

# Post-Surgical Chest and Neck Radiographs to Confirm the Successful Placement of the Inspire Implant for Obstructive Sleep Apnea: A Case Report

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## Abstract

Obstructive sleep apnea (OSA) is a prevalent condition marked by repetitive pharyngeal collapse during sleep, often treated with continuous positive airway pressure (CPAP). However, CPAP compliance remains suboptimal, leading to alternative treatments like the Inspire implant, which stimulates the hypoglossal nerve to maintain airway patency. This case report discusses a 75-year-old male with OSA and CPAP intolerance, successfully treated with the Inspire implant. Postoperative imaging confirmed the proper placement of the device, and the patient reported significant improvements in symptoms. This case highlights the expected radiographic findings of the device.

## Keywords

Inspire Implant, Obstructive Sleep Apnea, OSA, Continuous Positive Airway Pressure, CPAP, Radiography

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## 1. Introduction

Obstructive sleep apnea (OSA) is an increasingly common disorder that is characterized by the pharynx closing repetitively while sleeping. The most common treatment is continuous positive airway pressure (CPAP), which prevents pharyngeal collapse [1] [2]. However, patient compliance is reported to only be about 60% - 70%, sometimes due to nasal difficulties [2]. For patients who are experiencing CPAP non-compliance, nerve stimulation is an innovative surgery that can provide OSA relief

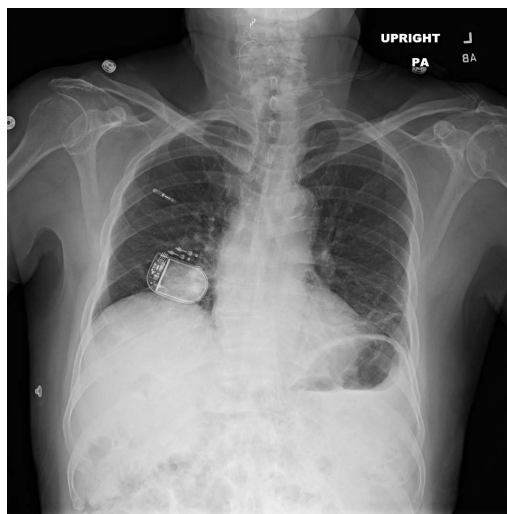
[1]. Patients can undergo implantation of the device, followed by polysomnography for titration of therapy settings. The implanted device provides electrical stimulation to the hypoglossal nerve, which results in forward displacement of the tongue and enlarges the velopharyngeal area to keep the upper airway patent [3] [4]. Typically, the implant is placed in the right anterior chest wall to account for any future cardiac implantable electronic devices and to reduce confounding signal noise from the cardiac system into the respiratory pressure sensor [5].

The Inspire implant can be radiographically evaluated post-surgically by the presence of the device in the chest wall along with the identification of the leads [6]. One lead extends towards the base of the tongue and the other is present on the chest wall to monitor respirations. There are three implantable devices available, with the Inspire Medical System being the only one currently approved the Food and Drug Administration (FDA) in the USA.

## 2. Clinical History

A 75-year-old man with essential hypertension, type 2 diabetes, and OSA presented to otolaryngology with an inability to tolerate CPAP. His hypertension was well-controlled with amlodipine and captopril. The most recent sleep study demonstrated an apnea-hypopnea index (AHI) of 39.5 events per hour with desaturations down to 71%, which increased to 67.1 events per hour in the supine position. The patient underwent drug-induced sleep endoscopy, demonstrating 80% collapse of the velopharynx, indicating that the patient was a good candidate for Inspire device implant. The Inspire implant was placed using a two-incision approach without complication. On subsequent follow-up clinic visits, the patient reported improvement in daytime hypersomnolence, energy level, and snoring. Repeat AHI 3 months after device placement was scored at 18.7 events per hour with desaturations down to 73%, which increased to 31.8 events per hour in the supine position.

## 3. Imaging Findings



(a)



(b)

**Figure 1.** (a), (b): PA and lateral chest radiographs show a right anterior chest wall Inspire implant with leads superimposing the right chest and right submandibular region. Mild bibasilar atelectasis is noted.



(a)



(b)

**Figure 2.** (a), (b): AP and lateral neck radiographs confirm the stimulator in the right submandibular region. There is no focal soft tissue swelling or abnormal gas collection. Tubing from an overlying nasal cannula is present. Multilevel cervical spondylosis is noted. Several teeth are absent.

Post-surgery chest radiographs revealed a right anterior chest wall Inspire implant with leads superimposing the right chest and right submandibular region. The impulse generator was similar in size and appearance to a cardiac pacemaker (**Figure 1**). Mild right hemidiaphragm elevation was chronic and similar to prior radiographs. Neck soft tissue radiographs confirmed the stimulator was in the right submandibular region. There was no focal soft tissue swelling or abnormal gas collection (**Figure 2**). The device was not flipped and the leads were not excessively stretched [6].

#### 4. Discussion

Soft tissue neck radiographs play a pivotal role in identifying the structural factors contributing to OSA. These radiographs can reveal key findings such as retrognathia (backward positioning of the lower jaw), micrognathia (an abnormally small jaw), or a narrow posterior air space. The success of the Inspire implant is closely tied to each patient's unique anatomy. If the genioglossus muscle is suitably positioned, the implant is more likely to yield positive outcomes [7].

Chest and neck radiographs are convenient examinations that can reveal post-surgical information about the implant, especially its position and complications. Clinical trials have revealed that adverse events associated with implants are

stimulation related discomfort, device related discomfort, insomnia, and tongue abrasion [8]. Chest and neck radiographs can provide important information on correct placement of the device and leads which can reduce treatment failure and delayed surgical revisions.

The integration of radiological assessments with clinical examinations enhances the precision and efficacy of the Inspire implant therapy for patients suffering from OSA, offering a novel avenue for improved quality of life and sleep health. A drawback of post-surgical radiographs is the lack of information about changes in tongue protrusion/fatiguability, which has been a reported short-term complication in Inspire implants. However, literature suggests that tongue fatiguability is not a concern in long-term treatment [9] [10].

## 5. Conclusion

This case demonstrates the successful use of the Inspire device in a patient with significant CPAP intolerance, resulting in improved sleep and reduced symptoms. Radiographic imaging plays an important role in confirming device placement and ensuring the absence of complications. The integration of clinical and radiological evaluations is essential for optimizing outcomes in OSA treatment as illustrated in this case report.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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