ORIGINAL ARTICLE

Acute Myocardial Infarction in Argentina. Third ARGEN-IAM-ST Registry Report and 8-Year Mortality Behavior

Infarto de miocardio en la Argentina. Tercer reporte del registro ARGEN-IAM-ST y comportamiento de la mortalidad en 8 años

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ABSTRACT

Background: The continuous Argentine ST-segment Elevation Acute Myocardial Infarction (ARGEN-IAM-ST) registry presents its third general report.
Objective: The aim of this study was to evaluate the main ST-segment elevation myocardial infarction (STEMI) markers of care and its complications in the continuous ARGEN-IAM-ST registry, and assess the outcome of reperfusion therapy and mortality in the last 8 years.
Methods: This was a national, prospective, multicenter study, including STEMI patients with up to 36-hour evolution.
Results: A total of 6765 patients, mean age 61±12 years, 65% male , were included in the study. A significant burden of cardiovascular risk factors was observed: 58% of patients had hypertension, 23% diabetes, 42% dyslipidemia, 37% were active smokers, and 17% had a family history of cardiovascular disease. In 13.5% of cases, patients had prior history of coronary heart disease. On admission, 49% presented with anterior AMI and 23% with heart failure. Median (interquartile range, IQR) pain-consultation time was 120 minutes (IQR 60 – 285), door-to-needle time 50 minutes (IQR 25 – 110) and door-to-balloon time 100 minutes (IQR 58 – 190)
Overall in-hospital mortality was 8.8%. An exploratory and descriptive analysis was performed to assess the variation in reperfusion and mortality over 8 years, showing no marked changes in mortality despite high reperfusion rates.
Conclusion: In the last 8 years, the mortality recorded in the ARGEN-IAM-ST registry has remained at high values despite the high reperfusion rates reported.

Keywords: Myocardial infarction – ST-segment elevation myocardial infarction – Epidemiology – Balloon angioplasty – Reperfusion

RESUMEN

Introducción: Se presenta el tercer reporte general del registro continuo de infarto ARGEN- IAM-ST
Objetivos: Evaluar los principales marcadores de atención y las complicaciones del infarto agudo de miocardio (IAM) con elevación del segmento ST en el registro continuo de infarto ARGEN-IAM-ST. Conocer la evolución de la terapia de reperfusión y la mortalidad en los últimos 8 años.
Material y métodos: Estudio prospectivo multicéntrico, con alcance nacional. Se incluyeron pacientes con IAM con elevación del segmento ST de hasta 36 horas de evolución.
Resultados: Se incluyeron 6765 pacientes, con una edad media de 61 ± 12 años, 65% de género masculino. Se observó una importante carga de factores de riesgo cardiovascular: hipertensión arterial 58%, diabetes 23%, dislipidemia 42%, tabaquismo activo 37% y antecedentes familiares de enfermedad cardiovascular 17%. El 13,5% presentó antecedente de enfermedad coronaria; al ingreso un 49% presentó IAM de cara anterior y el 23% falla cardíaca. La mediana de tiempo de dolor a la consulta fue de 120 minutos (rango intercuartílico, RIC, 60 – 285), el tiempo puerta-aguja fue de 50 minutos (RIC 25 – 110) y el tiempo puerta balón fue de 100 minutos (RIC 58 – 190).
La mortalidad general intrahospitalaria fue del 8,8%. Se realizó un análisis exploratorio y descriptivo para observar la variación de la reperfusión y mortalidad durante 8 años donde no se muestran cambios acentuados en la mortalidad a pesar de las altas tasas de reperfusión.
Conclusión: En los últimos 8 años la mortalidad registrada en el registro ARGEN IAM-ST se ha mantenido en valores elevados a pesar de las altas tasas de reporte de reperfusión.

Palabras claves: Infarto de miocardio - Infarto de miocardio con elevación del ST -Epidemiología - Angioplastia coronaria con balón – Reperfusión

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INTRODUCTION

Acute myocardial infarction (AMI) is the main cause of death in Argentina, as well as the main reason of clinical cardiovascular disease. Due to the burden it implies for the healthcare system, it is necessary to know the most important indicators of care, as well as the results and complications. (1) The continuous ST-segment elevation acute myocardial infarction (ARGEN-IAM-ST) registry led by the Argentine Society of Cardiology (SAC) and the Argentine Federation of Cardiology (FAC) allows an approach to the reality of care and has generated previous reports alerting on the results together with opportunities for improvement that could impact on usual clinical practice. Moreover, it is well-known that registries of common diseases are very useful tools to control the implementation of policies as the conformation of care networks, promote awareness of early consultation, incorporate new technologies, etc. (2)

In the case of the ARGEN-IAM-ST registry, active since 2015, the participation of centers from different provinces allows knowing the evolution of AMI care throughout time, not only in different regions, but also in different health systems of Argentina. Our objectives were to evaluate the main AMI markers of care and complications in the continuous ARGEN-IAM-ST registry and assess the reperfusion outcome and mortality in the last 8 years.

METHODS

The ARGEN-IAM-ST registry is a national, prospective, multicenter study carried out in collaboration between SAC and FAC, which is active since the end of 2014, and whose protocol has been previously published. (3) The target population were all patients suffering an AMI with ST-segment elevation within 36 hours from the event. Following the end of the first phase in December 2015, all the participating centers were invited to continue with the registry.

The most relevant data collected were coronary risk factors, history of comorbidities, clinical presentation, treatment used (antiplatelet agents, reperfusion, adjuvant therapy) and in-hospital clinical outcome. Data related to delay to achieve effective treatment were one of the mainstays for the registry report.

The following times and delays were considered:

1) Pain-consultation time: time elapsed between the onset of symptoms suggestive of coronary artery ischemia and the first medical contact.
2) Time to reperfusion: time elapsed between arrival to a medical center and onset of reperfusion treatment:
   a) In case of fibrinolytics:
      - Time window: time interval in minutes from symptom onset to start of infusion.
      - Door-to-needle time: time interval in minutes since arrival at the institution and start of infusion.
   b) In case of angioplasty
      - Time window: time interval in minutes from symptom onset to balloon inflation.
      - Door-to-balloon time: time interval in minutes from arrival at the institution to balloon inflation.

Data collection was performed in the REDCap platform.

Statistical analysis

Qualitative variables are presented as frequencies and percentages with their confidence intervals, and quantitative variables are described using mean and standard deviation (SD) or median and interquartile range (IQR), according to their distribution.

Discrete variables were analyzed with contingency tables and continuous variables using Student's t test or the Kruskall Wallis test for unpaired data, or the analysis of variance (ANOVA), as appropriate. Significance was considered for $p<0.05$. The R statistical package was used to perform the analysis.

The protocol was registered in ClinicalTrials.gov under the NCT2458885 number.

Ethical considerations

The ARGEN-IAM-ST registry protocol was approved by the ethics committee of the Argentine Society of Cardiology.

RESULTS

A total of 6765 patients were analyzed, with mean age 61±12 years and 65% male. A significant burden of cardiovascular risk factors was observed: 58% of patients had hypertension, 23% diabetes, 42% dyslipidemia, 37% were active smokers, and 17% had a family history of cardiovascular disease. In 13.5% of cases, patients had prior history of coronary heart disease. On admission, 49% presented with anterior AMI and 77% had Killip and Kimball (KK) A classification (Table 1). Recorded consultation and care times were longer than clinical recommendations, impacting on total ischemic time. Pain-consultation time was 120 minutes (IQR 60-285), door-to-needle time 50 minutes (IQR 25-110) and door-to-balloon time 100 minutes (58-190) (Table 2). Among the main causes of delay physicians reported patient delay in performing the consultation in 61% of cases, followed by ambulance-related delays in 35% and emergency room care in 25% of cases (Table 2 of Supplementary material).

Overall reperfusion rate was 89% and reperfusion strategies used were fibrinolytics in 16.6% and percutaneous coronary intervention (PCI) in 79,3% (89 % primary PCI) (Table 3). The chief cause for non-reperfusion was late presentation of the infarction in 3.5% of cases, according to the survey carried out in the registry (see Table 3 of the Supplementary material). In the case of in-hospital evolution, 12% heart failure (in patients admitted in KK A) and 9.8% atrial fibrillation were the most frequent complications, and 3.5% major bleeding was among other less frequent complications. Overall mortality was 8.8%, and the rest of in-hospital AMI complications are shown in Table 4. An exploratory and descriptive analysis was made to analyze the variation of reperfusion and mortality from 2015 to 2022 (complete annual periods were considered at the time of the report) showing no marked percent changes in mortality despite higher reperfusion rates (Figure 1), with the lowest mortality value recorded in the 2022 period (6%) and the maximum (9.3%) in 2017.

Table 1. Baseline characteristics.

Variable	Data N*	%	95% CI
Age, years, mean ± SD	61± 12		
Male gender	6755	65	64 – 66
Coronary risk factors			
Hypertension	6697	58	57 – 59
Diabetes	6640	23	22 – 24
Dyslipidemia	5125	42	41 – 43
Smoking	6635	37	36 – 38
Family history	6663	17	16 – 17.5
Cardiovascular history			
History of coronary heart disease	5479	13.5	12.5 – 14
Heart failure	6381	2.2	1.9 – 2.6
Stroke	2568	3.7	3 – 4.5
Peripheral vascular disease	2567	1.7	1.1 – 2.1
Atrial fibrillation / Atrial flutter	948	2,2	1.4-3.4
COPD	6386	3,5	3 – 4
Chronic kidney failure	2562	2.2	1.7 – 2.9
Prior aspirin use	6503	22	21 – 23
*Infarct location***	6598		
Anterior		49	48 – 50
Inferior		45	44 – 46
Lateral		5	4 – 5.5
Undefined		1	0.4 – 1.2
*Killip and Kimball on admission***	6598		
I		77	76 – 78
II		15	14 – 16
III		1	0.8 – 1.5
IV		7	7 – 8

* Number of patients from which the data was obtained
** It expresses the proportion of patients in each category
CI: Confidence interval; COPD: Chronic obstructive pulmonary disease; SD: Standard deviation

Table 2. Consultation and reperfusion times (in minutes).

Times	Median	IQR
Pain-consultation	120	60 – 285
Door-to-needle	50	25 – 110
Door-to-needle window	165	90 – 287
Door-to-balloon	100	58 – 190
Door-to-balloon window	310	185 – 595

IQR: Interquartile range

DISCUSSION

This report presents the third general data update of the ARGEN-IAM-ST registry, which allows monitoring the most important parameters involved in the care and outcome of patients treated for infarction in centers of different provinces in Argentina. (3,4)

Despite the core of participating centers has decreased, the registry continues with the incorporation of an annual volume of patients that allows a real-life critical view (see Table 1 of the Supplementary material)

On a first approach, no significant changes in treatment times and overall in-hospital mortality is observed compared with previous registry publications, which continue to be high. In addition, an extensive total ischemic time is recorded, especially in reperfusion times, which are longer than clinical practice guideline recommendations. (5-8) Regardless the heterogeneity of each period, due to the very dissimilar number of participating institutions, as well as their different complexity, which hinder an accurate statistical assessment as a comparative tool, the value of in-hospital overall mortality remains constant in the last 8 years and in percentages that can be improved beyond the comparative instruments.

This promotes the development of effective strategies to reverse this situation, reminding us of successful experiences in Argentina of infarction networks which have been shown to reduce times and

Reperfusion	Data N*	%	95% CI
Reperfused	6757	89	88 – 90
Fibrinolytics	6644	16.6	15.7 – 17.5
Angioplasty in the first 24 hours**	6535	79.3	78 – 80
Type of angioplasty ***	5190		
Primary coronary angioplasty		89.5	88 – 90
Rescue coronary angioplasty		5.5	5 – 6
Pharmacoinvasive therapy		3	3 – 4
Angioplasty for other causes		2	1.5 – 2.2

* Number of patients from which the data was obtained
** It includes primary coronary angioplasty, rescue coronary angioplasty and pharmacoinvasive therapy
*** It expresses the proportion of patients in each category
CI: Confidence interval

Table 3. Reperfusion therapy.

Events	Data N*	%	95% CI
Overall mortality	6752	8.8	8 – 9.5
Postinfarction angina	2969	5	4 – 6
Reinfartion	3030	4	3 – 5
Stroke	2965	2	1.5 – 2.5
Atrial fibrillation	2969	9.8	9 – 11
Heart failure during the evolution	289	12	10 – 13
Mechanical complications	4424		
Septal defect	84	1.9	1.5 – 2.3
Mitral regurgitation	33	0.52	0.3 – 0.8
External cardiac rupture	14	0.32	0.17 – 0.53
Hemorrhage	2458		
Mínimal	69	2.8	2.2 – 3.5
Moderate	49	2	1.5 – 2.7
Major	85	3.5	2.8 – 4.3

CI: confidence interval
* Number of patients from which the data was obtained

Table 4. Events during hospitalization.

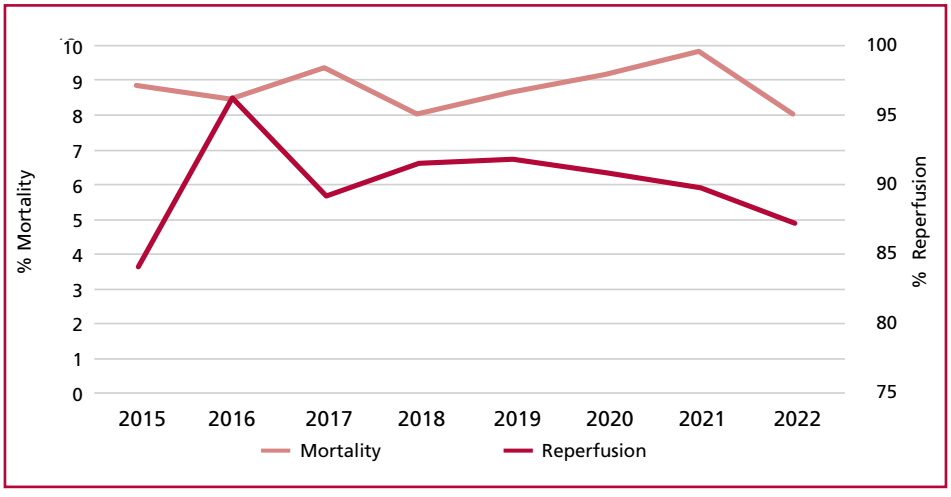

Fig. 1. Time variation of reperfusion therapy and mortality in the ARGEN-IAM-ST registry

improve the mortality rate, in addition to being a reasonable application tool in common clinical practice. (9-12) This type of strategy becomes appropriate considering that physicians reported ambulance and emergency room delays as a second and third factor that impact on total ischemic time, a relevant well-known factor of infarction mortality. (13) Moreover, the centers' heterogeneous complexity also affects results such as in-hospital mortality, indicating that network care could improve the use of resources according to the severity of the clinical condition. (14)

To conclude, it is necessary to highlight that local experiences in infarction care networks have been able to reproduce international results, a great stimulus and incentive for their implementation due to their reproducibility and low cost. (15,16)

Regarding in-hospital mortality, not only high values are observed compared with other registries, but no improvements are perceived throughout 8 years, which raises special concern if we consider the evolution of this marker in other registries over the course of 10 years. An example is the ARIAM registry from Andalucia, which recorded patients with ST-segment elevation and non-ST-segment elevation AMI, and reported 9.2% ST-segment elevation AMI in-hospital mortality in 2011, that decreased to 6.1% in 2021. (17,18)

In another international registry, including European countries, among them Italy, Spain, Denmark, Portugal, Sweden and Hungary, average raw ST-segment elevation AMI in-hospital mortality was 6.8%, and did not exceed 4.4% in 2021. (19,20)

Another behavior observed in the registry deserving attention is the high reperfusion rate in contrast with elevated mortality. A possible interpretation is the high total ischemic time evidenced in this registry and its known close relationship with adverse events, which as reported in previous registries, negatively impacts on survival. (4,13) Finally, although the registry has methodological weaknesses, it is still the only independent instrument open to the scientific community which allows discussing the reality of AMI in Argentina. It should therefore be strengthened to obtain information that will improve the quality of care.

Limitations

The ARGEN-IAM-ST registry is voluntary, without economic stimulus and without case audit in each institution. The contribution of participating investigators and institutions is essential for its support. This registry model can be subject to reporting bias and does not have a sampling strategy.

CONCLUSION

In the last 8 years, mortality recorded in the ARGEN-IAM-ST registry has remained elevated despite the high reperfusion rates reported. The ARGEN-IAM-ST registry shows that notwithstanding the availability of data to monitor the principal markers of AMI care, there have been no advances in strong indicators such as mortality, which is a call for attention indicating that political resolve is required to reverse these undesirable results in Argentina.

Conflicts of interest

None declared.

(See authors' conflict of interests forms on the web).

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SUPPLEMENTARY MATERIAL

Acute myocardial infarction. Third ARGEN-IAM-ST registry report and 8-year mortality behavior

Table 1. Participating centers, patients included, reperfusion therapy and in-hospital mortality, discriminated by year

	Reperfusion, n (%)	Mortality, n (%)	Centers
2015, n= 1723	1452 (84.3)	153 (8.8)	172
2016, n= 308	297 (96.4)	26 (8.4)	19
2017, n= 690	617 (89.4)	64 (9.3)	55
2018, n= 911	835 (91.7)	73 (8)	49
2019, n= 1045	961 (92)	90 (8.6)	39
2020, n= 679	617 (91)	62 (9.1)	31
2021, n= 871	788 (90)	85 (9.8)	21
2022, n= 473	417 (87.4)	38 (8)	19

Table 2. Causes of delay (more than one option could be chosen)

Cause of delay	%
Delay in patient consultation	61
Ambulance delay	35
Delay in emergency room care	25
Delay of the hemodynamic team	21

Table 3. Main causes for non-reperfusion

Causes for non-reperfusion	%
Late presentation	3.7
Small infarction	0.4
Older age	0.3
Contraindication for thrombolytic therapy	0.5
Lack of thrombolytic availability	0.3

APPENDIX

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