



PERSPECTIVES ON OSTEONECROSIS

Dr. David S. Hungerford, M.D.
Professor
Dept of Orthopaedic Surgery
Johns Hopkins University



PERSPECTIVES ON OSTEONECROSIS

Dr. David S. Hungerford, M.D.
Professor
Dept of Orthopaedic Surgery
Johns Hopkins University

Understanding Treatment Options In Osteonecrosis

- Etiopathology
- Natural History
- Consequences of Treatment

Osteonecrosis Occurs In The 'At Risk' Patient

Associated Condition

Steroids	Gout
Radiation	Alcohol Abuse
Smoking	Coagulopathies
Metabolic Disease	Lipid Disturbances
Major Trauma	

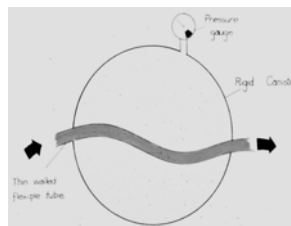
Osteonecrosis Occurs In The 'At Risk' Patient

Associated Condition

Steroids	Gout
Radiation	Alcohol Abuse
Smoking	Coagulopathies
Metabolic Disease	Lipid Disturbances
Major Trauma	

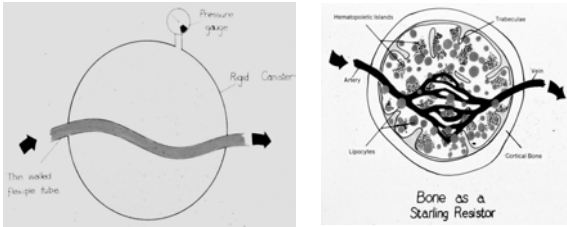
Exact Pathogenetic Pathway Unknown

Bone Functions as Starling Resistor



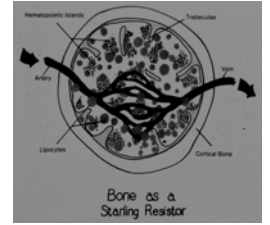
Exact Pathogenetic Pathway Unknown

Bone Functions as Starling Resistor



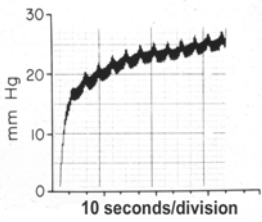
Exact Pathogenetic Pathway Unknown

- Fat cell hypertrophy
- Blood clots
- Emboli
- Infection



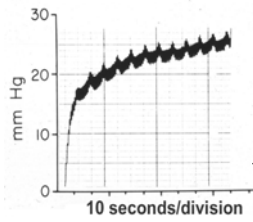
Increase BMP Hallmark of Osteonecrosis

Normal Bone Marrow Pressure

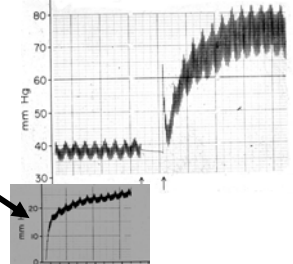


Increase BMP Hallmark of Osteonecrosis

Normal Bone Marrow Pressure

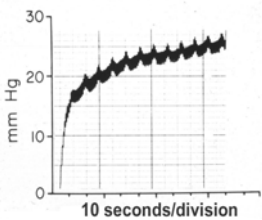


BMP and Stress Test in Stage I INFH

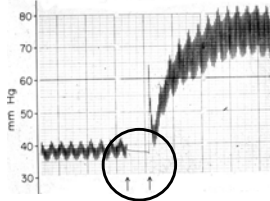


Increase BMP Hallmark of Osteonecrosis

Normal Bone Marrow Pressure



BMP and Stress Test in Stage I INFH

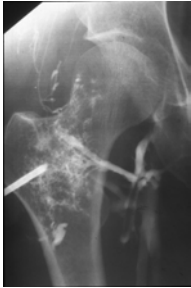


Widespread Vascular Disturbance in Osteonecrosis



NL Venogram

Widespread Vascular Disturbance in Osteonecrosis



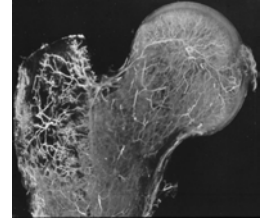
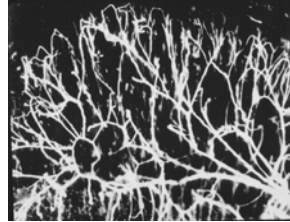
NL Venogram



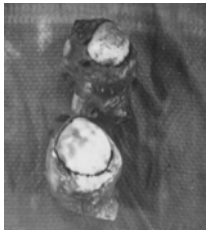
Abn Venogram

Pathogenesis of Osteonecrosis

Coagulation Defect May Be Final Common Path



Biomechanics of Collapse in Osteonecrosis



AP View

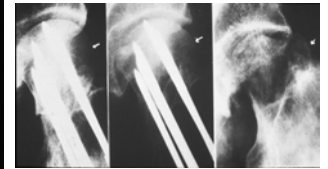
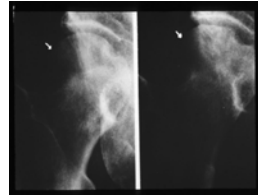


Top View

OA & ON - Same area of collapse/wear

Biomechanics of Collapse in Osteonecrosis

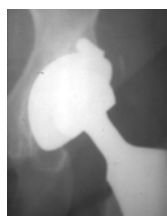
Valgus Fx Femoral Necks



The Face of Osteonecrosis



21 years old



15 years after THR

Average Age 38
25% <25 years old

The Economics of Osteonecrosis in U.S.

10% of THR = ~20,000/year

The Economics of Osteonecrosis in U.S.

10% of THR = ~20,000/year

1% Revision/year x AT Risk pool
400,000 = 4,000/year

Primary THR- \$20,000

Revision THR- \$40,000

The Economics of Osteonecrosis in U.S.

10% of THR = ~20,000/year

1% Revision/year x AT Risk pool
400,000 = 4,000/year

Primary THR- \$20,000

Revision THR- \$40,000

>\$560 million direct expenses/year

Natural History of No Treatment

(Observation, Protected Wt. Bearing)

21 studies 819

Mont et al. 1995

Natural History of No Treatment

(Observation, Protected Wt. Bearing)

21 studies 819

Usually 2-4 year F/U

22.7% Success
(0 32)

Mont et al. 1995

All Treatments Are Not Equal

Success Rate
Morbidity
Potential Complication
Impact on Subsequent THR

All Osteonecrosis is Not Equal

Important Variables
Stage

All Osteonecrosis is Not Equal

Important Variables

**Stage
Size**

All Osteonecrosis is Not Equal

Important Variables

**Stage
Size
Age**

All Osteonecrosis is Not Equal

Important Variables

**Stage
Size
Age
Underlying Disease**

**Osteonecrosis
Several Staging Systems**

**Ficat
Steinberg
ARCO
Marcus/Enneking**

**Pre-collapse
vs.
Post collapse**

**Osteonecrosis
Several Staging Systems**

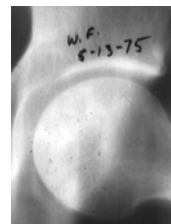
**Ficat
Steinberg
ARCO
Marcus/Enneking**

**Pre-collapse
vs.
Post collapse**

I & II = Precollapse in ALL

**Stage III
Osteonecrosis**

**The watershed between
cure and palliation**



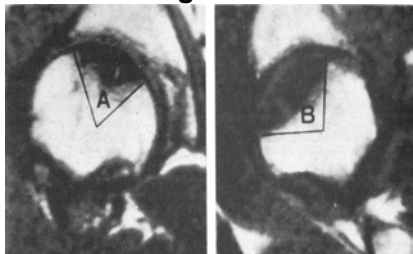
Stage II "Intact"



Stage III "it's broke"

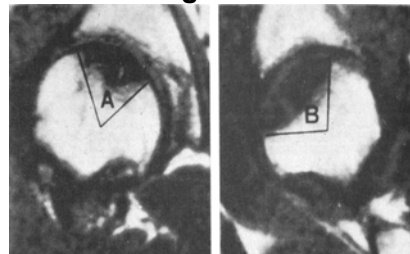
Osteonecrosis Staging

Steinberg Added Size



Osteonecrosis Staging

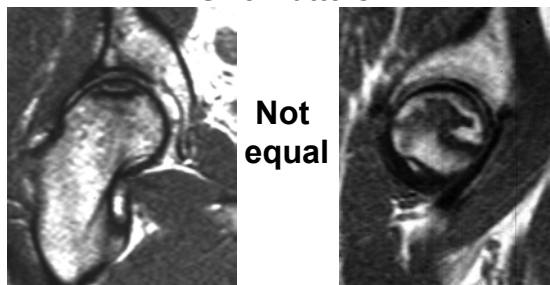
Steinberg Added Size



A + B = Kerboul Angle

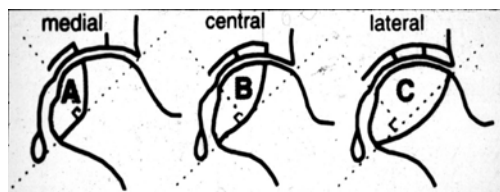
Osteonecrosis

Size Matters



Osteonecrosis Staging

Japanese added location



The Goal of Treatment in Osteonecrosis

Preserve the Femoral Head

The Goal of Treatment in Osteonecrosis

Preserve the Femoral Head

The Goal of Treatment in Osteonecrosis

Preserve the Femoral Head

- Core Decompression
- Osteotomy
- Free Fibular Graft
- Bone Graft
- Femoral Head Resurfacing

Core Decompression

- Simple, low cost
- Low morbidity
- Controversial

Core Decompression

"Ineffective, Dangerous Procedure"

Camp & Colwell 1986

Core Decompression

How to Reconcile?

"Ineffective, Dangerous Procedure"

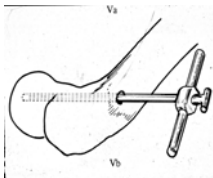
Camp & Colwell 1986

"First line of Treatment in our Unit"

Louis Solomon 1985

Core Decompression

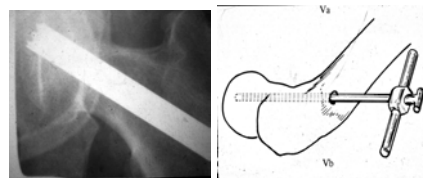
Avoid The Pit Falls



Entry @ Lat. Flare

Core Decompression

Avoid The Pit Falls

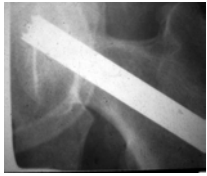


Biplane Image

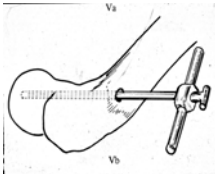
Entry @ Lat. Flare

Core Decompression

Avoid The Pit Falls



Biplane Image



Entry @ Lat. Flare



Crutches 6 wks.

Core Decompression

Pre Collapse Disease
1974- 1986

Stage I 24/25 [96%]

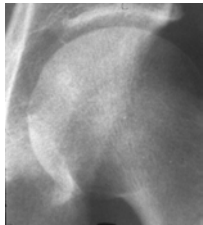
Stage II 14/23 [61%]

Stage I / II 80.7% Survival at 11 years

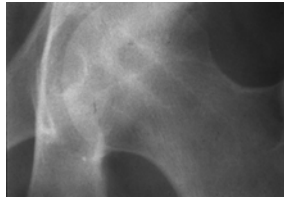
Bhatia, Jinnah, Hungerford, 1994

The Goal of Treatment in Osteonecrosis

Preserve The Femoral Head
Core Decompression



1975



1996

Two Small Prospective Studies Core vs. Protect Wt.

Stage I & II

	Stage I & II	
Core	36	27 / 36 (75%)
No Rx	28	8 / 28 (23%)

Stulberg CORR 1991
Robinson CORR 1992

Core vs. Protected Wt.

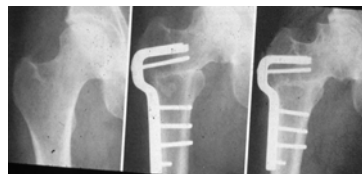
Literature Review

21 Studies 819 hips Nothing
23 Studies 1,206 hips Core

CORE		NOTHING	
Clinical Success	Clinical Success		
741 / 1,206	182 / 819		
63.5%	22.7%		

Mont et al JBJS 1995

Osteotomy for Osteonecrosis



Deforms the Femur

Osteotomy for Osteonecrosis



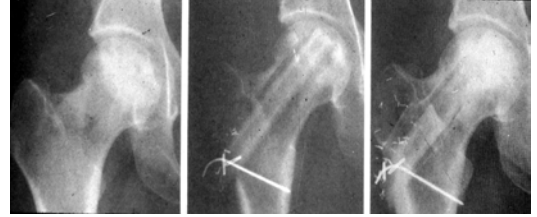
Deforms the Femur



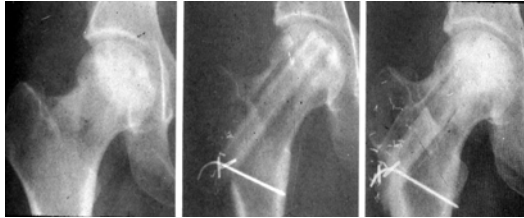
Sig. Morbidity

Suitable for some small Stage III

Free Vascular Fibular for Osteonecrosis



Free Vascular Fibular for Osteonecrosis



Donor morbidity
? Over kill

Free Vascular Fibular for Osteonecrosis

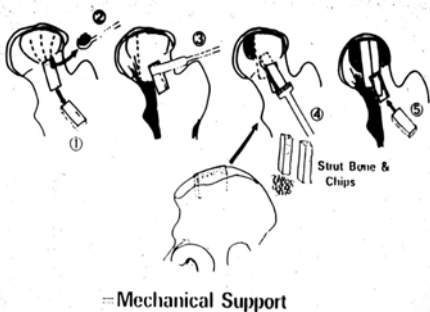
103 Hips

Stage II	89%
Stage III	77%
Stage IV	55%
Stage V	65%

5 Year Survival

Urbaniak 1996 JBJS

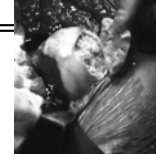
Trapdoor Procedure the concept



Trapdoor Procedure



Exposure

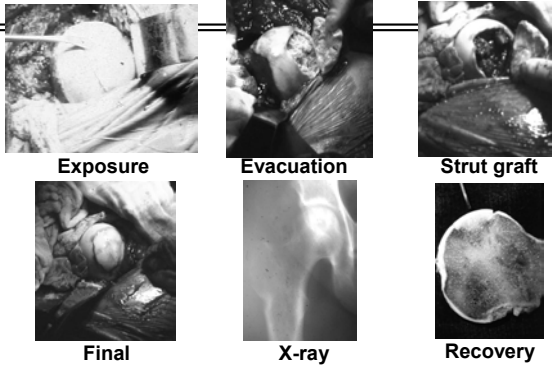


Evacuation



Strut graft

Trapdoor Procedure

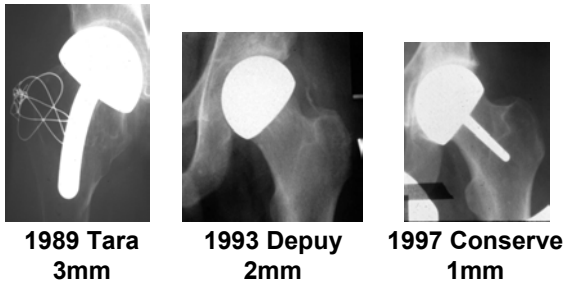


Trapdoor Procedure

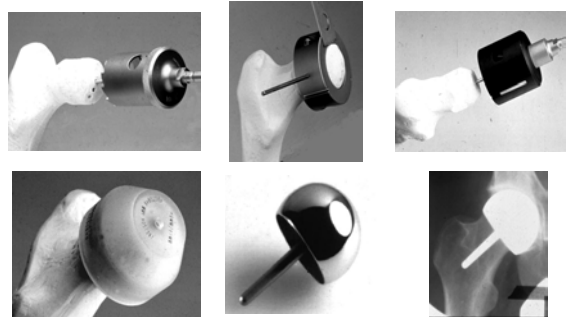
Clinical Results

13/20 successful @ 5 years
(65%)

Osteonecrosis Treatment Hemi-Resurfacing



Osteonecrosis Treatment Hemi-Resurfacing



Our Treatment Experience

100 Consecutive Patients
172 Hips with ON

No Rx	4	30% < 25 y.o.
Core	73	
Graft	10	
Osteotomy	2	
Femoral Cap	53	
THR	30	
	172	

Our Current Treatment for ON

Stage IV			
Stage III			
Stage II			
Stage I			
	<160°	160° - 220°	>220°

Our Current Treatment for ON

Stage IV			
Stage III			
Stage II	CORE		
Stage I	CORE	CORE	
	<160°	160° - 220°	>220°

Our Current Treatment for ON

Stage IV			
Stage III			
Stage II	CORE	CORE/BG/Resurface	
Stage I	CORE	CORE	
	<160°	160° - 220°	>220°

Our Current Treatment for ON

Stage IV			
Stage III			
Stage II	CORE	CORE/BG/Resurface	CORE/BG/Resurface
Stage I	CORE	CORE	CORE/Bone Graft
	<160°	160° - 220°	>220°

Our Current Treatment for ON

Stage IV	THR	THR	THR
Stage III	CORE/Bone Graft	Trap Door/Resurface	Resurface
Stage II	CORE	CORE/BG/Resurface	CORE/BG/Resurface
Stage I	CORE	CORE	CORE/Bone Graft
	<160°	160° - 220°	>220°

Osteonecrosis Treatment Future Prospects

**New Bone Graft Substitutes
and Bioactive Agents**

**Possible Rapid Complete Filling
of Necrotic Segment**



Defect



Op-1

Osteonecrosis Treatment Future Prospects

**Bone Graft Substitutes
Offer Mechanical Support**





Optiform

Preservative Procedures for ON

	% Success	Morbidity	Complication	Effect on THR
Cane/crutch				
CORE				
Free Fibula				
Trap Door				
Osteotomy				

Preservative Procedures for ON

	% Success	Morbidity	Complication	Effect on THR
Cane/crutch				
CORE				
Free Fibula				
Trap Door				
Osteotomy				

Preservative Procedures for ON

	% Success	Morbidity	Complication	Effect on THR
Cane/crutch				
CORE				
Free Fibula				
Trap Door				
Osteotomy				

Preservative Procedures for ON

	% Success	Morbidity	Complication	Effect on THR
Cane/crutch				
CORE				
Free Fibula				
Trap Door				
Osteotomy				

Preservative Procedures for ON

	% Success	Morbidity	Complication	Effect on THR
Cane/crutch				
CORE				
Free Fibula				
Trap Door				
Osteotomy				

PERSPECTIVES ON OSTEONECROSIS

Dr. David S. Hungerford, M.D.

Thank-you very much