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Have the Adrenal Glands a Specific Detoxifying Function in Intestinal Obstruction?

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The adrenal glands perform a number of functions which appear necessary for normal mammalian life. Some animals, especially rats and rabbits, are, however, able to survive bilateral adrenalectomy for several weeks. Many interesting experiments have been performed to show that the adrenal glands secrete a substance or substances which act as a special defensive agent in the destruction of various types of toxins. The detoxifying substances are believed to be elaborated principally by cells of a reticulo-endothelial nature which are located in the cortex of the gland.

The cause of death in low intestinal obstruction is not well known. Cutting[1] has, in a recent article, presented experimental evidence which seems to show that a material elaborated in the adrenal cortex neutralized or destroyed a toxin or toxins responsible for the effects of intestinal obstruction. The adrenal glands were, therefore, considered to act as a specific mechanism against a toxemia present in all cases of advanced intestinal obstruction. These deductions stimulated us to perform a group of experiments for the observation of the effects produced by the intravenous injection of a toxic material into animals on whom various types of operations had been performed. All surgical procedures were done with sterile technic and ether anesthesia. Bilateral adrenalectomies, unilateral adrenalectomies, cholecystectomies, unilateral nephrectomies, splenectomies and appendectomies were done on a group of 32 rabbits. Ten of the animals survived the operative procedure and appeared well 3 weeks later.

Complete intestinal obstruction was produced in a group of 10 rabbits by placing a double tie of linen tape 10 cm. proximal to the ileo-cecal valve. As soon as an animal died a sterile material was prepared from the fluid proximal to the point of obstruction. The technic for the preparation of this material has been described elsewhere by one of us.[2] The material obtained from each animal was then divided into 2 equal portions. One-half was injected intravenously through the ear vein into an animal on which a surgical proced-

[1] Cutting, R. A., *Arch. Surg.*, 1929, xix, 272.

[2] Wangensteen, O. H., and Chunn, S. S., *Arch. Surg.*, 1928, xvi, 606.

ure had been performed and one-half into a normal healthy animal which served as control. An effort was made to obtain as a control an animal which weighed more than one on which an operation had been performed. The results have been tabulated.

TABLE I.
The Effects Produced by the Intravenous Injection of a Toxin Material on Animals on Which Various Surgical Operations Had Been Performed.

Number	Sex	Weight in gm.	Type of Operation	Quantity of toxin injected intravenously in cc.	Degree of reaction following intravenous injection	Length of life after injection of toxin
Ex. 1	M	1725	Bilateral adrenalectomy	60	Marked	24 hrs.
Con. 1	M	1800	None	60	"	Died 15 min.
Ex. 2	F	1650	Left adrenalectomy	45	"	Well 2 days
Con. 2	F	1680	None	45	Moderate	10 hrs.
Ex. 3	F	2000	Right adrenalectomy	32	Slight	14 hrs.
Con. 3	F	2100	None	32	Marked	18 hrs.
Ex. 4	M	1410	Cholecystectomy	55	Moderate	Well 7 days
Con. 4	M	1470	None	55	"	21 hrs.
Ex. 5	M	1945	Cholecystectomy	40	"	14 hrs.
Con. 5	M	1990	None	40	Marked	2 hrs.
Ex. 6	M	2340	Right nephrectomy	35	"	Well 2 days
Con. 6	M	2425	None	35	Moderate	26 hrs.
Ex. 7	F	1870	Left nephrectomy	47	Marked	4 hrs.
Con. 7	F	1900	None	47	Slight	10 hrs.
Ex. 8	M	2125	Splenectomy	65	Marked	20 hrs.
Con. 8	M	2200	None	65	Moderate	29 hrs.
Ex. 9	F	1360	Splenectomy	54	Marked	22 hrs.
Con. 9	F	1420	None	54	"	46 hrs.
Ex. 10	F	1245	Appendectomy	36	Moderate	Well 8 days
Con. 10	F	1380	None	36	Slight	15 min.

Each pair of animals was ill after the injection of the material. The effects usually consisted of listlessness, weakness, tremors, spastic muscular contractions, rapid respiration, increased pulse rate, dilatation of the pupils and lowering of the blood pressure. A few animals developed a temporary comatose condition and 2 died soon after the injection. The degree of reaction varied considerably both among the animals which had been operated upon and among the controls. It is interesting to note that 7 of 10 animals on which operative procedure had been performed lived longer following the injection of the toxin than the normal animals which served as control. All 3 of the animals on which one or both of the adrenal glands had been removed lived longer than the control animal.

Deductions are difficult to make from this small series but it ap-

pears that following any major operative procedure the entire reticulo-endothelial system is mobilized for the defense of the body against the action of toxic material. The relatively few reticulo-endothelial cells found in the cortex of the adrenal gland do not appear to produce a specific substance for the defense of the body against the toxin produced in intestinal obstruction.

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The Effect of Ether and Chloroform on Kidney Function in Dogs With Obstructive Jaundice.

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Clairmont and Haberer[1] first directed attention to the terminal anuria that occasionally accompanies protracted obstruction of the common bile duct. This happening has frequently been observed since then but the mechanism of its occurrence is not well understood. It has been believed that the administration of ether anesthesia to patients with obstruction of the common bile duct has played a significant rôle in precipitating this event.

In this study we had planned to determine whether any of the commonly employed anesthetics have a deleterious influence on the kidney function in the presence of obstructive jaundice. Not having obtained any manifestations of such injury with chloroform or ether no further observations were made with other anesthetics in common use.

The common bile duct was divided and ligated in 16 normal dogs under aseptic conditions. Following the convalescence of the animal, deep ether anesthesia was administered for an hour at brief intervals (usually a week apart) following which the excretion of phenol-sulphon-phthalein and the blood urea and icterus index were obtained on 2 occasions soon after recovery from the anesthetic and again before its repetition a week later. In a few other dogs similarly obstructed, chloroform was administered in one instance by stomach tube and to 4 others by inhalation.

Blocks of tissue from the kidney and liver were obtained at necropsy from all the dogs that served as subjects of these experi-

[1] Clairmont, P., and Haberer, H., *Mitt. u. d. Grenzgeb. d. Med. u. Chir.*, 1911, xxii, 159.