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Stealth Navigation with iFuse-TORQ Implant for Sacroiliac Joint Fusion Technique Guide

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Learning Point of the Article:

This article is intended to provide a step-by-step guide for others to fuse the sacroiliac joint with the iFuse-TORQ implant under Stealth navigation.

Abstract

Introduction: Dysfunction of the sacroiliac (SI) joint exists in nearly one-third of patients with lower back pain. There are nuances in diagnosing SI joint dysfunction with a combination of physical exam maneuvers and intra-articular injections. The management of patients with SI joint pain can include posterior pelvic fixation, which traditionally has been described using fluoroscopy to obtain safe placement of implants.

Case Report: In this technique guide, we would like to introduce a novel technique of using Stealth navigation to facilitate SI fusion with the iFuse-TORQ implant.

Conclusion: SI dysfunction is a common cause of low back pain that can be difficult to diagnose and treat. In this technique guide, we describe the successful treatment of SI pathology using the Stealth Navigation with the iFuse-TORQ implant.

Keywords: Sacroiliac joint, iliosacral screw, o-arm, stealth navigation, fusion, arthrodesis, sacroiliac joint.

Introduction

Sacroiliac (SI) joint dysfunction is a well-known pain generator, and it is important to correctly differentiate from existing lumbar pathology; it has been noted that 15–30% of lower back pain is originating from the SI joints [1-3] There is no single physical exam maneuver or imaging that is diagnostic of SI joint dysfunction, which makes it difficult to diagnose, however, intra-articular SI joint injections can serve as a reliable diagnostic method [1]. When correctly diagnosed, patients who fail conservative measures are able to find relief with various options of SI joint fixation, and 33 different devices have been utilized for this procedure [4]. Minimally invasive SI joint fusion has been shown to improve pain, physical function, and quality of life when compared to conservative management [5]. This novel technique of fusing the SI joint with the iFuse-TORQ implant (SI-BONE, Inc., Santa Clara, CA) with Stealth navigation (Medtronic, Minneapolis, MN) has not yet been described in the literature, although navigation is an emerging standard for posterior pelvic fixation [6].

Case Report

Patients are positioned supine on a radiolucent table with a presacral bump to enable proper trajectory without hitting the table while allowing for bilateral iliosacral screws placement as needed. The legs are allowed to externally rotate and standard preparation and draping technique is applied. Proximally, the iliac crests should be exposed, and the lateral aspects of the patient should be draped as low as possible near the gluteal folds. Draping is then completed at the level of the pubic symphysis.

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Author's Photo Gallery


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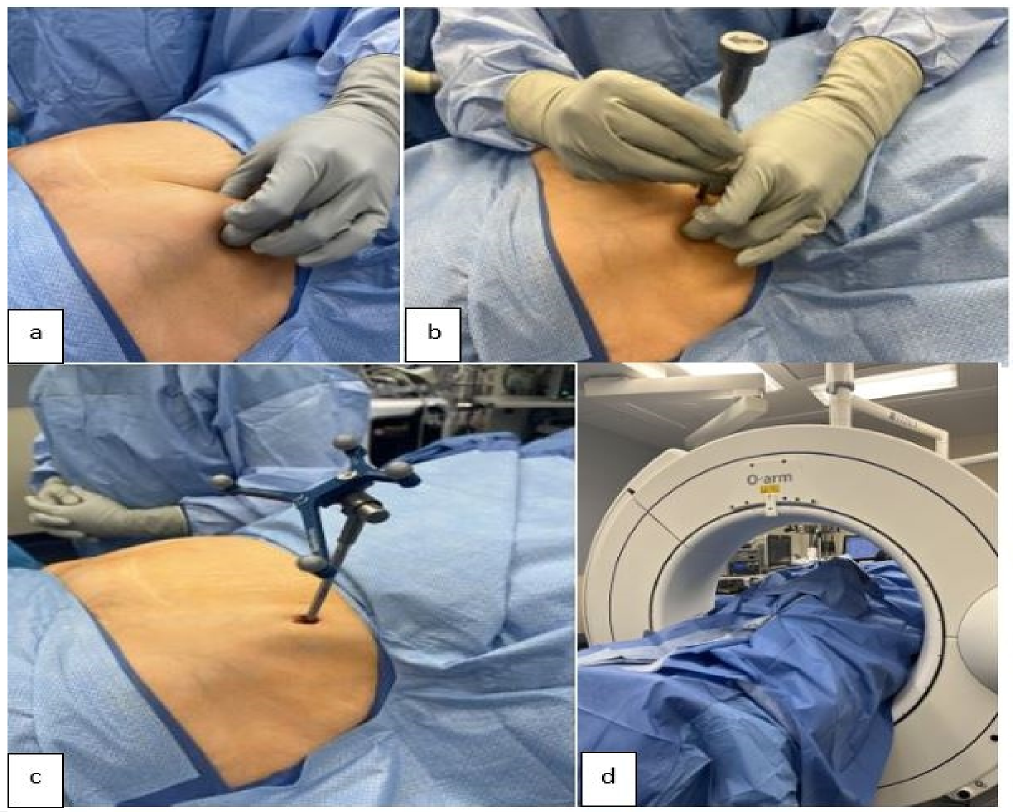

Figure 1: (a) Palpation of inner and outer table of the left ilium (b) The incision is made one finger breadth from the ASIS and then the stealth post is gently malleted in between the inner and outer table with the arrow pointing towards the feet (c) Ensure the stealth post is firmly secured and attach an array with the sensors viewable to the camera. (d) Before bringing the O-arm in for imaging, place two three-quarter drapes on each side of the stealth post and secure it with two nonpenetrating clamps proximally and distally. Then place a blue towel over the sensors.

For the Stealth navigation system, a small incision is made through the skin, overlying the palpable ilium, just one finger breadth proximal to the anterior superior iliac spine (Fig. 1a). The registration post is manually impacted into the ilium without predrilling, being mindful to mimic the trajectory of the iliac wing to keep the post within the inner and outer tables (Fig. 1b).The array is then attached and rotated to the appropriate number so that the sensors are viewable at all times by the Stealth unit (Fig. 1c).

Next, the field is covered with two three-quarter sheets and clipped together around the array with a towel over the top of the array as the O-arm machine was brought in to maintain a sterile field (Fig. 1d). Initial radiographs are taken by the O-arm machine to ensure that the area of interest was centered on the screen, in this case, the posterior ring and sacrum. Once confirmed to be in the appropriate position, the towel is removed from the array for visualization, and an O-arm spin is performed on the low radiation setting.

Preoperatively, the anticipated iliosacral screw trajectories are templated and measured, and this is again confirmed with the Stealth system. The navigated aiming gun is cannulated and allows real-time visualization of the guide wire for safety in placement (Fig. 2a, b, c). Initially, the navigated gun is used to find the rough starting point against the skin to allow appropriate incision placement (Fig. 2d). Next, the navigated gun is taken all the way down to the bone and an appropriate initial trajectory for our first right iliosacral screw is found and confirmed on Stealth navigation.

Once the appropriate trajectory is confirmed, the drill tip wire is passed through the guide/gun and advanced to the marked depth as templated preoperatively and confirmed intraoperatively. The aiming gun is then removed and the near cortex will require pre-drilling before moving to the contralateral side (Fig. 2e). The steps can then be repeated for additional screws on the ipsilateral or contralateral side.To ensure safety in placement of the wires, a second spin is performed in an identical fashion to the first spin. The images are then confirmed for safe wire placement and also to determine if anticipated screw lengths were appropriate.At this time, the screws can be placed without navigation, or a calibrated sensor can be utilized to follow the screw depth insertion in real-time (Fig. 2f). For final evaluation, wires are removed, and c-arm fluoroscopy is brought in for final assessment. Multiple radiographs are obtained (inlet, outlet, anteroposterior, and tangential views of the posterolateral ilium) to ensure that all screws are flush on bone and safe from the neural foramen (Fig. 3).

At this point, arrays on the ilium are removed and wounds are irrigated; layered closure is then performed, and small island dressings are utilized. Patients can be made weight-bearing as tolerated and discharged on the same day.

Discussion

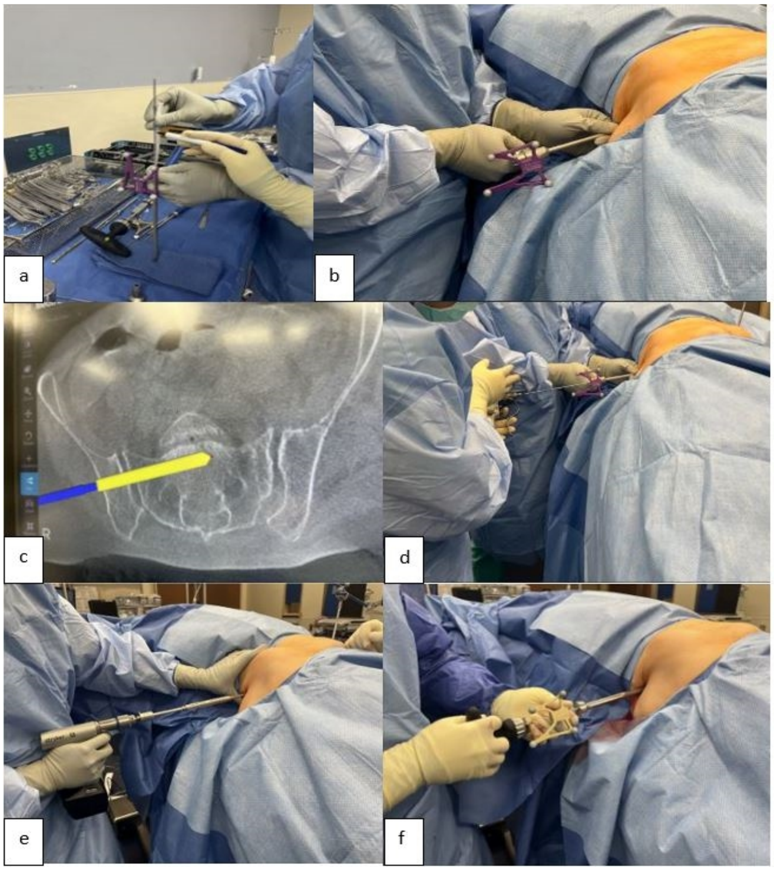

Figure 2: (a) On the back table with the wire inserted into the aiming gun, the wire is marked with the anticipated screw length. (b and c) The location of your incision can be found using the navigated gun with the projected trajectory of the screw. (d) Once the navigated gun is placed into the incision and the proper trajectory is found, the wire is inserted up to the marked line of the anticipated screw length. (e) Predrilling of the near cortex. (f) Insertion of the iFuse-TORQ implant with navigated handle.

The presence of lower back pain can be a debilitating condition, affecting a patient's ability to perform activities of daily living. This disease burden affects people worldwide at an annual prevalence of 15–45% [7]. It is imperative to differentiate the pain generators of the lower back as SI joint pain can have very similar presentations to lower lumbar and hip pathology. This would help mitigate unnecessary surgical intervention as some failed lower back pain surgery came from erroneous diagnoses, i.e., asymptomatic magnetic resonance imaging findings [8, 9].

In the past, SI joint dysfunction was not widely recognized as a harbinger of lower back pain, but with increasing recognition over the last decade and the advent of minimally invasive procedures for SI joint fusion, it has shown to be an effective solution to this problem [10]. The prevalence of lower back pain that is originating from the SI joints is approximately 15–30% [1-3]. Once conservative management has been exhausted, SI joint fusion has been shown to be a reliable option to improve pain, function, and quality of life [5].

Since the introduction of the triangular titanium implants from SI-BONE for SI joint fusion in 2009, there has been ongoing innovation to create additional implants to include the iFuse-TORQ implant that is used in this step-by-step guide. Similar to the triangular titanium implant, it is porous coated to facilitate osseointegration. The helical flutes and fenestrations allow it to self-harvest bone, along with its self-drilling and self-tapping features to minimize surgical steps. Another distinguishing feature of this implant is the hooked profile of the threads to mitigate toggle and compared to the traditional screw its torque pull-out strength is 23 times greater. With its unique design, the iFuse-TORQ implant is much more robust when it comes to posterior pelvic fixation and SI joint fusion (SI Bone:https://si-bone.com/) [11].

Using traditional fluoroscopy guidance for the placement of SI screws or implants has been widely adopted in current practice for posterior pelvic instrumentation. However, another safe and effective way is with technological advancements like the O-arm, which can provide 3D intraoperative computed

Figure 3: Final fluoroscopic images of the implants in good position.

tomography scans and Stealth navigation to use this data and navigate screws. This enabling technology has been shown to significantly reduce radiation doses to the patient and medical staff, as well as time for SI joint fixation [6]. There have also been cadaveric studies that demonstrated greater precision and accuracy with screw placements when using 3D navigation [12, 13].

Accuracy is crucial when implants are placed in the pelvis due to significant morbidity if these proximate structures, L5/S1 nerve roots, super gluteal and internal iliac arteries are compromised [6]. SI joint fusion can be obtained using a wide variety of implants and it can be safely performed with traditional fluoroscopy or navigated with the O-arm and Stealth technology. Our method of using Stealth navigation with the iFuse-TORQ implant has been successfully completed in two patients who found relief and left on the same day of surgery. We hope this guide will enable others to safely navigate the pelvis for SI joint fusion in patients with SI joint dysfunction.

Conclusion

In conclusion, SI dysfunction is a common cause of low back pain that can be debilitating for patients. In this technique guide, we describe the successful treatment of SI pathology using the Stealth Navigation with the iFuse-TORQ implant. We hope that this technique guide will allow surgeons to safely perform SI joint fusion using this implant to successfully treat those with SI joint dysfunction.

Clinical Message

Dysfunction of the SI joint can be debilitating for patients when performing activities of daily living. This pathology can be difficult to diagnose and treat. In this technique guide, we present a novel technique of using Stealth navigation to facilitate SI fusion with the iFuse-TORQ implant.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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