Harmonizing the Healing of Hand Trauma in a Piano Teacher: A Case Report on Pain Management in Ireland and Utilizing Butterfly Ultrasound for a Brachial Plexus Nerve Block

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Abstract

INTRODUCTION: This case report outlined a specialized surgical technique designed for the restoration of intricate hand functionality after a complex hand injury. It also highlighted the use of Butterfly iQ+ and its integration with iOS devices for teaching ultrasound techniques during the administration of a brachial plexus nerve block. Finally, concerns regarding pain management protocols in Ireland were raised.

CASE DETAILS: A 58-year-old piano teacher presented with a significant hand trauma. The restoration of intricate hand functionality essential for her profession as a piano teacher was a central concern. Her treatment included surgical exploration and wire fixation of the fractures. The application of Butterfly Ultrasound played an interesting role as an educational tool in anesthetic administration.

DISCUSSION:: The case presented significant challenges in postoperative rehabilitation, necessitating an adjustment to a more conservative approach due to the patient's high pain levels. This adjustment highlighted gaps in pain management and anesthetic care, especially during the transition from hospital to home care, revealing broader issues in Ireland's rehabilitation systems. The postoperative prescription of Oxycontin was inconsistent with established guidelines, pointing to a need for improved integration between primary and tertiary care.

CONCLUSION: This case underscored the importance of patient-specific, adaptable management strategies in trauma recovery. It showcased the potential role of Butterfly Ultrasound in clinical settings for anesthetic guidance and educational purposes. Finally, the report further prompted a broader dialogue on the improvement of pain management practices, particularly concerning the rise in opioid prescriptions in Ireland.

Case Background

This case report discussed a 58-year-old piano teacher's severe hand injury management, emphasizing the need for tailored surgical approaches to restore function for her professional piano playing[1,2]. The Butterfly iQ+'s seamless integration with iOS devices demonstrated its educational value as a "Point of Care" Ultrasound (POCUS) system in teaching ultrasound techniques during the administration of a brachial plexus nerve block[3–9]. Finally, the need for improved postoperative pain management to facilitate patient comfort and rehabilitation could not be more stressed[10]

Case Details

PRESENTING COMPLAINT:

A 58-year-old right-handed female piano teacher presented to the Hand Trauma Clinic at Cork University Hospital (CUH) with a referral from the CUH Emergency Department in the spring of 2023 after a fall on her outstretched hand that injured her right hand.

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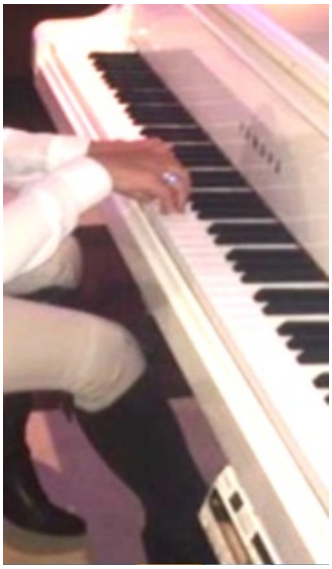

Figure 1: The patient's healthy hands minutes before the trauma

HISTORY OF PRESENTING COMPLAINT:

The patient tripped over the door threshold right before she was going to conduct a graduation service concert. When the patient fell, she hyperextended her middle finger while her other fingers were at flexion, causing a proximal interphalangeal (PIP) dislocation of her middle finger, where the proximal phalanx broke through the skin, as well as fracturing the proximal phalanges of her ring and little fingers. She complained of 10/10 pain in her fingers with loss of sensation on the palmar aspect of her distal middle phalanx. Upon presenting to the CUH Emergency Department, she was given 3mL methoxyflurane to inhale before reducing her middle PIP joint, which restored sensation and movement with intact peripheral pulses. Her hand was bandaged and splinted before she was referred to the Hand Trauma Clinic, where she was admitted for surgical exploration under anesthesia for her middle PIP joint as well as wire fixations of her 4th and 5th proximal phalanx fractures.

PAST SURGICAL HISTORY:

The patient's relevant surgical history included a successful percutaneous pinning of a left little finger fracture 30 years ago, which resulted in full function.

PAST MEDICAL HISTORY:

+Postmenopausal. +Presbyopia. No Hypertension, No Hyperparathyroidism, No Diabetes, No Osteoporosis.

MEDICATIONS:

Emergency Department (ED):

- Oxynorm 8 mg PO @ 19:30 and 5 mg PO @ 13:50
- Ibuprofen 400 mg PO @ 13:20 Tetanus IM @ 13:30
- Cefuroxime 15 g IV @ 13:30

On the ward:

- Paracetamol 1 g PO QDS 6 hrs.
- Ibuprofen 400 mg PO TDS 6hrs
- Lansoprazole 30 mg PO OD
- Clexane 40 mg S/C OD
- Oxynorm 5-10 mg PO

Post Operation:

- Paracetamol 1 g PO QDS 6 hrs
- Ibuprofen 400 mg PO TDS 6hrs
- Oxynorm 5mg every 4 hours 1 week
- Nexium 20mg Q.D.
- Amoxicillin 3 a day for 1 week Oral

ALLERGIES:

The patient reported that she had no known drug allergies, but she reported that she did not tolerate Tramadol well, and complained of painful swelling of the joints with Tramadol.

FAMILY HISTORY:

Family history was unremarkable.

SOCIAL HISTORY:

The patient was a piano teacher and had never smoked. She would take 1-2 alcoholic drinks on weekends. The patient lived with a partner. She used glasses to read. The patient felt mildly anxious about surgery, which she planned to alleviate by listening to classical piano music during the operation.

REVIEW OF SYSTEMS:

The patient had a light bruise on right cheek and an abrasion on her right knee, and a 4/10 sore shoulder. The patient denied fevers, lethargy, anorexia, weight loss, headaches, dizziness, or weakness.

Examination

On physical examination, the patient's right hand had a laceration on the palmar aspect of her middle finger along the PIP joint line with notable redness an swelling along the 3rd-5th proximal phalanges. The

Figure 2: The patient's preoperative hands with bandaging and immobilization.

Figure 3: The displaced fractures in her ring and little fingers (left and middle pictures). Surprisingly, there were no fractures in the middle finger despite the open dislocation of the PIP joint (right picture).

patient had 0-5 degrees active flexion in 3rd-5th PIP joints and 0-80 degrees flexion in all 5 distal interphalangeal (DIP) joints. Passive range of motion was not examined due to pain. Sensations in all fingers were intact. The remainder of the examination was unremarkable.

Anesthesia

During this case, the handheld Butterfly iQ+ Ultrasound was instrumental for the precise application of the brachial plexus nerve block. This ultrasound, notable for its portability and compatibility with iOS devices, was crucial for identifying anatomical structures. Its utilization by Dr. Brian O'Donnell showcased not only its utility in navigating complex anatomy but also emphasized Butterfly iQ+'s advantages over traditional ultrasound machines. Key benefits include its affordability, user-friendly interface, and the ability to perform a wide range of scans without the need for multiple probes. The Butterfly iQ+ is distinguished by its innovative single-probe solution, utilizing advanced semiconductor technology to generate images for various applications—from cardiac and abdominal to musculoskeletal scans. This adaptability, combined with cloud-based storage and AI-driven image analysis, enhances clinical workflows and decision-making. Furthermore, its compact design facilitates bedside use, making it an invaluable tool in both emergency settings and routine care. This case underscores the Butterfly iQ+'s role in advancing point-of-care diagnostics, providing an effective educational tool while ensuring patient comfort during procedures[11,12].

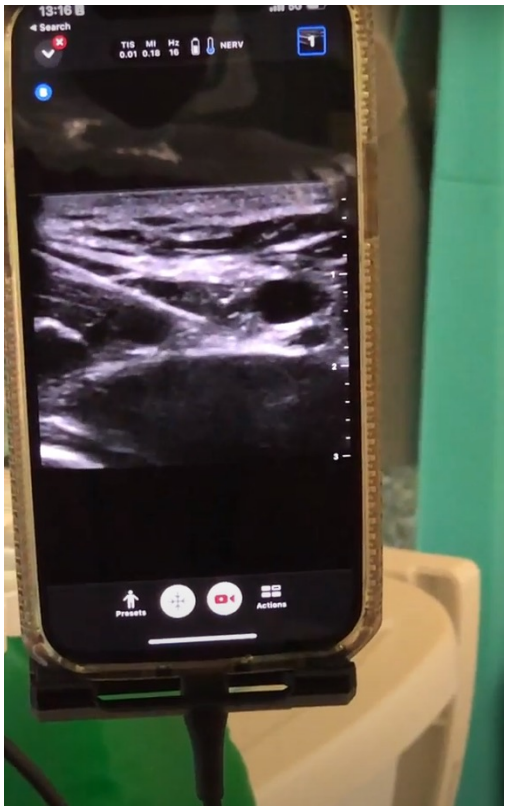

Figure 4: Dr. Brian O'Donnell taught the anatomical landmarks for the brachial plexus block using butterfly ultrasound and placing the needle adjacent to the median nerve complex to inject local anesthesia.

Figure 5: Middle PIP was explored, revealing that the nerves and blood vessels were intact but hyperextension is achieved because of volar plate damage.

Figure 6: Installing the last pin in the 5th proximal phalanx.

Figure 7: All four pins installed to fixate 4th and 5th proximal phalanx fractures.

Figure 8: Two wires are installed in each phalanx to prevent rotation around the fracture, while simultaneously aligning and stabilizing the fracture.

Management

The patient was instructed to present back to the clinic for rebandaging every three days for the first week. She was prescribed paracetamol, ibuprofen, and Oxynorm 5mg every 4 hours for one week for pain management upon discharge. However, five days post-surgery, the patient reported experiencing severe pain, rating it at 10 out of 10. She described a sensation of feeling the wires in her fingers and had exhausted her prescription. Consequently, she sought an additional prescription from her General Practitioner for Oxycodone 5mg to be taken orally twice daily for a week.

By the second week, a new splint was tailor made to allow for DIP flexion for the 4th and 5th fingers as well as a dorsal splint to keep the middle PIP joint from hyperextending. The patient was instructed to check up each week for 4 weeks, planning to remove the wires 4 weeks after the operation.

The patient was initially planned to begin practicing piano again by week 6, but this was postponed until

Figure 9: This patient's post-operative care involved the use of a splint at a Position of Safe Immobilization or POSI splint, where the patient's 4th and 5th Metacarpal-Phalangeal joints were ideally kept at 40 degrees flexion, however, this patient was only able to achieve 30 degrees flexion secondary to 10/10 pain.

Figure 10: The patient's wire removal was postponed until week 5 to ensure maximal chance of stabilizing the proximal phalanges.

week 8 secondary to pain and stiffness.

Discussion

Challenges in this case were not insubstantial. Notably, the post-operative rehabilitation duration had to be recalibrated. The initial ambitious rehabilitation plan was tempered by the patient's level of pain, necessitating a more conservative approach. This emphasized the need for flexible management strategies, tailored to individual patient needs and responses. However, the importance of a patient's motivation, compliance, and active participation in occupational therapies could not be overstated.

Furthermore, the patient's search for solutions to their unresolved pain revealed possible discrepancies in pain management and anesthetic care. The prescription of Oxycontin, a potent opioid, directly contradicted the "Guidance for Opioid Prescribing for Acute Non-Cancer Pain, Post Operative Pain, and Post-Procedure Pain"[10]. This discrepancy raises concerns about the consistency of integration between tertiary and primary care. Namely, the oversight in the adherence to established pain management protocols where non-opioid alternatives and multi-modal pain management strategies might have been more appropriate. This case illustrates the need for a more cohesive approach to pain management that spans the continuum of care from acute hospital settings to community-based rehabilitation and primary care. Enhancing communication and coordination between healthcare providers across these settings is crucial to ensure that pain management practices are consistent, evidence-based, and aligned with best practice guidelines.

Conclusion

This paper demonstrated the Butterfly Ultrasound's role in clinical settings for anesthetic guidance and teaching, particularly in the administration of brachial plexus nerve blocks. The study also focused on restoring high-level hand functionality in a patient who played the piano, combining traditional techniques like temporary wires with the patient's motivation and therapy compliance. Challenges included adjusting post-operative rehabilitation plans to manage pain, underscoring the need for flexible, patient-centered strategies, and addressing the concerning rise of opioid prescriptions in Ireland.

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