Title : COMPARISON OF ISOBARIC AND HYPERBARIC TETRACAINE SPINAL ANESTHESIA

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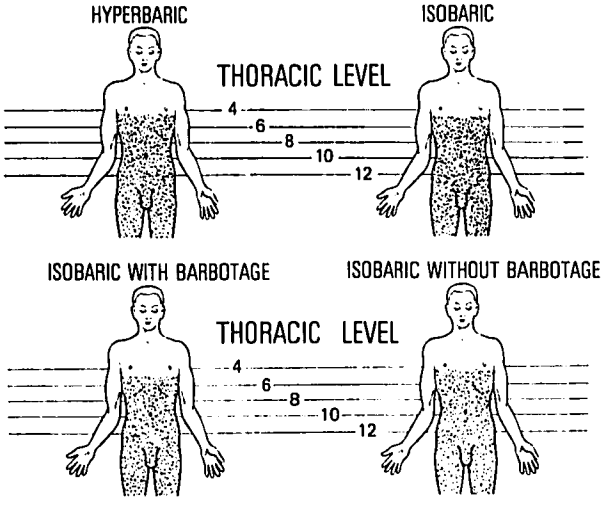
INTRODUCTION. Based primarily upon the undocumented observations of Barker[1] and Sise,[2] it is assumed that gravity determines the cephalad spread of subarachnoid sensory blockade and thereby affords a margin of safety. Consequently, hyperbaric tetracaine is used for spinal anesthesia. This randomized, blind-observer study compared the quantitative and temporal characteristics of sensory block produced by a tetracaine solution of the same density as cerebrospinal fluid (CSF) to that produced by tetracaine in dextrose.

METHOD.Ψ After identical preoperative medication, 103 consenting adult surgical patients, ASA I through III, underwent lumbar puncture (LP) in the sitting position via a 22 gauge needle at L3-4. Commercially-prepared isobaric, isotonic 1% tetracaine in saline (Breon) was mixed with an equal volume of the patient's own CSF aspirated at time of LP to make isobaric 0.5% tetracaine. Hyperbaric 0.5% tetracaine was prepared with equal volumes of 10% dextrose and the identical 1% tetracaine. Patients received 8, 10, or 12 mg of tetracaine in 1.6, 2.0, or 2.4 ml total volume, respectively, according to height; they were assigned to isobaric or hyperbaric groups (table of random numbers). In 30 patients in the isobaric group, injection was done with barbotage for 40 seconds. After injection, all patients returned to a level, supine position and remained undisturbed for 5 minutes; they were then placed in lithotomy for a variety of procedures. O.R. tables were horizontal at all times. At 5, 10, 15, 30 and 60 minutes after injection, sensory levels were tested with pinprick by a single physician observer unaware of the solution employed. The shoulder area served as control. Recovery room nurses tested sensory levels postoperatively each 15 minutes; they checked for return of motor function, defined as the endpoint of the anesthetic. Density of tetracaine in CSF was determined on five samples at known temperatures with a pyknometer and Mettler balance. Statistical comparisons were made by t-test and chi-square analysis; $p < 0.05$ was considered significant.

RESULTS. Mean height, weight, and age of the patients in each group were statistically indistinguishable. Fifty-two hyperbaric and 51 isobaric spinal anesthetics were studied. All patients had adequate anesthesia for surgery. The isobaricity of the tetracaine-CSF mixture was confirmed at 37°C with an average density of 0.9999 gm/ml; S.G. 37/37 1.0065. There were no differences in maximum cephalad sensory spread (figure), latency, or duration of hyperbaric as compared to isobaric tetracaine anesthesia (table). The rate and extent of the cephalad spread of sensory blockade produced by isobaric tetracaine was not significantly altered by barbotage. The incidence of bradycardia and/or hypotension was 10% for the hyperbaric group and 4% for the isobaric group ($p > 0.05$).

DISCUSSION. Classically, gravity has been considered the most important factor in the cephalad spread of spinal anesthetic solutions. Our data refute the concept that the addition of dextrose 10% to equal volumes of tetracaine 1% controls the cephalad spread of subarachnoid sensory blockade in level, supine patients. The concept of a hyperbaric bolus of tetracaine moving cephalad subject to gravity and the thoracic curvature of the vertebral column may not be valid. The ineffectiveness of barbotage in modifying sensory levels of the isobaric solution suggests that more importance be given to other factors such as total dose and volume. It is generally considered that the duration of a spinal anesthetic is correlated with the height of sensory blockade; our data confirmed this. We conclude that simple mechanical and physical factors (e.g. barbotage, gravity) are not as important in determining the subarachnoid spread of anesthetic solutions as has been believed.

SEGMENTAL SPREAD OF TETRACAINE SPINAL ANESTHESIA



all differences between groups statistically insignificant ($p > 0.05$)

	hyper	iso c bbtge.	iso s bbtge.
LATENCY*(mins.) inject → max.level	22.2±11.7	21.0±13.0	21.4± 11.9
DURATION*(mins.) inject → move	161.3±42.8	171.9±60.8	206.5± 54.5
# segments blocked* at endpoint (cephalad from L_{3-4})	5.8± 2.0	5.4± 1.6	4.6± 1.2

(*$p > 0.05$)

REFERENCES

1. Barker, A.E.: Clinical Experience with Spinal Analgesia in 100 cases. Br.Med.J.2:665,674, 1907
2. Sise, L.F.: Pontocaine-Glucose Solution for S Spinal Anesthesia. Surg. Clinics of North Am.15: 1501-1510, 1935

Ψ Approved by Research and Development Committee