Bispebjerg and Frederiksberg Hospital
Department of Physical and Occupational Therapy

Institute of Clinical Medicine
UNIVERSITY OF COPENHAGEN

- Rehabilitation after Hip Fracture -

How early – How intensive – How long & How!

Morten Tange Kristensen – Clinical Professor, Physical Therapist, PhD, Denmark


ONCE UPON A TIME IN THE WEST

There was a lack of evidence for rehabilitation after Hip Fracture

cochrane

Anmeldelse af 2004 Cochrane review

Der mangler evidens for til hoftenære frakturer

Der er et stort behov for RCT-studier af høj kvalitet, der undersøger, hvilken fysioterapi der er den bedste til hoftenære frakturer

AF FYSIOTERAPEUT MORTEN TANGE KRISTENSEN
FOTO PETER SALOUTOS/CORBIS

But - Huge progress has been achieved

- **+95% receive a plan for rehabilitation** when discharged from the acute hospital and provided in different settings

&

- **An extensive number of systematic reviews** provide some evidence for rehabilitation across the continuum of care after hip fracture

Positive findings But

Still – Only about 50% of survivors fully recover their pre-fracture New Mobility Score (NMS) function

2023 - Pre-fracture NMS recorded in

rkkp
regionernes kliniske kvalitetsudviklingsprogram

Archives of Orthopaedic and Trauma Surgery
https://doi.org/10.1007/s00402-022-04472-8

TRAUMA SURGERY

The majority of community-dwelling hip fracture patients return to independent living with minor increase in care needs: a prospective cohort study

Christina Frölich Frandsen[1,2] · Maiken Stilling[1,2,4] · Eva Natalia Glassou[1,3] · Torben Bæk Hansen[1,2]

50% of patients followed at 12 months fully regained their pre-fracture NMS level

THE GERONTOLOGICAL SOCIETY OF AMERICA®

Journals of Gerontology: Medical Sciences
cite as: *J Gerontol A Biol Sci Med Sci*, 2021, Vol. XX, No. XX, 1–8
https://doi.org/10.1093/gerona/glab256
Advance Access publication August 30, 2021

OXFORD

Research Article

Six Versus 12 Weeks of Outpatient Physical Therapy Including Progressive Resistance Training in Cognitively Intact Older Adults After Hip Fracture: A Multicenter Randomized Controlled Trial

Jan A. Overgaard, PT, MSc,[1,2,*] Thomas Kallemose, MSc,[3] Kathleen K. Mangione, PT, PhD,[4] and Morten T. Kristensen, PT, PhD[5,6]

54% of patients followed reached their pre-fracture NMS level of function at 6 months

One of the recent larger reviews (about 50 RCTs) on the effect of exercise therapy after hip fracture

THE GERONTOLOGICAL SOCIETY OF AMERICA®

Journals of Gerontology: Medical Sciences
cite as: *J Gerontol A Biol Sci Med Sci*, 2022, Vol. 77, No. 4, 861–871
https://doi.org/10.1093/gerona/glab236
Advance Access publication August 13, 2021

OXFORD

Review

Exercise Therapy Is Effective at Improving Short- and Long-Term Mobility, Activities of Daily Living, and Balance in Older Patients Following Hip Fracture: A Systematic Review and Meta-Analysis

Signe Hulsbæk, MPH,[1,*] Carsten Juhl, PhD,[2,3] Alice Røpke, MScOT,[2] Thomas Bandholm, PhD,[1,5] and Morten Tange Kristensen, PhD[1,4]

https://pubmed.ncbi.nlm.nih.gov/34387664/

CHRISTINE M. MCDONOUGH, PT, PhD • MARCIE HARRIS-HAYES, PT, DPT, MSCI
MORTEN TANGE KRISTENSEN, PT, PhD • JAN ARNHOLTZ OVERGAARD, PT, MSc • THOMAS B. HERRING, DPT
ANNE M. KENNY, MD • KATHLEEN KLINE MANGIONE, PT, PhD, FAPTA

Physical Therapy Management of Older Adults With Hip Fracture

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Academy of Orthopaedic Physical Therapy and the Academy of Geriatric Physical Therapy of the American Physical Therapy Association

J Orthop Sports Phys Ther. 2021;51(2):CPG1-CPG81. doi:10.2519/jospt.2021.0301

For author, coordinator, contributor, and reviewer affiliations, see end of text. Address correspondence to Clinical Practice Guidelines Managing Editor, Academy of Orthopaedic Physical Therapy, APTA, Inc, 2920 East Avenue South, Suite 200, La Crosse, WI 54601. E-mail: cpg@orthopt.org

Key Clinical Findings of Hip Pain and Mobility Deficits – Hip Fracture

↓

Measures to assess level of functioning, physical impairments to address with treatment, and response to treatment

↓

	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)

↓

Interventions tailored to address the specific hip fracture impairments and limitations identified on examination

↓

ACROSS THE ENTIRE EPISODE OF CARE/ALL SETTINGS

Structured Exercise – A

- Progressive, high-intensity resistive strength, balance, weight-bearing, and functional mobility training

Structured Exercise for Older Adults With Cognitive Impairment – B

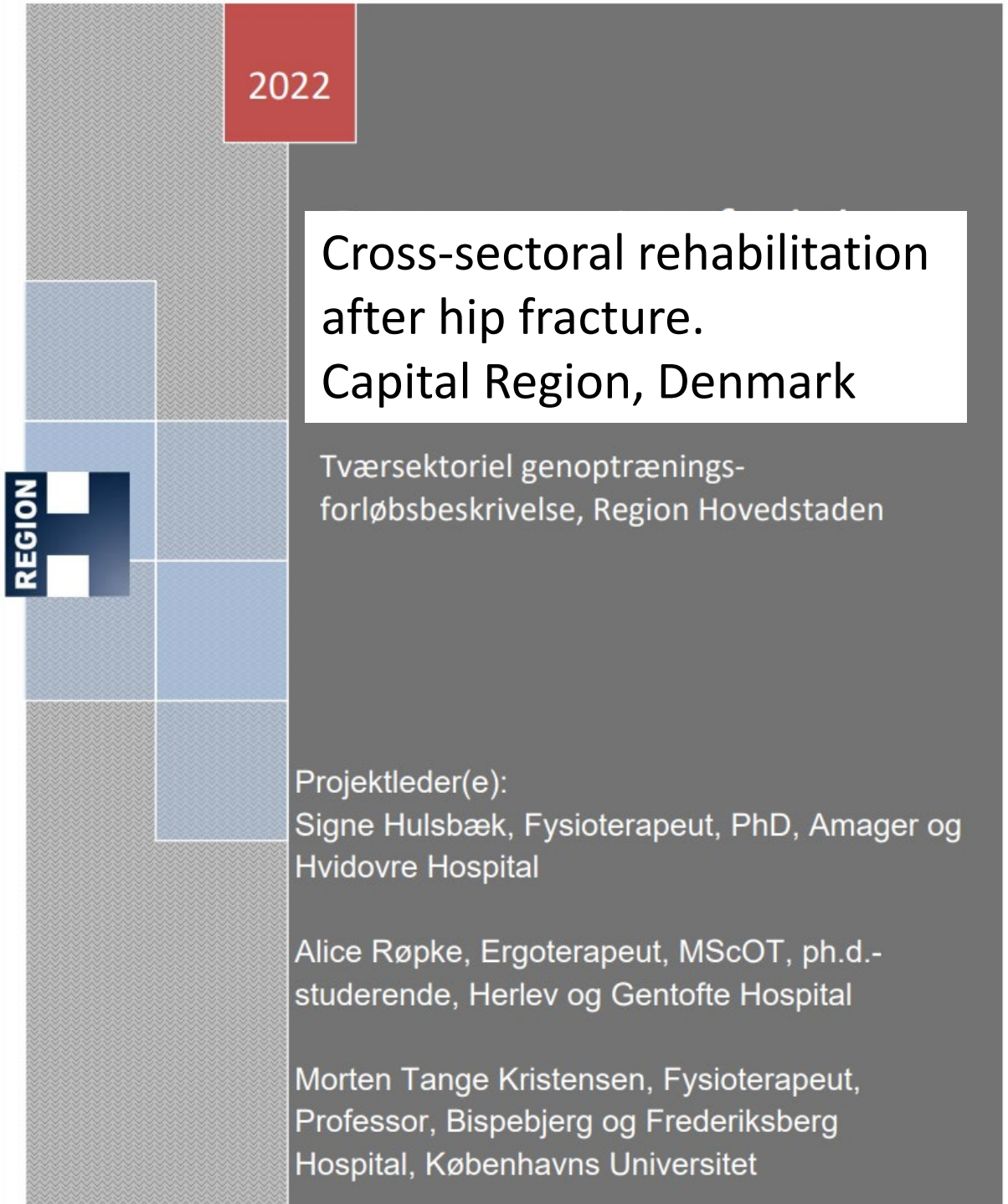
- For patients with mild to moderate dementia: progressive, high-intensity resistive strength, balance, weight-bearing, and functional mobility training

Interprofessional Management

- Participate in multicomponent, nonpharmacological intervention programs for at-risk older adults undergoing surgery to prevent delirium – C
- Assess hip fracture–related pain at rest and during activity (eg, walking) and implement strategies to minimize the patient's pain during the treatment session to optimize the patient's mobility – F
- Screen for risk of pressure ulcers – F
- Assess and document patient risk factors for falls and contribute to interprofessional management – A
- Contribute to interprofessional care to ensure that older adults with hip fracture are appropriately evaluated and treated for osteoporosis and risk of future fractures – F
- Provide guidance to the interprofessional team and patients on assistive devices and assistance level for transfers and ambulation for patients with hip fracture – F
- Elicit individual goals for recovery of function, which may include independent basic mobility, achieving prior level of function, return to prefracture residence, and activities to support long-term well-being – F

↓

Figure continues on page CPG34.



Recommendations for training & tests across the continuum of care after hip fracture:

- 0-2 weeks (acute phase)

- 3-12 weeks (sub-acute phase)

- +12 weeks (extended phase)

Followed NKR with Grade etc. for evaluation of exercise

https://www.researchgate.net/publication/371081611_Tvaesektoriel_genoptraeningsforlobsbeskrivelse_for_hoftenaert_brud_Region_Hovedstaden_2022pdf

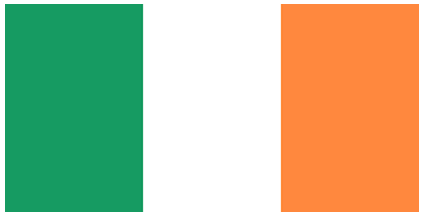
Mobilization out of bed <24 hours / day of or day after hip fracture surgery improves outcomes and reduce mortality

rkkp
regionernes kliniske kvalitetsudviklingsprogram

Findings from national hip fracture databases – published 2016-2020:

- Denmark - About 50% reduced 30-day mortality, shorter LOS and reduced readmission for patients mobilized <24h of surgery (day of or day after surgery) (Kristensen PK et al. 2016) https://pubmed.ncbi.nlm.nih.gov/27591269/)

- England - Better mobility function 30 days after discharge in patients mobilized on the day or day after surgery
  (Su B et al. 2018) https://pubmed.ncbi.nlm.nih.gov/29986698/
- UK - Early mobilization led to a two-fold increase in the odds of being discharged by 30-days postoperatively
  (Sheehan K et al. 2020) https://pubmed.ncbi.nlm.nih.gov/33098414/



- Ireland - Patients not mobilized early (POD1) were 46% more likely to die in hospital (Ferris H et al. 2020) https://doi.org/10.1007/s41999-020-00317-y.

But also, basic mobility (CAS) status at time of hospital discharge seems to matter.

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Difference:
CAS pre-fracture vs. CAS discharge

<u>Findings from the Danish hip fracture database – Published 2019 & 2021</u>

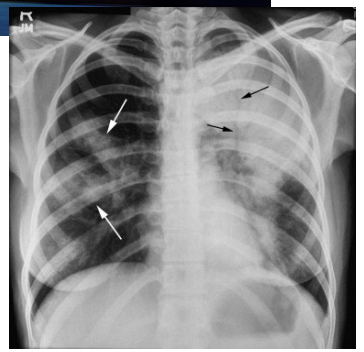
Patients not recovering pre-fracture basic mobility (CAS) at time of acute hospital discharge after a first-time hip fracture experienced a significantly increased risk of:

1-year cohort:

- ***aHR = 2.8 increased risk for 30-day mortality**
- ***aHR = 26% increased risk for 30-day readmission**

(Kristensen MT et al 2019) https://pubmed.ncbi.nlm.nih.gov/30615060/

+



4-year cohort:

- ***aHR = 35% increased risk for treated infection / pneumonia**

(Vesterager JD et al 2021) https://pubmed.ncbi.nlm.nih.gov/33941387/

*Sex, Age, BMI, Residential status, Fracture type, Charlson Comorbidity index and **<u>Length of acute hospital stay (LOS)</u>**

Acute care intensified Physiotherapy after hip fracture

Patients had 1 regular physiotherapy session in both studies

- **<u>Intervention:</u> 2 extra daily 30-min sessions (1 by AH assistant)**

Functional discharge criterias was achieved earlier than controls

Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday

HIP4Hips (High Intensity Physiotherapy for Hip fractures in the acute hospital setting): a randomised controlled trial

Lara A Kimmel[1,2], Susan M Liew[1,2], James M Sayer[1], Anne E Holland[1,3]

MJA 205 (2) • 18 July 2016

- **Intervention: 1 extra physiotherapy session daily on weekdays**

More patients achieved independent basic mobility (CAS) at discharge

Monday
Tuesday
Wednesday
Thursday
Friday

DISABILITY AND REHABILITATION
https://doi.org/10.1080/09638288.2023.2288672

Taylor & Francis
Taylor & Francis Group

PERSPECTIVES IN REHABILITATION

Intensified acute in-hospital physiotherapy for patients after hip fracture surgery: a pragmatic, randomized, controlled feasibility trial

Camilla Kampp Zilmer[a], Morten Tange Kristensen[a,b], S. Peter Magnusson[a,c,d], Inger Birgitte Bährentz[a], Thomas Giver Jensen[e], Signe Østergaard Zoffmann[a], Henrik Palm[e] and Theresa Bieler[a]

Physiotherapy first week after HF surgery in UK

ELSEVIER

Physiotherapy 120 (2023) 47–59

Physiotherapy

Adjusted Probability of:	≥ 2 hours physiotherapy (vs. less)	Recipients of mobilisation & exercise (vs. mobilisation alone)	Recipients of 6-7 days of physiotherapy (vs. 0-2 days)
Discharge home	+3%	+6%	
Survival	+4%	+3%	+8%
Outdoor mobility recovery	+6%	+11%	
Lower Readmission	+3%	+6%	

Frequency, duration, and type of physiotherapy in the week after hip fracture surgery – analysis of implications for discharge home, readmission, survival, and recovery of mobility

Orouba Almilaji[a,b], Salma Ayis[a], Aicha Goubar[a], Lauren Beaupre[c], Ian D. Cameron[d], Rhian Milton-Cole[a], Celia L. Gregson[e], Antony Johansen[f], Morten Tange Kristensen[g], Jay Magaziner[h], Finbarr C. Martin[a], Catherine Sackley[a,i], Euan Sadler[j], Toby O. Smith[k], Boris Sobolev[l], Katie J. Sheehan[a,*,1,2]

1st week after surgery

Findings suggests that first-week greater access to physiotherapy was associated with higher probability of positive outcomes

Weekdays vs. Weekdays+Weekend rehabilitation after HF in Japan

+Weekend was associated with a:

- **14% lower risk of in-hospital mortality (HR=0.86, 95%CI; 0.8 – 0.92) and**
- **fewer medical complications**

+Weekend group exhibited improved physical function at discharge in:

- **Transferring, OR= 1.17 [1.15–1.19],**
- **Walking, OR= 1.17 [1.15–1.2] and**
- **Stair climbing, OR= 1.06 [1.03–1.08]**

THE BONE & JOINT JOURNAL EST. 1948

■ TRAUMA

Association between additional weekend rehabilitation and in-hospital mortality in patients with hip fractures

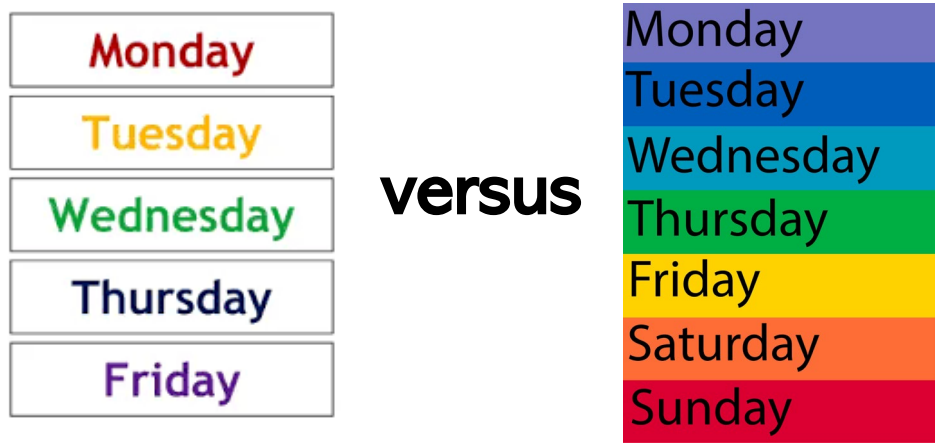
A PROPENSITY SCORE MATCHING ANALYSIS IN A MULTICENTRE DATABASE

T. Ogawa,
R. Onuma,
M. T. Kristensen,
T. Yoshii,
T. Fujiwara,
K. Fushimi,
A. Okawa,
T. Jinno

Bone Joint J 2023;105-B(8):872–879.

Aims

The aim of this study was to investigate the association between additional rehabilitation at the weekend, and in-hospital mortality and complications in patients with hip fracture who underwent surgery.



European Geriatric Medicine
https://doi.org/10.1007/s41999-024-00980-5

RESEARCH PAPER

Association between additional weekend rehabilitation and functional outcomes in patients with hip fractures: does age affect the effectiveness of weekend rehabilitation?

Takahisa Ogawa[1] · Ryo Onuma[2] · Hiromori Sagae[3] · Haggai Schermann[4,8] · Morten Tange Kristensen[5,9] · Kiyohide Fushimi[6] · Toshitaka Yoshii[1] · Tetsuya Jinno[1,7]

Mobilisation and functional training (week 0-2)

Strong recommendation

(↑↑) We recommend offering early mobilization and training focused on independence in basic functions, as soon as possible after surgery, and at least daily thereafter, unless contraindicated for surgical/medical reasons.

Practice recommendation : (√)

- Provide early (<24 hours) and frequent mobilization and training of basic mobility such as transfers and walking during the acute admission.
- The training should also include instruction in edema prophylaxis as well as individually adapted movement strength and endurance exercises for lower extremities

Strength training (week 0-2)

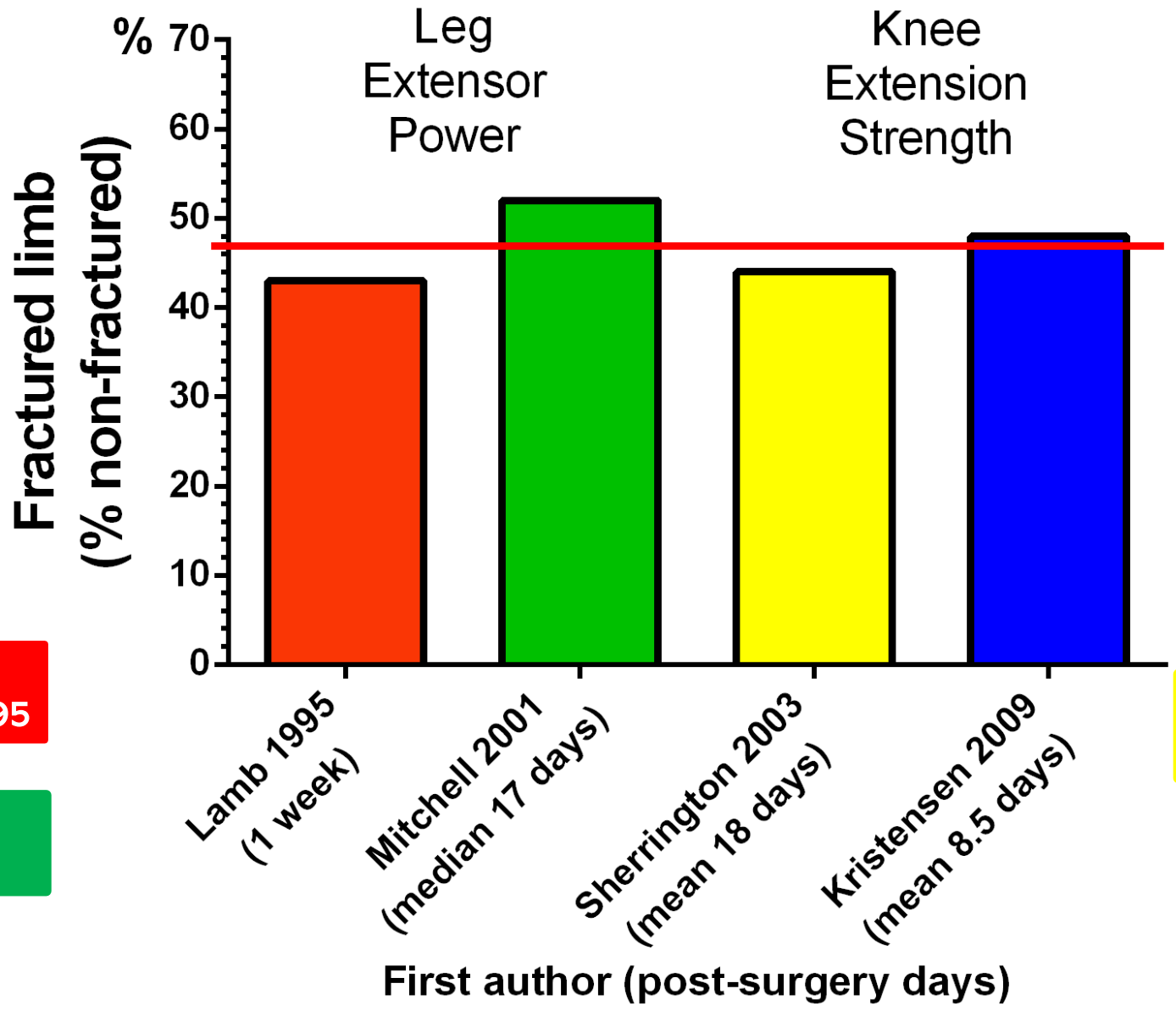
Weak/Conditional Recommendation

(↑) We suggest offering strength training during the acute hospitalization if this is of longer duration

Practice recommendation: (√)

- Offer strength training to patients admitted for more than 1 week in the acute/inpatient unit
- Strength training can take place sitting on the edge of the bed/bench/chair with training of the knee extensors with weight cuffs
- 3 sets of 10 repetitions, load of 10RM has been shown to be feasible
- 1 minute rest between sets and progression of load based on RM principles

Relevance: About 50% fractured limb muscle power/strength loss early after Hip Fracture



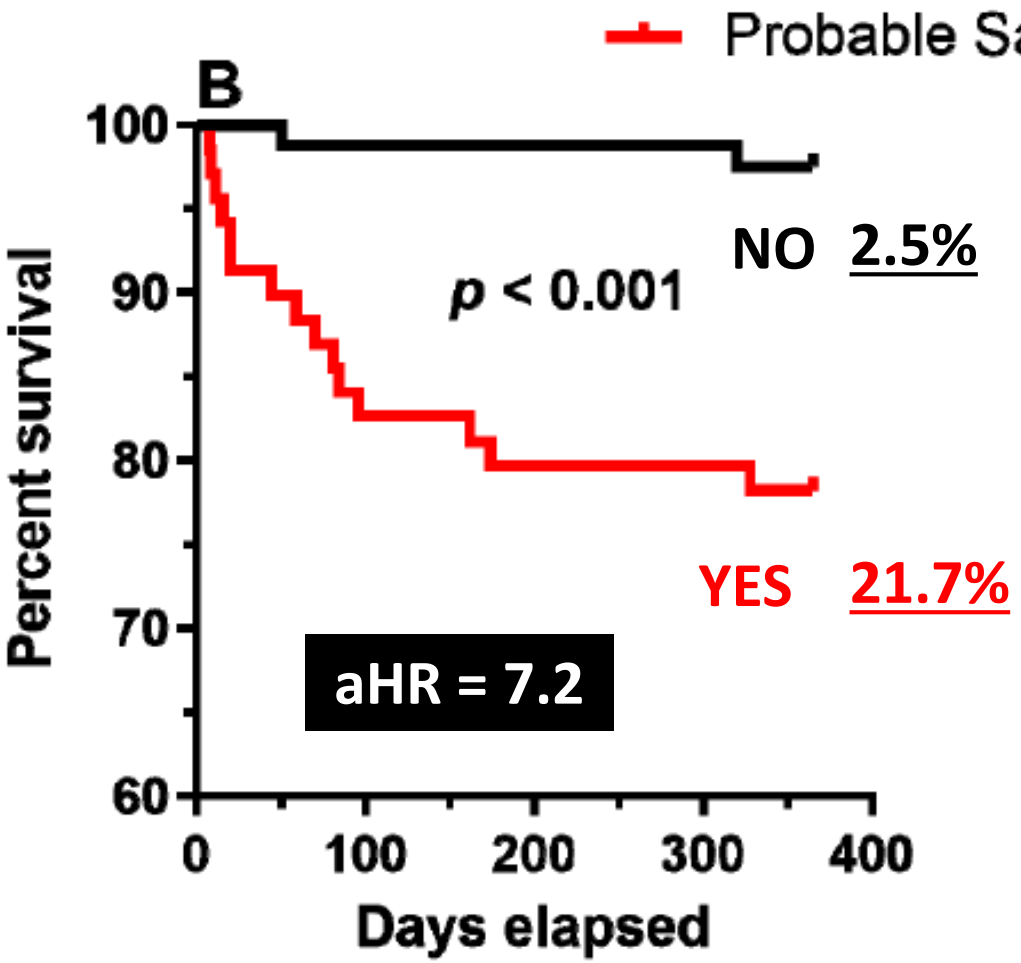
Lamb SE et al.
Age and Ageing 1995

Mitchell SL et al.
Clin Rehabil 2001

Sherrington C et al. Australian Journal of Physiotherapy 2003

Kristensen MT et al.
Clinical Biomechanics 2009

Relevance: About 50% of the best patients with Hip Fracture had signs of sarcopenia* related to <u>strength of the non-fractured leg</u>



1-Year Mortality

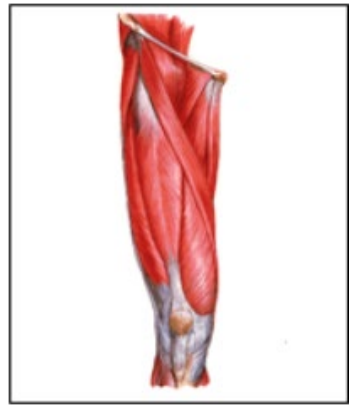
geriatrics MDPI

Article

Knee Extension Strength Measures Indicating Probable Sarcopenia Is Associated with Health-Related Outcomes and a Strong Predictor of 1-Year Mortality in Patients Following Hip Fracture Surgery

Morten Tange Kristensen [1,2,*], Signe Hulsbæk [1], Louise Lohmann Faber [3] and Lise Kronborg [4]

Geriatrics **2021**, *6*, 8. https://doi.org/10.3390/geriatrics6010008



*Cut-points for probable sarkopenia by Menant JC et al. 2017 https://pubmed.ncbi.nlm.nih.gov/27394415/

***Lowest sex-specific quintile of knee extension strength <23.64 kg for males; <15.24 kg for females**

ADL training week 0-2

Weak/Conditional Recommendation

(↑) We suggest offering ADL training during the acute admission as the effect is moderate for ADL

Practice recommendation: (√)

- Perform ADL assessment during the acute admission
- Consider to offer ADL training during longer hospitalizations
- Training can consist of Personal daily activities (PADL) with visits to the toilet, bathing, undressing and dressing, possibly with instruction and use of aids

Funktional- / balancetraining (week 3-12)

Weak/Conditional Recommendation

(↑) We suggest using functional training (incl. balance training) of progressive severity.

Practice recommendation: (√)

- Sit-to-Stand exercises
- Gait training on different surfaces
- Step and stair training exercises.
- Balance exercises (e.g. with decreasing support surface, different surfaces, obstacle exercises).
- Progressions: less support, more repetitions or extra load (elastic bands or weight vests) etc.

Styrketræning (week 3-12)

Weak/Conditional Recommendation

(↑) We suggest using structured and progressive strength training of hip/knee extensors and hip abductors as the effect is strong for strength and balance

Practice recommendation : (√)

- Large muscle groups in lower extremity + hip abd.
- Note restrictions.
- Minimum 2 times weekly.
- 3 sets.
- Slow adaptation, for example:
- 0-2 weeks: 15 repetitions (15 RM)
- 2-4 weeks: 12 repetitions (12 RM),
- >4 weeks: 10 repetitions (10 RM).
- The load is continuously adjusted according to exhaustion at the respective RM level.

Foto lånt af Jan A. Overgaard

Aerobic training (week 3-12)

Weak/Conditional Recommendation

(↑) We suggest using aerobic exercise as the effect is moderate for mobility.

Practice recommendation: (√)

- Aerobic training on e.g. exercise bike, arm ergometer or walking depending on the patient's functional capacity and resources.
- The intensity should be above 65% of maximum heart rate
- Training duration > 20 min.
- Frequency: Incl. studies - training 3-5 times a week.

ADL træning (week 3-12)

Weak/Conditional Recommendation

(↑) We suggest to offer ADL training during rehabilitation in the municipality

Practice recommendation: (√)

- Offer rehabilitation including ADL training where needed
- Training can consist of PADL e.g. bathing and dressing as well as Instrumental daily activities (IADL) e.g. cooking, shopping, transport
- Home visits in connection with discharge to own residence with a focus on fall prevention by e.g. removing barriers in surroundings

Motivational, fall prevention and educational interventions

Weak/Conditional Recommendation

(↑) We suggest using 'motivation-promoting, fall-preventing and patient-education interventions' in sub-acute rehabilitation as the effect is moderate for serious events (i.e. falls) and mobility

Practice recommendation: (√)

- **Motivation-promoting** interventions, e.g. function and activity-based goal setting), fall prevention (e.g. risk assessment of barriers at home)
- **Patient education** initiatives, e.g. information and expectations for the rehabilitation program
- Articulating the importance of progressive 'own activity' in addition to offered rehabilitation, for example that outdoor walking distance increases as functional level improves. They may be in connection with discharge to their own home, and during an ongoing rehabilitation program
- Encourage to maintain and motivate self-training after completion of rehab

Extended rehabilitation (Week 12+)

(↑↑) We recommend that continued rehabilitation be offered to patients who have not regained pre-fracture functional ability, as there is potential for further improvement after completion of usual "standard" offer.

Practice recommendation: (V)

- The training must be specifically aimed at the remaining deficits.
- Especially focus on strength training, balance training and fall prevention on avoiding secondary falls and fractures (cf. NKR for nutrition and exercise for the elderly with geriatric problems).
- Focus on promoting self-efficacy and motivation for activity and training, so that the patient can eventually transition to other regular training in the local area or self-training.

Summery – Rehabilitation after hip fracture - What to do!

Short-term rehab goal:
Regain pre-fracture CAS points as fast as possible

For those with reduced levels:

- Intensive training regarding independence in basic mobility activities
- ADL training of specific activities

To everyone:

- Functional training including balance exercises
- Deal with hip fracture-related pain as possible
- Structured and progressive strength training of essential muscle groups in lower extremity
- Training of aerobic capacity

Summery – Rehabilitation after hip fracture - What to do!

Long-term rehab goal:
Regain pre-fracture NMS points

- **Include outdoor walking as functionality increases**
- **Include motivational, fall prevention and educational actions**
- **Use valid tests to monitor changes over time, including recovery of pre-fracture level of function.**
- **Consider offering training until pre-fracture functional ability is regained!**

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REGION H

Many thanks for your attention!

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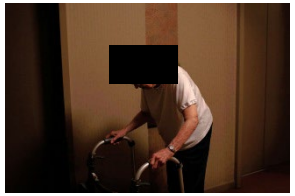
@TangeMorten

Handouts will be available here



The New Mobility Score (NMS, 0-9 points)				
Mobility	No difficulty and no aid	With a walking aid	With help from another person	Not at all
Able to get about the house (indoor walking)	3	2	1	0
Able to get out of the house (outdoor walking)	3	2	1	0
Able to go shopping (walking during shopping)	3	2	1	0
Kristensen MT: Updated from Parker and Palmer. *J Bone Joint Surg 1993, &* published in Kristensen and Kehlet. *Danish Medical Journal 2012*				

https://pubmed.ncbi.nlm.nih.gov/22677245/

English version of manual:
https://www.researchgate.net/publication/338066657_English_version_of_the_Modified_New_Mobility_Score_NMS_language_edited_and_updated_with_new_references_Dec_2019pdf

Used in:

Irish Hip Fracture Database IHFD

& from 2023 also in the Nationwide Danish Multidisciplinary Hip Fracture Database

Can be used for all patients with Hip Fracture

NMS with a cut-off at 5 points is a strong predictor of long-term mortality:

Parker and Palmer 1993
https://pubmed.ncbi.nlm.nih.gov/8376443/

Kristensen and Kehlet 2018
https://pubmed.ncbi.nlm.nih.gov/28946781/

Frandsen CF et al 2021
https://pubmed.ncbi.nlm.nih.gov/34854063/

The Cumulated Ambulation Score (CAS, 0-6 points)

Activity	Able to independently, (no assistance or guiding allowed)	Able to with human assistance or guiding from one or more persons	Not able to, despite human assistance and guiding
Getting in and out of bed	2	1	0
Sit to stand to sit from a chair with armrests	2	1	0
Walking with or without an appropriate aid	2	1	0

https://www.researchgate.net/publication/337474968_The_Cumulated_Ambulation_Score_CAS_English_version_manual_and_score-sheet_updated_with_more_references_2019pdf