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ULTRASOUND CHARACTERISTICS OF A NEW PROLONGED DRUG DELIVERY MATRIX FOR PERIPHERAL NERVE BLOCK

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Introduction

Liposomal bupivacaine has been used in peripheral nerve blocks to prolong duration of action of the local anesthetic and to reduce post-operative pain and perioperative opioid use. In practice, that preparation often falls short of eliminating opiate use for surgical patients in many settings. The pharmacokinetic profile of the delivery system and migration of the local anesthetic in tissue jointly contribute to limited efficacy and duration of action at target sites. A new and novel drug delivery matrix may afford a solution to these shortcomings. The hydrogel-lipid-microparticle formulation is a tunable delivery system with the ability to deliver medication for a longer and more specified time interval. Over 120 hours of extended analgesic effect has been demonstrated in canine and rat models. This technology opens a door to potentially eliminate the need for perioperative opioid use in select patients. In this study, we sought to determine the ultrasonographic characteristics of INSB200 and compare the results with commonly used aqueous phase local anesthetic preparations.

Materials and Methods

Institutional animal care and use committee waiver was obtained. In a room-temperature deceased-porcine (butchered ham) model, we sequentially injected commonly used local anesthetics: Ropivacaine (0.5%), bupivacaine (0.5%), and liposomal bupivacaine (Exparel). In addition, we injected two different preparations of hydrogel-lipid-microparticle matrix ropivacaine, 27mg/mL and 38mg/mL, (INSB200). The medicant was deposited into the test medium via 21 gauge - 50 mm needle at approximately 2.5 cm depth for each sample and performed under ultrasound guidance (Sonosite PX and 15-4 MHz probe). Pre and post injection images were collected for each preparation and evaluated for sample echogenicity and tissue extravasation.

Results/Case Report

The ultrasound characteristics of commonly used aqueous phase ropivacaine 0.5%, bupivacaine 0.5%, and liposomal bupivacaine preparations were consistent with clinical practice – showing a non-echogenic migration of medicant into tissue planes with significant tissue spread. Conversely, injection of both INSB200 preparations resulted in an echogenic pocket of medicant without significant tissue spread (Figure 1A, 1B).

Discussion

In this first report of the ultrasound characteristics of a new drug delivery matrix with ropivacaine, we noted two distinct observations: First, INSB200 demonstrates echogenicity with injection. Second, we did not observe any significant tissue spread of INSB200 in test medium when compared to other aqueous local anesthetic preparations.

These two properties of INSB200 are distinct from other agents and may provide clinical benefits. First, the INSB200 formulation allows for precise, non-migrating administration of a local anesthetic drug matrix which may be of benefit in certain non-planar peripheral nerve blocks (sciatic, femoral, and brachial plexus) which in the case of the upper extremity could reduce the incidence of phrenic nerve blockade. Localized, non-migrating anesthetic delivery may eventually allow for more precise and prolonged analgesia with lower drug volumes.

Second, its echogenic properties may aid in confirming placement of medication during regional anesthetic techniques. This is especially true with deeper ultrasound-guided injections, where aqueous formulations are often poorly visualized. Looking to the future, the hydrogel-lipid-microparticle matrix may be used to deliver other medications under ultrasound guidance (anti-inflammatory, chemotherapeutics, and antibiotics). In such cases, the echogenic property would aid in precise medication administration for proceduralists looking to positively identify the site of injection with a high degree of sensitivity.

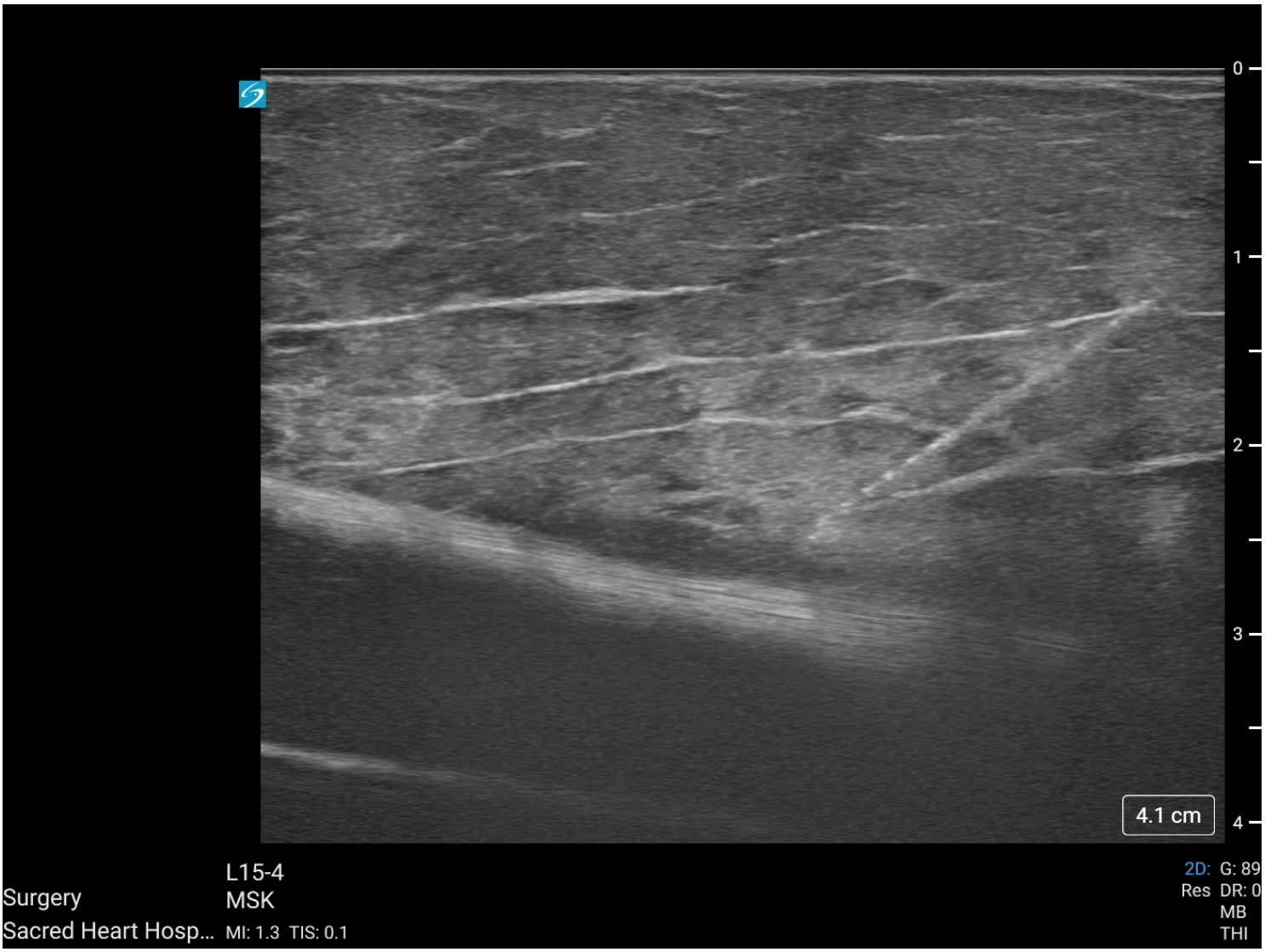
References

Chahar P, Cummings K, Liposomal bupivicaine: a review of a new bupiviciane formulation, J Pain Res, 2012; 5:257-264.

Disclosures

Yes

Tables / Images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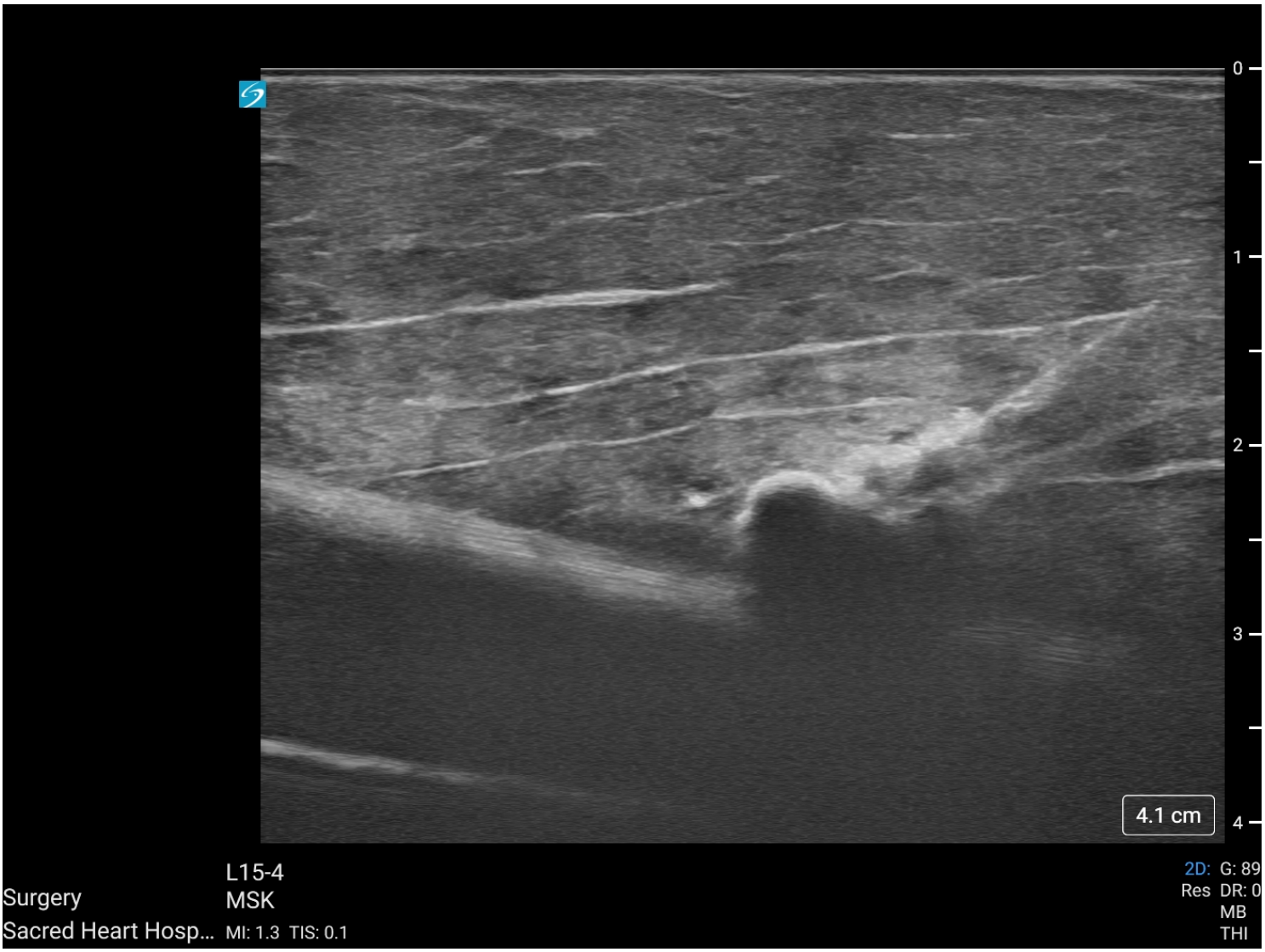
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