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ADVANCES IN ANESTHESIA

Liposomal Bupivacaine

Its Role in Regional Anesthesia and Postoperative Analgesia

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Keywords

• Analgesia • Epidural • Liposome bupivacaine • Peripheral nerve block
• Postoperative analgesia • Regional anesthesia • Long-acting local anesthetic

Key points

- Postsurgical pain duration is usually greater than the duration of analgesia provided by a single administration of traditional formulations of local anesthetics.
- Liposomes may be used to encase local anesthetics, which then release the active medication gradually over a period of multiple days, thus increasing the duration of a single-injection block.
- The United States Food and Drug Administration recently approved a liposomal bupivacaine formulation (Exparel) for use exclusively in wound infiltration.
- Exparel might soon be approved for use in epidural analgesia and peripheral nerve blocks. Initial clinical trials suggest a possible duration of more than 96 hours when administered in a femoral nerve block.
- At the time of this writing, there is no liposome bupivacaine formulation approved within the United States for use in either epidural or peripheral nerve blocks.

INTRODUCTION

Postsurgical pain usually outlasts the duration of analgesia provided by a single administration of traditional formulations of local anesthetics, whether introduced by infiltrating directly into a wound, into the epidural space, or as part of a peripheral nerve block. Bupivacaine hydrochloride (HCl) is currently the longest-acting local anesthetic approved by the United States Food and

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Drug Administration (US FDA), with an analgesic duration of up to 18 to 24 hours when administered in some peripheral nerve blocks. Although multiple analgesic adjuvants such as epinephrine and clonidine have been reported, currently there is no US FDA–approved medication that reliably extends the effective analgesic duration of single-injection epidural or peripheral nerve blocks beyond 24 hours [1,2].

LIPOSOMES

Liposomes consist of a hydrophilic head and 2 hydrophobic tails and were first proposed as a medication carrier in 1965 (Fig. 1) [3]. They can be characterized structurally as unilamellar vesicles with a single outer lipid bilayer (Fig. 2), multilamellar vesicles with concentric lipid bilayers (see Fig. 2), or multivesicular liposomes with nonconcentric lipid bilayers (Fig. 3) [4]. Multivesicular liposomes with nonconcentric lipid bilayers facilitate medication drug loading because of their large size. These multivesicular liposomes create a medication depot gradually releasing local anesthetic, which potentially leads to an extended duration of analgesia [5]. Multiple medications have been encapsulated with multivesicular liposomes, including morphine, fentanyl, chemotherapeutics, ibuprofen, neostigmine, and local anesthetics [4]. There are several routes of administration [4–14]:

- Topical
- Subcutaneous
- Intramuscular
- Intravenous
- Intraperitoneal
- Subconjunctival
- Intravitreal
- Intra-articular
- Intrathecal
- Perineural
- Epidural

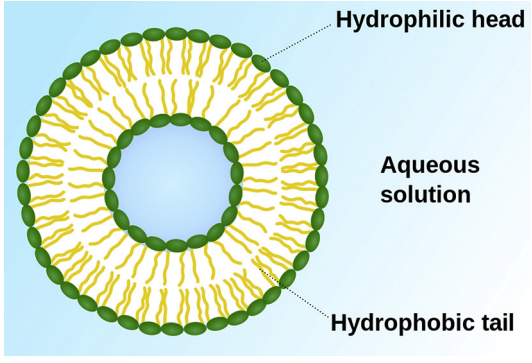

Fig. 1. Liposomes consisting of a hydrophilic head and 2 hydrophobic tails.