Prognostic relevance of intra-aortic balloon pump in patients with acute myocardial infarction complicated by cardiogenic shock: Nationwide population study in Taiwan

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Background

Intra-aortic balloon pump (IABP) is the most widely used form of mechanical hemodynamic support in patients with cardiogenic shock. However, usefulness of IABP in high risk patient population is conflicting. We examined whether the patient prognosis in Taiwan treated with IABP has improved when IABP was actively used for mechanical circulatory support.

Methods

We used Taiwan's National Health Insurance Research Database to retrospectively review 3145 (2358 men [75%]) cardiogenic shock patients who treated primary PCI due to acute myo cardial infarction (AMI) between 2000 and 2012. Primary outcome was all cause mortality and secondary outcome was heart failure. We used Cox proportional hazard regression analysis to determine association between covariates and study endpoints.

Results

A total of 1417 patients who received IABP therapy and 1728 patients who not received non-IABP were selected in this study. The mean age of IABP group and non-IABP group was 68.1±13.1 years and 67±13.3 years, respectively (p=0.02). Median follow-up time for death was 1.51 years in non-IABP group and 1.07 years in IABP group (p<0.0001). Median follow-up time for heart failure was 0.28 years in non-IABP group and 0.09 years in IABP group (p<0.0001) (Table 1).

Table 1. Baseline characteristics between non-IABP group (n = 1728) and IABP group (n = 1417)

Variable	All n	%	Non-IABP n	%	IABP n	%	p-value[a]
Age (years)							0.007
<50	335	10.7	174	10.1	161	11.4	
50-59	640	20.4	338	19.6	302	21.3	
60-69	645	20.5	330	19.1	315	22.2	
≥70	1525	48.5	886	51.3	639	45.1	
Mean (SD)	67.6	(13.2)	68.1	(13.1)	67.0	(13.3)	0.02[b]
Gender							0.17
Women	787	25.0	449	26.0	338	23.9	
Men	2358	75.0	1279	74.0	1079	76.2	
Comorbidity							
Previous MI	109	3.47	56	3.95	53	3.07	0.18
Previous HF	333	10.6	192	11.1	141	9.95	0.29
DM	872	27.7	485	28.1	387	27.3	0.64
CKD	209	6.65	131	7.58	78	5.50	0.02
HTN	1172	37.3	662	38.3	510	36.0	0.18
Previous CAD	615	19.6	352	20.4	263	18.6	0.20
Mean follow-up duration (median (IQR))							
Death	1.28	(3.14)	1.51	(3.54)	1.07	(2.78)	<0.0001[c]
Heart failure	0.15	(2.18)	0.28	(2.68)	0.09	(1.77)	<0.0001[c]

MI, myocardial infarction; HF, heart failure; DM, diabetes mellitus; CKD, chronic kidney disease; HTN, hypertension; CAD, coronary artery disease.
[a]Chi-square test, [b]t-test and [c]Wilcoxon rank sum test

During follow-up period, the adjusted hazard ratio for overall mortality was 1.22 (CI 95% 1.10-1.35, p<0.0001) and for overall heart failure was 1.24 (CI 95% 1.08-1.41, p<0.001) (Table 2).

Risk factors for all cause mortality were previous heart failure, diabetes, chronic kidney disease and hypertension (Table 3).

Table 2. Rate and HR for death and heart failure by age group and gender in Cox proportional hazard regression

Variable	Non-IABP n	Person years	Rate[d]	IABP n	Person years	Rate[d]	IABP vs. non-IABP HR (95% CI) Crude	Adjusted
DEATH								
Overall[a]	821	3593	22.9	722	2351	30.7	1.16 (1.05-1.28)[g]	1.22 (1.10-1.35)[g]
Age (years)[b]								
<50	36	534	6.74	38	413	9.20	1.22 (0.77-1.93)	1.21 (0.77-1.92)
50-59	96	943	10.2	116	596	19.5	1.57 (1.20-2.06)[f]	1.67 (1.27-2.20)[g]
60-69	135	804	16.8	154	596	25.9	1.30 (1.03-1.64)[e]	1.31 (1.04-1.66)[e]
70+	554	1312	42.2	414	747	55.5	1.12 (0.99-1.27)	1.14 (1.00-1.29)
Gender[c]								
Women	274	695	39.4	210	440	47.7	1.11 (0.92-1.33)	1.21 (1.01-1.45)[e]
Men	547	2898	18.9	512	1911	26.8	1.21 (1.07-1.36)[f]	1.24 (1.09-1.39)[g]
HEART FAILURE								
Overall[a]	471	2647	17.8	415	1559	26.6	1.21 (1.06-1.38)[f]	1.24 (1.08-1.41)[f]
Age (years)[b]								
<50	40	422	9.47	35	328	10.7	0.99 (0.63-1.55)	0.98 (0.63-1.55)
50-59	49	739	10.7	94	379	24.8	1.67 (1.23-2.26)[g]	1.70 (1.25-2.30)[g]
60-74	86	612	14.1	91	393	23.2	1.28 (0.96-1.73)	1.28 (0.96-1.73)
≥75	266	874	30.4	195	459	42.5	1.14 (0.94-1.36)	1.14 (0.95-1.37)
Gender[c]								
Women	130	485	26.8	94	242	38.9	1.10 (0.84-1.43)	1.13 (0.86-1.48)
Men	341	2162	15.8	321	1317	24.4	1.25 (1.08-1.46)[f]	1.27 (1.09-1.48)[f]

[a]Adjusted for age and chronic kidney disease, [b]Adjusted for chronic kidney disease, [c]Adjusted for age and chronic kidney disease.
[d]per 100 person-years, [e]p<0.01, [f]p<0.001, [g]p<0.0001

Table 3. HR for death and heart failure in multivariable Cox proportional hazard regression

|	HR for death	HR for heart failure
Age group	1.03 (1.03-1.04)[c]	1.01 (1.01-1.02)[c]
Men vs. women	1.17 (1.04-1.31)[b]	1.00 (0.85-1.18)
IABP vs. non-IABP	1.25 (1.13-1.39)[c]	1.25 (1.09-1.43)[b]
Comorbidity (no vs. yes)		
Previous MI	0.98 (0.76-1.27)	1.17 (0.86-1.60)
Previous HF	1.20 (1.02-1.41)[a]	1.70 (1.38-2.10)[c]
Diabetes	1.28 (1.14-1.44)[c]	1.10 (0.94-1.29)
Chronic kidney disease	1.39 (1.17-1.65)[c]	0.93 (0.71-1.21)
Hypertension	1.25 (1.11-1.40)[c]	1.16 (0.99-1.36)
Previous CAD	0.98 (0.86-1.12)	1.26 (1.05-1.51)[a]

[a]p<0.01, [b]p<0.001, [c]p<0.0001
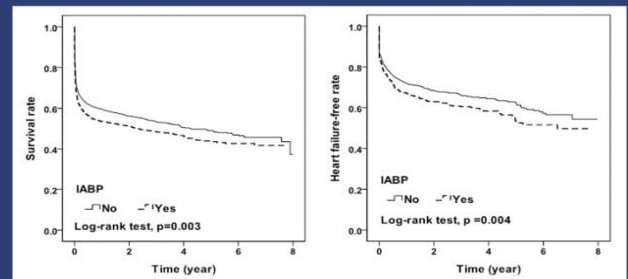
Figure 1. Survival and heart failure-free rate between non-IABP group and IABP group.

Conclusion

In this nationwide, population-based, retrospective cohort study, we found that mortality rate and heart failure rate not declined in cardiogenic shock patients who underwent primary PCI plus IABP therapy. Therefore, new type of mechanical circulatory support such as Impella should be considered for high risk, cardiogenic shock patients with AMI.

Conflict of interest: No conflict of interest