Short communications

Role of the chemoreceptor trigger zone in cyclopropane induced emesis in dogs

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Inhalation of cyclopropane in dogs, by the closed circuit method, for a fixed period, produced an emetic response during recovery from anaesthesia. Bilateral surgical ablation of the emetic chemoreceptor trigger zone of the area postrema rendered the dogs refractory to several times (3–6) the threshold emetic dose of cyclopropane.

Amongst the various inhalation anaesthetic agents, cyclopropane and ether give rise to the greatest incidence of postanaesthetic vomiting (Waters, 1936; Dent, Ram Chandra & Stephen, 1955). In an earlier study in this laboratory emesis could not be evoked in dogs, cats and monkeys with ether when given by different routes (Dixit, Badola, Pandey & Bhargava, 1966). On the other hand, Raventos (1956) reported a high incidence of vomiting in dogs and monkeys after cyclopropane anaesthesia. The chemoreceptive trigger zone (CTZ) is the site of the emetic action of apomorphine (Wang & Glaviano, 1954), emetine (Bhargava, Gupta & Chandra, 1961) reserpine (Bhargava, Dixit & Gupta, 1967) cardiac glycosides (Borison & Wang, 1951), catecholamines (Borison, 1959) and histamine (Bhargava & Dixit, 1968). In this study, the role of the CTZ in the emesis induced by cyclopropane anaesthesia was investigated.

Methods.—Twenty-nine dogs weighing 4·5 kg–12·0 kg were used. Ten to thirty minutes after feeding, cyclopropane was administered to the dogs at a fixed concentration of 33·3% in pure oxygen. All dogs were given cyclopropane for an initial period of 5 min and allowed to recover and watched for a positive emetic response over a period of 2 hours. An increase of 5 min in the duration of cyclopropane administration was made in each subsequent test until emesis was elicited. Thus the threshold emetic dose of cyclopropane was determined for each dog. The emetic tests were repeated after 5 days and no changes were observed in the threshold emetic response. Bilateral ablation of the CTZ was performed on these dogs and they were allowed to recover. Functional elimination of the CTZ was considered complete when the dogs failed to vomit in response to apomorphine (i.v. 200 μg/kg, 5 times the ED 100; Borison & Wang, 1951). The integrity of the vomiting centre was demonstrated by a positive emetic response to copper sulphate (300 mg in 25 ml water) administered orally through an intragastric tube on an empty stomach. Cyclopropane was again administered to the CTZ ablated dogs for the control threshold period and for a period several times the threshold.

Results.—In a series of dogs the duration of cyclopropane administration adequate for a 100% emetic response was determined. The incidence of emesis after varying periods of cyclopropane administration was determined in forty-one tests and was as follows: 5 min—35%, 10 min—66.6%, 15 min—80% and for 20 min—100%. The emetic response was accompanied by salivation, retching, muscular incoordination and sometimes defaecation and urination. In a series of seven dogs with bilateral ablation of the CTZ, several times the threshold emetic dose of cyclopropane

TABLE 1. *Effect of bilateral ablation of the CTZ on the cyclopropane-induced emetic response*

Expt. no.	Normal: Duration (min) of cyclopropane administration	Normal: Emetic response	After CTZ ablation: Duration (min) of cyclopropane administration	After CTZ ablation: Emetic response
1	5	+	5 and 15	—
2	5	+	5 and 30	—
3	5	+	5 and 30	—
4	5	+	5 and 30	—
5	10	+	10 and 30	—
6	5	+	5 and 30	—
7	5	+	5 and 30	—

was administered to elicit the emetic response. These results are summarized in Table 1. The procedure of CTZ ablation rendered the dogs resistant to 3–6 times the threshold emetic dose of cyclopropane.

Discussion. — Whereas age, sex, the physiological make up of the patient, the type and duration of surgery and the technique of anaesthesia and premedication may be contributory factors in post-operative vomiting, this study with cyclopropane in dogs has demonstrated an emetic action of the anaesthetic agent itself.

Bannister & Sattilaro (1962) suggested that the vomiting centre shared the general increase in reflex excitability observed during second stage anaesthesia and, like other motor areas, reacted to low levels of stimulation. This view is not supported by the results of this study because selective ablation of the CTZ afforded complete protection from the emetic action of cyclopropane anaesthesia. It is significant that the vomiting centre in these dogs was intact and responded to oral copper sulphate which excites gastric receptors which send impulses directly to the vomiting centre (Wang & Borison, 1952). A peripheral locus of action of cyclopropane, therefore, can be ruled out.

Histamine receptors have been postulated in the CTZ (Bhargava & Dixit, 1968), but an action of cyclopropane on these receptors does not appear likely because Dent *et al.* (1955) did not observe any protection of the emetic effect with the antihistamine drugs. Cyclopropane may therefore be acting on the same receptors in the CTZ as apomorphine.

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