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Title : EFFECTS OF DENSITY OF SOLUTION ON EXTENT OF SUBARACHNOID BLOCK

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**Introduction.** Although density of injectate is one of numerous factors determining the extent of spread of anesthetic solutions in the subarachnoid space, we know of no rationale for selecting any one density over another in supine patients. To search for differences upon which a decision might be based, we designed a double blind comparison of the effects of hyperbaric, isobaric, and hypobaric solutions on the rate of onset, extent, and duration of spinal anesthesia.

**Methods.** One hundred eighteen informed male patients scheduled for elective surgery were randomly assigned to receive either hyperbaric (43), isobaric (38), or hypobaric (37) solutions. Lumbar puncture was done with a 22 gauge spinal needle at the L 3-4 or L 4-5 interspace with the patient in the lateral decubitus position. All patients received 0.2% Pontocaine - 1 ml of 1% Pontocaine HCL (Winthrop Laboratories) diluted to 5 ml with either 10% dextrose solution, cerebrospinal fluid, or sterile water - injected at a rate of 0.1 ml per second. At the end of injection the patients were passively turned supine. The anesthetist assessed the levels of analgesia (pin prick), anesthesia (light touch), and motor block frequently but made no attempt to influence the level by changes in position of the patient or table. In the last 54 patients studied, levels were recorded at 5 minute intervals to determine the rate of onset. At 30 minutes an independent assessment of levels was made by an observer blind to the solution used. Duration of block was defined as the interval between time of injection and return of dorsiflexion of either great toe. Statements of significance were based on Chi square analysis, analysis of variance and Tukey's difference test.

**Results.** Our three patient groups were similar in physical status, age, height, and weight. At 20 minutes the levels of analgesia and anesthesia were stable except in the hypobaric group where the levels of anesthesia continued to rise for a further 10 minutes. The rate of onset of anesthesia was fastest with hyperbaric solutions (slope = 0.46 segments blocked per minute). At 10, 15, 20, and 25 minutes the levels of anesthesia were highest in the hyperbaric group and differed significantly from the hypobaric group (figure 1). At 30 minutes the ex-

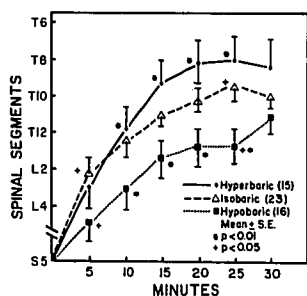


Fig 1: RATE OF ONSET - ANESTHESIA

tent of analgesia, anesthesia, and motor block produced by hyperbaric solutions was greater than isobaric or hypobaric solutions. Hypobaric solutions produced levels significantly higher in obese patients than in non-obese patients. This trend was seen in the other groups but was not significant (fig. 2).

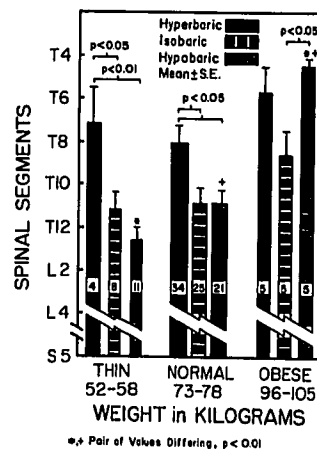


Fig 2: LEVEL of ANESTHESIA at 30 MIN.

The duration of block was significantly longer in the isobaric group ( $229 \pm 57$  min--mean  $\pm$  S.D.) than either hypobaric ( $197 \pm 49$  min) or hyperbaric ( $171 \pm 45$  min) groups. We noted a high incidence (12%) of sparing of isolated sacral or lumbar dermatomes. This occurred most frequently in the hypobaric group (18%), however it was not statistically significant.

**Discussion.** Our results demonstrate that the density of spinal injectates influences rate of onset, extent, and duration of spinal anesthesia. These effects are probably related to specific differences in convective dispersion by gravity of the three solutions in the subarachnoid space, and to the configuration of the thoraco-lumbar and sacral spine. Compression of the subarachnoid space and a decreased volume of cerebrospinal fluid would be expected to alter these effects and may partially explain our findings in obese patients. Hypobaric solutions produced disproportionately high spinal blocks in obese patients and were associated with the highest incidence of lumbar or sacral sparing. These findings have not been previously reported and are not explained by our current understanding of spread of solutions in the subarachnoid space.

Supported in part by National Institute of Aging Grant No. S-R01-AGO075