Short Report

Effect of Plasma-Cholinesterase Preparation on the Phase II Block of Succinylcholine Chloride in Man

YASUHIKO HASHIMOTO, TAKESHI SHIMA and SHUH MATSUKAWA

Department of Anesthesiology, Tohoku University School of Medicine, Sendai 980

HASHIMOTO, Y., SHIMA, T. and MATSUKAWA, S. Effect of Plasma-Cholinesterase Preparation on the Phase II Block of Succinylcholine Chloride in Man. Tohoku J. exp. Med., 1977, 122 (3), 301-302 — The effect of enriched human plasma-cholinesterase preparation on the phase II block of succinylcholine chloride was studied in man during anesthesia and surgery. Intravenous administration of 8 esterase units/kg of plasma-cholinesterase did not show any discernible effect on the phase II block of succinylcholine chloride, while edrophonium 10 mg clearly antagonized the block. The finding of the present study suggests that the preparation may be ineffective for patients with a prolonged apnea following the administration of succinylcholine chloride. —— plasma-cholinesterase; succinylcholine chloride; phase II block

It has been established that succinylcholine chloride (SCC), a depolarizing muscle relaxant, is hydrolyzed rapidly by plasma-cholinesterase (pChE) and the duration of action of SCC was inversely proportional to the pChE level. On the other hand, prolonged administration of a large amount of SCC may produce a non-depolarizing type of block (phase II block). Recently, Happle et al. (1973) reported that the administration of enriched human pChE was immediately successful in restoring breathing in a patient with prolonged apnea after SCC, possessing an atypical form of pChE. The purpose of the present study is to determine the effect of enriched human pChE preparation on the phase II block of SCC in man.

Eight adult patients, who were to undergo genito-urinary surgery, were studied during anesthesia and surgery. The patients were premedicated with meperidine and atropine one hr prior to anesthesia. After peridural analgesia, general anesthesia was induced with thiamyal sodium and maintained with nitrous oxide and oxygen. Endotracheal intubation was performed after the intravenous injection of 1 mg/kg of SCC and ventilation was assisted or controlled to provide an adequate respiratory exchange. Prior to the study the patients’ forearm and hand were fixed firmly to a specially designed metal armboard.

The median nerve was stimulated indirectly at the elbow using a Nihon Kohden SEN-1101 stimulator and a stimulus isolation unit with supramaximal square-wave stimuli of 0.2 msec duration through the subcutaneous needle electrodes. The electrical stimuli were applied with either 0.2 Hz or 2 Hz for 2 sec (train-of-four stimuli). The resultant force of adduction of the middle finger was measured by a force-displacement transducer connected to a recorder (Nihon Kohden multipurpose polygraph). The phase II block was

Received for publication, April 2, 1977.
Supported in part by Grant in Aid for Scientific Research from the Ministry of Education, Science and Culture, Japan, #187106.
determined by the train-of-four ratio at a twitch height 25, 50 or 75% of the initial value. Train-of-four ratio was expressed as a percentage of the ratio of the 4th response to the first. The block was considered to be phase II in nature if the train-of-four ratio was close to that of d-tubocurarine block (Shima et al. 1977).

When a steady twitch response was obtained, 6 mg/kg of SCC was administered intravenously by continuous infusion. The rate of continuous infusion was 0.3 mg/kg/min. After a full recovery of twitch tension, 1 mg/kg of SCC was given intravenously. The total cumulative dose of SCC was 8 mg/kg and this dose was sufficient to produce a complete phase II block. Eight esterase units (Hesterin 1949)/kg of pChE preparation was given intravenously during the recovery period from the block to determine the interaction with these drugs.

Fig. 1. Typical tracing of the effects of plasma-cholinesterase preparation and edrophonium on the phase II block of succinylcholine chloride. SCC: succinylcholine chloride. ChE: plasma-cholinesterase.

Fig. 1 shows a representative record from a subject in this study. Eight units/kg of pChE preparation did not show any discernible effect on the phase II block of SCC, while edrophonium 10 mg clearly antagonized the block (Fig. 1, lower trace).

Borders et al. (1955) reported that a therapeutic value for pChE is doubtful when given to patients at the time they are exhibiting a prolonged respiratory depression following SCC administration. The present study suggests that the administration of pChE preparation may be ineffective for the reversal of the receptor change, once it occurs, which is considered attributable to the development of phase II block of SCC.

References