MALIGNANT HYPERTHYREXIA: A THERAPEUTIC AND INVESTIGATIVE REGIMEN

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SUCCESSFUL CLINICAL MANAGEMENT of the malignant hyperthyreia syndrome depends on early diagnosis. It is essential that vigorous therapy be instituted before the rise in body temperature is severe or well established. Late diagnosis and inadequate therapy are important factors contributing to the mortality in this condition.

One of the authors (B.A.B.) has collected details of over 300 cases of malignant hyperthyreia with a mortality of over 60 per cent. A detailed analysis of 89 of these cases,¹ indicated a highly significant positive correlation between the maximum temperature level attained and mortality. Six cases in whom the maximum temperature was less than 102.9°F recovered and, in each case, anaesthesia was discontinued within a few minutes of induction.

The percentage survival diminishes as the maximum recorded body temperature increases (see Table I).

TABLE I
NUMBER OF ANAESTHETICS

Maximum Temperature °F	Died	Survived	Total	% Survival
99.0-102.9°F	—	6	6	100
103.0-106.9°F	9	14	23	61
107.0-110.9°F	37	8	45	18
110°F	5	1	6	17
(Not Specified)	6	8	14	57
Totals	57	37	94	36

In order to facilitate the early diagnosis and treatment of the malignant hyperthyreia syndrome, the following protocol is used at The Hospital for Sick Children, Toronto. It summarizes the early signs of the syndrome, outlines therapeutic and investigative measures, and indicates the location of specialized equipment and drugs which may be required. Copies of this protocol are placed in each operating room and are readily available for reference.

MALIGNANT HYPERTHYREXIA PROTOCOL

A. Recognition of the Syndrome

The syndrome usually presents with:

- (1) Hypertonus of skeletal muscle which may occur
 - (a) Immediately following the administration of succinylcholine. *Failure of*

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skeletal muscle to relax after succinylcholine is an indication to postpone surgery and re-evaluate.

(b) Later in the anaesthetic following the use of potent agents, commonly halothane.

(2) Unexplained tachypnoea, tachycardia, sweating, cyanosis, or overheated soda lime are non-specific early signs.

(3) A rise in body temperature ($>1^{\circ}\text{C}$)

From a prognostic point of view, it is highly desirable that the syndrome be recognized before the pyrexia reaction is severe or well-established. *A rise in body temperature may be a late sign.*

B. Therapeutic Measures

(1) Discontinue all potent inhalational agents and relaxants and stop surgery without delay.

(2) Hyperventilate with an oxygen-rich mixture or 100 per cent oxygen if necessary. Use vapour-free anaesthetic machine.

(3) Drug Therapy must be started immediately.

(a) Sodium bicarbonate (7.5 per cent) iv 4 ml/Kg stat. and repeat in accordance with blood gas measurements.

(b) Procaine hydrochloride (1 per cent) iv for cases exhibiting hypertonus of skeletal muscle. The loading dose is 30–40 mg/Kg followed by an infusion of .2 mg/Kg minute. Monitor the procaine infusion by ECG (2).

(c) Mannitol – 1 Gram/Kg iv.

(4) Commence active cooling. Place the patient in a rubber sheet, apply ice bags, and ice water and use fans. Intra-gastric cooling and cold enemata may also be considered.

(5) Insert an intravenous cannula and give refrigerated lactated Ringer's solution.

C. Investigative Measures

(1) Monitor by:

Oesophageal stethoscope

Blood pressure cuff

Electrocardiogram

Multichannel thermometer (rectal, oesophageal and muscle leads)

(2) Insert an arterial cannula for sampling.

(3) Take blood specimen (10 ml) immediately and measure:

Blood gases

Electrolytes (Na, K, Cl, Ca, PO_4)

Creatine phosphokinase (C.P.K.)

SCOT and LDH

Correct the electrolyte imbalance on the basis of the results. A hypocalcaemia and a hyperkalaemia followed by a hypokalaemia may be expected.

(4) Repeat the blood gas measurements at 10-minute intervals and correct on the basis of the results.

(5) Catheterise and take urine sample for haemoglobin and myoglobin estimation. Measure urine output.

D. Location of Equipment

(Detailed instructions are given in the protocol regarding the location in the operating suite of the following specialised equipment and drugs.)

Vapour-free anaesthetic machine, i.e. no vaporisers attached.

Multi-channel thermometer.

Rubber sheet, ice bags, ice and electric fans.

Intragastric cooling apparatus.

Drugs: Mannitol, Procaine, refrigerated Ringer Lactate and additional Sodium Bicarbonate and calcium gluconate.

SUMMARY

A reduction in mortality from the malignant hyperpyrexia syndrome may be expected if the diagnosis is made promptly and management is vigorous and aggressive. It is suggested that a summary of the early signs of the syndrome and an outline of therapeutic and investigative procedures be made readily accessible to anaesthetists in each operating room.

REFERENCES

1. BRITT, B.A. & KALOW, W. Malignant Hyperthermia: A Statistical Review. *Canad. Anaesth. Soc. J.*, 17: 293 (1970).
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