

## II° LATIN AMERICAN CATHETER ABLATION REGISTRY (LAHRS REGISTRY)

**Introduction:** global current real-world data related to catheter ablation is available. (1-5) However, information about this technique in Latin America is more limited. (6) The LAHRS REGISTRY aims to collect present Latin American data about technical and human resources employed in these procedures and their characteristics and results.

### **Steering Committee:**

1. Chair: Dr. Ulises Rojel Martinez (Mexico)
2. Vice-Chairs:
  - 2.1. Dr. Roberto Keegan (Argentina)
  - 2.2. Dr. Jose Llorente (Ecuador)

**Design:** observational retrospective cross-sectional study.

**Methods:** data will be uploaded on web-based electronic forms hosted on LAHRS website ([www.lahrs.org](http://www.lahrs.org))

First Step: *Investigator* sign up

- ID: e-mail address
- Password: generated automatically

1. *Investigator:*
  - 1.1. First name
  - 1.2. Last name
  - 1.3. Age
  - 1.4. Gender
    - 1.4.1. Male
    - 1.4.2. Female
  - 1.5. Country
    - 1.5.1. Argentina
    - 1.5.2. Bolivia
    - 1.5.3. Brasil
    - 1.5.4. Chile
    - 1.5.5. Colombia
    - 1.5.6. Costa Rica
    - 1.5.7. Cuba
    - 1.5.8. Ecuador
    - 1.5.9. El Salvador
    - 1.5.10. Guayana Francesa
    - 1.5.11. Granada
    - 1.5.12. Guatemala
    - 1.5.13. Guayana
    - 1.5.14. Haití
    - 1.5.15. Honduras
    - 1.5.16. Jamaica
    - 1.5.17. México
    - 1.5.18. Nicaragua
    - 1.5.19. Paraguay
    - 1.5.20. Panamá
    - 1.5.21. Perú
    - 1.5.22. Puerto Rico
    - 1.5.23. República Dominicana
    - 1.5.24. Surinam
    - 1.5.25. Uruguay
    - 1.5.26. Venezuela
  - 1.6. Years experience
    - 1.6.1. <5
    - 1.6.2. 5-10
    - 1.6.3. 10-20
    - 1.6.4. >20
  - 1.7. Skills
    - 1.7.1. Non-complex ablation

- 1.7.2.AF ablation
- 1.7.3.VT ablation
- 1.7.4.Cardioneuroablation
- 1.7.5.CIED implantation
- 1.7.6.Lead extraction
- 1.7.7.Left atrial appendage occlusion
- 1.8. Ablations/year
  - 1.8.1.<25
  - 1.8.2.<50
  - 1.8.3.<100
  - 1.8.4.≥100
- 1.9. Membership
  - 1.9.1.LAHRs
  - 1.9.2.EHRA
  - 1.9.3.HRS
  - 1.9.4.APHRS
- 1.10. Certification
  - 1.10.1.National scientific society
  - 1.10.2.LAHRs/EHRA
  - 1.10.3.EHRA
  - 1.10.4.HRS

Second step: *Centers and Procedure* data

- 2. *Center*
  - 2.1. Name
  - 2.2. Category
    - 2.2.1. Funding
      - 2.2.1.1.Public
      - 2.2.1.2.Private
    - 2.2.2. Academic
      - 2.2.2.1.Yes
      - 2.2.2.2.No
  - 2.3. Ablations/year
    - 2.3.1.<25
    - 2.3.2.<50
    - 2.3.3.<100
    - 2.3.4.≥100
  - 2.4. Procedure room
    - 2.4.1.EP lab
    - 2.4.2.Cardiology interventional
    - 2.4.3.Radiology interventional
    - 2.4.4.Operating
  - 2.5. EP lab
    - 2.5.1.1.0
    - 2.5.1.2.1
    - 2.5.1.3.2
    - 2.5.1.4.3
    - 2.5.1.5.4
    - 2.5.1.6.5
    - 2.5.1.7.>5
  - 2.6. Technical resources
    - 2.6.1.Energy
      - 2.6.1.1.Radiofrequency
      - 2.6.1.2.Cryoablation
      - 2.6.1.3.Pulsed Field Ablation
      - 2.6.1.4.Laser
    - 2.6.2.3-D mapping system
      - 2.6.2.1.No
      - 2.6.2.2.EnSite
      - 2.6.2.3.Carto
      - 2.6.2.4.Rhythmia
      - 2.6.2.5.Columbus

- 2.6.3. Intracardiac echocardiography
  - 2.6.3.1. Yes
  - 2.6.3.2. No
- 2.6.4. Remote navigation (magnetic/robotic)
  - 2.6.4.1. Yes
  - 2.6.4.2. No
- 2.6.5. Cardiac surgery
  - 2.6.5.1. Yes
  - 2.6.5.2. No
- 2.6.6. Temporary mechanical circulatory support device
  - 2.6.6.1. No
  - 2.6.6.2. ECMO
  - 2.6.6.3. Impella
  - 2.6.6.4. Centrifugal pump
- 2.7. Human Resources
  - 2.7.1. Electrophysiologists
    - 2.7.1.1.1
    - 2.7.1.2.2
    - 2.7.1.3.3
    - 2.7.1.4.4
    - 2.7.1.5.5
    - 2.7.1.6.6
    - 2.7.1.7.7
    - 2.7.1.8.8
    - 2.7.1.9.9
    - 2.7.1.10.10
    - 2.7.1.11.>10
  - 2.7.2. Electrophysiologists full time
    - 2.7.2.1.0
    - 2.7.2.2.1
    - 2.7.2.3.2
    - 2.7.2.4.3
    - 2.7.2.5.4
    - 2.7.2.6.5
    - 2.7.2.7.>5
  - 2.7.3. Fellows in training
    - 2.7.3.1.0
    - 2.7.3.2.1
    - 2.7.3.3.2
    - 2.7.3.4.3
    - 2.7.3.5.4
    - 2.7.3.6.5
    - 2.7.3.7.>5

### 3. Procedure

- 3.1. Age
- 3.2. Gender
  - 3.2.1. Male
  - 3.2.2. Female
- 3.3. Structural heart disease
  - 3.3.1. Structural normal heart
  - 3.3.2. LV hypertrophy
  - 3.3.3. LV fibrosis
  - 3.3.4. Coronary artery disease
  - 3.3.5. Dilated cardiomyopathy
  - 3.3.6. Non-dilated left ventricular cardiomyopathy
  - 3.3.7. Hypertrophic cardiomyopathy
  - 3.3.8. Restrictive cardiomyopathy
  - 3.3.9. Right ventricular arrhythmogenic cardiomyopathy
  - 3.3.10. Left ventricular non- compaction)
  - 3.3.11. Chagas' disease
  - 3.3.12. Aortic valvular heart disease

- 3.3.13. Mitral valvular heart disease
- 3.3.14. Tricuspid valvular heart disease
- 3.3.15. Pulmonar valvular heart disease
- 3.3.16. Congenital heart disease
- 3.3.17. Amyloidosis
- 3.3.18. Sarcoidosis
- 3.3.19. Conduction system disorder
- 3.3.20. Long QT syndrome
- 3.3.21. Short QT syndrome
- 3.3.22. Brugada syndrome
- 3.3.23. CPVT
- 3.3.24. Idiopathic VF
- 3.3.25. PVC-triggered VF
- 3.4. Cardiac surgery
  - 3.4.1. CABG
  - 3.4.2. Valve repair or replacement
  - 3.4.3. Congenital heart defect repair
  - 3.4.4. Septal myectomy
  - 3.4.5. Other
- 3.5. Arrhythmia
  - 3.5.1. Atrial fibrillation
  - 3.5.2. Atrial tachycardia (focal)
  - 3.5.3. Atrial tachycardia (macro-reentrant)
  - 3.5.4. PAC
  - 3.5.5. Junctional tachycardia
  - 3.5.6. AV nodal reentrant tachycardia
  - 3.5.7. AV node
  - 3.5.8. Manifest accessory pathway
  - 3.5.9. Concealed accessory pathway
  - 3.5.10. PVC/NSVT
  - 3.5.11. Non-SHD sustained VT
  - 3.5.12. SHD sustained VT
- 3.6. Operator (ablations/year)
  - 3.6.1. <25
  - 3.6.2. <50
  - 3.6.3. <100
  - 3.6.4. ≥100
- 3.7. Anesthesia
  - 3.7.1. Local
  - 3.7.2. Deep sedation
  - 3.7.3. General
- 3.8. Procedure number
  - 3.8.1. First ablation
  - 3.8.2. Redo
- 3.9. Full-dose heparin anticoagulation
  - 3.9.1. Yes
  - 3.9.2. No
- 3.10. Energy
  - 3.10.1. Radiofrequency
  - 3.10.2. Cryoablation
  - 3.10.3. Pulsed field ablation
  - 3.10.4. Alcohol infusion
  - 3.10.5. Radiofrequency (bipolar)
  - 3.10.6. Laser
- 3.11. Ablation catheter
  - 3.11.1. 3.5 mm tip
  - 3.11.2. 4 mm tip
  - 3.11.3. 6 mm tip
  - 3.11.4. 8 mm tip
  - 3.11.5. 10 mm tip
  - 3.11.6. Irrigated tip
  - 3.11.7. Multipolar
  - 3.11.8. Balloon

- 3.12. Irrigated catheter:
  - 3.12.1. Yes
  - 3.12.2. No
- 3.13. Contact force
  - 3.13.1. Yes
  - 3.13.2. No
- 3.14. HD mapping catheter
  - 3.14.1. Yes
  - 3.14.2. No
- 3.15. 3-D mapping system
  - 3.15.1. Yes
  - 3.15.2. No
- 3.16. Intracardiac echocardiography
  - 3.16.1. Yes
  - 3.16.2. No
- 3.17. Transeptal access
  - 3.17.1. Yes
  - 3.17.2. No
- 3.18. Retrograde aortic access
  - 3.18.1. Yes
  - 3.18.2. No
- 3.19. Epicardial access
  - 3.19.1. Yes
  - 3.19.2. No
- 3.20. Temporary mechanical circulatory support device
  - 3.20.1. ECMO
  - 3.20.2. Impella
  - 3.20.3. Centrifugal pump
- 3.21. Mapping technique
  - 3.21.1. Activation mapping
  - 3.21.2. Pace-mapping
  - 3.21.3. Entrainment
  - 3.21.4. Anatomical substrate mapping
  - 3.21.5. Functional substrate mapping
- 3.22. Substrate
  - 3.22.1. SP - slow pathway
  - 3.22.2. AP - (free-wall) - right anterior
  - 3.22.3. AP - (free-wall) - right lateral
  - 3.22.4. AP - (free-wall) - right posterior
  - 3.22.5. AP - (free-wall) - left anterior
  - 3.22.6. AP - (free-wall) - left lateral
  - 3.22.7. AP - (free-wall) - left posterior
  - 3.22.8. AP - (septal) antero-septal
  - 3.22.9. AP - (septal) para-Hisian
  - 3.22.10. AP - (septal) middle-septal
  - 3.22.11. AP - (septal) postero-septal (left endocardium)
  - 3.22.12. AP - (septal) postero-septal (right endocardium)
  - 3.22.13. AP - (septal) postero-septal (CSV)
  - 3.22.14. AP - Coumel
  - 3.22.15. AP - Mahaim
  - 3.22.16. AV - node
  - 3.22.17. RA - focal
  - 3.22.18. RA - cavo-tricuspid (CT) istmus
  - 3.22.19. RA - non-CT istmus
  - 3.22.20. RA - tricuspid annulus
  - 3.22.21. LA - focal
  - 3.22.22. LA - mitral istmus
  - 3.22.23. LA - non-mitral istmus
  - 3.22.24. LA - mitral annulus
  - 3.22.25. RV - endocardium
  - 3.22.26. RV - epicardium
  - 3.22.27. RV - outflow tract
  - 3.22.28. RV - moderator band

- 3.22.29. RV - papillary muscle
- 3.22.30. RV - right bundle
- 3.22.31. RV - tricuspid annulus
- 3.22.32. RV - anterior pulmonary cusp
- 3.22.33. RV - right pulmonary cusp
- 3.22.34. RV - left pulmonary cusp
- 3.22.35. LV - endocardium
- 3.22.36. LV - epicardium
- 3.22.37. LV - outflow tract
- 3.22.38. LV - NCC
- 3.22.39. LV - RCC
- 3.22.40. LV - LCC
- 3.22.41. LV - RLJ
- 3.22.42. LV - anterior fascicular
- 3.22.43. LV - posterior fascicular
- 3.22.44. LV - mitral annulus
- 3.22.45. LV - papillary muscle
- 3.22.46. LV - Purkinje
- 3.22.47. LV - summit
- 3.22.48. LV/RV - intramural septal
- 3.22.49. PV - isolation
- 3.22.50. PV - focal
- 3.22.51. CS - Coronary venous system
- 3.22.52. VOM - Vein of Marshal
- 3.22.53. SVC - isolation
- 3.22.54. SVC - focal
- 3.23. Success
  - 3.23.1. Yes
  - 3.23.2. No
  - 3.23.3. Yes/No
- 3.24. Arrhythmia succes
  - 3.24.1. Atrial fibrillation
  - 3.24.2. Atrial tachycardia (focal)
  - 3.24.3. Atrial tachycardia (macro-reentrant)
  - 3.24.4. PAC
  - 3.24.5. Junctional tachycardia
  - 3.24.6. AV node
  - 3.24.7. AV nodal reentrant tachycardia
  - 3.24.8. Manifest accessory pathway
  - 3.24.9. Concealed accessory pathway
  - 3.24.10. PVC/NSVT
  - 3.24.11. Non-SHD sustained VT
  - 3.24.12. SHD sustained VT
- 3.25. Substrate success
  - 3.25.1. SP - slow pathway
  - 3.25.2. AP - (free-wall) - right anterior
  - 3.25.3. AP - (free-wall) - right lateral
  - 3.25.4. AP - (free-wall) - right posterior
  - 3.25.5. AP - (free-wall) - left anterior
  - 3.25.6. AP - (free-wall) - left lateral
  - 3.25.7. AP - (free-wall) - left posterior
  - 3.25.8. AP - (septal) antero-septal
  - 3.25.9. AP - (septal) para-Hisian\_success
  - 3.25.10. AP - (septal) middle-septal
  - 3.25.11. AP - (septal) postero-septal (left endocardium)
  - 3.25.12. AP - (septal) postero-septal (right endocardium)
  - 3.25.13. AP - (septal) postero-septal (CSV)
  - 3.25.14. AP - Coumel
  - 3.25.15. AP - Mahaim
  - 3.25.16. AV - AV node
  - 3.25.17. RA - focal
  - 3.25.18. RA - cavo-tricuspid (CT) istmus
  - 3.25.19. RA - non-CT istmus

- 3.25.20. RA - tricuspid annulus
- 3.25.21. LA - focal
- 3.25.22. LA - mitral isthmus
- 3.25.23. LA - non-mitral isthmus
- 3.25.24. LA - mitral annulus
- 3.25.25. RV - endocardium
- 3.25.26. RV - epicardium
- 3.25.27. RV - outflow tract
- 3.25.28. RV - moderator band
- 3.25.29. RV - papillary muscle
- 3.25.30. RV - right bundle
- 3.25.31. RV - tricuspid annulus
- 3.25.32. RV - anterior pulmonary cusp
- 3.25.33. RV - right pulmonary cusp
- 3.25.34. RV - left pulmonary cusp
- 3.25.35. LV - endocardium
- 3.25.36. LV - epicardium
- 3.25.37. LV - outflow tract
- 3.25.38. LV - NCC
- 3.25.39. LV - RCC
- 3.25.40. LV - LCC
- 3.25.41. LV - RLJ
- 3.25.42. LV - anterior fascicular
- 3.25.43. LV - posterior fascicular
- 3.25.44. LV - mitral annulus
- 3.25.45. LV - papillary muscle
- 3.25.46. LV - Purkinje
- 3.25.47. LV - summit
- 3.25.48. LV/RV - intramural septal
- 3.25.49. PV - isolation
- 3.25.50. PV - focal
- 3.25.51. CS - Coronary venous system
- 3.25.52. VOM - Vein of Marshal
- 3.25.53. SVC - isolation
- 3.25.54. SVC - focal
- 3.26. Complications
  - 3.26.1. Yes
  - 3.26.2. No
- 3.27. Complications
  - 3.27.1. Bleeding requiring transfusion
  - 3.27.2. Bleeding requiring intervention
  - 3.27.3. Femoral AV fistula/pseudoaneurism
  - 3.27.4. Pericardial effusion
  - 3.27.5. Tamponade
  - 3.27.6. TIA
  - 3.27.7. Stroke
  - 3.27.8. Systemic peripheral embolism
  - 3.27.9. Venous/pulmonary embolism
  - 3.27.10. AV block requiring pacing
  - 3.27.11. Neumothorax/Hemothorax
  - 3.27.12. Myocardial infarction/ischemia
  - 3.27.13. Phrenic nerve injury
  - 3.27.14. Infection/sepsis
  - 3.27.15. Valve damage
  - 3.27.16. Pulmonary vein stenosis
  - 3.27.17. Atrio-esophageal fistula
  - 3.27.18. Death
- 3.28. Other complications/Comments

**Date:** data collection will start on December 1, 2023

**Data access:** Chair and Vice-Chairs will be the only members allowed to access the entire raw dataset. Anonymized investigator and center data will be extracted for further analysis.

**Patient informed consent:** not required

**Investigator informed consent:** data submission to the LAHRS REGISTRY give consent LAHRS for data to be presented at scientific meetings and published and for investigator and center names to be included in scientific presentations. LAHRS is committed to preserving data confidentiality and is not allowed to use them for any other reason than those aforementioned.

**Data ownership:** LAHRS has legal rights and complete control over the entire dataset with the only purpose of contributing to scientific investigation. LAHRS assumes possession and responsibility to take good care of the information and is not allowed to use it for any other reason than those aforementioned. Investigator has the legal rights and complete control exclusively over their own dataset, and LAHRS must make them available whenever asked.

**Authorship:** LAHRS will decide how to list the investigators' names in scientific presentations and publications, either as co-author or investigator, based on the number of procedures included.

**Definitions/Abbreviations:**

- Years experience: years performing interventional electrophysiology procedures
- Ablations/year\_investigator: number of ablation per year performed by the investigator
- Ablations/year\_center: number of ablation per year performed by the center
- Ablations/year\_operator: number of ablations per year performed by the first operator
- CIED: cardiac implantable electronic device
- Academic\_category: University center
- EP lab: exclusively dedicated to EP procedures
- ECMO: peripheral venoarterial extracorporeal membrane oxygenation
- Impella: microaxial flow pump
- Structural normal heart: image study (echocardiography, cardiac magnetic resonance, etc.) with no abnormality, including hypertrophy and fibrosis
- PAC: premature atrial contraction
- PVC: premature ventricular contraction
- CABG: coronary artery bypass grafting
- Full-dose heparin anticoagulation: intraprocedural activated clotting time (ACT) of >300 seconds
- HD mapping catheter: high density mapping catheter (HD grid™, Pentaray™, Octaray™, Optrell™, Orion™, etc)
- Anatomical substrate mapping: only anatomical-guided approach, e.g. target potentials, lines, etc
- Functional substrate mapping: other strategies added to anatomical-guided approach, e.g. ILAM, DEEP, etc
- Radiofrequency bipolar: second intracardiac catheter as grounding patch
- SP: AV nodal slow pathway
- AP: accessory pathway
- AV: AV node
- RA: right atrium
- LA: left atrium
- RV: right ventricle
- LV: left ventricle
- RLJ: right-left cusp junction
- CSV: Coronary venous system
- VOM: Vein of Marshal
- SVC: superior vena cava
- Substrate: more than one substrate is possible in the same procedure
- SHD: structural heart disease
- Success: Yes/No refers to those procedures where more than one substrate was intended, and one or more were successfully ablated and the other/s not. This is also valid for SHD sustained ventricular tachycardia when clinical VT was successfully ablated (non-inducible), but other/s VT are still inducible at the end of the procedure
- Arrhythmia success
  - Atrial fibrillation: complete PVI
  - Atrial tachycardia (focal): non-inducible
  - Atrial tachycardia (macro-reentrant): bidirectional block
  - Premature atrial contractions: no arrhythmia 30 min after successful application
  - Junctional tachycardia: no arrhythmia 30 min after successful application
  - AV node: complete AV block 30 min after successful application
  - AV nodal reentrant tachycardia: non-inducible
  - Manifest accessory pathway: no AV/VA preexcitation 30 min after successful application
  - Concealed accessory pathway: no VA preexcitation 30 min after successful application



- Premature ventricular contractions/NSVT: no arrhythmia 30 min after successful application
- Non-SHD sustained ventricular tachycardia: non-inducible
- SHD sustained ventricular tachycardia: non-inducible and/or intended substrate completely ablated
- Complications: any acute or late complication recorded between the procedure and the time of the patient's record review
- Other complications/Comments: any other complication or relevant information related to the procedure

## References

1. Cappato R., Ali H. Surveys and Registries on Catheter Ablation of Atrial Fibrillation: Fifteen Years of History. *Circ Arrhythm Electrophysiol.* 2021;14(1):e008073. DOI: 10.1161/CIRCEP.120.008073
2. Kaoutskaia A., Shurrah M., Amit G., et al. Canadian national electrophysiology ablation registry report 2011-2016. *BMC Health Serv Res.* 2021;21(1):435. DOI: 10.1186/s12913-021-06441-0
3. Anguera I., Cano Perez O., Bazan V., Spanish catheter ablation registry c. Spanish catheter ablation registry. 21st official report of the Heart Rhythm Association of the Spanish Society of Cardiology (2021). *Rev Esp Cardiol (Engl Ed).* 2022;75(12):1029-1039. DOI: 10.1016/j.rec.2022.08.013
4. Hsu J.C., Darden D., Du C., et al. Initial Findings From the National Cardiovascular Data Registry of Atrial Fibrillation Ablation Procedures. *J Am Coll Cardiol.* 2023;81(9):867-878. DOI: 10.1016/j.jacc.2022.11.060
5. Tilz R.R., Schmidt V., Purerfellner H., et al. A worldwide survey on incidence, management, and prognosis of oesophageal fistula formation following atrial fibrillation catheter ablation: the POTTER-AF study. *Eur Heart J.* 2023;44(27):2458-2469. DOI: 10.1093/eurheartj/ehad250
6. Keegan R., Aguinaga L., Fenelon G., et al. The first Latin American Catheter Ablation Registry. *Europace.* 2015;17(5):794-800. DOI: 10.1093/europace/euu322