THE ABSENCE OF DIFFERENTIAL BLOCKADE IN PERIDURAL ANAESTHESIA

BY

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SUMMARY

Anaesthetic levels to cold and pinprick sensation were studied in 45 patients given continuous lumbar peridural anaesthesia by methods previously described. Anaesthesia to cold preceded pinprick anaesthesia and the level of the former rose faster for the first 5 minutes, after which pinprick anaesthesia closely approximated it. After 30 minutes the average difference was only one-half dermatone. We conclude that there is no significant zone of differential sensory anaesthesia during peridural anaesthesia as occurs during spinal anaesthesia.

An area of differential blockade in spinal anaesthesia was reported in 1958 by Greene, who found that the levels of anaesthesia to pinprick and temperature discrimination did not coincide. He suggested that this resulted from two factors: smaller nerve fibres are more sensitive to the effects of local anaesthetics than are large nerve fibres (Gasser and Erlanger, 1929); and the concentration of local anaesthetic in spinal fluid progressively falls from the site of injection (Hellrich et al., 1950). Greene hypothesized that the zone of differential sensory anaesthesia indicated the presence of a level of sympathetic blockade that extended further cephalad than the level of pinprick anaesthesia. This was based on the fact that preganglionic sympathetic fibres are, like those nerve fibres transmitting the sensation of cold, smaller than somatic sensory fibres transmitting the sensation of touch (pinprick). Greene's zone of differential anaesthesia ranged from two to six spinal segments. Subsequently Walts, Kolpke and Margules (1964) demonstrated a comparable zone of differential blockade between somatic sensory and somatic motor levels, the former extending two or more spinal segments above the latter.

The present study was initiated to determine whether a zone of differential anaesthesia also occurs during peridural anaesthesia. Because of the difficulty of measuring sympathetic blockade on the trunk in man under clinical conditions, the zone of differential anaesthesia was studied using temperature discrimination, as in Greene's study.

METHODS

Forty-five patients (26 males, 19 females; age range 19 to 75) scheduled for elective general surgical procedures with conduction anaesthesia were studied. Premedication consisted of pentobarbitone (Nembutal) (100 mg) or hydroxyzine (Vistaril) (100 mg) intramuscularly 1 hour before induction of anaesthesia. With the patient in the flexed lateral decubitus position, the peridural space was identified through the L3-4 or L4-5 interspace by a modified loss-of-resistance technique. A 16-gauge Tuohy needle was inserted into the interspinous ligament and a well-lubricated 2-ml syringe containing local anaesthetic drug attached. The needle was alternately advanced 1-2 mm and aspirated, and then the resistance tested until the needle entered the epidural space allowing unopposed injection. The needle was advanced 1 mm further so that the entire bevel lay within the space. The syringe was detached, and lacking evidence of subarachnoid puncture, a 0.020-mm vinyl catheter was inserted in a cephalad direction for 2-3 cm (Hehre and Sayig, 1960). The patient was turned supine and a 1-ml test dose of anaesthetic was injected through the catheter to rule out subarachnoid
placement; several minutes later the amount of local anaesthetic expected to produce adequate anaesthesia for the proposed surgery was injected at a speed of 1 ml per 3-4 seconds. Lignocaine (Xylocaine) was the only local anaesthetic used throughout. The concentrations were: 1.2 per cent without adrenaline; 1.2 per cent with 1:200,000 adrenaline; and 2.0 per cent with 1:200,000 adrenaline. Surgical anaesthesia was achieved in all cases. The upper limit of sensory anaesthesia was determined bilaterally in the mid-clavicular line by touching the skin with a needle point at 1-cm intervals. The presence or absence of cold sensation was tested over the same area at the same intervals by the application of the tip of a 1-cm sponge soaked in diethyl ether. Levels were tested 2, 5, 10, 15 and 30 minutes after injection of the local anaesthetic.

RESULTS

Two minutes after injection of the total dose of local anaesthetic drug (fig. 1), anaesthesia to cold had appeared bilaterally in 25 patients, unilaterally in 2, and was not detected in 18. At the same time, sensory anaesthesia to pinprick was present bilaterally in 19 patients, unilaterally in 4, and was not detected in 22. The levels of anaesthesia to cold and pinprick did not coincide, as shown in the 2-minute figure.

Five minutes after injection, anaesthesia to cold was present bilaterally in 42 patients, unilaterally in 1, and was undetectable in 2. Anaesthesia to pinprick was present bilaterally in 42 and not detectable in 3. Again, as shown in the 5-minute figure, the levels of anaesthesia did not coincide.

Ten minutes after injection, all patients exhibited anaesthesia both to cold and pinprick bilaterally, as shown in the 10-minute figure. Levels of anaesthesia were established in all patients in 15 minutes, as shown, with little or no change between 15 and 30 minutes.

Thirty minutes after injection, 6 of the 45 patients exhibited a difference of 2 dermatomes between the level made anaesthetic to cold and the level made anaesthetic to pinprick, the former being more cephalad in all cases than the latter. Fourteen patients exhibited a difference of 1 dermatome. In 25 patients the levels of cold and pinprick anaesthesia coincided.

The concentration of lignocaine and the presence or absence of adrenaline in the lignocaine were not related to the presence or absence of a differential zone of anaesthesia.

In all patients, the onset of anaesthesia to cold preceded the loss of pinprick sensation, and the level of anaesthesia to cold rose faster than the level of anaesthesia to pinprick for the first 5 minutes. Thereafter, the levels of anaesthesia were closely approximated as shown in the 10- and 15-minute figures. In other words, an area of differential blockade existed transiently prior to the attainment of the final level of anaesthesia, but only minimally thereafter. The zone of differential anaesthesia in all 45 patients averaged approximately one-half dermatome, a figure that cannot be regarded as significant.

DISCUSSION

This investigation has shown that a large zone of differential blockade does not exist in peridural anaesthesia as it does in spinal anaesthesia. In the latter, the zone of differential anaesthesia results from diminishing concentration as the drug spreads from the site of subarachnoid injection. Local anaesthetic drug spreads through the peridural space without a decrease in concentration, and at the furthest spread, one nerve root will be bathed in drug but the contiguous will not. The former will be blocked, the latter unaffected. The fact that small fibres transmitting the sensation of cold were blocked before fibres transmitting pain demonstrates the effect of differential sensitivity, the result of which was an early though transient zone of differential anaesthesia.

The persistent one-half dermatome zone of differential blockade, after stabilization of the anaesthetic level could possibly result from diffusion of drug into the subarachnoid space, or it could be hypothesized that some fibres blocked in the peridural space enter the paravertebral ganglia and travel in a cephalad direction.

Greene (1958) hypothesized that the area of differential sensory anaesthesia in spinal anaesthesia indicated that preganglionic sympathetic fibres are blocked at least as high as (or higher than) fibres carrying the sensation of cold. For clinical purposes, this study shows that the zone of differential anaesthesia in stabilized peridural anaesthesia is small and probably insignificant.
Each patient (total 45) was tested bilaterally for the most cephalad extent of pinprick and temperature anaesthesia. The composite figures show the number of determinations plotted against the most cephalad segment blocked. Not all patients had anaesthesia at 2 and 5 minutes.
Therefore, we feel that a difference of several segments of sympathetic block exists between peridural anaesthesia and spinal anaesthesia of the same sensory level, and the physiological effects of peridural and spinal anaesthesia of similar sensory levels should not be compared unless the zone of differential block in the latter is taken into consideration.

REFERENCES

UNIVERSITY OF LEEDS: DEPARTMENT OF ANAESTHESIA
April 18-20, 1968

A meeting will be held to demonstrate some of the newer teaching methods as applied to the teaching of methods of measurement of relevance to anaesthesia. The meeting will be supported by the University television service and will feature overhead projectors, video tapes (professional and amateur made), live telecast, audio-tape recorded lectures, teaching machines, and the use of a permanently mounted laboratory practical course. All methods will be demonstrated as they might be used in the course of teaching methods of measurement relevant to anaesthesia.

Accommodation will be at a University Hall of Residence.

Further details and application forms may be obtained from the Department of Anaesthesia of the University of Leeds, 24 Hyde Terrace, Leeds 2.