

## Secondary osteoporosis prevention: three-year outcomes from a

## Fracture Liaison Service in elderly hip fracture patients



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# **OVERVIEW**

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# INTRODUCTION

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analyze the effect of the FLS model over the survival and mortality rates following a hip fracture determine the risk of suffering a second osteoporotic fracture and the adherence to treatment

# MATERIAL AND METHODS

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# Study design

prospective cohort study on patients over **60 years** with **hip fracture** 

Setting: University of Malaga (2016 - 2022)

First group: diagnosed between January 2016 and December 2016, before implementation of the FLS

Second group: diagnosed between January 2017 and December 2019, after the implementation of the FLS





# Study design

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#### **before** implementation of the FLS



#### after the implementation of the FLS







## Compare outcomes

# **FLS protocol**

#### **Evaluations During Hospitalization**

- ✓ Laboratory tests
- ✓ Mobility and Functional assessment
- ✓ physical therapy and exercise program
- ✓ Management of comorbidities

#### **Therapeutic interventions**

- ✓ Calcium + Vitamin D supplement
- ✓ **Oral bisphosphonates** (alendronic acid/risedronate) (**Subcutaneous denosumab** if renal/GI)
- ✓ Teriparatide for severe osteoporosis

#### Follow-up

✓ Visit at 1, 6 and 12 monthes





# **Statistical analysis**

Software: SPSS 24.0 & GPower 3.1.9.6

Tests:

- Normality: Shapiro-Wilk
- Comparisons: t-test (continuous),  $\chi^2$  (categorical)
- Survival: Kaplan-Meier (36-month follow-up)
- Multivariable: Cox regression (adjusted for age, fracture type, ASA)

#### First:

a survival analysis where the outcomes were either death or end of the 36-months follow-up period, here patients lost to follow-up were censored.

Second: mortality, any complication and second osteoporotic fracture rates were compared between the two groups (age, type of fracture and ASA score)

# RESULTS

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1366 patients (432M/934F) Mean age: 82.3

**Osteoporosis treatment**  $\uparrow$  (12.5% $\rightarrow$  79.3%)

**Overall Survival**↑ (802.6→823.9 days)

**Treatment adherence**  $(30.2\% \rightarrow 51.7\%)$ 

**One-year mortality rate**↓ (HR=0.74)

**Any complication**↓ (HR=0.62)

**Second fracture**↓ (HR=0.54)

# 3-year fallow-up

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# Results

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Parameter	Before FLS implementa- tion $(n=353)$	After FLS implementa- tion $(n = 1013)$	P value
Age, years	$82.27 \pm 8.21$	$82.36 \pm 7.71$	0.32
Gender			
Male	71 (20.1)	361 (35.6)	< 0.01*
Female	282 (79.9)	652 (64.4)	
Side			
Left	172 (48.7)	519 (51.2)	0.41
Right	181 (51.3)	494 (48.8)	
Fracture type			
Femoral neck	149 (42.2)	391 (38.6)	0.46
Trochanteric	175 (49.6)	540 (53.3)	
Subtrochanteric	29 (8.2)	82 (8.1)	
ASA	$2.58 \pm 0.70$	$2.61 \pm 0.67$	0.25
0	0 (0.0)	2 (0.2)	0.26
1	6 (1.7)	7 (0.7)	
2	175 (49.6)	475 (46.9)	
3	135 (38.2)	432 (42.6)	
4	37 (10.5)	97 (9.6)	
Anti-Osteoporotic treatment rate	44 (12.5)	803 (79.3)	< 0.01*
Initiated at hospitalization	22 (6.2)	556 (55.0)	< 0.01*
Initiated at out-patient clinic	22 (6.2)	244 (24.1)	< 0.01*
Anti-Osteoporotic Drugs			
Oral bisphosphonates	22 (50.0)	673 (83.8)	< 0.01*
Denosumab	14 (31.8)	61 (7.6)	
Teriparatide	8 (18.2)	69 (8.6)	

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#### Results

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Parameter	Before FLS implementa- tion $(n=355)$	After FLS implementation $(n = 1044)$	P value
Three-year mortality rate	141 (39.9)	413 (40.8)	0.79
One-month mortality rate	11 (3.1)	22 (2.2)	0.32
First-year mortality rate	77 (22.5)	187 (18.9)	0.14
Second-year mortality rate	24 (9.1)	107 (13.3)	0.07
Three-year mortality rate	29 (12.1)	97 (13.9)	0.48
Survival, days	$802.63 \pm 413.80$	$823.93 \pm 389.20$	0.01*
Second fracture rate	37 (10.5)	101 (10.0)	0.78
Hip fracture	15 (3.9)	42 (3.8)	0.46
Other fractures	22 (6.2)	59 (5.6)	
Adherence to treatment	13 (30.2)	416 (51.7)	< 0.01*
Complications	27 (7.6)	61 (6.0)	0.28
Cut-out	1 (0.3)	10 (0.9)	0.1
Medical complication	14 (3.9)	21 (2.0)	
Readmission	10 (2.8)	25 (2.5)	0.71
Reintervention	14 (3.9)	39 (3.7)	0.92

**Table 2**outcomes and complications

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	Albumin (g/dl)	Calcium (mg/dl)
	$2.63 \pm 0.61$	$8.14 \pm 0.76$
Gender		
Male	$2.66 \pm 0.64$	$8.17 \pm 0.74$
Female	$2.62 \pm 0.59$	$8.12 \pm 0.78$
Age, years	5	
60–69	$3.12 \pm 1.08$	$8.41 \pm 1.18$
70–79	$2.73 \pm 0.60$	$8.24 \pm 0.75$
80–89	$2.58 \pm 0.59$	$8.08 \pm 0.77$
90–99	$2.55 \pm 0.43$	$8.10 \pm 0.58$

Table 3 Routine blood test results 14

#### Vitamin D (ng/dl)

#### $15.02 \pm 10.59$

- $15.83 \pm 9.49$  $14.52 \pm 11.20$
- $15.65 \pm 8.05$
- $16.86 \pm 9.37$
- $14.75 \pm 9.60$
- $12.61 \pm 14.89$

	KE	esuits		
Females	Before FLS implementation (n=282)	After FLS implementation $(n=652)$	Crude HR	Adjusted HR
One-month mortality rate	7 (2.5)	14 (2.1)	0.86 (0.35–2.13)	0.75 (0.30–1.87)
One-year mortality rate	62 (22.0)	118 (18.1)	0.81 (0.59–1.10)	0.77 (0.56-1.05)
Two-year mortality rate	82 (29.1)	185 (28.4)	0.96 (0.74–1.24)	0.93 (0.72–1.21)
Three-year mortality rate	105 (37.2)	247 (37.9)	1.00 (0.78–1-26)	0.98 (0.78-1.23)
Any complication	20 (7.1)	43 (6.6)	0.74 (0.51–1.09)	0.75 (0.51-1.10)
Second fracture	30 (10.6)	72 (11.0)	0.49 (0.32-0.74)*	0.46 (0.30-0.71)*
Total	Before FLS implementation $(n=353)$	After FLS implementation $(n=1013)$	Crude HR	Adjusted HR
One-month mortality rate	4 (5.6)	8 (2.2)	0.39 (0.12–1.28)	0.36 (0.11–1.22)
One-year mortality rate	28 (39.4)	90 (24.9)	0.56 (0.39-0.86)*	0.57 (0.37-0.88)*
Two-year mortality rate	32 (45.1)	131 (36.3)	0.70 (0.48-1.04)	0.70 (0.47-1.03)
Three-year mortality rate	35 (49.3)	166 (46.0)	0.81 (0.56-1.16)	0.80 (0.56-1.15)
Any complication	7 (9.9)	18 (5.0)	0.40 (0.25-0.64)*	0.37 (0.23-0.60)*
Second fracture	7 (9.9)	29 (8.0)	0.77 (0.46–1.30)	0.80 (0.47-1.35)
Males	Before FLS implementation (n=71)	After FLS implementation (n=361)	Crude HR	Adjusted HR
One-month mortality rate	11 (3.1)	22 (2.2)	0.69 (0.34–1.42)	0.64 (0.31–1.32)
One-year mortality rate	90 (25.5)	208 (20.5)	0.78 (0.61-1.00)	0.74 (0.58–0.96)*
Two-year mortality rate	114 (32.3)	316 (31.2)	0.93 (0.76–1.16)	0.92 (0.74–1.14)
Three-year mortality rate	140 (39.7)	413 (40.8)	1.00 (0.83–1.21)	0.98 (0.81-1.19)
Any complication	27 (7.6)	61 (6.0)	0.62 (0.46-0.84)*	0.62 (0.46–0.84)*
Second fracture	37 (10.5)	101 (10.0)	0.56 (0.41-0.78)*	0.54 (0.39-0.75)*

**Table 4** Multivariable cox regression analysis on mortality and second fracture rates

#### Discussion • • • •

## Discussion

## I. Mortality & Survival Benefits

- ✓ ↓ 1-year mortality (HR=0.74, p<0.05)
- ✓ Consistent with global data (Netherlands, Italy, Finland)
- ✓ No 3-year mortality difference (40% in both groups)

#### **2. Fracture Prevention**

- ✓ ↓ Second fractures (HR=0.54, p<0.05)
- ✓ Aligns with Australian FLS data (30% reduction)
- $\checkmark$  Romosozumab further  $\downarrow$  vertebral fractures (FRAME study)



## Italy, Finland) th groups)

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## Discussion

#### **3. Treatment Impact**

- ✓ Adherence ↑ 51.7% vs 30.2% (p<0.01)</li>
- ✓ Best outcomes with:
  - Bisphosphonates/denosumab + Ca/Vit D
  - Zoledronic acid ( $\downarrow$  CV events/mortality)

#### 4. Complications & Costs

- $\checkmark$   $\downarrow$  Surgical complications (infections, implant failures)
- ✓ Potential cost-effectiveness



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## Discussion

### 5. Limitations

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- Observational design
- Short follow-up (3 years)
- Sample size imbalance

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#### Conclusion • • • •



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## Conclusion



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