

Quality control project: Volume - outcome relationship for the treatment of acute myocardial infarction by Primary Percutaneous Coronary Intervention.

Background:

PPCI is the recommended treatment of acute myocardial infarction when feasible within 90 minutes after diagnosis. These guidelines are applicable for "experienced" centers.

The definition of experienced centre is debated and many hospitals claim to have the right to undergo such treatment providing they have a catheterization lab "on board".

Aim of this project:

The goal of this project is to determine whether results of PPCI for acute MI are dependent on the volume of activity of each individual catheterization laboratory and/ or interventional cardiologist in Belgium.

Methods:

Collection of PCI data are requested to obtain reimbursement of PCI material. These data are collected via a web based clinical record form on a server located at the Heart House (Nice) under the supervision of the Belgian Working Group of Invasive Cardiology. Data accuracy is not checked, only peer review of selected cases has been performed to ensure quality control.

Results:

In 2007, 3881 patients admitted for acute myocardial infarction have been treated by PPCI in 31 cardiac centers. Overall in-hospital mortality is 7.16%. This figure is in accordance with the published literature.

Patients who died in-hospital were older and more often female. Renal failure, cardiac heart failure, previous myocardial infarction, stroke, peripheral vascular disease, valvular disease and bypass surgery were more frequent in patients who died.

Mortality was increase in type II diabetics and hypertensive. It was lower in patients with hypercholesterolemia and active smoking.

"facilitated" PPCI reduced death risk, which was also lower among patients transferred from another hospital.

As expected, patients admitted with cardiogenic shock, those surviving cardiac arrest and those already treated by inotropic agents carry a more than 10 fold risk of death.

Mortality after PPCI was also related to left ventricular function and extent of coronary disease.

Risk of death was significantly increased for left main PCI, conversely, it was lower for PCI of the right coronary artery.

Glycoprotein 2b/3a inhibitors were used in more than half of the patients and were more often used in survivors. Similarly, direct stenting and stent implantation were more frequent in patients who survived.

Incomplete reperfusion (TIMI flow 0/1) and inadequate dilatation (residual stenosis >50%) were more often observed in patients who died.

Also, non-survivors experienced more bleeding complications, stroke and recurrent myocardial infarction than those who left hospital alive.

All these data are shown on table 1.

In-hospital mortality was higher among cardiologists performing less than 60 PCI's per year. However, the risk increased among the few interventionalists performing more than 300 PCI's.

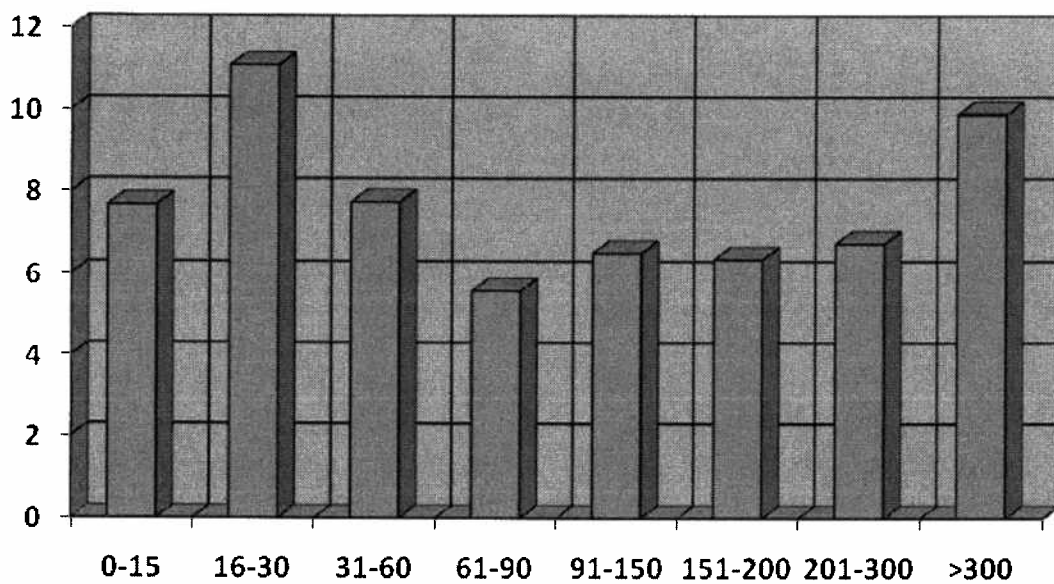


Figure 1: Percent in-hospital death (y) according to annual PCI volume of the operator (x).

The actual volume of PPCI performed per center is inversely correlated to in-hospital mortality, ($p=0.0114$, Spearman rank correlation, $r=-0.4487$) as illustrated on figure 2.

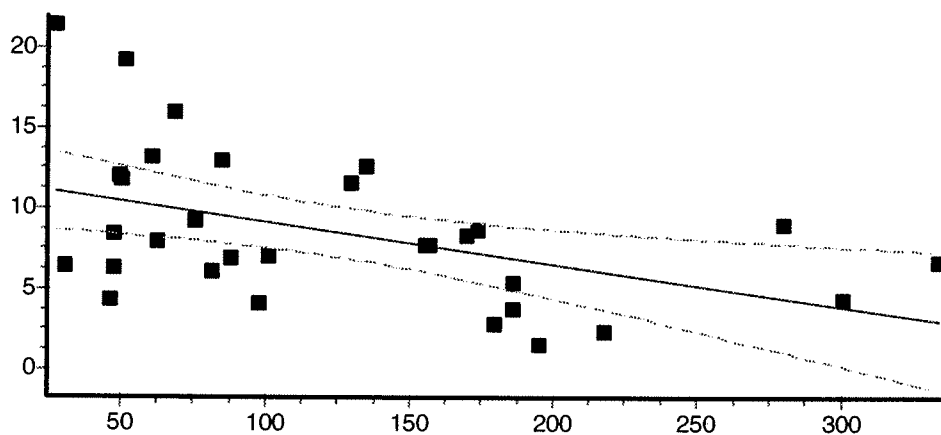


Figure 2: Correlation between PPCI volume per center and in-hospital mortality.

Table 1: Patients characteristics.

Death (n= 278)			Alive (n=3603)			p value	OR's	95%CI
Yes	No	%	Yes	No	%			

ale	176	102	63,31	2722	881	75,55	<0.0001	0.5585	0.43_0.71
/CAD	146	132	52,52	2380	1223	66,06	<0.0001	0.5684	0.44_0.71
gina	2	276	0,72	19	3584	0,53			
l	43	235	15,47	329	3274	9,13	0.0008	1.821	1.29_2.57
nal fail.	18	260	6,47	61	3542	1,69	<0.0001	4.020	2.34_6.90
IF	8	270	2,88	25	3578	0,69	0.0005	4.241	1.89_9.49
il	34	244	12,23	467	3136	12,96	NS		
roke	18	260	6,47	70	3533	1,94	<0.0001	3.49	2.05_5.95
VBG	15	263	5,40	94	3509	2,61	0.0117	2.13	1.27_3.71
'D	29	249	10,43	123	3480	3,41	<0.0001	3.29	2.15_5.04
lvular	16	262	5,76	47	3556	1,30	<0.0001	4.62	2.58_8.26
risk fact	98	180	35,25	804	2799	22,31			
tive									
rok.	89	189	32,01	922	2681	25,59	0.0226	1.37	1.05_1.78
rm.									
rok	55	223	19,78	1347	2256	37,39	<0.0001	0.41	0.30_0.56
ab typ2	46	232	16,55	352	3251	9,77	0.0005	1.83	1.31_2.56
ab typ1	12	266	4,32	89	3514	2,47	NS		
'N	136	142	48,92	1446	2157	40,13	0.005	1.43	1.12_1.82
olesterol	87	191	31,29	1476	2127	40,97	0.0019	0.66	0.50_0.85
'CI	249	29	89,57	3097	506	85,96	NS		
scue	19	259	6,83	259	3344	7,19	NS		
cilitated	10	268	3,60	247	3356	6,86	0.0477	0.51	0.26_0.96
ansfer	24	254	8,63	558	3045	15,49	0.0027	0.52	0.34_0.79
+	56	222	20,14	496	3107	13,77	0.0045	1.58	1.16_2.15
ock	143	135	51,44	206	3397	5,72	<0.0001	17.47	13.28_22.66
CA	121	157	43,53	179	3424	4,97	<0.0001	14.74	11.13_19.95
otropes	70	208	25,18	97	3506	2,69	<0.0001	12.16	8.68_17.04
>50%	37	241	13,31	1465	2138	40,66	<0.0001	0.22	0.16_0.32
40-50%	19	259	6,83	514	3089	14,27	0.0007	0.44	0.27_0.71
30-40%	31	247	11,15	261	3342	7,24	0.0237	1.61	1.08_2.38
<30%	56	222	20,14	135	3468	3,75	<0.0001	6.48	4.61_9.10
VKN	135	143	48,56	1228	2375	34,08	<0.0001	1.83	1.43_2.33
'D	86	192	30,94	1772	1831	49,18	<0.0001	0.46	0.35_0.60
'D	84	194	30,22	1056	2547	29,31	NS		
'D	101	177	36,33	743	2860	20,62	<0.0001	2.20	1.70_2.84
VKN	7	271	2,52	32	3571	0,89			
'pre	48	230	17,27	737	2866	20,46	NS		
'per	139	139	50,00	2032	1571	56,40	0.0447	0.77	0.60_0.99
'A	80	198	28,78	1430	2173	39,69	0.0004	0.61	0.47_0.80

D	117	161	42,09	1336	2267	37,08	NS		
X	47	231	16,91	566	3037	15,71	NS		
A	18	260	6,47	18	3585	0,50	<0.0001	13.79	7.09_26.8
G	8	270	2,88	44	3559	1,22	0.041	2.40	1.12_5.14
sgt	87	191	31,29	821	2782	22,79	0.0016	1.54	1.18_2.01
gt	21	257	7,55	127	3476	3,52	0.0013	2.24	1.38_3.61
furc	39	239	14,03	420	3183	11,66	NS		
MS	221	57	79,50	3332	271	92,48	<0.0001	0.31	0.23_0.43
ES	38	240	13,67	537	3066	14,90	NS		
stenting	51	227	18,35	1449	2154	40,22	<0.0001	0.33	0.24_0.46
MIO/1									
st	47	231	16,91	99	3504	2,75	<0.0001	7.20	4.96_10.4
0%post	32	246	11,51	91	3512	2,53	<0.0001	5.02	3.29_7.66
monol									
dial	253	25	91,01	3061	542	84,96	0.0077	1.79	1.17_2.73
	12	266	4,32	244	3359	6,77	NS		
c MI									
	18	260	6,47	27	3576	0,75	<0.0001	9.17	4.98_16.8
VBG	8	270	2,88	62	3541	1,72	NS		
roke	7	271	2,52	12	3591	0,33	<0.0001	7.73	3.02_19.8
eed	16	262	5,76	27	3576	0,75	<0.0001	8.09	4.30_15.2
DP									
_15	33	7,67		397		430			
_30	28	11,07		225		253			
_60	31	7,73		370		401			
_90	32	5,56		544		576			
_150	53	6,50		762		815			
1_200	38	6,35		560		598			
1_300	36	6,73		499		535			
00	27	9,89		246		273			
ENTRE									
101	14	8,24		156		170			
102	15	8,62		159		174			
103	25	8,93		255		280			
104	3	1,54		192		195			
105	5	2,29		213		218			
106	10	5,38		176		186			
107	5	2,78		175		180			
108	5	7,94		58		63			
109	22	6,59		312		334			
110	7	3,76		179		186			
111	12	7,69		144		156			
112	7	6,93		94		101			

116	11	15,94	58	69
117	2	6,45	29	31
201	17	12,59	118	135
202	11	12,94	74	85
203	10	19,23	42	52
204	3	6,25	45	48
205	8	13,11	53	61
206	6	12,00	44	50
207	6	11,76	45	51
301	13	4,32	288	301
302	4	8,33	44	48
303	15	11,54	115	130
304	2	4,26	45	47
305	12	7,64	145	157
307	5	6,10	77	82
308	6	6,82	82	88
309	4	4,08	94	98
311	7	9,21	69	76
315	6	21,43	22	28

Conclusions:

In-hospital mortality following PPCI in Belgium is similar to that observed in similar registries (around 7-9%). This survey identified the classical factors associated with an increased mortality in this setting.

Operator volume is not a critical issue, although the risk of death is increased when the intervention is performed by cardiologists doing less than 60 PCI's per year. Surprisingly, the mortality rate increases for high volume operators. This could be related to the fact that, in some centers, interventions performed by low volume operators or by fellows in cardiology are signed by a senior cardiologist. This observation needs to be clarified in the future.

There is clearly an inverse relation with center volume. Centers treating less than 150 myocardial infarction per year have an in-hospital mortality which is 30 to 50% higher than what is observed in high volume centers. This observation needs to be confirmed after adjustment for baseline differences. At first glance, the population treated in low volume centers didn't differ from that admitted in high volume hospital, however.

This survey has pointed out another important limitation. Clearly, in-hospital mortality is lower than expected in some centers (centers 104, 105,107). This raises questions on the validity of the information, at least mortality, recorded by these hospitals. It was already noted by the peer reviewers that data collection in center 104 was erroneous or incomplete for many items. The same issue is possible for centers 105 and 107. Action should be taken to inform these centers and to help them to improve their data collection. Conversely, centers with high mortality rate should be informed and action should be undertaken to help them improve their results.