Brain Emboli After Left Ventricular Endocardial Ablation

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In EPS

- Thromboembolic complications commonly occur in RF ablation procedures (0.6–1.3% of cases) with a higher risk when the procedure is performed on the left side of the heart (1.8–2.0% of cases)
- Comparison of Hemostatic Activation Created by Right- and Left-Heart Radiofrequency Catheter Ablation (plasma levels of P-selectin, TAT, and D-dimer at different stages of procedure and between the two groups)
  →Similar hemostatic activation occurred during and immediately after RF ablation in both groups. Sustained elevation of the hemostatic marker after the ablation procedure in the right-heart group was observed as of significant therapeutic and prognostic implications.

In AF

- Catheter ablation is associated with an incidence of thromboembolism of about 1%
- In 2006. Using highly sensitive diffusion-weighted magnetic resonance imaging (DW-MRI) of the brain, pulmonary vein isolation is associated with a 10% incidence of silent cerebral microembolism.
  Several studies have since used DW-MRI to detect new silent acute lesions in 7%–38%

In VT- PVC ablation

- Widespread practice of meticulous anticoagulation monitoring both before and during procedure in high-risk cases has resulted in low overall thromboembolic occurrence

Table 5.1 Studies on post-myocardial infarction ventricular tachycardia (post-MI VT)

Authors	Number of patients	Number of patients with post-MI VT	Number of procedures in CAD	TE prophylaxis	Thromboembolic complications		Local hemorrhage/tamponade	
					CVA/TIA	Other	Hemorrhage/ pseudoaneurism	Tamponade
Morady *et al.* [35]	15	15	15	5000IU, 1000/h	0	0	0	0
Kim *et al.* [36]	21	21	30	4000IU, 1000/h	0	0	0	0
Rothman *et al.* [37]	35	35	44	NA	0	1	1	0
Stevenson *et al.* [38]	52	52	69	5000IU, 1000/h	1	0	1	0
Callans *et al.* [39]	66	66	95	5000IU ACT 250–300	3	0	0	2
Ortiz *et al.* [40]	34	34	42	5000IU, 1000/h	0	0	0	0
Calkins *et al.* [41]	146	119	171	ACT >250	4	1	1	3
O'Callaghan *et al.* [42]	55	55	55	ACT >300	0	1	1	0
Borger *et al.** [43]	151	89	89	ACT >2.5–3 x baseline	2	0	0	1
Della Bella *et al.* [44]	124	124	139	5000–10,000IU ACT 200–250	1	2	0	0
O'Donnell *et al.* [45]	109	109	109?	ACT >250	1	0	8	3
Segal *et al.* [46]	40	40	44	ACT >250	2	0	2	3
Stevenson *et al.* [47]	231	231	252	Heparin dose not specified	0	0	11	1
Total	1079	990	1154		14 (1.3%)	5 (0.5%)	25 (2.3%)	13 (1.0)

*Data from this series refer to the 89 patients with post-MI VT.
IU, international units; ACT, activated clotting time; CVA, cerebrovascular accident; TIA, transient ischemic attack.

Right ventricular mapping and ablation

Unless other risk factors are present, catheter ablation within the right ventricle does not require use of systemic heparin. Some centers may use heparin for the prevention of deep venous thrombosis and pulmonary embolism, especially if a prolonged procedure is anticipated. Placement of multiple venous catheters or extensive catheter ablation may warrant the use of systemic anticoagulation. Similarly, patients with a prior history of deep venous thrombosis or pulmonary embolism, presence of a hypercoagulable state (e.g., factor V Leiden), or right to left cardiac shunt with increased risk for paradoxical embolism should undergo systemic anticoagulation.

Anticoagulation is not needed following the procedure; however, some centers advocate the use of aspirin at a dose from 75 mg to 325 mg for 3–12 weeks.

Left ventricular mapping and ablation in the absence of structural heart disease

Systemic anticoagulation with intravenous heparin is recommended intraoperatively for all patients undergoing left ventricular catheter ablation procedures. In case of extensive ablation, aspirin may be given postoperatively at a dose from 75 mg to 325 mg for 4–8 weeks. Some centers advocate postprocedural warfarin use in patients with additional risk factors for thromboembolism or if extensive ablation was performed.

Left ventricular mapping and ablation in the presence of structural heart disease

Patients with a history of structural heart disease referred for left ventricular catheter ablation may already receive systemic anticoagulation for other reasons. In these patients warfarin therapy may be stopped 3–5 days prior to the procedure. Subsequent bridging with unfractionated or low-molecular-weight heparin is indicated in patients at high risk for thromboembolism.

Preoperative screening for left ventricular thrombus is required in all patients. Mobile left ventricular thrombus is an absolute contraindication to catheter ablation. In contrast, left ventricular catheter ablation may be performed despite the presence of laminated thrombus, if the patient has been therapeutically anticoagulated with warfarin for at least 4 weeks prior to ablation.

Intraoperative anticoagulation schemes differ between centers. Unfractionated heparin is administered as an initial bolus (5000–10,000 IU or 50–100 IU/kg) followed by intermittent boluses or continuous infusion to maintain a target ACT ⩾250 s. Certain electrode arrays with high thrombogenicity may require an ACT ⩾300 s. Some centers give the initial heparin bolus after catheter placement within the left ventricle is confirmed in order to preserve the option of transseptal access if difficulties with retrograde arterial access are encountered. Pericardial access should be obtained prior to ventricular instrumentation and the subsequent need for intraprocedural anticoagulation.

Circulation

ORIGINAL RESEARCH ARTICLE

Brain Emboli After Left Ventricular Endocardial Ablation

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Study

- 18 consecutive patients meeting study criteria scheduled for VT or PVC ablation over a 9-month period.
- Left ventricular (LV) ablation were compared to a control group of those undergoing right ventricular (RV) ablation only. (LVT: 2, LPVC: 10, RVT: 1, RPVC:5)
- Excluded: ICD or PM.
- Radiofrequency energy was used for ablation in all cases and heparin was administered with goal activated clotting times of 300-400 seconds for all LV procedures.
- Pre- and post-procedural brain MRI was performed on each patient within a week of the ablation procedure. Embolic infarcts were defined as new foci of reduced diffusion and high signal intensity on fluid-attenuated inversion recovery brain MRI within a vascular distribution.

- Mean age: 58
- Half were men, half had a history of hypertension and the majority had no known vascular disease or heart failure

- 07 patients (58%) had a total of 16 cerebral emboli after LV ablation, compared with none after RV ablation (p=0.04). 07 of 11 patients (63%) managed with a retrograde approach to the left ventricle developed at least one new brain lesion.
- No new symptoms and exhibited no abnormalities on physical examination (…might be associated with more subtle cognitive decline)

Conclusions

- More than half of patients undergoing routine LV ablation procedures (predominately PVC ablations) experienced new brain emboli after the procedure.

Doctor explained

"Given no evidence of new brain injury with right-sided procedures, we suspect the high rate of new brain injury in these patients may be related to the approach we generally take - specifically, the standard practice is to introduce our ablation catheter via the femoral artery, up the aorta, around the aortic arch and across the aortic valve. While only based on speculation at this point, it's possible we are inadvertently dislodging debris from the blood vessel wall or heart valve as the ablation catheter traverses this path, which then travels to the brain."

" The formation of blood clots during the procedure, which then dislodge and travel to the brain. However, the risk of blood clot formation is well known and likely mitigated by the blood thinning agents that are routinely administered during these procedures"

- While this study involved only 18 patients, the numbers of embolic events in the small group are fairly striking. This occurred despite using current catheter technology and appropriate levels of anticoagulation. It is also important to recognize that patients with documented evidence of brain emboli most often did not have symptoms of clinically apparent stroke.
- "On the other hand, previous studies have shown that these small lesions can resolve if repeat MRIs are performed a few weeks later".

Need larger studies

- Transseptal access of the left ventricle may be associated with lower cerebral emboli risk ?

- The long-term sequelae of these asymptomatic brain emboli

Stroke after cardiac catheterization

- **Ischemic stroke** — In most cases, the mechanism of ischemic stroke is directly related to cardiac catheterization itself, which initially involves advancing catheters over wires into the aorta, generally using either transfemoral or transradial access. Catheter or wire manipulation may dislodge debris made up of thrombus, calcific material, or cholesterol particles from atherosclerotic plaques within the aortic arch and the proximal carotid and vertebral arteries.
- In addition, fresh thrombus material may form at the catheter and guidewire tips.

Expert Rev Cardiovasc Ther. 2012 Oct;10(10):1297-305. doi: 10.1586/erc.12.78.

Stroke in patients undergoing coronary angiography and percutaneous coronary intervention: incidence, predictors, outcome and therapeutic options.

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Author information

Abstract

In the present day, coronary angiography and percutaneous coronary intervention are considered to be safe procedures with low complication rates in general. Nevertheless due to their widespread use and their application in a continually aging population known to carry a higher risk for complications, periprocedural stroke affects thousands of patients undergoing coronary angiography and percutaneous coronary intervention worldwide every year. Stroke is reported to occur in 0.05-0.1% of diagnostic cardiac catheterizations and in 0.18-0.44% of patients treated with percutaneous coronary intervention in clinical routine today. Despite all improvements in pharmacological and technical issues, the rate of stroke after cardiac catheterization has remained almost constant over the last 20 years of invasive cardiology of invasive and interventional cardiology, which is most probably due to the immutability of the majority of risk factors before cardiac procedures. An advanced age, arterial hypertension, diabetes mellitus, coronary angiography performed under emergency conditions, history of stroke, renal failure, the use of an intra-aortic balloon pump, congestive heart failure and interventions at bypass grafts have been identified as risk factors for periprocedural stroke in large registries. Due to exceedingly high rates of mortality and disability stroke after coronary angiography still has an enormous impact on the patient's prognosis and on quality of life. If patients survive this devastating complication, most of them suffer from persistent neurological deficits such as motor or speech disorders. For its low incidence and consecutively missing data from randomized clinical trials, an evidence-based treatment could not yet be established, and treatment options are generally based on case series and small studies only. Nevertheless, intra-arterial thrombolysis and mechanical embolectomy seem to be promising and relatively safe approaches in the treatment of periprocedural ischemic stroke. Further research by randomized trials and large registries are needed to validate its efficacy and safety.


Thank
you!