

## Case Report

## Reproducible transient asystolic arrest during intramedullary reaming of the femoral canal: A case report

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## ABSTRACT

The utilization of intramedullary devices in the surgical fixation of hip fractures is increasing. Although intramedullary devices offer many advantages in the treatment of these injuries, they are also associated with a unique set of potential complications, particularly during preparation of the femoral canal. Cardiac dysrhythmia resulting from reaming the femoral canal is rare and has not been previously described in detail in the literature. We present the case of a 69-year-old male with an infected right cephalomedullary femoral nail who underwent removal of hardware and experienced reproducible, transient asystolic cardiac arrest during reaming of the femoral canal and offer potential explanations for this event.

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### 1. Background

Hip fractures are one of the most common orthopaedic injuries sustained by geriatric patients worldwide.<sup>1</sup> While various methods of surgical fixation can be employed in the treatment of these injuries, the utilization of reamed intramedullary devices has significantly increased over the past few decades.<sup>2</sup> This has been attributed to the minimally invasive nature of the procedure, the biomechanical advantages offered by intramedullary devices, and the benefits provided in early post-operative rehabilitation.<sup>3</sup> Although reamed intramedullary devices offer many advantages in the treatment of hip fractures, they are also associated with a unique set of potential complications. Most of these complications are technical in nature and can be easily avoided by using appropriate surgical technique.<sup>3</sup> Rarely, serious systemic complications from intramedullary fixation can occur, particularly during preparation of the femoral canal, including fat embolization, acute respiratory distress syndrome, and even cardiac dysrhythmia.<sup>4,5</sup>

### 2. Case presentation

A 69-year-old male with a history of remote myocardial infarction status post percutaneous coronary intervention and chronic atrial fibrillation managed with rivaroxaban underwent treatment of a right intertrochanteric hip fracture with a Depuy-Synthes Titanium Trochanteric Fixation Nail System (Warsaw, IN, USA) at an outside hospital. The patient's initial post-operative course was uneventful, but he presented to our clinic approximately 2 months after surgery with signs and symptoms concerning for periprosthetic infection.

On examination of the right hip, there was a 1 × 2 mm draining sinus tract at the distal third of the most proximal incision with associated erythema and swelling. Radiographs of the right femur demonstrated a healed intertrochanteric hip fracture with a well-positioned cephalomedullary nail without evidence of failure (Fig. 1). Significant degenerative changes of the hip joint were also appreciated on these films. CT scan of the right hip confirmed osseous union of the fracture without evidence of hardware failure or any significant fluid collection. Inflammatory labs were significant for a WBC 9.8 K/cmm, ESR 30 mm/hr, and CRP 10.9 mg/dL. Consequently, recommendations were to proceed with incision and debridement of the right hip, removal of hardware, and placement of antibiotic spacer in preparation for a staged total hip arthroplasty. Given the patient's cardiac history, referral to cardiology for pre-operative risk stratification and medical optimization was scheduled.

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**Fig. 1.** Pre-operative anteroposterior and lateral radiographs of the right femur demonstrating a well positioned cephalomedullary nail with no evidence of failure, evidence of callus formation at prior fracture site, and significant post-traumatic degenerative changes of the right hip.

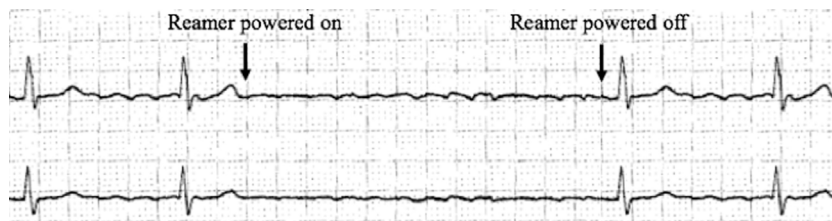
Transthoracic echocardiogram was performed in the cardiology clinic and demonstrated an ejection fraction of 50% with trace tricuspid valve regurgitation and patient was diagnosed with New York Heart Association (NYHA) Class II congestive heart failure. Revised Cardiac Risk Index (RCRI) score was calculated to be 2, conferring a 6.6% perioperative cardiovascular risk and no additional cardiac testing or intervention was recommended based on the American College of Cardiology and American Heart Association guidelines. In regards to the patient's anticoagulation regimen for chronic atrial fibrillation, patient was instructed to hold two doses of rivaroxaban prior to surgery with

recommendation to restart the medication on post-operative day 2 at the surgeon's discretion.

The patient was taken back to the operative theatre in February 2017 with an American Society of Anesthesiologists (ASA) score of 3E. Prior to induction of anesthesia, the patient was noted to be in atrial fibrillation without rapid ventricular response. An arterial line was placed for intra-operative hemodynamic monitoring and general endotracheal anesthesia was induced without complication utilizing propofol, fentanyl, lidocaine, and succinylcholine. After routine preparation of the extremity, a standard posterior approach to the right hip that incorporated the previous surgical incision was performed from the lateral decubitus position on a pegboard. Systematic debridement of infected tissue and removal of the cephalomedullary screw and femoral nail were uncomplicated. The hip was dislocated and femoral head was excised in standard fashion. A box osteotome and femoral canal finder were used to enter the intramedullary canal of the femur and an 8 mm starting reamer was placed into the femoral canal over a ball-tipped guidewire. As soon as the reamer was powered, the patient entered an apparent asystolic cardiac arrest. Consequently, the reamer was removed and the patient's heart rhythm immediately returned to baseline atrial fibrillation without any intervention from the anesthesia team (Fig. 2). Given the transient nature of the abnormal rhythm and the patient's immediate conversion back to baseline atrial fibrillation after the reamer was removed, the asystolic arrest reading was thought to be artifact secondary to interference. Consequently, we proceeded to ream the femoral canal once again while carefully monitoring the patient's hemodynamic status. The patient entered asystolic arrest immediately after the reamer was powered for the second time. Furthermore, the patient's pulse simultaneously ceased on the arterial line tracing demonstrating that the event was genuine. Similar to the first event, the patient's rhythm immediately returned to baseline atrial fibrillation and the pulse tracing on the arterial line returned on removal of the reamer.

Given the patient's cardiac history and discussion with anesthesia team, we collectively decided to abort the procedure at this time. Conversation was had with the patient's family member and the decision was made to definitively treat the patient's periprosthetic infection with a girdlestone amputation (Fig. 3). The wound was closed in standard fashion, the patient was extubated, and transferred to the surgical intensive care unit in stable condition. Total operative time was one hour and 29 min. Estimated blood loss was 600 ml and total intravenous fluids given were 1000 ml crystalloid.

The patient remained hemodynamically stable in atrial fibrillation without rapid ventricular response throughout the post-operative period. Intra-operative cultures ultimately grew *anaerococcus vaginalis* and the patient was started on intravenous vancomycin for 6-week course on recommendations from the infectious disease team. A discussion involving the surgical and anesthesia teams was had with the patient and his family regarding the potential of future re-operation with a temporary



**Fig. 2.** Example of intra-operative electrocardiogram tracing demonstrating transition from atrial fibrillation to asystolic cardiac arrest with powering of the femoral reamer and return to baseline atrial fibrillation when reamer was powered off.

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