

Characterization of a previously unrecognized clinical phenomenon: Delayed shock after cardiac implantable electronic device extraction



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BACKGROUND Transvenous lead extraction remains a challenging procedure with inherent risk and associated complications.

OBJECTIVE We sought to characterize and evaluate predictors of delayed shock after transvenous lead extraction with no intraprocedural complications.

METHODS We retrospectively analyzed data of 217 consecutive patients who underwent extraction between 2010 and 2015. The primary end point was sudden onset of shock more than 4 hours after the completion of the procedure. Shock was defined as at least 30 minutes of persistent hypotension, necessitating vasopressors. Patients with mechanical or hemorrhagic shock were excluded.

RESULTS Seventeen patients (9%) developed delayed shock during the first 24 hours. Reasons for shock were sepsis (47%) or no apparent cause (53%). In multivariate analysis, patients with delayed shock had significantly lower glomerular filtration rate (median estimated glomerular filtration rate 53 mL/min vs 73 mL/min; $P = .001$), had more signs of systemic infection before extraction

(fever, bacteremia, and leukocytosis; $P < .05$), and had more lead/tip remnants (29% vs 3%; $P < .001$). Patients presenting with delayed shock had significantly higher mortality rates at 1-year follow-up (10 [59%] vs 40 [23%], respectively; $P < .01$). Multivariate analysis adjusted for 1-year mortality risk was 114% higher (hazard ratio 2.14; 95% confidence interval 1.02–4.47; $P < .05$) in patients presenting with delayed shock.

CONCLUSION We describe a previously unrecognized clinical phenomenon of delayed shock developing after extraction. Patients with predictors of this condition at baseline should be identified and followed up closely. Even with prompt treatment, long-term mortality rates remain high.

KEYWORDS Transvenous lead extraction; Shock; Mortality; CIED infection

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Introduction

Indications for cardiac implantable electronic devices (CIEDs) have dramatically expanded over the past decade.^{1–3}

Accordingly there is a rising need for transvenous lead extraction (TLE) procedures. In spite of the evolution in extraction techniques from simple traction to extraction with powered sheaths and laser assistance leading to success rates exceeding 95% in most specialized centers,^{4,5} TLE remains a technically challenging procedure that is still associated with small but inherent risks and procedural mortality.^{4–8} Therefore, prediction of complications is vital.

To date, the leading risk factors for complications during lead removal procedures include elderly patients, female sex,

heart failure, calcification of leads, renal failure, body surface area, presence of multiple leads, and lead implant duration.^{9–14}

We observed that in some cases, patients completed the procedure without any associated complications but developed an unexpected and rapidly progressive delayed shock during their first 24 hours without a clear mechanical etiology.

Hence, our objectives in this study were to characterize and evaluate the predictors leading to this serious clinical condition and to examine the impact thereof on mortality.

Methods

We retrospectively analyzed all consecutive patients who underwent TLE of either pacemaker or implantable cardioverter-defibrillator leads at our medical center between July 1st, 2010 and July 30th, 2015. Patients were older than

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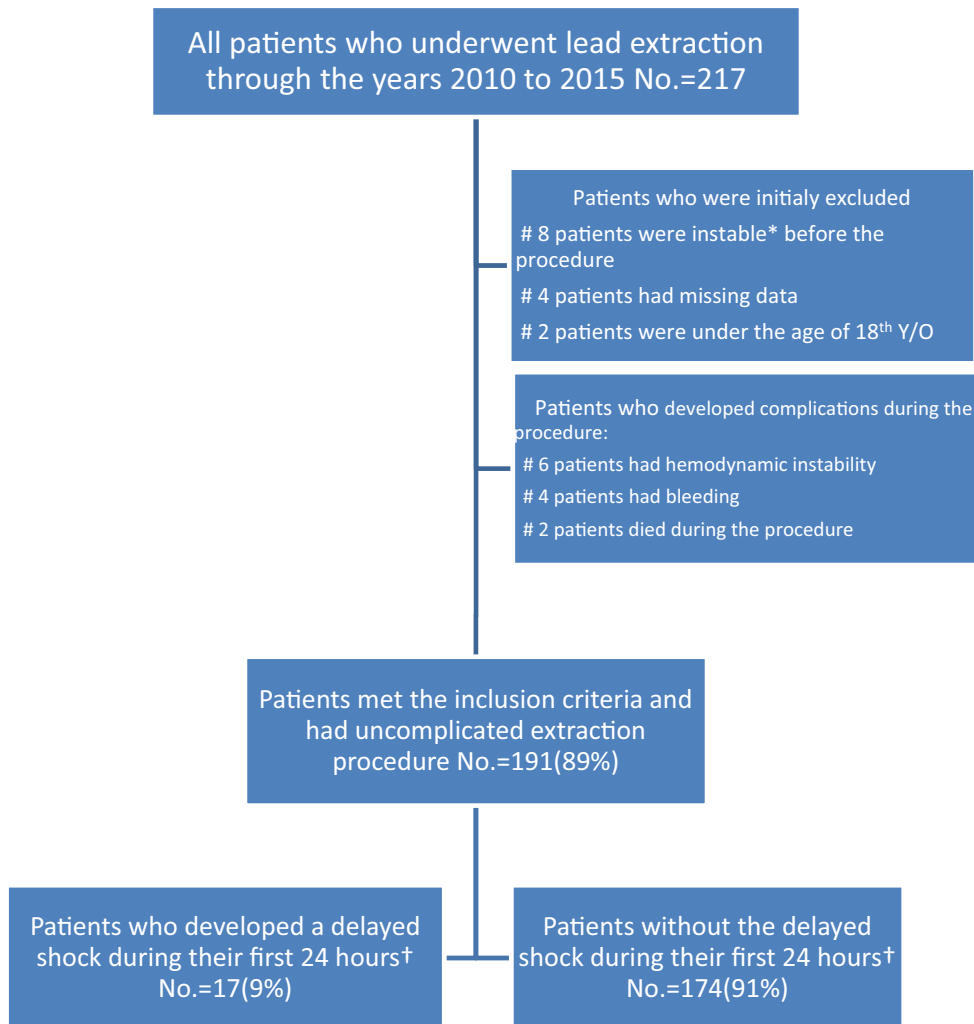


Figure 1 Flowchart of patients through the trial. *Instable patients were defined as patients on recent mechanical ventilation and patients on intravenous vasopressors. [†]The first 24 hours after the extraction procedure.

18 years and were stable (no recent initiation of mechanical ventilation, nor current use of vasopressors).

Demographic, historical, procedural, and hospitalization data were obtained from the electronic medical records and prospectively collected. The Social Security Death Index was used to determine the dates of death that occurred after procedures. The study was approved by the Institutional Helsinki Review Board of our institute.

The TLE procedures were performed, with a cardiothoracic surgeon immediately available on site. Invasive hemodynamic monitoring and large-bore venous access were uniform, and a temporary pacemaker wire was positioned when indicated. Simple traction was applied to all leads at the beginning of each case. If this did not result in successful lead extraction, a mechanical or powered sheath was used.¹⁵

All cases in this study were done under general anesthesia. A transesophageal echocardiography probe was available in the room.

Powered sheaths included mainly the GlideLight Laser Sheath (Spectranetics, Colorado Springs, CO) but also Evolution RL Controlled-Rotation Dilator Sheath (Cook

Medical, Bloomington, IN) and others. In some instances, a femoral approach was needed for successful extraction.

Procedural outcome and success was defined in accordance with the 2009 HRS consensus guidelines.¹⁶ All patients were monitored and hospitalized in our cardiac intensive care unit or step-down unit during their first post-procedural day.

Delayed shock after TLE was defined as hemodynamic instability with a sudden drop of $\geq 40\%$ in the systolic arterial pressure for at least continuous 30 minutes,¹⁷ necessitating the admission of intravenous vasopressors support, occurring at least 4 hours after the end of uncomplicated procedure and within less than 1-day postprocedure.

Mechanical complication was defined as cardiac/vascular avulsion or tear leading to any intervention.

All patients presenting with delayed shock underwent immediate echocardiography (to exclude cardiogenic shock), complete blood count screening, and blood cultures.

Sepsis was defined according to the American College of Chest Physicians of Critical Care Medicine criteria.¹⁸

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