PARENTERAL NUTRITION AND INTRAVENOUS FLUID THERAPY

THESIS

SUBMITTED FOR THE PARTIAL FULFILMENT OF THE MASTER DEGREE OF ANAESTHESIOLOGY.

By

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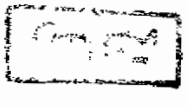

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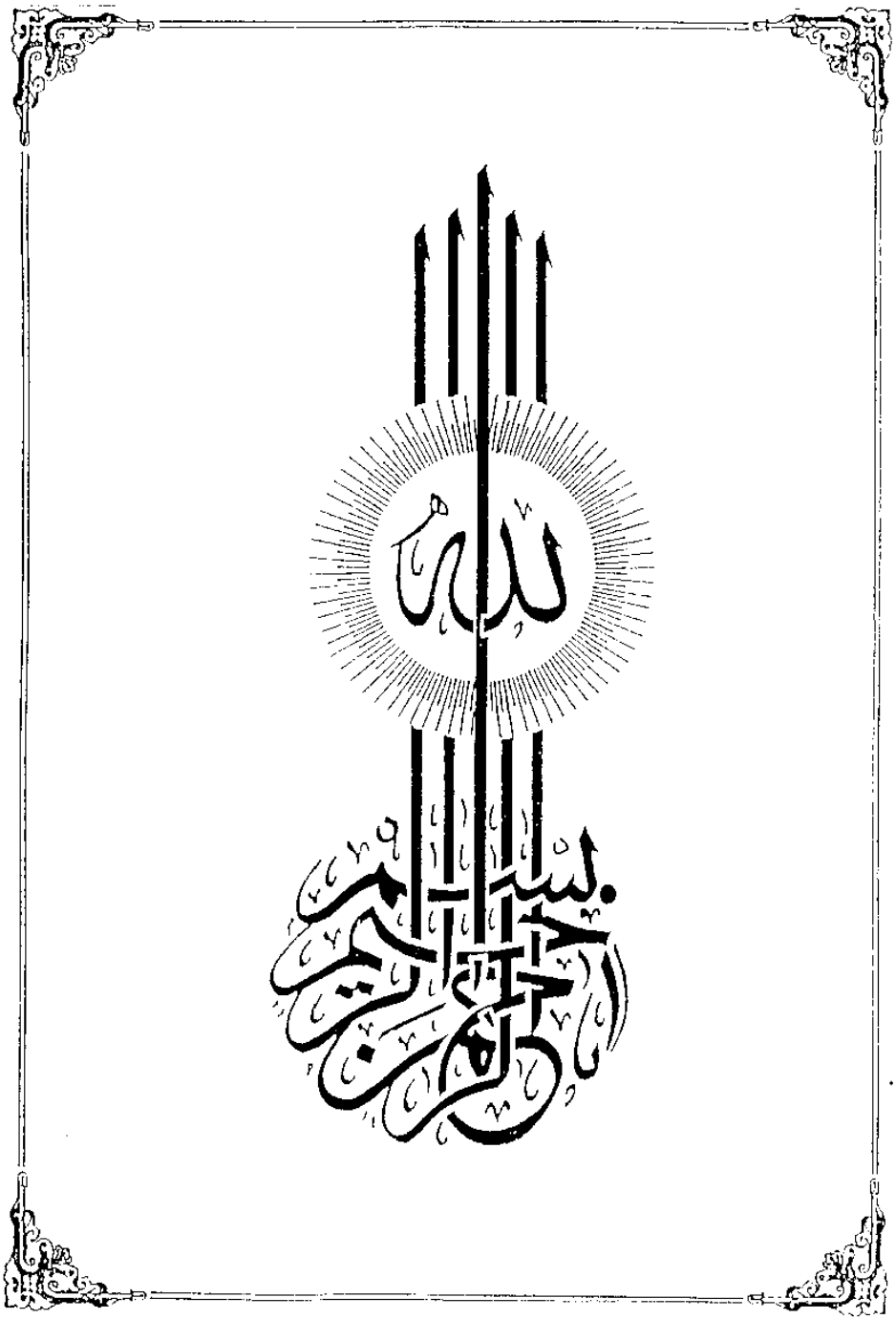
C O N T E N T S



A C K N O W L E D G E M E N T

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I WISH TO EXPRESS MY DEEPEST THANKS AND MOST SINCRERE GRATITUDE TO ALL THOSE WHO, THROUGH THEIR HELP, CO-OPERATION, GUIDANCE AND INVALUABLE ADVICES MADE IT POSSIBLE FOR THIS THESIS TO SEE LIGHT.

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I ALSO WISH TO RECORD MY SINCERS INDEBTEDNESS TO PROFESSOR DR. KADRY THE MASTER OF OUR DEPARTMENT AND ALL THE MEMBERS OF OUR DEPARTMENT, FOR HELPING ME GREATLY IN COMPILING AND PREPARING MY THESIS.

INTRODUCTION

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Meals are normally taken intermittently and because of the time required for digestion and resporption, such an intake of food results in a relatively continuous supply of amino-acids, fat and carbohydrates to the blood stream.

In certain pathological conditions appetite may diminshed as well normal intake of foods may be interfered whilst at the same time there is an increased need to rebuild body tissues affected by the disease itself.

These two factors combine to deplete body stores of nutrients and a method must be done to prevent such phenomenon.

Also with the development of work in intensive care unit where some patient may remain for several days without any fluid or food intake orally.

All these factors and conditions, lead to the development of state of parentral nutrition and the fluid intake by other means than the normal oral route.

These include all types of nutrients and electrolytes and fluid.

So the purpose of parentral nutrition is to replace wholly or partially oral intake of food and to maintian the composition of the body tissues.

The main part of any organism is built up of oxygen, carbon, hydrogen and nitrogen. These elements are present in man in the form of water protein, fat, and carbohydrate in a constant ratio (TABE 1).

All these factors were found to be in continous dynamic replacement and movement with frequent processes of anabolism and catabolism and on the other hand the balance of anabolism and catabolism was found to be disturbed as in mal-nutrition and catabolism (TABLE 2).

In such conditions the intake must be done to compensate for the loss and defficiency.

N X 6 X 4

ELEMENT	KG	BASAL
PROTEIN	11,5	70KG
FAT	10,5	MAIN
CARBOHYDRATE	0,4	
WATER	43KG	

TABLE 1 AMOUNT OF DIFFERENT ELEMENTS IN HUMAN (REID DJ.1967)

CONDITION	AVERAGE N LOSS PER DAY
BURN	31 GN
BLEEDING PEPTIC ULCER	18
LONG BONE FRACTURE	14
PNEUMONECTOMY	21-108
LARGE BODY SURFACE op	14-42
RADICAL MASTECTOMY	15-32
THYRIODECTOMY	3-24
CHOLECYSTECTOMY	11-38
GASTRIC OPERATIONS	3-24

TABEL 2 : NITROGEN LOSSES IN SOME PATHOLOGICAL CONDITIONS (RHOAD'S 1952)

The stores of different nutrients suffice for varying lengths of time in the starving state.

In particular the reserves of free amino-acids and carbohydrates are small (TABLE 3).

As the amount of free amino-acids corresponds only a few hours consuption and this result in a rapid breakdown of protein in order to maintain the pool of free amino-acids.

It has been known for a long time that malnutrition results in a number of consequences and complications such as, increase susceptability to infection, hypoproteinaemia which causes oedema and poor wound healing, muscular atrophy,anaemia and apathy, paralytic ileus, peritonitis.

The consequences of starvation and malnutrition may not be as dramatic as acute disturbances of fluid and electrolyte balance which is rapidly manifested but once these consequences are manifest, they are often difficult to remedy and for this reason the old adage " Prevention is better than cure" is true.

In adequate nutrition is common in the pre-operative perio In many cases the poor nutritional state will not be obvious until after surgery (Löfström 1975)

An uncomplicated post-operative course means earlier dischar of patient from the hospital, so there are strong medical and economic reasons in favour of intensive intra-venous feeding is cases where adequate amounts of foods cannot be taken orall

NITRIENT	TIME OF RESERVE
AMINO ACIDS	2-4 HOURS
CARBOHYDRATES	13 HOUSE
FAT (12% OF BODY WEIGHT)	27 DAYS
THIAMINE	30-60 DAYS
ASCORBIC ACID	60-120 DAYS
NIACIN	60-180DAYS
RIBOFLAVIN	60-180DAYS
VITAMIN A	90-365 DAYS
IRON WOMEN (CHILD BEARING AGE)	125 DAYS
IRON MEN	750 DAYS
IODIN	1000 DAYS

TABLE 3 ; PERIODS OF WHICH RESERVES OF VARIOUS NUTRIENTS WILL LAST AFTER STARVATION IN MAN(AFTER BRIKEETAL. 1968)

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P H S I O L O G Y

PHYSIOLOGICAL ASPECTS

Before discusion of parentral nutrition we must review in short the metabolic processes of the human body,both at normal condition and deffeciency these include :-

I - Water and Electrolytes

II - Protein Metabolism.

III - Fat Metabolism.

IV - Carbohydrate Metabolism.

I - WATER AND ELECTROLYTES

The body water constitutes about 60% of the normal body weight. Our understanding of body composition and alterations in disease states has been aided greatly by dilution techniques using radio-active isotopes.

Other experimental techniques have been developed which measure interstitial and intra-cellular constituents invivo.

Direct measurements of total body water have been done with dilution techniques utilizing heavy water and various tracer substances when any of these substances are injected, they diffuse rapidly throughout the body and across all membranes, establishing equilibrium within two to three(2:3) hours.

The measuring of the resultant concentration alows calculation of the total volume of distribution,in this case total body water equales :-

$$\text{Total Body Water} = \frac{\text{INJECTATE COUNTS X INJECTATE VOLUME}}{\text{FINAL COUNTS}}$$

The body water is distributed between two compartements the intracellular and extracellular compartements. The intracellular compartements is twice the size of extra-cellular.

So in a man 80 KGM body weight the picture will be:-
80 KGM body weight
48 Litres total body water
32 Litres intra-cellular compartement
16 Litres extracellular compartement
3-3,5 litres plasma of extracellular.
12-13 Litres interstitial fluid from extra-cellula part.

So by this results we can calcuate rapidly the volume of adult plasma by estimating the plasma volume as 4% of the ideal body weight.

Intravascular fluid exchanges across capillary walls with the interstitial fluid. The delivery or removal of meta-bolic products from intracellular space is based on a bi-directional transfer of constituents across the inter-stitial space between the intracellular fluid and intravas-cular fluid.

adult about 4000-4200 mEq - of which 50 % is extracellular, 40% in the bone and only 10% intracellular.

Total body potassium on the other hand found to be about 3200 mEq, 98% of which intracellular and only 2% extracellular. chloride is the principal extracellular anion with concentration 103 mEq./litre while phosphate is the most intracellular cations (140 mEq./litre) intracellular chloride and extracellula phoshates both measure approximately 2 mEq./litre.

Bicarbonate is the other major extracellular anion and is equally distributed between intracellular and extracellular fluid and is freely exchangeable (TABLE 4).

As we seen in table (4),such differences in transcellular ionic gradients are present even though the all membranes are freely permeable to these ions. This active ionic transport against concentration gradients exists which requires some form of energy to drive the pump mechanism to maintain ionic gradients. Sodium is pumped out of the cell to which leaks in by passive diffusion. This outward pumping of sodium is linked to the inward pumping of potassium.
The maintenace of ionic gradients by energy dependent pumps is vital for the normal metabolic functions of the cell. Cellular function is impaired when the pumping mechanism is inhibited, such as hypoxia and hypothermia(shock).

Regulation of fluid exchange :-

Even though the extracellular fluid and intarcellular fluid differ substantially in electrolyte concentration,the concentration of the osmotically active particles is roughly equal between the two compartements,and any change in the osmolarity in one chamber will be reflected on the other.

The osmotic concentration is expressed in terms of osmolarity i.e. The number of osmotically active particles per litre of solution and the osmotic effect in the same time depend on the number of particles not on their charge or their valence.
so the plasma proteins,although they are large molecules

BODY COMPOSITION

TABLE 4

MATERIAL	ELEMENT SUBDIVISION	%
WATER	EXTRACELLULAR	20-25 %
60%	INTRAVASCULAR	4- 5 %
	INTERSTITIAL	16-20 %
	INTRACELLULAR	40%
SODIUM	4000-4200 mEq.	
	EXTRACELLULAR	50 %
	INTRACELLULAR	10 %
	BONE	40 %
POTASSIUM	3200 mEq.	
	EXTRACELLULAR	2 %
	INTRACELLULAR	98 %
CHLORIDE	2000 mEq.	
	EXTRACELLULAR	99%
	INTRACELLULAR	1%
PHOSPHATE	3000 mEq.	
	EXTRACELLULAR	1%
	INTRACELLULAR	99%