'CARBOCAINE' : CLINICAL USE OF A NEW LOCAL ANAESTHETIC

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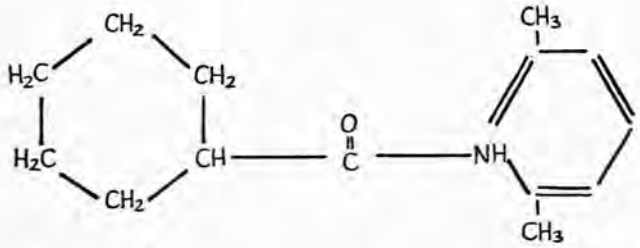
A great deal of work has been done in an attempt to produce safer and more effective local anaesthetic drugs. Carbocaine is a recent addition to this list, and claims have been made for it which indicate that, under certain conditions, it might be the drug of choice.

Chemically it differs from the other commonly used local anaesthetics, having the following formula:[1]



The following advantages have been claimed for carbocaine:

1. Rapid onset of analgesia[3,4]
2. Intense analgesia[3,4]
3. Long duration of action if used with adrenaline[1,3]
4. Effective analgesia if used without adrenaline[1-5]
5. Great potency[3,5]
6. Low systemic toxicity[1-3]
7. Low tissue toxicity[1-6]
8. It does not inhibit the action of sulphonamides[8]
9. Stability — it can be boiled repeatedly.[1]

THIS SERIES

The series here reported consists of nerve blocks and infiltrations performed on 109 listed and emergency cases in a busy general hospital (Table I).

TABLE I. TOTAL NUMBER OF CASES

Epidural (lumbar 37, caudal 5)	42
Brachial plexus block	27
Abdominal field block	5
Deep cervical block	1
Posterior splanchnic block	4
Finger, wrist, and elbow blocks	12
Miscellaneous	18
	109

The results have been analysed and the following extracted.

1. *Onset of analgesia.* From Table II it will be seen that with carbocaine large nerve trunks required 13 minutes, on an average, and small nerves 7 minutes, for a block to become effective. After direct infiltration of the area of operation, however, analgesia was instantaneous. The presence of adrenaline made no difference to the speed of onset of analgesia. There was no difference in the speed of onset between carbocaine and lignocaine (Table III).

2. *Intensity of analgesia.* That produced by carbocaine was similar to the intense analgesia of lignocaine.

TABLE II. TIME OF ONSET OF ANALGESIA AND ITS DURATION: CARBOCAINE

	Time of onset		*Duration*	
	With adrenaline	*Without adrenaline*	*With adrenaline*	*Without adrenaline*
Epidural block	13 minutes [5 - 20] (18)	13 minutes [10 - 20] (8)	165 minutes [135 - 180] (12)	105 minutes [90 - 120] (5)
Brachial plexus block	13 minutes [5 - 30] (23)	11 minutes [8 - 13] (4)	228 minutes [150 - 330] (13)	100 minutes [75 - 120] (4)
Minor nerve blocks	7 minutes [4 - 15] (4)	7 minutes [5 - 12] (7)	210 minutes [180 - 240] (4)	100 minutes [75 - 125] (6)
Direct infiltration	Instantaneous		210 minutes [180 - 260] (4)	90 minutes [60 - 125] (6)

Figures in square brackets [ ] give the minimum and maximum range in minutes.
Figures in round brackets ( ) give the number of cases.

3. *Duration of analgesia* (Table II). The addition of adrenaline made a striking difference to the duration of the analgesia. *Without adrenaline* all effective concentrations of carbocaine gave an analgesia lasting about 100 minutes. *With adrenaline* the average duration rose to over 200 minutes, except for epidural blocks (Table III), where the average was 165 minutes. The concentration of adrenaline used was 1 in 200,000.[3]

TABLE III. ONSET AND DURATION: EPIDURAL BLOCKS*: COMPARISON OF CARBOCAINE WITH LIGNOCAINE

	Carbocaine	*Lignocaine*
Onset ..	13 minutes (18 cases)	12 minutes (49 cases)
Duration ..	165 minutes (12 cases)	150 minutes (18 cases)

* All with adrenaline 1 in 200,000.

4. *Effectiveness without adrenaline*. With the exception of cocaine, the action of all local analgesic drugs is greatly enhanced by the addition of adrenaline. The adrenaline acts by reducing absorption of the drug at the site of injection and so (*a*) increases the duration and (*b*) the intensity of the local analgesia, and (*c*) decreases the rate of absorption of the drug and so decreases the risk of toxic reactions, or, alternatively, allows a larger dose of drug to be injected.[9] Carbocaine without adrenaline gave a highly satisfactory block in all the cases. The only difference noticed was the decreased duration of the block (Table II). It is therefore the local anaesthetic of choice wherever injections have to be made in the vicinity of end-arteries e.g. when blocking a finger. It is far more satisfactory than lignocaine without adrenaline.[3]

5. *Potency*. The potency of carbocaine is indicated in the following table:

Concentration of carbocaine	*Infiltration*	*Nerve block (brachial plexus)*
0·25%	Adequate analgesia	Inadequate analgesia
0·5%	Intense analgesia	Adequate analgesia. Motor power still present
1·0%	Intense analgesia	Intense analgesia. Marked paresis
1·2%	Intense analgesia	Intense analgesia. Complete paralysis

6. *Systemic toxicity*. Claims are made that carbocaine is considerably less toxic than lignocaine.[1-3] The usual signs of overdosage are: (*a*) central nervous irritability — apprehension, nausea and vomiting, twitching, convulsions; and (*b*) cardiovascular and respiratory depression going from a mild drop in blood pressure to an apnoeic pulseless state.[10] In the present series no signs of toxicity from carbocaine were encountered, notwithstanding that several of the patients were desperately ill. Some of them were emaciated, many were old (7% of the entire series being over 80 years of age), while 4 were deeply jaundiced. In no case did the total dose of carbocaine exceed 0·5 g. Since the dose must always be considered relative to the condition of the patient, a fit healthy patient should tolerate more than 0·5 g. of carbocaine.[9]

7. *Tissue toxicity*. No evidence of damage to tissue was seen.

8. *Inhibition of sulphonamides*. This was not considered in the present series but, unlike procaine and amethocaine, carbocaine is not broken down to *p*-aminobenzoic acid, and so does not inhibit sulphonamides.[8]

9. *Stability*. Many of the nerve blocks in this series were performed after the carbocaine had been autoclaved, on some occasions several times. The drug was effective in all cases.

Comparison with Lignocaine

In Table III a comparison is made between a series of lumbar epidural blocks with carbocaine and a series with lignocaine, plus 1 in 200,000 adrenaline in all the cases. No difference was noted in time of onset and intensity of analgesia.

The average duration of analgesia with carbocaine was 165 minutes (12 cases), which is slightly longer than the average duration with lignocaine, which was 150 minutes (18 cases). This agrees with other workers.[1,3]

Although no cases in this series were given lignocaine without adrenaline, extensive comparisons by several workers have shown lignocaine without adrenaline to be markedly inferior to carbocaine without adrenaline.[1-5]

Whereas lignocaine produces drowsiness from systemic absorption when used in large doses, this effect was not noticed with carbocaine in the present series.[11]

SUMMARY AND CONCLUSIONS

The results in a series of 109 cases of nerve block performed with carbocaine are analysed, and certain com-

parisons are made with lignocaine. The following conclusions are drawn:

Carbocaine is a highly effective local anaesthetic. It has a rapid onset, the analgesia produced is intense, and the duration of anaesthesia is effectively controlled by the addition or omission of adrenaline. It is a drug of low general toxicity, and does not irritate tissues or delay healing in the concentrations recommended.

Has carbocaine a place in clinical use? Of recent years lignocaine has been considered the drug of choice. However, in all types of local analgesia (excluding topical and spinal analgesia, which were not tested) carbocaine is as effective and safe as lignocaine. It has certain noteworthy advantages over lignocaine, as follows:

1. It is highly effective when used without adrenaline, while the effect of other local anaesthetic drugs is decreased in these circumstances. This has 2 advantages, viz.:

(*a*) It makes it the anaesthetic of choice when an end-artery is in the region of the nerve to be blocked, e.g. in a finger nerve block, or when a local anaesthetic is being used in the region of diseased arteries, as in vascular investigations or in vascular surgery.

(*b*) It enables carbocaine to be used without adrenaline as a medium short-acting drug, or with adrenaline as a long-acting drug. If 0·5 g. of carbocaine has to be exceeded, then adrenaline 1 in 200,000 should be added. This will decrease the rate of absorption and so minimize the chance of toxic reactions.

2. Carbocaine is less toxic than lignocaine, and so should be preferred to lignocaine, especially in the aged, in the very sick, and where large quantities have to be injected.

3. The average duration of action of carbocaine when used with adrenaline is slightly longer than that of lignocaine.

The recommended concentrations of carbocaine are as follows:

Infiltration anaesthesia	0·25 - 0·5%
Nerve block for small nerves	0·5 - 1·0%
Nerve block for large nerves	1·0 - 1·2%

If it is desired to retain motor power in doing a brachial-plexus block, then 0·5% carbocaine should be used. Carbocaine 1·2% will cause complete paralysis.

Adrenaline should be added if analgesia is required for more than 1½ hours, or if very large doses are to be injected.

Adrenaline should *not* be added if less than 1½ hours of analgesia is required, or if the injection is in the region of an end-artery.

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