (osteoarthritis)

•Wear and tear deteriorates natural cushion, leading to bone-on-bone contact, soreness and swelling



Assessing your pain

- Do you sometimes limp?
- Is it difficult to perform daily tasks—like walking, housework or tying shoes?
- Does pain limit your activities & lifestyle?
- Does one leg feel "shorter"?
- Do you have balance problems?
- Do you experience pain in the thigh, groin or buttocks?
- Does pain radiate to the knee?

Assessing your pain

- Rate your pain on a scale of 1 to 5
- For most people, the tipping point is about 4 or 5—that's when the pain becomes too difficult and they turn to a surgeon for relief!



1. 2008 DePuy Orthopaedics, Inc. Hip Attitudes & Usage Study.

How can your pain be treated?

Medications

- Analgesics

Injections

- Steroids

Water therapy

- Soaking, hot packs

Exercise & physical therapy

- Good for weight loss



Hip replacement

- Implants replace damaged surfaces
- Helps relieve pain and improve mobility
- 270,000 each year in the U.S.¹



1. Thomas Healthcare, Market Scan Research Data, 2007.

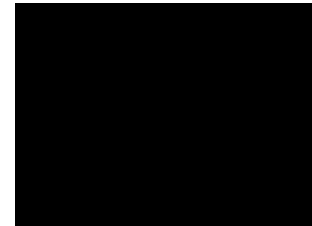
What is hip replacement?

A surgical procedure that removes and replaces diseased joint surfaces with implants



How does it work?

- Diseased area in hip socket removed & re-shaped
- New cup secured in socket
- Liner placed within cup
- Stem inserted in leg bone (femur)
- Ball placed in cup



Head Size and Bearing Surface



How does it work?



Pre-op



Post-op

Which bearing is right for you?

When choosing a bearing, I consider:

- Range of motion
- Stability
- Wear characteristics
- Lifestyle
- Age, weight & gender
- Severity of disease

I will work with you to choose materials that are right for you.



Bearing Options

What is the bearing?

The bearing is the union of the ball and the cup—where moving parts of the hip implant interact

Bearing options:

- Metal-on-plastic (polyethylene)
- Ceramic-on-plastic (polyethylene)
- Ceramic-on-ceramic*
- Metal-on-metal (I do not use, nor have I ever implanted)



*Duraloc® Option System

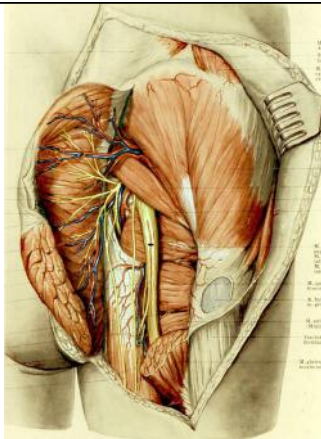
Traditional Posterior Approach

- Longer Incision
- Muscles removed from bone
- Permanent hip precautions



Traditional Posterior Approach

- Average 5-day hospital stay
- Average 3-month recovery time
- Approximately 12-inch incision
- Large scar on thigh
- Performed for decades
- Surgeon can fully see hip joint
- Disruption of muscles and tissue



Minimally invasive hip surgery

What is it?

- A less invasive approach to traditional surgery
- Involves about 75% smaller incision (or incisions)
- Uses traditional components (cup, ball and stem)
- Because less muscle and other soft tissues are involved, patients can potentially recover more quickly



Minimally invasive surgery

- Shorter hospital stay
- Reduce recovery time
- 3- to 4-inch incision
- Smaller, less noticeable scar
- Less blood loss
- Less disruption of muscles and tissue
- Less pain after surgery



Benefits of minimally invasive hip surgery

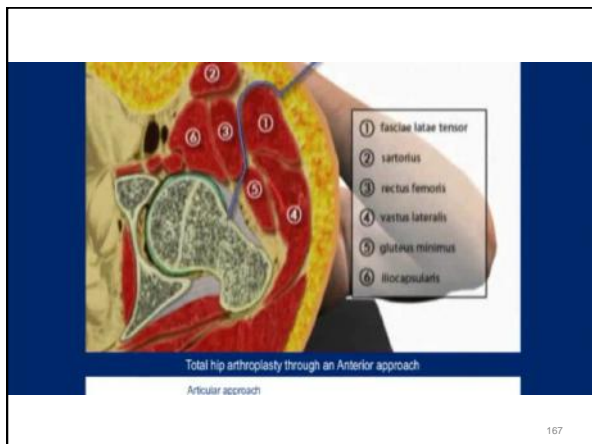
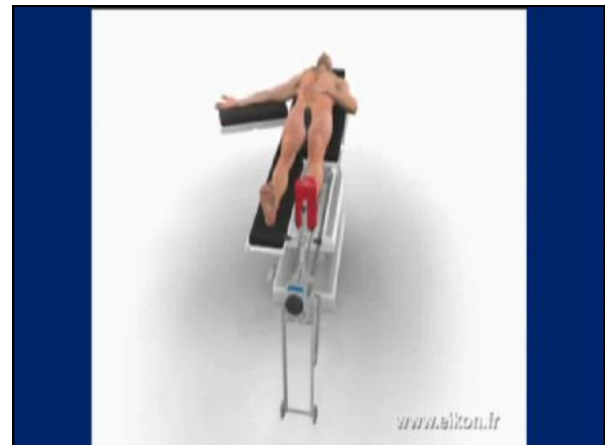
- Smaller incision
- Less trauma to the body
- Quicker recovery and healing



Anterior Approach

What is it?

- Incision is made on the front (anterior) of the leg rather than the side (lateral) or back (posterior)
- Surgeon can work between muscles and tissues without detaching them from the hip or thigh bones
- Uses a high-tech table and intra-operative x-ray for precise positioning of implant



Traditional surgery

- Patients typically lie on side or front
- Incision on side or back of leg
- Surgeon detaches muscles, disrupts tissue
- Surgeon relies on **post-operative** x-ray to check component placement & leg length



Anterior Approach

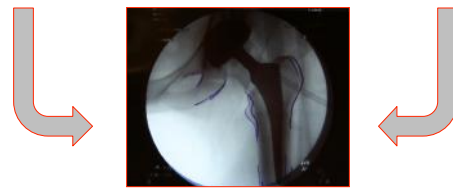
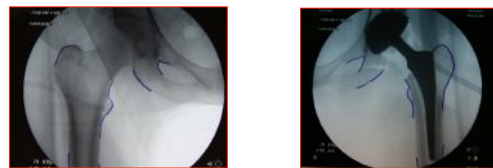
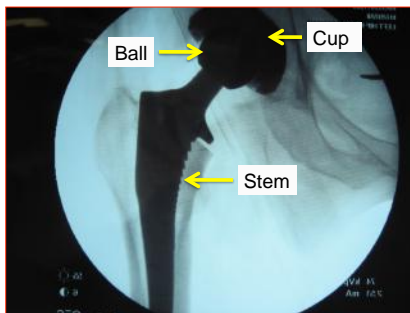
- Patients lie on back
- Incision on front of leg
- No detachment of muscles, minimal disruption of tissue
- Surgeon can check component placement & leg length with X-ray during procedure



Intra-operative Assessment of Component Position



Assurance of Ideal position of Hip Replacement Components



Overlapping Films

Bilateral Hip Replacements



Potential benefits of the Anterior Approach

- Less trauma to the body
- Smaller incision
- Potentially less pain
- Less tissue disruption, may lead to faster rehabilitation
- Fewer restrictions during recovery

Data on file at DePuy Orthopaedics, Inc.



Should you wait to replace your hip?

- **Assess your pain and ability to function**
 - Do you have difficulty sleeping or performing basic functions (shopping or walking up the stairs)?
 - Does medication no longer provide relief?
- **Early diagnosis and treatment are important**
 - Delaying may lower your quality of life¹
- **Osteoarthritis is degenerative—it won't get better and may get worse**

1. Fortin PR, et al. Outcomes of Total Hip and Knee Replacement. *Arthritis & Rheumatism*. 1999;42:1722-1728.
2. Fortin PR, et al. Timing of Total Joint Replacement Affects Clinical Outcomes Among Patients With Osteoarthritis of the Hip or Knee. *Arthritis & Rheumatism*. 2002;46:3327-3330.

What other patients have to say

- In a recent study of 600 people who chose hip replacement:
 - More than 96% said hip replacement enabled them to move freely and without pain.¹
 - 90% said they were able to participate in their favorite activities.¹



1. DePuy Hip Pain: A&U/Segmentation. Final Report January 2008. Data on file.

Summary

- The leading cause of hip pain is osteoarthritis
- Osteoarthritis is degenerative—it won't get better and may get worse
- Early diagnosis and treatment of osteoarthritis are important
- Hip replacement helps relieve pain and improve mobility

Thank You!