THE EFFECTS OF BUPIVACAINE–GLUCOSE MONOHYDRATE ON NEURAL STRUCTURES: AN EXPERIMENTAL STUDY

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ABSTRACT:

Facet joint is one of the sources of low back pain. Several agents have been used for temporary and permanent pain relief in facet syndrome. Bupivacaine–glucose monohydrate is a long–acting agent which relieves pain when applied topically. This study investigated the effects of this agent on neural structures, and revealed that the bupivacaine–glucose monohydrate has a minimal effect on neural structures characterized by minimal nuclear hyperchromatosis. It is concluded that bupivacaine–glucose monohydrate is a safe agent and can be used for long–term pain relief.

Key Words: *Facet joint, facet syndrome, facet injection, bupivacaine–glucose monohydrate*

INTRODUCTION

There are a variety of causes for pain in the degenerative spine, including discogenic pain, facet joint, spondylogenic pain, radiculopathy, myofascial, reffered pain, and mixed pain (6). A typical low back pain reproduction has been reported by injecting hypertonic saline into the facet joint capsule in several studies (2, 3, 6–8). Therefore, the facet injection has been used for treatment of low back pain of facet origin. Either steroids or several anesthetic agents were used with benefit and minimal risk. The anesthetics used are commonly short–acting agents. They are used for temporary pain relief and are indicator of effectiveness of more aggressive pain–relieving procedures (e.g., radio frequence faset denervation) (4, 5, 9, –11). The effects and side–effects of long–acting anaesthetic, however, is not known. The aim of this study is to determine the effects of a long–acting anaesthetic, bupivacaine–glucose monohydrate, on neural structures.

MATERIAL AND METHODS

Twenty male rats (Rattus Norvegicus) weighting 250±15 gm were used. According to the agents injected, animals were randomly placed into four subgroups, including (1) Saline (0.85% NaCl); (2) bupivacaine (Marcain); (3) bupivacaine–glucose monohydrate (marcain heavy), and (4) 90% alcohol. Each group contained 5 animals. Animals were anaesthetized using controlled Ether. Under sterile conditions, the agents were administered into the area around the femoral nerve. On the postoperative third day, rats were decapitated and femoral nerves of the rats were removed. The specimens were taken for histopathological investigation. Specimens were incised from end to end cross–sectionally and dyed with hemotoxyleneosine.

RESULTS

Histopathological examination of specimens revealed different behavior patterns against the agents injected. Histopathological changes following absolute alcohol injection were characterized by cromatolysis and nuclear condansations, and homogenous cell changes like eosinophilic material associated with the absence of nuclei. All these changes were appreciated as "late period ischemic cell changes" (Fig. 1). The nerve tissue changes in the bupivacaine–glucose monohydrate group were in natural form except for minimal nuclear hyperchromatosis (Fig. 2), whereas there were no structural changes in bupivacaine and Saline injection groups (Fig. 3 and 4).

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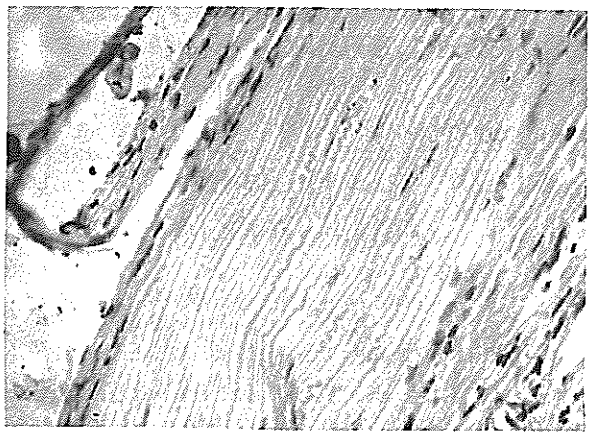


Fig. 1: Ischemic changes after the alcohol injection.

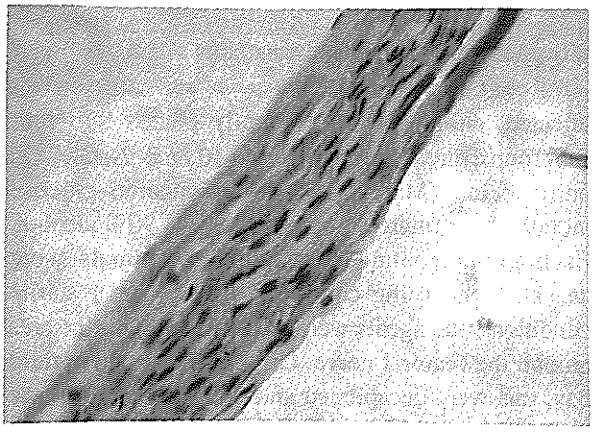
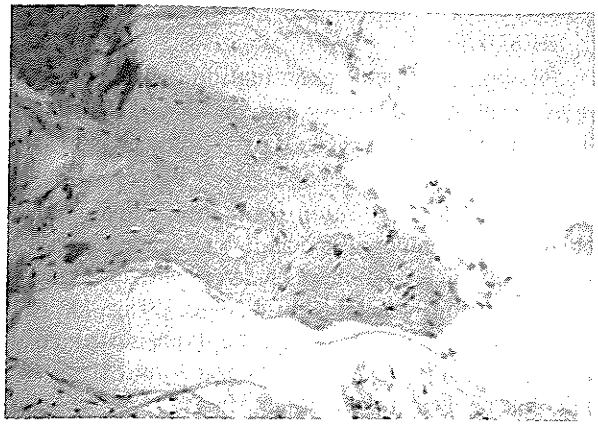


Fig. 2: A picture of the nerve tissue changes treated with bupivacaine–glucose monohydrate characterized by natural appearance with minimal nuclear hyperchromatosis.

DISCUSSION

The role of facet joint as a source for pain has been known since 1911 (6). To relieve pain of facet origin, several medicines have been used (5, 6, 9–11). However, a facet injection is associated with a variety of histopathological changes in the facet joint capsule and nerves innervating the facet joint (11).

The facet joint is innervated by medial branches of the dorsal primary rami. Each facet joint receives innervation from at least two spinal levels. The facet joint contains encapsulated, unencapsulated and free nerve endings which have nociceptors and mechanoreceptors (2). The main therapeutic effect of facet joint injections remain to be variable. A review of the literature reveals a long–term good outcome in 20–30% of cases, whereas there is a temporary pain–relief period in 50–68% of cases (6). The effect of short–acting agents is nonspecific. Lilius et al., indicated that the pericapsular injection is as effective as the intracapsular method (7). This fact dictates the use of long–acting agents. However, the side–effects of these agents on neural structures is not known. However, the prolonged effect should be associated with decrease of the prolonged activity in the C fibers without interrupting the "burst activity" (1). This study showed that Bupivacaine–glcose monohydrate, as a long–acting agent, has no denervating effect on the nerve tissue. On the basis of the results presented in this study, it can be concluded that Bupivacaine–glucose monohydrate, as a long–acting anaesthetic



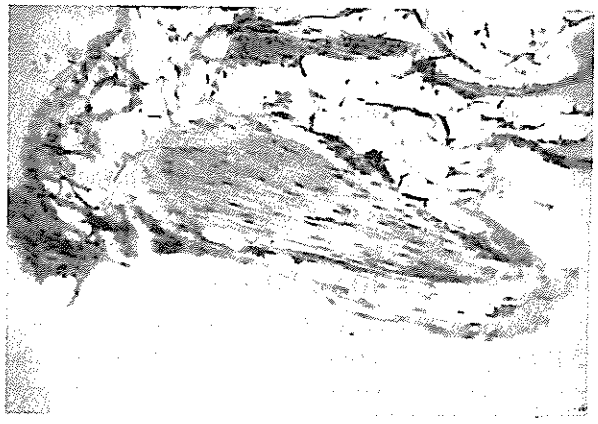


Fig. 3 and 4: Pictures of the nerve tissue treated with bupivacaine and saline, with no structural changes.

agent, can be used for long–term pain relief in patients with facet syndrome safely. Further studies are necessary to determine the effectiveness of long–acting agent injections in facet syndrome.

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