The Effects of Liposomal Bupivacaine on Postoperative Pain Management Following Surgical Clipping of Brain Aneurysms

University of Wisconsin-Oshkosh College of Nursing
Jordin Schnell BSN, RN, SRNA
Chairperson: Dr. Kathleen Wren, PhD, CRNA

Abstract

Purpose: While Exparel has been approved and is widely successful with gross positive results in a multitude of surgical specialties, little research has been calculated and evaluated regarding its efficacy for use in cranial surgery for post-operative analgesia.
Design: A retrospective chart review was implemented at Froedtert Memorial Lutheran Hospital. A total of 50 patients were included in this study. Thirty of those received Exparel (treatment group) and twenty patients did not receive Exparel (control group).
Methodology: The dose, frequency, and route of opioid given within 72hrs post-op was documented and calculated to MME. The average IV & PO MME per day was also calculated along with total length of hospital stay (LOS).
Results: Statistically significant differences were seen regarding average PO MME & total combined MME (IV & PO) with the treatment group requiring significantly less PO opioids post-op.

PICOT Question

In patients undergoing surgical clipping of unruptured anterior brain aneurysms, is the use of intraoperative liposomal bupivacaine within the subcutaneous tissue more effective than IV and oral opioids by increasing pain control with lower required narcotics and decreased hospital length of stay within 72 hours postoperatively?

Theoretical Model

The Gate Control Theory of pain describes in detail the concept of a pain-modulating system in which the spinal cord can open and close, resembling a gate, that allows for an increase or decrease in perception of pain. With this model, physical, emotional, and behavioral changes within the patient can negatively or positively impact pain control and management, limiting or disrupting the ability to better succeed in this project.

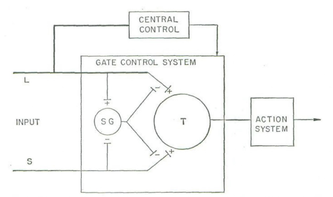


Fig. 4. Schematic diagram of the gate control theory of pain mechanisms: *L*, the large-diameter fibers; *S*, the small-diameter fibers. The fibers project to the substantia gelatinosa (*SG*) and first central transmission (*T*) cells. The inhibitory effect exerted by *SG* on the afferent fiber terminals is increased by activity in *L* fibers and decreased by activity in *S* fibers. The central control trigger is represented by a line running from the large-fiber system to the central control mechanisms; these mechanisms, in turn, project back to the gate control system. The *T* cells project to the entry cells of the action system. +, Excitation; −, inhibition (see text).

Introduction & Background

- Liposomal bupivacaine (Exparel) has been successful in decreasing post-op pain, overall reported pain, and hospital length of stay. While Exparel has been effective for pain management in spine surgery, minimal research has been documented on use in brain surgery. Due to its long-lasting formulation and duration of action of approximately 72 hours, it is projected that Exparel will show similar results and efficacy to those of other surgical specialties.
- Currently, patients experience extreme levels of post-op pain and discomfort following neurosurgical procedures. After surgery, this patient population requires frequent repositioning and administration of opiates and adjuvants to maintain a fraction of their desired comfort and pain level. Despite efforts to alleviate pain and optimize comfort, patients continue to exhibit signs of pain and state severe discomfort.

Project Design

- Retrospective chart review focusing on optimizing pain management and decreasing hospital length of stays with the use of Exparel in neurosurgery
- **Implementation site**: Froedtert Memorial Lutheran Hospital (FMLH) in Milwaukee, Wisconsin
- **Study population**: neurological population suffering from non-ruptured cerebral brain aneurysms requiring elective surgical clipping
- **Exclusion criteria**: ruptured cerebral aneurysm, age < 18yo, allergy to bupivacaine, patients requiring post-op mechanical ventilation

Review of Literature

Intraoperative hemodynamic stability

- Scalp blocks infiltrated with fifteen milliliters of 0.75% ropivacaine prior to craniotomies were shown to result in significantly lower intraoperative HR and MAP during skin incision and dura opening compared to those who received 0.75% ropivacaine as a tissue infiltration (Yang et al, 2019)

Pain scores

- In a randomized, placebo controlled, double-blind study, a group of twenty patients received twenty milliliters of 0.9% normal saline in a scalp block, while the treatment group received twenty milliliters of 0.5% bupivacaine (Canakci et al, 2017)
- The treatment group receiving the bupivacaine were noted to have significantly lower VAS scores at the thirty-minute mark, and further at hours 1, 2, 4, 6, and 12 post-operatively compared to the control group who received normal saline (2017)

Administration of postoperative analgesics

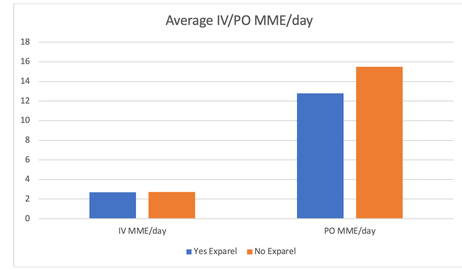
- In a randomized, controlled study, the treatment group where only 0.25% bupivacaine or 1% lidocaine was administered without adjuvants (Decadron or Magnesium) required more post-operative opioid administration compared to other groups (Nasr et al, 2020)

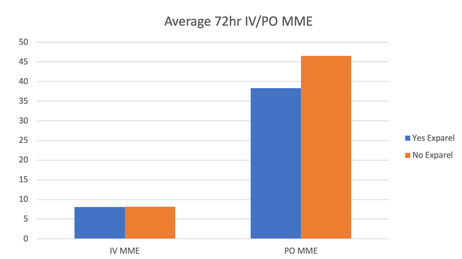
Length of hospital stay

- In a randomized controlled trial, there was no difference in hospital length of stay between the control and treatment groups (Rigamonti et al, 2019)

Results

- No statistically significant difference was seen between the cohort & treatment groups regarding **total IV MME** within 72hrs post-op (treatment = 8.08 MME, control = 8.18 MME)
- Statistically significant difference was seen between the cohort & treatment groups regarding **total PO MME** within 72hrs post-op (treatment = 38.33 MME, control = 46.5 MME)
- No statistically significant difference was seen between **LOS** between both groups (treatment = 3.23 days, control = 3.3 days, p = 0.239)





References

- Canakci, E., Unal, D., Yildirim, T., & Yilmaz, A. (2017). Our scalp block results in craniotomy cases. *Journal of Anesthesia & Intensive Care Medicine, 2*(4), 001-008.
- Dziegielewski, C., Skead, C., Canturk, T., Webber, C., Fernando, S. M., Thompson, L. H., Foster, M., Ristovic, V., Lawlor, P. G., Chaudhuri, D., Dave, C., Herritt, B., Bush, S. H., Kanji, S., Tanuseputro, P., Thavorn, K., Rosenberg, E., & Kyeremanteng, K. (2021). Delirium and associated length of stay and costs in critical ill patients. *Critical Care Research and Practice,* 1-8.
- Malik, O., Kaye, A. D., Kaye, A., Belani, K., & Urman, R. D. (2017). Emerging roles of liposomal bupivacaine in anesthesia practice. *Journal of Anaesthesiology Clinical Pharmacology, 33*(2), 151-156.
- Melzack, R. & Wall, P. D. (1965). Pain mechanisms: A new theory. *Science, 150*(3699), 971-979.
- Nasr, Y. M., Waly, S. H., & Morsy, A. A. (2020). Scalp block for awake craniotomy: Lidocaine-bupivacaine versus lidocaine-bupivacaine with adjuvants. *Egyptian Journal of Anesthesia, 36*(1), 7-15.
- Rigamonti, A., Garavaglia, M. M., Ma, K., Crescini, C., Mistry, N., Thorpe, K., Cusimano, M. D., Das, S., Hare, G. M. T., & Mazer, C. D. (2019). Effect of bilateral scalp nerve blocks on postoperative pain and discharge times in patients undergoing supratentorial craniotomy and general anesthesia: A randomized-controlled trial. *Canadian Journal of Anesthesia, 67*, 452-461.
- Rivas, E., Cohen, B., Pu, X., Xiang, L., Saasouh, W., Mao, G., Minko, P., Mosteller, L., Volio, A., Maheshwari, K., Sessler, D. I., & Turan, A. (2022). Pain and opioid consumption and mobilization after surgery: Post hoc analysis of two randomized trials. *Anesthesiology, 1*(136), 115-126.
- Yang, X., Ma, J., Li, K., Chen, L., Dong, R., Lu, Y., Zhang, Z., & Peng, M. (2019). A comparison of effects of scalp nerve block and local anesthetic infiltration on inflammatory response, hemodynamic response, and postoperative pain in patients undergoing craniotomy for cerebral aneurysms: A randomized controlled trial. *BMC Anesthesiology, 19*(91), 1-11.