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Outcomes of ceramic versus metal heads after primary hip hemiarthroplasty in a national cohort up to 10 years of follow-up

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INTRODUCTION

Hip fracture is a common condition in the elderly, and patients with fracture have high mortality. Hip fracture is the main cause of osteoporosis-related disease burden in developed countries. Due to the severe consequence of hip fracture, it's important to assess the best treatment option for hip fracture patients undergoing hip hemiarthroplasty.

AIM

To investigate the clinical outcomes and survival for femoral neck fracture patients with hip hemiarthroplasty using ceramic versus metal heads.

METHODOLOGY

Study population: Patients identified from the National Health Insurance claims data, with an index femoral neck fracture admission and undergoing hip hemiarthroplasty between 2010~2018 and followed until 2019.

Hip fracture patients (ICD-9 and ICD-10 diagnostic code of 820 and S72) (n=247994)

Exclusion criteria

- Patient onset age below 50 years old(n=20144)
- Having hip fracture history in the prior year (n=22850)
- Pathological fracture, traumatic fracture(n=15944)
- Missing data in age, sex(n=2104)
- Diagnosed with cancer(n=6515)
- Current surgery code not hemiarthroplasty (ICD9:81.52/ICD10:0SRA,0SRE,0SRR,0SRS) (n=122421)
- Medical device codes not included in the scope of this study (n=8221)

Femoral neck fracture incident patients aged 50 and older (n=49795)

Hemiarthroplasty patients with metal head (n=47158)

Hemiarthroplasty patients with ceramic head (n=2637)

2:1 Match

Metal head group (n=5118)

Ceramic head group (n=2559)

The patients were matched for age ± 1 year, same gender, calendar year and comorbidities (diabetes, acute myocardial infarction, stroke, chronic obstructive pulmonary disease, end-stage renal disease, liver cirrhosis)

STATISTICAL ANALYSIS

Sub-distribution hazard models

✓ Calculate the hazard ratio of revision, reoperation, and postoperative complications for the two groups. Death was modeled as a competing risk for clinical outcomes, controlling for individual and hospital variables.

Kaplan–Meier methods and Cox proportional hazards model

✓ Estimate post-operative survival and calculate the hazard ratio of death.

Lifetime survival extrapolation

✓ Used iSQoL2 package of R software to estimate life expectancy (LE) and loss-of-life expectancy(loss-of-LE)

RESULTS

Table 1. Demographic characteristic

	Metal head group (N=5118)		Ceramic head group(N=2559)		
	N	%	N	%	p-value
Gender					
Male	1550	30.29%	775	30.29%	1
Female	3568	69.71%	1784	69.71%	
Age Mean ± SD	73.41 ± 9.48		73.40 ± 9.48		
50-54	83	1.62%	42	1.64%	
55-59	271	5.30%	135	5.28%	
60-64	692	13.52%	346	13.52%	
65-69	799	15.61%	398	15.55%	0.99
70-74	846	16.53%	424	16.57%	
75-79	936	18.29%	469	18.33%	
80-84	849	16.59%	423	16.53%	
Above 85	642	12.54%	322	12.58%	
Insured salary					
Low income households	1698	33.18%	748	29.23%	
Craft unions	1964	38.37%	891	34.82%	
Insured salary ≤ NTD$40100	826	16.14%	460	17.98%	<0.01
Insured salary > NTD$40100	630	12.31%	460	17.98%	
Comorbidities					
Diabetes	1836	35.87%	918	35.87%	
Acute myocardial infarction	16	0.31%	8	0.31%	
Stroke	452	8.83%	226	8.83%	
Chronic obstructive pulmonary disease	136	2.66%	68	2.66%	1
End-stage renal disease	30	0.59%	15	0.59%	
Liver cirrhosis	32	0.63%	16	0.63%	
Hospital location					
Taipei, New Taipei, Keelung	1302	25.44%	1137	44.43%	
Yilan, Hualien, Taitung	329	6.43%	52	2.03%	
Taoyuan , Hsinchu, Miaoli	762	14.89%	324	12.66%	
Taichung, Changhua, Nantou	1004	19.62%	393	15.36%	<0.01
Yunlin,Chiayi,Tainan	752	14.69%	414	16.18%	
Kaohsiung, Pingtung	969	18.93%	239	9.34%	
Hospital Ownership					
Public hosptials	1715	33.51%	766	29.93%	
Proprietary hospitals	2246	43.88%	1339	52.33%	<0.01
Private hospital	1157	22.61%	454	17.74%	
Hospital level					
Medical center	1370	26.77%	795	31.07%	
Regional hospitals.	2506	48.96%	1138	44.47%	<0.01
Local Community Hospitals	1242	24.27%	626	24.46%	

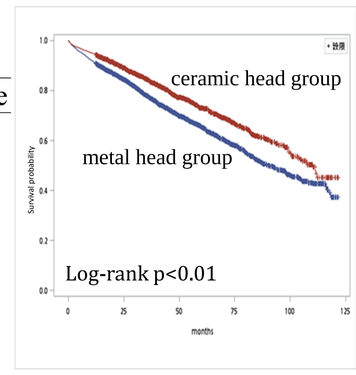

Figure 1. Postoperative Survival status

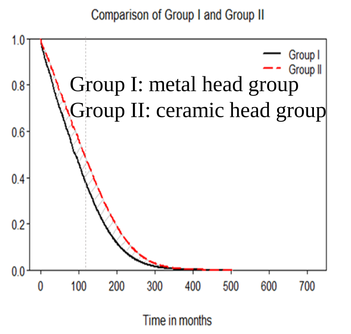

Figure 2. Life Expectancy

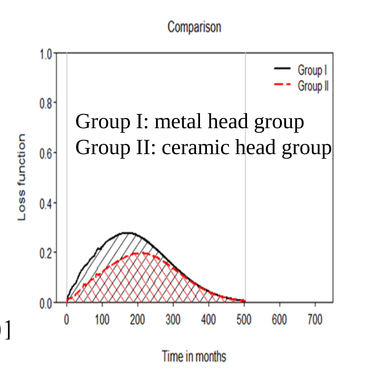

Figure 3. loss-of-LE

ceramic head group had 1.72 fewer loss-of-LE years than metal head group, but no significant difference (P=0.15)

Table 2. Ceramic head group Postoperative adjusted hazard (Ref: metal head group)

	Postoperative 1 year	Postoperative 5 year	Postoperative 10 year
Revision	0.91	0.95	0.92
Reoperation	**0.65****	**0.81***	**0.81***
Death	**0.64****	**0.73****	**0.74****
	Postoperative 1 month	Postoperative 3 month	Postoperative 1 year
Pulmonary embolism	-	-	0.34
Pressure ulcers	0.68	0.53	**0.47****
Pneumonia	0.96	**0.7***	**0.75****
Deep vein thrombosis	-	0.18	0.52
All-cause complications	0.85	**0.62****	**0.68****

*: p-value <0.05; **:p-value<0.01

Adjusted variables: Age, Gender, Hospital variables, Bone cement, Insured salary

CONCLUSION

For femoral neck fracture patients undergoing hip hemiarthroplasties, the risk of revision, LE, and loss-of-LE were not significantly different in patients using ceramic or metal heads, But the ceramic head bipolar group had significantly lower hazard ratios in reoperation, pressure ulcer, pneumonia, all-cause complications, and mortality.