

Would Surgeon-Initiated Osteoporosis Screening and Treatment in Total Hip Arthroplasty Patients be Economically Viable in Preventing Periprosthetic Fracture?

Amy Zhao, Amil Raj Agarwal, Zachary Pearson, Andrew Harris, Alex Gu¹, Rachel Ranson², Sandesh Rao, Savyasachi C Thakkar, Gregory Golladay³

¹George Washington University School of Medicine An, ²NYU Langone Orthopedic Hospital, ³VCU Health

INTRODUCTION: Although only 2% of patients undergoing total hip arthroplasty (THA) sustain a periprosthetic fracture (PPF), the associated morbidity and economic burden of these few fractures justify means for their prevention. As most of these fractures are due to occult osteoporosis, prompt screening and treatment in patients at high-risk for osteoporosis may not only be efficacious in reducing the risk of these fractures but also reduce the economic burden associated with said fractures. Orthopaedic surgeons can play a tremendous role in the osteoporosis epidemic by screening at-risk patients and initiating the treatment pathway. However, wide-scale screening with dual-energy x-ray absorptiometry (DEXA) and subsequent treatment is costly, and it is unknown whether this would be economically feasible for PPF prophylaxis. The aim of this study was to determine whether and at what break-even incidence rates osteoporosis screening and treatment would be economically viable in preventing PPF in patients undergoing elective THA.

METHODS: The costs of DEXA screening, three-year treatment with oral bisphosphonates, estrogen hormonal therapy, or denosumab, and treatment of PPF were collected from the literature and included in a break-even analysis. Rates of occult osteoporosis at time of THA and 5-year postoperative PPF were observed from the literature and included in our analysis (Figure 1). The absolute risk reduction (ARR) and break-even incidence rate (BEIR) related to screening and treatment were used to evaluate the cost-effectiveness of intervention. The calculated BEIR was used as the threshold required for the intervention to be cost-effective, with a negative BEIR indicating the intervention would never be economically viable.

RESULTS: One in 179 PPFs (ARR 0.6%) need to be prevented for screening and treatment with oral bisphosphonates to be economically justified to prevent PPF. The BEIR was negative (-0.1%, -0.03%) when the cost of screening and treatment exceeded \$400, and when the cost of care for periprosthetic fractures was less than \$25,000.

DISCUSSION AND CONCLUSION: Our study expanded the literature observing trends in osteoporosis treatment, finding that surgeon-initiated osteoporosis screening and treatment in patients undergoing elective THA is economically feasible in reducing PPF. DEXA screening, and treatment with oral bisphosphonates is cost-effective if they reduce the PPF rate by 0.6%.

Figure 1: Break-Even Analysis Equation

$$BEIR = \frac{(PPF_0 \cdot C_{PPF}) - C_{Treatment}}{C_{PPF}}$$

BEIR = break-even fracture incidence rate; PPF₀ = initial PPF rate; C_{PPF} = cost of treating PPF; C_{Treatment} = cost of screening and treatment

Table 1: Cost-effectiveness of Osteoporosis Screening and Treatment for PPF Prevention: Different Medication Categories

Cost of Screening and Treatment (\$, USD)	Cost of Care for Periprosthetic Fracture (\$, USD)	Initial Periprosthetic Fracture Rate (%)	Break-Even Periprosthetic Fracture Rate (%)	ARR (%)	NSI
		0.90	0.3	0.6	179
Oral Bisphosphonates (\$22.8k)	41,790	0.90	0.4	0.5	198
Estrogen hormone therapy (\$210.6k)	41,790	0.90	0.4	0.5	198
Denosumab (\$123.6k)	41,790	0.90	-2.1	3.0	34

just

Table 2: Cost-effectiveness of Osteoporosis Screening and Treatment for PPF Prevention: Varying Medication Costs

Cost of Screening and Treatment (\$, USD)	Cost of Care for Periprosthetic Fracture (\$, USD)	Initial Periprosthetic Fracture Rate (%)	Break-Even Periprosthetic Fracture Rate (%)	ARR (%)	NSI
100	41,790	0.90	0.7	0.2	418
200	41,790	0.90	0.4	0.5	209
300	41,790	0.90	0.2	0.7	140
400	41,790	0.90	-0.1	1.0	104
500	41,790	0.90	-0.3	1.2	84

Table 3: Cost-effectiveness of Osteoporosis Screening and Treatment for PPF Prevention: Varying Cost of Care for PPF

Cost of Screening and Treatment (\$, USD)	Cost of Care for Periprosthetic Fracture (\$, USD)	Initial Periprosthetic Fracture Rate (%)	Break-Even Periprosthetic Fracture Rate (%)	ARR (%)	NSI
		0.90	0.3	0.6	179
Oral Bisphosphonates					
212.88	10,000	0.90	-1.429	2.329	43
212.88	25,000	0.90	-0.032	0.932	107
212.88	50,000	0.90	0.434	0.466	215
212.88	75,000	0.90	0.900	0.000	322
212.88	100,000	0.90	0.667	0.233	429
212.88	150,000	0.90	0.351	0.549	644
Estrogen					
210.60	10,000	0.90	-1.207	2.107	47
210.60	25,000	0.90	0.887	0.013	119
210.60	50,000	0.90	0.476	0.423	237
210.60	75,000	0.90	0.619	0.281	356
210.60	100,000	0.90	0.689	0.211	475
210.60	150,000	0.90	0.765	0.140	712
Denosumab					
123.60	10,000	0.90	-11.437	12.337	8
123.60	25,000	0.90	-4.035	4.935	20
123.60	50,000	0.90	-1.567	2.467	41
123.60	75,000	0.90	-0.745	1.445	61
123.60	100,000	0.90	-0.334	1.234	81
123.60	150,000	0.90	0.078	0.822	122