

THE BLOOD GLUCOSE IN GENERAL ANAESTHESIA.

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THE BLOOD GLUCOSE IN GENERAL ANAESTHESIA.

An investigation of the changes in the percentage of glucose in blood during general anaesthesia in 89 cases, the influence of insulin on these changes, with observations on the pre-operative percentage, and on the renal threshold for glucose.

The work has been arranged as follows:-

- (A). INTRODUCTION, PROCEDURE, and METHODS.
 - (B). PART 1. The influence of a general anaesthetic on the blood sugar.
PART 2. The influence of a general anaesthetic on the blood sugar when insulin is administered before, or early in, anaesthesia.
PART 3. The influence of a general anaesthetic, (a) without, (b) with, insulin on the post-operative urines.
PART 4. The pre-operative blood sugar.
 - (C). PRECIS OF RESULTS and DISCUSSION.
 - (D). GENERAL SUMMARY of RESULTS.
 - (E). CONCLUSIONS.
 - (F). BIBLIOGRAPHY.
 - (G). APPENDIX:- Blood Sugar Curves of all cases.
-

This investigation has been carried out in the Biochemical Laboratory of the Wolverhampton and Staffordshire General Hospital, with the kind permission of the Board of Management and of Dr.S.C.Dyke,Pathologist to the hospital, for whose friendly encouragement and criticism I am much indebted. Mr.Deansley,B.Sc.,F.R.C.S.,and Mr.Cholmley,F.R.C.S.,Honorary Surgeons to the hospital, gave access to their wards and operating theatres as required, and greatly facilitated the progress of the enquiry, as did all the members of the anaesthetic staff. For all this friendly co-operation I wish to express my cordial thanks.

General Object.

The object of the work is to study the effect of anaesthesia on the blood glucose, and to determine if insulin in anaesthesia causes any variation in the blood glucose or influences the general condition of the patient.

(A)

PROCEDURE.

In all, 89 cases were studied. No selection was made, and during the period of ten months covered by this work there was no abnormal factor to regulate the type of patient admitted to the hospital. There were 43 males, and 46 females in the series, the ages varying from 9 to 76 years. Of the total 44 were under, and 45 above, 40 years of age. Approximately 90% of the patients were treated for chronic, as opposed to acute, disease.

Preparation for Operation.

About half of the cases received a hypodermic injection of morphine sulphate 1/6gr., Scopolamine 1/150gr., about 12 to 16 hours prior to operation, and of atropine 1/100gr., before entering the anaesthetist's room. The remaining cases received no hypodermic medication as a rule, but individual anaesthetists ordered such as they considered advisable. These were noted in each case when given. The influence of these injections at such prolonged periods previous to operation, may, so far as the Blood Sugar is concerned, be considered as negligible. A cup of weak tea, but no solid food was given early on the morning of operation, i.e. from two to four or more hours before. Most of the operations were performed in the forenoon.

Anaesthetics.

Chloroform(C), Ether(E), or Chloroform and Ether mixture(CE) was given in all cases (except Case 16, where a spinal anaesthetic, Stovaine, was employed) at the discretion of the anaesthetist. It has been considered inadvisable to draw any sharp line of demarcation between chloroform or ether cases, because neither chloroform nor ether was, as a rule, given alone throughout a case. Induction was usually by chloroform, or CE mixture, but anaesthesia was generally maintained by CE mixture or by Ether. Apart therefore, from noting the nature of the anaesthetic given no conclusions have been drawn from the use of one or other anaesthetic.

Salines.

Where a saline, whether containing glucose or not, was given, the fact was noted as well as the method of administration. K.H.Tallermann (1) has shown that glucose is readily absorbed from the rectum, with a consequent rise in the Blood Sugar, averaging 0.030% in the course of an hour. A somewhat similar rise would doubtless occur in an intra-peritoneal administration (Case 11, Series I). Such cases have, therefore, been omitted from the general averages of the different series shown later.

(A).

Methods.

H. MacLean's method (2) was employed for estimating the Blood Sugar, on account of its general facility for clinical work, and because of its accuracy, which is greater, as shown by de Wesselow (3) than Benedict's Picric Acid method, in which substances such as creatinin are estimated as well as sugar.

The estimations were carried out on the same day as the blood was taken, generally, in fact, during the progress of the operation.

The first two urines passed after anaesthesia were collected and tested next day. There was no difference of importance between the two specimens, so that the results of testing the first urine only are shown.

The urinary tests carried out were:-

- (1). for Sugar:-(a) The Fermentation test with yeast.
(b) Fehling's test (Bertrand's modification).
- (2). for Acetone:- Rothera's test (4).
- (3). for Diacetic Acid:-(a) Lindeman's test (5).
(b) Gerhardt's test (6).
- (4). for Pentoses:- Bial's reagent was employed (7).
- (5). for Albumen:- (a) The Heat test.
(b) Salicylsulphonic Acid test (8).
- (6). The Reaction, Specific Gravity, and nature of the Precipitate were also observed in each case.

For various reasons it was not possible to obtain a urinary sample in every case.

INSULIN.

The preparation by Messrs. Boots was employed throughout. Variations do occur in the strength of Insulin, but these may be neglected as insignificant.

General Procedure.

In all 89 cases, the blood was taken in the ante-room, either immediately prior to the administration of the anaesthetic, or while induction was proceeding. The exact time of taking the blood for testing was noted and the time of commencing the anaesthetic. The times at which subsequent specimens were taken (generally at 20 to 30 minute intervals), and the duration of the anaesthesia, were also noted.

In the case of each patient the following particulars are recorded:- Name, age, sex, preliminary sedatives, disease, operation performed, and in addition the presence of any factor, such as severe struggling, undue haemorrhage, asphyxia, cyanosis, adiposity, cachexia, whether salines or other restoratives or sedatives were administered, and also whether there was much handling of the liver during the course of the operation (e.g. as in case 9, Series I), the state of the patients during anaesthesia, and recovery from anaesthesia.

(A)

General Procedure. (continued).

The cases are divided into two series I and II, of 46 and 43 patients respectively. The procedure was the same throughout, except that in Series II a hypodermic dose of Insulin, varying from 5-12 units was given either prior to the operation or early in anaesthesia, the time of administration being noted in every case.

Details of each case are shown on separate sheets in the appendix, and where possible, a Blood Sugar curve or graph has been constructed with time (in minutes) as abscissae and Blood Sugar (percentage) as ordinates.

(B).

Part. 1.

THE INFLUENCE OF A GENERAL ANAESTHETIC ON THE BLOOD SUGAR.

Series I, Nos. 1 to 46.

The cases under consideration are shown in detail in the Appendix, with Blood Sugar curves attached. The results are summarised, in part, in Table A overleaf.

(a). Of 38 cases, in which two or more Blood Sugar estimations were taken, no less than 36 showed a distinct, well defined, rise during anaesthesia. Two cases alone, nos. 26 and 37, showed a fall without any special reason being apparent. Of these 38 cases, the maximum Blood Sugar was reached at the end, or after the end, of anaesthesia in all but four cases (nos. 26, 28, 37, and 44). Case No. 22 is equivocal in its figures.

In the whole series, there are 30 cases in which anaesthesia lasted at least 30 minutes. Taking the average for these 30 we get:-

Blood Sugar before operation-----	0.131%
" " after $\frac{1}{2}$ hour anaesthesia-----	0.173%
Average increase in $\frac{1}{2}$ hour-----	0.042%

(b). In the series, there are nine cases in which anaesthetics were administered for over an hour. The average for these cases works out as follows:-

Blood Sugar before operation-----	0.137%
" " after $\frac{1}{2}$ hour anaesthesia-----	0.180%
" " " 1 " "-----	0.241%
Average increase in 1st. $\frac{1}{2}$ hour-----	0.043%
" " " " hour-----	0.104%

This shows a rate of increase greater in the second half hour than in the first.

(c). In the series, there are seven cases only (nos. 9, 17, 18, 20, 22, 23, 28) in which Blood Sugar estimations were carried out up to 250 minutes from the commencement of anaesthesia, and which had not received salines. The average works out as follows:- (See Table B overleaf)

Blood Sugar before operation-----	0.124%
" " after 50 minutes anaesthesia----	0.187%
" " " 100 " "-----	0.183%
" " " 150 " "-----	0.182%
" " " 200 " "-----	0.180%
" " " 250 " "-----	0.172%

Curves to illustrate (a), (b), and (c) are shown overleaf with the corresponding curves of Series II, on the one diagram.

(d). Where the pre-operative Blood Sugar is below 0.110% the actual increase after 30 minutes anaesthesia averages 0.050% (11 cases); where the pre-operative Blood Sugar is 0.150% or over, the actual increase is only 0.007% (8 cases).

TABLE A

SERIES I
(NON-INSULIN)

To illustrate changes
in % Blood Sugar
in anaesthesia

NUMBER IN SERIES	ANAESTHETIC C, E, or CE.	PERIOD (IN MINUTES) OF ADMINISTRATION OF ANAESTHETIC	% BLOOD SUGAR BEFORE OPERATION.	% BLOOD SUGAR AFTER 30 MINS. ANAESTHESIA	% BLOOD SUGAR AFTER 60 MINS. ANAESTHESIA	INCREASE + DECREASE - IN 30 MINS.	INCREASE + DECREASE - IN 60 MINS.	MAXIMUM % IN ANAESTHESIA
1	E	125	.177	.250	.270	+073	+093	.297
2	CE	47	.122	.200	-	+078	-	.241
3	CE	44	.115	.196	-	+081	-	.196
4	E	71	.160	.185	.210	+025	+050	.216
5	E	21	.146	-	-	-	-	.181
6	CE	75	.184	.168	.227	-016	+043	.227
7	CE	60	.100	.117	.216	+017	+116	.206
8	E	38	.122	.180	-	+058	-	.187
9	CE	65	.083	.180	.222	+097	+139	.222
10	E	25	.110	-	-	-	-	.162
11	CE	31	.191	.211	-	+020	-	.211
12	E	26	.083	-	-	-	-	.149
13	CE	85	.146	.181	.293	+035	+147	.386
14	E	40	.117	.146	-	+029	-	.156
15	CE	47	.143	-	-	-	-	.147
16	Spinal	-	.149	.129	-	+020	-	.129
17	CE	38	.137	.203	-	+066	-	.206
18	CE	43	.150	.165	-	+015	-	.184
19	E	35	.118	-	-	-	-	.156
20	CE	39	.095	.152	-	+057	-	.166
21	E	78	.175	.240	.313	+065	+138	.320
22	CE	38	.120	.181	-	+061	-	.181
23	CE	23	.141	-	-	-	-	.156
24	CE	27	.099	.139	-	+040	-	.137
25	E	48	.109	.160	-	+051	-	.202
26	E	44	.207	.135	-	-072	-	.207
27	CE	70	.093	.140	.223	+047	+130	.243
28	CE	35	.142	.210	-	+066	-	.216
29	CE	35	.048	.111	-	+063	-	.120
30	CE	35	.143	.215	-	+072	-	.225
31	CE	38	.109	.175	-	+066	-	.227
32	CE	30	.109	.150	-	+041	-	.187
33	CE	25	.145	-	-	-	-	.206
34	CE	60	-	-	-	-	-	.156
37	CE	35	.180	.168	-	-012	-	.181
41	CE	35	.160	.178	-	+018	-	.181
43	CE	40	.106	.158	-	+052	-	.175
44	CE	105	.118	.160	.191	+042	+073	.206

SUMMARY OF TABLE A.

Series I. (non-insulin).

Average Blood Sugars:-

- (1). Before operation, of all cases of the series (37) = 0.130%
- (2). Before operation, of all cases lasting 30mins. (30) = 0.131%
After 30 minutes, " " " " " " = 0.173%
Increase in 30 minutes = 0.042%
- (3). Before operation, of all cases lasting 60mins. (9) = 0.137%
After 30 minutes, " " " " " " = 0.180%
" 60 " " " " " " = 0.241%
Increase in 30 minutes = 0.043%
" " 60 " " = 0.104%
-

TABLE B
(NON-INSULIN)
SERIES I.

CASES IN SERIES I which had received no saline, no insulin, no lengthy anaesthesia, and in which observations on the percentage Blood Sugar were taken up to 250 minutes.

NUMBER IN SERIES	ANESTHETIC C. E. OR CE.	PERIOD OF ANAESTHESIA IN MINUTES.	% BLOOD SUGAR AT 0 MINS.	% BLOOD SUGAR AT 50 MINS.	% BLOOD SUGAR AT 100 MINS.	% BLOOD SUGAR AT 150 MINS.	% BLOOD SUGAR AT 200 MINS.	% BLOOD SUGAR AT 250 MINS.
9	CE	65	.083	.218	.220	.212	.208	.202
17	CE	38	.137	.205	.210	.200	.195	.190
18	CE	43	.150	.185	.176	.170	.160	.155
20	CE	39	.095	.165	.165	.165	.160	—
22	CE	38	.120	.170	.148	.160	.170	.180
23	CE	23	.141	.155	.150	.145	.140	.135
28	CE	35	.142	.208	.210	.220	.227	.170
AVERAGE VALUES →		40	.124	.187	.183	.182	.180	.172

(B)

Part. II.

THE INFLUENCE ON THE BLOOD SUGAR OF THE ADMINISTRATION OF INSULIN BEFORE, OR EARLY IN, GENERAL ANAESTHESIA.

Series II. Nos. 1 to 43.

All the cases are shown in detail in the appendix, with the accompanying Blood Sugar curves. Each case received a hypodermic injection of Insulin, the average dose being 10 units. The results are summarised, in part, in Table C. overleaf. Of the 43 cases, 42 showed a definite rise in the Blood Sugar percentage during anaesthesia (except No. 31). Of these 42 cases, the maximum Blood Sugar occurred at the end or after the end of anaesthesia in 34 cases. In other words, in 9 cases out of 43 the Blood Sugar had reached its maximum and then began to decrease before the anaesthesia had terminated (cases Nos. 4, 10, 12, 18, 14, 24, 31, 32, 36.)

(a)

In this series there are 33 cases in which the anaesthetic was administered for at least 30 minutes. The average for these 33 cases is as follows:-

Blood Sugar before operation	-----	0.113%
" " after 30min. anaesthesia	-----	0.160%
" " Increase in 30min.	=	0.047%

(b)

There are 19 cases in which the anaesthetic was administered for over an hour. The average figures for this group are as follows:-

Blood Sugar before operation	-----	0.107%
" " after 30min. anaesthesia	-----	0.152%
" " " 60 " "	-----	0.177%
" " Increase in 1st. half hour	---	0.045%
" " " " " hour	-----	0.070%

This shows a diminishing rate of increase in the second half hour.

(c)

In the series of 43 cases, there are eight cases (Nos. 3, 6, 7, 8, 11, 15, 21) in which Blood Sugar estimations were carried out for at least 250 minutes, and which received no salines. The average duration of anaesthesia here was 43 minutes, and the average dose of Insulin 10 units. The average figures work out as follows:- (See Table D overleaf)

Blood Sugar before operation	-----	0.101%
" " after 50 minutes	-----	0.149%
" " " 100 "	-----	0.150%
" " " 150 "	-----	0.143%
" " " 200 "	-----	0.136%
" " " 250 "	-----	0.129%

Curves to illustrate (a), (b), and (c) are shown along with the corresponding curves from Series I.

NUMBER IN SERIES	ANESTHETIC C. E. or CE.	INSULIN DOSAGE (UNITS)	PERIOD OF ADMINISTRATION OF ANESTHETIC (MINUTES)	% BLOOD SUGAR BEFORE OPERATION	% BLOOD SUGAR AFTER 30 MINS. ANESTHESIA	% BLOOD SUGAR AFTER 60 MINS ANESTHESIA	INCREASE (+) DECREASE (-) IN 30 MINS.	INCREASE (+) DECREASE (-) IN 60 MINS.	MAXIMUM % BLOOD SUGAR IN ANESTHESIA
1	CR	5	25	.162	-	-	-	-	.266
2	CR	5	57	.134	.190	-	+056	-	.237
3	CE	10	72	.095	.100	.120	+005	+025	.187
4	CE	8	50	.143	.253	-	+110	-	.253
5	C→E	12	100	.100	.150	.230	+050	+130	.287
6	CE	10	23	.050	-	-	-	-	.143
7	CE	10	25	.118	-	-	-	-	.
8	CR	10	27	.088	.210	-	+122	-	.214
9	CE	11	50	.106	.106	-	.000	-	.147
10	CE	10	150	.119	.170	.165	+051	+046	.187
11	CE	12	60	.090	.135	.184	+045	+094	.184
12	C→E	11	85	.100	.178	.195	+078	+095	.211
13	CE→E	10	35	.095	.141	-	+046	+141	.141
14	C→E	12	95	.075	.115	+156	+040	+081	.181
15	CE	10	40	.118	.142	-	+024	-	.175
16	C→E	12	72	.075	.130	.217	+055	+142	.259
17	CE	10	60	.098	.115	.133	+017	+035	.133
18	CE	10	95	.081	.075	.130	-006	+049	.206
19	CE	10	85	.150	.238	.278	+088	+138	.306
20	CE→E	10	45	.165	.190	-	+025	-	.206
21	E	10	55	.131	.156	.095	+025	-036	.206
22	C→E	10	58	.081	.173	.234	+092	+153	.237
23	CE	10	25	.056	-	-	-	-	.
24	E	10	35	.110	.175	-	+065	-	.175
25	CE	10	12	.118	-	-	-	-	.162
26	CE	10	30	.143	.162	-	+019	-	.193
27	CE	10	65	.118	.165	.193	+047	+075	.193
28	CE	10	15	.118	-	-	-	-	.137
29	CE	10	40	.112	.145	-	+033	-	.150
30	CE	10	65	.175	.184	.190	+009	+015	.193
31	CE	10	20	.143	-	-	-	-	.143
32	E	12	60	.106	.230	.206	+124	+100	.237
33	CE	10	20	.037	-	-	-	-	.193
34	C	12	28	.125	.148	-	+023	-	.150
35	CE	10	90	.100	.133	.147	+033	+047	.175
36	CE	12	60	.100	.120	.131	+020	+031	.143
37	E	12	30	.137	.168	-	+031	-	.168
38	CE	12	20	.086	-	-	-	-	.162
39	CE	12	77	.075	.110	.125	+035	+050	.131
40	CE	12	43	.135	.180	-	+045	-	.206
41	CE	12	16	.110	-	-	-	-	.175
42	E	12	72	.156	.205	.233	+049	+077	.268
43	CE	12	35	.100	.191	-	+091	-	.206

TABLE C
(INSULIN CASES)
SERIES II.

To illustrate changes in % blood sugar in anaesthesia where insulin also given.

SUMMARY OF TABLE C.

Series II.(insulin).

Average Blood Sugars:-

(1).Before operation, of all cases of the series (43) = 0.110%

(2).Before operation, of all cases lasting 30mins. (33) = 0.113%

After 30 minutes, " " " " " " = 0.160%

Increase in 30 minutes = 0.047%

(3).Before operation, of all cases lasting 60mins. (19) = 0.107%

After 30 minutes, " " " " " " = 0.152%

" 60 " " " " " " = 0.177%

Increase in 30 minutes = 0.045%

" " 60 " " = 0.070%

TABLE D.
[INSULIN SERIES]

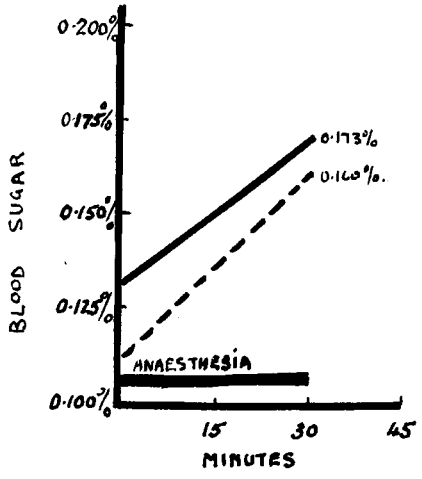
SERIES II

CASES IN SERIES II which had received no saline, no lengthy anaesthesia, and in which observations on the % blood sugar were taken up to 250 minutes. Each case received 10 units of insulin.

NUMBER IN SERIES II	ANAESTHETIC C. E. or CE.	DOSE OF INSULIN (UNITS)	PERIOD OF ANAESTHESIA IN MINUTES	% BLOOD SUGAR AT 0 MINS.	% BLOOD SUGAR AT 50 MINS.	% BLOOD SUGAR AT 100 MINS.	% BLOOD SUGAR AT 150 MINS.	% BLOOD SUGAR AT 200 MINS.	% BLOOD SUGAR AT 250 MINS.
3	CE	10	72	.095	.100	.180	.175	.170	.165
6	CE	10	23	.050	.130	.110	.100	.090	.080
7	CE	10	25	.118	.154	.150	.147	.143	.137?
8	CE	10	27	.090	.210	.180	.155	.130	.100
11	CE	10	60	.094	.180	.175	.165	.150	.140
15	CE	10	40	.118	.170	.150	.130	.110	.095?
21	E	10	55	.130	.100	.111	.135	.160	.185
29	CE	10	40	.112	.150	.143	.140	.133	.130
Average values →		10	43	.101	.149	.150	.143	.136	.129

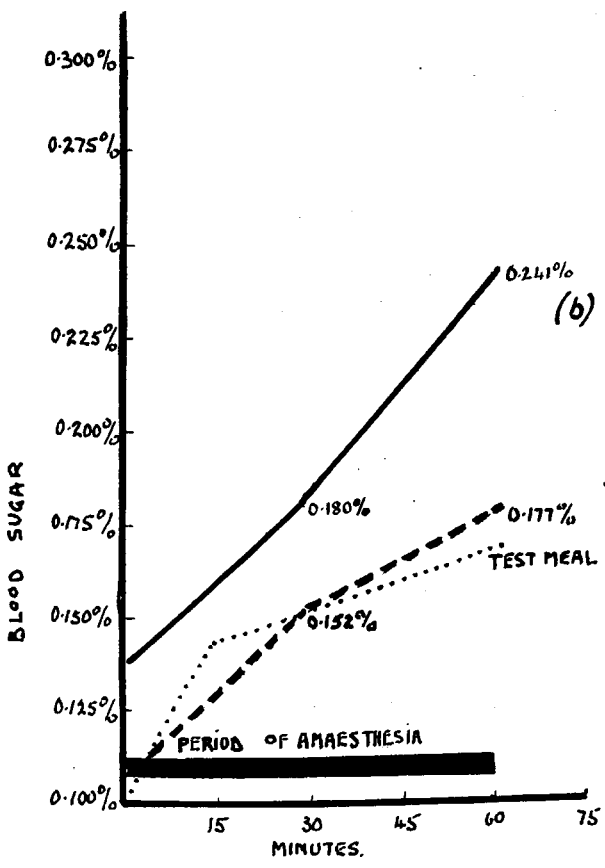
GRAPHS OF AVERAGES.

(a)



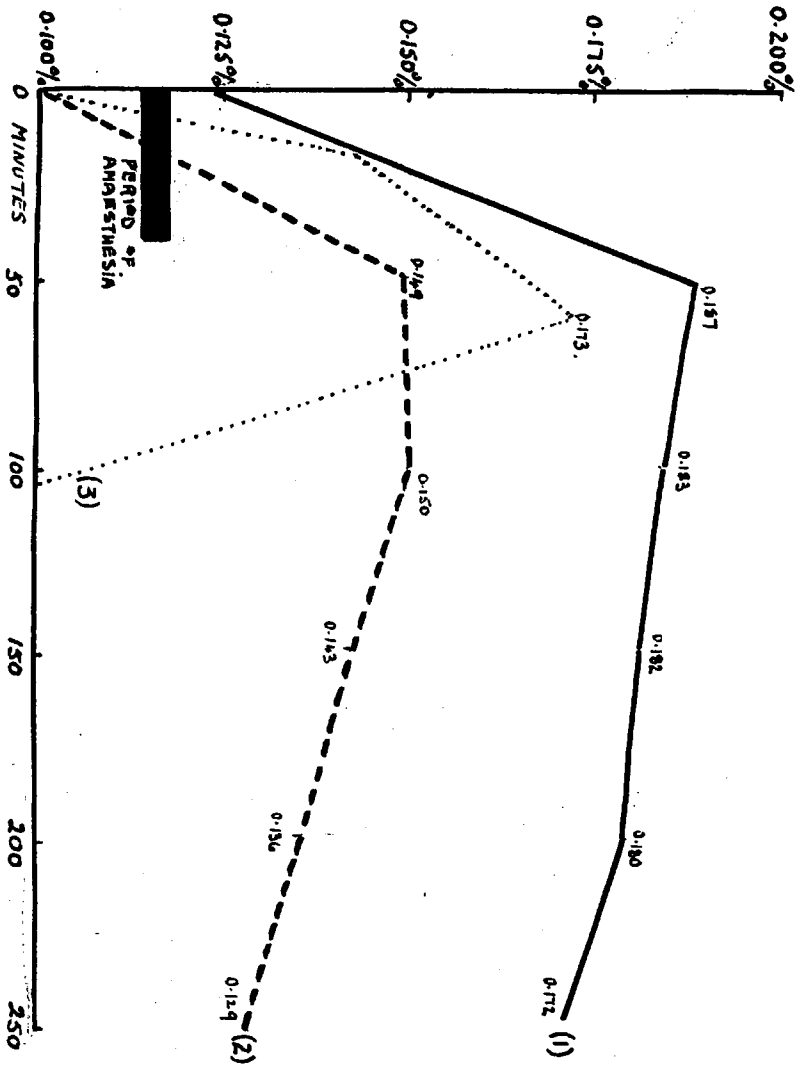
(a) RISE OF BLOOD SUGAR IN 30 MINS. ANAESTHESIA
 — WITHOUT INSULIN. 30 CASES.
 - - - WITH 10 UNITS INSULIN. 33 CASES.

(b)



(b) RISE OF BLOOD SUGAR IN 60 MINS. ANAESTHESIA
 — WITHOUT INSULIN 9 CASES.
 - - - WITH 10 UNITS INSULIN 19 CASES.
 COMPARED WITH THE RISE DUE TO
 50GM. GLUCOSE [MACLEAY]
 TEST MEAL

GRAPH OF AVERAGES (CONTINUED)



(c)

RISE AND FALL OF THE BLOOD SUGAR

- (1) IN ANAESTHESIA OF 40 MINS. DURATION, WITH NO INSULIN — AVERAGE OF 7 CASES.
- - - (2) " " " 43 " " " 10 UNITS INSULIN — " 8 " .
- (3) AFTER A TEST MEAL OF 50 GM. GLUCOSE (MACLEAN)

(B).

Part II. (continued).

Percentage Blood Sugar, reckoned from Time of Insulin
administration as Zero.

In the preceding figures and curves, no allowance has been made for the time in anaesthesia at which Insulin was given. As this might be a factor of considerable importance, Table E has been drawn up from the separate curves of the 43 cases in the series, to demonstrate this one particular point. The Blood Sugars are calculated from the curves, taking the time of giving Insulin as zero, and working at stated, fixed, intervals from that time. Taking all cases lasting 30 minutes from time of giving Insulin, the following figures are obtained:-

(i). Average Blood Sugar at time of giving Insulin ----0.123%
" " " 30mins. after " " ----0.163%
Increase in Blood Sugar = 0.040%

For cases lasting 60 minutes (ten cases) :-

(ii). Average Blood Sugar at time of giving Insulin ----0.118%
" " " 30mins. after " " ----0.163%
" " " 60 " " " " ----0.204%
Increase in $\frac{1}{2}$ hour = 0.045%
" " 1 " = 0.086%

For cases lasting 75 minutes (Nos. 5, 10, 12, 14, 18, 35) :-

(iii). Average Blood Sugar at time of giving Insulin ----0.104%
" " " 30mins. after " " ----0.143%
" " " 60 " " " " ----0.176%
" " " 75 " " " " ----0.193%
Increase in first $\frac{1}{2}$ hour = 0.039%
" "second " " = 0.033%
" " fifth $\frac{1}{2}$ " = 0.017%

Curves to illustrate (ii) and (iii) are shown overleaf.

TABLE E.

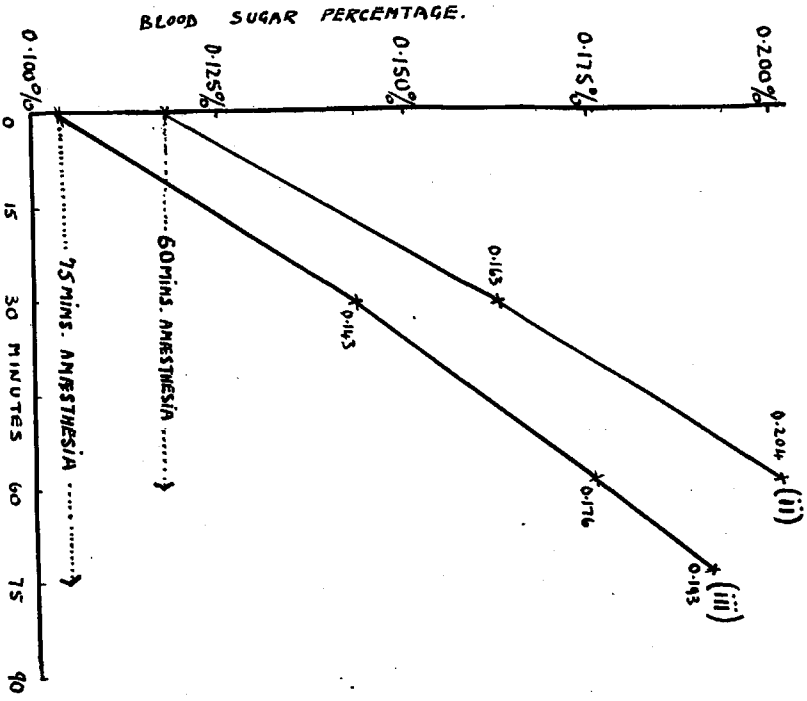
[INSULIN SERIES]

SERIES II.

To show change in % Blood Sugar in anaesthesia in cases where insulin is administered at zero minutes, no saline injections given in these cases.

NUMBER IN SERIES II	INSULIN DOSE IN UNITS	% BLOOD SUGAR AT TIME OF ADMINISTRATION OF INSULIN	% BLOOD SUGAR 30 MINS. AFTER INSULIN	% BLOOD SUGAR 60 MINS. AFTER INSULIN	% BLOOD SUGAR 75 MINS. AFTER INSULIN
2	5	.163	.198	—	—
3	10	.100	.137	—	—
4	8	.183	.241	—	—
5	12	.100	.161	.242	.287
9	11	.106	.114	—	—
10	10	.130	.173	.165	.165
11	12	.099	.161	—	—
12	11	.128	.191	.191	.165
13	10	.108	.140	—	—
14	12	.083	.122	.162	.180
15	10	.118	.150	—	—
16	12	.082	.158	.259	—
17	10	.107	.126	—	—
18	10	.078	.075	.150	.206
19	10	.209	.265	.300	—
20	10	.175	.206	—	—
21	10	.138	.142	—	—
22	10	.081	.175	.235	—
24	10	.112	.166	—	—
26	10	.144	.163	—	—
29	10	.114	.148	—	—
30	10	.176	.186	.193	—
35	10	.107	.138	.148	.154

GRAPH OF AVERAGES



(d.)

GRAPH TO SHOW RISE IN BLOOD SUGAR IN ANAESTHESIA IN CASES WHERE 10 UNITS OF INSULIN WERE GIVEN. ANAESTHESIA COMMENCED BEFORE INSULIN GIVEN.

- (ii) IS THE AVERAGE OF 10 CASES OF 60 MINS. ANAESTHESIA.
- (iii) " " " " " 6 " " 75 " "

(B).

Part III.

THE INFLUENCE OF A GENERAL ANAESTHETIC (a)without, (b)with
INSULIN INJECTION ON THE POST-OPERATIVE URINE.

The results of the more important tests carried out - for sugar, acetone, and diacetic acid - are summarised in Table F for Series I, and in Table G for the Insulin Series II.

Bial's Test (7) for Pentoses was also used, but the result was negative throughout.

Albumen, Glycuronates, Reaction (acid or alkaline) and Specific Gravity were also noted, but as the results had no group significance, they are not included in the tables. The usual Reaction was acid, the average Specific Gravity about 1030, albumen generally absent, and a precipitate of pink urates present in the first specimen. Mucus frequently took the place of the urate deposit in the later specimens, while there were also fewer Fehling's +ve reactions. Bertrand's modification of Fehling's solution was used throughout.(53).

Lindeman's Test (5) for Diacetic Acid was used in addition to Gerhardt's (6), but after some fifty cases it was abandoned as unreliable.

Comparison of Tables F and G.

Series.	No. of Urines.	Fehling's Reaction +ve.	Fermentation +ve	Acetone +ve	Diacetic Acid +ve.
Non-Insulin	25	76%	16%	60%	12%
Insulin.	21	57%	0%	62%	14%

Relation of the Maximum % Blood Sugar to the presence of a Fehling's-reducing substance in the Urine.

In the summaries to Tables G and F, overleaf, all the cases have been classified according to whether the Maximum % Blood Sugar was above or below 0.180, the figure frequently accepted as the Renal Threshold for Sugar, and according to a +ve or -ve Fehling's Reaction.

Combining the two tables there were:-

1. 19 cases with %Blood Sugar over 0.180%, giving a +ve Fehling's Reaction
2. 12 " " " " " " " " " -ve " "
3. 12 " " " " " under " " " +ve " "
4. 3 " " " " " " " " " -ve " "

Only 3 cases (NOS. 7 and 9 of Series I, and NO.15 of Series II) showed albumenuria after operation.

TABLE F.
 SERIES I
 [NON INSULIN]

Table of Results of Urinary Tests in Series I

NUMBER IN SERIES	FEHLING'S TEST FOR GLUCOSE*	FERMENTATION WITH YEAST.	ACETONE TEST (ROTHER'S)	DIACETIC ACID. DIPYRROIC CHLORIDE WILHELM'S	MAXIMUM % BLOOD SUGAR.
1	Trace	.	+	-	.297
2	+	.	+	-	.241
3	+	-	+	-	.196
4	+	-	++	-	.216
5	+	-	++	-	.181
6	+	+	+	- -	.227
7	+	.	+	+	.206
9	-	-	++	- +	.222
11	+	+	-	- -	.291
13	-	-	-	-	.386
15	lactose+	-	++	+	.147
16	-	-	-	-	.129
17	-	-	+	+	.206
18	+	-	-	-	.184
19	+	+	-	-	.156
21	+	-	-	- -	.320
22	-	-	+	- -	.181
23	+	-	++	- -	.156
24	+	-	+	- -	.146
25	trace	-	-	- -	.225
27	-	-	+	- -	.243
31	+	-	-	- -	.227
32	+	+	++	+	.187
34	+	-	-	-	.156
41	+	-	-	-	.181

* BERTRAND'S MODIFICATION.

SUMMARY OF TABLE F.

Series I.

Number of Urines tested -----25
Fehling's Reaction +ve -----19
Fermentation with Yeast ----- 4
Acetone present -----15
Diacetic Acid present ----- 3

Of 19 urines giving a +ve Fehling's Reaction,
11 contained Acetone.

Cases where the maximum % Blood Sugar was OVER 0.180%

- (1) with +ve Fehling's Reaction:-Nos. 1,2,3,4,5,6,7, 11, 18, 21, 25, 31, 32, 41.
i.e. 14 cases varying from 0.181%
to 0.320%.
- (2) " -ve " " Nos. 9, 13, 17, 22, 27.
i.e. 5 cases varying from 0.181%
to 0.386%.

Cases where the maximum % Blood Sugar was UNDER 0.180%.

- (1) with +ve Fehling's Reaction:-Nos. 15, 19, 23, 24, 34.
i.e. 5 cases varying from 0.146%
to 0.156%
- (2) " -ve " " No. 16.
i.e. one case at 0.129%.

In all cases Bertrand's modification of Fehling's solution was
used. (53).

TABLE G.
 SERIES II
 [INSULIN CASES]

Table of Results of Urinary Tests in Series II.

NUMBER IN SERIES II	FENLING'S TEST for GLUCOSE *	FERMENTATION TEST WITH YEAST.	ACETONE TEST (ROTHERAS)	DIACETIC ACID (1) FERRIC CHLORIDE (2) LINDERMANS.	MAXIMUM % BLOOD SUGAR.
1	-	-	-	-	.266
3	+	-	+	+	.187
4	trace	-	+	+	.253
5	trace	-	+	-	.287
6	trace	-	+	-	.143
7	trace	-	+	+	.156
8	-	-	-	-	.214
9	-	-	-	-	.147
11	-	-	-	-	.184
12	-	-	-	-	.211
14	-	-	-	-	.181
15	trace	-	+	+	.175
17	+	.	+	+	.133
20	-	.	+	+	.206
24	trace	-	+	+	.175
26	-	-	+	+	.193
28	trace	.	+	-	.137
29	trace	-	+	+	.150
32	trace	.	-	-	.237
33	+	.	-	-	.193
41	-	.	+	-	.175.

* BERTRAND'S MODIFICATION.

SUMMARY OF TABLE G.

Series II.

Number of Urines tested -----21
Reductions of Fehling's Solution -----12
Fermentations with Yeast -----None.
Acetone present -----13
Diacetic Acid present ----- 3

Of 12 urines containing a Fehling-reducing substance,
Acetone was present in 10.

Cases where the Maximum % Blood Sugar was over 0.180%

- (1) with +ve Fehling's Test:- Nos.3,4,5,32,33.
i.e.5 cases varying from 0.187% to 0.287%.
- (2) " -ve " " Nos.1,8,11,12,14,20,26.
i.e.7 cases varying from 0.181% to 0.266%.

Cases where the Maximum % Blood Sugar was under 0.180%

- (1) with +ve Fehling's Test :-Nos.6,7,15,17,24,28,29.
i.e.7 cases varying from 0.133% to 0.175%.
- (2). " -ve " " Nos.9,41.
i.e.2 cases,0.147% to 0.175%
-

(B)

Part IV.

The Pre-operative Blood Sugar.

The fasting or pre-operative Blood Sugar percentages in the 89 cases of this work have been grouped in the following tables to illustrate certain relationships.

Tables H and J, for the Non-Insulin and Insulin Series, respectively, have been drawn up to illustrate the relationship between % Blood Sugar fasting, on the one hand, with (1)sex, and (2)age, on the other. An examination of these tables reveals the following averages:-

(a).

Average fasting or resting Blood Sugar of 41 males,
ages ranging from 9 - 76 years, and with various complaints = 0.116%
(the lowest being 0.037%-cancer of the pylorus-and the
highest 0.191%-abdominal adhesions)

(b).

Average fasting or resting Blood Sugar of 46 females,
ages ranging from 15-69 years, and with various complaints = 0.124%
(the lowest being 0.056% - pregnancy,
the highest " 0.207% - abdominal adhesions).

(c).

Average fasting or resting Blood Sugar of 87 cases,
both sexes, all ages, and all complaints # 0.120%

(d).

The following tables illustrate the averages for different age groups:-

MALES.			FEMALES.		
AGE under 40.	40-60.	60 & over.	AGE under 40.	40-60.	60 & over.
No. of 19	16	7	No. of 22	19	5
Cases			Cases		
B.S. 0.116%	0.113%	0.119%	B.S. 0.122%	0.122%	0.138%

(e).

Tables K and L, with their summary, Table M, have been constructed to illustrate

- (1) the resting Blood Sugar in different types of disease, the disease group being clearly indicated at the side.
- (2) the response of the Blood Sugar to the administration of a general anaesthetic in 15 minutes, and in 30 minutes, in different individuals and (Table M) in different disease groups.

(f).

See next page.

(B).

Part IV. (continued).

(f). The Blood Sugar and Obesity.

It is unwise to draw conclusions from obesity, per se, in such a series of pathological cases as this, but where a patient was observed to be particularly obese, or particularly cachectic, a note was taken of the fact, and these observations are embodied in Tables K and L.

(1).

Considering the resting or fasting Blood Sugar alone, the following averages are obtained:-

16 particularly thin cases (chiefly cancer & gastric ulcer)

Average %B.S. = 0.115%.

11 particularly obese cases (includes 6 gall-stone cases)

Average % B.S. = 0.125%.

(2).

Where observations could be maintained for over 30 minutes anaesthesia it was found that the response of the Blood Sugar to a general anaesthetic in this series was as follows:-

	%B.S.before.	%B.S.after 15m.	%B.S.after 30
9 thin patients :-	0.134%	0.165%	0.171%
9 obese " :-	0.117%	0.145%	0.174%

*an. Res. vol.
no. 100.*

(3).

It was indicated earlier that in certain cases in each series there was a rise in the % Blood Sugar succeeded by a fall during the course of anaesthesia. These cases are :- Series I, Nos. 22, 28, 37, 44, and Series II, Nos. 4, 10, 12, 14, 24, 32, 36. An examination of these 11 cases shows that 4 were very thin, 6 medium build, and only 1 obese - apparently indicating a tendency for the fall in Blood Sugar to set in earlier in people of thin or medium build than in the obese.

TABLE H
SERIES I

[NON-INSULIN]

TABLE TO SHOW RELATIONSHIP BETWEEN
SEX, AGE AND RESTING % BLOOD SUGAR.

NUMBER IN SERIES	SEX	AGE	% BLOOD SUGAR
1	M	52	.177
2	F	50	.122
3	M	26	.115
4	F	35	.160
5	M	24	.146
6	M	31	.184
7	F	30	.100
8	M	9	.122
9	M	35	.083
10	F	40	.110
11	M	19	.191
12	M	54	.083
13	F	50	.143
14	F	28	.117
15	F	27	.143
16	M	54	.109
17	F	30	.137
18	F	49	.150
19	F	27	.118
20	F	40	.095
21	F	50	.175
22	F	21	.120

NUMBER IN SERIES	SEX	AGE	% BLOOD SUGAR
23	F	40	.141
24	M	31	.099
25	F	60	.109
26	F	45	.207
27	F	56	.093
28	M	76	.142
29	M	50	.048
30	M	66	.143
31	M	19	.109
32	F	29	.109
33	M	48	.145
35	M	31	.100
36	M	24	.164
37	F	27	.180
38	M	62	.086
39	M	46	.175
41	F	48	.160
42	F	69	.112
43	F	44	.106
44	M	46	.118
45	M	62	.106
46	M	57	.137

TABLE J.
SERIES II

TABLE TO SHOW RELATIONSHIP BETWEEN
SEX, AGE AND % BLOOD SUGAR, RESTING

NUMBER IN SERIES	SEX	AGE	% BLOOD SUGAR
1	F	60	.162
2	M	33	.134
3	F	37	.095
4	F	60	.143
5	M	32	.100
6	M	23	.050
7	F	48	.118
8	M	24	.088
9	M	31	.106
10	M	61	.119
11	M	32	.090
12	M	49	.100
13	M	44	.095
14	M	41	.075
15	F	23	.118
16	F	53	.075
17	F	30	.098
18	F	31	.081
19	F	52	.150
20	F	66	.165
21	M	51	.131

NUMBER IN SERIES	SEX	AGE	% BLOOD SUGAR.
22	F	50	.081
23	F	42	.056
24	F	32	.110
25	F	39	.118
26	F	33	.143
27	M	66	.118
28	F	26	.118
29	F	15	.112
30	F	27	.175
31	M	43	.143
32	F	52	.106
33	M	42	.037
34	F	43	.125
35	F	55	.100
36	M	41	.100
37	M	50	.137
38	F	18	.086
39	M	36	.075
40	F	23	.135
41	F	27	.110
42	M	39	.156
43	M	34	.100

TABLE K.
SERIES I

DISEASE AND (OR) LOCATION.	NUMBER IN SERIES I	% BLOOD SUGAR BEFORE ANAESTHESIA	% BLOOD SUGAR AFTER 15 MINS ANAESTHESIA	% BLOOD SUGAR AFTER 30 MINS. ANAESTHESIA.	OBESITY [O] CACHEXIA [C]
CANCER-BREAST	42	.112	-	-	
" PROSTATE	28	.142	.200	.210	
CANCER-STOMACH	1	.177	.246	.251	C
" OESOPHAGUS.	12	.082	.116	-	C
" PYLORUS	29	.048	.080	.110	
" OESOPHAGUS	33	.145	.180	-	
" COLON	39	.175	-	-	
T.B. PERITONITIS	10	.110	.135	-	
" ADHESIONS.	11	.191	.200	.212	
" ABD. RECTUS.	14	.117	.141	.157	
" CERVICAL GLDS	37	.180	.175	.170	
" PANCR. ABSCESS	36	.150	.168	-	C
GALL-STONES.	2	.122	.150	.200	
HYDATID CYSTS.	9	.083	.140	.180	
GALL-STONES	25	.109	.125	.150	O
" "	27	.093	.106	.140	O
" "	30	.143	.180	.215	
" "	41	.160	.170	.180	O
" "	44	.118	.141	.161	O
GASTRIC ULCER	6	.184	.172	.168	
" "	13	.150	.170	.200	O
" "	21	.175	.200	.240	O
APPENDICITIS	3	.113	.150	.197	
"	7	.100	.108	.115	
"	15	.143	-	-	
"	18	.150	.151	.165	
THYROID ADENOMA	4	.160	.171	.186	
" "	17	.137	.170	.203	
" "	22	.120	.150	.181	
HERNIA	23	.141	.150	-	
"	31	.109	.140	.190	
VARICOSE VEINS	32	.109	.128	.150+	
FEBRILE	38	.086	-	-	
PROSTATIC STRICT.	35	.102	.112	-	
PROLAPSE UTERUS	20	.095	.130	.153	O
ABDOMINAL -NIL	24	.100	.120	-	

Table to illustrate the response of the Blood Sugar to a general anaesthetic in different types of disease.

TABLE L

SERIES II

DISEASE AND (OR) LOCATION	NUMBER IN SERIES I	% BLOOD SUGAR BEFORE ANAESTHESIA	% BLOOD SUGAR AFTER 15 MINS. ANAESTHESIA	% BLOOD SUGAR AFTER 30 MINS. ANAESTHESIA	OBESITY "O" CACHEXIA "C"
CANCER - BREAST	1	.162	.220	.242	
" UTERUS	22	.081	.142	.175	O
" BREAST.	27	.118	.150	.165	
CANCER - PYLORUS	4	.143	.200	.253	C
" COLON	10	.120	.140	.170	
" STOMACH	20	.160	.175	.190	C
" "	33	.037	.112	-	C
T.B. KIDNEY	30	.175	.180	.183	
" CERVICAL GLDS.	11	.090	.110	.133	
" SALPINGITIS	17	.098	.108	.116	C
" CERVICAL GLDS	18	.080	.078	.076	
" " "	24	.105	.135	.175	
" " "	29	.112	.130	.145	
GALL - STONES	16	.070	.090	.130	O
" "	19	.150	.198	.240	O
GASTRIC ULLER	43	.100	.160	.195	C
DUODENAL "	2	.134	.171	.191	
" "	5	.100	.130	.155	C
" "	12	.100	.143	.177	
GASTRIC "	13	.090	.118	.141	
PREVIOUS DUOD "	14	.075	.095	.115	
GASTRIC "	36	.095	.093	.120	
" "	37	.137	.152	.168	
" "	39	.075	.100	.110	C
APPENDICITIS	6	.050	.112	-	C
"	38	.086	.140	-	
"	41	.112	.153	-	
"	42	.156	.185	.206	
THYROID CYST.	3	.095	.097	.100	
HAE MORRHIDS.	7	.118	.140	-	O
CYST.	8	.088	.160	.210	
PREGNANCY	23	.056	-	-	
VARICOCELE	31	.143	-	-	
PRACTURE	40	.135	.156	.180	
ABDOMINAL - NIL	26	.143	.153	.162	C

Table to illustrate the response
of the Blood Sugar to a
general anaesthetic in
different types of disease.

A summary of Tables K and L.

To illustrate the resting % Blood Sugar in different disease groups, and the variations within each group. Also to demonstrate the average group response to a general anesthetic.

TABLE M.

SERIES I AND II.

DISEASE GROUP.	LOWEST % BLOOD SUGAR	HIGHEST % BLOOD SUGAR	AVERAGE % BLOOD SUGAR RESTING
CANCER - NON-ALIMENTARY. 5 CASES.	.081	.162	.123
CANCER - ALIMENTARY. 9 CASES.	.037	.177	.121.
TUBERCULOSIS - CHIEFLY GLANDULAR. 11 CASES	.080	.191	.128
GALL-BLADDER AND HEPATIC DISEASE 9 CASES	.070	.160	.116
GASTRIC AND DUODENAL ULCER. 12 CASES.	.075	.184	.118
APPENDICITIS (CHRONIC) 8 CASES	.050	.156	.114
THYROID (SIMPLE HYPERTROPHY) 4 CASES.	.095	.160	.128
GROUP OF VARIOUS NON-DEBILITATED CASES. 10 CASES.	.056	.143	.108

NUMBER OF CASES CONSIDERED	AVERAGE % BLOOD SUGAR RESTING	% BLOOD SUGAR AFTER 15 MINS.	% BLOOD SUGAR AFTER 30 MINS.	INCREASE IN 15 MINS IN ANAESTHESIA	INCREASE IN 30 MINS IN ANAESTHESIA
4	.126	.178	.198	.052	.072
5	.130	.168	.195	.038	.065
9	.127	.140	.152	.013	.025
9	.116	.144	.177	.028	.061
9	.118	.141	.165	.023	.047
4	.137	.154	.175	.017	.038
4	.128	.147	.168	.019	.040
4	.110	.146	.186	.036	.073

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

Table B. has been drawn up to show the Blood Sugar changes up to 250 minutes from beginning anaesthesia in cases which received no saline afterwards. From this table the upper curve on "graph c" has been drawn to illustrate the average course of the Blood Sugar in these cases. In them, the maximum occurred about ten minutes after the cessation of anaesthesia. Lund and Richardson(12) found the average rise in the Blood Sugar in the first half hour to be 0.051% in 17 cases (method of Folin and Wu). This compares closely with the figure 0.045% obtained in the present series. When the longer anaesthesias (over 60 minutes) are considered as a group it is to be noted that the rate of increase in the second half hour was greater than in the first (0.061% compared to 0.042%). This may be wholly, or in part, due to the fact that in the first half hour some 5-10 minutes may be taken up by the induction of anaesthesia

It is of interest that Lund and Richardson attempted to correlate the extent of the increase of Blood Sugar in their cases with the following factors:-

- (1). Basal metabolism rate.
- (2). Pulse rate before and after operation.
- (3). Cyanosis during anaesthesia.
- (4). Amount of ether given.
- (5). Temperature of the patient.
- (6). Severity of post-operative symptoms.
- (7). Post-operative basal metabolism curve.
- (8). Duration of the disease.
- (9). Loss or gain of weight.
- (10) Age.

In their series no correlation of the data on these points could be found. So far as the above factors are concerned, with the exception of Nos. (1) and (7), which were not observed, general agreement must be expressed with Lund and Richardson's findings. With reference to age, the results obtained from Series I (Tables A and H combined) were:-

Ages under 40 - 14 cases

Average Incr. in B.S. in 30 mins. = 0.042%.

Ages over 40 - 15 cases

Average Incr. in B.S. in 30 mins. = 0.044%.

This demonstrates that age has no special influence on the extent of the rise in the Blood Sugar in anaesthesia.

No evidence of any particular influence on the Blood Sugar of fear, emotion, pain, or fatigue, previous to operation, was observed in the few cases in which estimations were made. The equanimity and nonchalance of the majority of the patients were remarkable. Epstein and Aschner (11) have shown similar results.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

The observation on the previous page, that in cases where the initial Blood Sugar was low the increase in 30 minutes was very great, and vice versa, is paralleled by that of Jacobsen (13). This worker noted, on giving 100 gms. glucose as a test meal, that the maximum Blood Sugar percentage was reached in 30 minutes in those cases where the original Blood Sugar was low, but might be delayed for 90 minutes where the original Blood Sugar was high.

The giving of morphia (1/6gr. of the sulphate) some 12 hours before operation can reasonably be considered as negligible in its effects on the Blood Sugar. Similarly, a pre-operative hyperglycaemia due to other factors such as

- (1). diabetes.
- (2). food.
- (3). exercise. (Brosalem. O. and Sterkel. H.), (14).
- (4). haemorrhage. (Epstein and Baehr.), (15).

may be considered absent, as the preparation for operation was uniform throughout.

- (3). The rate of fall of the Blood Sugar on the cessation of the anaesthesia was very considerably slower than the rate of the initial rise.

This is well illustrated on graph "C", where a curve, the average for a series of 7 cases on which extended observations were made, has been drawn. In three hours the Blood Sugar, after 40 minutes anaesthesia, had only fallen from 0.187% to 0.175%. In Lund and Richardson's cases an average Blood Sugar of 0.101% rose to 0.152% in half an hour, and 3 to 6 hours later it had only fallen to 0.137%. These workers, however, fail to state the average duration of anaesthesia. On graph "C" is also shown the curve of the Blood Sugar after 50 gms. glucose in normal individuals, as carried out by MacLean (16). A comparison between these two curves illustrates the marked change in carbohydrate metabolism caused by anaesthesia. When one considers that the variation in the glucose content of the blood is, in the normal case, due to exogenous sugar, and in the other, due to the alteration or mobilisation of endogenous sugar, or sugar-producing reserves, the actual difference has an increased significance.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

- (4). When a 10-12 unit dose of Insulin was given immediately before or early in anaesthesia in 35 cases, the Blood Sugar percentage increased by 0.047%, compared to an increase of 0.042% in 30 cases in which no Insulin was given. In the second half hour of anaesthesia where 10-12 units had been given, the Blood Sugar increased by 0.025%, (19 cases), compared with an increase of 0.061% where no Insulin had been given (9 cases). In 9 cases out of 43 in which the same amount of Insulin was given, the maximum point or peak of the Blood Sugar curve occurred during the course of anaesthesia, i.e. before the end of the operation a fall in the Blood Sugar had set in.

A dose of Insulin not exceeding 12 units during these observations was decided upon in order to obviate any risk of a hypoglycaemic reaction manifesting itself in an unrecognised case of renal glycosuria. As a matter of fact, no hypoglycaemic symptoms were observed, unless in one case (No. 3) where very profuse sweating occurred during the course of anaesthesia, possibly due to the action of Insulin. The Insulin was given subcutaneously throughout, so that its mode of action might be uniform. Mueller, Wiener and Wiener (17) have demonstrated that Insulin given intradermally has a greater Blood Sugar reducing value than the same dose given subcutaneously to the same animal under the same conditions, and these workers concluded that there are two physiological mechanisms whereby Insulin exerts its effects on the sugar metabolism, one method being a stimulation of glycogenesis in the liver through the medium of the parasympathetic system, and the other a direct hormone action on the glucose molecule itself. The subcutaneous route only was used in all cases of this series.

It will be evident from the results shown above that Insulin given subcutaneously, in 10 unit doses, does not exert any particularly marked influence on the Blood Sugar in anaesthesia until at least half an hour after its administration. In the second half hour the effect is quite evident, the average increment being reduced from 0.061% to 0.025%. 10-12 units, however, is too small a dose to abolish the hyperglycaemia due to ether when it is given immediately before the administration of the anaesthetic, but nevertheless it served in 9 cases out of 43 (i.e. 21%) to cause a rising Blood Sugar to fall while ether was still being given. It must be noted that the foregoing figures are only the average ones of the 43 cases studied, and that there was very considerable variation in individual cases. Some reacted quickly to the Insulin, while in others there was very little apparent effect. A comparison of cases 21 and 22 demonstrates how variable these effects might be. Though the procedure was similar, case 21 showed a fall of 0.036%, while case 22 showed a rise of 0.153%. The same batch of Insulin was used throughout these cases.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

This extreme variability in the pharmacological effects of Insulin is in keeping with the observation of Fletcher and Campbell (18), who showed that the extent of the fall of the Blood Sugar after Insulin did not bear any accurate relationship to the amount of Insulin given, even in the one patient.

The delayed effect of the Insulin on the Blood Sugar in the second half hour of anaesthesia on the foregoing surgical cases, none of whom was known to have diabetes, recalls the significant observation of Hepburn (19) and his collaborators that Insulin can scarcely cause any lowering of the Blood Sugar in diabetic (depancreatized) dogs whilst under ether, from which Macleod (20) inferred that ether might neutralise the action of Insulin when there was no glycogen in the liver.

- (5). The effect of 10 units of Insulin in later periods after anaesthesia was to hasten the return of the Blood Sugar to normal.

A comparison of the two upper curves on graph "c" illustrates the average change of the Blood Sugar in the Insulin and the non-insulin series.

- (6). A 10-12 unit dose of Insulin given to patients already anaesthetised by Ether or Chloroform-Ether mixture had practically no effect in checking or diminishing the extent of the hyperglycaemia due to the anaesthetic.

The observations of paragraph (4) above are based on the results obtained in the whole series of cases, 43 in number. Almost half of this number received their injection of Insulin either prior to the giving of the anaesthetic or else during the induction, i.e. before complete anaesthesia had been established.

Table E has been drawn up to afford the means of considering the effect of 10-12 units of Insulin given after the patients were already anaesthetised. The figures in Table E have been obtained strictly from the curves, taking the time of giving Insulin as zero, and working at fixed intervals from then, throughout the period of full anaesthesia. Again as indicated in paragraph (4) above, the results are variable, but the extent of the variation is not quite so marked as in these of the whole series.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

(6). continued.

Considering the ten cases in which anaesthesia lasted for an hour from the time of giving Insulin, one finds the average increase in the first 30 minutes to be 0.045%, and in the second 30 minutes to be 0.041%. Comparable figures are obtained for those cases which lasted 75 minutes. For 23 such cases the average increase in the first half hour was 0.040%. These figures have all been plotted on graph "D". An examination of these figures and a comparison of graph "D" with the curves on graphs "A", "B", and "C" demonstrates that injection of 10 units of Insulin after anaesthesia had set in had no appreciable effect on the Blood Sugar up to 75 minutes.

Taken in conjunction with the results mentioned in paragraph (4) these facts indicate that, while 10-12 units of Insulin given before the induction of anaesthesia reduces the extent of the hyperglycaemic reaction of anaesthetics such as Ether or Chloroform-Ether mixture it is of little use if given after anaesthesia has been induced. They would further indicate that if Insulin in 10 unit doses were to be given to a diabetic patient prior to operation, it should be given at least half an hour before operation. Macleod (21) recommends administration of Insulin for several days prior to operation on diabetics, in order to augment the reserves of glycogen. He has also stated that Insulin is of little avail in combating post-operative coma, if its administration is delayed until after the operation. Eadie has shown that the maximal influence of Insulin in suppressing an alimentary hyperglycaemia due to sugar administration is exerted when Insulin is given 75 to 90 minutes before the sugar. MacLeod (22) has shown that when given to dogs in which the hyperglycaemia due to ether is already established more Insulin is required to bring the Blood Sugar within normal limits than when the animal is given Insulin before ether.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

- (7).. The administration of a 10 unit dose of Insulin before an anaesthetic considerably reduced the amount of Fehling's-reducing substances in the post-anaesthetic urine. A similar dose of Insulin was not found to exert any appreciable effect on the presence of Acetone or of Diacetic Acid in the urine.

76% of the post-operative urines in Series I were found to reduce Fehling's solution, compared with 57% in the Insulin Series. Many substances are considered as able to reduce Fehling's solution (Hutchison and Rainy (23).), but of such substances glucose is by far the most common. Uric acid, creatinin, lactose, glycuronic acid, and the products of certain drugs, such as chloroform, are among the number. Experience tends to show, however, that, with the exception of sugar, these are inconstant in their appearance, and irregular in their effects on the reduction of Fehling's solution. Bial's test for pentoses was used throughout, but with negative results. Griffin and Thompson (24) consider that this test eliminates the possibility of glycuronates being present. In the cases studied here the average reduction of Fehling's solution was definite but generally there was not sufficient sugar present to give much fermentation with yeast. (4 cases in 25).

The 10 unit dose of Insulin here given did not appear to reduce the percentage of cases of ketonuria due to the anaesthetic. Banting and Best (25) and their collaborators showed that Insulin decreased ketonuria, even although glycosuria might still be considerable. Macleod, (26), has suggested that ketonuria only occurs when the glycogen of the liver has disappeared, and that glycogen can be built up in the liver as a consequence of the injection of Insulin. The occurrence of ketonuria with diminishing glycogen stores in the hepatic tissue may explain the action of anaesthetics in causing the Blood Sugar to increase, e.g. from a toxic action on the liver causing glycogenolysis.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

(8). The Renal Threshold for Sugar was found to be very variable. much more variable than is generally supposed - and too variable to permit one assigning definite normal limits to it. The figures obtained emphasise the need for a reconsideration of the validity of the theory of the Renal Threshold.

The response of the urines tested to Fehling's solution may be summarised thus:- (46 urines tested)

Number of Cases.	Blood Sugar Variation.	Fehling's Reduction.
19 cases	from 0.181% to 0.320%	Present.
12 "	" 0.133% to 0.175%	Present.
12 "	" 0.181% " 0.386%	Absent.
3 "	" 0.129% " 0.175%	Absent.

Certain difficulties stand in the way of a correct estimation of the Renal Threshold:- (a) it is almost impossible to make quite certain that the Blood Sugar observed is actually at the highest level attained during or after anaesthesia, or after a glucose meal. (b) even when the blood and urine are removed as close together as possible they cannot be considered as simultaneous specimens. (c) while the Blood Sugar curve is falling the relationship between the Blood Sugar concentration in blood and in urine may be quite different from what it is while the curve is ascending. (d) the rate of urine formation is an unknown and variable but important factor.

Many authorities are in close agreement on the question of the Renal Threshold for Sugar. MacLeod (27) considers it to stand between 0.160% and 0.180%, Todd (28) from 0.170% to 0.180%, MacLean (29) from 0.160% to 0.170%. Host (30) from an interesting study on carbohydrate tolerance in pregnant women has shown that early in pregnancy the position of the Threshold is 'normal', and glycosuria is due to marked hyperglycaemia, and is not, as is generally believed, of renal origin, while, on the other hand, in the latter part of pregnancy the Renal Threshold is often so low that glycosuria often occurs independently of a hyperglycaemia, indicating, therefore, a renal glycosuria. O.L.V. de Wesselow (31) regards the normal threshold as 0.180%, but recognises the variations below and above that figure. "The threshold may be raised and no appreciable amounts of glucose will appear in the urine, even although the Blood Sugar is very much above any level attained in health. In this latter group sugar may be absent from urine when the Blood Sugar

(8). continued.

has reached a figure of 0.20% or even 0.30%". Goto and Kuno (32), studying carbohydrate tolerance in the Japanese, found 40% of men who had glycosuria with a Blood Sugar below 0.190%. These workers placed the upper level of the Renal Threshold definitely at 0.170%, but they were unable to state the lower level.

The workers quoted above have based their conclusions generally on studies of the carbohydrate tolerance, and the giving of standard doses of glucose.

A study of the results of the present cases where the increase in the Blood Sugar has been obtained from an endogenous source, i.e. by glycogenolysis, demonstrates two interesting points; viz., (1) that 28% of the series failed to show glycosuria although their Blood Sugar was over 0.180%, and (2) that 28% of the series showed glycosuria with a Blood Sugar of less than 0.175%. One case (No. 13, Series I) had a Blood Sugar curve which reached to 0.386%, received an anaesthetic for 85 minutes, and then a rectal saline with 5% glucose, and had a Blood Sugar constantly above 0.200% for over four hours, and yet the first urine passed when consciousness was regained neither gave a +ve Fehling's reaction nor fermented with yeast.

The deduction which must be made from the present work is that 56% of the cases here observed do not accord with the doctrine of a fixed renal threshold of about 0.180%. When, in addition, it is remembered that traces of sugar or related carbohydrates can be demonstrated in normal urines, a further doubt is thrown upon the validity of the theory. The theory itself is attractive and frequently useful as a working hypothesis, but it fails to give an adequate explanation of the occurrence of the two foregoing facts. Until, however, more evidence on the subject has accumulated it is difficult to furnish a better explanation of the process.

The renal threshold -if there is one -must be considered as being of much greater variability than is generally supposed. This series of cases shows that it varies greatly between one non-diabetic person and another, under the influence of an anaesthetic. It even appears to change during the course of pregnancy (Host). (30). For all the evidence to the contrary, it may vary frequently to slight degrees in normal persons at different times and under different conditions. No physiological fluids in the body have an absolutely constant composition, but appear to be influenced, if only very slightly, by various physical and metabolic processes in the attempt to maintain a condition of physiological equilibrium. The renal threshold is not unlikely to be one such factor.

PRECIS OF RESULTS AND DISCUSSION THEREON.

(8). continued.

With the foregoing reservations, it may be concluded, therefore, that the so-called Renal Threshold is a very variable level of the Blood Sugar. It may average about 0.180%, but thresholds much above or a little below this figure exist without any obvious departure from health. A threshold of 0.250% is not necessarily incompatible with health. Until another explanation can be furnished to replace it, it is inadvisable to go so far as Benedict, Osterberg, and Neuwirth (33), who deny the significance of the Renal Threshold, and in addition, plead for the abandonment of that doctrine without, however, offering one to replace it.

The facts that the cases here studied are all surgical, some having lesions leading to profound metabolic disturbance, and that it is impossible to overcome the obstacles previously mentioned as incidental to the estimation of the Renal Threshold, prevent one attempting to state definitely the limits within which the normal physiological threshold may be considered to lie. To say, however, as many workers do, that, as a rule, the Renal Threshold is about 0.180% is to establish a rule virtually full of exceptions.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

(9). The average pre-operative or resting Blood Sugar was found to be, in the 89 cases studied, 0.116% for males, and 0.124% for females; average for the series 0.120%. The range was from 0.050% up to 0.207%. (MacLean's method on arterial blood).

The results obtained by other workers are shown in the table below. Their results are, as a rule, obtained from healthy persons unlike those here studied, which are all surgical cases. There is a general correspondence between all their figures as regards the upper limit of the fasting Blood Sugar. The estimations in the present series were carried out on arterial blood which, as shown by Faber (34) has a slightly higher Blood Sugar concentration than venous blood, also demonstrated by Wertheimer (35).

The resting Blood Sugar:-

Observers.	Methods.	Average %.	Variations.
MacLean (36)	MacLean.	0.100%	---
Epstein & Aschner (37)	Lewis & Benedict.	0.090%	0.066%-0.109%
Liefmann & Stern (38)	---	0.085%	---
Todd (39)	---	0.100%	0.090%-0.120%
Host (40)	Hagedorn & Norman-Jensen.	0.097%	---
Gettler & Baker (41)	Original Lewis Benedict.		0.050%-0.120%
Hopkins (42)	Bang mino.		0.060%-0.110%
Myers & Bailey (43)	Modified Lewis Benedict.		0.090%-0.110%
Williams & Humphries (44)	Original Lewis Benedict.		0.070%-0.140%
De Wesselow (45)			0.070%-0.110%

Host (40) found the average Blood Sugar in healthy men to be slightly less (0.095%) than in healthy women (0.099%), while Epstein and Aschner (37) found the reverse in surgical cases, males 0.096%, females 0.084%. Sex, therefore, appears to exercise no particular influence on the Blood Sugar so far as the above results are concerned.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

(10). Age was not found to exercise any appreciable influence on the Blood Sugar in persons under 60 years. Over that age there was evinced in both sexes a tendency for the Blood Sugar to rise slightly.

The tables in the summary of Part IV are drawn up to illustrate the Blood Sugar in different age groups.

Spence (46) has shown that as age advances there is a tendency for the Blood Sugar curve after a glucose meal to approach the diabetic type, i.e. with a slightly elevated fasting level, a considerable rise, and a slow, prolonged fall.

(11). The pre-operative or resting Blood Sugar was found to vary slightly in different disease groups, being highest in thyroid cases and lowest in the group of non-debilitating complaints, e.g. hernia, fracture, etc. Malignant disease (cancer) occupied an intermediate position. The obese patients on the whole, had a resting Blood Sugar above the cachectic.

Among the many conditions and agencies leading to a high resting Blood Sugar, mention is made of diabetes, Graves' disease, obesity, nephritis with high blood pressure, sepsis, malignant tumours, and haemorrhage. (de Wesselow 47). The present series gives confirmation of this in the case of simple hyperthyroidism (0.128%), cancer (0.123%), and obesity (0.125%), while it was also noted that the cases of surgical tuberculosis (chiefly cervical glands) had also a relatively high Blood Sugar, 0.123%. It must be recollected, however, that half of the obese subjects were also afflicted with gall-stones. Two of the cases of cancer of the pylorus were found to have a resting Blood Sugar of 0.048% and 0.037%. No observations were made on cases of sepsis, haemorrhage, or nephritis.

(12). The range of the pre-operative Blood Sugar within each disease group was found to be much greater than in health.

Three cases of cancer of the stomach had, for example, pre-operative Blood Sugars of 0.037%, 0.048%, and 0.177%: two cases of chronic appendicitis figures of 0.050% and 0.156%: two cases of thyroid enlargement 0.095% and 0.160%, and two cases of gall-stones 0.070% and 0.160%.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

- (13). The extent of the average increase, in different disease groups, due to the administration of the anaesthetic for a given time varied considerably, being greatest in the groups of non-debilitated cases and in malignant disease, and least in the cases of Tuberculosis (chiefly of cervical glands) and chronic appendicitis.

In this connection it should be recalled that Friedenwald and Grove(48) have made the interesting observation that a hyperglycaemia with slow return to normal, consequent on a glucose meal, is not uncommon in malignant tumours of the intestinal tract. This was noted in 72 cases out of 75. They concluded from their work that the blood changes associated with malignant disease appeared to be the result of a widespread disorder of the function of the body tissues, involving the kidneys and the endocrine organs.

In the cases studied here the estimation of the Blood Sugar changes in anaesthesia afforded no point of diagnostic value, comparable to Friedenwald and Grove's observation, but it is notable that the Blood Sugar response to anaesthesia was greater in the malignant tumours than in other diseases. Table M shows the collected figures for each disease group on which the foregoing observations are based.

- (14). In a series of pathological cases it is unwise to draw rigid conclusions from a study of obesity or cachexia, since one or other condition is so frequently a concomitant of serious disease, but, if the nature of the diseases be ignored for the moment, the particularly obese cases in the series showed a slightly higher Blood Sugar percentage than the particularly thin cases (0.125% compared to 0.115%), while the increase after 30 minutes anaesthesia was considerably greater in the fat than in the thin cases, the increase being 0.057% in the former and 0.037% in the latter. It was also observed that the return to normal tended to set in earlier in the thin patients.

PRECIS OF RESULTS AND DISCUSSION THEREON. (continued).

- (15). In seven out of the 89 cases, the resting Blood Sugar was found to be 0.075% or under. Six of these were cases of gastrointestinal disease. They illustrate the fact that patients may be perfectly conscious, and the usual signs of hypoglycaemia absent, with the Blood Sugar at an abnormally low level, e.g. as low as 0.050%.

The cases referred to are:-

No. of cases.	Disease.	Initial %Blood Sugar.
Series I. 29.	Cancer of Pylorus.	0.048%.
Series II. 6.	Chronic Appendicitis.	0.050%.
" 14.	Duodenal Ulcer.	0.075%.
" 16.	Gall Stones.	0.075%.
" 23.	Pregnancy.	0.056%.
" 33.	Cancer of Stomach.	0.037%.
" 39.	Duodenal Ulcer.	0.075%.

P.J. Cammidge (49) has published notes on two cases of hypoglycaemia. The first was that of a man of 46, whose complaint was the slow onset of weakness, giddiness, and lethargy, and whose fasting or resting Blood Sugar was 0.045%, which a 50gm. glucose meal did not raise above 0.100%. there was no glycosuria. The cause was considered to be hypoglycaemia due to a defect in the functional activity of the liver, accentuated by a toxæmia of hepatic and intestinal origin. The second case was that of a man whose complaint was weakness, lethargy, and increase in weight. His resting Blood Sugar was 0.050%. He excreted sugar after a test meal. Cammidge considered that in this case the cause of the glycosuria lay in a low calcium content of the blood, thus causing unusual permeability of the kidneys for dextrose. The patient improved under calcium and parathyroid therapy.

MacLeod (50) has indicated that in man subjective symptoms of hypoglycaemia due to Insulin administration usually commence at about 0.075%. In animals at 0.045% definite objective symptoms are usually observed.

Fletcher and Campbell (51) stated that there are patients who become aware of hypoglycaemia when the Blood Sugar is between 0.080% and 0.090%, while, on the other hand, there are cases where no symptoms have been observed at the level of 0.054%. A Blood Sugar of 0.035% is usually accompanied by unconsciousness. The lowest Blood Sugar observed by these workers was 0.025%.

MacLeod (52) has suggested that symptoms of Insulin hypoglycaemia may be due to the rapidity of the fall in the Blood Sugar, rather than to its absolute level.

These results, together with those of other investigators quoted above, indicate the necessity for careful search for an organic lesion, especially of the alimentary tract, whenever an unusually low Blood Sugar is discovered.

PRECIS OF RESULTS. (Continued).

(16). General observations on the patients, on the ease or otherwise with which they stood the stress of the operation, on their clinical condition after the operation, post-operative vomiting, shock, collapse, recovery from the anaesthetic, revealed no substantial difference between those who had received insulin and those who had not received it.

(D).

GENERAL SUMMARY OF RESULTS.

The administration of Ether, or of Chloroform-Ether Mixture, as an anaesthetic, raised the Blood Sugar to a considerable but varying extent. The amount of the increase bore some proportion to the length of the period of administration, except in cases where the initial Blood Sugar was already high. Obese cases responded more actively than cachectic cases. A fall in the Blood Sugar generally set in within a few minutes of stopping the anaesthetic. The rate and extent of the rise in 40 minutes anaesthesia was very similar to that consequent on giving 50gms. glucose, but the rate of return to normal was very much slower.

Small doses of Insulin given just before the anaesthetic had the effect of diminishing the extent of the rise of the Blood Sugar, and of accelerating the rate of return to normal. Given when hyperglycaemia was already in progress Insulin in 10 unit doses had little or no effect in checking the increase in blood glucose due to the anaesthetic. The effect on the Blood Sugar of 10 units of Insulin varied very considerably between one individual and another.

10 units of Insulin before anaesthesia reduced the amount of the Fehling's reducing substances in the urine, but did not appear to exercise any appreciable effect on the presence of Acetone or Diacetic Acid therein.

Of the cases examined, none of whom were known to be diabetic, 28% excreted sugar with Blood Sugars below 0.175%, and 28% failed to excrete sugar with Blood Sugars varying from 0.180% to 0.386%, thus showing greatly diverging threshold values.

The average resting Blood Sugar was found to be 0.120%. It was independent of age below about 60 years, and was slightly raised in the obese and in the female sex. It varied greatly with different diseases, cases of simple hyperthyroidism, gastro-intestinal cancer, cervical adenitis showing a slightly raised Blood Sugar on the average. Wide divergencies, however, occurred within each age and disease group. The extent of the increase in the Blood Sugar, in anaesthesia, in malignant disease of the intestinal tract, was found to be greater than in any of the other disease groups here studied.

Resting Blood Sugars at a level below 0.075% were found in 8% of cases, without signs of hypoglycaemia. All these cases, with one exception, had gastro-intestinal disease.

The administration of 10-12 units of Insulin prior to surgical operations was not found to influence the clinical condition of the patients, either beneficially or otherwise.

(E).

CONCLUSIONS.

Insulin, given in small doses prior to general anaesthesia, has the effect of diminishing the extent of the increase in Blood Sugar which practically always occurs with ether or chloroform-ether mixture, but it exercises little or no influence if given after the hyperglycaemic process has begun to manifest itself. To produce its maximal sugar-reducing effect Insulin should be given at least 30 minutes before the anaesthetic.

Insulin in small doses before operation confers no particular clinical benefit upon the patient unless he is diabetic.

The average resting Blood Sugar is about 0.120%, and tends to vary with sex, the amount of adipose tissue, and with the nature of the disease.

The Blood Sugar response in anaesthesia in cases of malignant tumours is greater, on the average, than the response in most other common surgical conditions.

Evidence of the great variability of the Renal Threshold in anaesthesia is adduced, and certain facts stated which are not consistent with the validity of the doctrine of the Renal Threshold.

A resting Blood Sugar at a hypoglycaemic level is common, (8% of all cases observed) and frequently found as a concomitant of gastro-intestinal disease of an organic nature.

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I hereby certify that all the whole of the experimental work described in the accompanying Thesis has been carried out by myself, and also that the Thesis itself is my own unaided composition.

Robert Lindsay Mackay.
11th Jan. 1927.

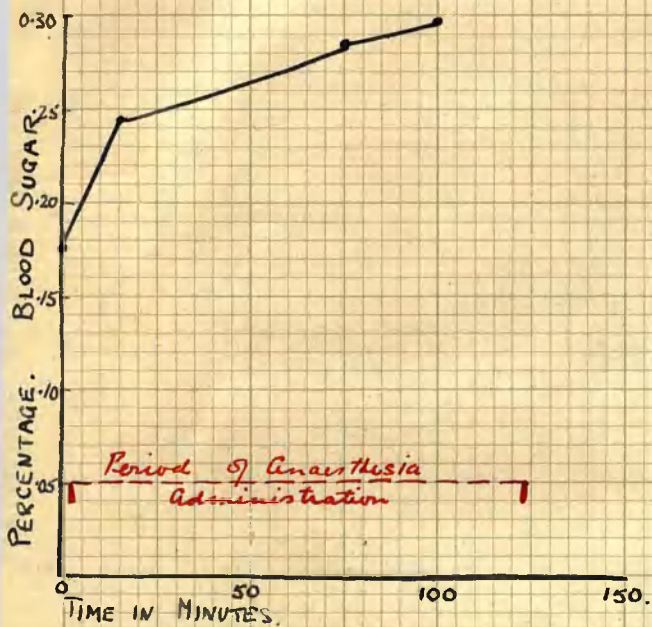
Thesis on " The Blood Glucose in General Anaesthesia "

THE BLOOD GLUCOSE IN GENERAL ANAESTHESIA.

(G).

APPENDIX.

The Blood Sugar curves of all the cases of each series are shown separately in the pages which follow, together with all the personal data and the results of the urinary examinations.



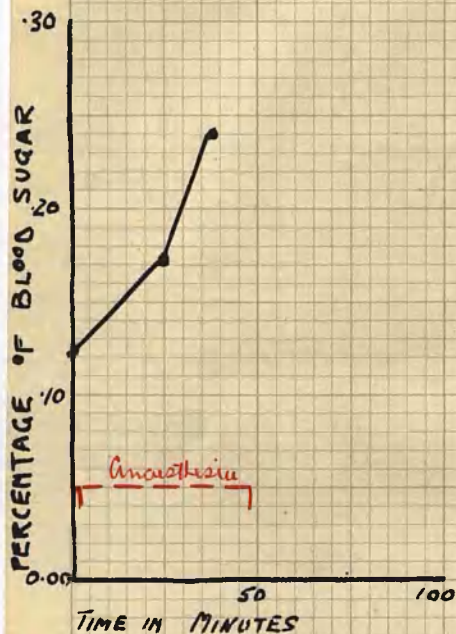
Name.	Thos. Small.
Age	52.
Anaesthetic	Ether, open.
Sedatives before oper.	Morphine $\frac{1}{6}$. Atropine $\frac{1}{50}$.
Disease.	Gastric Carcinoma
Operation	Gastro-entriostomy.
General condition.	Poor condition, emaciated

<u>Time-table</u>	<u>Blood Sugar</u>
<u>Minutes</u>	<u>Percentage</u>
0	0.177% /o then Ether.
15	0.246%
75	0.286%
100	0.297%
125	Anaesthetic ended.

<u>Urine before operation</u>	—	normal.
<u>" after "</u>	—	Glucose + trace. Acetone + ve Diabetic - ve Albumen - ve. Mucus + ve.

CASE No 2

SERIES I



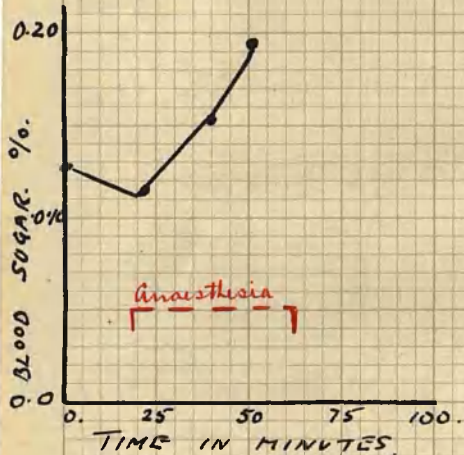
NAME. Rose Smart.
 AGE. 50
 ANAESTHETIC. CHCl_3 → mixture of C & E then with oxygen.
 SEDATIVES. Morphine $\frac{1}{2}$ gr.
 DISEASE. Gall-stones.
 OPERATION. Cholecystectomy.
 GENERAL CONDITION. Well nourished.

TIME-TABLE (MINUTES)	% BLOOD SUGAR.
0	0.122%
25	0.172%
37	0.241%
47	Anaesthesia ended.

Urine before operation — Normal.
 " after " — Glucose +ve
 Acetone +ve
 Diacetic A. —ve
 Albumen —ve.
 Urates +ve.
 Acid Reaction +ve.

CASE No. 3

SERIES I



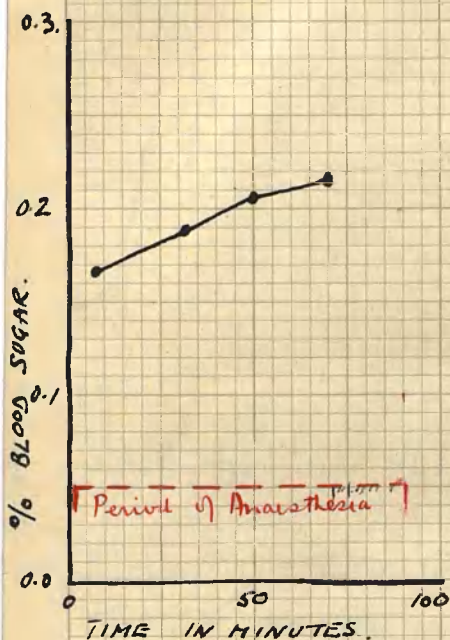
NAME Wm. Harrison
 AGE 26.
 ANAESTHETIC CHCl_3 → mixture.
 SEDATIVES Morph $\frac{1}{6}$ + Atropine $\frac{1}{100}$
 DISEASE ? Chronic appendicitis
 OPERATION Appendicectomy.
 GENERAL CONDITION. Very good.

TIME-TABLE (minutes)	% BLOOD SUGAR.
0	0.128 %
18 → CE	0.113 %
22	0.152 %
38	0.196 %
51	0.196 %
62 → CE ended.	

Urine before operation — Normal.
 Urine after operation —
 (two specimens) Glucose? + (Felling's reduced)
 Acetone +
 Diacetic -ve
 Albumen -ve
 Urates +ve.
 Fermentation -ve.
 Acid Reaction +ve.

CASE No. 4

SERIES I



NAME Ethel Lockley.
 AGE 35
 ANAESTHETIC ETHER.
 SEDATIVES Morph $\frac{1}{6}$ Amp. $\frac{1}{100}$.
 DISEASE SIMPLE CYSTIC OVARY
 OPERATION Removal.
 GENERAL CONDITION Fair

TIME TABLE.

0.
 8.
 32.
 50
 71

% BLOOD SUGAR.

Anaesthetic started.
 0.166 %.
 0.187 %.
 0.206 %
 0.216 %.
 Anaesthetic ended.

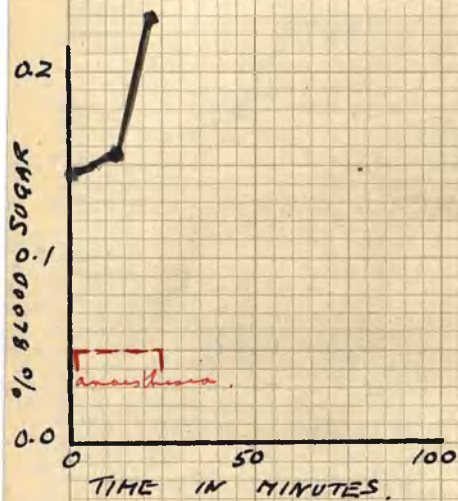
Urine before operation — Normal.

Urine after operation —
 (two specimens)

Fehling Test. + ve.
 Fermentation - ve.
 Acetone ++ ve.
 Diaetic A. - ve.
 Albumen - ve.
 Urate +
 Spec. Grav 1040.

CASE No. 5

SERIES I



NAME	TLR. Richards	TIME TABLE	% BLOOD SUGAR.
AGE	24.	0	0.146%
ANÆSTHETIC	Ether.	13	0.152%
SEDATIVES	morph $\frac{1}{6}$.	21	0.181%
DISEASE	???		
OPERATION	Laparotomy - nil found.		
GENERAL CONDITION	Good.		

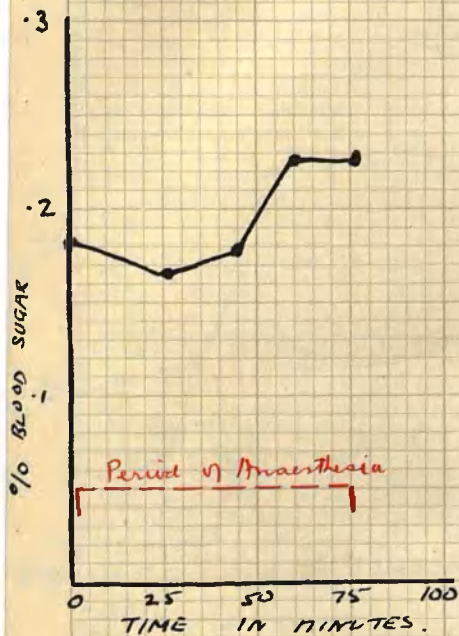
Urine before — normal.

Urine after operation
(two specimens)

Fehling's Test.	+ve.
Fermentation	-ve.
Acetone	++ve
Diastase A.	-ve.
Albumen	-ve
Uates	+ve.
Spec. grav.	1031.
acid reaction	+ve.

CASE No 6

SERIES I



NAME F. Wilkes.
 AGE 31.
 ANAESTHETIC CHCl_3 , then CCl_4 mixture.
 SEDATIVES Morphine Atropine
 DISEASE Gastric ulcer + Dilatation
 Pyloric Stenosis.
 OPERATION. Gastroenterostomy.
 GENERAL CONDITION. Thin

TIME TABLE.
(minutes)

% BLOOD SUGAR.

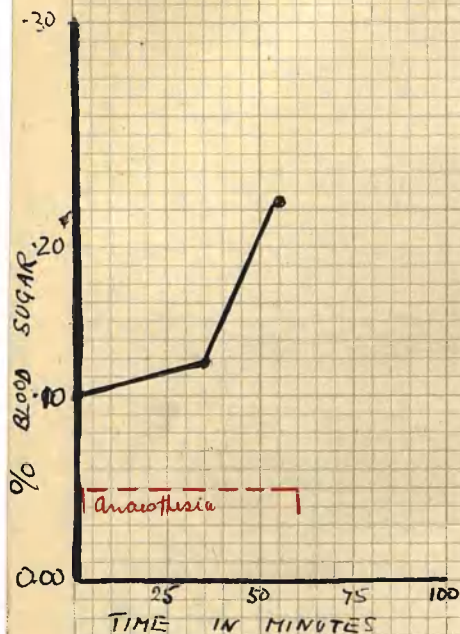
0	0.184 %
26	0.162 %
44	0.177 %
62	0.227 %
78	0.227 %

Urine after operation - (two specimens)

Fehling's Test.	+ve.
Fermentation	+ve.
Acetone	+ve.
Reaction (Zell.)	-ve.
Landmann's Test	-ve.
Albumen	-ve.
Urates	+ve.
Spes-grav.	1030.

CASE No 7

SERIES I



NAME Emily Paddock
 AGE 30
 ANAESTHETIC CHCl_3 then CE Mixture
 SEDATIVES Morph '64. Atropine 100gr.
 DISEASE ?? Rt. sided pain.
 slight visceropain
 OPERATION Appendicectomy
 GENERAL CONDITION Fair.

TIME-TABLE
 (minutes)

0
 25
 35
 54

% BLOOD SUGAR

0-100% then CHCl_3
 Catheterisation of Ureters
 0-118% and CE
 Mixture
 0-206%

Urine before operation Normal.

Urine after operation (two specimens)

Fehling's Test +ve.

Acetone +ve

Diacetic (FeCl_2) +ve

(Lundmann's) +ve.

Albumen +ve.

Uates +ve

Aut Reaction +ve

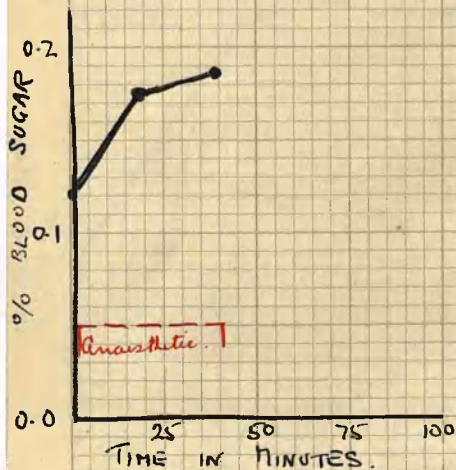
Spec. Gr. 1030

Blood. +ve

(from catheter?)

CASE No 8

SERIES I



TIME TABLE
(minutes)

% BLOOD SUGAR.

NAME Graham Gallegmore
 AGE 9.
 ANAESTHETIC Open Ether.
 SEDATIVES Morphine m 5.
 DISEASE Pyloric Stenosis &
 Gastric Dilatation
 OPERATION Pylorotomy.
 GENERAL CONDITION Thin.

0

0.122%

18

0.177%

38

0.187%

Time not available

CASE No 9

SERIES I



NAME Arthur Wootton
 AGE 35
 ANAESTHETIC CHCl_3 , then Ether.
 SEDATIVES Nil.
 DISEASE Hydatid Cysts in Liver
 OPERATION Removal.
 GENERAL CONDITION Fair.

TIME TABLE
(MINUTES)

% BLOOD SUGAR

0	0.083%
5	CHCl_3 , then Ether.
26	0.156%
45	0.216%
68	0.222%
70	Anaesthetic finished
260	0.204%

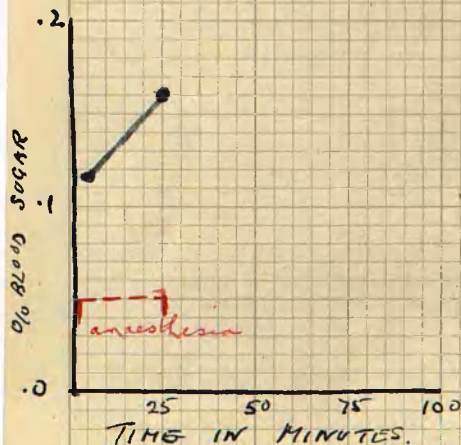
Much liver-handling during operation.

Urine after operation (two specimens)

Fehling's Test	-ve
Fermentation	-ve.
Acetone	++ve
Diacetic Acid	-ve (FeCl_2)
" "	+ (Benedict)
Albumen	+ve
Urates	+ve.
Acid Reaction	+ve.

CASE No 10

SERIES I.



TIME TABLE
(minutes)

% BLOOD SUGAR

NAME *Maud Humphries*

AGE *40.*

ANAESTHETIC *Open Ether.*

SEDATIVES *Morph $\frac{1}{6}$ Atropine $\frac{1}{100}$*

DISEASE *[? T.B.] Pelvic Peritonitis*

OPERATION. *Laparotomy.*

GENERAL CONDITION. *Very poor.*

*Temperature had been 103°
for 4 days.*

Patient died next day.

0.

Ether given

6

0.117%

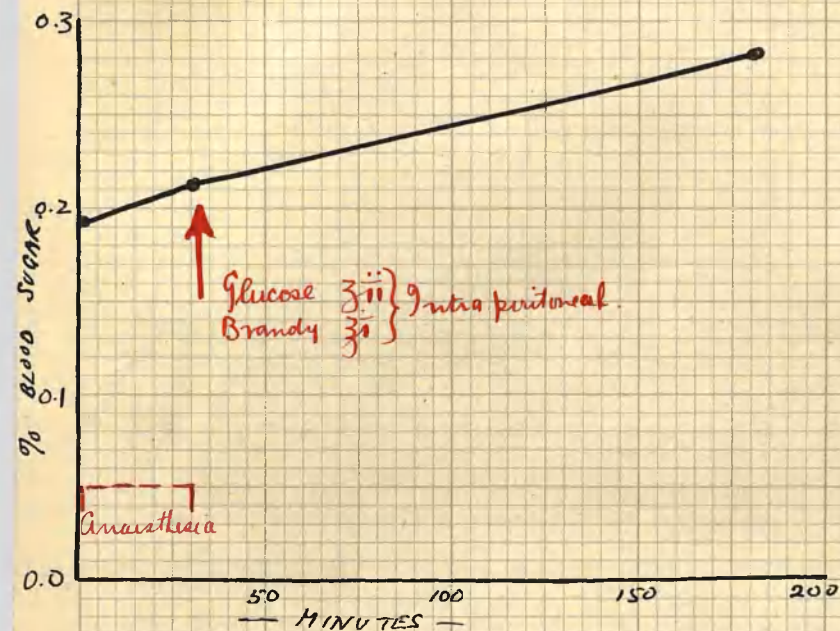
25

0.162%

Time not available.

CASE No 11

SERIES I



NAME Ralph Bloor.
 AGE 19.
 ANAESTHETIC $CHCl_3$, then Ether.
 SEDATIVES Morph $\frac{1}{6}$ Atuspine $\frac{1}{60}$
 DISEASE Acute intestinal obstruction due to T.B. adhesions.
 OPERATION Laparotomy.
 GENERAL CONDITION. Poor.

TIME-TABLE
(minutes)

BLOOD SUGAR

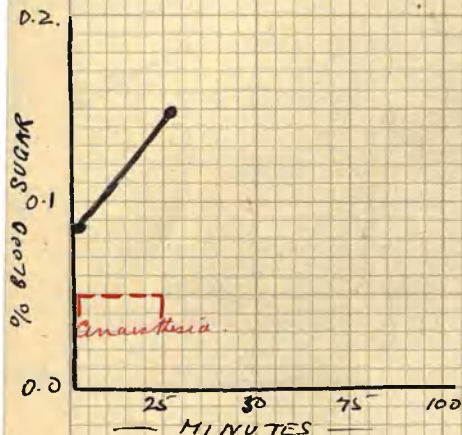
0. $CHCl_3$, then Ether
 2 0.191%
 29 0.211%
 31 3.ii glucose and 3i brandy, intra peritoneal
 180 0.291%

Urine after operation (two specimens)

Fehling's Test. +ve (trace)
 Fermentation +ve (trace)
 Acetone -ve
 Diacetic Acid $FeCl_2$ -ve.
 Linderman's. -ve.
 Albumen -ve
 Urea +ve.
 Acid Reaction +ve.

CASE No 12

SERIES I



NAME Joseph Collett.
 AGE 54.
 ANAESTHETIC Open Ether.
 SEDATIVES Morph $\frac{1}{6}$ Atropine $\frac{1}{100}$ gr.
 DISEASE Oesophageal Carcinoma.
 OPERATION Gastrectomy.
 GENERAL CONDITION Emaciated.

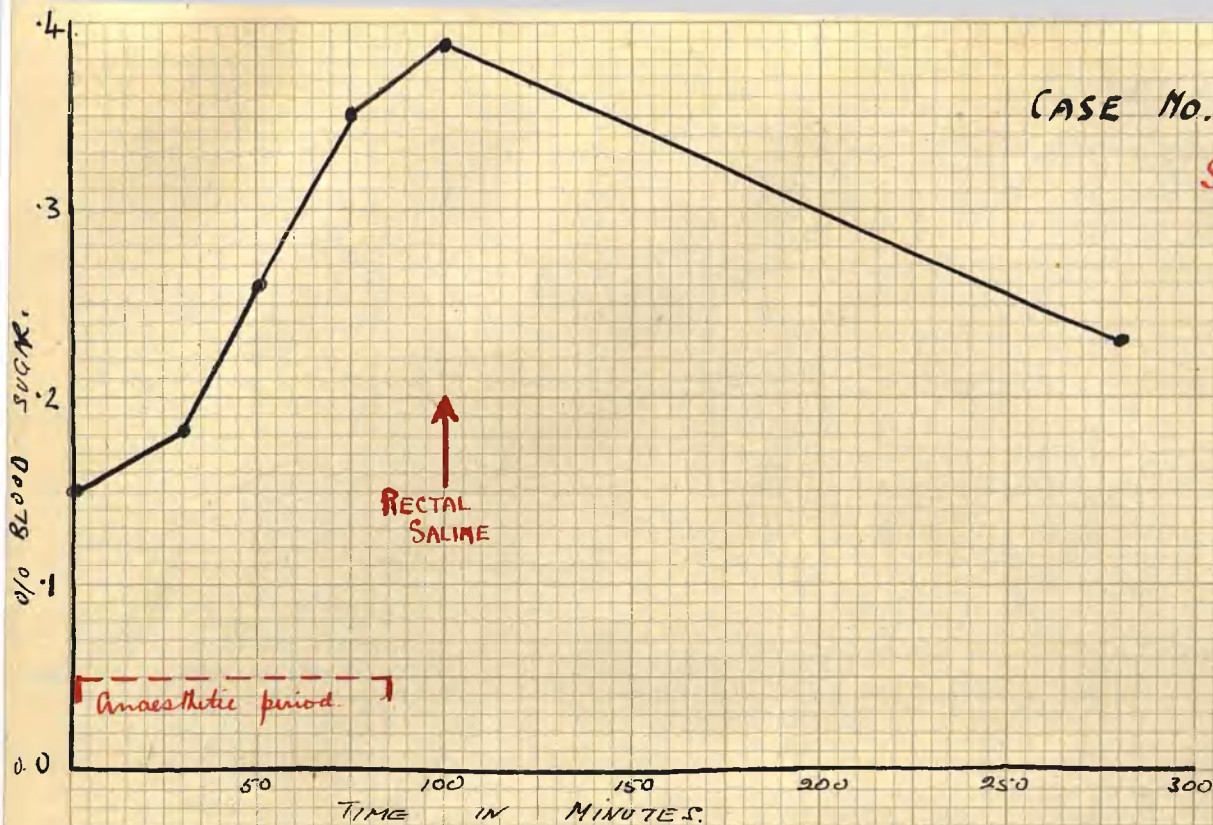
TIME TABLE.
(minutes)

% BLOOD SUGAR

0
2
26

CE MIXTURE, then Ether
 0.083%
 0.149%
 Anaesthetic stopped

Urine not available



NAME	Eliz. Cridginton	TIME-TABLE (MINUTES)	% BLOOD SUGAR
AGE	50	0	CHCl ₃ , then Ether
ANAESTHETIC	CHCl ₃ , then Ether.	5	0.150%
SEDATIVES	Morph $\frac{1}{6}$. Atropine $\frac{1}{100}$.	30	0.181%
DISEASE	Gastric blow. Chr. Appendix Hern glass stomach.	50	0.260%
OPERATION	Gastrectomy, Gastroenterostomy and appendicectomy.	75	0.350%
GENERAL CONDITION	Poor condition. Patient collapsed at end of operation. Rectal salines with glucose given.	85	Anaesthetic stopped.
		100	0.386%
		280	Rectal Saline for collapse 0.229%

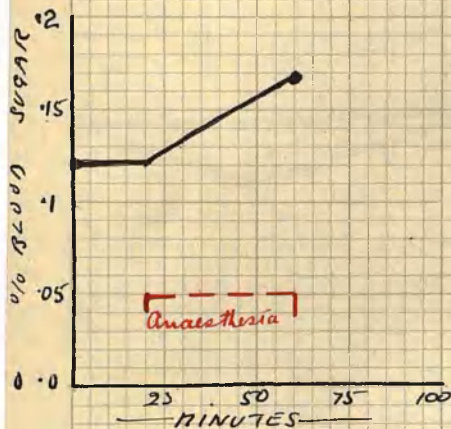
Urine before operation: - Albumen + ve.
Fehling's. - ve.
Acetone - ve

Urine after operation: -
(two specimens)

Fehling's - ve.
Fermentation - ve.
Acetone - ve.
Diabetic - ve.
Albumen - ve.
Urates + ve.
Acid Reaction + ve.
S.G. 1020.

CASE No. 14

SERIES I



TIME-TABLE
(minutes)

% BLOOD SUGAR

NAME W.W. Watts
 AGE 28
 ANAESTHETIC Open Ether.
 SEDATIVES Morphine 6 gr Morphine 100 gr.
 DISEASE T.B. Abscess in Rv. Reclus Sheath
 with T.B. Mesenteric Glands.
 OPERATION.
 GENERAL CONDITION Fair.

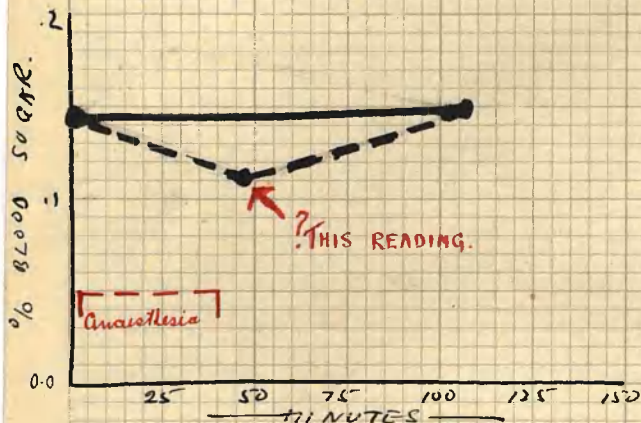
0
 20
 60

0.117%
 Ether given
 0.156%
 Anaesthesia finished

Urine not available.

CASE No 15

SERIES I



NAME Sarah Crange.
 AGE 27.
 ANAESTHETIC CHCl_3 , then Ether.
 SEDATIVES Atropine $\frac{1}{100}$ gr.
 DISEASE Appendix Abscess (not burst)
 OPERATION Laparotomy with cholecystectomy.
 GENERAL CONDITION. Probably two months pregnant.

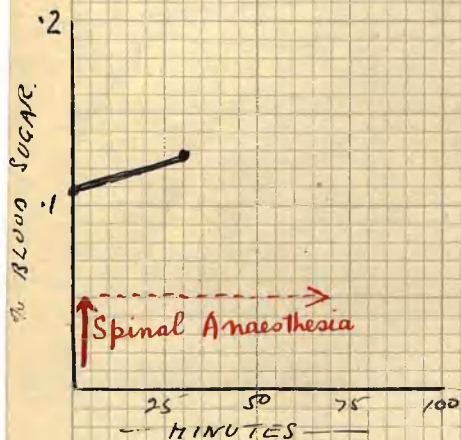
TIME TABLE (minutes)	% BLOOD SUGAR.
0	0.143%
1	CHCl_3 then Ether.
47	0.110% [? was filtrate upset]
48	Anaesthesia finished.
107	0.147%

Urine after operation (two specimens)

Fehling's Test	+ve (? lactose)
Fermentation	-ve.
Acetone	++ve.
Diacetyl Acid (FeCl_2)	+ve)
Lindeman's	+ve.
Albumen	-ve.
Urates	+ve.

CASE No. 16

SERIES I.



TIME TABLE
(minutes)

% BLOOD SUGAR

NAME Joseph Bantey.
 AGE 54.
 ANAESTHETIC Spinal Anaesthesia.
 (Stovaine)
 SEDATIVES Morphine $\frac{1}{6}$ gr. Atropine $\frac{1}{100}$
 DISEASE Haemorrhoids
 OPERATION Removal of same.
 GENERAL CONDITION. Poor. Arteriosclerosis.

0	0.109%
1	Spinal Anaesthesia given
29	0.129%

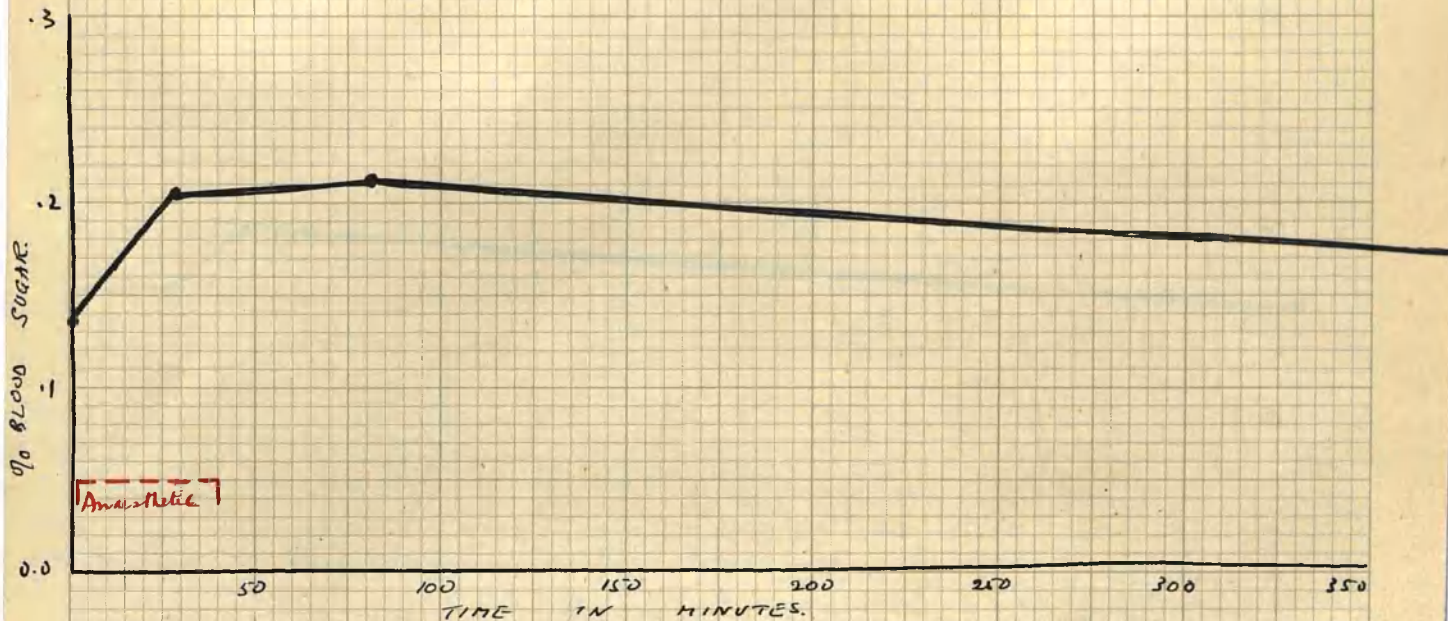
Urine before operation

Urine after operation (two specimens)

Fehling's Test.	- ve.
Fermentation	- ve.
Acetone	- ve.
Diacetic Acid	- ve.
Albumen	- ve.
Urate	+ ve.
Acid reaction	+ ve.

CASE No. 17

SERIES I



NAME Annie Newell.
 AGE 30 years.
 ANAESTHETIC C.E. Mixture. No oxygen.
 SEDATIVES Morphine $\frac{1}{6}$ gr. Atropine $\frac{1}{100}$.
 DISEASE Adenoma (simple) of Thyroid.
 OPERATION Removal of tumour.
 GENERAL CONDITION Fair. Nervous.

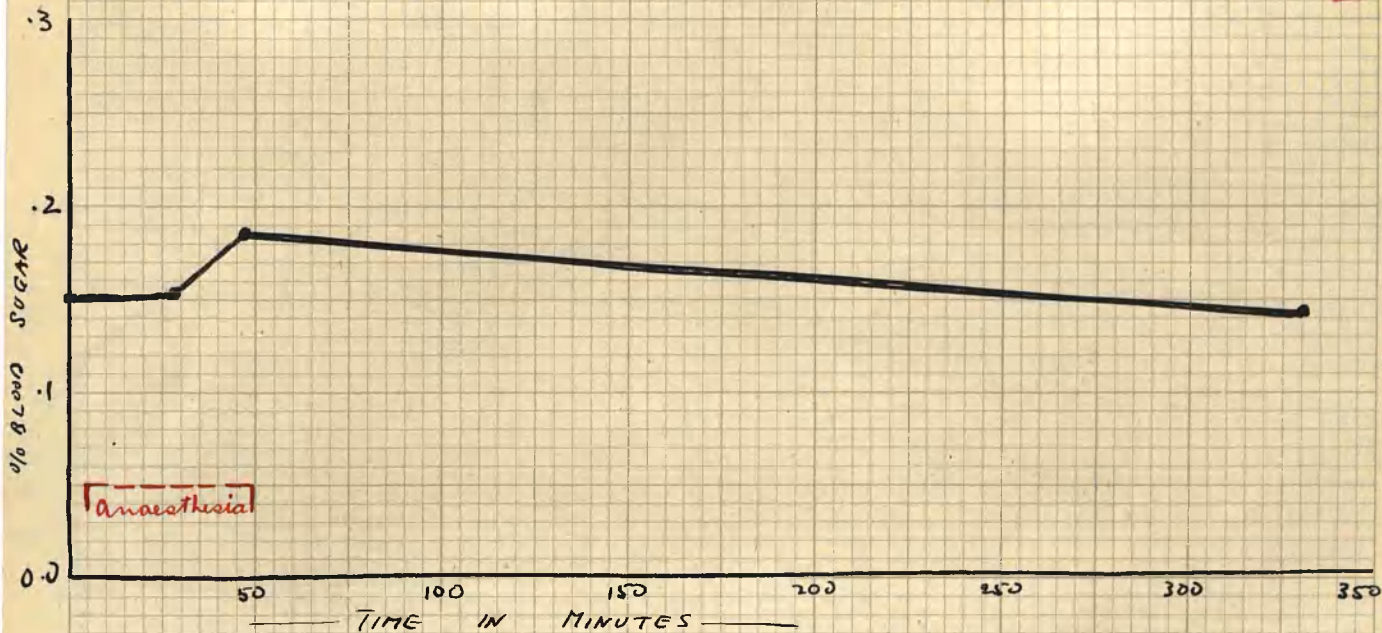
TIME TABLE.	% BLOOD SUGAR.
0 min	0.137%
28 "	0.202% Then C.E. Mixture
38 "	0.206% Anaesthetic Stopped.
80 "	0.206%
380 "	0.172%

Urine before operation - Normal
 Urine after operation (two specimens)

Fehling's Test - ve.
 Fermentation - ve.
 Acetone + ve.
 Diacetic A. (F.A.) trace.
 " " (Lindeman) trace.
 Albumen - ve.
 Urates + ve.
 Acid reaction + ve.

CASE No 18

SERIES I



NAME Clara Fox.
 AGE 49.
 ANAESTHETIC C.E. Mixture. No oxygen.
 Then Ether
 SEDATIVES Morphine & Atropine 100
 DISEASE Chronic Appendicitis
 with Gastroptosis.
 OPERATION Appendicectomy.
 GENERAL CONDITION Fair.

TIME TABLE
(minutes)

0
5
18
27
48
330

% BLOOD SUGAR

0.150%
 C.E. MIXTURE
 ETHER
 0.152%
 0.184%
 Anaesthetic Stopped
 0.143%

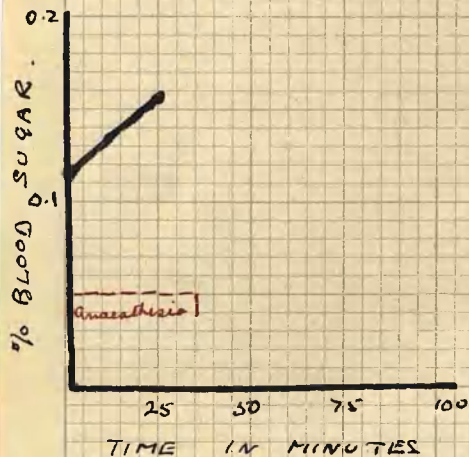
Urine before operation — Normal.

Urine after operation

Fehling's Test + ve.
 Fermentation - ve.
 Acetone - ve.
 Diacetic A. - ve.
 Albumen - ve.
 Urales + ve.
 Acid Reaction. + ve.

CASE No. 19

SERIES I.



TIME TABLE

% BLOOD SUGAR

NAME Maria Knight.
 AGE 27.
 ANAESTHETIC Ether with oxygen
 SEDATIVES Morph. $\frac{1}{6}$ Morphine $\frac{1}{100}$ gr.
 DISEASE ?? Abdominal pain
 OPERATION. nil found.
 Laparotomy.
 GENERAL CONDITION Fair.

0 0.118%
 25 0.156%
 35 CF finished

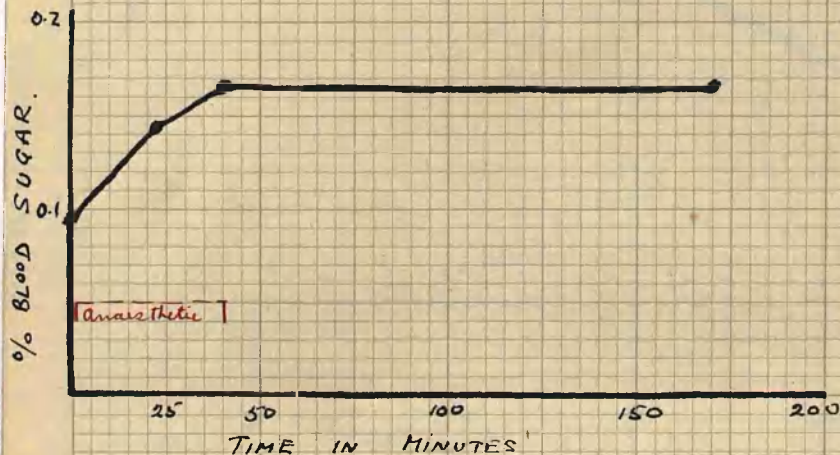
Urine before operation - normal

Urine after operation

Fehling's Test +ve (trace)
 Fermentation +ve (trace)
 Acetone -ve
 Diacetic A. -ve
 Albumen -ve
 Urates +ve
 Acid Reaction +ve

CASE NO. 20

SERIES I



TIME - TABLE
(minutes)

% BLOOD SUGAR

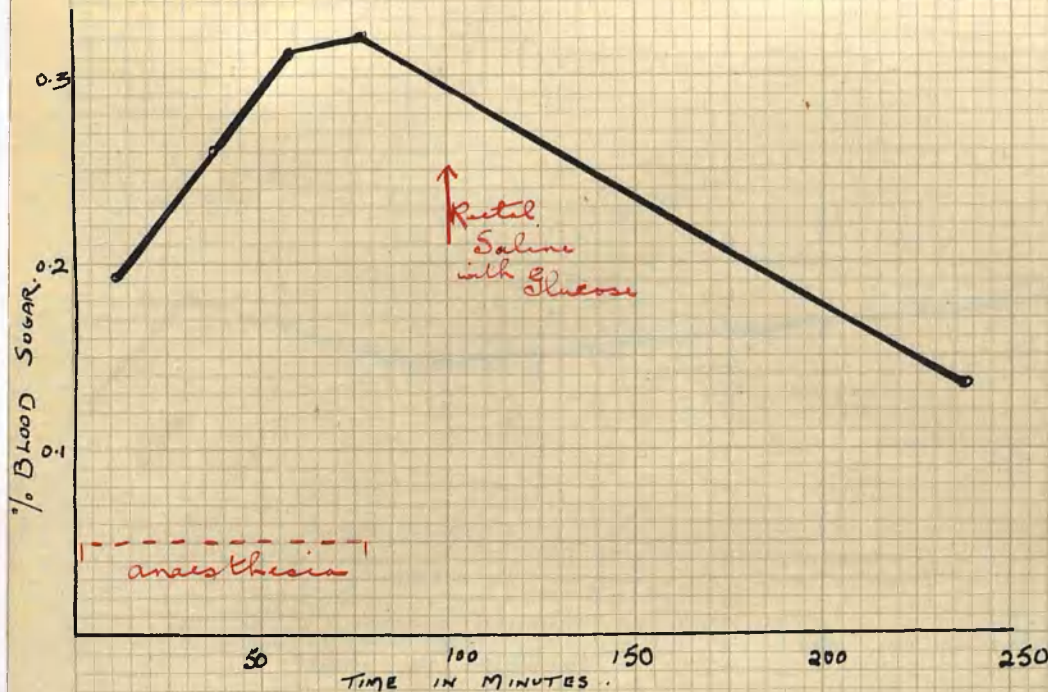
NAME *Jemina Walters*
 AGE *40 years*
 ANAESTHETIC *C.E. Mixture*
 SEDATIVES *Atropine $\frac{1}{100}$ gr.*
 DISEASE *Prolapsus Uteri.*
 OPERATION *? Ventrifixation.
 or "Slings operation"*
 GENERAL CONDITION *Fair.*

0 *0.095%*
 2. *C.E. mixture*
 23 *0.141%*
 40 *0.166%*
 41 *C.E. finished*
 170. *0.166%*

Urine not available.

CASE N^o. 21.

SERIES I



NAME Ann Cummins
 AGE 50.
 ANAESTHETIC Ether with Oxygen
 SEDATIVES Morph by catheter 100 gr
 DISEASE Gastric Ulcer
 OPERATION Gastro-enterostomy
 GENERAL CONDITION Fat.

TIME TABLE
(MINUTES)

% BLOOD SUGAR

0
 12.
 34.
 57.
 77.
 78
 237.

anaesthesia begun
 0.191 %
 0.260 %
 0.310 %
 0.320 %
 anaesthesia finished
 0.137 %

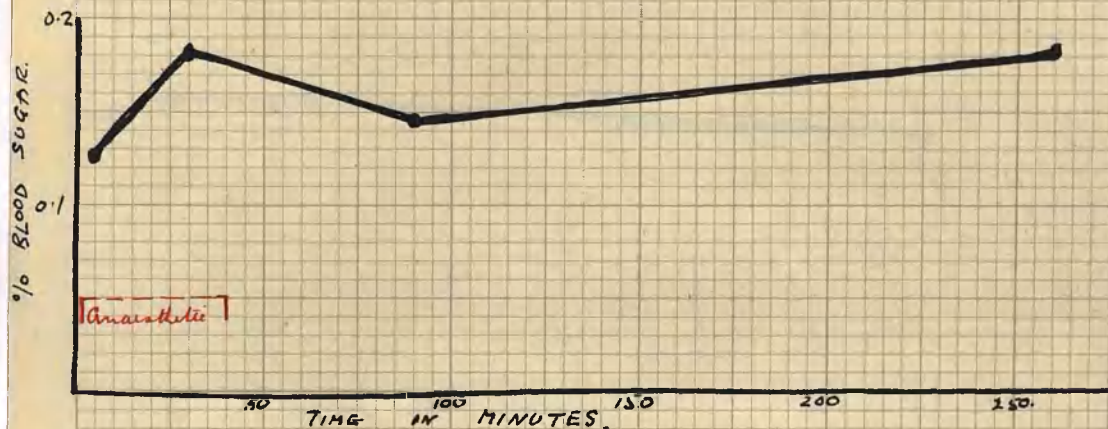
Urine before Operation: Normal

Urine after Operation: two urines

Fehling's Test	+ ve (trace)
*emittion	- ve
Acetone	- ve
Bailey A (FeCl ₂)	- ve
" (Lindeman's)	- ve
Pantone (Bile)	- ve
Albumen	- ve
Urotes	+ ve
Acid Reaction	+ ve.

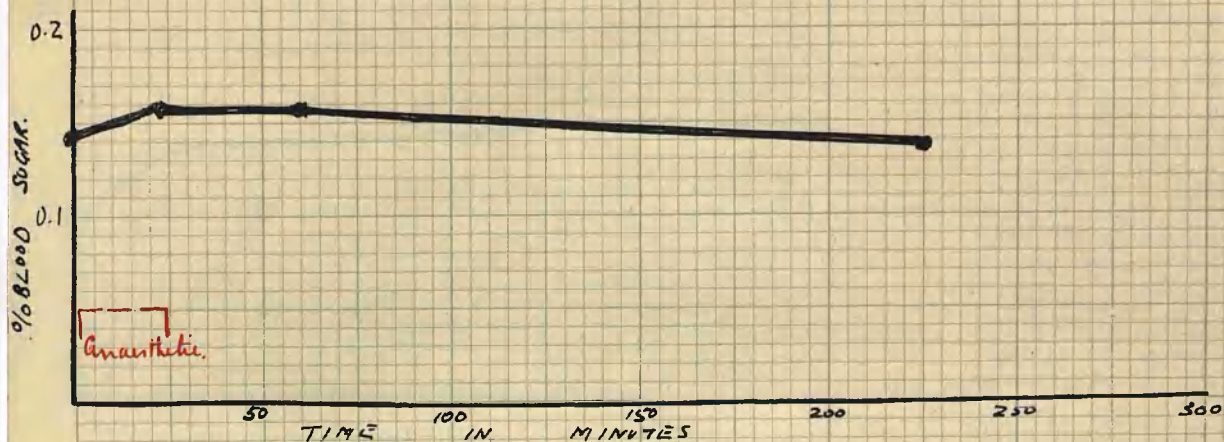
CASE No. 22

SERIES I



NAME	Jesse Smith.	TIME TABLE (minutes)	% BLOOD SUGAR
AGE	21.	0	CE mixture
ANAESTHETIC	CE Mixture, then Ether.	5	0.128% and Ether.
SEDATIVES	Morphine $\frac{1}{6}$ & Atropine $\frac{1}{100}$	30	0.181%
DISEASE	Adenoma of Thyroid.	38	Anaesthetic finished.
OPERATION	Removal.	90	0.146%
GENERAL CONDITION.	Thin. Good condition Slight loss of blood	260	0.181%

Urine before operation	Normal.
Urine after operation	.
Fehling's Test	- ve.
Fermentation	- ve.
Acetone	+ ve.
Diculle A. (F.C.)	- ve.
(Lindeman's)	- ve.
Albumen	- ve.
Pentoses (Bial's)	- ve.
Uates	+ ve.
Acid Reaction	+ ve.



NAME Emily Dunn.
 AGE 40.
 ANAESTHETIC Chloroform, then Ether.
 SEDATIVES Morphine 1/6 Atropine 1/100.
 DISEASE Inguinal Hernia.
 OPERATION Radical Operation.
 GENERAL CONDITION Fair.

TIME TABLE (minutes)

0
 23
 60
 225

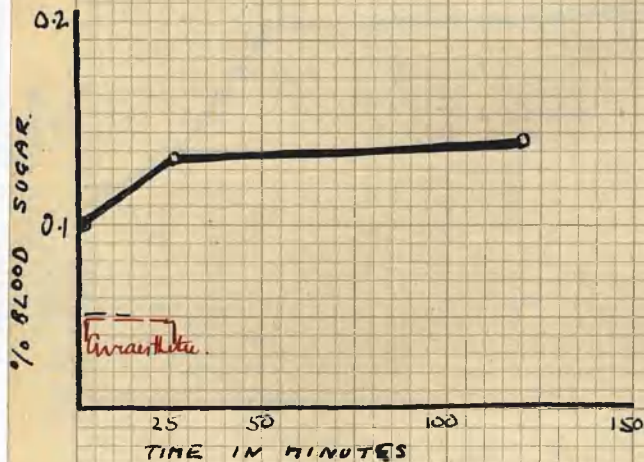
% BLOOD SUGAR

0.141%
 then Chloroform + Ether
 0.156%
 Anesthetic finished
 0.156%
 0.139%

Urine before operation: - Normal.

Urine after operation: -
(two specimens)

Fehling's Test. +ve (trace)
 Fermentation -ve.
 Acetone ++ve.
 Diacetyl A (Fehling) -ve
 " (Fendemann) -ve.
 Pentoses (Bial) -ve.
 Albumen -ve.
 Urates +ve
 Acid Reaction +ve
 Specific Gravity 1032.



NAME Sid Crosswell.
 AGE 31 years.
 ANAESTHETIC CE Mixture → Ether.
 SEDATIVES Morph $\frac{3}{8}$ Atropine $\frac{1}{100}$.
 DISEASE X-Ray diagnosis of gastric ulcer.
 Nil found.
 OPERATION Laparotomy.
 GENERAL CONDITION Fair.

Time in minutes	% Blood Sugar
0	CE mixture, 1cc Ether
2	0.100%
27	0.137%
120	Anesthetic finished 0.146%

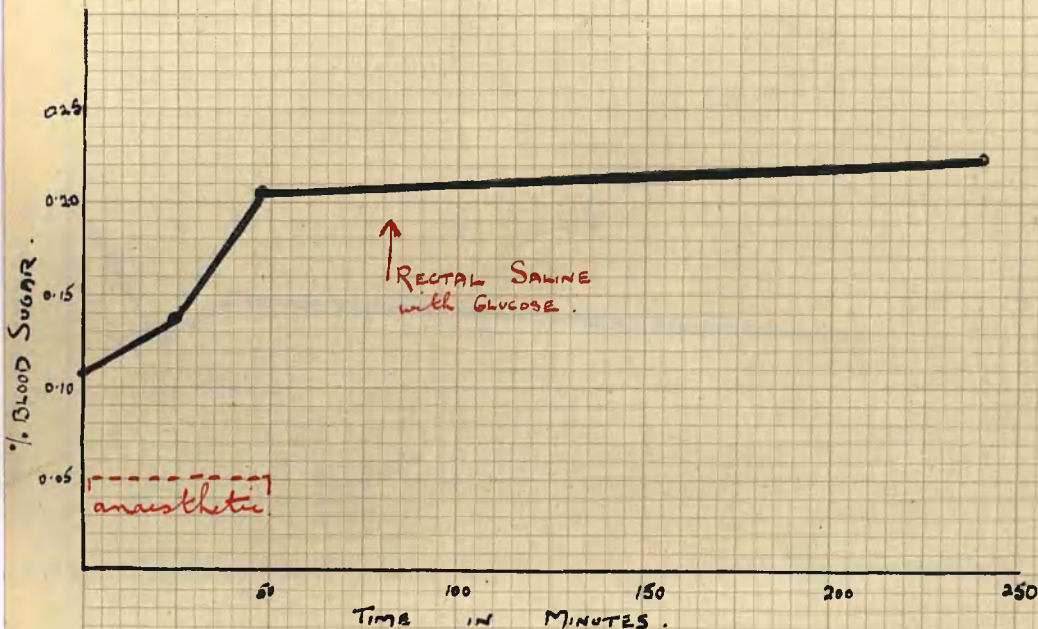
Urine before operation: - Normal.

Urine after operation (two specimens)

Fehling's Test.	- + (od trace)
Fermentation	-ve
Acetone	+ve
Diacetic A. (Feh's)	-ve
" (Lundeman's)	-ve
Pentoses (Bial's)	-ve
Albumen	-ve
Acid Reaction	+ve.
Urates	+ve.
Specific Gravity	1040.

CASE N^o. 25.

SERIES I.

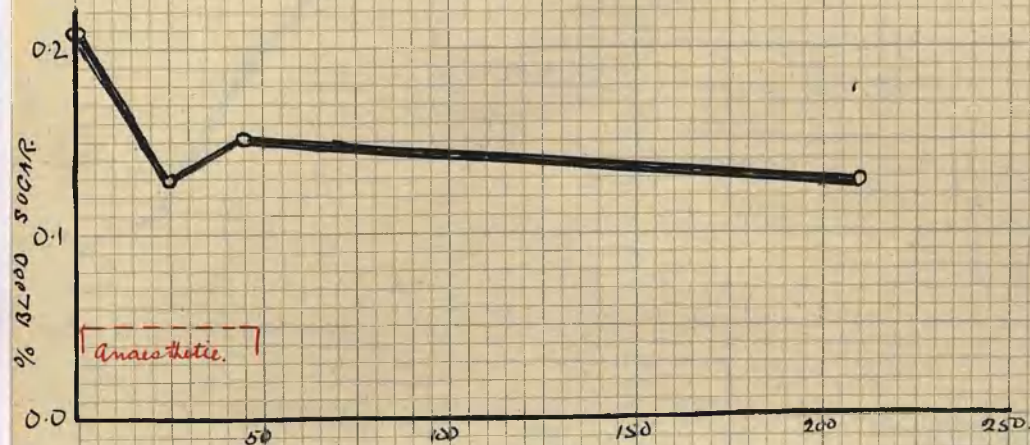


		<u>TIME IN MINUTES</u>	<u>% BLOOD SUGAR</u>
NAME	Mary Brownshaw.	0	0.109% thru Ether.
AGE	60.	25	0.137%
ANAESTHETIC.	Ether.	48	0.202% anaesthetic finished.
SEDATIVES.	Morph. 6gr. Atropine 1/100.	240	0.225%.
DISEASE.	Chronic Pancreatitis and Gall Stones.		
OPERATION.	Cholecystectomy.		
GENERAL CONDITION.	Fat.		

Urea before Operation - Normal

" after "

Fehling's Test - sl. trace
 Fermentation - ve
 Acetone - ve
 Dinitro A (Feh₂) - ve
 " (Sulzmann) - ve
 Pentose - ve
 albumen - ve
 Urea - + ve
 Acid Reaction + ve
 Specific Gravity 1040.



NAME Florence Timmins
 AGE 45
 ANAESTHETIC Ether
 SEDATIVES nil.
 DISEASE Abdominal Adhesions
 (previous appendicitis)
 OPERATION Laparotomy.
 GENERAL CONDITION. Fair.
 (This blood seemed very thin, and of
 low coagulability)

TIME TABLE
(minutes)

0
25
44
210

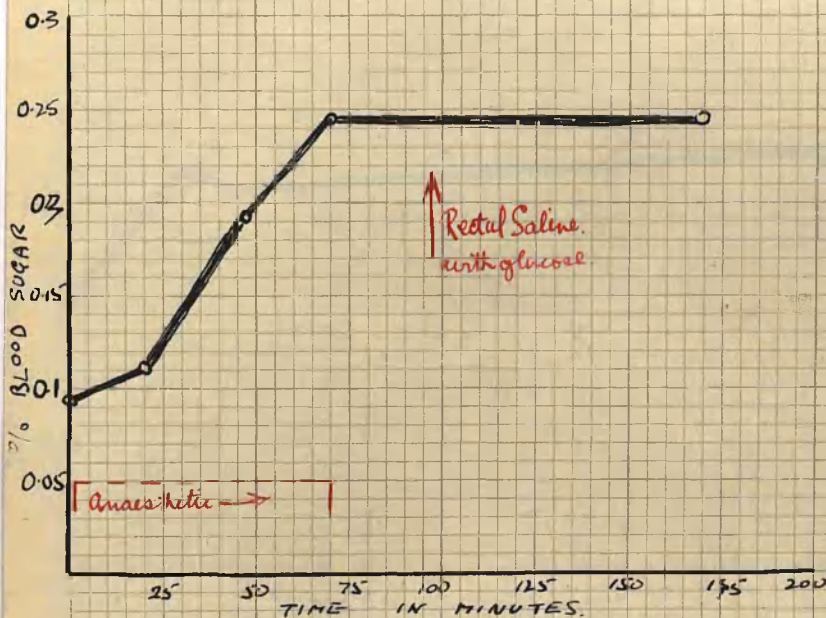
% BLOOD SUGAR

0-20 7% then Ether
 0.129%
 0 152% → Ether stopped.
 0.128%

Time not available

CASE No. 27

SERIES I



NAME Emily Christian
 AGE 56.
 ANAESTHETIC Morph. $\frac{1}{6}$ Atropine $\frac{1}{100}$ R.
 SEDATIVES CE Mixture, then Ether.
 DISEASE Gall stones
 OPERATION Cholecystectomy.
 GENERAL CONDITION Fat. Liver much handled.

Patient died a day after operation

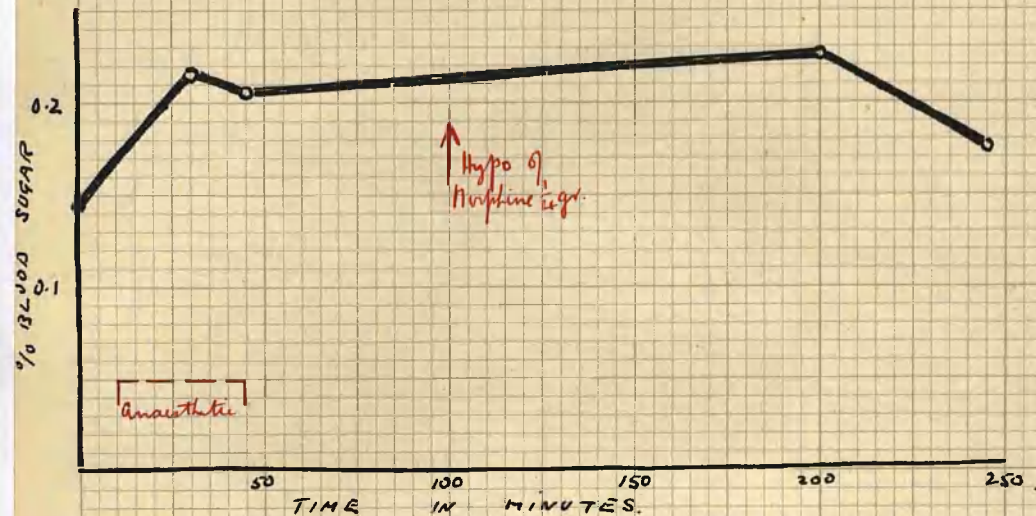
TIME TABLE (minutes)	% BLOOD SUGAR
0	0.093% then CE mixture \rightarrow Ether.
20	0.112%
47	0.193%
70	0.243% \leftarrow anaesthetic ended glucose saline 3X in bed
170	0.243%

Urine before operation Bile +ve
 (otherwise normal)

Urine after operation
 Fehling's Test -ve.
 Fermentation -ve.
 Acetone +ve.
 Ducrest A (FeCl₃) -ve.
 "(Lindeman's) -ve.
 Pentoses (Bial's) -ve.
 Albumen -ve.
 Acid reaction +ve.
 Urates +ve.
 Specific gravity 1030.

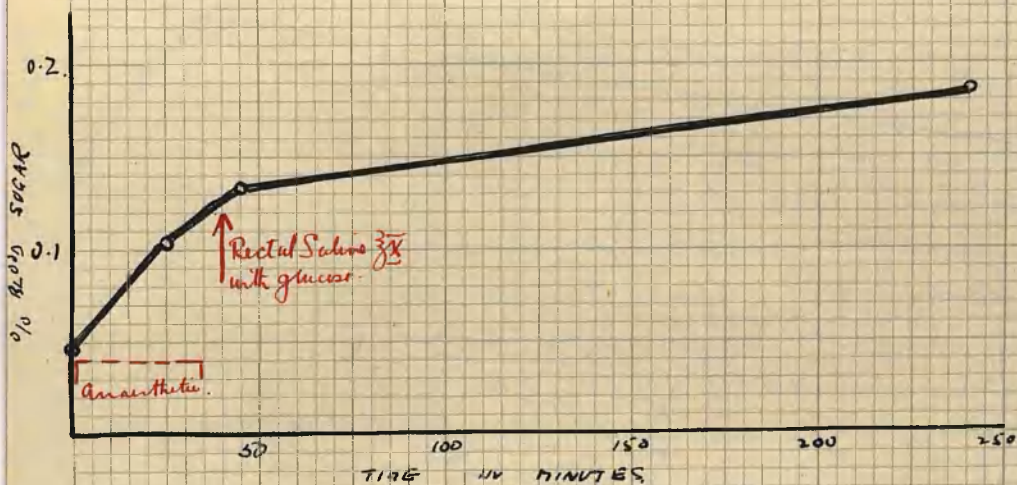
CASE No. 28

SERIES I



		TIME-TABLE (minutes)	% BLOOD SUGAR
NAME	Joseph Beddowes.	0	0.142%
AGE	76.	10	0.216%
ANAESTHETIC	CA mixture, then Ether	15	0.206%
SEDATIVES	Alupine $\frac{7}{100}$	200	0.227%
DISEASE	Enlarged prostate ? malignant.	245	0.175%
OPERATION.	Prostatectomy.		
GENERAL CONDITION.	— Some blood loss.		

Urine not available

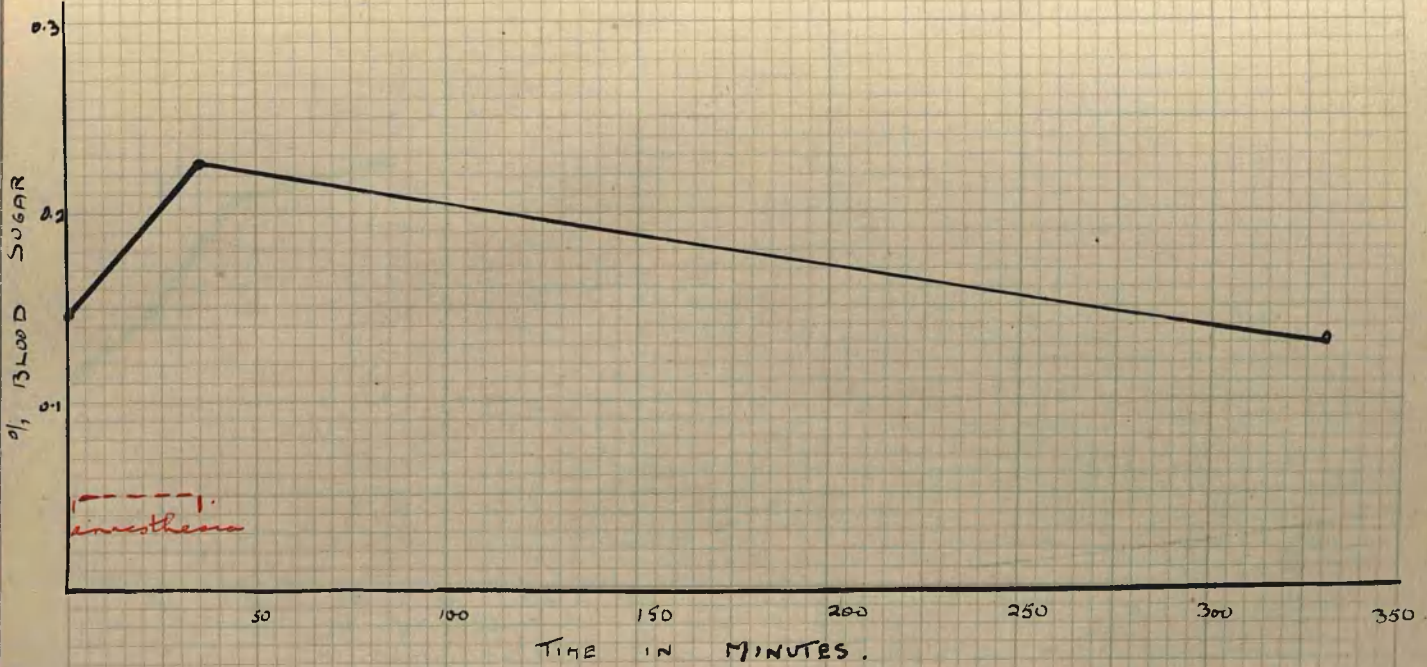


		TIME TABLE (minutes)	% BLOOD SUGAR
NAME	Richard Palen	0	CE mixture, 11cc Ether.
AGE	50	0	0.048%
ANAESTHETIC	CE mixture, 11cc Ether.	25	0.104%
SEDATIVES	Atropine 100.	35	Anaesthetic ended.
DISEASE	Carcinoma of Pylorus. (Stenosed) ± Hepatic metastases	45	0.133%
OPERATION	Gastroenterostomy.	240	0.186%
GENERAL CONDITION	Poor. Very little blood in patient.		

Urine before operation — normal.
Urine after operation — not available

CASE N^o. 30

SERIES I



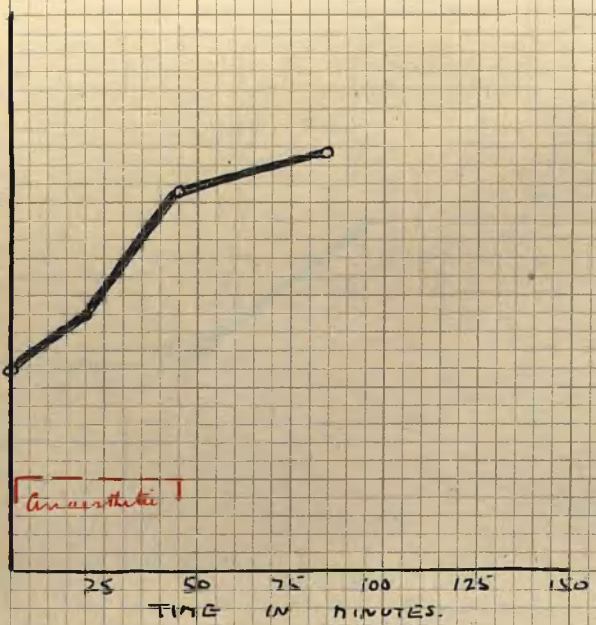
NAME	Henry Cartwright	TIME TABLE (MINUTES)	% BLOOD SUGAR
AGE	66	0	0.143%
ANAESTHETIC	CE mixture then ether		then CE mixture then ether
SEDATIVES	Atropine	35	0.225%
DISEASE	Gall Stones.	330	0.131%
OPERATION	Cholecystectomy		
GENERAL CONDITION	Poor. Not much blood in patient		

Urine not available

CASE NO. 31

SERIES I

% BLOOD SUGAR

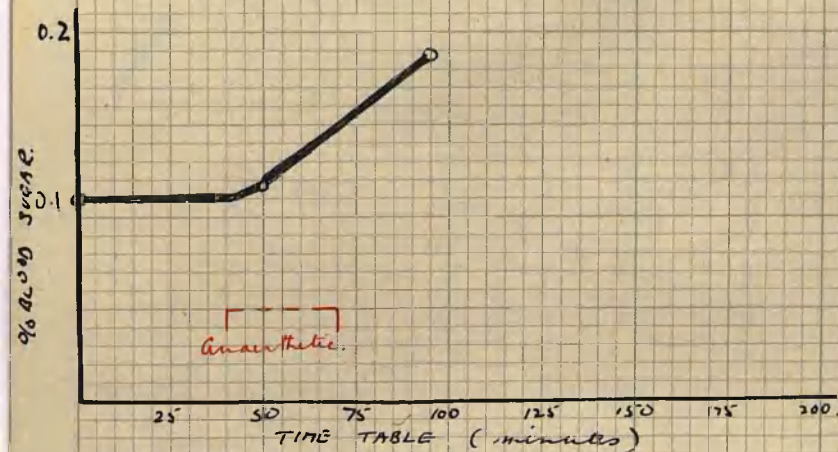


NAME Vincent Evans.
 AGE 10
 ANAESTHETIC Atropine 150.
 SEDATIVES ~~X~~ Chloroform, then Ether
 DISEASE Ventral hernia (post appendix abscess)
 OPERATION Repair of abdominal wall.
 GENERAL CONDITION Good.

TIME TABLE (minutes)	% BLOOD SUGAR.
0	0.109% Chloroform.
7	Ether.
20	0.139%
45	0.206%
	Anaesthetic finished.
83	0.227%

Urine before operation :- Normal.
 Urine after operation

Fehling's Test.	+ve.
Fermentation	-ve.
Acetone	-ve.
Deacetic Acid	-ve.
Pentoses (Biels)	-ve.
Albumen	-ve.
Urates	+ve.
Acid Reaction	+ve.



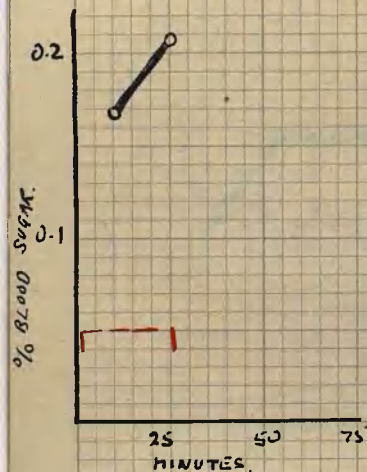
NAME Adelaide Edge.
 AGE 29
 ANAESTHETIC CE. Mixture.
 SEDATIVES Atropine.
 DISEASE Varicose veins of legs.
 OPERATION Removal.
 GENERAL CONDITION. Good.

TIME TABLE (minutes)	% BLOOD SUGAR
0	0.109%
40	CE Mixture
50	0.117%
70	Anaesthetic stopped.
95	0.187%

Urine before operation :- normal.

Urine after operation (two specimens)

Fehling's Test.	+ve (trace)
Fermentation	+ve (2 nd specimen)
Acetone	++ve.
Diastase N (F.C.D.)	+ve.
" (Lindeman's)	+ve.
Albumen	-ve.
acid reaction	+ve.
Urea	+ve.
Spec. Gravity	1030.



TIME TABLE
(minutes)

% BLOOD SUGAR

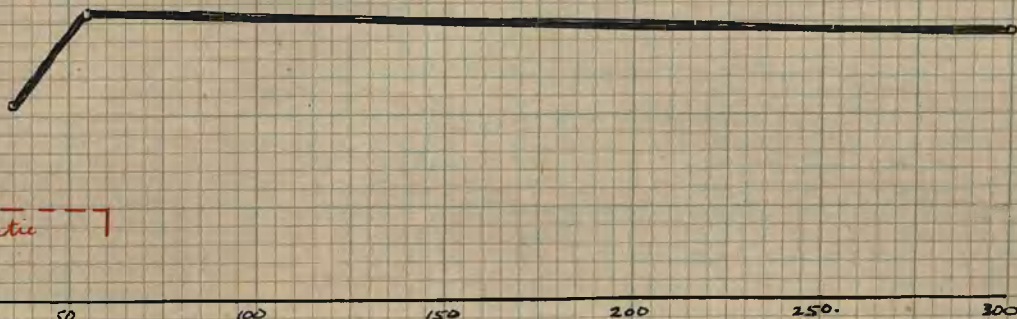
NAME William Smith.
 AGE 48.
 ANAESTHETIC CE Mixture, then Ether.
 SEDATIVES Atropine $\frac{1}{100}$ gr.
 DISEASE Carcinoma of Oesophagus.
 OPERATION Gastrectomy.
 GENERAL CONDITION Thin and emaciated.

0
 10
 25

CE Mixture
 0.168%
 0.206%
 Anaesthetic finished.

None not available

% BLOOD SUGAR



NAME Peter Hand.
 AGE 63.
 ANAESTHETIC CE mixture.
 SEDATIVES Morph & Atropine 1/100 gr.
 DISEASE Achylia Gastrica.
 OPERATION no organic lesion found,
 apart from slight pyloric stenosis
 → Pylorectomy.
 GENERAL CONDITION Good.

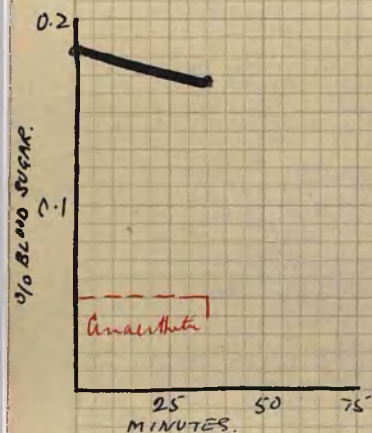
TIME TABLE (minutes)	% BLOOD SUGAR.
0	CE started.
35	0.106%
55	0.156%
60	Anaesthetic ended.
300	0.143%

Urine before operation :- Normal.
 Urine after operation

Fehling's Test.	+ve (trace)
Fermentation	-ve.
Acetone	-ve.
Diastase A.	-ve.
Albumen	-ve.
Penoxes (Beal's)	-ve.
Chlorides	+ve.
acid reaction	+ve.
Spec. Gravity	1030 trace.

CASE No. 37.

SERIES I.



NAME Ellen Mountford
 Age 27.
 ANAESTHETIC CE mixture → Ether
 SEDATIVE Morphine $\frac{1}{6}$ Atropine $\frac{1}{100}$
 DISEASE T.B Glands of Neck
 OPERATION Removal of glands.
 GENERAL CONDITION Good
 INSULIN DOSAGE Nil

TIME TABLE
(minutes)

% BLOOD SUGAR

0	CE mixture → Ether
3	0.181%
35	0.168%
	Anesthetic ended.

Urine before operation Normal.
Urine after operation: - Not available.

SERIES I

CASE NO 40

T.B. Gardner Male. aet 61. Ether. Morph to Mastp 100.

Prostatic Carcinoma. Previous Cystotomy.

Blood Urea 14/11/15 96 mgms.

" " 17/11/15 54 mgms.

% Blood Sugar. 0.196%
20 mins under Ether.

B. Fullwood. Male. aet 46. Ether. Morph to Mastp 100.

Malignant Ascites.

Time of Op. Operation:-

Fell. + trace. Acetone + ve.

Ferment - ve. Diastase - ve.

Albumen - ve. Acid + ve.

Sp. Grav 1030. Ureter + ve.

% Blood Sugar 0.181%
5 minutes under Ether.

Male, aet 62. with temperature of 101° F. before operation, which however, was not performed.

CASE NO 38

% Blood Sugar 0.086%

B. Allen. Male. aet 31. CE Mixture. Morph to Mastp 100.

Methal Stricture & Enlarged Prostate.

% Blood Sugar 0.112%
10 minutes under CE Mixture.

CASE NO 35

J. Lampkill. Male. aet 24. E.F. Mixture. Morph to Mastp 100

Pilon Abscess. Thin

CASE NO 36

% Blood Sugar 0.168%
10 minutes after CE Mixture.

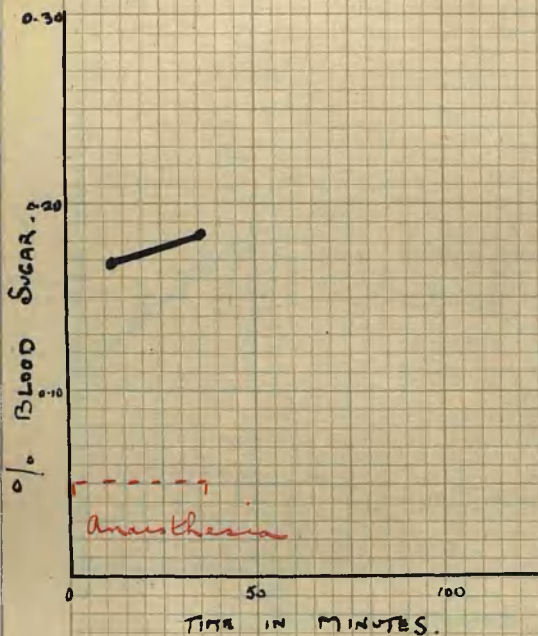
Emily Coakley. Female. aet 69. Succinamide of Bread.
Previous removal of breast 35 yrs previously. Mastp to Mastp 100

CASE NO. 42.
0.112%

% Blood Sugar before operation.

CASE N^o 41

SERIES I.



NAME Alice Lewis
 AGE 48.
 ANAESTHETIC CE mixture, then Ether
 SEDATIVES Atropine
 DISEASE ? Gall Stones.
 OPERATION Appendectomy.
 GENERAL CONDITION Fat.

TIME TABLE.
 (MINUTES)

% BLOOD SUGAR.

0

CE mixture
 then Ether

12

0.168 %

35

0.181 %

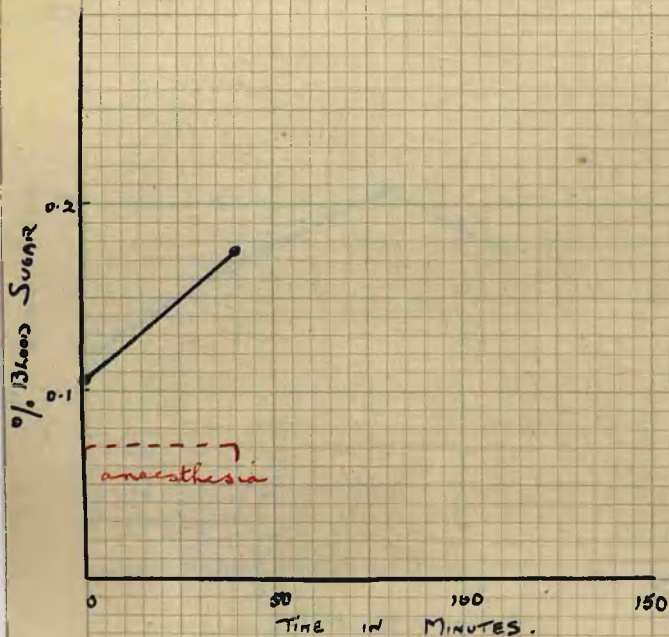
Urine before Operations - Normal

" after "

Gelling's Test + trace
 Fermentation - ve
 Acetone - ve
 Dinitro A - ve
 Albumin - ve
 Acid Reaction + ve
 Urobilin + ve
 Specific Gravity 1038

CASE N° 43

SERIES I.

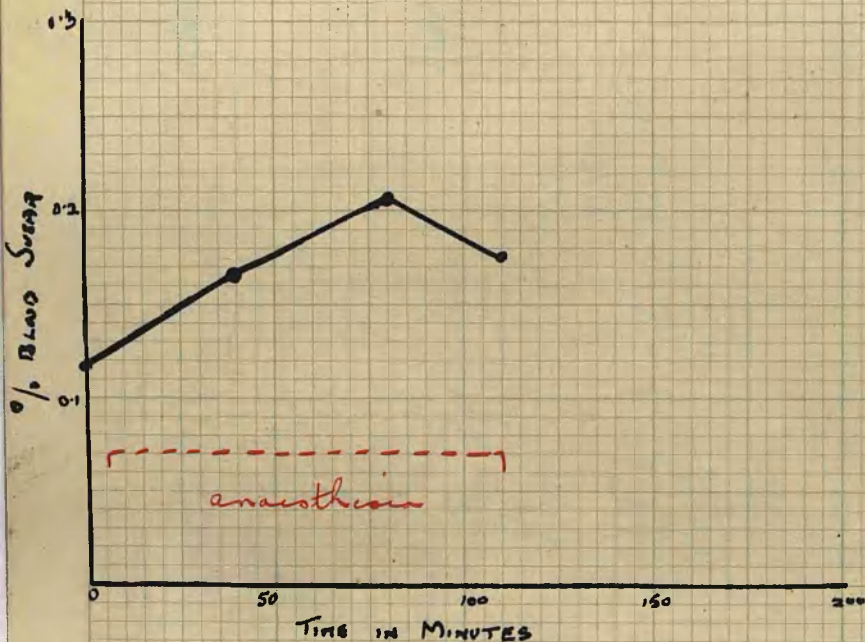


NAME Lucy Onions
 AGE 44.
 ANAESTHETIC Chloroform, then Ether (mainly E.)
 SEDATIVES Morphine & atropine.
 DISEASE Uterine fibroids
 OPERATION Hysterectomy.
 GENERAL CONDITION. Very little blood. (pale).

<u>Time Table</u> (MINUTES)	<u>% BLOOD SUGAR</u>
0	0.106% C → E.
40	0.145% <i>anaesthesia ended</i>
<u>Urine before Operation</u> - normal	
<u>" after "</u> - not available	

CASE N^o 44

SERIES I.



NAME James Ashby.
 AGE 46
 ANAESTHETIC C → C.E.
 SEDATIVES (C.E. with morphine).
 DISEASE. ? Gall Stones.
 OPERATION Appendicectomy.
 GENERAL CONDITION Fat.

TIME TABLE
(MINUTES).

% BLOOD SUGAR

0	0.118%
5	C → CE
40	0.168%
80	0.206%
110	0.175% anaesthetic end.

Urine before Operation - normal
" after " - not available.

SERIES I.

John C —
Leukoplakia

Male. 62.

Neutrophils $\frac{1}{100}$.

% Blood Sugar
before operation

0.106%

CASE No 45

John Ellis

Papilloma of Bladder (recurrent)

Male. 57.

Neutrophils $\frac{1}{100}$

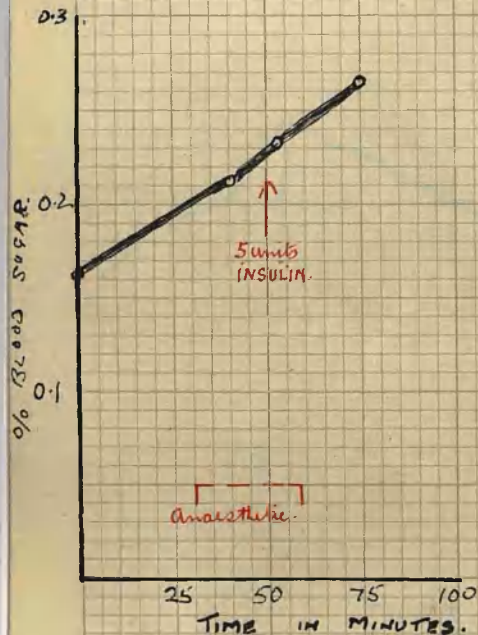
% Blood Sugar
before operation

0.137%

CASE No 46

CASE NO. 1

Series II



TIME TABLE
(minutes)

% BLOOD SUGAR

NAME Sarah Dunn.
 AGE 60
 ANAESTHETIC $CHCl_3 \rightarrow$ Ether.
 SEDATIVES Morph $\frac{1}{6}$ Atrop $\frac{1}{100}$.
 DISEASE Carcinoma Mammal.
 OPERATION Amputation of Breast.
 GENERAL CONDITION. Great operative shock
 INSULIN DOSE. 5 units.

0. 0.162%
 30. Chloroform begun
 40. 0.213% Ether.
 50. 5 units insulin
 53. 0.231%
 55. Anesthetic ended.
 75. 0.266%
 Salines then given for operative shock.

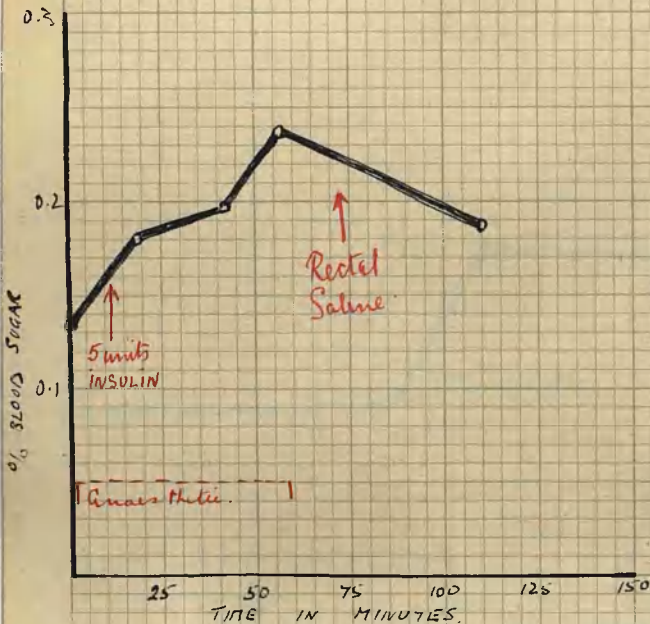
Urine before operation - Normal.

Urine after operation

Fehling's Test - ve.
 Fermentation - ve.
 Acetone - ve.
 Diastase Acid - ve.
 Pentoses (Biels) - ve.
 Albumen - ve.
 Neutral reaction + ve.

CASE No. 2.

SERIES II.



NAME *Williams Cahill.*
 AGE *33.*
 ANAESTHETIC *CHCl₃ → CE Mixture*
 SEDATIVES *Morph. Scopolamine Atropine*
 DISEASE *Duodenal Ulcer.*
 OPERATION *Gastro-enterostomy.*
 GENERAL CONDITION. *Good.*
 INSULIN DOSE *5 units*

TIME TABLE
(minutes)

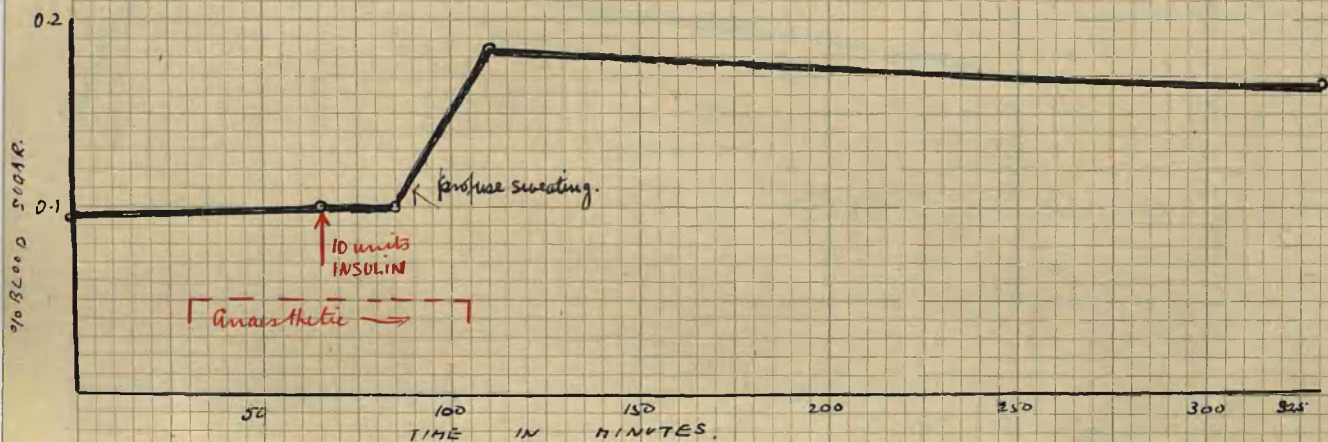
% BLOOD SUGAR

0	0.13%
3	CHCl ₃ begun
13	5 units insulin
15	CE Mixture
19	0.179%
42	0.197%
57	0.237%
	Anaesthetic ended
120	0.193%

Urine before operation *Normal.*
Urine after operation *Not available*

CASE NO. 3

SERIES II.



NAME Annie Shepherd
 AGE 37.
 ANAESTHETIC $\text{CHCl}_3 \rightarrow$ Ether
 SEDATIVES Morphine $\frac{1}{6}$ & Atropine $\frac{1}{100}$
 DISEASE Gritte (simple)
 OPERATION Removal.
 GENERAL CONDITION Considerable haemorrhage.
 INSULIN DOSE 10 units.

TIME TABLE (minutes)

% BLOOD SUGAR.

0	0.095%
33	Chloroform.
40	Ether.
65	0.100%
66	10 units insulin
85	0.100%
105	Anaesthetic ended.
120	0.187%
330	0.168%

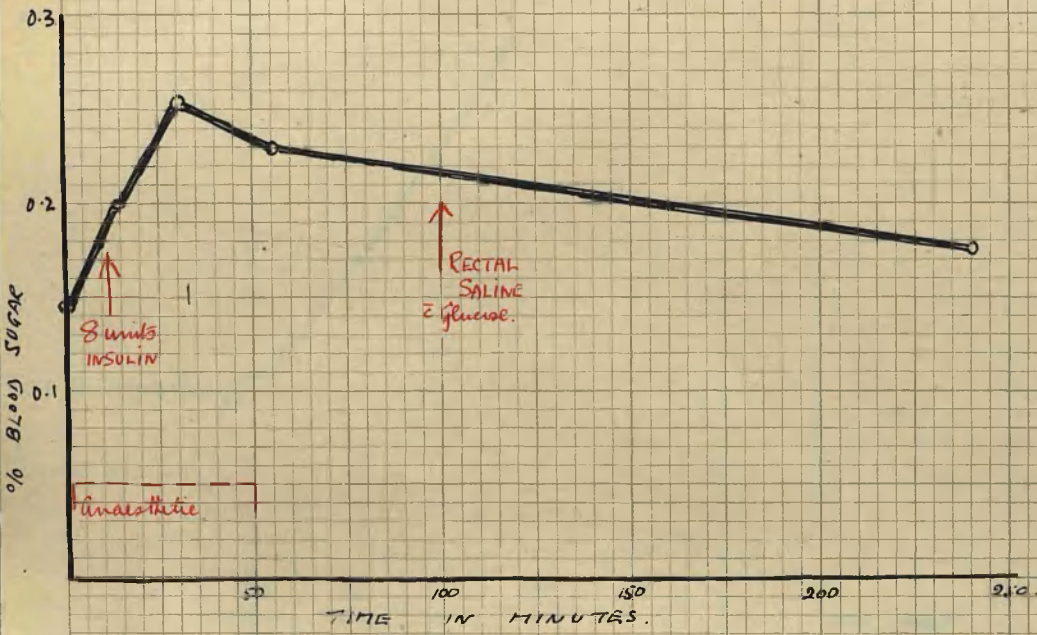
Urine before operation: - normal.

Urine after operation

Fehling's Test.	+ ve.
Fermentation	- ve.
Acetone	+ ve.
Diastase A (F.C.G.)	+ ve.
" (Lundeman's)	??
Pentoses (Biats)	- ve.
Acid reaction	+ ve.
Urate	+ ve.
Spec. Gravity	1038

CASE No. 4

SERIES II



NAME Lydia Turner
 AGE 60
 ANAESTHETIC CE. mixture.
 SEDATIVES Atropine 1/60 gr.
 DISEASE Carcinoma of Pylorus
 & Stenosis
 OPERATION Gastro-intestinal.
 GENERAL CONDITION Poor. Previous jaundice. Thin
 INSULIN DOSAGE. 8 units.

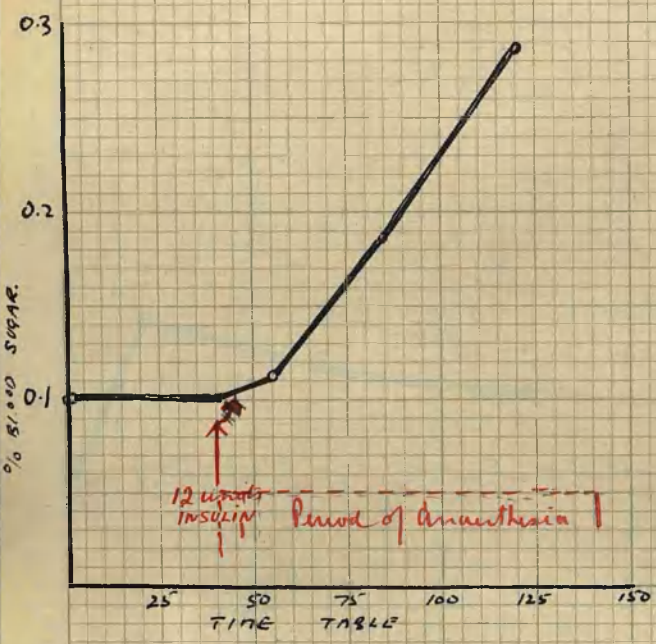
TIME TABLE

TIME	% BLOOD SUGAR
0	0.163%
12 minutes	0.253%
14	0.285%
30	0.253%
55	0.225%
50	Anesthetic ended.
100	Saline (rectal) with glucose.
210	0.177%

Urine not available for spectrum
time after operation

Fehling's Test.	+ ve. (trace)
Fermentation	- ve.
Acetone	+ ve
Diastase A. (Teal's)	+ ve.
(Lindemann's)	- ve.
Albumen	- ve
Pentoses (Biels)	- ve.
Acid Reaction	+ ve.
Ureates	+ ve.

CASE NO 5
 SERIES II



NAME John Bellusky.
 AGE 32
 ANAESTHETIC Chl₃, then Ether.
 SEDATIVE Morph $\frac{1}{6}$, Scap $\frac{1}{10}$, Morph. $\frac{1}{100}$.
 DISEASE Duodenal Ulcer & Appendicitis.
 OPERATION Gastroenterostomy
 GENERAL CONDITION Thin
 INSULIN DOSAGE 12 units.

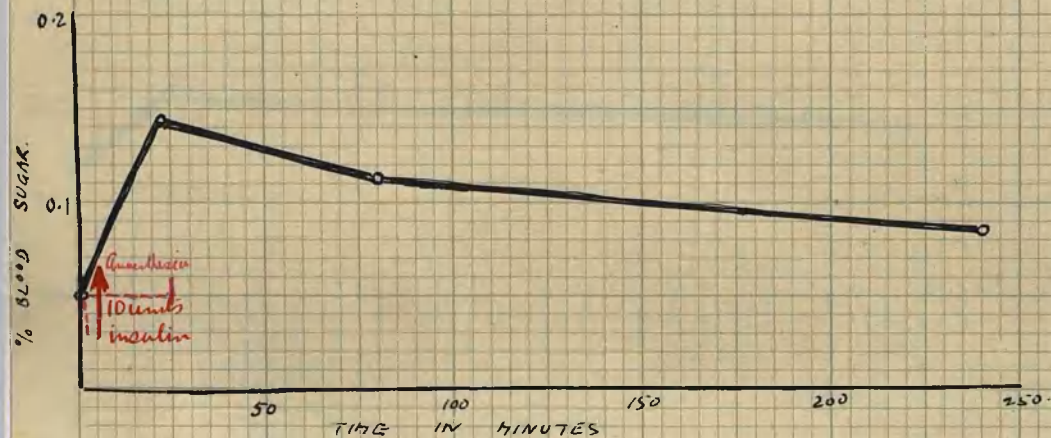
TIME TABLE	% BLOOD SUGAR
0	0.100%
40.	Chl ₃ . Segun.
45	12 units insulin.
46	Ether.
55	0.113%
85	0.157%
120	0.287%
140.	Anaesthetic ended.

Urine before operation - Normal.
 Urine after operation

Fehling's Test.	+ve (trace)
Fermentation	-ve.
Rothera	+ve (trace)
Diastase (Chl ₃)	-ve.
Pentoses	-ve.
Albumen	-ve.
Acid Reaction	+ve.
Ureates	+ve.

CASE No. 6

SERIES II.



NAME Albert Cox.
 AGE 23.
 ANAESTHETIC Ck. Mixture
 SEDATIVES Atropine $\frac{1}{100}$.
 DISEASE Chronic appendicitis
 OPERATION Appendicectomy.
 GENERAL CONDITION Thin. nervous.
 INSULIN DOSAGE 10 units.

TIME TABLE

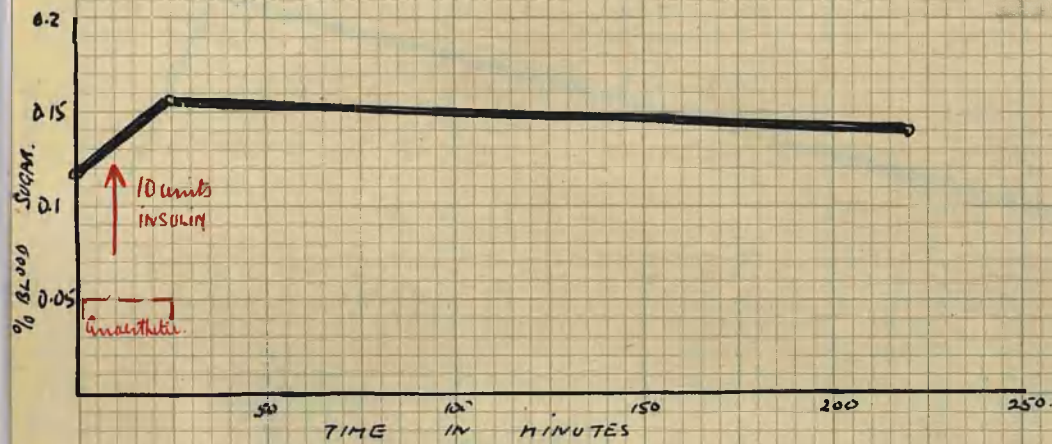
% BLOOD SUGAR

0 0.050 %.
 5 Ck. mixture
 23 10 units insulin
0.143 %.
 80 anesthesia ended.
 240 0.112 %.
0.087 %.

Urine before operation normal.
Urine after operation

Fehling's Test. +ve (trace)
 Fermentation -ve.
 Acetone ++ve.
 Diacetic A -ve.
 Pentoses -ve.
 Albumen -ve.
 Acid Reaction +ve.
 Urates +ve.
 Spec. Gravity 1050.

CASE No 7
 SERIES II.



NAME Julia Burnett.
 AGE 48
 ANAESTHETIC CE mixture, then Ether.
 SEDATIVES Atropine 100.
 DISEASE Haemorrhoids.
 OPERATION Removal.
 GENERAL CONDITION. Fairly good. Fat.
 INSULIN DOSAGE. 10 units.

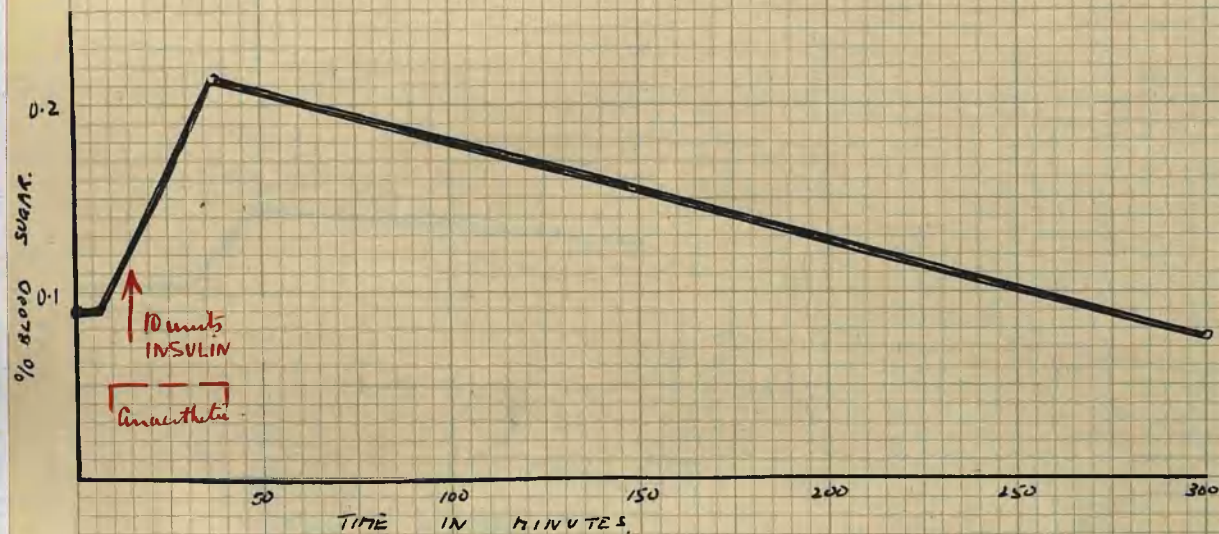
TIME TABLE	% BLOOD SUGAR
0	0.118%
10	0.156%
200	0.140%

CE mixture, then Ether.
 10 units insulin.
 Anesthetic in dist.

Urine before operation: - normal.
 Urine after operation
 Fehling's Test +ve (trace)
 Fermentation -ve
 Acetone ++ve
 Diacetic A. (7e Cl₂) -ve.
 Pentoses (Biab's) -ve.
 Albumin -ve.
 Acid Reaction +ve.
 Specific Gravity 1034.
 Urate. +ve.

CASE NO. 8

SERIES II



NAME *William Bradley*
 AGE *24*
 ANAESTHETIC *CE mixture.*
 SEDATIVES *Morph, Scopolamine & Atropine.*
 DISEASE *Cyst in Rt. Leg. nature unknown.*
 OPERATION *Removal.*
 GENERAL CONDITION *Good, muscular.*
 INSULIN DOSAGE *10 units.*

TIME TABLE

% BLOOD SUGAR

0 *.088%*
 10 *CE mixture*
 15 *10 units insulin.*
 37 *.214%*
 300 *Anaesthetic ended. .075%.*

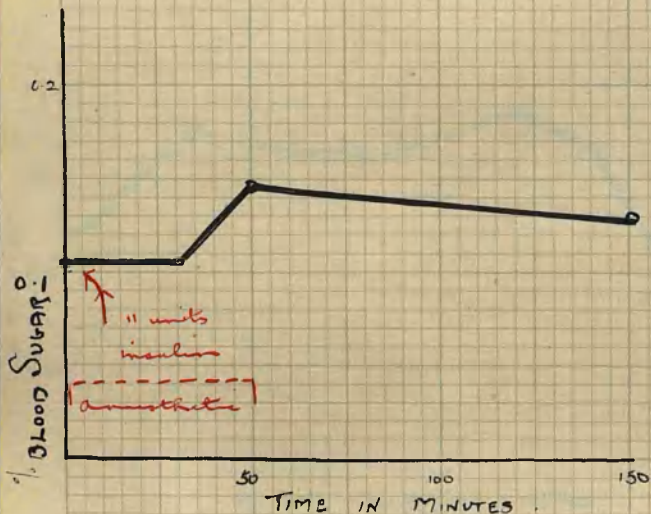
Urine before operation :- *normal.*

Urine after operation

Fehling's Test *- ve.*
 Fermentation *- ve.*
 Acetone *- ve.*
 Diastase A (Fehling) *- ve.*
 " (Lindemann's) *- ve.*
 Pentoses (Bial's) *- ve.*
 Glycerates *- ve.*
 Albumen *- ve.*
 and Reaction *+ ve.*

CASE N^o 9

SERIES II.



NAME Benj. Butler
 AGE 31
 ANAESTHETIC CHCl₃, then CE Nitro
 SEDATIVE Morph to Scopolin 30 & Atropin 100.
 DISEASE ? Sarcoma Maxilla of Humans.
 OPERATION Scraping bone
 GENERAL CONDITION. Good. (Wound - ve)
 INSULIN DOSAGE. 11 units

TIME TABLE

0
 5
 10
 30
 50
 150

% BLOOD SUGAR.

0.106%
 CHCl₃ begins
 11 units insulin
 CE nitro
 0.106%
 0.147%
 anesthetic end
 0.131%

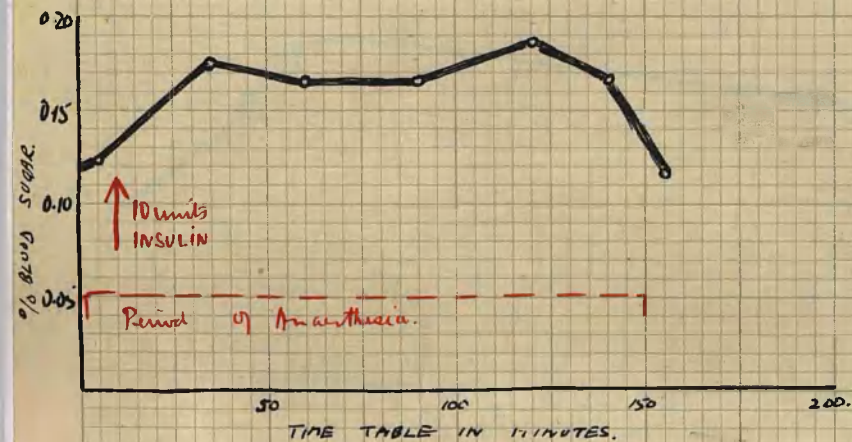
Urine before Operation :- Normal.

Urine after Operation :-

Gellig's Test - ve
 Ferrumtion - ve
 Acetone - ve
 Dextin A. - ve
 Albumin - ve
 Penton (Bial) - ve
 Uroto - + ve
 Acid Reaction + ve
 Specific Gravity 1032.

CASE NO 10

SERIES II



NAME	William Kay.
AGE	61
ANAESTHETIC	CE Mixture
SEDATIVES	Nuph. Scopolamine Atropine.
DISEASE	Carcinoma of Splenic Flexure.
OPERATION	Resection of Colon.
GENERAL CONDITION.	Poor. Great operative shock.
INSULIN DOSAGE.	10 units.
	Patient died next day.

TIME TABLE

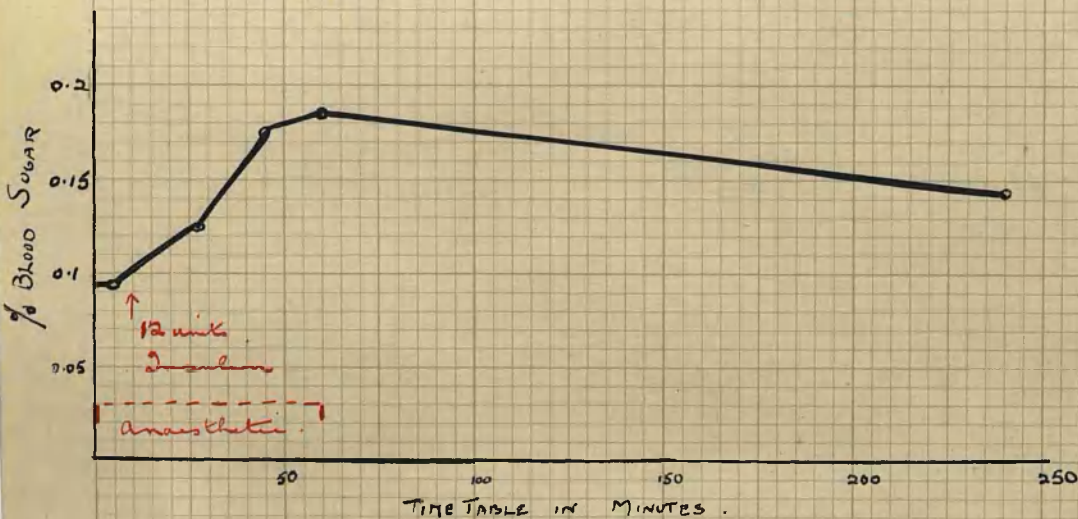
% BLOOD SUGAR

0	CE Mixture.
5	0.123%
10	10 units Insulin
35	0.175%
60	0.165%
90	0.165%
120	0.187%
140	0.168%
150	CE mixture stopped
155	0.118%

Urine not available

CASE N^o 11

SERIES II



NAME Henry Hoffer
 AGE 32
 ANAESTHETIC CE mixture
 SEDATIVES atropine
 DISEASE
 OPERATION T.B. Glans of Neck
 GENERAL CONDITION Poor
 INSULIN DOSAGE 12 units
(no sickness).

TIME TABLE	% Blood Sugar
0	CE mixture
5	0.094 %
10	12 units insulin
27	0.125 %
45	0.178 %
60	0.184 %
240	0.143 %

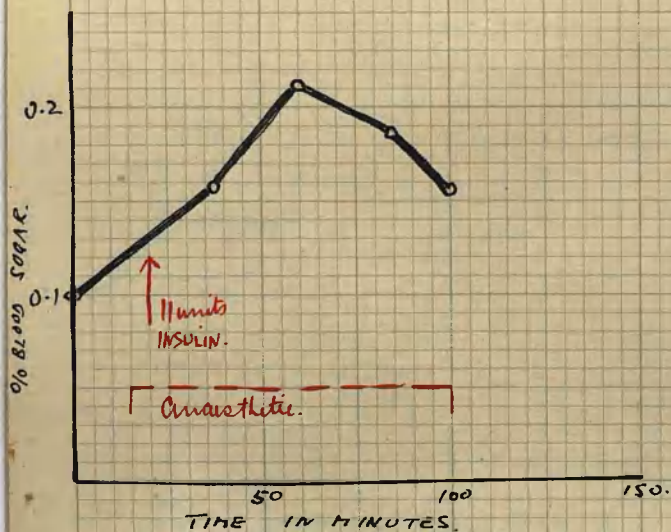
Urine before Operation :- Normal

Urine after Operation :-

Tellings Test	- ve
Formication	- ve
Acetone	- ve
Diastase A.	- ve
Pentose	- ve
all	- ve
Acid Reaction	+ ve
Specific Gravity	1031

CASE No. 2

SERIES II



TIME TABLE

% BLOOD SUGAR

NAME Charles Willis
 AGE 49.
 ANAESTHETIC $\text{CHCl}_3 \rightarrow$ Ether
 SEDATIVES Morph. Scopolamine Atropine
 DISEASE Duodenal Ulcer.
 OPERATION Gastro enterostomy.
 GENERAL CONDITION Fair
 INSULLIN DOSAGE 11 units.

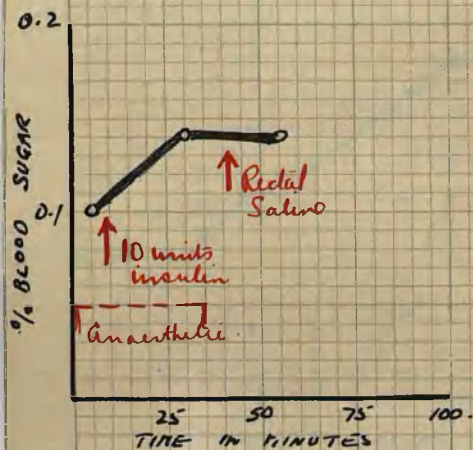
0	0.100%
15	$\text{CHCl}_3 \rightarrow$ Ether
20	11 units insulin.
37	0.156%
60	0.211%
85	0.187%
100	0.156% Anaesthetic ended.

Urine before operation :- Normal.
 Urine after operation

Fehling's Test.	-ve.
Fermentation	-ve.
Acetone	-ve.
Diastase A	-ve.
Albumen	-ve.
Pantones (Bial's)	-ve.
Uates	+ve.
Acid Reaction	+ve.
Specific Gravity	1030

CASE No. 13

SERIES II



TIME TABLE (minutes)

% BLOOD SUGAR

NAME Percy Minton
 AGE 44
 ANAESTHETIC CK mixture → Ether
 SEDATIVE Atropine $\frac{1}{100}$
 DISEASE Gastric ulcer
 OPERATION Gastroenterotomy
 GENERAL CONDITION Fair
 INSULIN DOSAGE 10 units

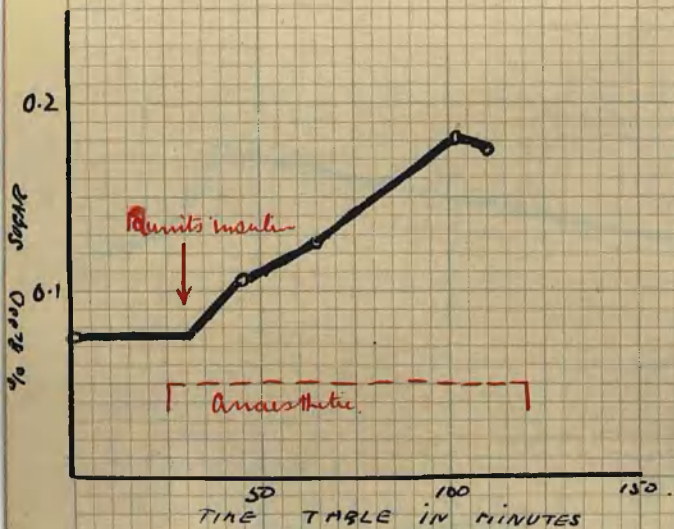
0 CK mixture
 5 · 100% + Ether
 10 10 units insulin
 30 · 14.1%
 35 Anaesthetic ended
 45 Saline + glucose
 55 0-14.1%

Urine before operation: - normal.

Urine after operation not available.

CASE No. 114

SERIES II



NAME	Frank Crockett.
AGE	41.
ANAESTHETIC	Chl ₃ → Ether & Oxygen.
SEDATIVES	Morph. Scopolamine Atropine
DISEASE	Adhesions to liver Prev. gastro-enterostomy for duodenal ulcer.
OPERATION	Anastomosis.
GENERAL CONDITION	Medium build
INSULIN DOSAGE	12 units insulin

TIME TABLE
(minutes)

% BLOOD SUGAR

0	0.075%
25	Chl ₃ → Ether & Oxygen
27	12 units insulin.
45	0.106%
65	0.125%
103	0.181%
115	0.175%
120	Anaesthetic ended.

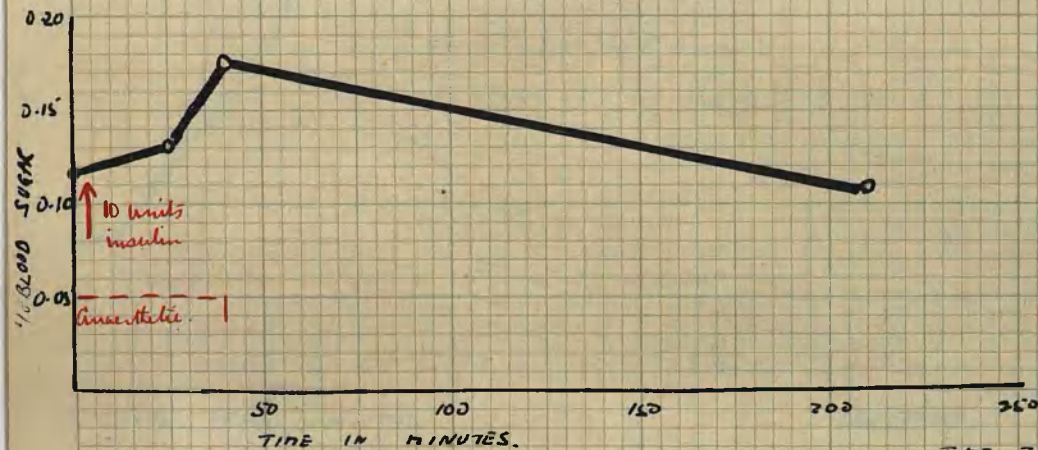
Urine before operation: - Not available.

Urine after operation

Fehling's Test.	-ve.
Fermentation	-ve.
Acetone	-ve & ve.
Diabetic Acid	-ve.
Albumen	-ve.
Acid reaction	+ve.
Specific Gravity	1028
Urate (sediment)	+ve.

CASE No. 15

SERIES II



		TIME TABLE	% BLOOD SUGAR
NAME	Mary Crosswell.	0	CE Mixture
AGE	23	1	0.118%
ANAESTHETIC	CE Mixture.	3	10 units insulin
SEDATIVES	Morph $\frac{1}{100}$ Atropine $\frac{1}{100}$	25	0.131%
DISEASE	Nephroposis.	40	0.175%
OPERATION			Anesthetic ended.
GENERAL CONDITION	Thin.	210	0.106%
INSULIN DOSAGE	10 units.		

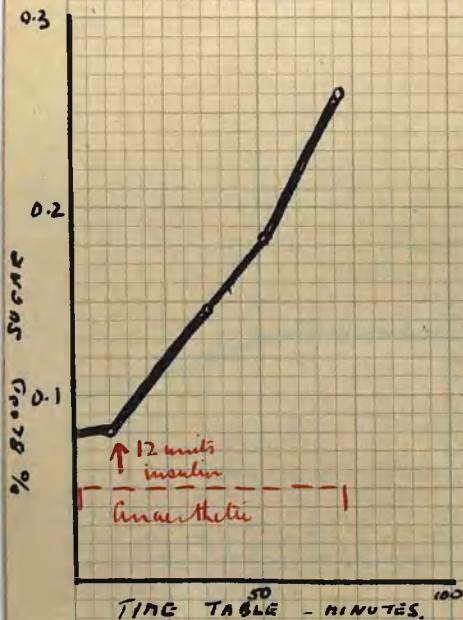
Urine before operation: - Normal.

Urine after operation

Fehling's Test.	+ve. (trace)
Fermentation	-ve.
Acetone	+ve.
Diastatic Acid	-ve.
Pentoses	-ve.
Albumen	+ve
White matter	+ve.
Acid Reaction	+ve
Spec. Gravity	1030.

CASE No. 16

SERIES II



NAME Elizabeth Rhodes.
 AGE 53.
 ANAESTHETIC CHCl_3 , then Ether.
 SEDATIVES Morphine $\frac{700}{100}$
 Atropine $\frac{2}{100}$
 DISEASE Gallstones.
 OPERATION Cholecystectomy.
 GENERAL CONDITION Fair, fat.
 INSULIN DOSAGE 12 units
 Considerable liver handling

TIME TABLE

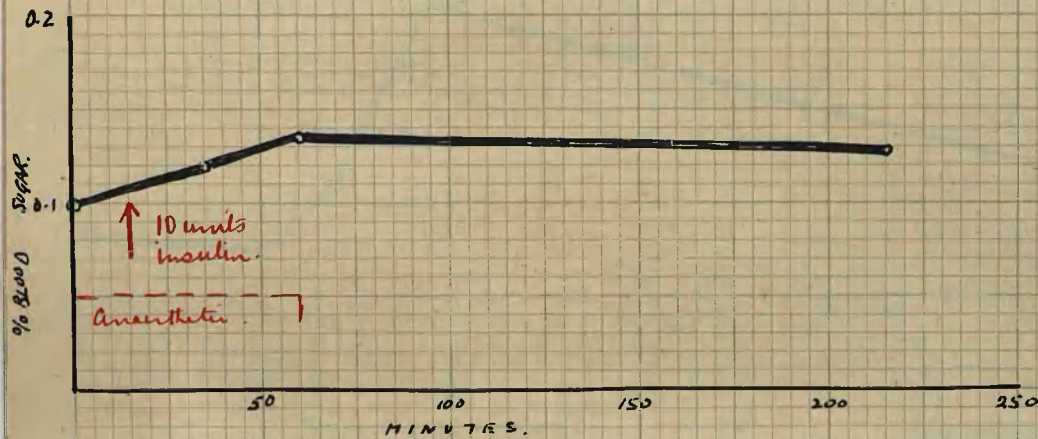
% BLOOD SUGAR

0 CHCl_3 then Ether.
 10 0.081%
 12 12 units insulin
 37 0.147%
 52 0.181%
 72 0.259%
 Anesthetic ended.

Urine not available

CASE NO. 17.

SERIES II



NAME *Lily Brice.*
 AGE *30.*
 ANAESTHETIC *CE. mixture.*
 SEDATIVES *Morph. Scopolamine Atropine.*
 DISEASE *Abdominal Adhesions*
T.B. Salpingitis
 OPERATION *Previous peritonitis*
→ Appendicectomy.
 GENERAL CONDITION *Then.*
 INSULIN DOSAGE *10 units.*

TIME TABLE

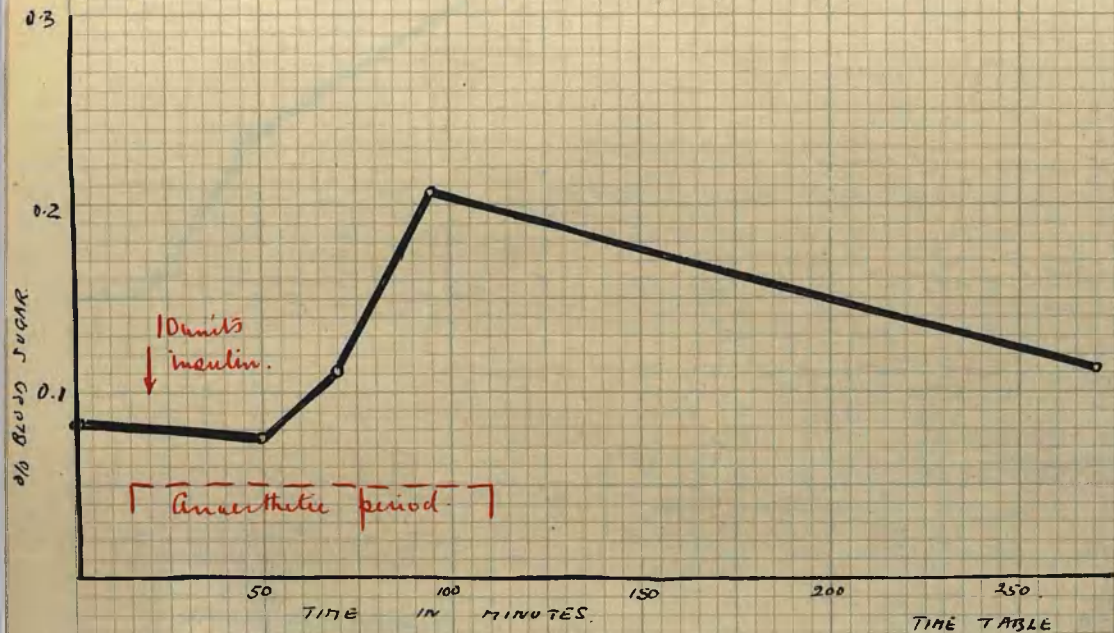
% BLOOD SUGAR

TIME	% BLOOD SUGAR
0	<i>CE. mixture.</i>
0	<i>0.098%</i>
15	<i>10 units insulin.</i>
35	<i>0.118%</i>
60	<i>0.133%</i>
	<i>Anaesthetic ended.</i>
215	<i>0.128%</i>

Urine before operation	Normal.
Urine after operation	
Fehling's Test.	<i>+ve.</i>
Acetone	<i>+ve.</i>
Diastase fluid	<i>-ve.</i>
Albumen	<i>-ve.</i>
Acid Reaction	<i>+ve.</i>
Urea	<i>+ve.</i>
Specific Gravity	<i>1030.</i>

CASE No. 18

SERIES 10

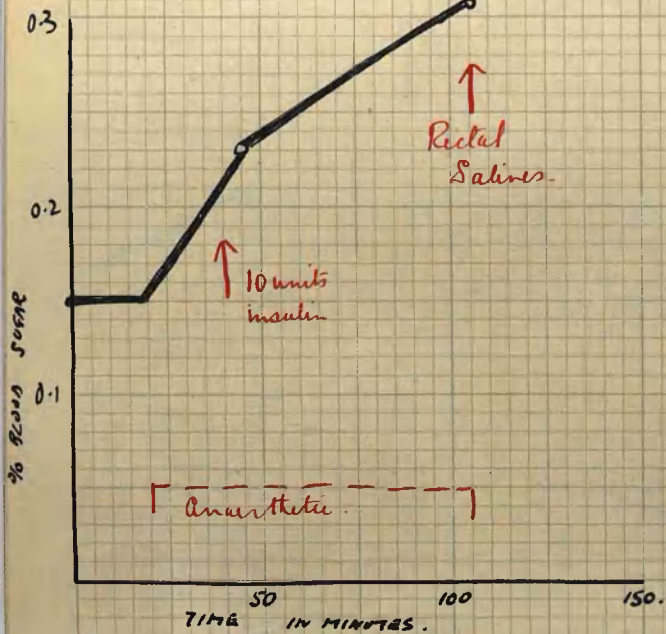


		TIME TABLE	% BLOOD SUGAR
NAME	Annie Hall	0	0.081%
AGE	31.	15	CK mixture, with a struggle.
ANAESTHETIC	CE mixture	20	10 units insulin.
SEDATIVES	Morph Scopolamine Atropine.	50	0.075%
DISEASE	T.B. Glands in Neck.	70	0.112%
OPERATION	Removal.	95	0.206%
GENERAL CONDITION	Good.	110	Anesthetic ended.
INSULIN DOSAGE	10 units.	270	0.112%

Urine not available

CASE No. 19

SERIES II



NAME Margt. Meek
 AGE 52.
 ANAESTHETIC CE → Ether
 SEDATIVES Morph Atropine.
 DISEASE Acute cholecystitis with gallstones. High temp. Pus present.
 OPERATION → Cholecystectomy.
 GENERAL CONDITION Fair. Very collapsed at end of operation.
 INSULIN DOSAGE 10 units
Patient died at midnight vomiting blood.

TIME-TABLE (minutes)

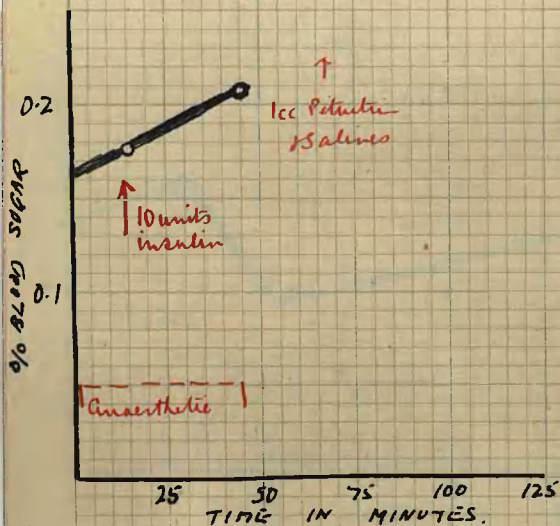
% BLOOD SUGAR

0	0.150%
20	CE → Ether
40	10 units insulin
45	0.231%
105	0.306%
	Anaesthetic ended.

Urine before Operation: normal
Urine after Operation: not available.

CASE No. 20.

SERIES 11



NAME *Eleg. Nash.*
 AGE *66.*
 ANAESTHETIC *Ch. Mixture, then Ether.*
 SEDATIVES *Atropine $\frac{1}{100}$ gr.*
 DISEASE *? Malignant Ulcer of Stomach.*
 OPERATION *Gastro enterostomy.*
 GENERAL CONDITION *Thin.*
 INSULIN DOSAGE *10 units.*

TIME TABLE

0 *Ch. Mixture, then Ether.*
15 *0.175%.*
10 units insulin.
45 *0.206%.*
Anaesthetic ended.

% BLOOD SUGAR

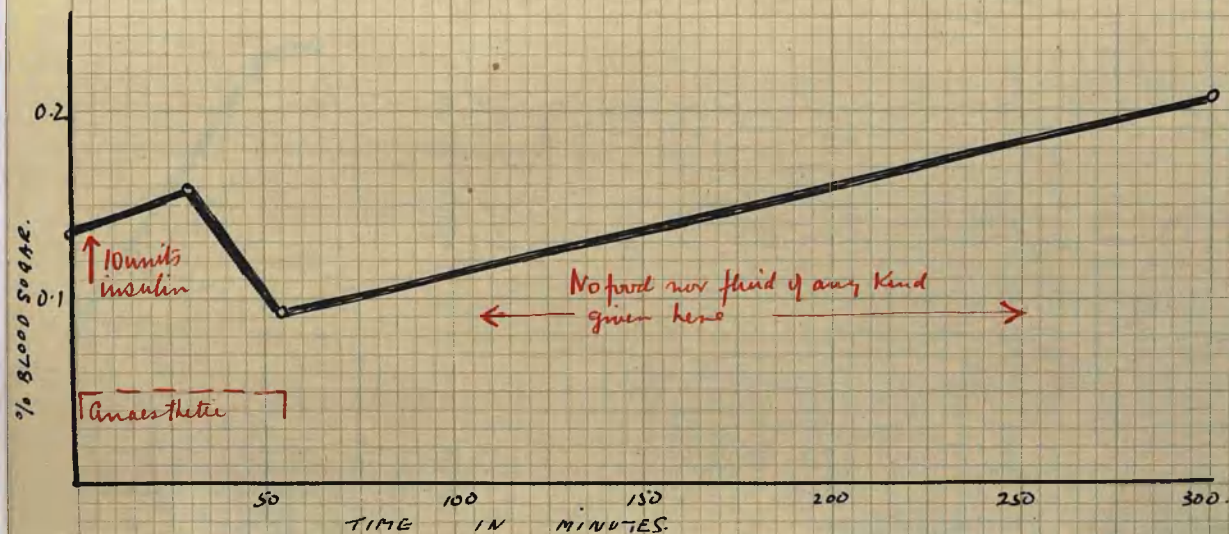
Urine before operation:- *Normal.*

Urine after operation:-

Fehling's Test. *-ve.*
Acetone *+ve.*
Disacchar. A. *?*
Albumen *-ve.*
Acid reaction *+ve.*
Specific Gravity *1020.*

CASE No. 21

SERIES II



NAME Thos. Powell.
 AGE 51
 ANAESTHETIC Ether.
 SEDATIVES Morph. Scop. + Atropine.
 DISEASE Recurrent Papilloma of Bladder.
 OPERATION Removal + Castration.
 GENERAL CONDITION Fair.
 INSULIN DOSAGE. 10 units.

TIME TABLE
(in minutes)

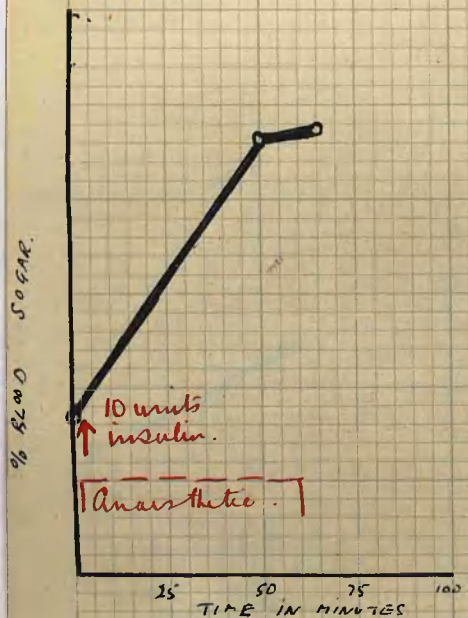
TIME TABLE (in minutes)	% BLOOD SUGAR
0.	0.131%
5	then CHOC → Ether. 10 units insulin
30	0.156%
55	0.093%
300	Anaesthetic ended. 0.206%

Urine before operation: - Blood + ur
 pus + ur
 albumen + ur.

Urine after operation: - not available

CASE No. 22

SERIES II



NAME Amy Powell.
 AGE 50.
 ANAESTHETIC CHCl₃ → then Ether.
 SEDATIVES Morph, scopolamine & Morphine
 DISEASE Carcinoma Uteri.
 OPERATION Hysterectomy.
 GENERAL CONDITION Fair. Fat.
 INSULIN DOSAGE 10 units.

TIME TABLE
(minutes)

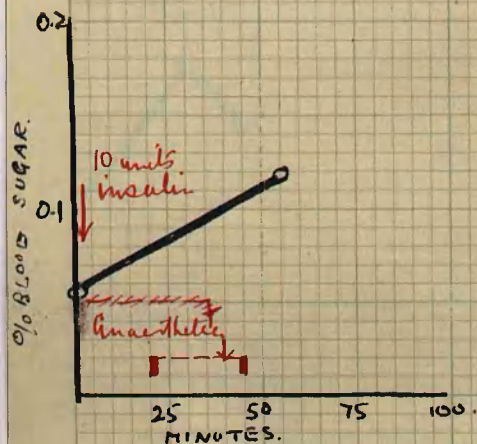
% BLOOD SUGAR

0	0.081%
2	10 units insulin.
3	CHCl ₃ , then Ether.
50	0.231%
60	Anaesthetic ended.
66	0.237%

Urine before operation: - normal.
Urine not available after operation

CASE No. 23

SERIES II



TIME TABLE
(minutes)

% BLOOD SUGAR

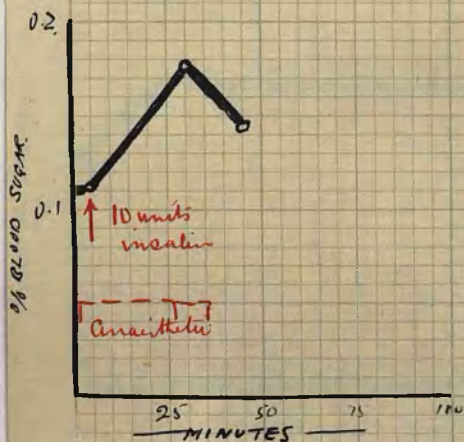
NAME	Florence Smith
AGE	42.
ANAESTHETIC	CE mixture.
SEDATIVE	Morph. Scopolamine Atropine
DISEASE	nil — [? ovarian cyst]
OPERATION	nil, except laparotomy.
GENERAL CONDITION	Good. [Patient $\frac{7}{12}$ pregnant]
INSULIN DOSAGE	10 units.

0	0.056%
1	10 units insulin
20	CE mixture
45	CE ended.
55	0.118%

Urine not available.

CASE No. 24

SERIES II



NAME Elsie Pugh.
 AGE 32.
 ANAESTHETIC $CHCl_3$ then Ether.
 SEDATIVES Morph. Scopolamine. Atropine.
 DISEASE T.B. Stomach & neck.
 OPERATION Removal.
 GENERAL CONDITION Good.
 INSULIN DOSAGE 10 units

TIME TABLE

% BLOOD SUGAR

0	$CHCl_3 \rightarrow$ Ether
5	0.112%
7	10 units insulin
30	0.175%
45	0.143%
35	Anaesthetic ended.

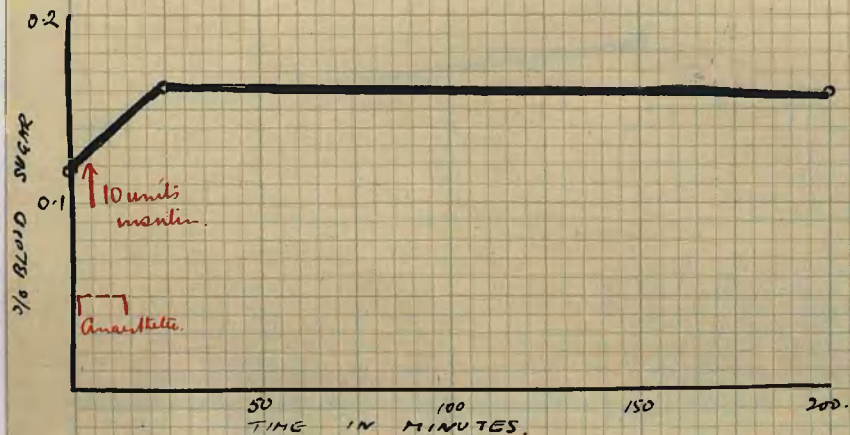
Urine before operation: Normal.

Urine after operation

Fehling's Test.	+ve (trace)
Fermentation	-ve.
Acetone	+ +ve.
Diabetic fluid	-ve.
Albumen	-ve
Chlorides	+ve.
Acid reaction	+ve.
Sp. Gravity	1020.

CASE No. 25

SERIES II



NAME Ellen Cross.
 AGE 39.
 ANAESTHETIC CE mixture, then Ether.
 SEDATIVES Atropine 100
 DISEASE Recto Vaginal Fistula.
 OPERATION Repair.
 GENERAL CONDITION One week after labour. Thin.
 INSULIN DOSAGE 10 units.

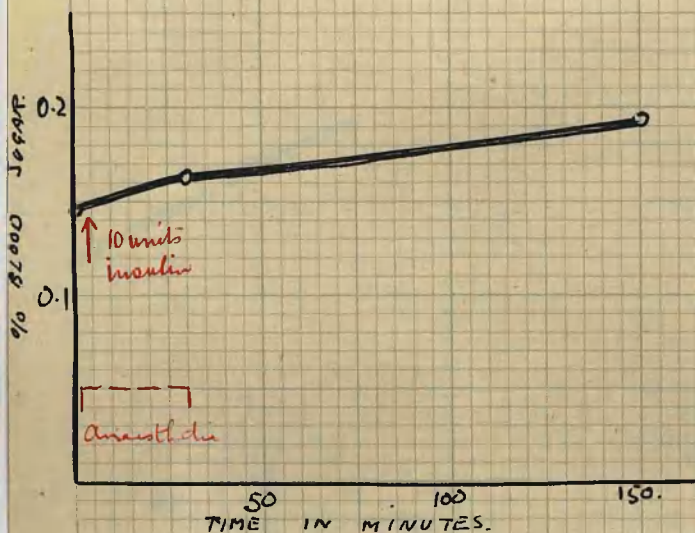
TIME TABLE

TIME	% BLOOD SUGAR
0	CE mixture → Ether. 0.118%
6	10 units insulin
12	Anarkete a sed.
24	0.162%
200	0.156%

Urine not available

CASE NO. 26.

SERIES II.



NAME Amy Weaver.
 AGE 33.
 ANAESTHETIC CE mixture.
 SEDATIVE Morph. Scopolamine Atropine
 DISEASE ? Gastric Ulcer.
 OPERATION Laparotomy, nil found.
 GENERAL CONDITION Fair. Thin
 INSULIN DOSAGE 10 units.

TIME TABLE
(minutes)

% BLOOD SUGAR

0	0.143%
2	CE mixture.
30	10 units insulin
	0.162%
	Anaesthetic ended.
150	0.193%

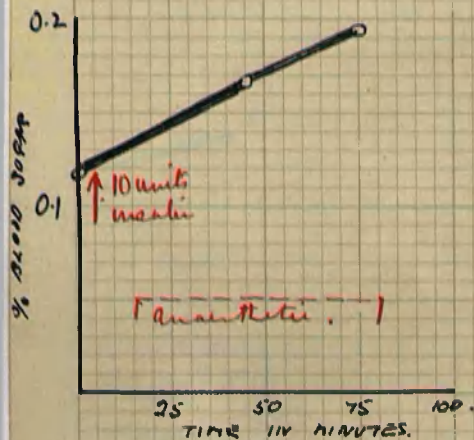
Urine before operation: - Normal.

Urine after operation

Fehling's Test	-- ve.
Fermentation	- ve.
Acetone	++ ve.
Diacetic Acid	trace.
Albumen	- ve.
Chlorides	+ ve.
Acid reaction	+ ve.
Specific Gravity	1025.

CASE No. 27

SERIES II



TIME TABLE
(min)

% BLOOD SUGAR

NAME George Benson.
 AGE 66.
 ANESTHETIC C₂ Mirtine, then Ether.
 SEDATIVES Morph. Scopolamine Atropine.
 DISEASE Carcinoma of Breast.
 OPERATION Removal.
 GENERAL CONDITION Fair. Muscular.
 INSULIN DOSAGE 10 units.

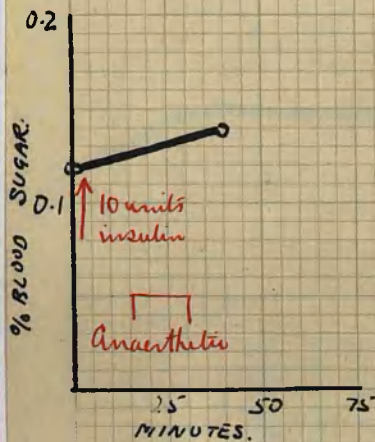
0 0.118%
 5 10 units insulin
 15 CE Mirtine → Ether
 45 0.168%
 75 0.193%
 80 Anesthetic ended.

Urine before - normal.

Urine after - not available.

CASE No. 28.

SERIES II.



NAME Amy Wood.
 AGE 26.
 ANESTHETIC ~~C.F.~~ Mixture → Ether.
 SEDATIVES Morph $\frac{1}{6}$ Atropin $\frac{1}{100}$.
 DISEASE Endometritis, post abortion
 OPERATION Dilatation & Curette
 GENERAL CONDITION Good.
 INSULIN DOSAGE 10 units.

TIME TABLE
(minutes)

% BLOOD SUGAR

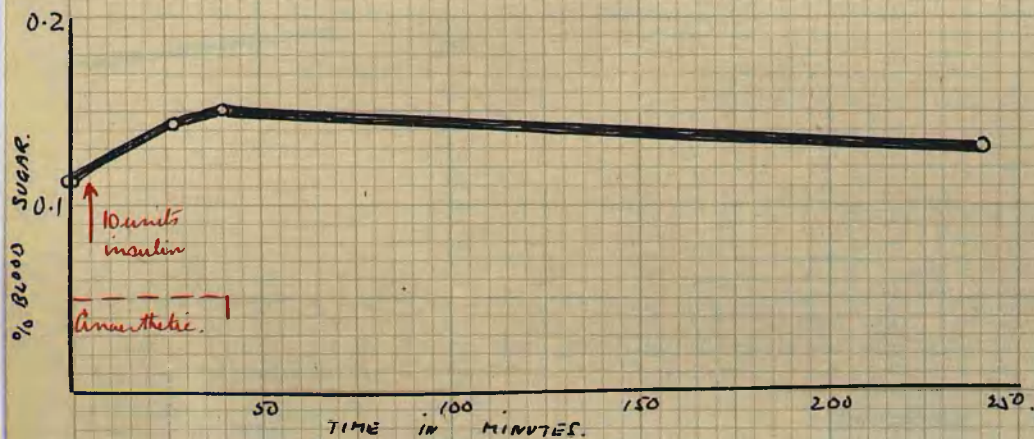
0.	0.118%
1	10 units insulin
15.	C.F. Mixture → Ether
30.	Anaesthetic ended
40.	0.137% (conscious then)

Urine after operation

Fehling's Test.	-	+(trace)
Acetone		+ ve.
Diabetic		- ve
Albumen		- ve.
Reaction		slight acid.
Specific Gravity		1020.

CASE NO. 29

SERIES 11



NAME Phyllis Banatt.
 AGE 15
 ANAESTHETIC $\text{CHCl}_3 \rightarrow$ Ether.
 SEDATIVES Morph $\frac{1}{6}$ Atropine $\frac{1}{100}$
 DISEASE T. B. Glands of neck.
 OPERATION Removal of glands.
 GENERAL CONDITION Good. Big girl.
 INSULIN DOSAGE. 10 units.

TIME TABLE

TIME	% BLOOD SUGAR
0	$\text{CHCl}_3 \rightarrow$ Ether.
1.	0.112%
3.	10 units insulin
26.	0.143%
40.	0.150%
41	Anaesthetic ended.
240.	0.131%

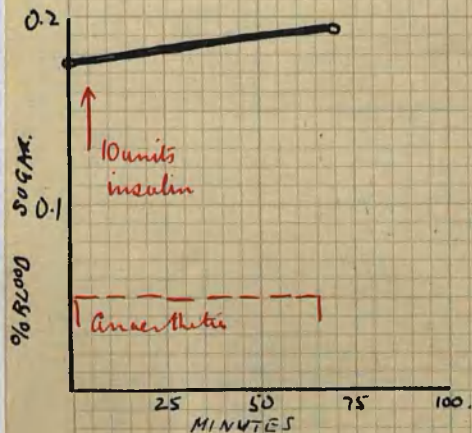
Urine before operation: - Normal.

Urine after operation

Fehling's test.	+(trace)
Fermentation	-ve.
Acetone	+ve.
Diabetic acid	+(trace)
Albumen	-ve.
Acid reaction	+ve
Specific Gravity.	1035.

CASE No. 30.

SERIES II



NAME Margaret Coffey.
 AGE 27.
 ANAESTHETIC $CHCl_3 \rightarrow CE$ mixture.
 SEDATIVES $1/100$ Scopolamine $1/100$ Atropine $1/100$
 DISEASE T.B. Uterus (from T.B. Kidney)
 OPERATION Removal of Uterus.
 GENERAL CONDITION Poor.
 INSULIN DOSEAGE. 10 units.

TIME TABLE
(minutes)

% BLOOD SUGAR

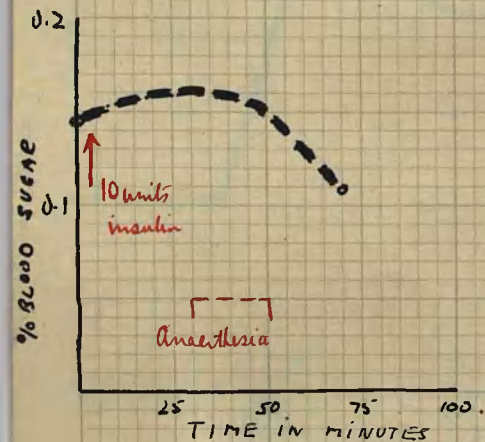
0.	$CHCl_3 \rightarrow CE$ mixture.
2.	0.175%
5.	10 units insulin
65.	Anaesthetic ended.
70.	0.193%

Urine before operation:- albumen +.

Urine after operation:- not available

CASE No. 31

SERIES II.



NAME Charles Powell.
AGE 43.
ANAESTHETIC $\text{CHCl}_3 \rightarrow \text{CE Mureline}$.
SEDATIVES morph. Scopolamine Muspinis
DISEASE Varicocle.
OPERATION Removal.
GENERAL CONDITION Good.
INSULIN DOSAGE 10 units.

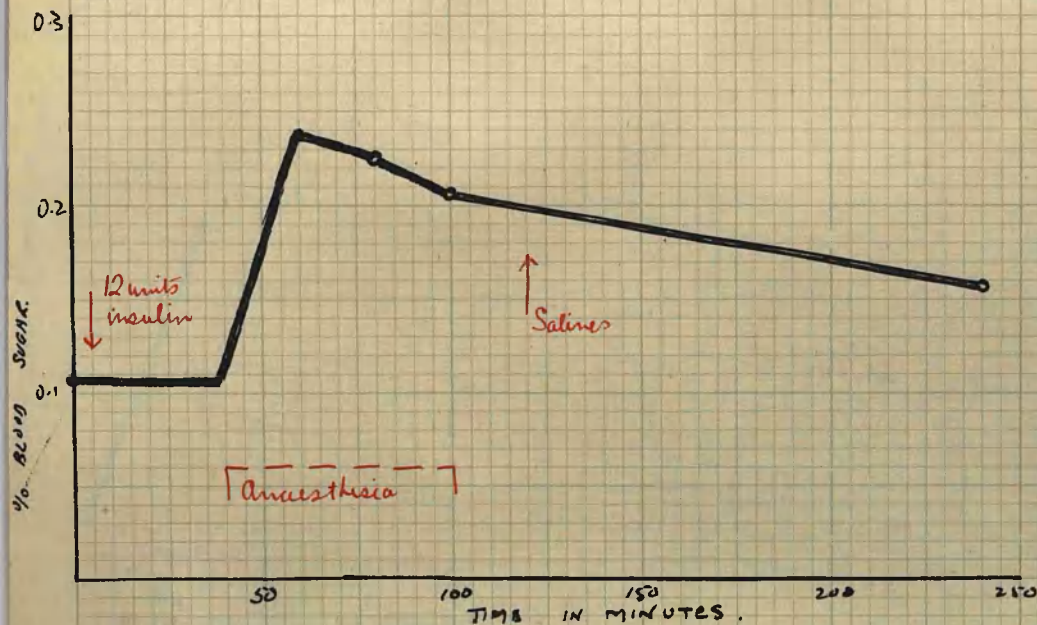
TIME TABLE

	<u>% BLOOD SUGAR</u>
0.	0.143%
1	10 units insulin
30.	$\text{CHCl}_3 \rightarrow \text{CE Mureline}$
50.	Anaesthetic ended.
70.	0.106%

Urine not available.

CASE No. 32.

SERIES II.



		TIME TABLE	% BLOOD SUGAR
NAME	Annie Meaker	0	0.106%
AGE	52.	5	12 units insulin
ANAESTHETIC	CE mixture, then Ether.	40	CE mixture, then Ether.
SEDATIVES	$\frac{1}{2}$ gr. morph. (suppository)	60	0.237%
DISEASE	Ingenital neuralgia	80	0.225%
OPERATION	pres. removal of $\frac{2}{3}$ parotid gland plus removal of glossopharyngeus.	100	0.206%
GENERAL CONDITION	Poor. medium build	120	Anaesthetic ended. Rectal Saline.
INSULIN Dosage	12 units.	240	0.156%

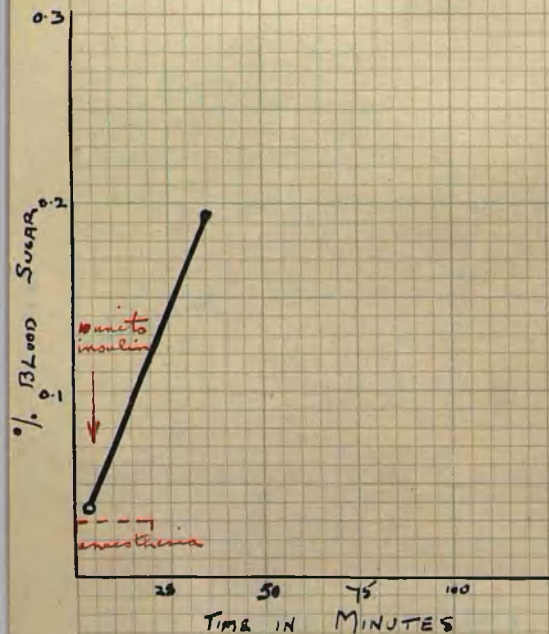
Urine before operation :- Normal.

Urine after :-

Fehling's Test :-	+ Trace
Acetone.	- ve.
Diabetic Acid	- ve.
Albumen	- ve.
Chlonds	+ ve.
Acid Reaction	+ ve.
Specific Gravity	1030.

CASE N^o 33

SERIES II.



TIME TABLE
(MINUTES)

% BLOOD SUGAR

NAME Alfred Smith.
 AGE 42.
 ANAESTHETIC CHCl₃ then ether.
 SEDATIVES Atropine & Morphine
 DISEASE Carcinoma of Stomach.
 OPERATION Leforectomy
 GENERAL CONDITION. Thin.
 INSULIN DOSAGE. 10 units.

0

CHCl₃

3

0.037%

5

ether

10 units Insulin

20

Anaesthetic ended.

30

0.193%

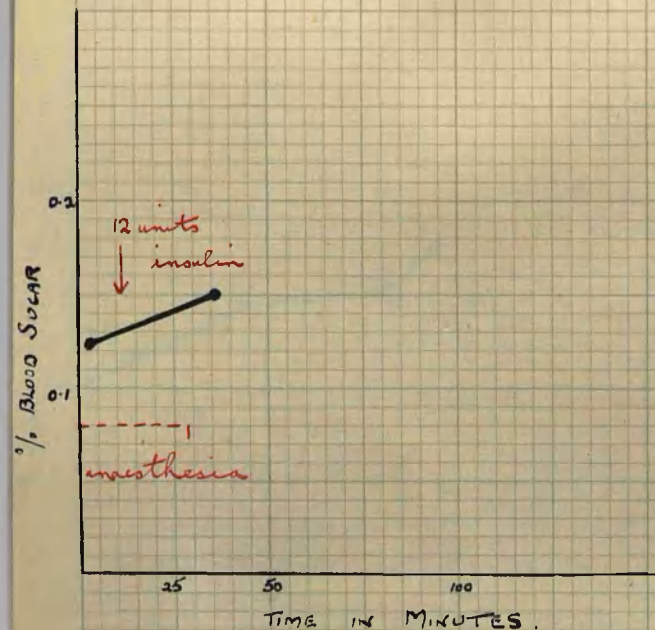
Urine before Operation :- Normal

Urine after operation :-

Felling's Test	+ve
Acetone	-ve
Diastase A	-ve
Albumin	-ve
Chlorides	+ve
Acid Reaction	+ve.

CASE N^o 34

SERIES II



NAME *Nellie Davies*
 AGE *43*
 ANAESTHETIC *CHCl₃*
 SEDATIVES *Sedolamin & Morph.*
 DISEASE *? Gall Stones.*
 OPERATION *abdominal exploration.*
 GENERAL CONDITION *(nil found).*
 INSULIN DOSAGE *12 units.*

TIME TABLE
(MINUTES)

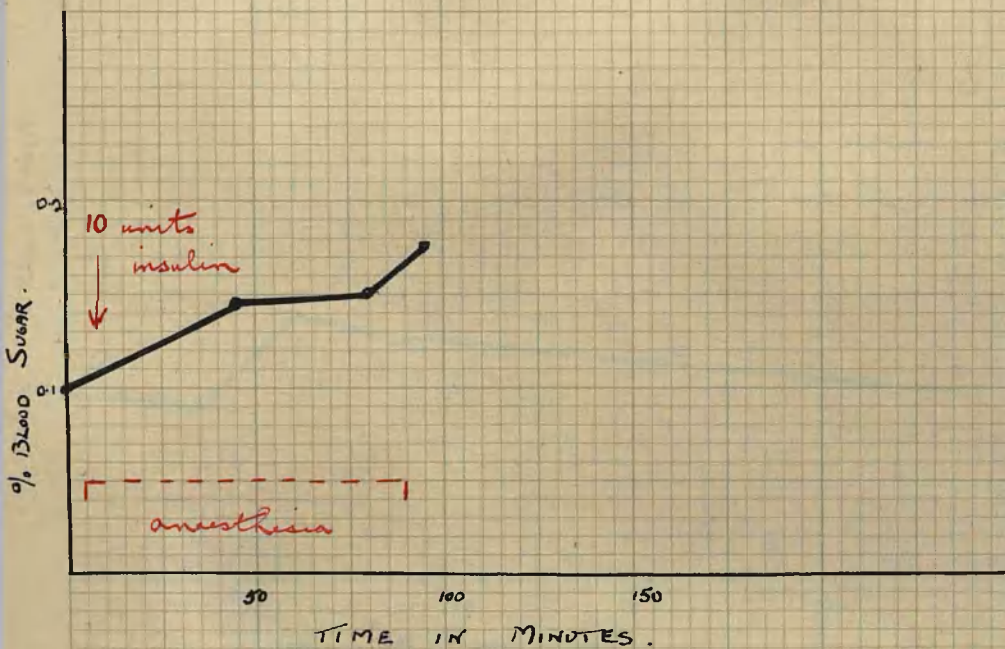
% BLOOD SUGAR

<i>0</i>	<i>CHCl₃.</i>
<i>3</i>	<i>0.125%</i>
<i>12</i>	<i>12 units Insulin</i>
<i>28</i>	<i>Anaesthetic ended.</i>
<i>36</i>	<i>0.150%</i>

Urine not available

CASE N° 35

SERIES II.



NAME Kate Cadden
 AGE 55
 ANAESTHETIC CHCl_3 thru GE mixture
 SEDATIVES Morph. & Scopolamine
 DISEASE Chronic Intestinal Obstruction
 OPERATION Ventral hernia
 GENERAL CONDITION.
 INSULIN DOSAGE 10 units.

TIME TABLE
(MINUTES)

% BLOOD SUGAR

0

0.100%

5

CHCl_3 thru GE mixture

8

10 units insulin

45

0.143%

80

0.150%

95

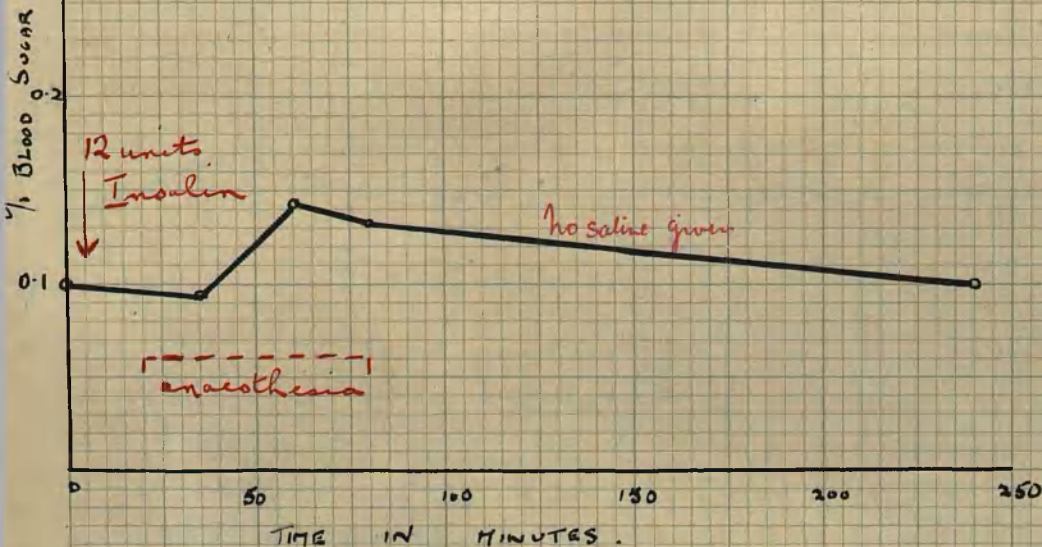
0.145%

anesthesia end.

Urine not available.

CASE N^o. 36

SERIES II.

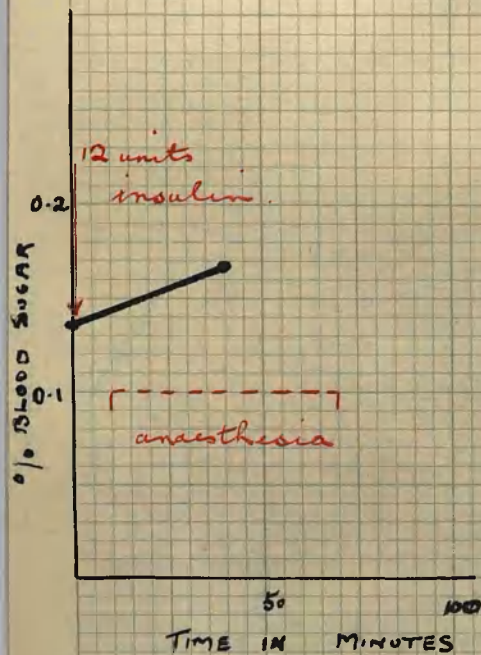


		TIME TABLE (MINUTES)	% BLOOD SUGAR.
NAME	G. R. Thomas	0	0.100%
AGE	41	5	12 units Insulin
ANAESTHETIC	C.E. mixture.	20	C.E. mixture.
SEDATIVES	Morph. Scop. + atropin.	35	0.093%
DISEASE	Gastric ulcer.	60	0.143%
OPERATION		80	0.131%
GENERAL CONDITION.	Medium Build.	240	anaesthesia ended.
INSULIN DOSAGE.	12 units.		0.100%

Urine before operation - Normal
 " after " - not available

CASE N^o. 37

SERIES II.



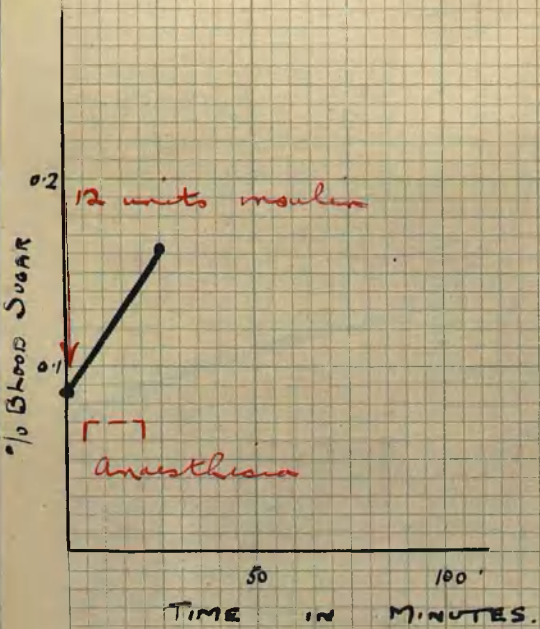
NAME J. Steele
 AGE 50
 ANAESTHETIC C.E. mixture, Ether.
 SEDATIVES Atropine & Morphine
 DISEASE Chronic gastric ulcer.
 OPERATION
 GENERAL CONDITION. Good
 INSULIN DOSAGE. 12 units.

TIME TABLE (MINUTES)	% BLOOD SUGAR
0	0.137%
1	12 units insulin
10	C.E. mixture than Ether.
40	0.168%
70	anaesthetic ended.

Urine before Operation - Normal
" after " - not available

CASE N° 38

SERIES II.



NAME Edith Burke
 AGE 18
 ANAESTHETIC C.E. mixture then ether
 SEDATIVES Atropine
 DISEASE Chronic appendicitis
 OPERATION Appendicectomy
 GENERAL CONDITION Medium build
 INSULIN DOSAGE 12 units

TIME TABLE
(MINUTES)

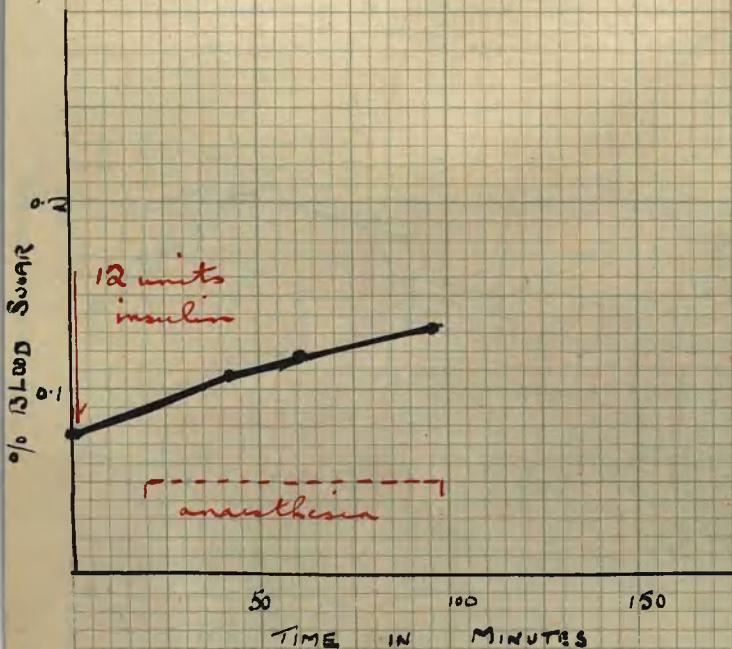
% BLOOD SUGAR

0 0.086 %
 1 12 units insulin
 5 C.E. mixture then ether
 20 anaesthetic ended
 25 0.162 %

Urine before Operation - Normal
 " " " - not available

CASE N° 39

SERIES II.



NAME Ernest Fellows
 AGE 36
 ANAESTHETIC CHCl_3 thru C.E. mixture
 SEDATIVES
 DISEASE Duodenal ulcer
 OPERATION Caution & Finney's Operation
 GENERAL CONDITION Thin.
 INSULIN DOSAGE 12 units.

TIME TABLE
(MINUTES)

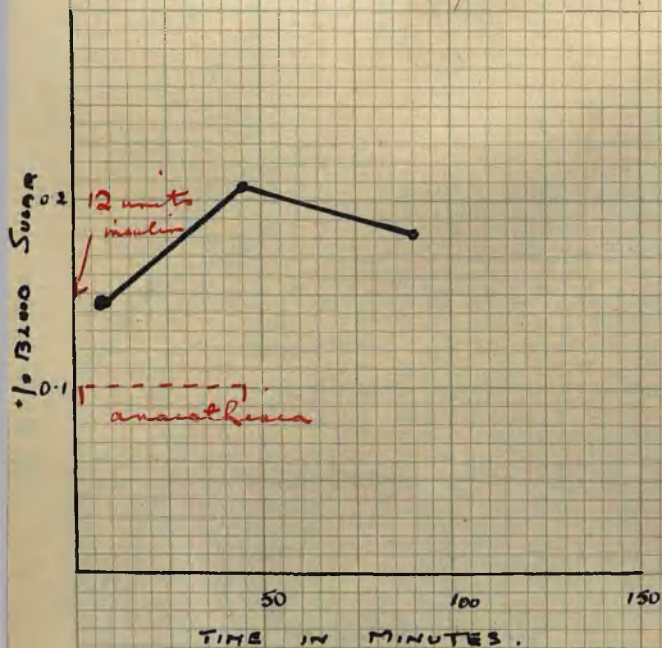
% BLOOD SUGAR

0	0.075%
2	12 units insulin
20	CHCl_3 thru C.E. mixture
42	0.106%
60	0.118%
97	0.131%
	anaesthetic used.

Urine before Operation - Normal
 " after " - not available

CASE N° 40

SERIES II



NAME Carrie Foster
 AGE 23.
 ANAESTHETIC CE mixture → Eth
 SEDATIVES Atropin.
 DISEASE Fracture of Tibia.
 OPERATION Plecting. ↑ clavicles
 GENERAL CONDITION Medium build.
 INSULIN DOSAGE 12 units.

TIME TABLE
(MINUTES)

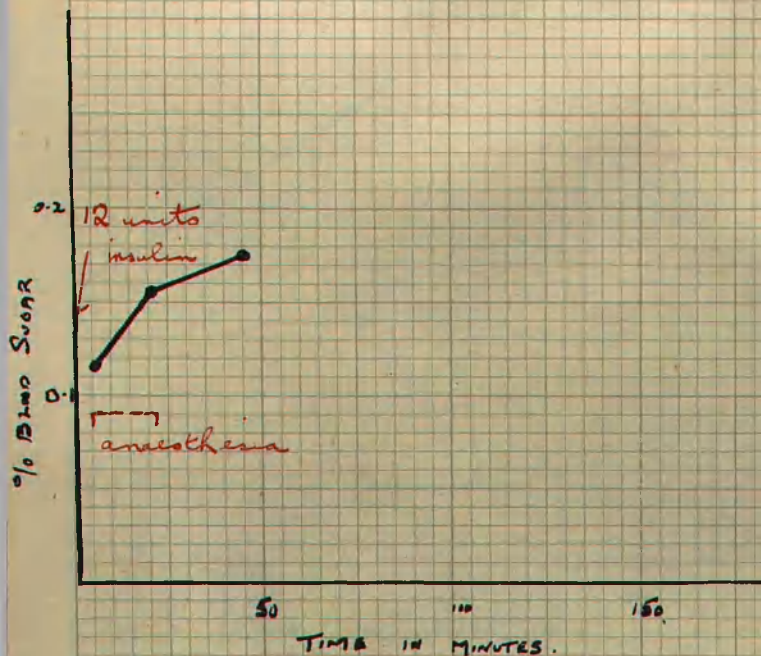
% BLOOD SUGAR

0	12 units insulin
2	CE mixture → Eth
8	0.143%
45	0.206%
90	anaesthetic ended 0.181%

Urine before Operation - Normal
" after " - not available

CASE N° 41

SERIES II



NAME *Nellie Billingham*
 AGE *27*
 ANAESTHETIC *C.E. mixture → Ether.*
 SEDATIVES *Atropine.*
 DISEASE *appendicitis*
 OPERATION *appendicectomy*
 GENERAL CONDITION.
 INSULIN DOSAGE *12 units.*

TIME TABLE
(MINUTES.)

% BLOOD SUGAR

0	<i>12 units insulin</i>
5	<i>C.E. mixture → Ether.</i>
6	<i>0.112%</i>
21	<i>0.156%</i>
	<i>anesthesia ended.</i>
46	<i>0.175%</i>

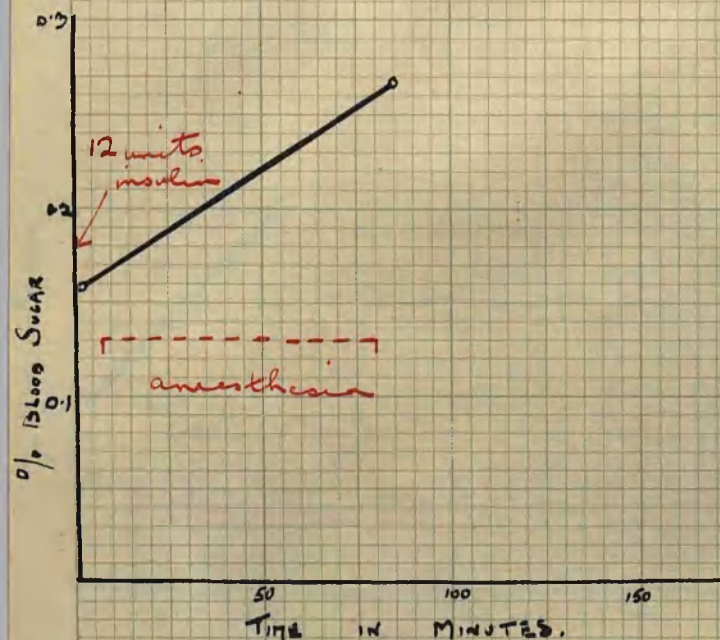
Urine before Operation - *normal*

" after "

<i>Fehling's Test</i>	<i>- ve</i>
<i>Acetone</i>	<i>+ ve</i>
<i>Diastase A</i>	<i>- ve</i>
<i>Albumen</i>	<i>- ve</i>

CASE N^o 42

SERIES II



NAME Henry Westwood.
 AGE 39.
 ANESTHETIC C.E. mixture, then ether.
 SEDATIVES Morphine, Scopolamine & atropine
 DISEASE Gastroptosis, appendicitis with
 adhesions & T.B.
 OPERATION appendicectomy, calcified glands.
 GENERAL CONDITION
 INSULIN DOSAGE 12 units.

TIME TABLE
(MINUTES)

% BLOOD SUGAR

0

12 units insulin

2

0.156%

8

C.E. mixture then Ether.

80

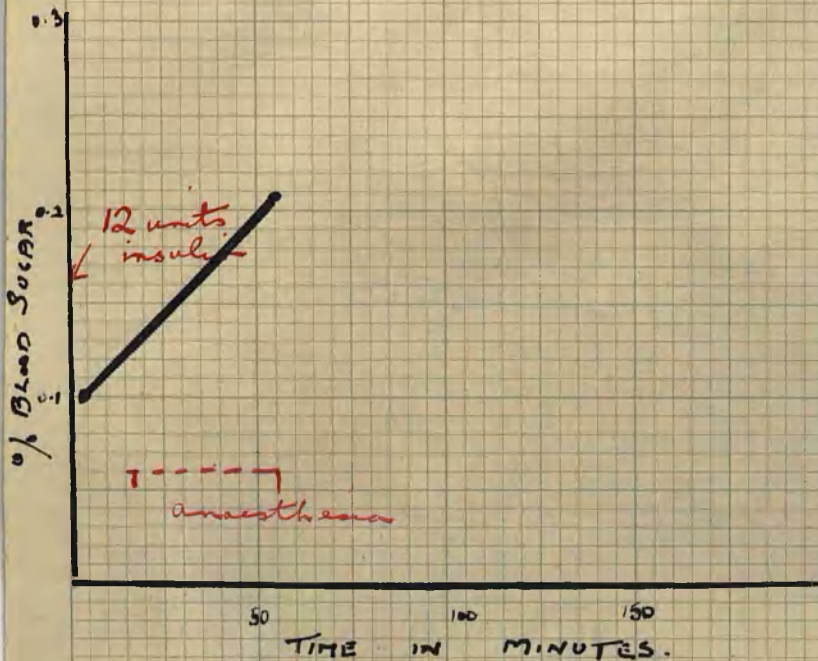
anesthesia ended.

85

0.268%

CASE N^o. 43.

SERIES II.



NAME Rupert Burns
 AGE 34
 ANAESTHETIC C. Emster, then Eth
 SEDATIVES Morphine Scopol. & atropine
 DISEASE Gastric ulcer
 OPERATION
 GENERAL CONDITION Thin
 INSULIN DOSAGE 12 units.

TIME TABLE
(MINUTES)

% BLOOD SUGAR

0

12 units insulin

3

0.100%

20

C. Emster → Eth

55

0.206%

anesthetist ended.

Urine before operation - normal.

Urine after operation - not available