

CHAPTER IV

DISCUSSION



The lowest surface pressure - surface area curve of each figure was used as the standard curve for each system.

Action of Lidocaine Hydrochloride and Bupivacaine Hydrochloride on the Mixed Egg Lecithin - Cholesterol Films.

From curves (Fig. 6-17) showed that when different concentrations of bupivacaine hydrochloride or lidocaine hydrochloride had been present in the subphases, the curves were shifted up from the standard curves. They meant that the local anaesthetics might penetrate into the monomolecular films (Zatz, 1972) or interact with some substances of the films (Felmeister et al., 1971; Auslander et al., 1975). These phenomena caused more molecular density at the surface, the surface tensions were therefore reduced, i.e. the surface pressure were increased. Furthermore, it was also observed that if the egg lecithin molecules in the monomolecular films were increased, the curves would be more shifted up because of the more increased surface pressure (Martin et al., 1969; Langmuir, 1917). It might be thought that these local anaesthetics could penetrate into the mixed egg lecithin - cholesterol films because of egg lecithin molecules, or they might interact with egg lecithin molecules (Skou, 1961; Feinstein, 1964). The ability of these local anaesthetics in lowering surface tension was not effected by cholesterol molecules because when cholesterol molecules in the monomolecular

films were reduced the curves were still shifted up.

Comparison between the action of lidocaine hydrochloride and bupivacaine hydrochloride on the mixed egg lecithin - cholesterol films of each system showed that bupivacaine hydrochloride would increase surface pressure more than lidocaine hydrochloride. According to Table IV & V the films on the subphases containing bupivacaine hydrochloride were collapsed at the wider area or higher surface pressure than the films on the subphases containing lidocaine hydrochloride. In 1956, Shanes had suggested that the analgesic or anaesthetic efficiency of local anaesthetics corresponded to their ability to increase surface pressure of lipid monomolecular layer in the nerve membranes. (Goodman and Gilman, 1970; Shanes, 1956). The results of this experiment also corresponded to Shanes' suggestion and many clinical reports which showed that the potency of bupivacaine hydrochloride was greater than lidocaine hydrochloride. (Kuah, 1968; Rubin, 1968; Dowing et al., 1969; Reynold, 1971).

Considering the influence of pH on the action of these two local anaesthetics, the increasing ability of surface pressure would be more when pH was changed to alkaline pH. The result shown in Table V was obviously different from Table IV. At pH 5.9, the interaction of 0.25% lidocaine hydrochloride on the mixed egg lecithin - cholesterol films (1:3, and 2:2 area ratios) was not statistically significant, but 0.5% lidocaine hydrochloride and both concentrations (0.25% and 0.5%) of bupivacaine hydrochloride significantly interacted with the mixed lipid films. At pH 7.2, all lidocaine hydrochloride and bupivacaine hydrochloride concentrations significantly interacted with the films, and the difference between bupivacaine

hydrochloride and lidocaine hydrochloride actions on the films at pH 7.2, were greater than the different actions on the films at pH 5.9. There had been the explanation that the blocking action of local anaesthetics was due to local anaesthetic base only (Goodman and Gilman,1970). The aqueous solutions of lidocaine hydrochloride and bupivacaine hydrochloride were slightly acid (Wade et al.,1977), They were therefore easily hydrolysed in alkaline pH.

The actions of these local anaesthetics on the mixed lipid monomolecular films also depended on their concentration.

The Actions of Lidocaine Hydrochloride and Bupivacaine Hydrochloride on the Mixed Egg Lecithin - Cholesterol - Bovine Serum Albumin Films.

The actions of these local anaesthetics on the mixed lipids and protein film were also depended on the number of egg lecithin molecules, pH and their concentration. At pH 5.9, comparison between the last column of Table VI and IV the per cent of trough area at the film collapsing point was not significantly different but at pH 7.2 the results were quite different. This might be due to the loss of bovine serum albumin from the surface at pH 5.9 which is near its isoelectric point (Weiner and Rosoff.,1972) but at pH 7.2 bovine serum albumin can increase the surface pressure. Anyhow the interaction of both lidocaine hydrochloride and bupivacaine hydrochloride on cell membranes were due mainly with the phospholipid.