

A Contemporary Guide to Management of Lead Removal, Fragments and Ghost Leads: Solutions to Accommodate Changing Technology

Kellen Choi, DO, FACOS¹, Laura Davis¹, Fumihiko Nakamura¹, Crystal Valadon¹, Zebulun Cope², Andrew Park¹, Chris Wilson¹, Steven Siegel, MD³

¹University of Louisville, Department of Urology, Louisville, KY

²University of Louisville, Department of Obstetrics and Gynecology, Louisville, KY

³Minnesota Urology Centers for Female Urology and Continence Care, Woodbury, MN



Introduction

- Although MRI-compatible Sacral Neuromodulation (SNM) devices are now being used, many patients still have older, non-compliant SNM devices implanted, either in part or in whole
- There is currently no standardized method of removing intact or fragmented retained SNM leads, or “ghost leads”
- Our practice’s technique for removing challenging retained leads and fragments is illustrated
- Additionally, we examine the safety of MRI in patients whose retained leads and fragments can not be removed despite these methods

Methods

- A contemporary summary of published SNM lead removal methods has been collated, studied, and provided
- The methods used in our practice for removal of SNM retained leads, fragments, and ghost leads are outlined
- A three-patient case series is included to illustrate our removal method in practice
- Contextual factors leading to decisions for each patient case are detailed
- The potential use and safety of MRI for patients who have retained leads or fragments that can not be removed is elucidated

Results

- Our technique provides the surgeon several advantages over the antecedent methods
 - Preoperative imaging (Figure 1)
 - Small single incision over the IPG site to remove generator
 - Small counter incision at the lead insertion site, minimizing cautery to limit the risk of thermal nerve damage
 - Leave pseudocapsule intact to prevent tined lead from causing traction injury (Figure 2)
 - Employ manual traction
- Despite historical concerns, data indicates that there are safe and effective means to perform MRI on appropriately selected patients if whole leads, fragments, or ghost leads are unable to be removed.
 - Potentially more invasive means of removal are therefore unnecessary in these patients
- Besides MRI incompatibility, various reasons exist for removing both older and newer SNM devices, such as insufficient clinical result, device failure due to lead fracture or migration, pain and paresthesia due to suboptimal placement, or infection of the IPG or lead
- To further relate our findings in the context of newer devices, our future projects will include mouse-model experiments and removing retained Neuspere devices utilizing the methods described

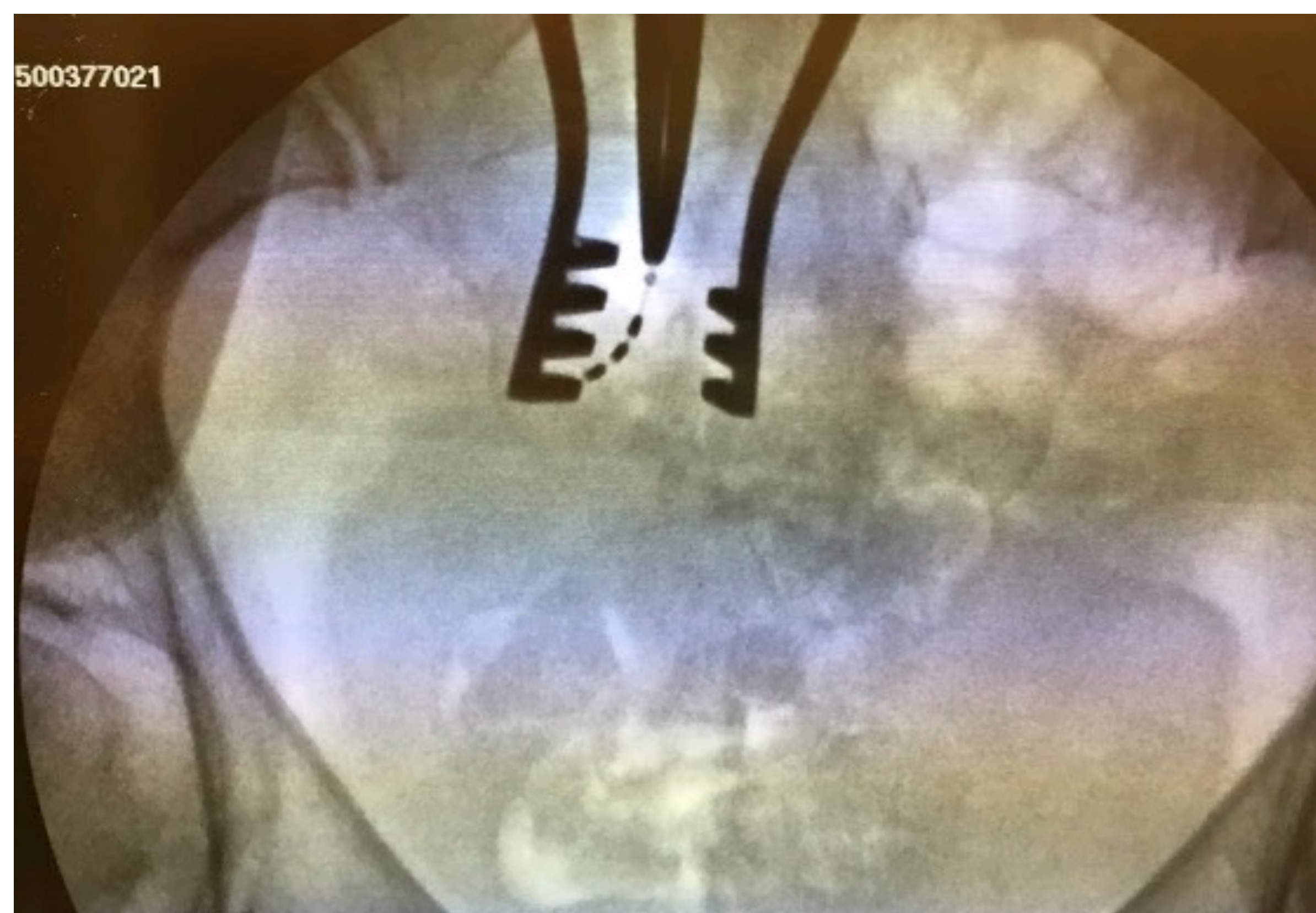


Figure 1. Ghost lead identified on CT scan; Weitlaner retractor and hemostat used in the same patient to further delineate the spatial orientation and laterality of the ghost leads during time of removal



Figure 2. Lead fragments with pseudocapsule

Conclusions

- Removal of intact, fragmented, or ghost leads may be necessary secondary to an adverse event, uncertainty of future device complications, conditions that require MRI evaluation in patients with older devices, or device replacement
- Though various proposed techniques for removal exist, our method has been successful in removing challenging leads and fragments in entirety without adverse sequela
- If removal of retained leads is determined to be impossible, invasive measures involving neurosurgery may be unnecessary as studies have shown encouraging safety results regarding the use of MRI in most instances of retained lead components

Limitations

- There are few published articles describing procedures to safely and efficiently remove various types of retained leads
- More studies on the safety, imaging accuracy, and device integrity for patients with retained leads or fragments who require MRI could provide more clarification on existing data
- Due to a wide range of SNM technologies being utilized in patient populations, results can vary, and further studies are necessary in the context of newer devices