고관절/대퇴/슬관절 수술 후 재활

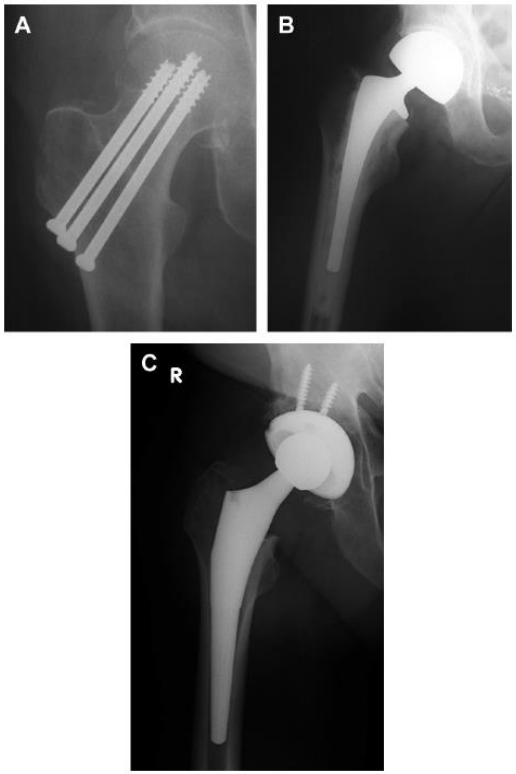

Fig. 3. Anteroposterior radiographs showing treatment options for a femoral neck fracture. (*A*) Cannulated screws. (*B*) Hemiarthroplasty. (*C*) Total hip arthroplasty.

The mortality rate within 1 year after hip fracture is as high as 36% despite aggressive

Although surgical care is crucial for improving outcomes after a hip fracture, the proposal that a hip fracture in an older person represents a geriatric rather than an orthopaedic disorder calls for new clinical approaches.[7] Comprehensive geriatric care is an alternative

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재활의학과 민경훈

Mears, Clin Geriatr Med 2014; 30: 229-41
Bhandari et al., N Engl J Med 2017; 377: 2053-62
Prestom et al., JAMA 2015; 385: 1623-33

Outline

- Hip fracture surgery
  - Classification
  - Surgical approach
- Is comprehensive rehab required after hip fracture surgery?
- Rehab
  - Weight bearing
  - Early mobilization
  - Occupation therapy
- Total knee arthroplasty

Outline 1

- Hip fracture surgery
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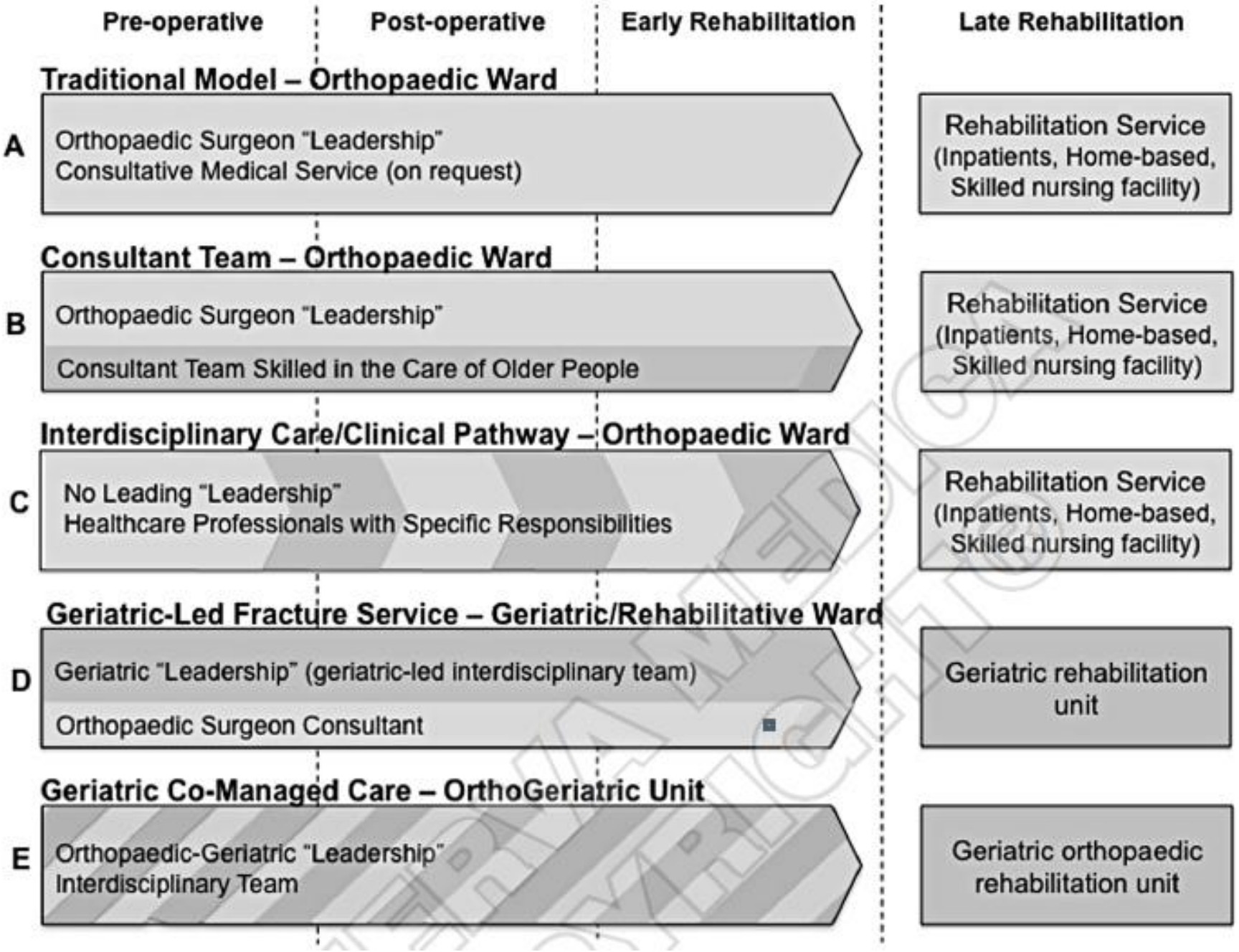


Giusti et al., Eur J Phys Rehabil Med 2011; 47: 281-96

Classification and Surgical Approaches to Hip Fractures for Nonsurgeons

Simon C. Mears, MD, PhD*

KEYWORDS

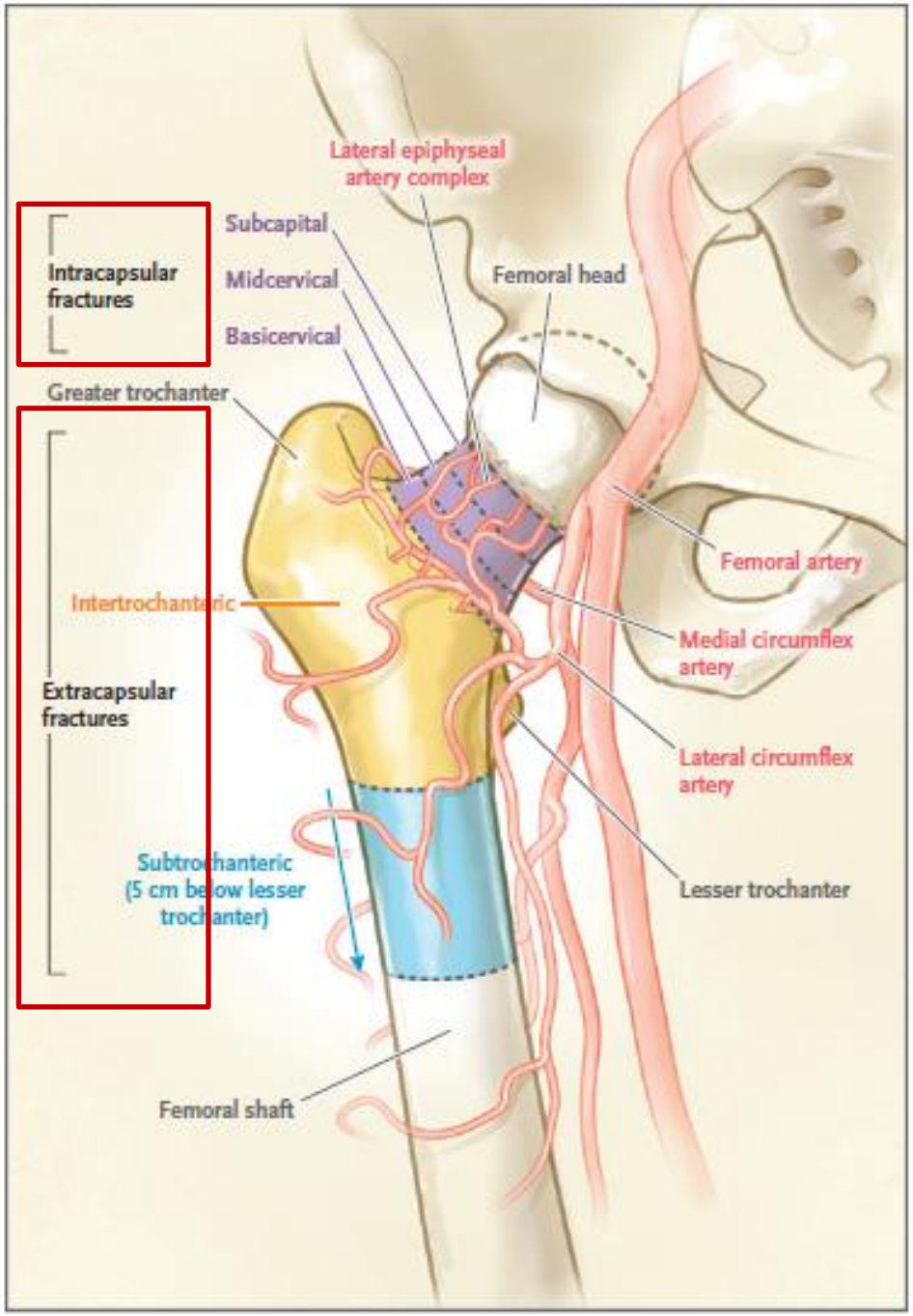
• Femoral neck fracture • Intertrochanteric hip fracture • Surgery
• Patient activity level • Fracture type

KEY POINTS

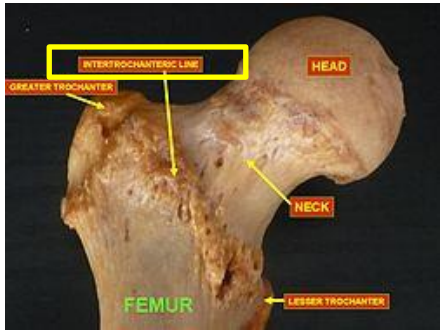
- Knowledge of hip fractures and surgical repair helps nonsurgeons develop communication with surgeons, leading to improved outcomes for elderly patients.

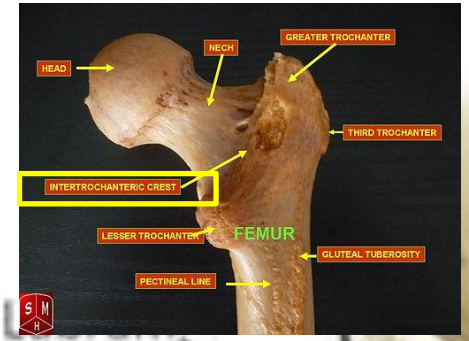
Mears, Clin Geriatr Med 2014; 30: 229-41


이 환자분은 subtrochanteric fracture 수술을 해서, weight bearing시 주의가 필요합니다.

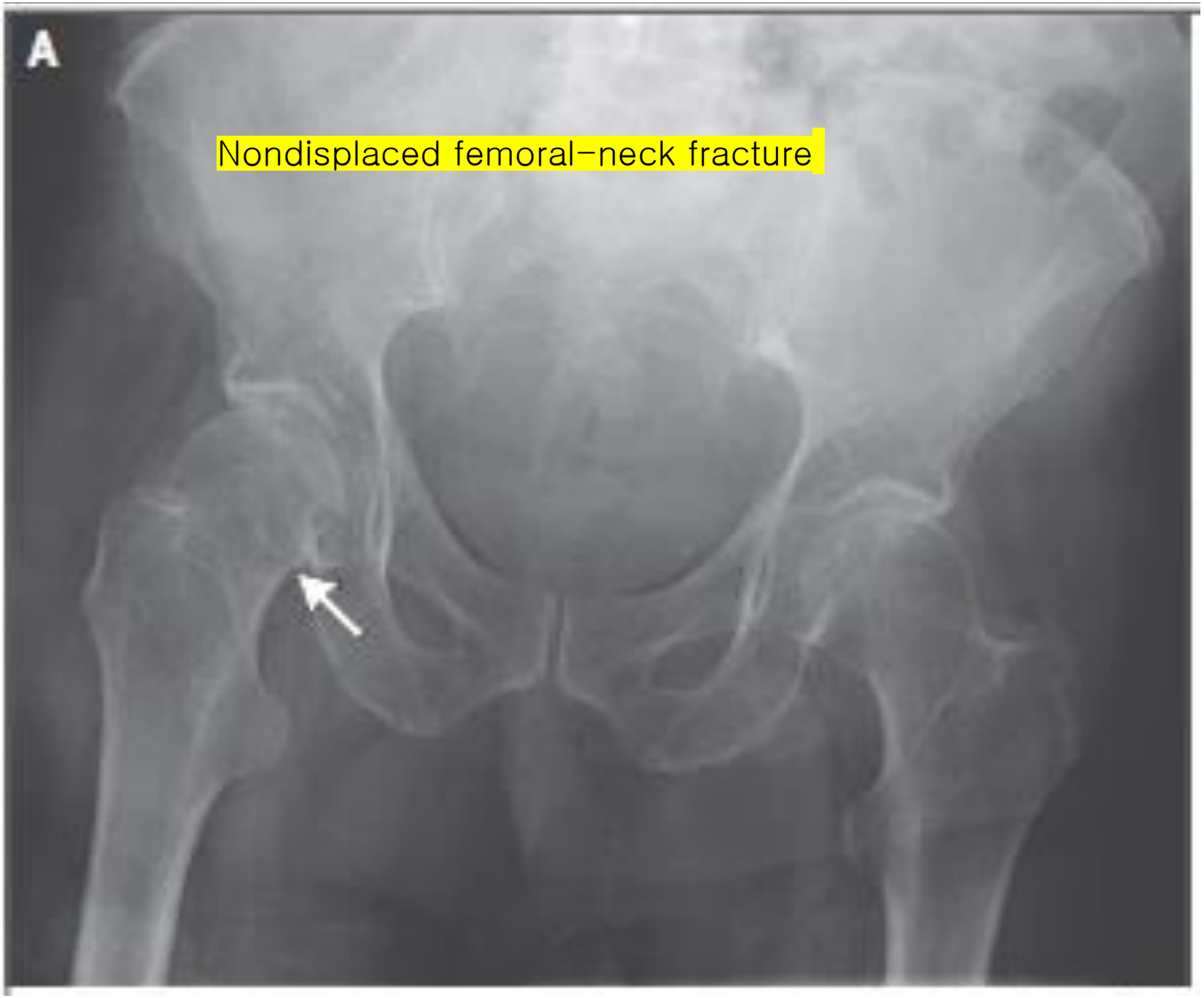


Bhandari et al., N Engl J Med 2017; 377: 2053-62





Kuhlman & Domb, Am Fam Physician 2009; 80: 1429-34
https://www.wikiwand.com/en/Upper_extremity_of_femur



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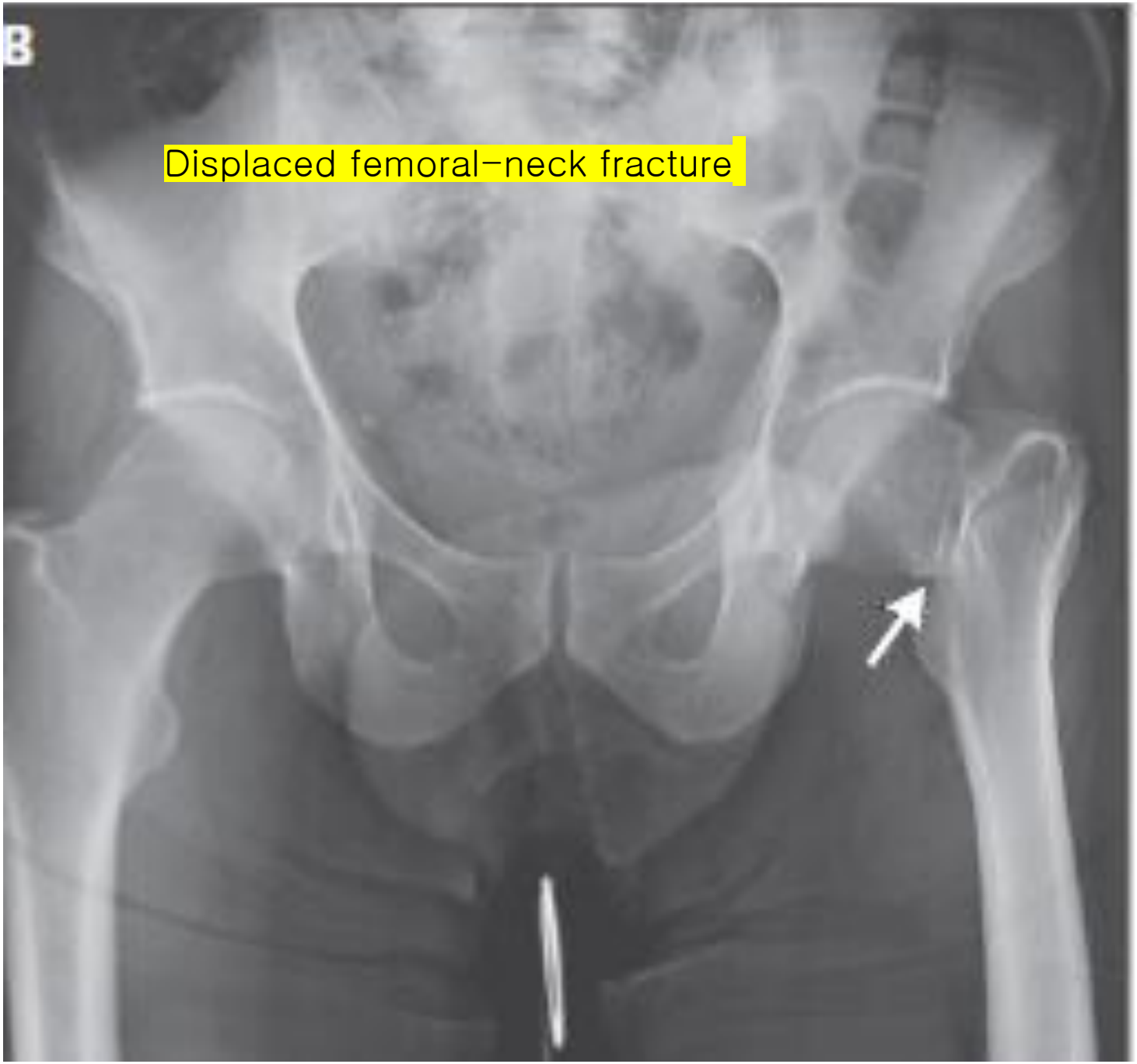


Bhandari et al., N Engl J Med 2017; 377: 2053-62

Nondisplaced femoral-neck fracture

Screw fixation

Stage I

Stage II

Displaced femoral-neck fracture

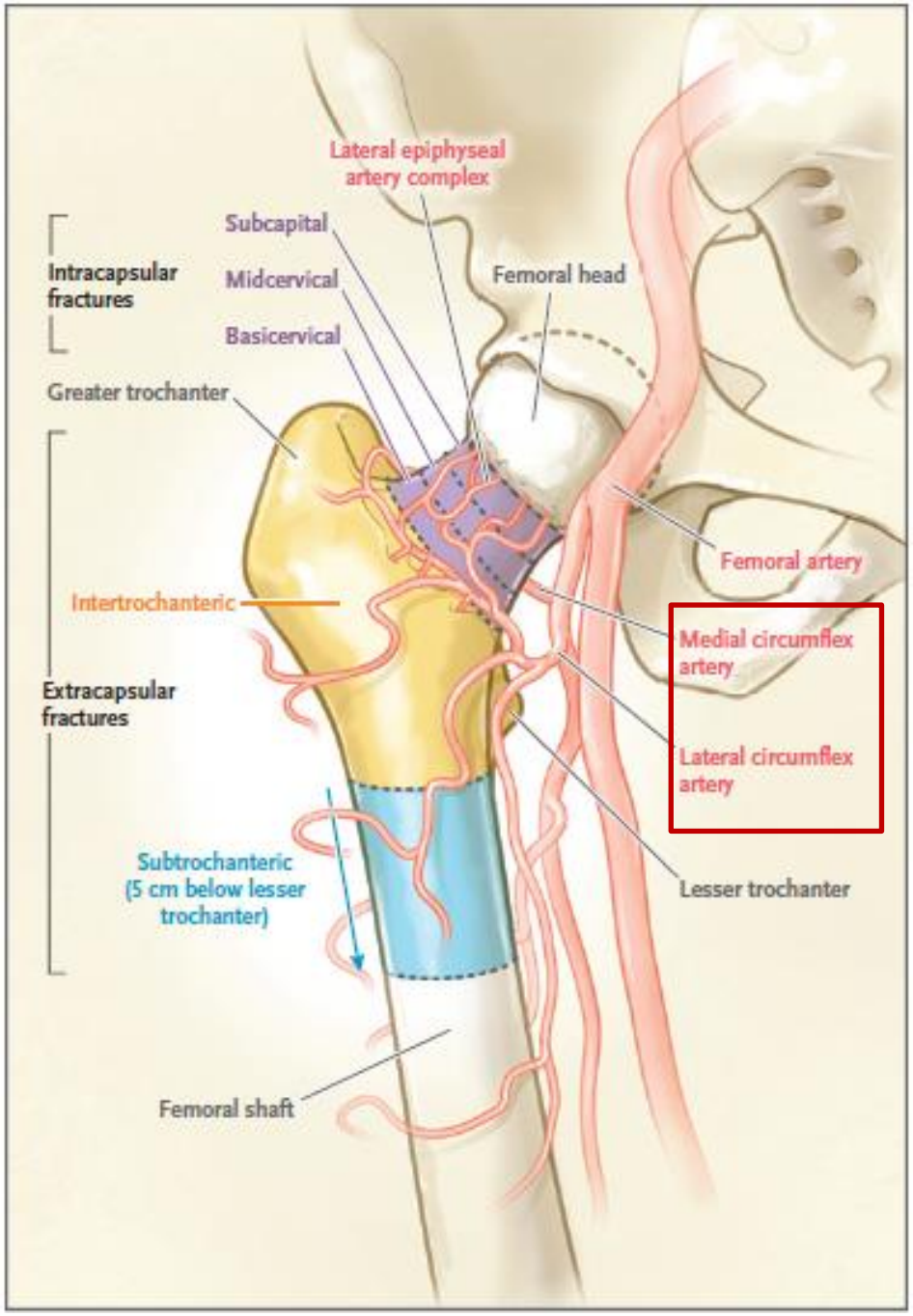
Joint replacement

Stage III

Stage IV

FIGURE 55-3 Garden classification of femoral neck fractures.

John C. Weinlein Chapter 55. Fractures and dislocations of the hip Campbell's Operative Orthopaedics 14th E-Book



Bhandari et al., N Engl J Med 2017; 377: 2053-62
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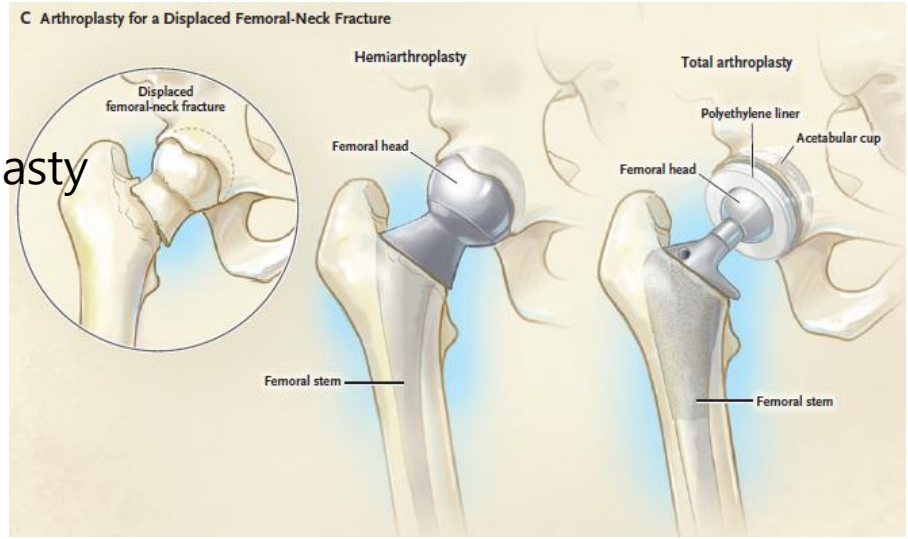
THA vs. Hemiarthroplasty



The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 5, 2019 VOL. 381 NO. 23

Total Hip Arthroplasty or Hemiarthroplasty for Hip Fracture

The HEALTH Investigators*

HEALTH investigators, N Engl J Med 2019; 381: 2199-208
Bhandari et al., N Engl J Med 2017; 377: 2053-62

From January 2009 through May 2017, we randomly assigned 1495 patients to undergo total hip arthroplasty (749 patients) or hemiarthroplasty (746 patients). The final 24-month assessments

PATIENTS

We enrolled patients at 80 participating sites in Canada, the United States, Spain, the United Kingdom, the Netherlands, Norway, Finland, Australia, New Zealand, and South Africa. To be eligible for participation, patients had to be 50 years of age or older, had to have a low-energy displaced fracture of the femoral neck that was planned to

Table 1. Patient Demographic Characteristics.*

Characteristic	Total Hip Arthroplasty (N=718)	Hemiarthroplasty (N=723)
Age — yr†	79.1±8.3	78.6±8.6
Age — no./total no. (%)		
50 to 70 yr	136/718 (18.9)	149/722 (20.6)
71 to 80 yr	249/718 (34.7)	247/722 (34.2)
≥81 yr	333/718 (46.4)	326/722 (45.2)
Sex — no./total no. (%)		
Male	208/718 (29.0)	223/722 (30.9)
Female	510/718 (71.0)	499/722 (69.1)
Race or ethnic group — no./total no. (%)‡		
Native or aboriginal	2/716 (0.3)	1/721 (0.1)
South Asian	3/716 (0.4)	6/721 (0.8)
East Asian	7/716 (1.0)	7/721 (1.0)
Hispanic or Latino	7/716 (1.0)	6/721 (0.8)
White	683/716 (95.4)	684/721 (94.9)
Black	12/716 (1.7)	15/721 (2.1)
Middle Eastern	2/716 (0.3)	2/721 (0.3)
Body-mass index — no./total no. (%)§		
Underweight, <18.5	35/697 (5.0)	38/705 (5.4)
Normal weight, 18.5–24.9	357/697 (51.2)	336/705 (47.7)
Overweight, 25–29.9	217/697 (31.1)	243/705 (34.5)
Obese, 30–39.9	77/697 (11.0)	83/705 (11.8)
Morbidly obese, ≥40	11/697 (1.6)	5/705 (0.7)
Prefracture living status — no./total no. (%)		
Institutionalized	30/718 (4.2)	27/723 (3.7)
Not institutionalized	688/718 (95.8)	696/723 (96.3)
Prefracture functional status — no./total no. (%)		
Uses assistive device for ambulation	187/718 (26.0)	182/723 (25.2)
Able to ambulate without assistive device	531/718 (74.0)	541/723 (74.8)
Previous surgery to affected hip — no./total no. (%)	2/714 (0.3)	1/722 (0.1)
Major coexisting conditions — no./total no. (%)		
Osteopenia	28/715 (3.9)	30/722 (4.2)
Osteoporosis	114/715 (15.9)	110/722 (15.2)
Lung disease	127/715 (17.8)	122/722 (16.9)
Diabetes	135/715 (18.9)	145/722 (20.1)
Ulcers or stomach disease	49/715 (6.9)	67/722 (9.3)
Kidney disease	71/715 (9.9)	67/722 (9.3)
Anemia or other blood disease	48/715 (6.7)	55/722 (7.6)
Depression	70/715 (9.8)	84/722 (11.6)
Cancer	65/715 (9.1)	80/722 (11.1)
Osteoarthritis, degenerative arthritis	111/715 (15.5)	91/722 (12.6)
Back pain	64/715 (9.0)	71/722 (9.8)
Rheumatoid arthritis	13/715 (1.8)	21/722 (2.9)
Heart disease	247/715 (34.5)	249/722 (34.5)
High blood pressure	434/715 (60.7)	443/722 (61.4)

HEALTH investigators, N Engl J Med 2019; 381: 2199-208

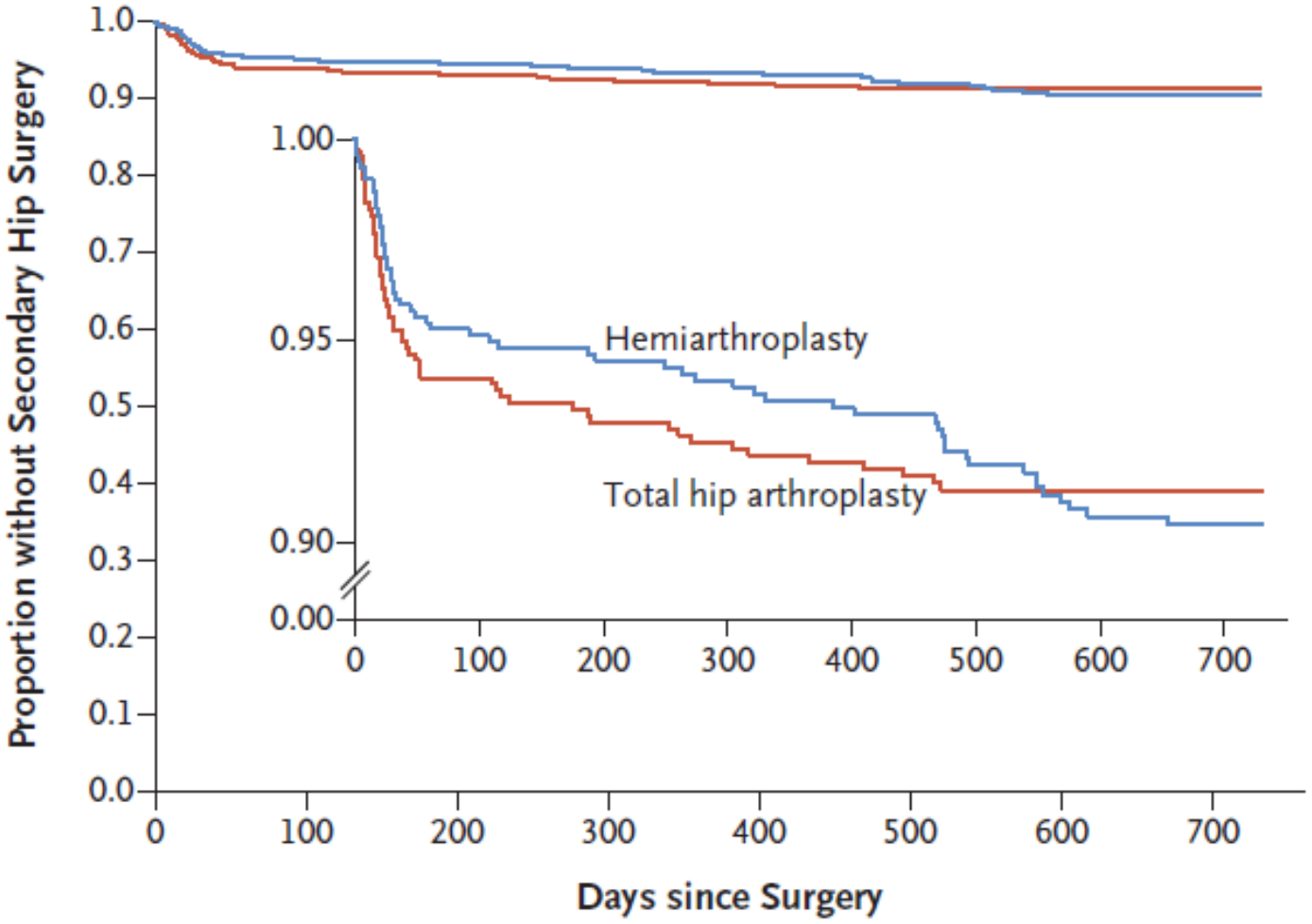


Figure 1. Kaplan–Meier Curves for the Primary End Point.

The primary end point was any unplanned secondary hip procedure within 24 months after the initial surgery. The inset shows the same data on an expanded y axis.

Table 4. Health-Related Quality of Life, Function, and Overall Health End Points.

End Point	Patients with Data (N=1441)	Mean Difference in Score at 24 Mo, Total Hip Arthroplasty vs. Hemiarthroplasty (99% CI)*
	no. (%)	
WOMAC total score†	943 (65.4)	–6.37 (–9.18 to –3.56)
WOMAC pain score†	990 (68.7)	–0.93 (–1.42 to –0.44)
WOMAC stiffness score†	987 (68.5)	–0.44 (–0.65 to –0.23)
WOMAC function score†	947 (65.7)	–4.97 (–7.11 to –2.83)
EQ-5D utility index score‡	1141 (79.2)	0.04 (–0.03 to 0.11)
EQ-5D VAS score‡	1111 (77.1)	0.72 (–2.02 to 3.46)
SF-12 PCS§	1006 (69.8)	1.41 (–0.33 to 3.14)
SF-12 MCS§	1006 (69.8)	1.34 (–0.38 to 3.05)
		Odds Ratio (99% CI)
TUG¶	1268 (88.0)	0.72 (0.38 to 1.36)

* The mean difference was obtained from the multilevel model.

† Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) total scores range from 0 to 96, with higher scores indicating worse pain, stiffness, and function; it is the sum of the pain score (range, 0 to 20), stiffness score (range, 0 to 8), and function score (range, 0 to 68). For the total score, the minimal clinically important difference calculated in different studies ranges from 9 to 22.

‡ The European Quality of Life–5 Dimensions (EQ-5D) measures quality of life in five dimensions; utility scores range from –0.109 to 1, with higher scores indicating better states of health. Scores on the EQ-5D visual analogue scale (VAS) range from 0 to 100, with higher scores indicating better states of health.

§ The 12-Item Short Form General Health Survey (SF-12) measures health-related quality of life and includes a physical composite score (PCS) and a mental composite score (MCS). Each composite score ranges from 0 to 100, with higher scores indicating better states of health.

¶ Timed Up and Go (TUG) results were dichotomized, with patients who took more than 12 seconds to complete the test or were unable to complete the test compared with patients who took 12 seconds or less to complete the test. The odds ratio (total hip arthroplasty vs. hemiarthroplasty) is for completing the test in more than 12 seconds or not being able to complete the test and was obtained from the multilevel model.

Table 3. Serious Adverse Events.

End Point	Total Hip Arthroplasty (N=718)	Hemiarthroplasty (N=723)	P Value*
	number (percent)		
Any serious adverse event†	300 (41.8)	265 (36.7)	0.13
Hip fracture–related serious adverse event	59 (8.2)	57 (7.9)	0.85
Neurologic serious adverse event	28 (3.9)	26 (3.6)	0.78
Respiratory serious adverse event	42 (5.8)	37 (5.1)	0.56
Cardiac serious adverse event	51 (7.1)	49 (6.8)	0.84
Renal serious adverse event	23 (3.2)	22 (3.0)	0.88
Vascular serious adverse event	22 (3.1)	16 (2.2)	0.33
Other serious adverse event	201 (28.0)	177 (24.5)	0.14
Non–trial-related fracture‡	50 (7.0)	37 (5.1)	
Non–trial-related dislocation‡	2 (0.3)	0	
Other non–trial-related injury‡	10 (1.4)	14 (1.9)	
Cellulitis	2 (0.3)	2 (0.3)	
Death	103 (14.3)	95 (13.1)	
Multiorgan failure	1 (0.1)	2 (0.3)	
Osteoporosis, new or worsening	0	1 (0.1)	
Sepsis	9 (1.3)	8 (1.1)	
Reported by site as “other”	66 (9.2)	60 (8.3)	

HEALTH investigators, N Engl J Med 2019; 381: 2199-208

Table 2. Trial End Points.

End Point	Total Hip Arthroplasty (N=718)	Hemiarthroplasty (N=723)	Hazard Ratio (95% or 99% CI)*	P Value†
	number (percent)			
Primary end point: unplanned secondary procedure	57 (7.9)	60 (8.3)	0.95 (0.64–1.40)‡	0.79
Components of primary end point§				
Closed reduction of hip dislocation	29 (4.0)	12 (1.7)		
Open reduction of hip dislocation	4 (0.6)	2 (0.3)		
Open reduction of fracture	5 (0.7)	8 (1.1)		
Soft-tissue procedure	15 (2.1)	15 (2.1)		
Insertion of antibiotic spacer	3 (0.4)	3 (0.4)		
Full implant exchange	7 (1.0)	18 (2.5)		
Partial implant exchange	19 (2.6)	18 (2.5)		
Implant adjustment: reorientation of stem	0	2 (0.3)		
Implant adjustment: reorientation of acetabulum component	2 (0.3)	0		
Implant removal with no replacement	3 (0.4)	3 (0.4)		
Excision heterotopic ossification	0	0		
Supplementary fixation	3 (0.4)	1 (0.1)		
Other	1 (0.1)	3 (0.4)		
Secondary end points				
Death	103 (14.3)	95 (13.1)	1.10 (0.77–1.58)	0.48
Serious adverse event¶	300 (41.8)	265 (36.7)	1.16 (0.90–1.51)	0.13
Any hip-related complication‖	132 (18.4)	118 (16.3)	1.13 (0.81–1.57)	
Periprosthetic fracture	38 (5.3)	35 (4.8)	1.08 (0.61–1.88)	
Hip instability or dislocation**	34 (4.7)	17 (2.4)	2.00 (0.97–4.09)	
Superficial surgical-site infection	9 (1.3)	6 (0.8)		
Deep surgical-site infection	17 (2.4)	16 (2.2)		
Another wound-healing problem	6 (0.8)	5 (0.7)		
Another soft-tissue procedure	11 (1.5)	11 (1.5)		
Clinically important heterotopic ossification††	29 (4.0)	24 (3.3)	1.19 (0.62–2.30)	
Abductor failure	1 (0.1)	3 (0.4)		
Implant failure: loosening or subsidence	5 (0.7)	5 (0.7)		
Implant failure: breakage	1 (0.1)	0		
Pain	6 (0.8)	12 (1.7)		
Neurovascular injury: technical error	2 (0.3)	1 (0.1)		
Other	7 (1.0)	13 (1.8)		

HEALTH investigators, N Engl J Med 2019; 381: 2199-208

the acetabulum with prostheses. Advocates of total hip arthroplasty perceive benefits with regard to patient function and quality of life as compared with hemiarthroplasty. There are concerns, however, that total hip arthroplasty has greater associated surgical morbidity than hemiarthroplasty and may increase the risk of dislocation, which often leads to a secondary procedure to reduce or revise the prosthesis.[1] Meta-analyses of studies

throplasty.[16,17] However, total hip arthroplasty has a higher risk of dislocation than partial replacement because the latter uses a larger head.[18]

HEALTH investigators, N Engl J Med 2019; 381: 2199-208
Mears, Clin Geriatr Med 2014; 30: 229-41

The decision to proceed with fixation or arthroplasty depends on fracture characteristics and physiologic patient age. Displaced femoral neck fractures in younger patients (<65 years of age) should be treated with anatomic reduction and stable internal fixation. Displaced femoral neck fractures in older patients should be treated with arthroplasty. A high-quality

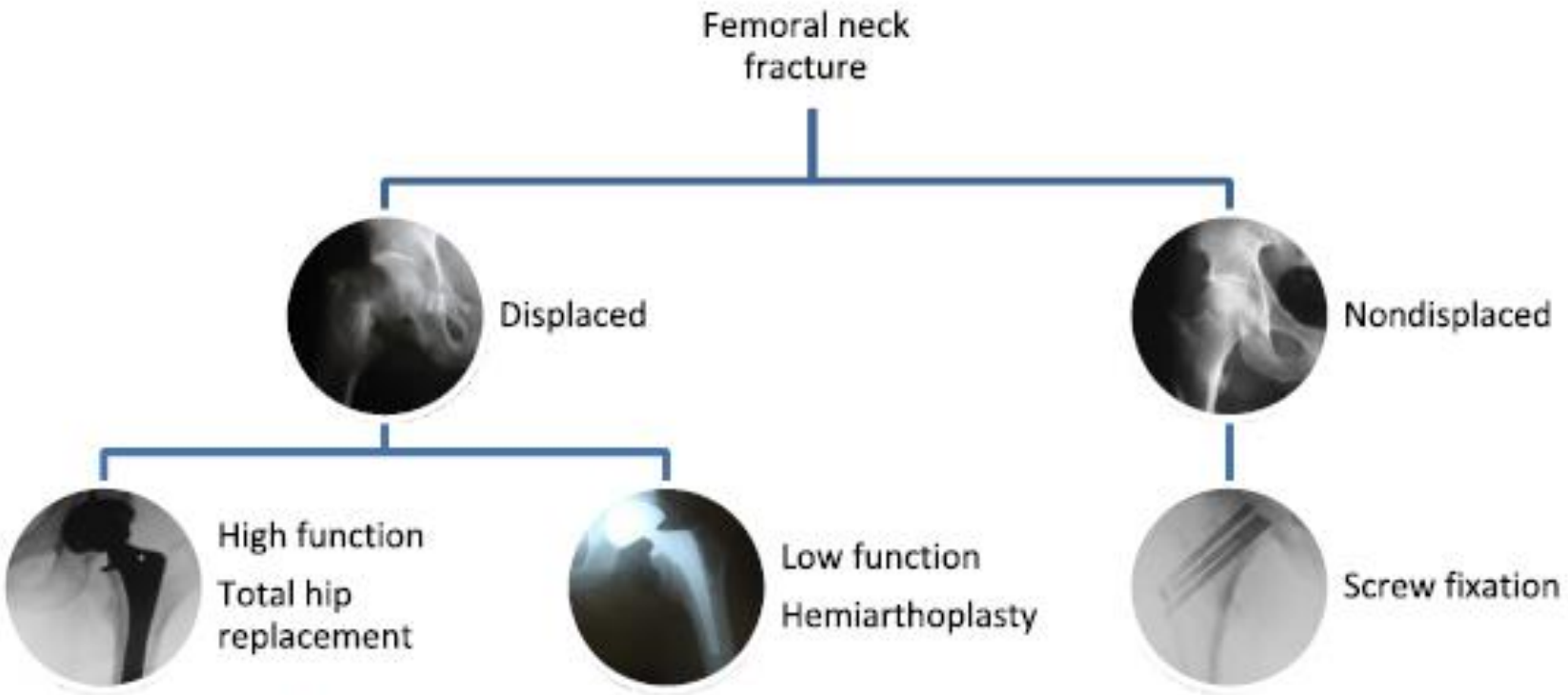
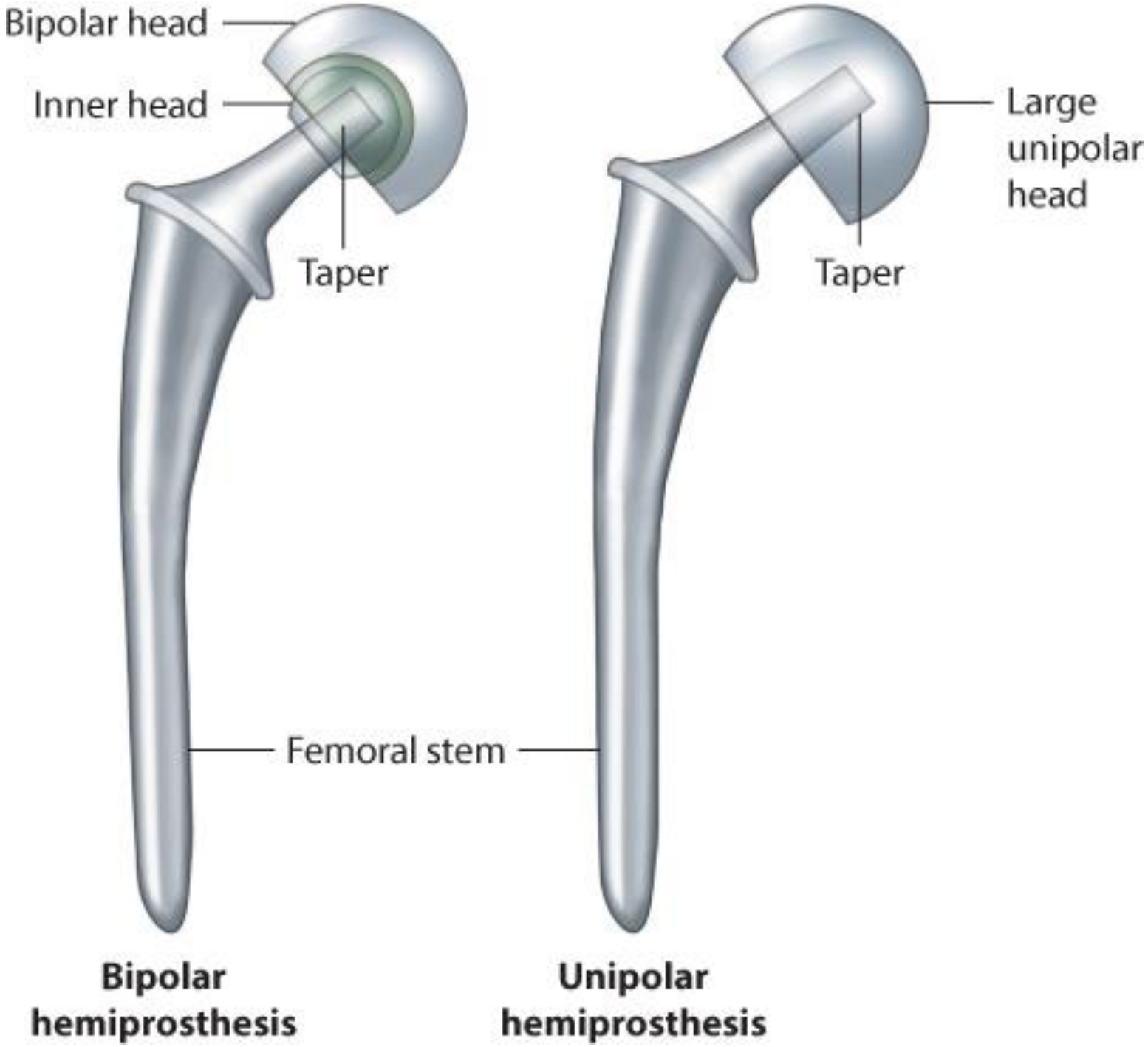


Fig. 4. Algorithm for the treatment of femoral neck fractures.

Dislocation ↓
Side effect ↓

Mears, Clin Geriatr Med 2014; 30: 229-41
John C. Weinlein Chapter 55. Fractures and dislocations of the hip Campbell's Operative Orthopaedics 14th E-Book


Bipolar head
Inner head
Taper
Femoral stem
Large unipolar head
Taper
Bipolar hemiprosthesis
Unipolar hemiprosthesis

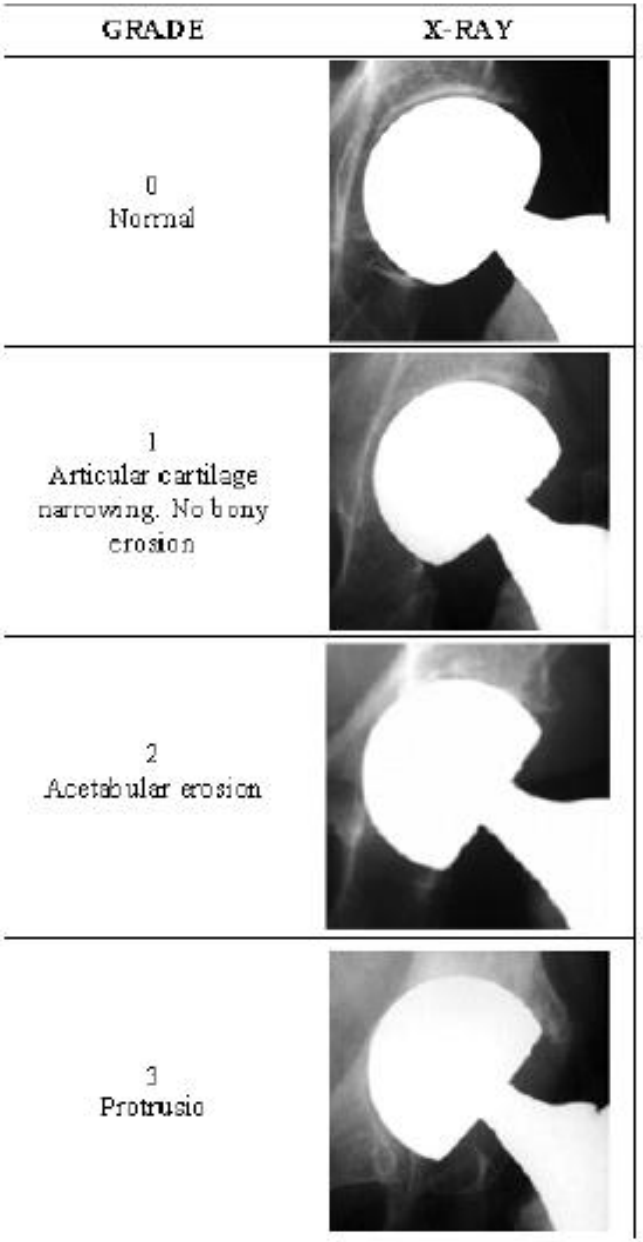


Fig.1. Grading system for acetabular erosion.

Fig. 1 Unipolar hemiarthroplasty

Fig. 2 Bipolar hemiarthroplasty

Enocson et al., Int Orthop 2012; 36: 711-7

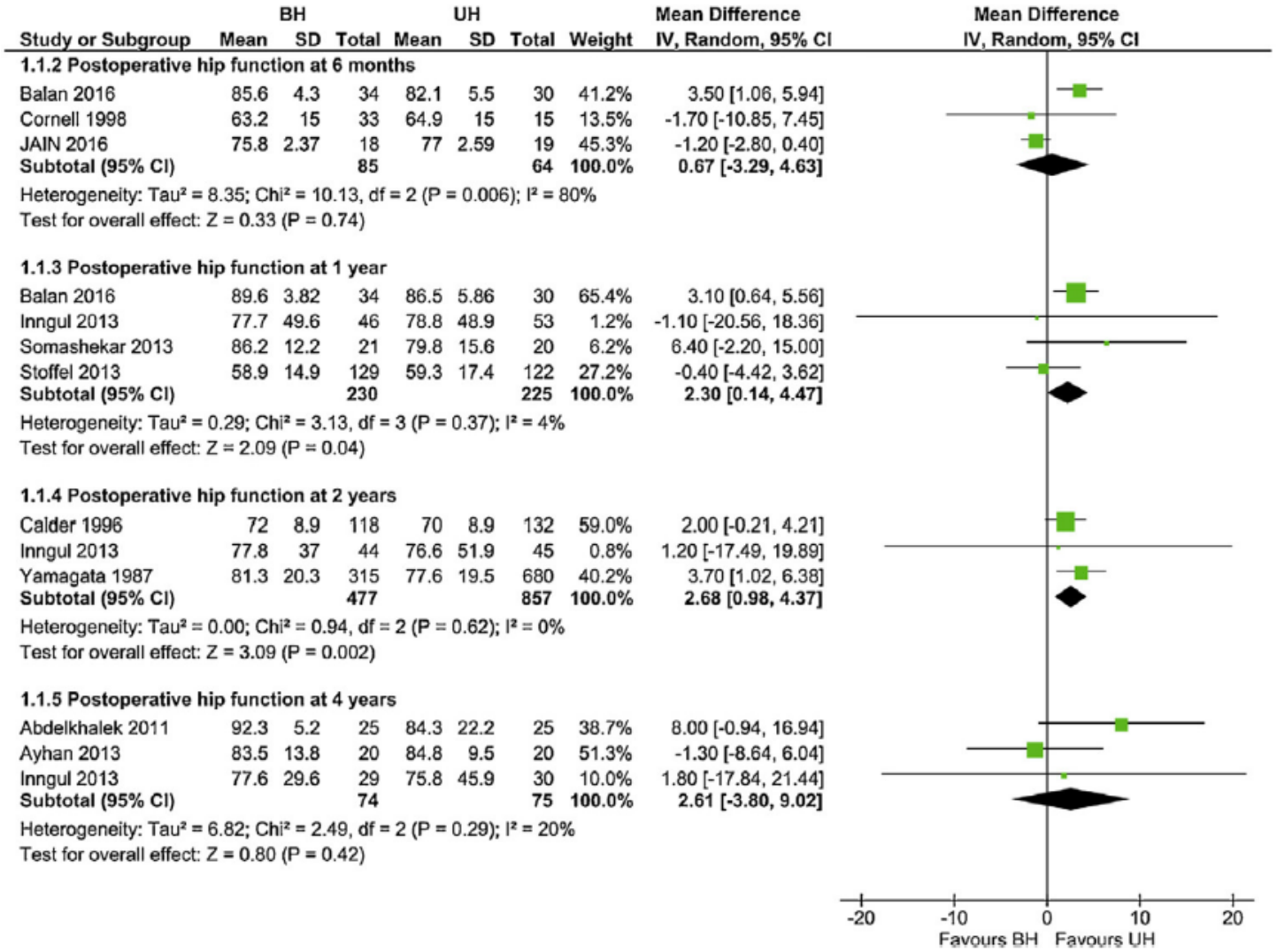


Fig. 3. Forest plot of postoperative hip function.

Cemented vs. Cementless

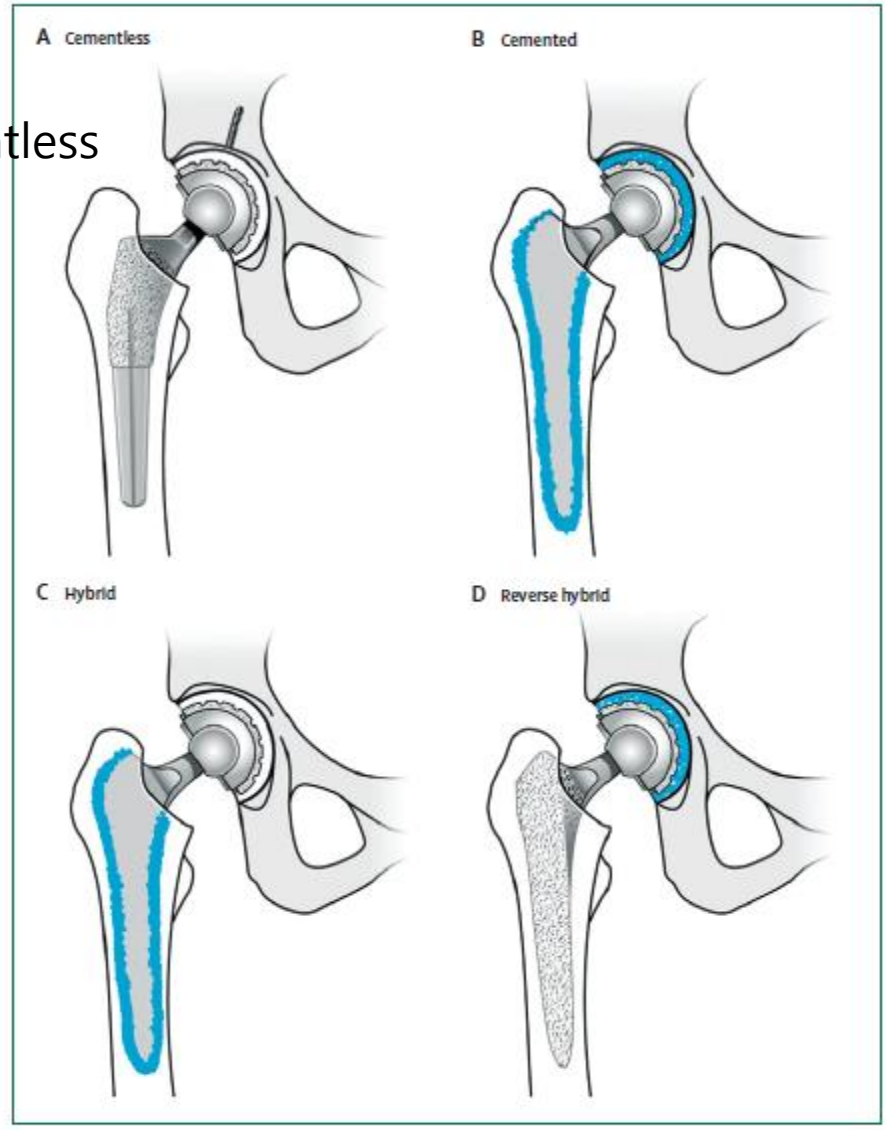
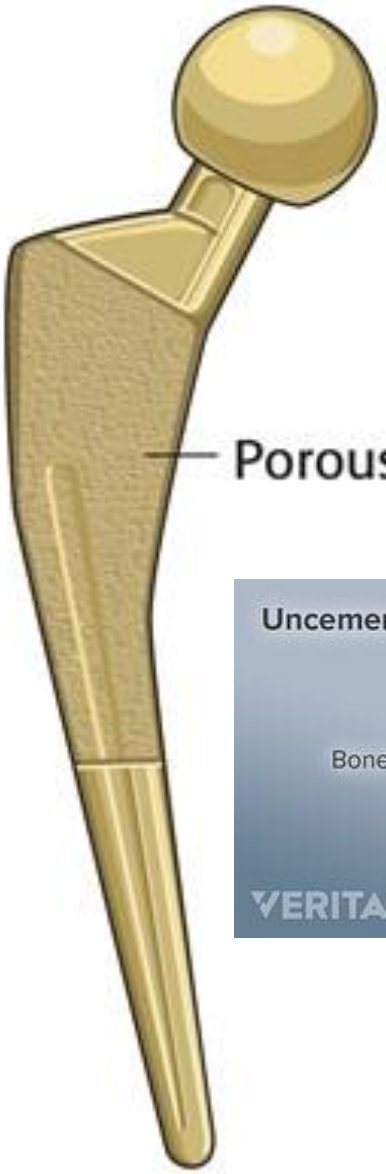
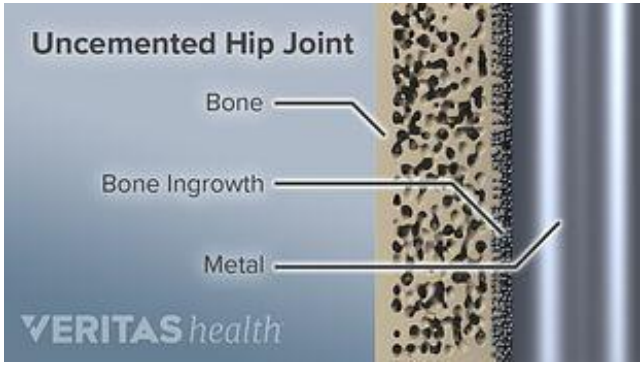


Figure 2: **Overview of four different fixation options for the femoral stem and acetabular cup in total hip arthroplasty with a metal-on-polyethylene bearing surface**
(A) Fully cementless design with a proximally porous coated femoral stem. (B) Fully cemented design. (C) Hybrid design with a cemented stem and cementless cup. (D) Reverse hybrid design with a cemented cup and cementless design with an extensively (fully) porous coated femoral stem. Alternative bearing surfaces (eg, ceramic-on-polyethyelene, ceramic-on-ceramic, metal-on-metal) can be used with these fixation methods. Acetabular screws can be used to augment cementless fixation of the acetabular cup. The original Charnley prosthesis was a cemented design. For clarity, cement is shown shaded in blue.

Pivec et al., Lancet 2012; 380: 1768-77

Cemented or press-fit





Bony ingrowth

FIGURE 3.52 Reaming of femoral canal. Hand or power reamers must be lateralized into greater trochanter to maintain neutral alignment in femoral canal. (Redrawn courtesy Smith & Nephew, Memphis, TN.) **SEE TECHNIQUES 3.5 AND 3.6.**

Femur reamer
(확공기)

Polymethylmethacrylate (PMMA)

FIGURE 3.59 Cement pressurization. Flexible pressurizing

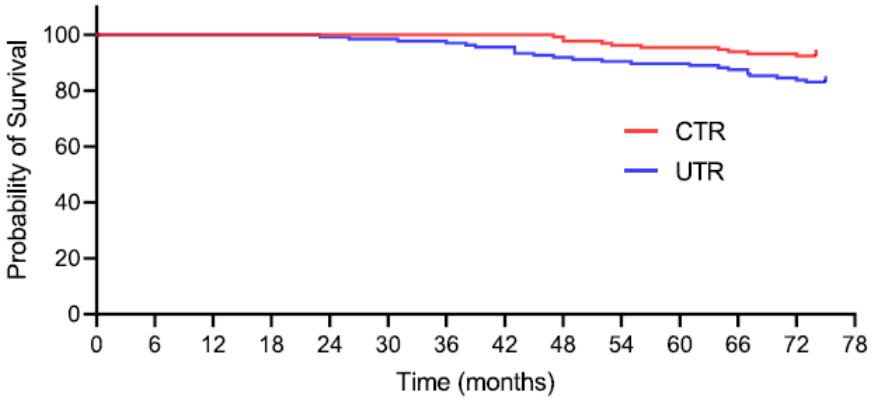


Fig. 2 Kaplan–Meier survival curve for both groups with prosthesis revision for any reason as the endpoint

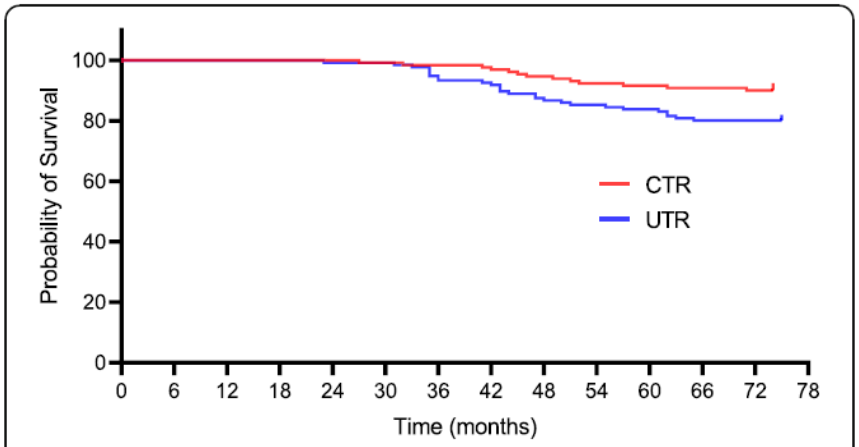


Fig. 3 Kaplan–Meier survival curve for both groups with prosthesis loosening as endpoint

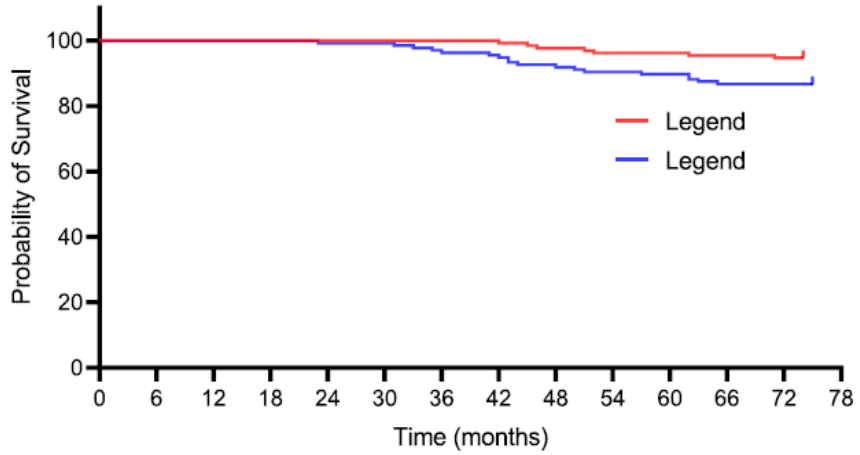
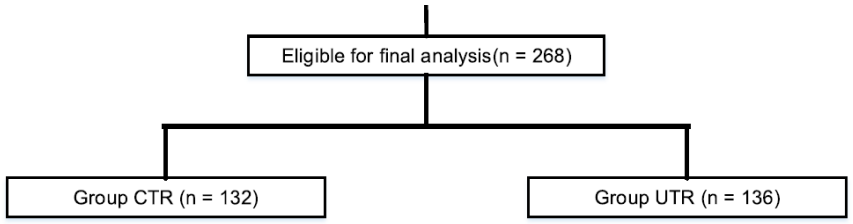


Fig. 4 Kaplan–Meier survival curve for both groups with periprosthetic fracture as endpoint

Cemented or uncemented total hip replacement (CTR or UTR)



neck fractures (AO/OTA type 31B/C) who had undergone a primary UTR or CTR (CTR: *n* = 132, mean age, 67.43 ± 6.51 years; UTR: *n* = 136, mean age, 67.65 ± 6.13 years) during 2007–2014, and these patients were followed until 2019. Follow-up occurred 1, 3, 6, and 12 months postoperatively and yearly thereafter. The primary endpoint was

sent a slightly higher risk of fractures during or after insertion.[21–24] Recent studies have shown that there is a lower risk of periprosthetic fractures with the use of cemented stems in elderly patients.[21–24]

Mears, Clin Geriatr Med 2014; 30: 229-41

Unipolar Bipolar Cementless Cemented

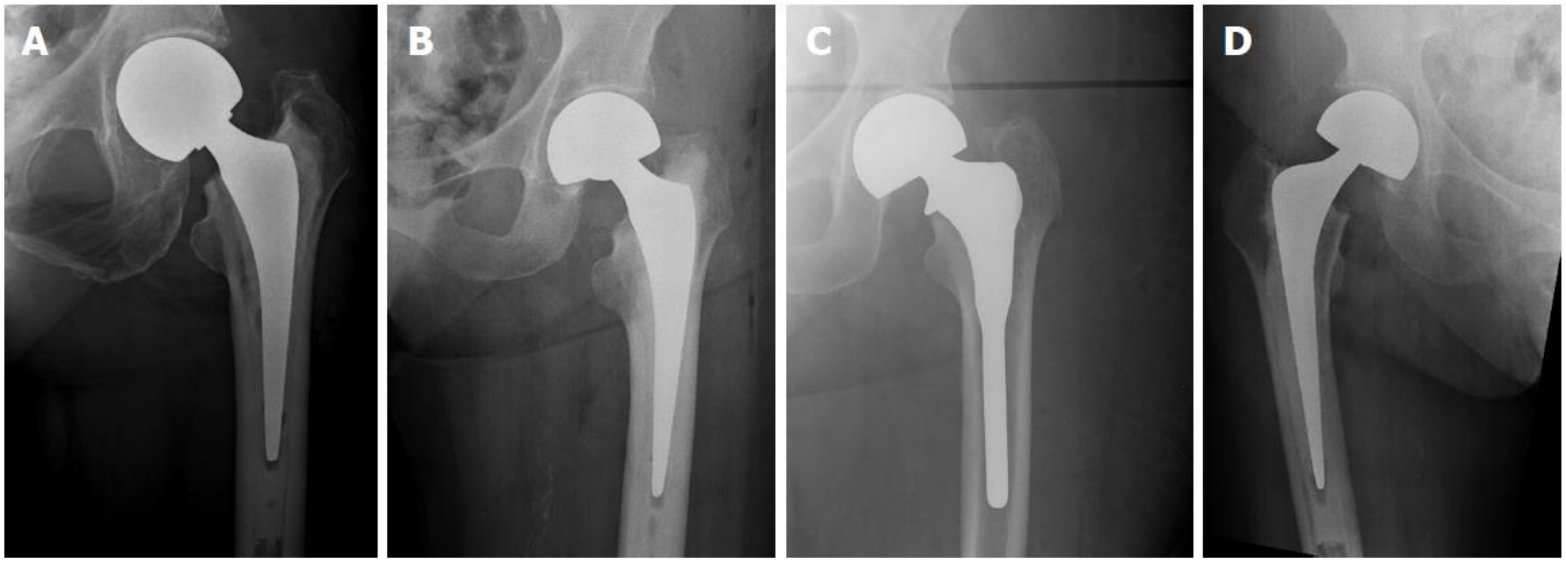
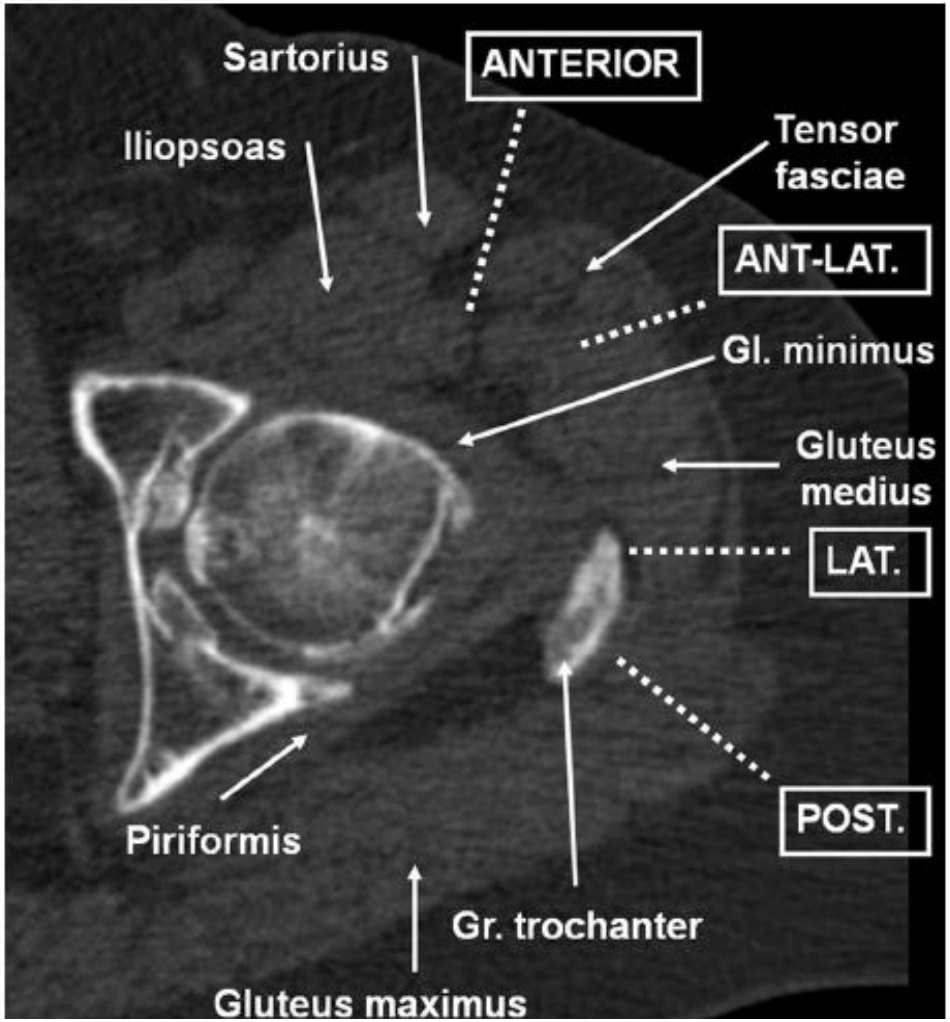


Figure 1 A hip hemi-arthroplasty with a unipolar component head (A); a hip hemi-arthroplasty with a bipolar component head (B); a hip hemi-arthroplasty with an uncemented femoral stem (C); and a hip hemi-arthroplasty with a cemented femoral stem (D).

Robertson et al., World J Orthop 2018; 9: 235-44

Which approach?



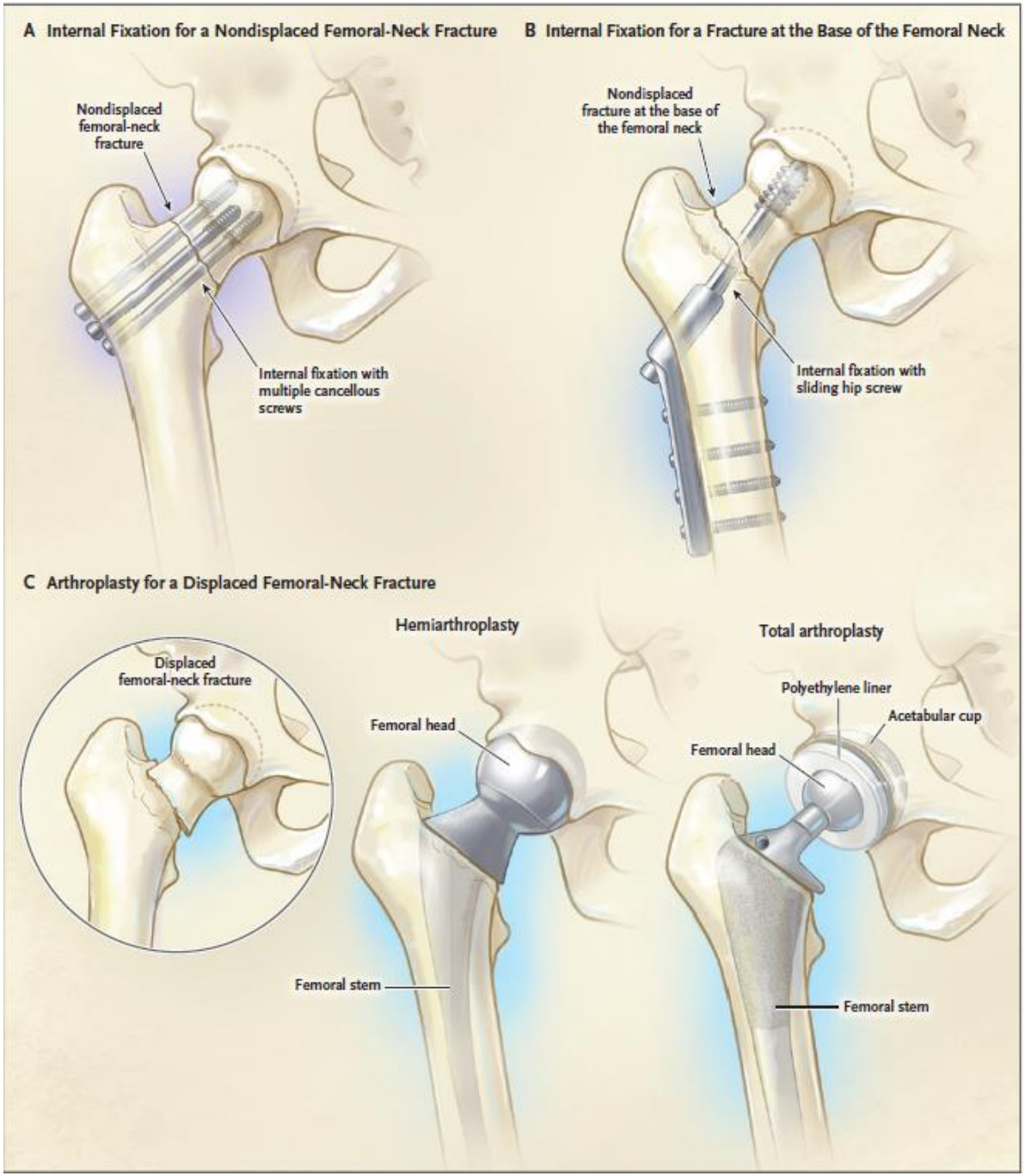
Anterior: sartorius and TFL
Anterolateral: TFL and G. med
Post: piriformis and short hip ERs

Huppertz et al., Skelet Radiol 2014; 43: 1041-51

Table 1
Advantages and disadvantages of the 3 surgical approaches to arthroplasty

Approach	Advantage	Disadvantage
Posterolateral	No abductor damage (low limp) Extensile	Higher dislocation risk
Anterolateral	Low dislocation risk	Possible abductor damage (higher limp)
Anterior	Low dislocation risk Low limp risk	More difficult Requires fluoroscopy

Mears, Clin Geriatr Med 2014; 30: 229-41



Bhandari et al., N Engl J Med 2017; 377: 2053-62

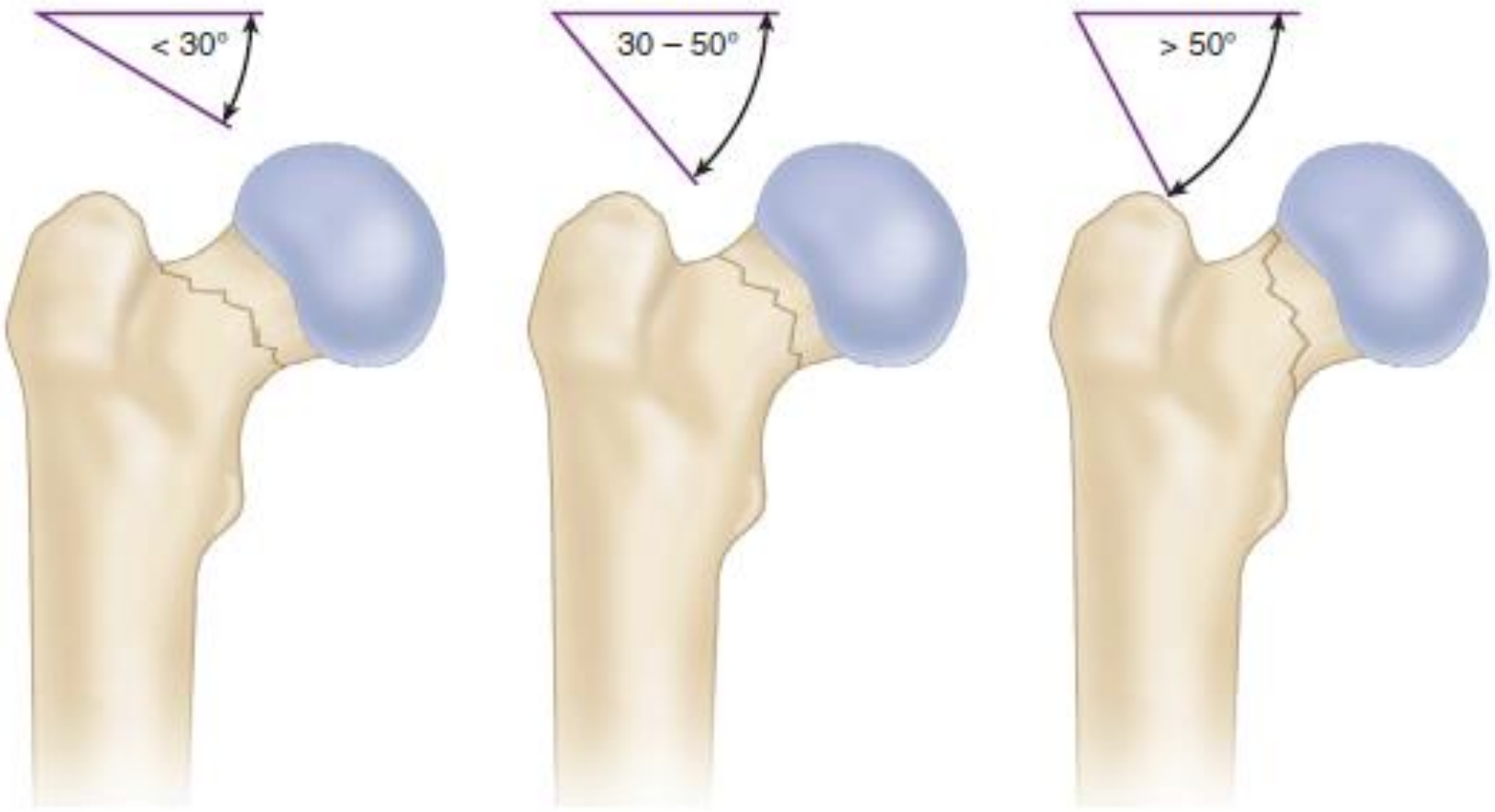
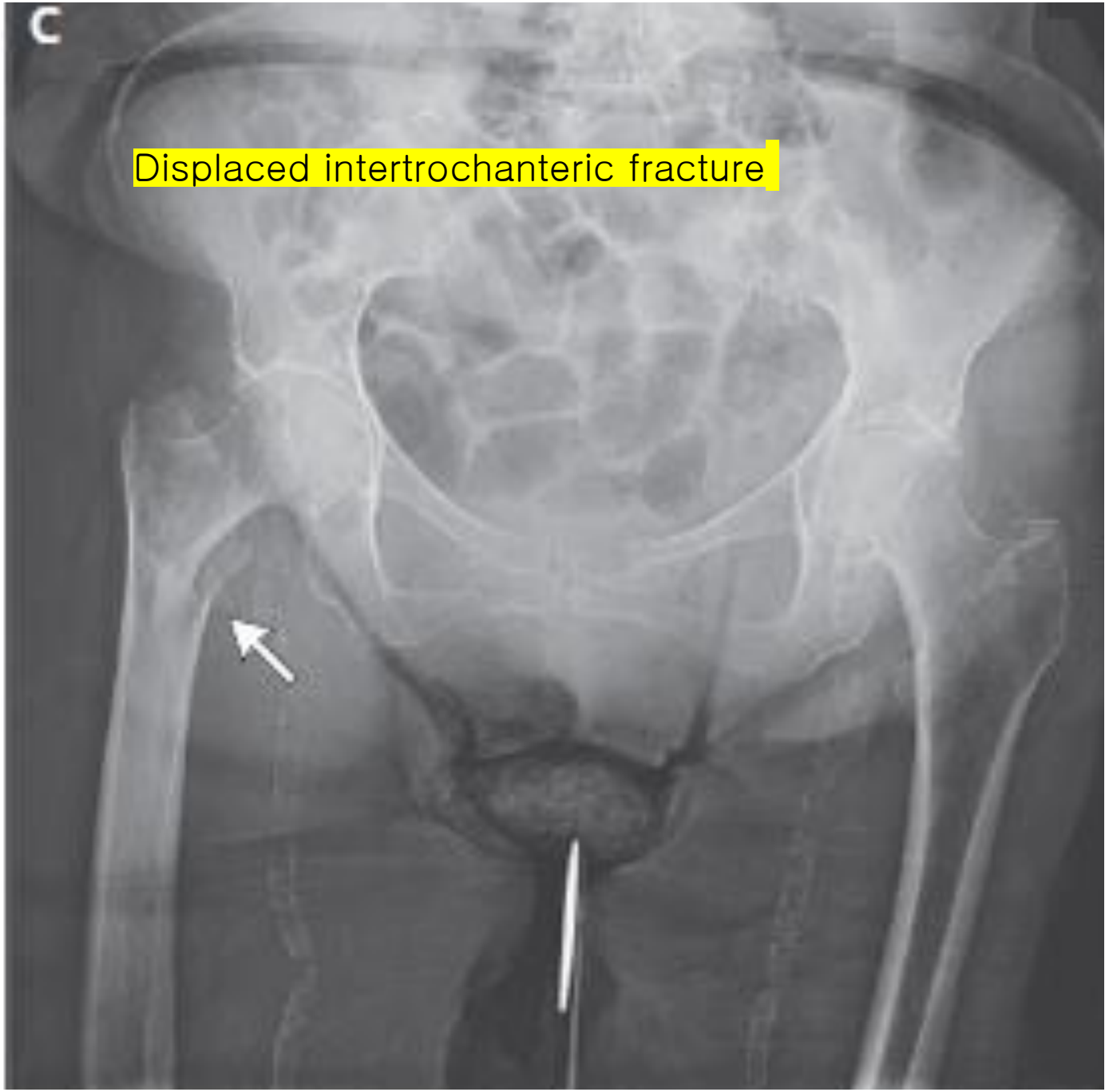


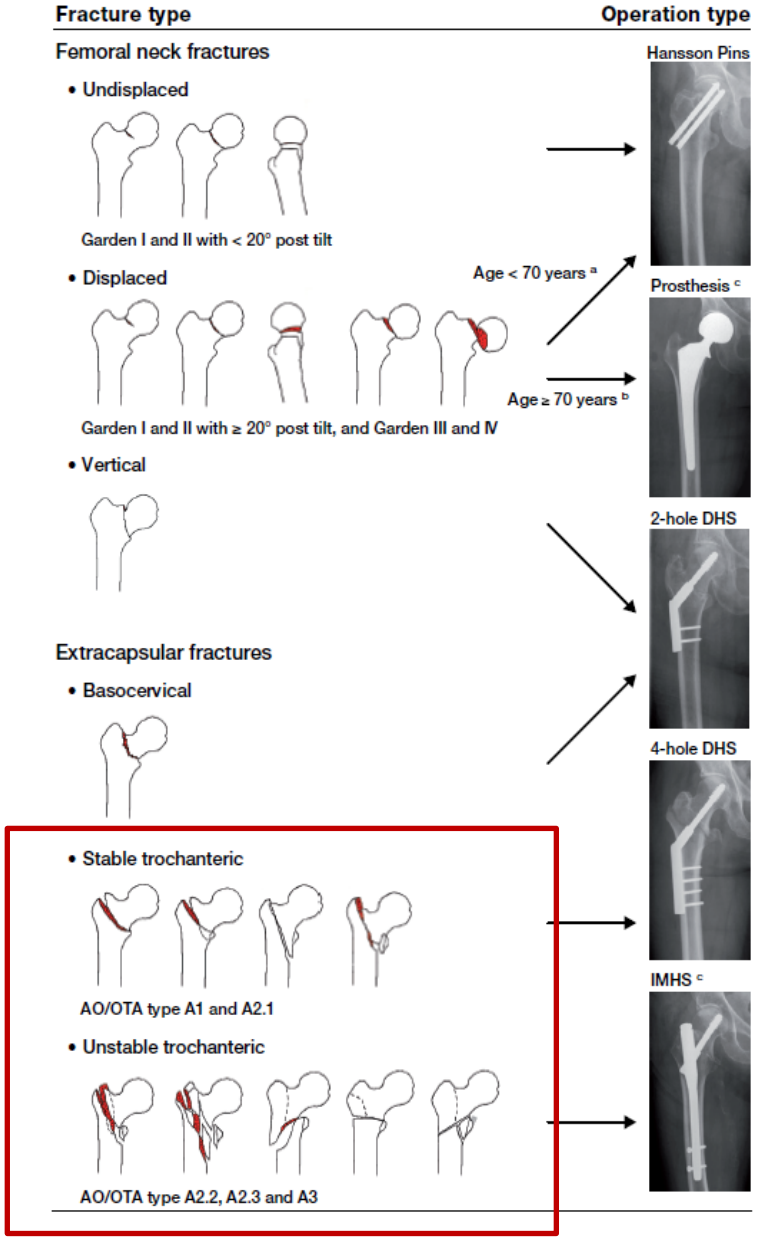
FIGURE 55-4 Pauwels classification of femoral neck fractures.

Stable Less stable Unstable

John C. Weinlein Chapter 55. Fractures and dislocations of the hip Campbell's Operative Orthopaedics 14th E-Book



Bhandari et al., N Engl J Med 2017; 377: 2053-62



Palm et al., Acta Orthopaedica 2012; 83: 26-30

Fracture Stability

Stable

- Intact lateral buttress
- Few pieces (no comminution)

Unstable

- Lateral buttress is fractured
- Many pieces (comminution)
- Reverse oblique pattern
- Subtrochanteric fractures

Mears, Clin Geriatr Med 2014; 30: 229-41

Reverse Oblique Fractures of the Femur

Classic Intertrochanteric

Intact lateral cortex

Reverse Oblique

The fracture starts from medial proximal to lateral distal and extends to include the lateral cortex distally.

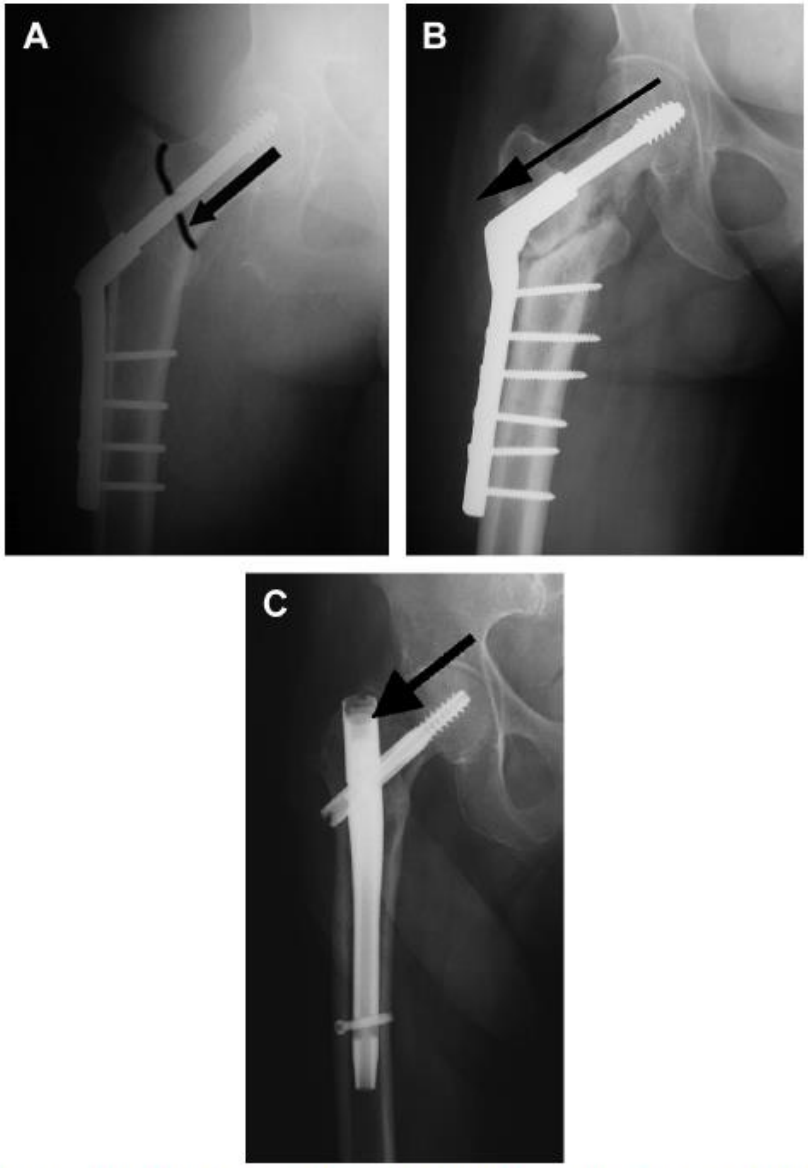
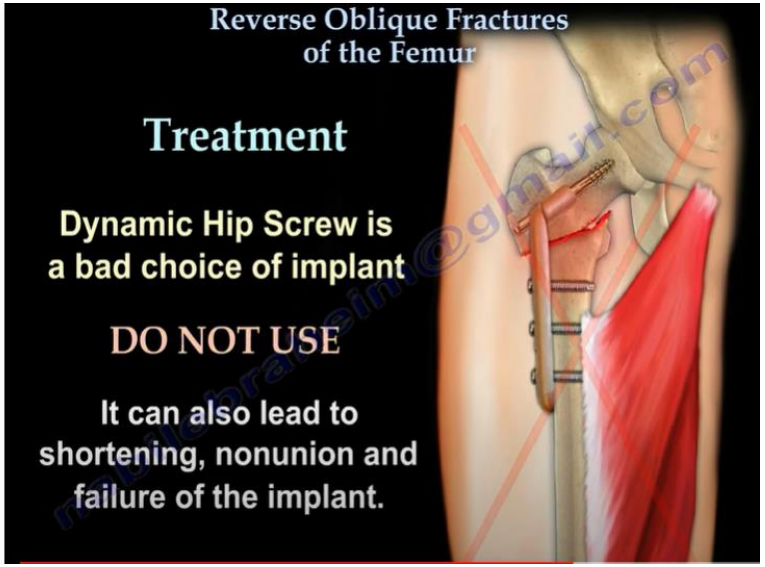
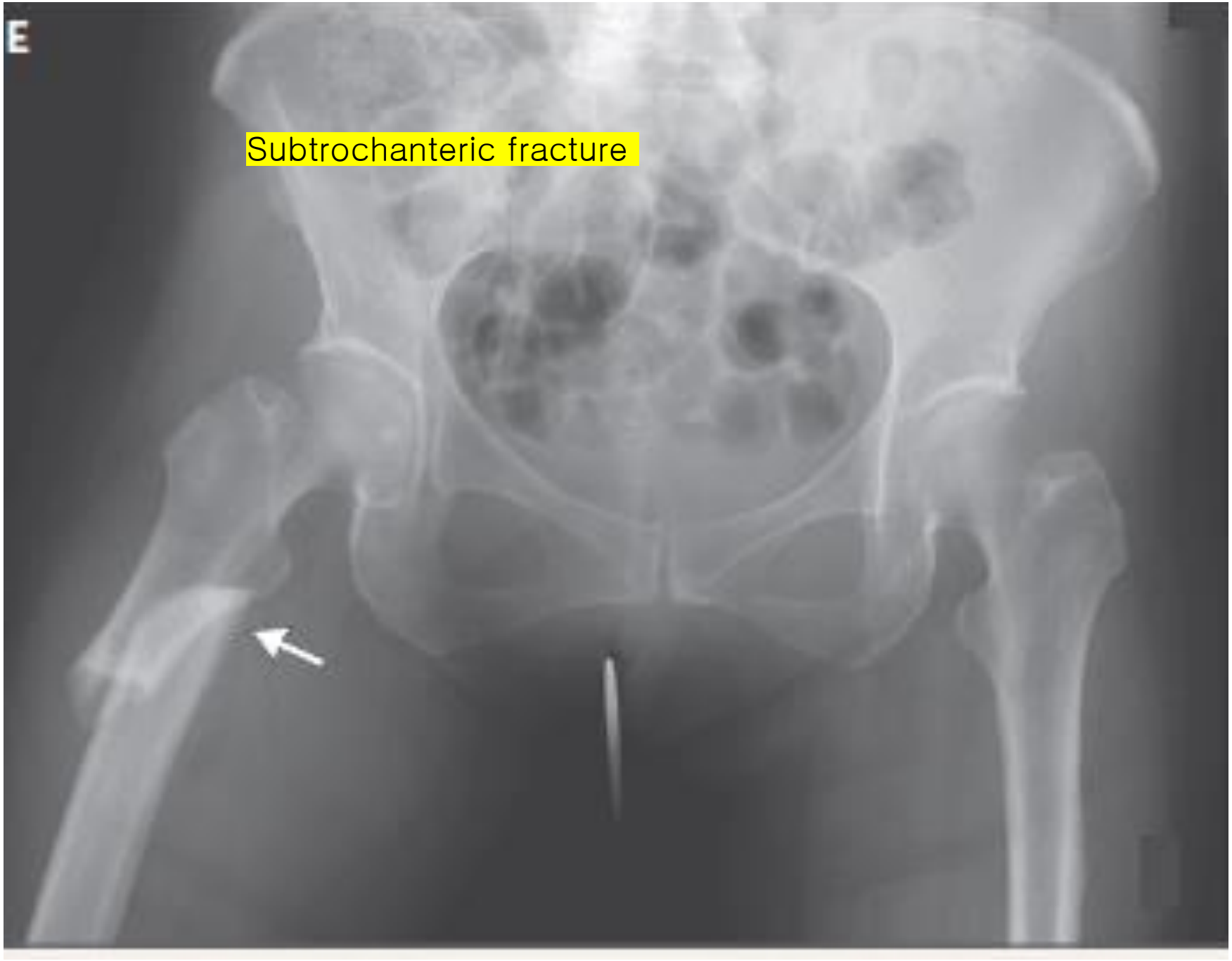


Fig. 6. Anteroposterior radiographs showing treatment options and biomechanics for intertrochanteric fractures. (*A*) SHS in a stable fracture. The arrow shows the vector of force during standing. With the lateral cortex intact, the fracture can stably impact as the screw slides within the barrel of the plate. (*B*) SHS in an unstable fracture. In this reverse oblique pattern, the plate cannot resist the sliding force in the direction of the arrow, and the device fails before fracture healing. (*C*) IMHS in an unstable fracture. The fracture impacts along the path indicated by the arrow, and the nail itself acts as a limitation to the sliding of the screw.



Mears, Clin Geriatr Med 2014; 30: 229-41
https://www.youtube.com/watch?v=7L45pkgj5iQ



Bhandari et al., N Engl J Med 2017; 377: 2053-62

Fig. 1. A, B: Subtrochanteric fracture of left femur treated by limited open reduction and intramedullary fixation; C: postoperative 4 weeks; D: postoperative 12 weeks; E: intraoperative macroscopic view of the incisions (from left to right: a 3 cm-long incision for the distal nail, 4 cm for limited open reduction at fracture end, 2 cm for the proximal nail, 3 cm at the entry point).

In summary ①

TABLE 2 Hip Fracture Type, Surgical Treatment, and Related Precautions[36,230]

Fracture Type	Surgical Treatment	Dislocation Precaution or Adverse Outcome
Stable femoral neck, minimally displaced valgus impacted femoral neck	Fixation Fixation with percutaneous cannulated screws	None
Unstable, displaced femoral neck	Unipolar or bipolar hemiarthroplasty with cemented stem, anterior or posterior approach Although evidence is limited, THA is often chosen over hemiarthroplasty for more active or younger patients	Lower dislocation rate in hemiarthroplasty than in THA[116,240,270,277,279] Dislocation precautions (limiting adduction, flexion, internal rotation) may be recommended for the posterior approach Evidence is limited and evolving on precaution use, and recommendations may be dependent on patient and surgical factors[57,256] Usually, no dislocation precautions are used for patients with the anterior approach
Stable intertrochanteric fracture	Cephalomedullary nail or sliding (dynamic) hip screw	None
Unstable intertrochanteric	Cephalomedullary nail	None
Subtrochanteric or reverse obliquity fractures	Long cephalomedullary nail	None

Abbreviation: THA, total hip arthroplasty.

McDonough et al., J Orthop Sports Phys Ther 2021; 51: CPG1-CPG81

Outline 2

- Hip fracture surgery
  - Classification
  - Surgical approach
- Is comprehensive rehab required after hip fracture surgery?
- Rehab
  - Weight bearing
  - Early mobilization
  - Occupational therapy
- Total knee arthroplasty

Formal Physical Therapy After Total Hip Arthroplasty Is Not Required

A Randomized Controlled Trial

Matthew S. Austin, MD, Brian T. Urbani, BS, MS, Andrew N. Fleischman, MD, Navin D. Fernando, MD, FRCSC, James J. Purtill, MD, William J. Hozack, MD, Javad Parvizi, MD, FRCS, and Richard H. Rothman, MD, PhD

Investigation performed at The Rothman Institute, Department of Orthopaedic Surgery, Thomas Jefferson University, Philadelphia, Pennsylvania

therapy. This is a critical issue that requires examination, as outpatient therapy services after total hip arthroplasty accounted for $180.4 million of costs for U.S. Medicare patients alone in 2009[14,15]. Given the uncertain benefit of utilizing such a costly ancillary service, the efficacy of outpatient therapy in improving

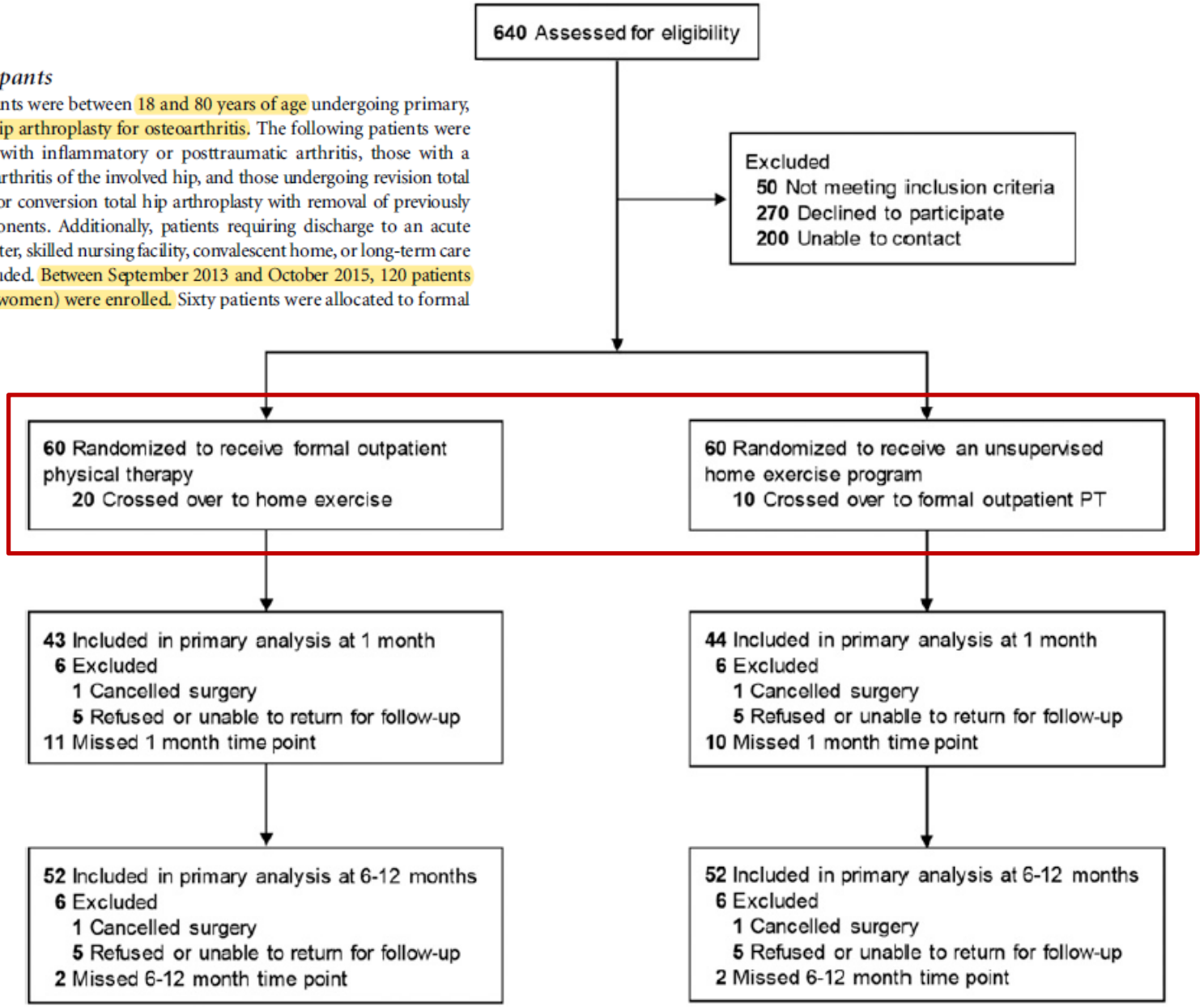
1억 8천만달러, 2천억원; 2009년 U.S. Medicare

Austin et al., J Bone Joint Surg Am 2017; 99: 648-55

Department of Orthopaedic Surgery, Thomas Jefferson University, Philadelphia, Pennsylvania

Study Participants

Eligible participants were between 18 and 80 years of age undergoing primary, unilateral total hip arthroplasty for osteoarthritis. The following patients were excluded: those with inflammatory or posttraumatic arthritis, those with a history of septic arthritis of the involved hip, and those undergoing revision total hip arthroplasty or conversion total hip arthroplasty with removal of previously implanted components. Additionally, patients requiring discharge to an acute rehabilitation center, skilled nursing facility, convalescent home, or long-term care facility were excluded. Between September 2013 and October 2015, 120 patients (66 men and 54 women) were enrolled. Sixty patients were allocated to formal



Austin et al., J Bone Joint Surg Am 2017; 99: 648-55

Interventions

All patients received daily inpatient physical therapy and occupational therapy until the time of hospital discharge. The formal outpatient physical therapy group received 2 weeks of in-home physical therapy followed by formal outpatient therapy, with 2 to 3 weekly sessions for an additional 8 weeks after the surgical procedure. Additionally, patients were provided with a list of suggested physical therapy exercises to be performed at home. The unsupervised home exercise group followed a 10-week unsupervised home exercise program based on a detailed physical therapy manual that was provided to patients prior to discharge. This

Austin et al., J Bone Joint Surg Am 2017; 99: 648-55

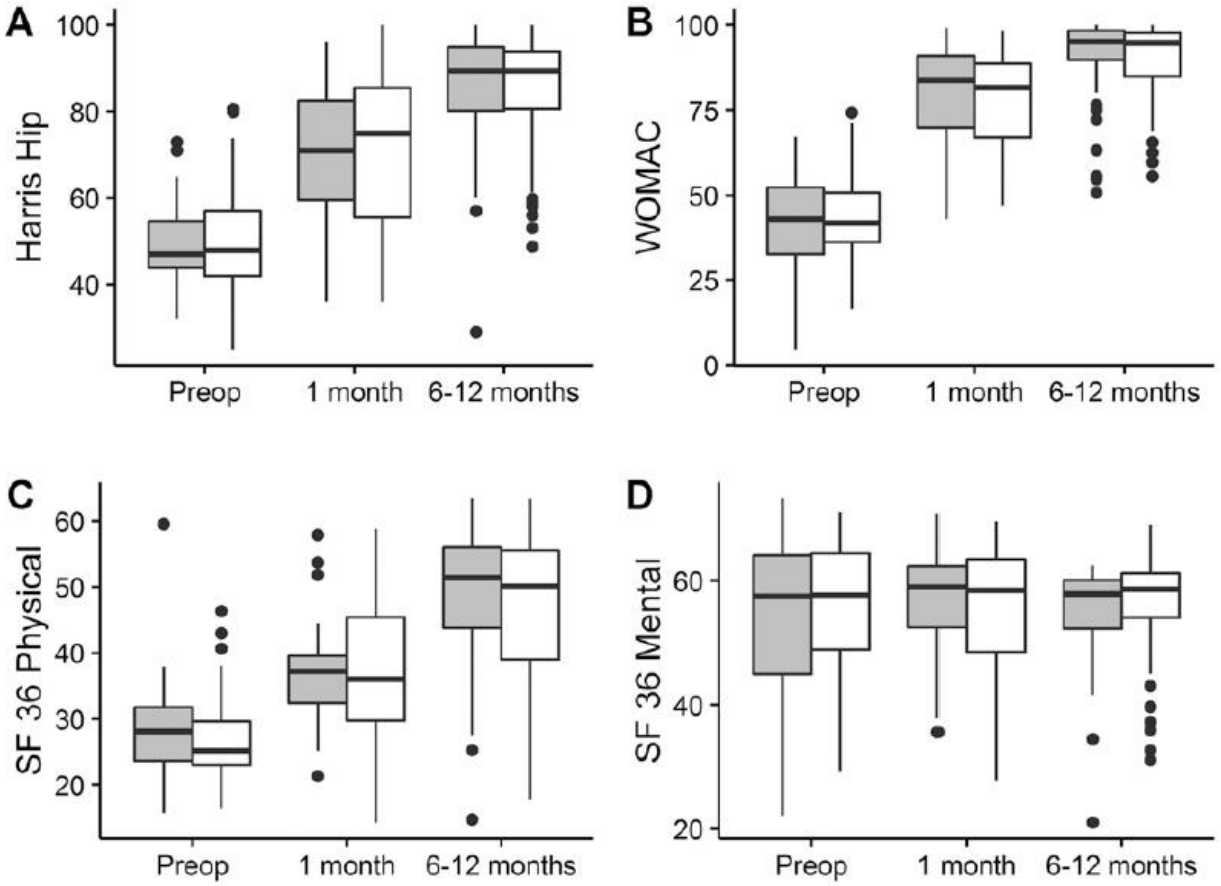


Fig. 2

Boxplot showing functional measures by group over time. The shaded boxes indicate the formal physical therapy group, and the white boxes indicate the unsupervised home exercise group. The boxes are formed by the top quartile, median, and bottom quartile, the whiskers indicate 1.5 times the interquartile range, and the black circles indicate outliers.

Conclusions: This randomized trial suggests that unsupervised home exercise is both safe and efficacious for a majority of patients undergoing total hip arthroplasty, and formal physical therapy may not be required.

Level of Evidence: Therapeutic Level I. See Instructions for Authors for a complete description of levels of evidence.

Formal Physical Therapy After Total Hip Arthroplasty Is Not Required

A Randomized Controlled Trial

This major finding has led all joint surgeons at our institution to discontinue the routine use of formal outpatient therapy for most patients after total hip arthroplasty.

Austin et al., J Bone Joint Surg Am 2017; 99: 648-55

Truthfulness in Titles

support the null hypothesis of equivalence in study outcomes between intervention groups.

Even if the problems over patient selectivity and type II statistical error did not exist, there is another issue: The reader does not know what forms of rehabilitation therapy were provided to the patients assigned to the outpatient therapy arm of the study.[3] We know that these patients were supposed to receive 2 weeks of home therapy with 2 or 3 weekly sessions of outpatient therapy for 8 weeks provided by a physical therapist, but nothing is written about the actual intervention. Thus, even if the study had adequate internal validity for its conclusions, the reader has simply no idea of what the formal rehabilitation intervention was in those assigned to the formal therapy arm of the study.

Research articles need more than a catchy or provocative title to help build a strong foundation of evidence on rehabilitation interventions. Clinical trials have to be carefully designed and planned to be scientifically adequate and defensible for conclusions to be drawn from them. The findings of the Austin et al trial can be a stimulus for future clinical trials that:

- Define with clarity and more precision what happens in the rehabilitation process provided to participants and the degree to which the interventions are actually delivered to participants.
- Include the patients that represent the population to whom the researchers want to generalize the results.
- Have sufficient statistical power to answer the very important question, "For whom is an evidence-based program of rehabilitation intervention post–total hip replacement deemed efficacious or effective?"

Such future trials will serve as a much stronger foundation for measuring rehabilitation intervention efficacy and effectiveness.

Alan M. Jette

A.M. Jette, PT, PhD, FAPTA, is editor in chief of **PTJ**.

Alan M. Jette, PT, Ph.D., MPH, FAPTA

Jette's research focuses on evaluation of rehabilitation outcomes, functional measurement, and the prevention and treatment of disability.

He served as Dean of Boston University's Sargent College of Health and Rehabilitation Sciences from 1996-2004 and was Professor of Health Policy & Management at the Boston University School of Public Health from 2005-2017. He currently serves at the MGH Institute of Health Professions as Professor of Rehabilitation Sciences.

In 2013, Dr. Jette was elected to the National Academy of Medicine, formerly the Institute of Medicine. He is Editor-in-Chief of the journal PHYSICAL THERAPY.

Jette, Phys Ther 2017; 97: 855-6

entices the reader to examine the study more closely. Unfortunately, I will be using this article with future students as an example of a title that—though provocative—is *not* an accurate portrayal of the results of the study. It is a title that could

Study Participants

Eligible participants were between 18 and 80 years of age undergoing primary, unilateral total hip arthroplasty for osteoarthritis. The following patients were excluded: those with inflammatory or posttraumatic arthritis, those with a history of septic arthritis of the involved hip, and those undergoing revision total hip arthroplasty or conversion total hip arthroplasty with removal of previously implanted components. Additionally, patients requiring discharge to an acute rehabilitation center, skilled nursing facility, convalescent home, or long-term care facility were excluded. Between September 2013 and October 2015, 120 patients

In addition, selection bias may have influenced our cohort and even may have impacted the course of treatment for some patients. Patients of a higher socioeconomic and education level may have had a greater appreciation for the value of the study and thus more commonly may have agreed to par-

Austin et al., J Bone Joint Surg Am 2017; 99: 648-55

TABLE II Baseline Demographic Characteristics and Functional Scores Based on Adherence to Protocol

Variable	Allocated to Formal Physical Therapy Group			Allocated to Home Exercise Group		
	Per Protocol (N = 34)	Crossover (N = 20)	P Value	Per Protocol (N = 44)	Crossover (N = 10)	P Value
Age* *(yr)*	60.8 ± 8.7	61.9 ± 8.0 37%	0.62	61.4 ± 7.3	66.2 ± 9.8 19%	0.08
Sex†			0.88			1.0
Male	20	13		23	5	
Female	14	7		21	5	
BMI* *(kg/m²)*	30.4 ± 5.3	30.4 ± 5.1	1.0	28.3 ± 5.2	28.1 ± 6.0	0.91
Approach†			0.53			1.0
Direct anterior	7	2		11	2	
Direct lateral	27	18		33	8	
Length of stay* *(days)*	1.13 ± 0.35	1.19 ± 0.54	0.77	1.15 ± 0.50	1.00 ± 0	0.47
Charlson Comorbidity Index* *(points)*						
Not adjusted for age	0.26 ± 0.67	0.20 ± 0.70	0.74	0.25 ± 0.58	0.50 ± 1.3	0.34
Adjusted for age	2.79 ± 1.3	2.80 ± 1.2	0.99	2.91 ± 1.27	3.30 ± 1.3	0.39
ASA* *(points)*	2.41 ± 0.56	2.55 ± 0.51	0.37	2.30 ± 0.55	2.50 ± 0.53	0.29
Preoperative scores* *(points)*						
HHS	48.8 ± 8.6	50.6 ± 10.6	0.57	50.6 ± 13.3	43.3 ± 6.7	0.12
WOMAC	42.3 ± 14.5	41.4 ± 14.9	0.85	44.2 ± 11.6	36.8 ± 12.3	0.09
SF-36 Physical Health Component Summary	28.8 ± 7.8	26.5 ± 5.9	0.33	27.6 ± 7.2	23.9 ± 4.6	0.15
SF-36 Mental Health Component Summary	53.5 ± 12.7	52.4 ± 14.8	0.79	55.6 ± 11.0	56.2 ± 8.2	0.88

*The values are given as the mean and the standard deviation. †The values are given as the number of patients.

Austin et al., J Bone Joint Surg Am 2017; 99: 648-55

- Define with clarity and more precision what happens in the rehabilitation process provided to participants and the degree to which the interventions are actually delivered to participants.
- Include the patients that represent the population to whom the researchers want to generalize the results.
- Have sufficient statistical power to answer the very important question, "For whom is an evidence-based program of rehabilitation intervention post–total hip replacement deemed efficacious or effective?"

Jette, Phys Ther 2017; 97: 855-6

Methods We did a prospective, single-centre, randomised, parallel-group, controlled trial. Between April 18, 2008, and Dec 30, 2010, we randomly assigned home-dwelling patients with hip-fractures aged 70 years or older who were able to walk 10 m before their fracture, to either comprehensive geriatric care or orthopaedic care in the emergency

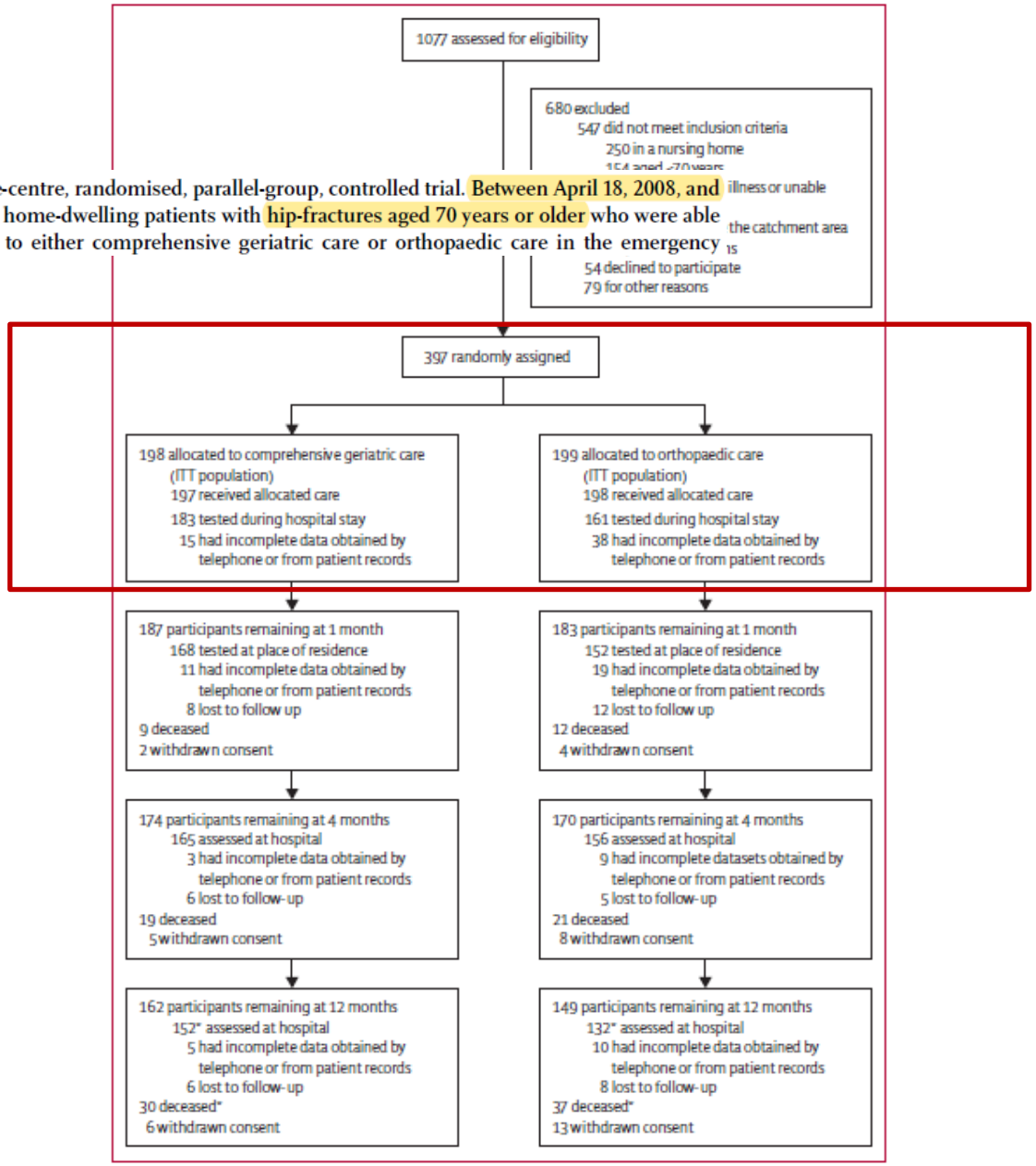


Figure 1: **Trial profile**

*One participant registered as deceased in the comprehensive geriatric care group and one in the orthopaedic care group finished their final tests before death. Data for health-care services and economics were available for all patients except one in the orthopaedic care group who withdrew consent to collect data from registries; therefore n=198 in both groups.

Presto et al., Lancet 2015; 385: 1623-33

Baseline characteristics did not differ between the groups (table 2). For the 397 randomly assigned patients,

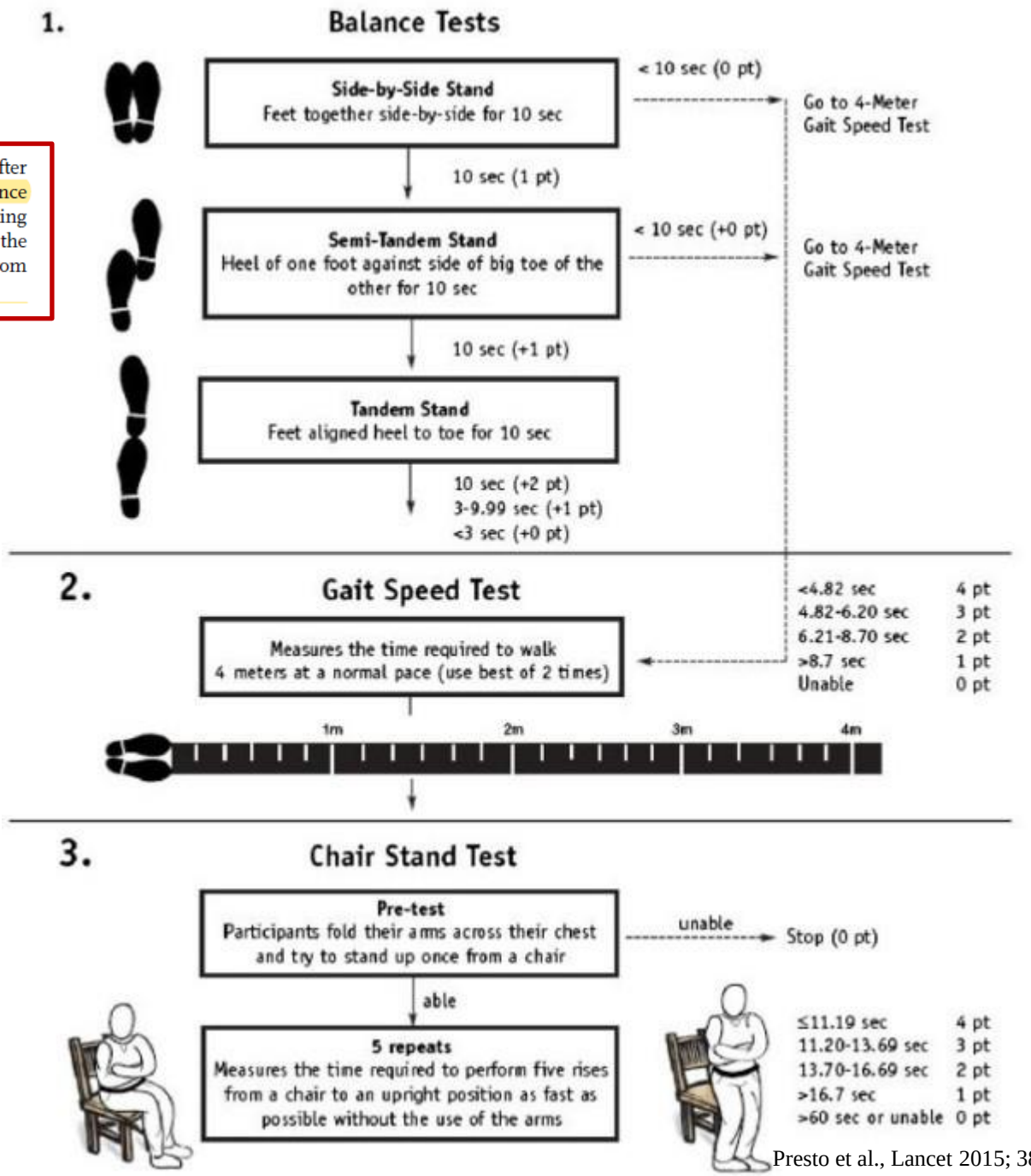
	Comprehensive geriatric care (N=198)	Orthopaedic care (N=199)
Age (years)	83·4 (5·4)	83·2 (6·4)
Female	145 (73%)	148 (74%)
Sheltered housing	26 (13%)	20 (10%)
Living alone	115 (58%)	124 (62%)
Barthel Index (0–20)	18·3 (2·3)	18·1 (2·8)
Nottingham Extended ADL scale (0–66)	42·5 (17·7)	41·9 (17·5)
Clinical Dementia Rating Scale (0–18)	2·7 (4·0)	2·7 (3·9)
APACHE II (5–89)	9·3 (3·3)	9·1 (2·9)
Charlson comorbidity index (0–30)	2·3 (2·3)	2·3 (2·0)
Previous diagnoses		
Heart disease	97 (49%)	89 (45%)
Stroke	49 (25%)	57 (29%)
Diabetes	23 (12%)	28 (14%)
Dementia	27 (14%)	26 (13%)
Cancer	53 (27%)	43 (22%)
Kidney disease	18 (9%)	9 (5%)
Fracture type		
Femoral neck	119 (60%)	127 (64%)
Trochanteric	66 (33%)	58 (29%)
Subtrochanteric	13 (7%)	14 (7%)
Surgical treatment		
Hemiarthroplasty	76 (38%)	88 (44%)
Screws	38 (19%)	32 (16%)
Bone plates and screws	69 (35%)	63 (32%)
Other	13 (7%)	14 (7%)
Died before surgery	2 (1%)	2 (1%)

Data are mean (SD) or n (%). ADL=activities of daily living. APACHE II=Acute Physiology And Chronic Health Evaluation disease severity classification II.

Table 2: **Baseline characteristics**

Presto et al., Lancet 2015; 385: 1623-33

The primary outcome was mobility at 4 months after surgery measured by the Short Physical Performance Battery (SPPB),[17] assessing standing balance, walking speed, and ability to rise from a chair, assessed in the intention-to-treat population. The total score ranges from 0–12; high scores suggest better mobility.



Presto et al., Lancet 2015; 385: 1623-33

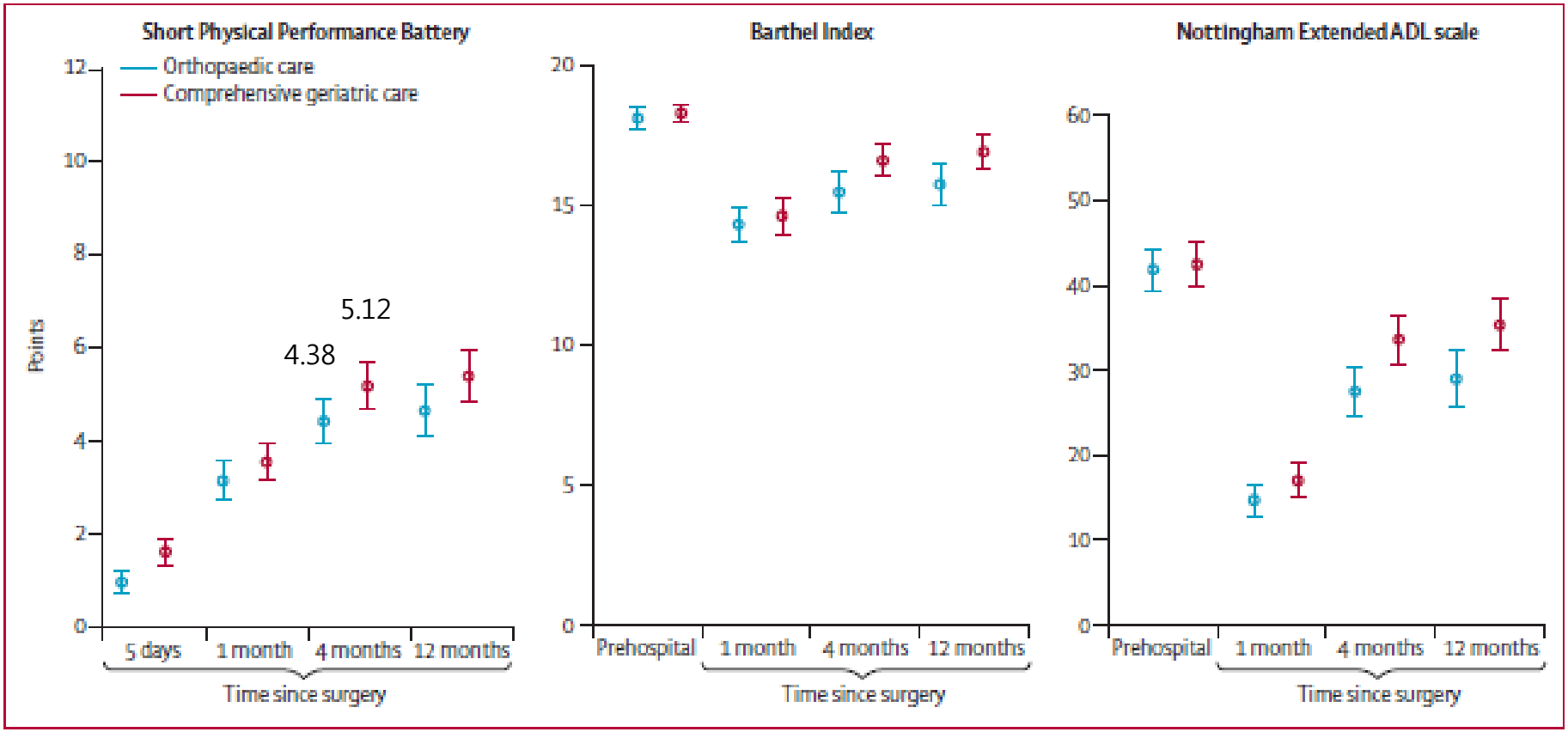


Figure 2: **Mobility, activities of daily living, and instrumental activities of daily living**
Data are mean, 95% CI. ADL=activities of daily living.

4 months	174		170			
Mobility						
Short Physical Performance Battery	165	5·12 (0·20)	160	4·38 (0·20)	0·74 (0·18 to 1·30)	0·010

treatment of elderly patients. Usually the team is comprised of a geriatrician collaborating with nursing staff trained in geriatrics, physiotherapists, and occupational therapists, and in many cases a nutritionist and a social worker. The interdisciplinary team should collaborate

Comprehensive geriatric care?

Table 2 Comprehensive geriatric assessment at the Department of Geriatrics

Dimensions assessed	*Somatic health* – concurrent injuries or medical conditions, drug regimen, pain, falls, osteoporosis
	Mental health - cognition, depression, anxiety
	Function - ADL, IADL, mobility, sensory loss, elimination
	Social situation - place of residence, network, caregiver burden
Interdisciplinary team work	Dedicated responsibilities
Interdisciplinary team meetings	1st day postoperatively: plan for individual treatment, goal setting, discharge planning,
	4th day postoperatively: evaluation, discharge planning
Systematic approach	*Checklists*
	Treatment protocols
	Assessment scales (Barthel Index, Cumulated Ambulation
	Score: Confusion Assessment Method, Verbal Rating Scale)
Mobilization/Rehabilitation	Mobilization out of bed 1st day postoperatively
	Individualised plan for mobilization and participation in ADL being integrated in care plans and ward activities
Discharge planning	Collaboration with patient, caregivers and municipality
	Mapping of pre-fracture function, place of residence and social situation
	Discuss discharge destination 1st day postoperatively
	Set realistic short- and long-term goals
	Organize institutional care, aids, assistance, physiotherapy when appropriate

ADL – Activities of Daily Living. IADL- Instrumental Activities of Daily Living.

Slatvedt et al., BMC Res Notes 2012; 5: 355

	Comprehensive geriatric care	Orthopaedic care
Department	Department of Geriatrics, Clinic of Internal Medicine	Department of Orthopaedic Surgery, Clinic of Orthopaedics and Rheumatology
Facilities*	Geriatric ward: Five one-bed rooms organised in a group together reserved for patients with hip fractures within a 15-bed ward	Orthopaedic trauma ward: One, two, or four-bed rooms in a 19-bed ward before, or single rooms in a 24-bed ward after relocation Mixed orthopaedic trauma patient population
Team members, †number per bed		
Geriatricians	0·13	..
Registered nurses, licensed practical nurses	1·67	1·48
Physiotherapists	0·13	0·09 (0·07 after relocation)
Occupational therapists	0·13	None
Orthopaedic surgeons	..	0·11 (0·08 after relocation)
Treatment	Structured, systematic interdisciplinary comprehensive geriatric assessment and care focusing on: somatic health (comorbidity management, review of drug regimens, pain, nutrition, elimination, hydration, osteoporosis, and prevention of falls); mental health (depression, delirium); function (mobility, p-ADL and i-ADL) and social situation Early discharge planning Early mobilisation and initiation of rehabilitation	Following of routines of Department of Orthopaedic Surgery

For both groups, management of standard treatment and surgery is the same: standard treatment consists of preoperative intravenous fluid, analgesia (preoperative femoral nerve block, regular paracetamol, opioids on demand), thromboembolic prophylaxis, perioperative antibiotic prophylaxis, use of pressure relieving mattresses to avoid decubitus ulcers, and preoperative assessments by an anaesthetist; surgery consists of spinal anaesthesia, two-screw fixation for non-dislocated femoral neck fractures, hemiarthroplasty for dislocated femoral neck fractures, and a sliding hip screw system for trochanteric and subtrochanteric fractures (some subtrochanteric fractures are fixed with antegrade intramedullary nailing). p-ADL=personal Activities of Daily Living. i-ADL=instrumental Activities of Daily living. *Orthopaedic care was relocated to a new hospital building after 219 of 397 patients were recruited. †Separate teams with no collaboration.

Table 1: **Management in the comprehensive geriatric assessment and care and the orthopaedic care groups**

Presto et al., Lancet 2015; 385: 1623-33

	Comprehensive geriatric care (n=198)	Orthopaedic care (n=198)	Difference	
	Mean (SD)	Mean (SD)	Estimate (95% CI)	p value
Index stay	11 868 (4185)	9537 (4393)	2331 (1483 to 3178)	<0·0001
Hospital costs after discharge	7745 (15 006)	11 022 (20 119)	−3277 (−6784 to 230)	0·07
Rehabilitation stay	8105 (9076)	9633 (11 125)	−1529 (−3535 to 477)	0·14
Nursing home stay	14 874 (30 153)	18 798 (32 959)	−3923 (−10 164 to 2318)	0·22
Other primary health and care services	11 741 (15 128)	10 496 (14 498)	1246 (−1683 to 4173)	0·40
Total cost	54 332 (38 048)	59 486 (44 301)	−5154 (−13 311 to 3007)	0·22

Costs are in euros for 2010.

Table 5: **Cost per patient**

Presto et al., Lancet 2015; 385: 1623-33

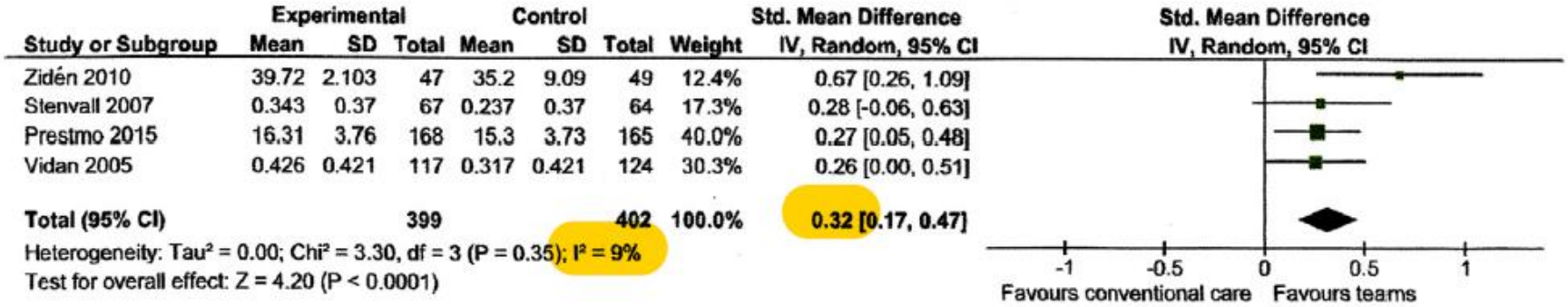
KQ1. 고관절 골절 수술 이후, 병원 기반 다학제 치료가 통상 치료보다 효과적인가?

최종 선정 문헌

Authors	Study No.	Title
Nordström, P., et al. (2018).	SR1	"Effects of Geriatric Team Rehabilitation After Hip Fracture: Meta-Analysis of Randomized Controlled Trials." Journal of the American Medical Directors Association **19**(10): 840-845.
Bachmann, S., et al. (2010).	SR2	"Inpatient rehabilitation specifically designed for geriatric patients: systematic review and meta-analysis of randomised controlled trials." BMJ(340): c1718
Handoll, H. H., et al. (2009).	SR3	"Multidisciplinary rehabilitation for older people with hip fractures." Cochrane Database Syst Rev(4): Cd007125.
Halbert, J., et al. (2007).	SR4	"Multi-disciplinary rehabilitation after hip fracture is associated with improved outcome: a systematic review." Journal of rehabilitation medicine **39**(7): 507-512.

SR: systemic review

Seven studies of at least moderate quality with a total of 1763 participants



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Zidén 2010	39.72	2.103	47	35.2	9.09	49	12.4%	0.67 [0.26, 1.09]
Stenvall 2007	0.343	0.37	67	0.237	0.37	64	17.3%	0.28 [-0.06, 0.63]
Prestmo 2015	16.31	3.76	168	15.3	3.73	165	40.0%	0.27 [0.05, 0.48]
Vidan 2005	0.426	0.421	117	0.317	0.421	124	30.3%	0.26 [0.00, 0.51]
Total (95% CI)			**399**			**402**	**100.0%**	**0.32 [0.17, 0.47]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.30$, $df = 3$ ($P = 0.35$); $I^2 = 9\%$

Test for overall effect: $Z = 4.20$ ($P < 0.0001$)

Fig. 2. Effects of the intervention on ADLs, evaluated in 4 studies. ADLs were evaluated as closely as possible to 4 months after the intervention.

Nordstrom et al., J Am Med Dir Assoc 2018; 19: 840-5

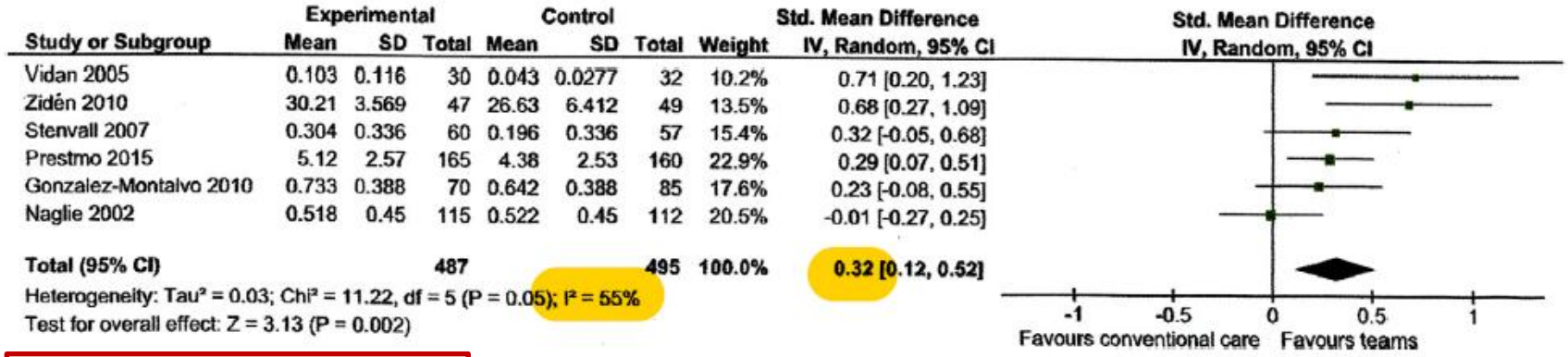


Fig. 3. Effects of the intervention on mobility, evaluated in 6 studies. Mobility was evaluated as closely as possible to 4 months after the intervention.

In summary ②

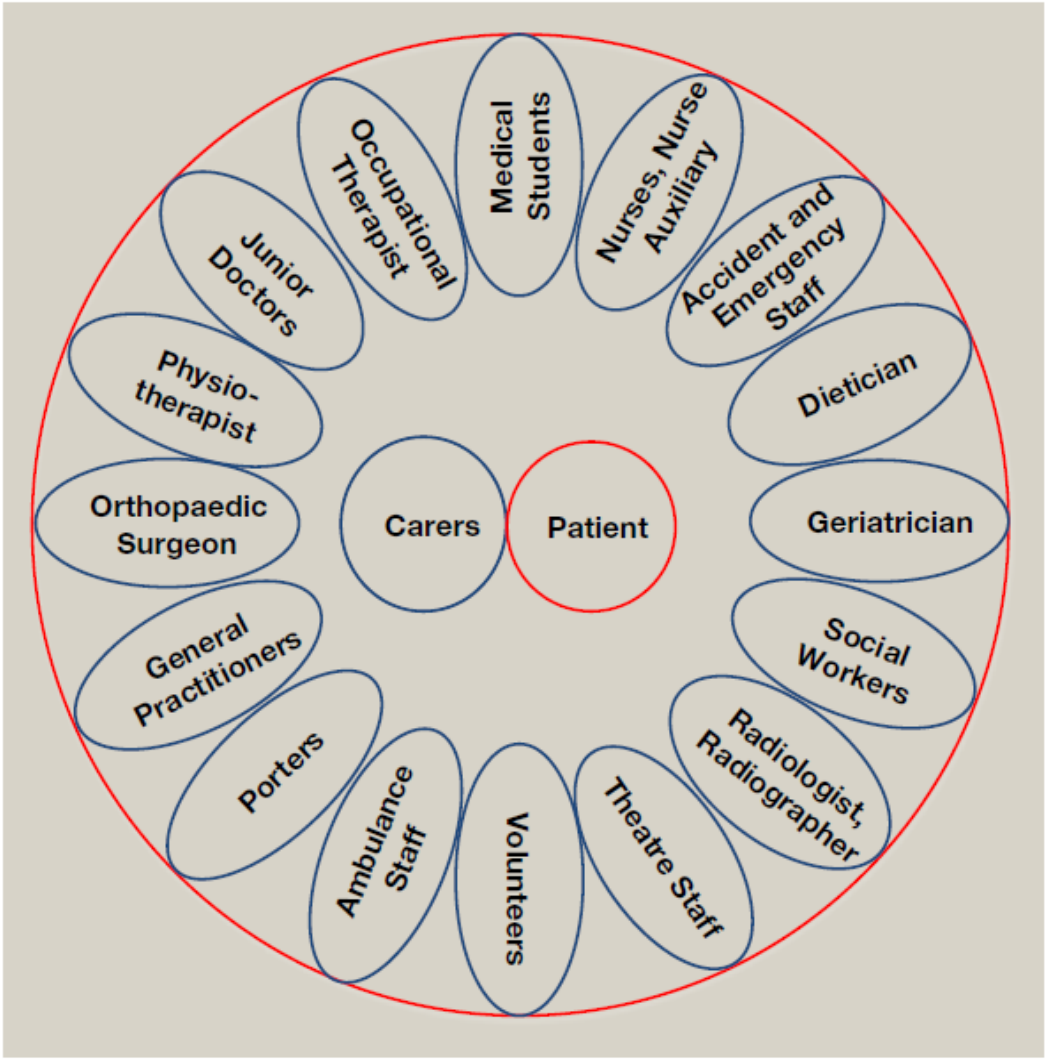


Figure 1 The multidisciplinary team involved in looking after hip fracture patients is extensive.

Riemen & Hutchison, Orthop Trauma 2016; 30: 117--22

Outline 3

- Hip fracture surgery
  - Classification
  - Surgical approach
- Is comprehensive rehab required after hip fracture surgery?
- Rehab
  - Weight bearing
  - Early mobilization
  - Occupational therapy
- Total knee arthroplasty

TABLE 6 Effects of Balance and Progressive Resistance Training

Study/Outcome	Balance Training[a]	Progressive Resistance Training[a]	Extended Exercise After Discharge[b]
Diong et al[66]			
Mobility[c]	0.32 (0.09, 0.55)	0.67 (0.25, 1.08)	
Lee et al[174]			
Balance	0.57 (0.15, 0.99)		
Lower extremity strength	0.28 (0.12, 0.43)		
Gait	0.19 (0.04, 0.35)		
Physical functioning	0.39 (0.11, 0.68)		
Physical performance measures[d]	0.66 (0.13, 1.19)		
Activities of daily living[e]	0.48 (0.04, 0.93)		
Health-related quality of life[f]	0.60 (0.02, 1.18)		
Lee et al[175]			
Balance		0.55 (0.31, 0.80)	
Lower extremity strength		0.42 (0.10, 0.74)	
Gait		0.50 (0.30, 0.70)	
Physical functioning		0.41 (0.24, 0.58)	
Physical performance measures[d]		0.84 (0.20, 1.48)	
Activities of daily living[e]		0.24 (0.04, 0.44)	
Health-related quality of life[f]		Not reported	
Auais et al[14]			
Balance			0.32 (0.15, 0.49)
Lower extremity strength			0.47 (0.27, 0.66)[g]
Gait			0.42 (0.11, 0.73)[h]
Physical functioning			No difference
Physical performance measures[d]			0.53 (0.27, 0.78)
Activities of daily living[e]			No difference
Health-related quality of life[f]			Not reported

[a] *Values are standardized mean difference (95% confidence interval).*
[b] *Values are effect size (95% confidence interval).*
[c] *Included a wide range of mobility outcomes.*
[d] *The timed up-and-go test, the modified Physical Performance Test, the Physical Performance and Mobility Examination, and the Short Physical Performance Battery.*
[e] *The Barthel index, the Functional Independence Measure, basic and instrumental activities of daily living tests, and Lawton's Instrumental Activities of Daily Living Scale.*
[f] *The Medical Outcomes Study 36-Item Short-Form Health Survey (perceived health and self-reported outdoor mobility) and the EuroQol-5 dimensions scale.*
[g] *Affected leg.*
[h] *Fast gait speed; differences were not found for normal gait speed and for the 6-minute walk test.*

McDonough et al., J Orthop Sports Phys Ther 2021; 51: CPG1-CPG81

Strengthening exercise

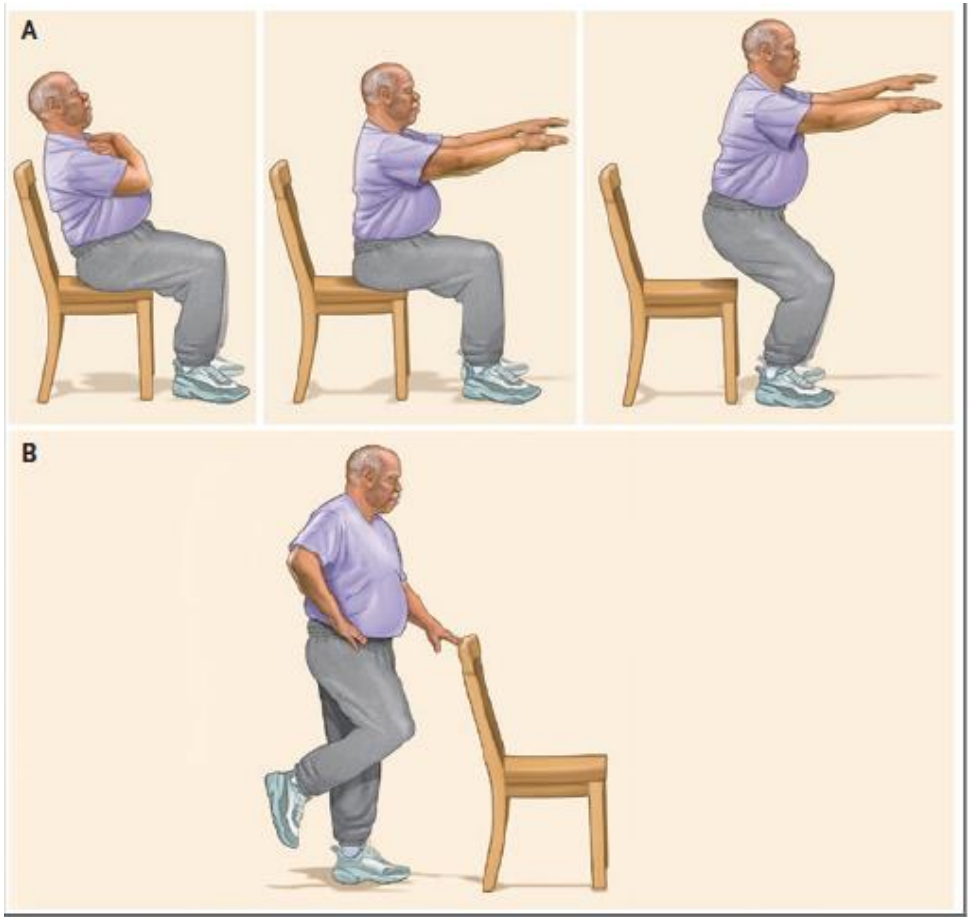


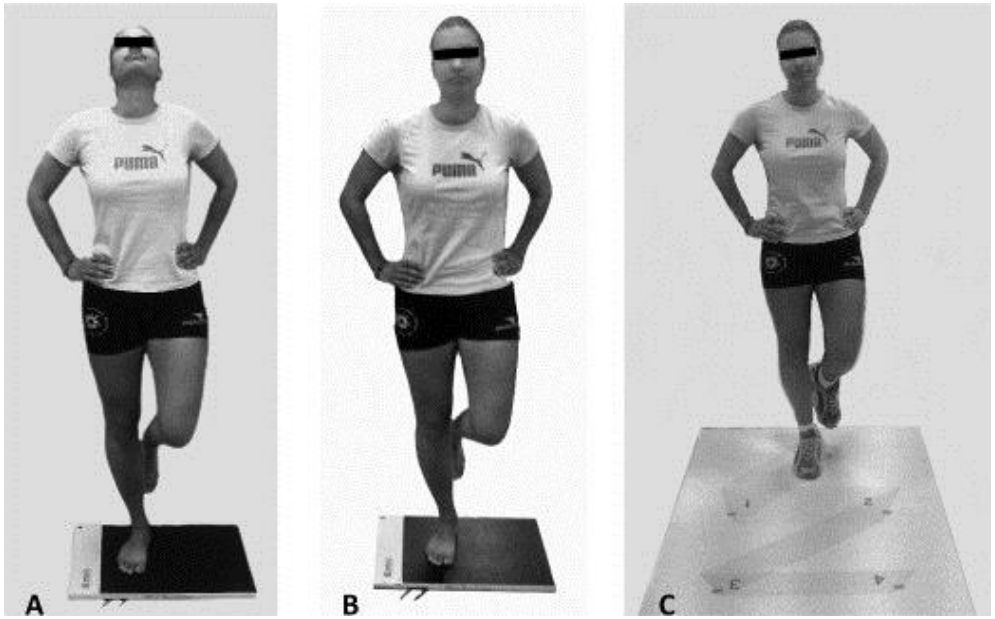
Figure 2. Home-Based Exercises for Leg Strengthening and Balance.

Panel A shows a home-based leg-strengthening exercise based on the Go4Life program developed by the National Institute on Aging. Patients can use their arms to assist with standing, if needed, and progress to standing with arms outstretched as illustrated for two sets of 10 to 15 repetitions. Panel B shows a home-based exercise to improve balance based on the Go4Life program. Patients should stand on one foot behind a sturdy chair, holding on to the chair for balance, and attempt to hold the position for up to 10 seconds. The exercise is repeated 10 to 15 times for each leg. Specific instructions for patients and links to additional exercises are available in the Supplementary Appendix.

Ganz & Latham, N Engl J Med 2020; 382: 734-43

Balance training

In general, the unipedal standing balance exercise was carried out as follows. With their eyes open, subjects were instructed to stand on their right leg for 1 min and then their left leg for another minute, for a total of 2 min, three times in a day. If a subject was unable to stand on one leg continuously for 1 min and required several breaks, he or she was instructed to stand on

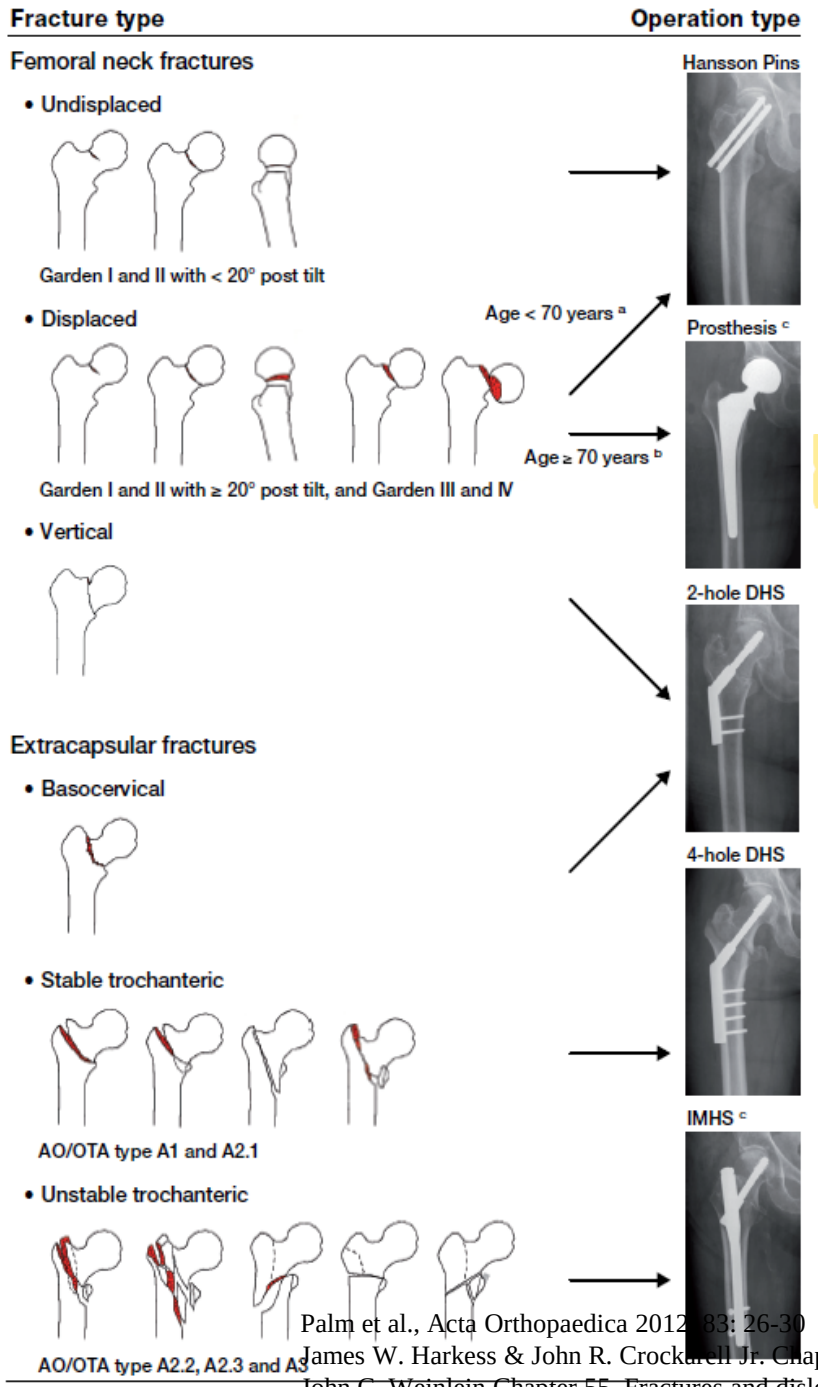


Sakamoto et al., J Orthop Sci 2006; 11: 467-72
Iatridou et al., J Bodyw Mov Ther 2014; 18: 159-64

Weight bearing

days and progress more rapidly. The amount of weight bearing allowed on the operated limb depends on the means of fixation of the components, the presence of structural bone grafts, stress risers in the femur, and trochanteric osteotomy. If the components were cemented, early weight bearing to tolerance is permitted. With cementless, porous ingrowth implants, many authors recommend limited weight bearing for 6 to 8 weeks, whereas others encourage early weight bearing as comfort allows. In a literature review involving cementless implants and weight-bearing restrictions, Hol et al. found no adverse effects on subsidence and osseointegration with unrestricted weight bearing. They did recommend protected weight bearing during stair climbing for the first weeks after surgery because of high torsional loads. All implants and patients may not be the same in this regard, and the decision must be individualized according to the implant and experience of the surgeon. When the patient is able to walk far

James W. Harkess & John R. Crockarell Jr. Chapter 03. Arthroplasty of the hip Campbell's Operative Orthopaedics 14th E-Book



There is no universally accepted postoperative rehabilitation program after THA. Although a pain-free hip can be restored

POSTOPERATIVE CARE. Patients with high-energy femoral neck fractures are kept at touch-down (weight of leg) weight bearing for 10 to 12 weeks. Older patients are allowed protected weight bearing with a walker if their balance and other medical comorbidities allow. Patients who cannot safely ambulate are encouraged to mobilize to a chair to minimize pulmonary complications.

If the components were cemented, early weight bearing to tolerance is permitted. With cementless, porous ingrowth

POSTOPERATIVE CARE. Patients with intertrochanteric femoral fractures treated with a compression hip screw are allowed to bear weight as tolerated in most circumstances because this device is used in more stable fracture patterns.

POSTOPERATIVE CARE. Patients with intertrochanteric femoral fractures treated with an intramedullary device are allowed to bear weight as tolerated in most circumstances; however, this device may be used in more unstable fracture patterns and occasionally weight-bearing status needs to be modified based on these fracture patterns.

POSTOPERATIVE CARE. Patients with subtrochanteric femoral fractures treated with an intramedullary device typically are allowed touch-down weight bearing for the first 6 weeks and advanced based on healing as shown on follow-up radiographs.

Palm et al., Acta Orthopaedica 2012; 83: 26-30

James W. Harkess & John R. Crockarell Jr. Chapter 03. Arthroplasty of the hip Campbell's Operative Orthopaedics 14th E-Book

John C. Weinlein Chapter 55. Fractures and dislocations of the hip Campbell's Operative Orthopaedics 14th E-Book

If the components were cemented, early weight bearing to tolerance is permitted. With cementless, porous ingrowth

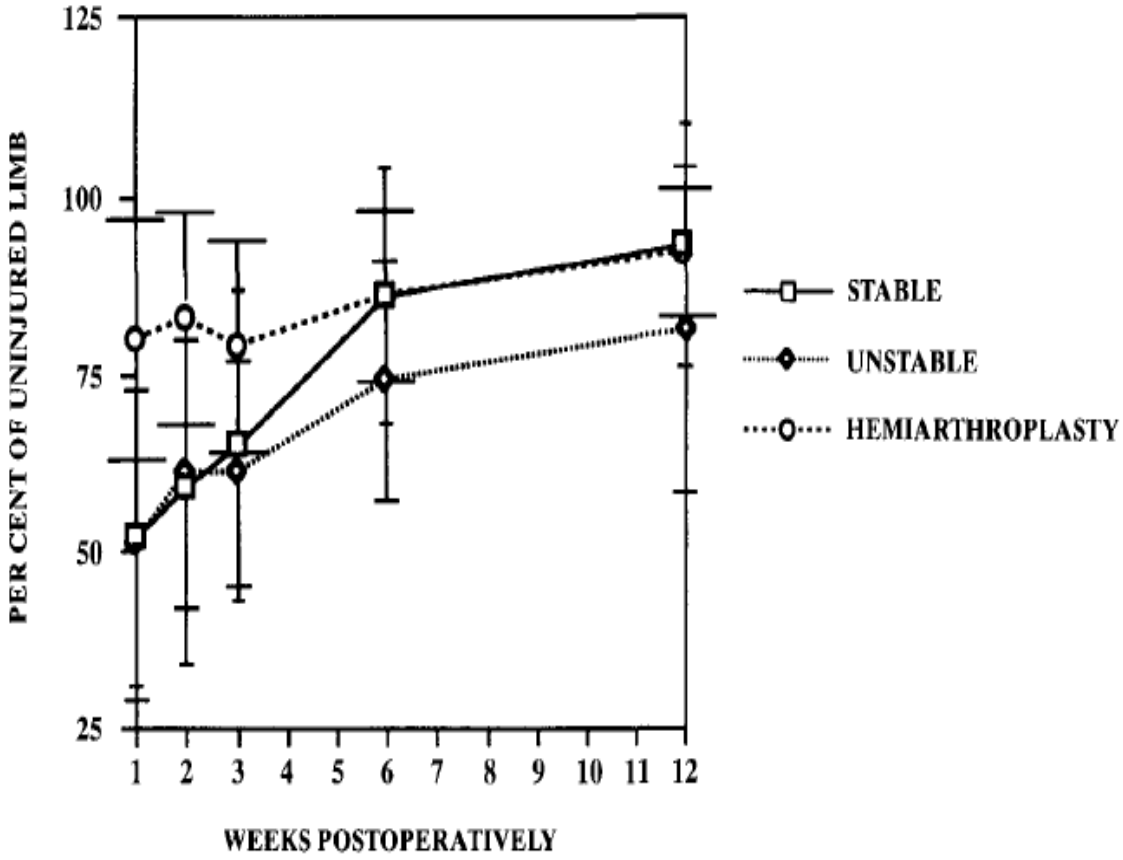


FIG. 1

Graph of the average postoperative weight-bearing load on the injured limb, shown as a percentage of that on the uninjured limb, for the three treatment groups. The standard deviations are shown by the I-bars (short horizontal bars indicate stable fractures; medium horizontal bars, unstable fractures; and long horizontal bars, hemiarthroplasties).

한국어판 낙상효능척도-국제형 (Korean version of falls efficacy scale – international, KFES-I)

	항목	전혀 문제없다	약간 어렵다	상당히 어렵다	매우 어렵다
1	집안 청소하기				
2	옷 입기/벗기				
3	간단한 음식준비하기				
4	목욕이나 샤워하기				
5	상점에 가기				
6	의자에 앉거나 일어나기				
7	계단 올라가거나 내려가기				
8	주변 산책하기				
9	손을 뻗거나 웅크리기				
10	전화 받기				
11	미끄러운 길을 걷기				
12	친구/친척 방문하기				
13	사람 많은 곳 가기				
14	평탄하지 않은 길 걷기				
15	경사진 곳 올라가거나 내려가기				
16	외부(친목)행사 참가 위해 외출하기				

FES-I translated to Korean by Mi Jung Kim from Yardley L, Todd C, et al. 2005; doi:https://doi.org/10.1093/ageing/afi196.

TABLE 4 Summary of Recommendations and Levels of Evidence for Outcome Measures[a]

	Early Postoperative Period: Inpatient Settings		Postacute Period: Inpatient Settings		Postacute Period: Community Settings	
Domain	**Must/Should**	**May**	**Must/Should**	**May**	**Must/Should**	**May**
Body functions and structures – physical impairment measures						
Pain	VRS (A)		VRS (A)		VRS (A)	
Lower extremity strength/power	Knee extension (A)		Knee extension (A) Hip muscles (B)		Knee extension (A) Hip muscles (B)	
Activity limitations						
Basic mobility: balance, transfers, ambulation	CAS (A) TUG test (A) NMS: prefracture (B)	AM-PAC basic mobility form (C) SPPB (C)	CAS (A) TUG test (A) NMS (B)	AM-PAC basic mobility form (C) DEMMI (C) SPPB (C)	CAS (A) TUG test (A) NMS (B)	AM-PAC basic mobility form (C) DEMMI (C) SPPB (C)
Gait speed/endurance	Gait speed (A)		Gait speed (A) 6MWT (B)	5-times or 30-s sit-to-stand (B)	Gait speed (A) 6MWT (B)	5-times or 30-s sit-to-stand (B)
Physical function		SF-36 PF-10 (C) FIM (C)		SF-36 PF-10 (C) FIM (C)		SF-36 PF-10 (C)
Fear of falling/self-efficacy	FES-I (B)		FES-I (B)		FES-I (B)	
Health-related quality of life		EQ-5D-3L (C) SF-36 (C)		EQ-5D-3L (C) SF-36 (C)		EQ-5D-3L (C) SF-36 (C)

Abbreviations: 6MWT, 6-minute walk test; AM-PAC, Activity Measure for Post-Acute Care; CAS, Cumulated Ambulation Score; DEMMI, de Morton Mobility Index; EQ-5D-3L, 3-level version of the EuroQol-5 dimensions scale; FES-I, Falls Efficacy Scale-International; FIM, Functional Independence Measure; NMS, New Mobility Score; PF-10, 10-item physical functioning scale; SF-36, Medical Outcomes Study 36-Item Short-Form Health Survey; SPPB, Short Physical Performance Battery; TUG, timed up and go; VRS, verbal rating scale.

[a]*A, strong evidence; B, moderate evidence; C, weak evidence.*

Early rehab

The aims of surgery are to control pain and promote early mobilisation; delay from admission to surgery causes distress to the patient and is associated with greater morbidity and mortality.

Standard 2

All patients with hip fracture who are medically fit should have surgery within 48 hours of admission, and during normal working hours

NHFD Fields 1.04 and 4.01

Early mobilisation is effective in lowering the risk of clinical thrombosis

British Orthopaedic Association, The Care of Patients with Fragility Fracture 2007; Chandlers Printers Ltd

EA: 수술 후 48시간 이내에 first ambulation

Table 2. Day 7 postoperative outcomes per group: true early ambulation (TEA) versus failed early ambulation (FEA) versus delayed ambulation (DA)

	TEA (n = 19)	FEA (n = 10)	DA (n = 31)	P value
Function				
Mean walking metres (range)	82.55 (0.5–400)	34.70 (5–103)	29.71 (0–150)	0.008*† 0.03*‡ 0.15§
Transfers, n (%)				
Independent	11 (57.9)	5 (50)	4 (12.9)	0.007*†
Assistance	5 (26.3)	5 (50)	21 (67.7)	0.009*‡ 0.000*§
Step, n (%)				
Independent	10 (52.6)	0 (0)	23 (74.2)	0.12†
Failed/unable	4 (15.7)	9 (90)	1 (.03)	0.32‡ 0.04*§
Discharge destination				
Home n (%)	5 (26.3)	0 (0)	1 (3.2)	
Fast stream rehabilitation n (%)	6 (31.6)	2 (20)	14 (45.2)	0.38†
Slow stream rehabilitation n (%)	7 (36.8)	7 (70)	16 (51.6)	0.19‡
Nursing home n (%)	1 (5.3)	0 (0)	0 (0)	0.44§
Death n (%)	0 (0)	1 (10)	0 (0)	
LOS (days acute care)				
Mean (range)	¶9.27 (4–33)	17.90 (5–33)	11.39 (5–24)	0.59‡ 0.003*§
Troponin				
Tested n (%)	8 (42)	7 (70)	18 (58)	0.138‡
Positive n (%)	2 (25)	6 (85.7)	6 (33.3)	0.01*§

*Significant. †TEA versus DA. ‡EA versus DA. §TEA versus FEA. ¶n = 18, outlier removed.

Oldmeadow et al., ANZ J Surg 2006; 76: 607-11

Early mobilization post-surgery is resource intensive. Patients who fracture their hip may be physically and medically compromised before their injury[6] and at risk of significant functional decline afterwards.[7] Despite routine ambulation protocols for patients with fractured hip encouraging ambulation as soon as possible after surgery, in practice the timing is commonly affected by the availability of a physiotherapist (if weekday or weekend day) and the patient's condition (medical stability). A previous study at The Alfred reported that the time to first ambulate for patients with hip fracture varied considerably.[8] For those managed by a clinical pathway that recommended early mobilization, their first walk occurred day 3 (average 89 h) post-surgery compared with day 4 (average 116 h) post-surgery for those not on pathway management.

Early mobilization is challenging and uncomfortable for the patient and requires the assistance of one or sometimes two physiotherapists available 7 days per week. Benefits must be rigorously evaluated to justify recommending ambulation soon after surgery.

Oldmeadow et al., ANZ J Surg 2006; 76: 607-11

In patients who have undergone surgery for hip fracture, what is the clinical and cost effectiveness of early mobilisation (<48 hours after surgery) compared to late mobilisation on functional status, mortality, place of residence/discharge, pain and quality of life?

1.7 Mobilisation strategies

1.7.1 Offer patients a physiotherapy assessment and, unless medically or surgically contraindicated, mobilisation on the day after surgery. **[2011]**

1.7.2 Offer patients mobilisation at least once a day and ensure regular physiotherapy review. **[2011]**

747명, non-RCT

Table 2 Mortality, length of stay and in-hospital complications

	Physiotherapy on POD1 ($n=525$)	Delayed physiotherapy ($n=222$)	p value
Mortality within hospitalization, n (%)	17 (3.2)	15 (6.8)	0.046
One-year mortality, n (%)	95 (18.1)	50 (22.5)	0.188
Blood transfusions ± SD	0.6 ± 0.9	0.6 ± 0.9	0.538
Time to surgery, hours ± SD	25.2 ± 13.7	23 ± 10.1	0.014
Length of stay ± SD	9.1 ± 5.6	9 ± 6.6	0.951
In-hospital complications ± SD	0.7 ± 1	0.8 ± 1.2	0.392
In-hospital complications, n (%)			
Delirium	40 (8.8)	12 (5.4)	0.467
Urinary tract infection	38 (7.2)	20 (9)	0.443
Atrial fibrillation[a]	29 (5.5)	19 (8.6)	0.135
Pneumonia	29 (5.5)	14 (6.3)	0.455
Pulmonary congestion	23 (4.4)	6 (2.7)	0.141
Myocardial infraction	9 (1.7)	4 (1.8)	0.731
Gastrointestinal bleeding	6 (1.1)	6 (2.7)	1
Cerebrovascular event	7 (1.3)	4 (1.8)	1
Pressure sore	7 (1.3)	1 (0.5)	0.198
Systemic inflammatory immune syndrome	7 (1.3)	0	0.740
Pulmonary emboli	4 (0.8)	2 (0.9)	0.447
Chronic obstructive pulmonary disease exacerbation	3 (0.6)	0	0.111
Other	42 (8)	17 (7.7)	1
			0.559

[a]Either acute or an exacerbation of a prior condition

Materials and methods A retrospective study comparing consecutive patients, 65 years and older, who were operated for fragility hip fractures between 2011 and 2016, within 48 h from admission, and started PT treatment either in the first post-operative day (POD1) or later (POD2-5). Patients were operated upon as soon as medically possible and in accordance with

Frenkel Rutenberg et al., Arch Orthop Trauma Surg 2018; 138: 1519-24

Table 4. Frequency of Complications by Days to Ambulation After Surgery

Condition	Days to Ambulation	RR*	95% CI	Mean ± *SD*	*p*
Pneumonia	1				
	2	4.4	.2–128		
	3	4.2	.06–331		
	4 or more	10.3	.8–295.6		
New-onset delirium	1				
	2	10	1.5–573		
	3	17	1.9–1180		
	4 or more	21	3.2–1503		
Pneumonia and or new-onset delirium	1				
	2	6.8	1.4–64		
	3	8.7	1.2–95		
	4 or more	14.3	2.8–137		
Length of hospital stay (d)	1			5 ± 2.2	.01
	2			5.6 ± 2.6	
	3			5.6 ± 1.5	
	4 or more			9.9 ± 9	

Notes: *Relative risk (RR) was calculated based on frequency cocomplication among subjects ambulated on day 1 after surgery unless specified otherwise.

CI = confidence interval; *SD* = standard deviation.

Kamel et al., J Gerontol A Biol Sci Med Sci 2003; 58: 1042-5

Sit out of bed (SOOB) as soon as possible

Occupational therapy

independence.[5] Many hip fracture patients did not receive OT. The use or not of OT intervention was decided by the attending physician at the physician's discretion. Because the doctor has the authority to prescribe the rehabilitation, they are thus able to judge whether OT intervention is used or not. Clinically, patients with lower ADL have been considered to require OT. However, this is not so. Therefore, it is thought that whether OT is used or not depends on the preference of the doctor, for example, aside from the preference of the patient.

Uruma et al., Geriatr Gerontol Int 2019; 19: 611-5

5개 RCT, 524명

ADL

Physical function

Health perception, emotion

Fall

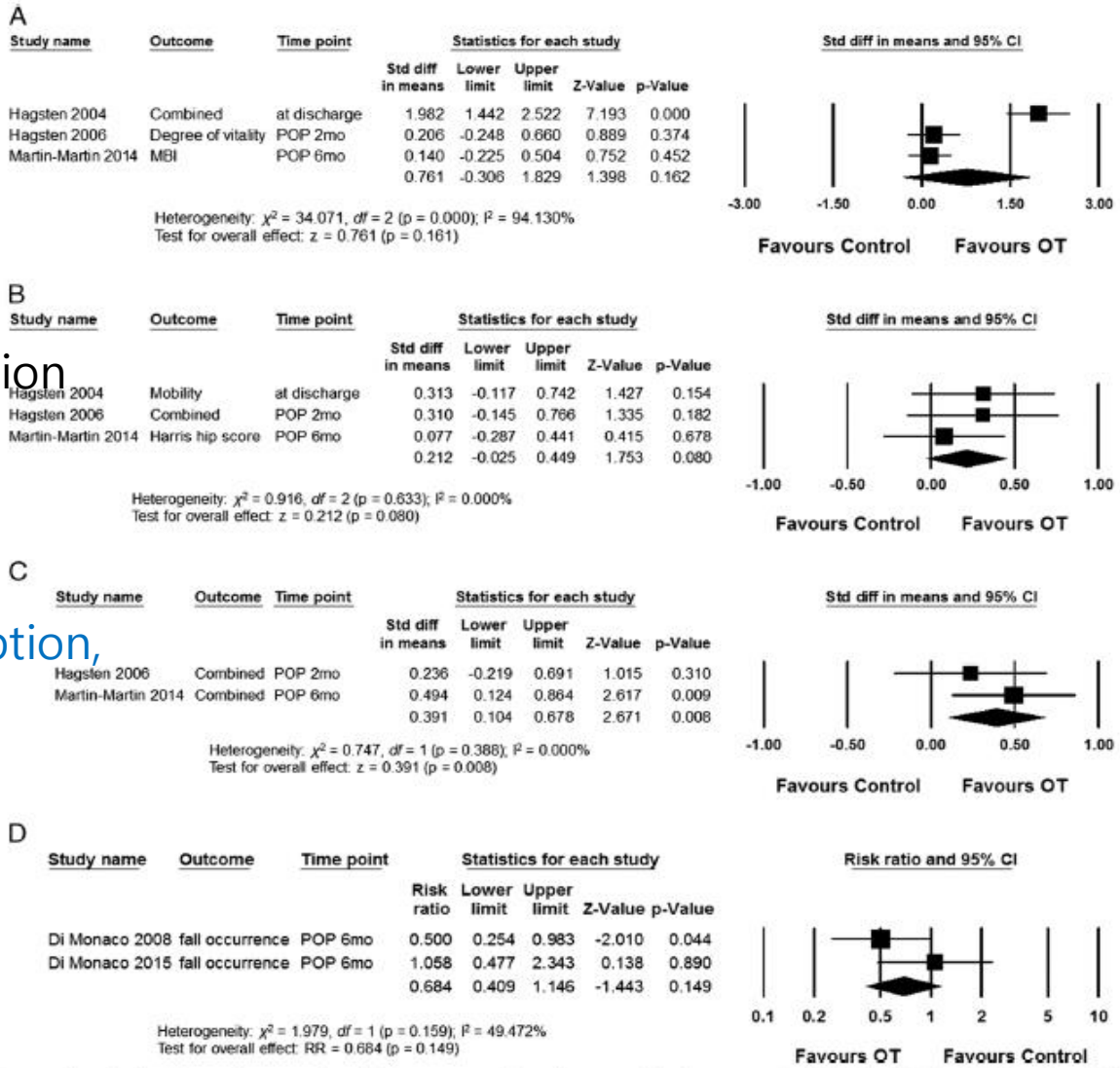


FIGURE 2. Forest plots of the effects of occupational therapy on various characteristics (outcomes): (A) ADL, (B) physical function, (C) health perception and emotion, and (D) fall occurrence. Effect sizes are shown as Hedges' g-standardized mean differences with 95% confidence intervals.

Lee et al., Am J Phys Med Rehabil 2019; 98: 292-8

ized training, which lasted 45–60 minutes each weekday morning. The therapist and the patient planned the training activities that were important for self-care and independence at home. With support and under supervision, the patient trained as independently as possible to get up from the bed, to go to the bathroom and perform morning activities, and to dress. The need of each patient regarding technical aids was investigated and the patient was trained with the aids that were considered necessary. During the hospital stay, both the occupational therapist for the study and the patient visited the patient's home to decide together how to prepare and adapt the home environment for maximum independence.

Using the toilet

When sitting down on the toilet

1. Take small steps and turn until your back is toward the toilet.
2. Back up to the toilet until you feel it touch the back of your legs.
3. Slide your operated leg out in front as you sit down.
4. If using a toilet with arm rests, reach back for both arm rests and lower yourself onto the toilet.
5. If using a raised toilet seat without arm rests, keep one hand on the walker as you reach back for the toilet seat with your other hand.

When getting up from the toilet

1. Slide your operated leg out in front of you before you stand up.
2. If you are using a toilet with arm rests, put your hands on the arm rests and push yourself up, then move your hands to the walker.
3. If you are using a toilet without arm rests, put one hand on the walker and push off the toilet seat with your other hand.
4. Balance yourself before you start to walk.

Hagsten et al., Acta Orthop Scand 2004; 75: 177-83
https://www.bswhealth.com/SiteCollectionDocuments/specialties/orthopedics/hip-fracture-brochure.pdf

In summary ③

- Rehab
  - Encourage weight bearing
  - Early mobilization
  - Occupational therapy

Outline 4

- Hip fracture surgery
  - Classification
  - Surgical approach
- Is comprehensive rehab required after hip fracture surgery?
- Rehab
  - Weight bearing
  - Early mobilization
  - Occupational therapy
- Total knee arthroplasty

POSTOPERATIVE MANAGEMENT

Postoperative physical therapy and rehabilitation greatly influence the outcome of TKA. Initially, a compressive dressing is worn to decrease postoperative bleeding, and a knee immobilizer may be used until quadriceps strength is adequate to ensure stability during ambulation.

Range-of-motion exercises are performed postoperatively, with or without the assistance of a continuous passive motion machine. Continuous passive motion has been shown in multiple studies to assist in obtaining knee flexion more quickly, which may decrease the length of stay in the hospital. Continuous passive motion has not been proved to affect the prevalence of DVT, long-term knee range of motion, or knee functional scores.

Passive knee extension is encouraged by placing the patient's foot on a pillow while in bed. Dangling the legs over

관절가동범위운동: 무릎펴기 개선

- **손깍지 끼고 무릎 누르기**

1. 침대에 앉은 상태에서 발을 쭉 펴세요(발목에 수건을 받쳐도 됩니다.)
2. 양손으로 무릎을 지긋이 최대한으로 누르고, 3~5초를 세세요.
3. 이 동작을 10~15번 반복하시고, 하루에 3~5회 하세요.
4. 무릎을 최대한 펴는 이 운동이 상당히 중요합니다.

관절가동범위운동: 다리 흔들기

- **다리 흔들기**

1. 두 발이 바닥에 닿지 않은 상태로 의자에 앉아서 교대로 발을 앞, 뒤로 흔들어 줍니다.
2. 이 동작을 10~15번 반복하시고, 하루에 3~5회 하세요.



Rehabilitation protocols following total knee arthroplasty: a review of study designs and outcome measures

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Contributions: (I) Conception and design: IM Dávila Castrodad, NS Mohamed, TM Recai, MM Abraham; (II) Administrative support: NS Mohamed, JI Etcheson, RE Delanois; (III) Provision of study materials or patients: JI Etcheson, RE Delanois; (IV) Collection and assembly of data: IM Dávila Castrodad, TM Recai, MM Abraham, A Edalatpour; (V) Data analysis and interpretation: IM Dávila Castrodad, TM Recai, MM Abraham, NS Mohamed, A Edalatpour; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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Abstract: Total knee arthroplasty (TKA) is among the most common elective procedures performed worldwide. Recent efforts have been made to significantly improve patient outcomes, specifically with postoperative rehabilitation. Despite the many rehabilitation modalities available, the optimal rehabilitation strategy has yet to be determined. Therefore, this systematic review focuses on evaluating existing postoperative rehabilitation protocols. Specifically, this review analyses the study designs, rehabilitation methods, and outcome measures of postoperative rehabilitation protocols for TKA recipients in the past five years. The PubMed, EMBASE, and Cochrane Library databases were queried for studies evaluating rehabilitation protocols following primary TKA. Of the 11,013 studies identified within the last five years, 70 met the inclusion and exclusion criteria. After assessing for relevance and removing duplicates, a final count of 20 studies remained for analysis. Level-of-evidence was determined by the American Academy of Orthopaedic Surgeons (AAOS) classification system. Our findings demonstrated that continuous passive motion and inpatient rehabilitation may not provide additional benefit to the patient or healthcare system. However, early rehabilitation, telerehabilitation, outpatient therapy, high intensity, and high velocity exercise may be successful forms of rehabilitation. Additionally, weight-bearing biofeedback, neuromuscular electrical stimulation, and balance control appear to be beneficial adjuncts to conventional rehabilitation. Postoperative rehabilitation following TKA facilitates patient recovery and improves quality of life. This systematic review analyzed the existing rehabilitation protocols from the past five years. Some studies did not accurately describe the conventional rehabilitation protocols, the duration of therapy sessions, and the timing of these sessions. As such, future studies should explicitly describe their methodology. This will allow high-quality assessments and the conception of standardized protocols.

Keywords: Total knee arthroplasty (TKA); postoperative rehabilitation; physical therapy; physiotherapy

treatment. The Nintendo Wii Fit Plus game and associated Wii Balance Board were utilized for WB biofeedback training (Nintendo of America, Inc, Redmond, WA). A standard bariatric walker was placed around the balance board, which was placed in front of a sturdy chair so the patient was protected on all sides from a potential fall. Patients were instructed in a progressive series of games, depending on ability level, and received feedback on proper performance of each task while playing the corresponding game (TABLE 1). All


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In summary

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