Percutaneous Lead Extraction in Patients with Large Vegetations: Limiting our Aspirations

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Title: Percutaneous Lead Extraction in Patients with Large Vegetations: Limiting our Aspirations.

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Transvenous lead extraction (TLE) in the 1960's involved orthopedic-style pulley systems that joined the exposed portion of the lead to progressively heavier weights hanging from the bed. Sustained tension on the lead was maintained until the patient experienced discomfort, ventricular arrhythmias, or noticeable resistance developed, and was maintained for minutes to days. The location of the lead within the chest was monitored with daily chest radiographs and the ensuing*bang* of the weight hitting the floor of the intensive care unit signified case conclusion; at which point the patient was assessed. Complications were erratic and included lead laceration and possible migration, injury to the tricuspid valve (TV), myocardial avulsion, tamponade, and death.[1] Due to the immature nature of the procedure at that time, it was relegated to infectious indications including lead-related endocarditis, at that time referred to as "catheter fever".

Contemporary TLE has evolved into a highly refined practice with a multitude of tools and predictable results, and procedural indications that now span infection, venous occlusion, management of redundant leads, and access to magnetic resonance imaging.[2]Procedural imaging with computed tomography (CT) and real-time ultrasound-based tools have similarly changed the TLE experience with identification of adhesions, thrombi, vegetations, and complications.[3] Large lead-related masses have historically caused angst due to the possibility of being sheared off by the extraction sheath and embolizing to the lung, and still represent a relative contraindication to percutaneous TLE.[2]

In this issue of the *Journal of Cardiovascular Electrophysiology* , Giacopelli, et al.[4] present the outcomes of 25 consecutive patients (mean age 64 years, 68% male) including 5 with pacemakers, 10 with implantable cardioverter-defibrillators, and 10 with cardiac resynchronization therapy devices, who underwent TLE with vegetations [?]10 mm on transesophageal echocardiography (TEE). Contrast-enhanced CT was performed before and after TLE with 18 (72%) patients showing subclinical pulmonary embolism (PE). Vegetation size (median of 17.5 mm and maximum of 30 mm) did not differ in those with and without PE (20.0 mm vs. 14.0 mm, p=0.116). Complete TLE success was achieved in all patients with 76% requiring advanced tools and 2 needing femoral snaring, and there were no significant procedural complications. In the group with pre-TLE

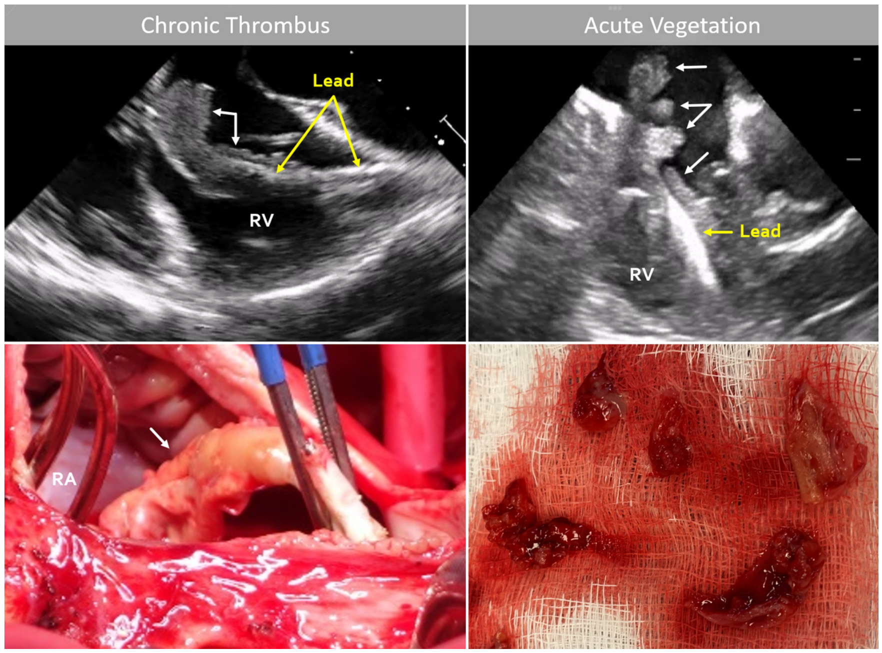
PE, a post-TLE scan confirmed the presence of PE in only 14/18 (78%) and there were no patients with new PE formation. During a median follow-up period of 19.4 months, no re-infection of the new implanted systems was reported and there were 5 deaths (20%); with no differences between the groups. The authors concluded that subclinical PE was common in this clinical scenario but did not influence the complexity or safety of the procedure.

Several aspects of this paper warrant comment. No data are reported on the size or location of the PEs nor the time between the first and second CT. It is possible that small PEs would not be identified on subsequent studies days after antibiotics had already been started. Patients also received acute and chronic anticoagulation if PE was identified, which in the setting of vegetations, is generally not indicated and could potentially lead to bleeding. The authors did not provide information regarding infectious pathogens or the timing of culture clearance, which could influence treatment. Additionally, it is unclear which patients received new CIED systems including the type and timing of reimplantation, which might influence subsequent infectious risk. A vascular occlusion balloon was not used in any patients in this report. While this tool is associated with a reduced risk of death in the setting of a superior vena cava laceration when used properly, it has also been shown to be thrombogenic during long dwell times,[5] and use could impact post-operative CTs in future studies. Despite utilizing transthoracic echocardiography during TLE, neither TEE nor intracardiac echocardiography were used intraoperatively and thus no information regarding the precise location of the vegetations within the heart is known. Importantly, no information regarding the characteristics of the vegetations other than size was reported.

Not all lead-related masses are created equal with two distinct sub-types previously described.[6] The first is composed of thickened endocardium and fibrous tissue covering the leads and ultimately forming into connective tissue. These masses, commonly found on leads behind the TV, are caused by a vortical flow pattern leading to low shear stress on the lead surface and provoking neointimal hyperplasia,[7] and range from small fibrous strands to large, smooth organized thrombus (Figure, left column). Despite their sterile nature, TLE in the setting of a large, mature thrombus could result in embolization and obstruction of the pulmonary artery resulting in symptomatic PE. The second type, frequently seen in the setting of infective endocarditis, is composed of inflammatory cells, platelets, adhesion molecules, fresh fibrin, and bacteria binding to coagulum and forming vegetations. They are typically longer, more likely to be multi-lobular, and commonly span several chambers of the heart (Figure, right column). These vegetations that are typically acute, with friable finger-like projections, characteristically break apart upon being sheared off during TLE, with reports showing low risk of symptomatic PE.[8] Vegetations that are lobular, however, have been associated with worse outcomes.[9]

Despite acute procedural success in the setting of lead-related vegetations, mortality rates at 1 year approach 25%.[10] Indeed, despite successful TLE in this report, 20% of patients were dead at 1.5 years. Although complete understanding of the mechanism of these poor outcomes remains unknown, septic emboli, lung abscesses, and infected lead "ghosts" have been implicated.[11] Vegetation removal prior to TLE has thus represented an appealing therapeutic option with reports of successful percutaneous aspiration prior to TLE showing promising results, albeit with unknown long-term benefit.[12,13] Although the lack of new PEs after TLE in this report does not directly support the effort, cost, and added risk of such a strategy, "debulking" of infectious burden remains a tempting complementary treatment. Importantly, the acute safety of TLE with large vegetations in this study should not be extrapolated to chronic, large lead-related masses, which are more like to cause acute PE if embolized. While aspiration of these sterile masses prior to TLE is appealing from a procedural outcome perspective, their morphologic characteristics, and the imperfect, but evolving, aspiration sheaths currently available are limiting, and requires consideration of surgical extraction. Further advancements in aspiration catheter technology and the development of right ventricular outflow track filters might influence future management.

TLE continues to represent the gold standard for the management of lead-related infection.[2] Due to the extensive work of the pathfinders in the vanguard of procedural development, the sound of crashing weights has been supplanted by those that power advancing sheaths. Yet despite the safe and predictable nature of modern-day TLE, the sobering long-term mortality of patients with infectious indications remains out of proportion to acute procedural success. While infectious "debulking" continues to represent the most attractive and practical complementary option to address this incongruity, future studies should concentrate both on identification of mass characteristics that suggest success, as well as determining if long-term benefits exist above and beyond lead removal. However, if improvement in clinical outcomes that warrant this added cost and effort are not identified, we should likely limit our aspirations.



Figure

(Left column) A large chronic thrombus seen on transesophageal echocardiography (top, white arrows) and during surgical lead extraction (bottom, white arrow). Note how the mass appears white, rubbery, and has smooth borders, and was ultimately removed in one piece. (Right column) A large vegetation seen on intracardiac echocardiography (top, white arrows) prior to percutaneous lead extraction preceded by vegetation aspiration. Note how the mass has multiple lobules, is generally red, and was removed in multiple pieces (bottom). RV = right ventricle, RA = right atrium.

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