Double the Reoperation Rate of Femoral Neck Fractures Treated with Osteosynthesis Compared to Arthroplasty in Patients 65 Years or Older

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INTRODUCTION: Femoral neck fractures (FNF) are usually fragility fractures that are associated with a high patient morbidity and mortality. While FNFs are commonly treated operatively with osteosynthesis or arthroplasty, it is unknown if patients 65 years or older who sustain a FNF should only undergo arthroplasty. Therefore, this study aimed to compare outcomes between patients aged ≥ 65 years who had a FNF and were treated with osteosynthesis or arthroplasty, including: 1) patient characteristics; 2) healthcare utilization; and 3) rates of reoperation and mortality at 90-days, 1-year, 2-years, and 3-years postoperatively.

METHODS: The Florida and Maryland State Inpatient Databases were queried from January 2016 to December 2019 for all patients aged ≥ 65 years who had a FNF and were treated operatively. Included patients were stratified into groups according to the operative treatment – Osteosynthesis (e.g., closed reduction internal fixation and open reduction internal fixation) or Arthroplasty (e.g., hemiarthroplasty and total hip arthroplasty). Demographics characteristics, complications, 90-day readmissions, discharge destination, reoperation, and mortality were compared between groups.

RESULTS: Among 21,794 patients included, 17,477 (80%) were treated with arthroplasty and 4,497 (20%) with osteosynthesis. The cohort differed in terms of age (p<0.0001) and Elixhauser Based Risk Group distribution (p<0.0001), with the arthroplasty group being older and with a higher risk group score (**Table 1**). The arthroplasty group had higher rates of arrythmias (p<0.0001), deficiency anemia (p=0.003), blood loss anemia (p<0.0001), hypertension (p=0.03), fluid/electrolyte imbalances (p<0.0001), neurological disorders (p=0.002), paralysis (p=0.01), renal failure (p=0.04), and valvular disease (p=0.0005). The osteosynthesis group had higher rates of uncomplicated diabetes mellitus (p=0.001) and drug abuse (p=0.04) (**Table 2**). Inpatient hospital length of stay was longer for the arthroplasty group (5.6 ± 3.9 days *vs.* 5.0 ± 3.7 days; p<0.0001). The specific complications occurring within 90-days postoperatively are shown in **Table 3.** The arthroplasty group had slightly higher rate of reoperation compared to the osteosynthesis group at 90-days postoperatively (3.3% *vs.* 2.9%). However, the rate of reoperation for the osteosynthesis group increased 2.4-times to 7.1% after 1-year postoperatively and kept increasing throughout the three-year study period (**Table 4).** Meanwhile, the rate of reoperation for the arthroplasty group varied slightly from 4.1% to 4.6% throughout the same period. The mortality rates for both groups are shown in **Table 5**. There were minor differences including a slightly higher mortality rate for the arthroplasty at 90-days, 1-year, and 2-years (**Table 5**).

DISCUSSION AND CONCLUSION:

This cohort analysis from two state inpatient databases observed that most patients 65 years or older who sustained a FNF underwent hip arthroplasty, while 1 out of 5 underwent osteosynthesis. Overall, patients who were treated with arthroplasty were older and had a higher comorbidity burden. However, 3-years postoperatively the rate of reoperation was more than double for patients treated with osteosynthesis compared to those treated with arthroplasty. Orthopaedic surgeons should consider treating all FNFs in patients 65 years or older with arthroplasty. If needed, this patient population should be referred to arthroplasty surgeons for definitive care.

Table 1. Cohort characteristics

Variable	Arthroplasty (n=17,477)	Osteosynthesis (n=4,497)	P-Value
Age (years)			**<0.0001**
65 – 69	1,493 (8.5)	496 (11.0)	
70 – 74	2,234 (12.8)	649 (14.4)	
75 – 80	2,895 (16.6)	817 (18.2)	
80 – 84	3,597 (20.6)	870 (19.3)	
85 – 89	3,789 (21.7)	881 (19.6)	
90 – 94	2,575 (14.7)	576 (12.8)	
95+	894 (5.1)	208 (4.6)	
Sex			
Male	5,820 (33.3)	1,468 (32.6)	0.82
Female	11,657 (66.7)	3,029 (67.4)	
Race			
White	14,905 (85.3)	3,831 (85.2)	
Black	857 (4.9)	208 (4.6)	
Hispanic	1,262 (7.2)	337 (7.5)	
Asian or Pacific Islander	131 (0.7)	39 (0.9)	
Native American	13 (0.1)	* (*)	
Other	189 (1.1)	52 (1.2)	
Median Household Income			0.10
1st quartile (0-25)	4,765 (27.3)	1,176 (26.2)	
2nd quartile (26-50)	5,332 (30.5)	1,389 (30.9	
3rd quartile (51-75)	4,351 (24.9)	1,074 (23.9	
4th quartile (76-100)	2,818 (16.1)	779 (17.3)	
Insurance			0.47
Medicaid	102 (0.6)	23 (0.5)	
Medicare	16,642 (95.2)	4,267 (94.9)	
Other	276 (1.6)	84 (1.9)	
Private	409 (2.3)	114 (2.5)	
None	48 (0.3)	* (*)	
Elixhauser Based Risk Group			**<0.0001**
Low	8,700 (49.8)	2,393 (53.2)	
Medium	6,360 (36.4)	1,575 (35.0)	
High	2,417 (13.8)	529 (11.8)	

** Values <11 were blinded per HCUP data reporting guidelines.*

Table 2. Presence of Comorbidities for the Study Cohort

Elixhauser Comorbidities	Arthroplasty (n=17,477)	Osteosynthesis (n=4,497)	P-Value
AIDS	14 (0.1)	* (*)	0.85
Alcohol abuse	539 (3.1)	146 (3.2)	0.58
Arrhythmia	4,572 (26.2)	1,031 (22.9)	**<0.0001**
Deficiency anemia	4,196 (24.0)	983 (21.9)	**0.003**
Rheumatoid arthritis	657 (3.8)	183 (4.1)	0.33
Blood loss anemia	314 (1.8)	43 (1.0)	**<0.0001**
Congestive heart failure	2,388 (13.7)	593 (13.2)	0.40
Chronic lung disease	3,732 (21.4)	1,002 (22.3)	0.18
Coagulopathy	1,459 (8.3)	341 (7.6)	0.10
Depression	2,542 (14.5)	656 (14.6)	0.94
Diabetes mellitus - uncomplicated	1,985 (11.4)	588 (13.1)	**0.001**
Diabetes mellitus - complicated	1,843 (10.5)	460 (10.2)	0.54
Drug abuse	158 (0.9)	56 (1.2)	**0.04**
Hypertension	13,577 (77.7)	3,425 (76.2)	**0.03**
Hypothyroidism	3,871 (22.1)	1,025 (22.8)	0.35
Liver disease	309 (1.8)	79 (1.8)	0.96
Lymphoma	123 (0.7)	30 (0.7)	0.79
Fluid/electrolyte imbalance	5,737 (32.8)	1,227 (27.3)	**<0.0001**
Metastatic cancer	199 (1.1)	57 (1.3)	0.47
Neurological disorders	877 (18.6)	746 (16.6)	**0.002**
Obesity	877 (5.0)	214 (4.8)	0.48
Paralysis	553 (3.2)	109 (2.4)	**0.01**
Peripheral vascular disease	1,226 (7.0)	351 (7.8)	0.07
Psychoses	391 (2.2)	103 (2.3)	0.83
Pulmonary circulation disorders	137 (0.8)	28 (0.6)	0.26
Renal failure	3,230 (18.5)	772 (17.2)	**0.04**
Solid tumor without metastasis	349 (2.0)	87 (1.9)	0.79
Peptic ulcer disease	101 (0.6)	29 (0.6)	0.62
Valvular disease	2,247 (12.9)	492 (10.9)	**0.0005**
Weight loss	1,043 (6.0)	260 (5.8)	0.64

** Values <11 were blinded per HCUP data reporting guidelines.*

Table 3. Complications occurring within 90-days post-operatively

	Arthroplasty		Fixation		P value
Mechanical complication	**491**	159.9%	20	1.6%	**<0.0001**
Mechanical loosening	31	0.5%	*	*	0.18
Dislocation of prosthetic joint	451	7.8%	*	*	**<0.0001**
Prosthetic joint implant failure	*	*	*	*	0.21
Peri-prosthetic fracture	11	0.2%	*	*	0.83
Peri-prosthetic osteolysis	0	0.0%	0	0.0%	N.A.
Articular bearing surface wear	0	0.0%	0	0.0%	N.A.
Unspecified/other mechanical	13	0.2%	*	*	0.11
Non-mechanical complications	**4,922**	85.3%	1,009	82.0%	**0.003**
Postoperative shock	12	0.2%	0	0.0%	0.11
Hemorrhage/hematoma/seroma	93	1.6%	14	1.1%	0.22
Disruption of wound	109	1.9%	*	*	0.004
Infection	**1,628**	28.2%	**301**	24.5%	**0.0071**
Postoperative infection	209	3.6%	24	1.9%	0.003
Infection/inflammatory reaction	0	0.0%	0	0.0%	N.A.
Urinary tract infection	1,455	25.2%	279	22.7%	0.0584
cellulitis/abscess	0	0.0%	0	0.0%	0.7057
Acute posthemorrhagic anemia	2,299	39.9%	400	32.5%	<0.0001
Pulmonary embolism and infarction	973	16.9%	202	16.4%	0.6935
Lower extremity DVT	214	3.7%	41	3.3%	0.5182
Pulmonary insufficiency	174	3.0%	27	2.2%	0.1162
Transfusion of blood and products	670	11.6%	120	9.7%	0.0599
Organ System					
Central nervous system	189	61.6%	49	1%	0.22
Cardiac	3,096	1008.5%	624	10%	0.06
Peripheral vascular	0	0.0%	0	0%	N.A.
Respiratory	682	222.1%	156	2%	0.41
Gastrointestinal	281	91.5%	56	1%	0.63
Genitourinary	*	*	*	*	0.74
Other organ-specific complications	0	0.0%	0	0.0%	0.26

Table 4. Reoperation

	90-days	1yr	2yr	3yr
Arthroplasty	3.3%	4.1%	4.5%	4.6%
Osteosynthesis	2.9%	7.1%	8.3%	9.2%

Table 5. Mortality

	90-days	1yr	2yr	3yr
Arthroplasty	7.6%	9.3%	10.4%	11.0%
Fixation	7.3%	7.9%	9.7%	11.0%