ARTIFICIAL HIBERNATION: A REPORT OF FORTY-TWO CLINICAL CASES*

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ON SEVERAL OCCASIONS the subject of Artificial Hibernation has been discussed before the Canadian Anaesthetists' Society by Dr. Fernando Hudon of Quebec City. We thought, therefore, it would be of some interest to present a series of 42 clinical cases of which 22 were medical and 20 were surgical.

From the concepts of Claude Bernard, Cannon, Reilly and Selye, Laborit evolved his technique of "Artificial Hibernation," by which he transforms a homeothermic organism to a poikilothermic organism.

Summarizing these two concepts, we can say that a homeothermic being is one who can maintain a constant internal environment in spite of a changing external environment. Under conditions of severe stress the homeothermic state becomes a disadvantage because the expenditure of energy in maintaining this constancy will tend to exhaust the organism and to hasten death. When an organism approaches the poikilothermic state, the constancy of the internal environment is partly sacrificed, energy is conserved, and life is prolonged.

Laborit concluded that artificial hibernation, utilizing the "lytic cocktail," could be a valuable means of maintaining life of patients *in extremis*.

Our modest series of cases would seem to bear this out. There were patients whose lives were prolonged for periods as long as two months.

The series was divided into two groups: first, the surgical, where hibernation was used only for the period of surgery; and second, the medical, where this technique was employed as a resuscitative measure. Some of the patients of the second group went on to further treatment by surgery during the period of hibernation.

MEDICAL CASES (Table I)

In our series of medical cases, 14 out of 22 patients were *in extremis*; every conventional treatment had failed, and death was imminent.

Six out of these fourteen patients represented cases of cerebro-vascular accidents associated with hyperthermia. All of them showed clinical improvement during hibernation. Four died upon emerging from hibernation; the other two died two months later. Post-mortem examinations demonstrated lesions incompatible with life in every case.

Another five of these fourteen patients had severe head injuries and they were also *in extremis* when they were submitted to hibernation. All were operated on either before or during hibernation. Four out of the five did well and had complete recovery. The hibernation lasted from three to ten days depending upon the reaction of the patient to attempts at rewarming. The patient who died was a 68-year-old arterio-sclerotic male, who had quite extensive and profuse subdural bleeding. This was on the fourth day of hibernation following an exploratory craniotomy.

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TABLE I
MEDICAL CASES SUBMITTED TO ARTIFICIAL HIBERNATION

Central hyperthermia following	Cerebro-vascular accidents	6 cases
	Severe cerebral trauma	5 cases
	Surgery of the posterior fossa	2 cases
	Fat embolism	1 case
Postoperative shock with lower nephron nephrosis		1 case
Postoperative thyroid crisis		1 case
Mitigated hibernation for psychoneurosis		3 cases
	recurring infection	1 case
Postoperative sedation in drug addiction.		2 cases
		22 cases

Two other cases, of central sustained hyperthermia following surgery of the posterior fossa, were helped by mitigated hibernation. The temperature was lowered and they recovered.

One of the cases was a severe postoperative shock with lower nephron nephrosis. In my opinion, this patient was aided by hibernation; diuresis followed, the blood pressure stabilized, and correction of the electrolyte balance was made possible. However, the patient had severe pulmonary atelectasis which resisted treatment and at the first attempt at rewarming she died following a tracheo-bronchial toilet.

Another case was that of a man who did not adhere to the therapy for his hyperthyroidism. Following emergency surgery for a kidney abscess, a thyroid crisis occurred which was promptly controlled by hibernation.

Another four patients had modified hibernation. Three of those were treated by induced sleep of seven to ten days' duration for psychoneurosis. There was doubtful temporary improvement of the condition. The fourth case was that of a young woman with abscesses recurring over a period of two years. She was cured of her infection by hibernation. She was found to be a case of drug addiction with self-mutilation and is still doing well four months after treatment.

SURGICAL CASES (Table II)

We believe that surgery can derive benefit from the hibernation technique in two ways. First, it can be extended to newer and wider fields, for example, to brain surgery involving interruption of the circulation or to cardiomy for repair of congenital defects (we have had no experience with this type of case¹). Secondly, patients in poor physical condition subjected to long and extensive surgery, will be helped by the technique. Our series of 20 cases belong to this group.

There were 6 cases of radical neck dissection with simultaneous wide excision of the primary cancerous tumours; 3 cases in which extensive blood loss was anticipated; 3 cases of toxic goiter; and 8 other cases where patients in poor physical state were submitted to extensive surgery.

¹Since the presentation of this paper, we have had a case of an aneurysm of the anterior communicante; the patient underwent surgery under artificial hibernation, the rectal temperature being lowered to 83°F. Ligation and resection of the aneurysm were possible and the patient is doing well five months after operation.

TABLE II
SURGICAL CASES SUBMITTED TO ARTIFICIAL HIBERNATION

Radical neck dissection with excision in continuity of the cancerous lesion	6 cases
Massive haemorrhage during surgery	3 cases
Toxic goiter	3 cases
Very poor risk patients	8 cases
	20 cases

Hibernation helps in these cases by reduction of the homeothermic response to surgical and haemorrhagic stresses, and by potentiation of anaesthetic agents. Weaker and less toxic drugs can be used. Nitrous oxide with higher concentrations of oxygen supplemented with small amounts of demerol is all that is necessary in most cases. Such a technique disturbs these patients very little, yet they are well protected against pain and harmful reflexes. Minimal hypothermia reduces even further their metabolic requirements. In this state of "reduced life," not only do they tolerate extensive surgery well, but they have much less post-operative distress and yet are co-operative.

The most interesting cases in our series were those of radical neck dissection. Prior to the use of the hibernation technique, the maintenance of blood pressure during surgery in this type of case, was always a problem even though more blood was replaced than the estimated loss. This was particularly true for the aged patients (we had three over 70 and one over 90), who, having been subjected to the stress of extensive and prolonged gland dissection, were then exposed to additional haemorrhagic stress from the wide excision of the primary growth. Not only has artificial hibernation minimized the dangers of such extensive surgery but it has also markedly reduced postoperative morbidity, especially following pulmonary complications. As a matter of fact, these patients responded to the spoken voice as soon as they were extubated, and there was an absence of nausea and vomiting with early retention of fluids. A few were ambulatory the day of the operation. Minimal sedation was required, and in some instances, no opiates at all were given.

The course in the three toxic goiter cases was uneventful except for a transient tachycardia.

In the three haemorrhagic cases, the patients did unexpectedly well.

The seven patients who were poor surgical risks did strikingly well, except one. This was a case of an oesophagectomy on a 73-year-old malnourished patient. He died during the third postoperative day. The post-mortem examination showed bleeding from the operative site. This was the only death of the surgical series.

SUMMARY AND CONCLUSION

Our observations of a series of 42 patients subjected to Artificial Hibernation have been presented with emphasis on the resuscitative value of this technique. Artificial hibernation is a delicate and exacting technique which has widened the scope of surgery and of resuscitation.*

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RÉSUMÉ

Une étude clinique sur 42 cas d'hibernation artificielle est présentée dont 22 cas médicaux et 20 cas chirurgicaux.

Cette étude, à notre avis, démontre bien l'extension possible de la réanimation grâce à l'hibernothérapie. Cette technique est également d'un grand secours en chirurgie chez les grands malades.

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