TITLE

BLOOD SUGAR LEVELS IN STARVED IN-PATIENT CHILDREN COMING FOR ELECTIVE SURGERY AS COMPARED TO NON-STARVED IN-PATIENTS AT THE KENYATTA NATIONAL HOSPITAL.

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A DISSERTATION SUBMITTED IN PART - FULFILMENT FOR THE DEGREE OF MASTER OF MEDICINE (ANAESTHESIA), UNIVERSITY OF NAIROBI.

CONTENTS

DECLARATION

This dissertation is my original work and has not, to my knowledge, been presented for a degree in any other University.

JAGDISH BACHUBHAI SONIGRA (M.B.Ch.B)

This dissertation has been submitted for examination with my approval.

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SUMMARY

A prospective study was carried out at Kenyatta National Hospital to determine the blood sugar levels in two groups of children - one starved and coming for surgery and the other group not starved. Both groups consisted of in-patient children ranging from half to ten years age. The aim of the study was to determine whether there was a statistical significance between the two groups and to determine the correlation between the length of fast and the blood glucose levels.

The first group (starved children) consisted of one hundred and ten inpatients of which males were seventy five i.e. 68.3% and females were thirty five i.e. 31.7%. The average age of the children in this group was 5.9 ± 2.9 years and ranged from six months to ten years. These patients were all starved from the last hospital meal, at around 6 p.m. in the evening, except for a few very small children who were fed at around midnight. The mean length of fast in this group was 16.7 ± 3.0 hours and ranged from 9.7 to 22.8 hours. Premedication was the same for all patients in this group being Atropine 0.01mg/kg body weight and pethidine 1.0 - 1.5 mg/kg body weight. The blood samples were taken immediately after an inhalation induction with nitrous oxide (67%) oxygen (33%) and halothane (0-3%) before intubation or any surgical stimulus. The mean blood glucose level in this group was 3.3 ± 0.35 mmol/l and ranged from 2.4 - 4.4 mmol/l.

The second group (non starved) was the control group and consisted of

inpatients who were for surgery, but not on the day of sampling and had hence had their morning breakfast - at approximately 6 a.m. This group consisted of eighty five patients of which males were 50 (58.8%) and females were 35(41.2%) The average age was 7.6 years and ranged from 2.3 to 10 years. The mean length of fast was 1.8 $\pm$ 1.1 hours and ranged from 0.3 to 3.8 hours. The samples were taken from willing patients and the average blood sugar level was 5.2 $\pm$ 0.5 mmol/l and ranged from 3.6 to 6.3 mmol/l. It was found that none of the patients in either group was hypoglycemic, although some of the children in the study group had very low blood sugar levels.

One patient was discovered to be an undiagnosed diabetic with a fasting blood sugar of 20.8 mmol/l which was reconfirmed. This patient was not included in the study and the information conveyed to the relevant ward.

The study showed that 38.2% of the patients in the study group had a value corresponding to the mean sugar level vaule, whereas in the control group, it was 40.0% of the patients with the mean value.

The study also showed that as whereas 37 (33.7% of the patients in the first group had blood sugar levels of less than 3.3 mmol/l no patients in the second group had a blood sugar level of less than 3.6 mmol/l.

Out of the 37 children in the first greoup, 28 (25.5%) were males and the remaining 9 (8.2%) females. It was also found that 3 (2.7%) of the patients had a blood sugar level of less than 2.8 mmol/l out of which 2 (18%) were mal and 1 (0.99%) was a female.

The difference between the mean glucose levels of both groups was found to be statistically significant ($P < 0.01$) and that there was no correlation between the length of the fast and the blood sugar level.

Hypoglycemia in this study, as well as in others was definded as a blood sugar level of less than 2.2 mmol/l (40mg/dl).

It is recommended that patients should not be given a feed for 6 hours pre-operatively and clear liquids for 4 hours pre-operatively and that intra-venous fluids should be continued post-operatively to correct fluid deficits till the patient is fully awake and feeding orally.

INTRODUCTION

Since the risks of vomiting and inhalation of gastric contents are inherent in anaesthesia, established practice is that all patients for elective surgery, whether adults or children, should undergo a period of fasting and fluid deprivation (1). This is more so as out patient surgery becomes increasingly popular. The period of fast varies from six to twelve hours and even more depending on the institution, and except for special circumstances, there is no parenteral replacement of fluid or energy. There exists the possibility of hypoglycemia occurring in such patients.

In studies of prolonged starvation, it was found that adults were able to sustain normal blood glucose levels (2). In paediatric practice it has been suggested that in some patients the period of starvation pre-operatively may be excessive and may result in hypoglycemia (3,4) . Studies done to analyse the effects of pre-operative starvation on blood glucose levels in children have produced apparently conflicting results(1,5,6,7). The risk of hypoglycemia from prolonged pre-operative starvation was studied by Thomas in 1974 (5) who analysed blood glucose concentration on induction of anaesthesia in two groups of children. He found that five out of eighteen in patients aged less than four years were hypoglycemic after fasting for eight to ten hours from 0600 hours. On the basis of his study, he introduced feeding regimes in which children under four years received milk or fruit syrup four to six hours before operation (Table 24).

In apparent contradiction another study done at the same institution by Graham1979 (6) was unable to demonstrate hypoglycemia in any of the thirty one patients undergoing out patient surgery with a minimum of eight hours fast and aged less than five years.

This led to suggestions that perhaps in-patients differed from outpatients with regard to glucose homeostasis or that an overnight fast might be better tolerated than one undertaken during the day. The first of these hypotheses was examined by Jensen et al (1) who compared pre-operative glucose levels in anaesthetised children aged between six months and nine years undergoing inpatient and outpatient surgery in the morning. They found no difference in the blood glucose levels between inpatients and outpatients and between starved children and those fed on fruit water and syrup with invertose twenty grammes percent. Out of the ninety two patients in this study, only one was found to be hypoglycemic after an overnight fast. In the studies undertaken (1,6,7) no correlation between the duration of fast and the blood sug level was found.

At Kenyatta National Hospital (KNH) all inpatient children who are for elective surgery are not fed anything after the last hospital meal on the night before surgery. The last hospital meal is at about 6.00 pm in the evening. The only exception are the neonates and infants who receive a feed at around midnight and then nothing more till the time of surgery.

In the case of outpatients for day case surgery, their parents are instructed not to feed them after supper the previous night (not to be later than 9.00 pm.). The number of children coming for outpatient surgery is very small compared to the children coming for inpatient surgery, for a number of reasons. The surgical lists in which children are operated upon at K.N.H. are mostly full day lists starting in the morning and continuing through lunch hour till late afternoon. There is no specific protocol about which child will be operated upon at what time for a number of reasons. Thus the fast is a continuous one for the children whether they are operated upon in the morning or afternoon with all of them undergoing a minimum of an overnight fast. The purpose of this study was to determine whether there was a significant difference between the two groups of children, one starved and the other unstarved, whether there was a correlation between the length of the fast and the blood glucose levels and to make any such recommendations as deemed necessary.

AIMS AND OBJECTIVES

The purpose of this study undertaken at K.N.H. was

1. To study the relationship between the length of fast and blood glucose levels in children coming for elective surgery.
2. To determine the statistical significance between the blood glucose levels of starved and unstarved children.
3. To make any such recommendation as needed to make if any changes in current management of such patients.

MATERIALS AND METHODS

Two groups of healthy children aged between half (6 months) to ten years were studied, all of them being inpatients admitted for elective surgery.

STUDY GROUP

The first group consisted of one hundred and ten children who were fasted overnight after the last hospital meal at around 6 p.m. Information about the last meal was collected from the parents. None of them came to the operating room with any intra-venous (i.v.) lines and fluids.

CONTROL GROUP

This consisted of eighty five inpatients who were awaiting surgery but not on the day of blood sampling. Hence they were not fasted and had taken their morning breakfast.

ANAESTHESIA

All the children in the study group were premedicated with Atropine 0.01mg/kg body weight and pethidine 1-1.5 mg/kg body weight. Induction was standard in them all with nitrous oxide (67%) oxygen (33%) and halothane (0-3%) inhalation technique. This was not so in the control group.

BLOOD SUGAR MEASUREMENTS

In the study group all blood samples were taken immediately after induction (disappearance of the eye lash reflex) and before any surgical stress or intubation was carried out.

A blood sample of two millilitres was taken after venepuncture and put in a fluoride bottle. The sample was analysed within two hours by the glucose oxidase method which has an accuracy of ± 5% of the result.

In the control group which consisted of all volunteers, a blood sample of two millilitres (2mls) after venepuncture was collected in fluoride bottles and analysed within two hours by the same method.

In both groups the veins for venepuncture were those of the forearm and the cubital fossa, except for four patients in the study group who needed to have femoral taps for sampling. Statistical differences were compared using Students t-test.

RESULTS

The results were divided into the various parameters investigated

1. SEX

A total of 195 children (all inpatients) were studied and divided into two groups:- - the first group comprising of 110 inpatients and

- the second group comprising of 85 inpatients.

Tables 1 and 2 show the sex distribution of patients in each group and in the first study group, 75 patients (68.3%) were males and 35 patients (31.7%) were females. The corresponding figures in the second (control) group were 50 males (58.8%) and 35 (41.2%) females.

2. AGE

The ages of the children in both groups were comparable and the patient distribution according to age is shown in Tables 3 & 4 and by histograms in Tables 5 & 6.

It was found that the largest number of children in each group fell in the age group of 9 - 10 years i.e. older than 9 years and upto 10. In the study group, this age group consisited of 23 patients (20.9%) while in the control group, it was 28 patients (32.9%). The study group had 11 patients (10%) in the 8 - 9 year age group while the control study had 16 patients (18.8%) Therefore , while the study group had a total of 34 patients (30.9%) in the age range of 8-10 years the control study had a total of 44 patients (51.7%) in the same age range. In other words, while the study group had slightly less than one third (1/3) of its patients in the 2 oldest age groups, the control group had more than a half (1/2) of its patients in the same group. The sex distribution of the patients accordiing to the age group is shown in Tables 7 and 8. The mean age of the children in the study group was 5.8 years in the study group and 7-6 years in the control group with ranges of 1/2 to 10 years and 2.3 to 10 years respectively for each group.

3 STARVATION TIME

Tables 11 and 12 show the patient distribution according to the duration of fast for the study and control groups respectively whereas Tables 13 and 14 show the sex distributuion for the duration of the fast.

The mean duration of fast for thestudy group was 16.7 hours and ranged from 9.7 to 22.8 hours. For the control group the mean was 1.8 hours with a range of 0.3 to 3.8 hours (Tables 15 & 16) They showed that despite a wide range of the fast length in the study group, 50 patients (45.4%) that is nearly half of them, fell in a 3 hour range from 15 - 18 hours. They (the tables) also showed that while only 15 patients (13.6%) in the study group were in the fasting length of 16 - 17 hours (i.e. the mean fast group) in the control study it was 34 patients (40.0%) in its mean fast group - 1-2 hours.

4. BLOOD GLUCOSE LEVEL

The blood glucose levels of the children in both groups are shown in Tables 17, 18, 19 and 20. The mean glucose level in the study group was 3.3 mmol/l and and ranged from 2.4 to 4.4 mmol/l while in the control group the mean glucose level was 5.2 mmol/l and ranged from 3.6 to 6.2 mmol/l (Tables 21 and 22). The difference in the mean blood glucose level in both groups was found to be statistically significant by Students t-test ($p<0.01$). Despite the wide range in the glucose levels in each group, 2.0 mmol/l in the study group and 2.6 mmol/l in the control group it was found that 90 patients (81.8%) in the study group fell in the range of 3.3 $\pm$ 0.2 mmol/l i.e. range of 3.1 to 3.5 mmol/l. In the control group, the corresponding figures were 67 patients (78.8%) within the range of 5.2 $\pm$ 0.2 mmol/l i.e. 5.0 to 5.4 mmol/l. Hence despite the wide range in glucose levels, the majority of the patients in each group had glucose levels close around the mean values for each group. One child was found to be an unknown diabetic with a blood sugar level of 20.8 mmol/l which was reconfirmed and the patient was not included in the study. The results were conveyed to the relevant ward.

The study group had 42 patients (38.2%) with the same glucose level as the mean (3.3 mmol/l) with 37 patients (33.6%) having less than 3.3mmol/l. The remaining 31 patients (28.2%) in this group had levels of more than 3.3 mmol/l.

The control group had 34 patients (40.0%) with the same blood glucose level as the mean value for that group (5.2mmol/l) while 25 patients (29.4%) had glucose levels of less than 5.2 mmol/l and the remaining 26 patients (30.6% with more than 5.2 mmol/l.

The study also showed that whereas 37 patients (33.6%) had a sugar level of less than 3.3 mmol/l in the study group, no patient in the control group had a glucose level of less than 3.3 mmol/l (the lowest being 3.6 mmol/l). Out of these 37 patients, 28 (25.5%) were males and 9(8.2%) were females (Table 23). The table also showed that 3 patients (2.7%) in the study group had glucose levels of less than 2.8mmol/l (50mg/dl) out of which 2 (1.8%) wee males and 1 (0.9%) was a female.

Hypoglycemia was defined as a blood sugar level of less than 2.2 mmol/l (40 mg/dl) and none of the patients in either group was hypoglycemic - the lowest level recorded being 2.4 mmol/l in the study group.

No correlation was found between the duration of the fast and the blood glucose levels which was in keeping with other studies (1,5,6,7,32)

All the children with blood glucose levels of less than 2.8 mmol/l were less than 4 years age and out of the 37 patientd with levels of less than 3.3mmol/l 28 patients were aged less than four years.

If however a hypoglycemic child is subjected to periods of hypoxia, hypertension and acidaemia brain damage is possible in that child (21,24,25). Hypoglycemia is provoked by fasting although it is not an inevitable consequence of withholding food (5). The body conserves glucose by a decrease in the concentration of circulating insulin and an increase in the concentration of circulating Growth Hormone. (Glick et al 1965) (26). In contradiction Whichelow et al (27) found no difference in the insulin levels in fasting morning and afternoon groups. He also found that insulin levels after intra-venous glucose therapy were lower in the afternoon group than morning group. Moreover, there is evidence of increased resistance to the peripheral effects of insulin in the afternoon (28). The concentrations of circulating Growth hormone, glucagon, cortisol, adrenalin and to a lesser degree oestrogens, are increased by a reduction in the blood glucose levels to hypoglycemic ones (9,29,30,31). The effects of the various factors involved is illustrated

in Figure 1 (31). Diurnal variation in the level of circulating cortisol provides a possible explanation for higher blood glucose levels in the morning (7,9). The plasma concentration of cortisol is higher in the morning and it produces a hyperglycemic effect by increasing the activity of the enzyme Hepatic G-6-phosphatase and possibly by slowing intra-cellular phosphorylation of glucose (7,8,9).

Various studies done on blood glucose concentrations after induction have produced apparently conflicting results with the incidence of hypoglycemia ranging from 10% to 29% depending on which definition was taken(5,6,33,34). In the present study, the mean blood glucose level was significantly lower in the starved group than in the unstarved group though not a single patient was hypoglycemic by the accepted definition. The lowest blood sugar level recorded was 2.4 mmol/l (43mg/dl) with the mean being 3.3 ± 0.35 mmol/l (59.4 ± 6.3 mg/dl). This mean value was found to be higher than the mean in Thomas' Study (5). This lack of hypoglycemia was in keeping with other studies which compared morning and afternoon groups in which the morning group had undergone an overnight fast like in the present study (1,6,7). The children were scheduled for various kinds of surgery.

In contrast, Thomas (5) in his study in 1974 found a mean blood glucose level of 2.6 ± 0.92 mmol/l (46.4 ±16.5 mg/dl) and that 28% of the patients in the study were hypoglycemic. The children in his study were all for correction if strabismus and were for surgery in the afternoon.

Graham in 1979 (6) on the other hand did not get any hypoglycemic child, though 13% of his children had blood glucose levels of less than 3.3 mmol/l (60mg/dl). He obtained a mean glucose level of 4.7 ±1.15 mmol/l (84.6 ± 20.7 mg/dl). He postulated that an extention of an overnight fast is better tolerated than an extension of the fast between breakfast and lunch. Graham's study included patients for a variety of minor surgical procedures and was done in the morning group who were fasted overnight.

Bevan and Burn (34) studying a mixed group of patients found that out of 39 patients aged less than 5 years only one had a blood glucose concentration of less than 2.8mmol/l while 30% of the patients had a level of less than 3.3 mmol/l.

Jensen (1), in his study had patients who were anaesthetised in the morning (like Graham's) and he found that only one patient was hypoglycemic and he obtained a mean glucose level of more than 70mg/dl (3.9mmol/l) in all his various groups. This was in agreement with Graham's study but he also found no differences in the mean glucose levels between inpatients and out patients (which was not studied in this project). Again, the patients were all for minor surgery. After Thomas advocated feeding regimes for pre-operative children to reduce hypoglycemia, Ibrahim and Fry (35), investigated two groups of patients for elective surgery. One group was starved overnight whereas the other group received maltose syrup. (125 millilitres for the under 2 year age group and 250 millilitres for the older children) which was given two hours pre-operatively with an injection of metoclopramide intra-muscularly to hasten absorption. They found no significant difference in blood glucose levels in either group at induction though the post operative blood glucose level was significantly higher than the induction glucose level in the maltose fed group. In the starved group there was no such significant increase in the post operative glucose level. Redfern et al (7) found in their study that the afternoon groups had a lower sugar level than the morning group 4.4 $\pm$ 0.13 mmol/l and 4.8 $\pm$ 0.12 mmol/l respectively being the mean glucose levels for both groups). The morning group were fasted overnight like in the present study. Minor surgical cases only were taken.

PREMEDICATIONS

Different kinds of premedications have been used in different studies. In the present study, premedication was with atropine 0.01 to 0.02 milligrammes per kilogram of body weight (mg/kg body weight.) Redfern et al (7) in their study investigated patients who had received no premedication, Temazepam or Trimeprazine syrups 1 to 2 hours pre-operatively and they found that the afternoon group patients who had received Temazepam had significantly higher blood sugar levels than the non-premedicated group. Temazepam syrup (dose 1mg/kg body weight) contains 36.4 calories in 5 millilitres of the syrup. Temazepam premedicated children also had higher glucose values than trimeprazine group (dose 3mg/kg body weight) Trimeprazine syrup contains only 11.4 calories in 5 millilitres of the syrup.

Thomas' group had also received trimeprazine as premedication whereas Graham s group received only atropine, atropine and morphine or atropine and pethidine. Except for the two syrups, the other drugs have no effect on blood sugar level either in calorific value or in mobilising glucose.

INDUCTION

The other factor to be considered is the different induction techniques used. In the present study, all the patients were induced with nitrous oxide, oxygen and halothane. Halothane is known to increase the sensitivity to insulin but does not affect the blood sugar (4). Thomas induced his patients with Thiopentone (4mg/kg body weight) and pancuronium (0.13 mg kg/body weight). Graham used Thiopentone (4mg/kg body weight) and suxamethonium (1mg/kg body weight) or pancuronium (0.125 mg /kg body weight or tubo-curnarine (0.75 mg/kg body weight). Redfern induced with Thiopentone (4.8 mg/kg body weight) and suxamethonium 1mg/kg body weight). As seen the same barbiturate with a different muscle relaxant (of both depolarising and non-depolarising group) was used. The effect of the different neuromuscular agents could be of relevance, especially if suxamethonium was used as the blood draining a recently exercised large muscle mass (after suxamethonium induced fasciculations) should have a lower glucose concentration in it (6).

SAMPLING

The other parameter which could be of relevance is the different sampling site. In the present study, all samples of blood were venous with the majority being from the veins in the dorsum of the hand and the cubital fossa. Three of the patients needed to have femoral taps for sampling. As suxamethonium was not used in the present study, the glucose level should not be expected to be different from the different sites but if like in Graham's study, suxamethonium was used, then one would have expected that the femoral veins to have the lowest glucose levels. Thomas used the long saphenous vein for his blood samples. Graham used arterialised capillary samples in three of his patients and all of Bevan & Burns (34) 39 patients had arterialised capillary samples taken. Based on prolonged starvation studies in children by Chaussain (36), he found that the capillary sugar level was significantly reduced after fasting for 8 hours. Chaussain and colleagues (1974) (37) also reported blood glucose concentrations which were significantlyreduced after 24 hours starvation. The other studies did not report the site of blood sampling.

ANALYSIS

In the present study, the samples were analysed by the glucose oxidase method, while different methods have also been used. Thomas had his samples analysed by autoanalysis (38) with an accuracy of ± 0.05. Graham also analysed his samples with the same method as Thomas (of Morley, Dawson and Marks) (15,38). Redfern et al analysed their samples with the Trinder method (39), Jensen used the 0- toluidine method (40). Ibrahim and Fry used a modified Trinders method by autoanalysis. Hence different methods have been used with possibly differing degrees of accuracy and the other factor would be ther personnel who performed it. No follow up was done in this study to analyse the stress of surgery on the post operative glucose levels which has been done in other studies and found to be approximately 1mmol/l higher than induction levels (7,35,41). The present study, in agreement with other studies (6,7,33,42) found no correlation between the blood glucose levels and the length of the fast. The present study has not attempted to compare the relationship between weight and glucose levels. This has been a problem with other

studies (18,41,43) in which a large number of infants and children below norma
weight

have been included.While the other studies may indicate that the very young and/or underweight are at an increased risk of developing hypoglycemia follwing routine pre-operative fasting, they do not reflect the incidence of hypoglycemia in normal preschool children. The present study must have invariably included some underweight children, hence presenting a bias and it was also found that all the children with blood sugar level of less than 2.8mmol/l were less than four years of age and 28 patients out of 37 with blood sugar levels of less than 3.3 mmol/l were under 4 years age. Hence it appears that the very young children are at a higher risk of developing very low sugar levels bordering on hypoglycemia. In view of the high incidence of hypoglycemia in his study, Thomas advocated that milk feeds be given 4 hours pre-operatively and this appreared to be justified by the very small amounts of residual gastric contents thus reducing the risk of aspiration. However, the gastric emptying time can be increased upto 12 hours under fear and emotional stress (44,45). It was to increase the gastric emptying that prompted Ibrahim and Fry to use intra muscular metoclopramide (35,46).

SUMMARY

Therefore in summary:-

The present study showed a significant difference in the blood glucose levels between inpatient children fasted overnight for elective surgery and between unfasted children though not a single case of hypoglycemia was encountered -hypoglycemia being defined as a blood glucose level of less than 2.2 mmol/l (40mg/dl). The study, like others, also showed no correlation between the length of fasting and the blood sugar level though it revealed that the mean length of fast was very long (16.7 hours) the maximim being nearly 23 hours. Despite the wide range of blood glucose levels in both groups, the majority of the patients fell in around the mean values for each group though 1 patient had a glucose level of 2.4 mmol/l in the starved group. It was also apparent that the younger children were at a higher risk of developing low glucose levels bordering on hypoglycemia, though in general, overall fasting was well tolerated. The one child who was found to be an unknown diabetic was not included in this study.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study did not show any incidence of hypoglycemia in starved pre-operative children, although low values of glucose levels and high hours of fasting were observed.

In general, it appears that starvation is well tolerated in healthy children and precautions against hypoglycemia, like a feed pre-operatively, is unnecessary.

Added to this, there is always the risk of aspirating the residual volume of feed in the stomach with the risk of pulmonary complications.

On the other hand it has been confirmed that children fed 6 hours pre-operatively have a higher blood glucose concentration (1,3,4,5). There is also the possibility of brain damage occurring in a child who has undergone physiological stress-hypoxia, hypertension and acidosis (24).

What is accepted is that patients who have been starved are in a fluid deficit whether hypoglycemic or not. This deficit can be a significant one if the starvation period is very long, which is often the case (6).

It would therefore seem appropriate from the point of view of patient comfort and hydration to keep the duration of pre-operative starvation to a minimum (7), but the difficulty of formulating simple yet safe feeding instructions is formidable (6), as patient communication can be difficult (47).

Fry and Ibrahim have recommended a maltose sweetened drink to be given two hours pre-operatively with an injection of metoclopromide intra muscularly to hasten absorption.

Redfern et al. in their institution recommends not giving food for six hours pre-operatively and encourage clear fluids for upto 4 hours pre-operatively. An intra-venous infusion of fluids would be highly recommended in children as this not only helps to reduce hypoglycemia, but also goes a long way in preventing fluid deficit. The other advantage would be the reduction in the risk of aspiration of gastric contents after a feed. The major drawback would be the insertion of intra-venous Cannulae's which could be difficult in the smaller children. It is therefore recommended that patients for elective surgery should not be given a feed for 6 hours pre-operatively and clear liquids for *4 hours pre-operatively. The anaesthetist should be aware of the* possible risk of vomiting in such a patient and take suitable measures against it.

The second recommendation would be to continue with intra-venous fluid therapy till the fluid deficit is corrected and the patient is fully awake.

TABLE 1- SEX DISTRIBUTION-
STUDY GROUP

SEX	NO.OF PATIENTS	%
MALES	75	68.2
FEMALES	35	31.8
TOTAL	110	100

TABLE 2-SEX DISTRIBUTION-
CONTROL GROUP

SEX	NO. OF PATIENTS	%
MALES	50	58.8
FEMALES	35	41.2
TOTAL	85	100

TABLE 3-AGE DISTRIBUTION-
STUDY GROUP

AGE (YEARS)	NUMBER	%
0-1	6	5.5%
1-2	7	6.4%
2-3	11	10.0%
3-4	8	7.3%
4-5	11	10.0%
5-6	13	11.8%
6-7	8	7.3%
7-8	12	10.9%
8-9	11	10.0%
9-10	23	20.9%
TOTAL	110	100%

TABLE 4-AGE DISTRIBUTION-
CONTROL GROUP

AGE (YEARS)	NUMBER	%
0-1	0	0%
1-2	0	0%
2-3	2	2.4%
3-4	2	2.4%
4-5	5	5.9%
5-6	8	9.4%
6-7	11	12.9%
7-8	13	15.3%
8-9	16	18.8%
9-10	28	32.9%
TOTAL	85	100%

TABLE 5 - HISTOGRAM OF PATIENT DISTRIBUTION TO AGE GROUP - STUDY GROUP

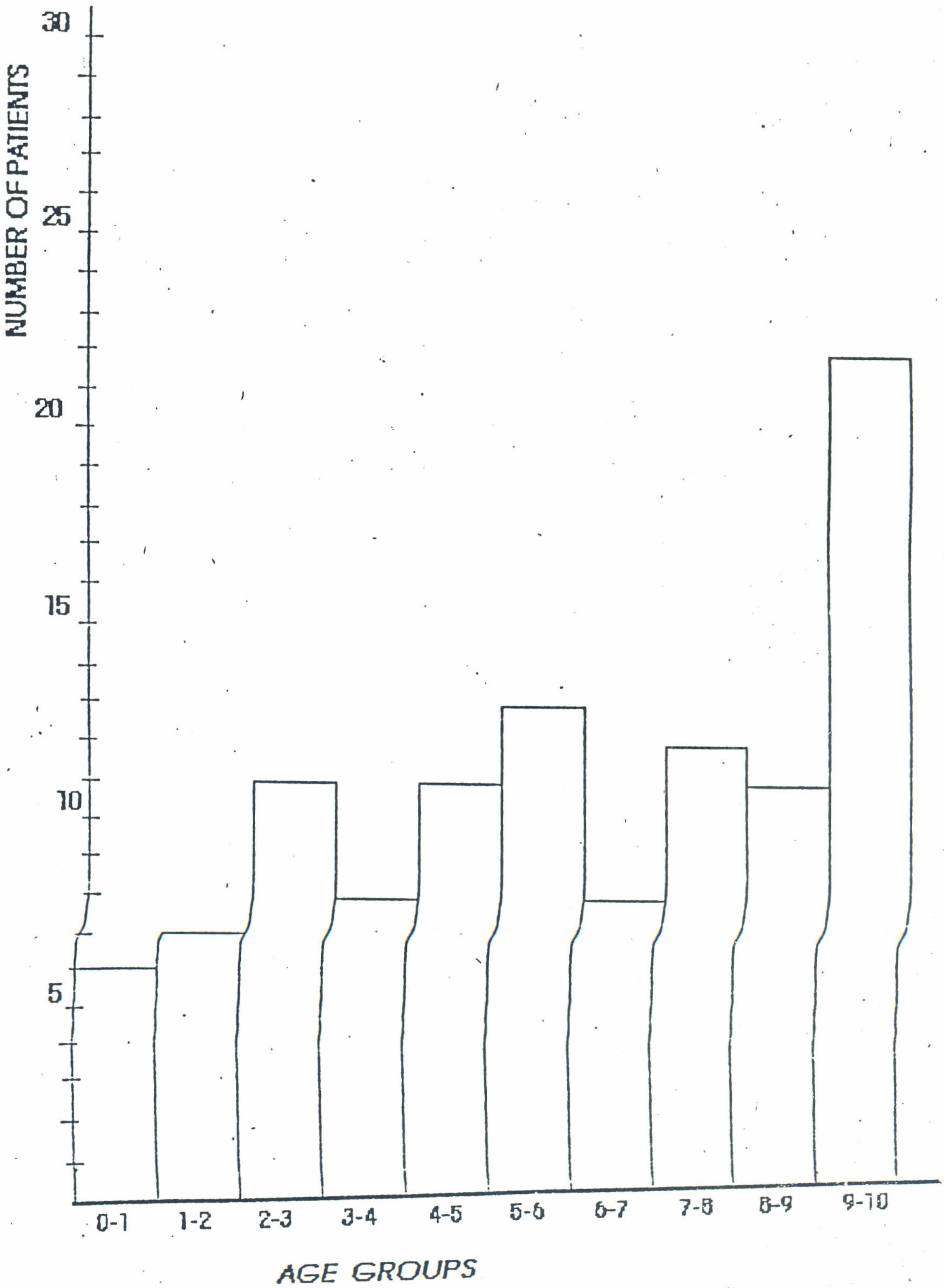

TABLE 6 - HISTOGRAM OF PATIENT DISTRIBUTION TO AGE GROUP - CONTROL GROUP

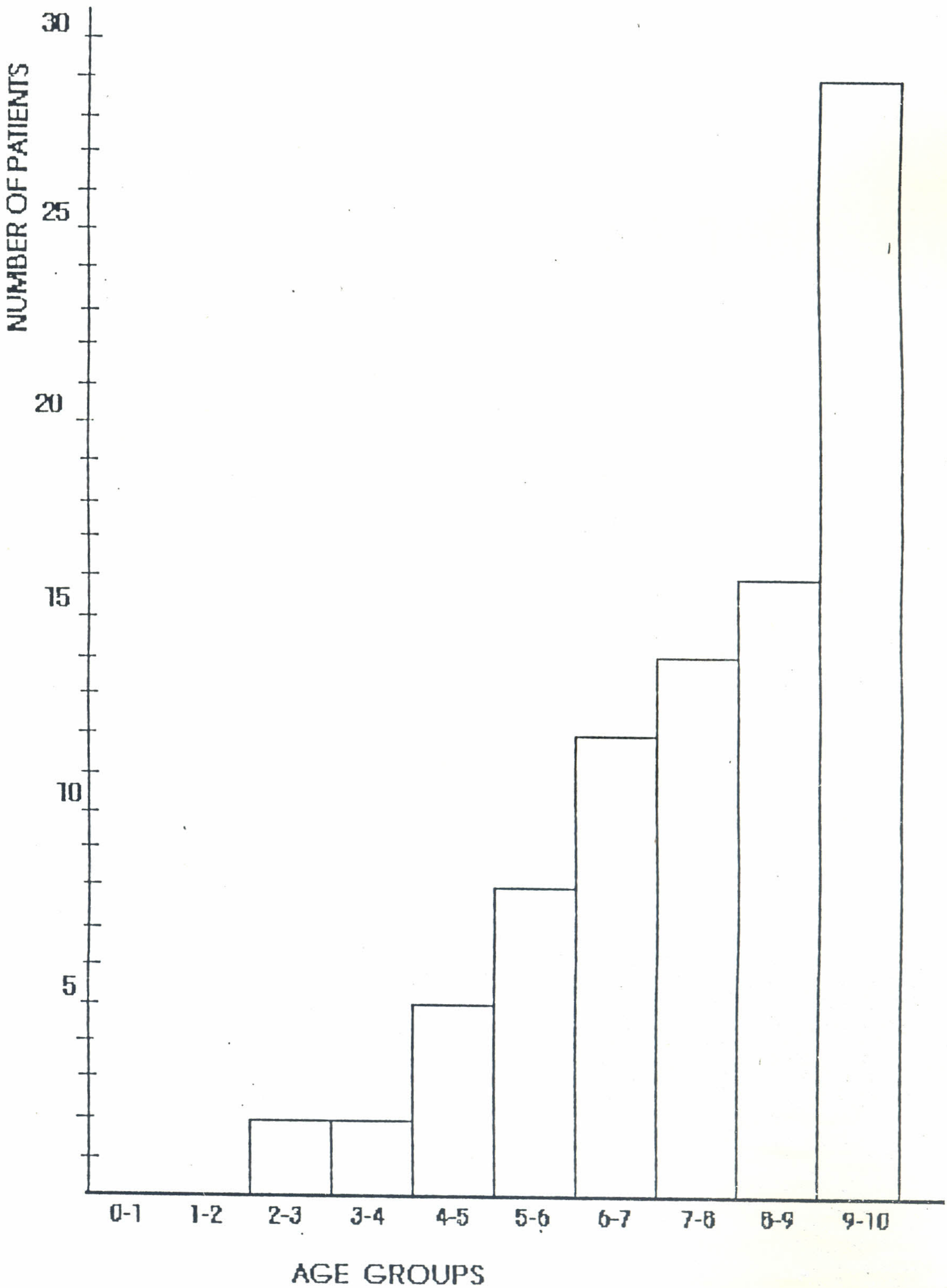

TABLE 7-AGE & SEX DISTRIBUTION-
STUDY GROUP

AGE (YEARS)	MALES	FEMALES	TOTAL
0-1	6	0	6
1-2	2	5	7
2-3	9	2	11
3-4	4	4	8
4-5	10	1	11
5-6	6	7	13
6-7	5	3	8
7-8	10	2	12
8-9	5	6	11
9-10	18	5	23
TOTAL	75	35	110

TABLE 8-AGE & SEX DISTRIBUTION-
CONTROL GROUP

AGE (YEARS)	MALES	FEMALES	TOTAL
0-1	0	0	0
1-2	0	0	0
2-3	1	1	2
3-4	0	2	2
4-5	2	3	5
5-6	6	2	8
6-7	6	5	11
7-8	7	6	13
8-9	10	6	16
9-10	18	10	28
TOTAL	50	35	85

TABLE 9-MEAN AGE-STUDY GROUP

NUMBER OF CHILDREN		110
AGE YEARS	MEAN I±ISD	5.85+2.88
	SEM	0.27
	RANGE	0.5-10YRS

TABLE 10-MEAN AGE-CONTROL GROUP

NUMBER OF CHILDREN		110
AGE YEARS	MEAN±ISD	7.64+4.04
	SEM	0.44
	RANGE	2.3-10

TABLE II-PATIENT DISTRIBUTION
FAST LENGTH-STUDY GROUP

HOURS OF STARVATION	NUMBER	%
9-10	2	1.8%
10-11	2	1.8%
11-12	4	3.6%
12-13	7	6.4%
13-14	3	2.7%
14-15	7	6.4%
15-16	21	19.1%
16-17	15	13.6%
17-18	14	12.7%
18-19	10	9.1%
19-20	7	6.4%
20-21	9	8.2%
21-22	3	2.7%
22-23	6	5.5%
TOTAL	110	100%

TABLE 12-PATIENT DISTRIBUTION TO FAST LENGTH-STUDY GROUP

HOURS OF STARVATION	NUMBER	%
0-1	21	24.7
1-2	34	40.0
2-3	12	14.1
3-4	18	21.2
TOTAL	85	100%

TABLE13-SEX DISTRIBUTION TO LENGTH OF FAST-STUDY GROUP

HOURS OF STARVATION	MALES	FEMALES	TOTAL
9-10	1	1	2
10-11	2	1	2
11-12	4	2	4
12-13	7	3	7
13-14	3	0	3
14-15	7	1	7
15-16	21	6	21
16-17	15	3	15
17-18	14	6	14
18-19	10	2	10
19-20	7	3	7
20-21	9	4	9
21-22	3	1	3
22-23	6	2	6
TOTAL	75	35	110

TABLE 14-SEX DISTRIBUTION TO LENGTH OF FAST-CONTROL GROUP

HOURS OF STARVATION	MALES	FEMALES	TOTAL
0-1	13	8	21
1-2	19	15	34
2-3	8	4	12
3-4	10	8	18
TOTAL	50	35	85

TABLE 15-MEAN LENGTH OF FAST-STUDY GROUP

NUMBER		110
FASTING HOURS	MEAN ± 1SD	16.7 1.06
	SEM	0.29
	RANGE	9.7-22.8

TABLE16 MEAN FAST LENGTH-CONTROL GROUP

NUMBER		85
FASTING HOURS	MEAN ± 1SD	1.82 1.06
	SEM	0.12
	RANGE	0.33-3.75

TABLE 17-PATIENT DISTRIBUTION TO GLUCOSE LEVELS-STUDY GROUP

BLOOD GLUCOSE LEVELS (MMOL/L)	NO. OF PATIENTS
2.4	1
2.5	1
2.6	0
2.7	1
2.8	2
2.9	2
3.0	3
3.1	11
3.2	16
3.3	42
3.4	13
3.5	8
3.6	3
3.7	1
3.8	2
3.9	1
4.0	0
4.1	0
4.2	1
4.3	1
4.4	1

TABLE 18 PATIENT DISTRIBUTION
TO GLUCOSE LEVELS-CONTROL GROUP

BLOOD GLUCOSE LEVELS (MMOL/L)	NO. OF PATIENTS
3.6	1
3.7	0
3.8	1
3.9	0
4.0	0
4.1	0
4.2	0
4.3	0
4.4	1
4.5	1
4.6	1
4.7	1
4.8	1
4.9	3
5.0	11
5.1	4
5.2	3.4
5.3	11
5.4	4
5.5	0
5.6	2
5.7	1
5.8	1
5.9	3
6.0	1
6.1	2
6.2	1

TABLE 19; DIAGRAM OF PATIENT DISTRIBUTION TO GLUCOSE LEVELS- STUDY GROUP

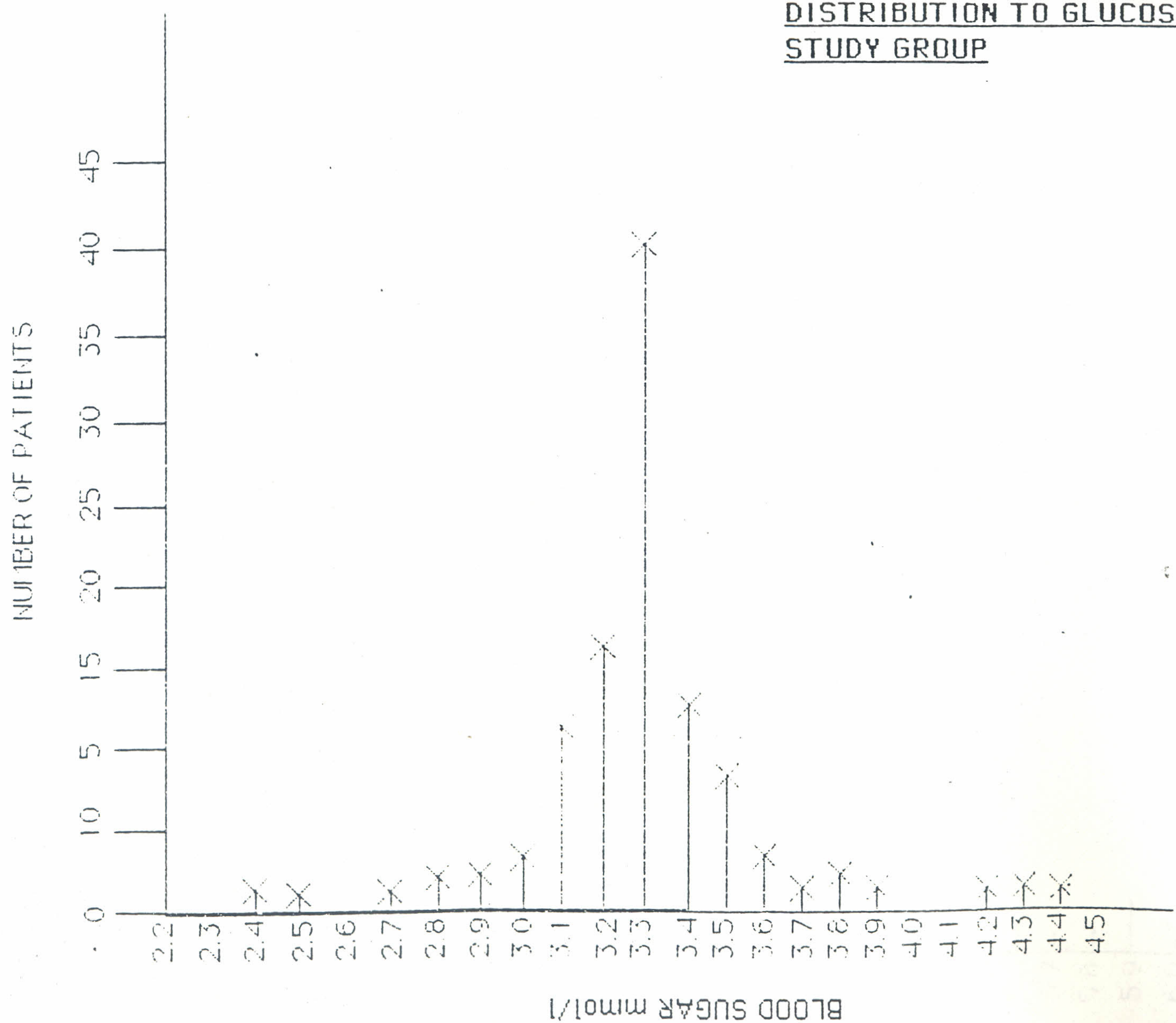

TABLE 20; DIAGRAM OF PATIENT DISTRIBUTION TO GLUCOSE LEVELS- CONTROL GROUP

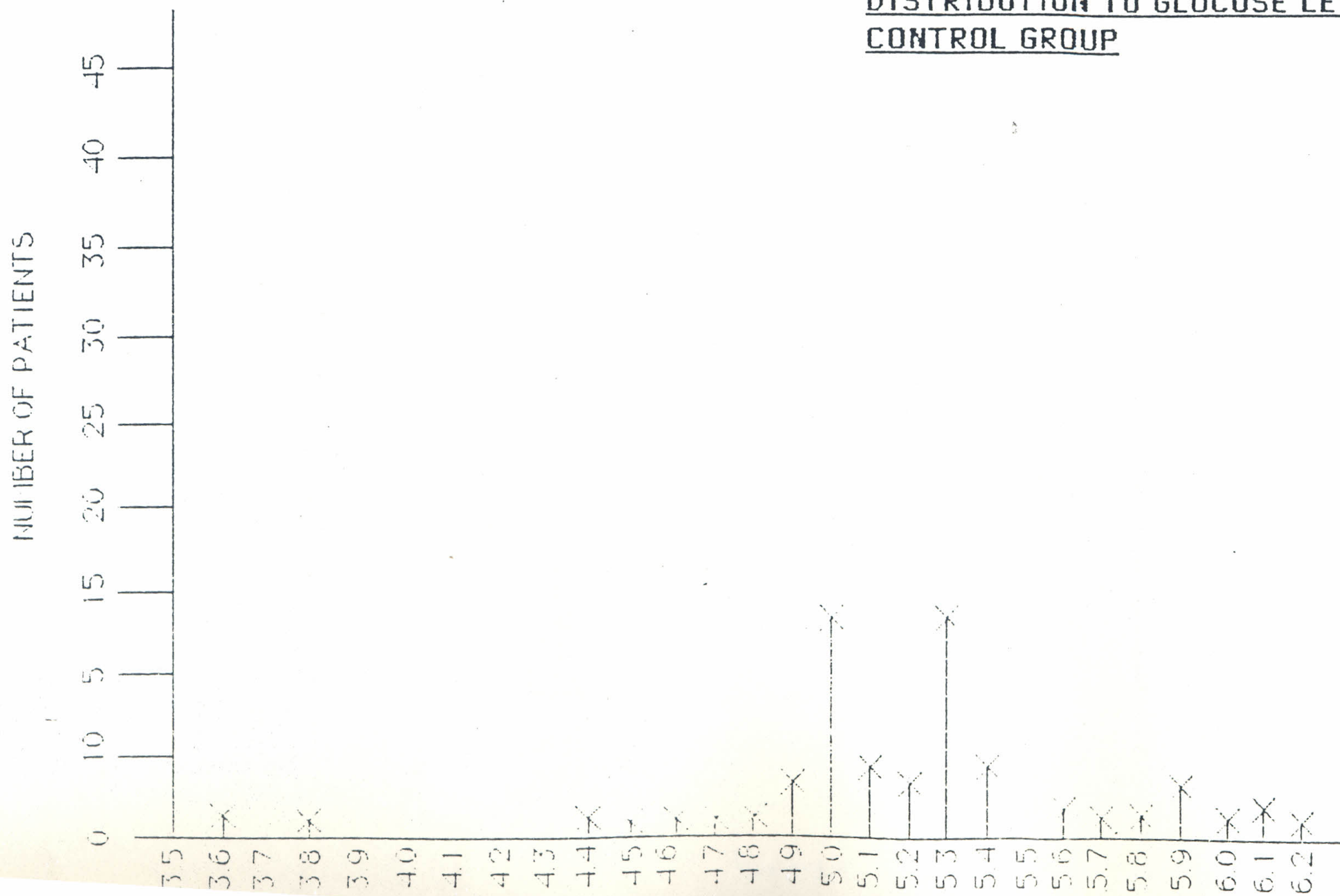

TABLE 21-MEAN GLUCOSE LEVELS-
STUDY GROUP

NUMBER	110	
BLOOD GLUCOSE LEVEL (mmol/l)	MEAN±1SD	3.3 ± 0.35
	SEM	0.03
	RANGE	2.4-4.4

TABLE 22-MEAN GLUCOSE LEVELS-
CONTROL GROUP

NUMBER	85	
BLOOD GLUCOSE LEVEL (mmol/l)	MEAN±1SD	5.2 ± 0.51
	SEM	0.07
	RANGE	3.6-6.2

TABLE 23-INCIDENCE OF HYPOGLECEMIA-
STUDY GROUP

NUMBER AND SEX DISTRIBUTION OF PATIENTS		NUMBER OF PATIENTS WITH BLOOD GLUCOSE LEVEL OF		
		<2.2MMOL/L (40mg%)	<2.5MMOL/L (50mg%)	<3.3MMOL/L (40mg%6
MALES	50	0	2	26
(%)	65.2%	0	1.5%	25.5%
FEMALES	35	0	1	9
(%)	31.8%	0	0.9%	5.2%
TOTAL	110	0	3	3.7%
(%)	100	0	2.7%	33.7

TABLE 24 -FEEDING TIME REGIME AT ALDER HEY CHILDREN'S HOSPITAL BYTHOMAS(1974)FOR PRE-OPERATIVE CHILDREN ON DAY OF SURGERY

AGE GROUPING		FEEDING REGIME
INFANTS LESS THAN ONE YEAR	MORNING CASES	NO MILK FEED AFTER MIDNIGHT 5% DEXTROSE 10 mls kg/l AT 6 A.M.
	AFTERNOON CASES	LAST MILK FEED AT 7 A.M. 5% DEXTROSE 10 mls kg/l AT10 A.M
CHILDREN 1-5 YEARS	MORNING CASES	MILK10mls kg/l AT 6 A.M. (MAXIMUM 250 ml).
	AFTERNOON CASES	LIGHT BREAKFAST AT 7 A.M. MILK 10 mlkg/l AT 10 A.M.
CHILDREN MORE THAN 5 YEARS	MORNING CASES	NOTHING BY MOUTH IN MORNING
	AFTERNOON CASES	LIGHT BREAKFAST AT 7 A.M.

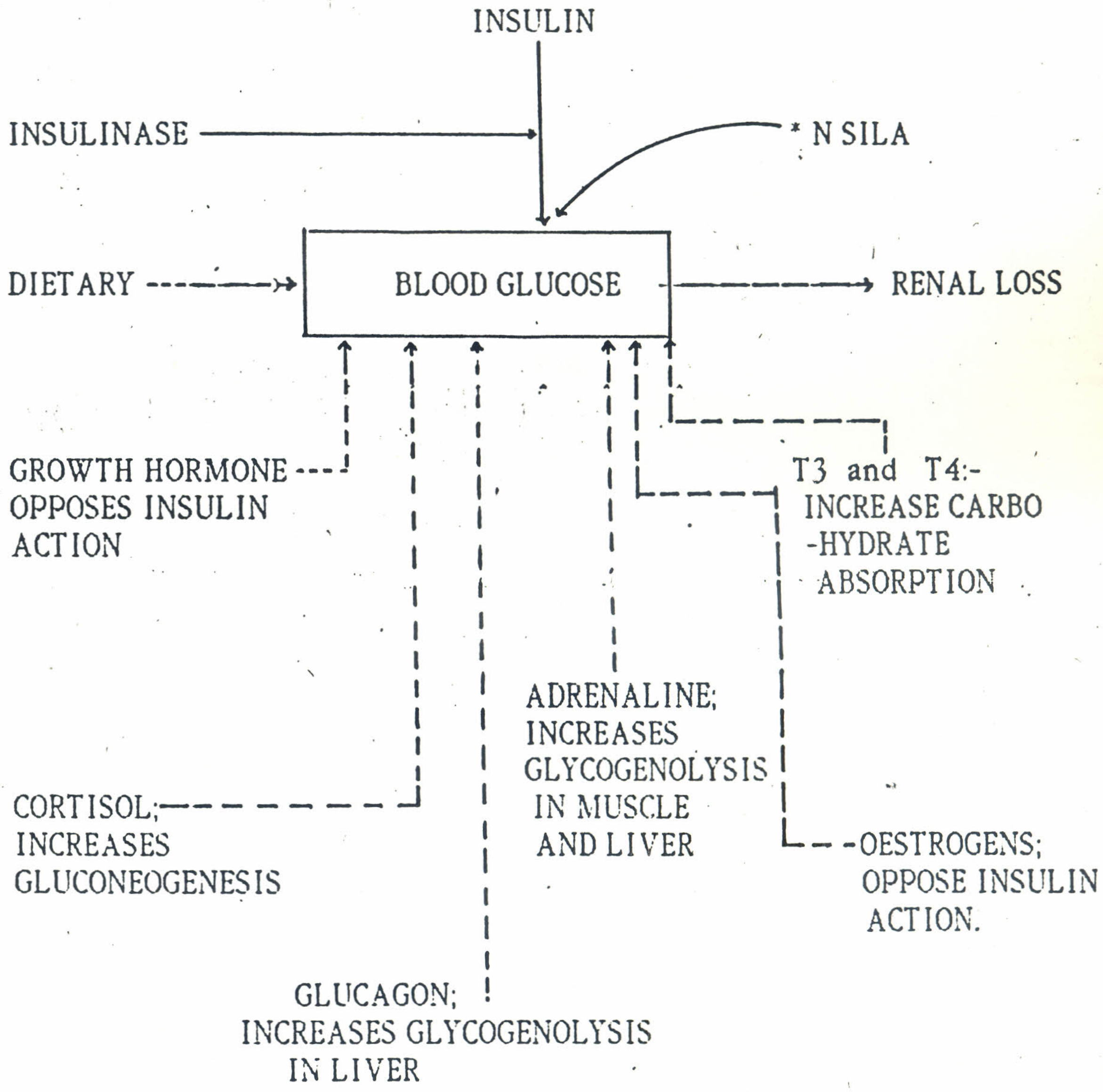

FIGURE 1; REGULATION OF BLOOD GLUCOSE LEVELS INCLUDING DIETARY, RENAL AND ENDOCRINE FACTORS

- - - - - → ACTIONS TENDING TO INCREASE BLOOD GLUCOSE LEVELS

———→ REFERS TO INHIBITORY ACTION

* N SILA:- NON SUPPRESIBLE INSULIN - LIKE ACTIVITY

APPENDIX
QUESTIONAIRRE FORM

DATE:-
NAME:-
AGE:-
SEX:-
I.P.NO.:-
WARD:-
DIAGNOSIS:-
OPERATION:-
PREMEDICATION:-
TYPE:-
TIME:-
TIME OF LAST MEAL:-
TIME OF BLOOD SAMPLING:-
HOURS OF STARVATION:-
BLOOD SUGAR RESULT(mmol /l):-
GENERAL COMMENTS:-

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