A STUDY OF SOME EFFECTS OF PELVIC LAPAROSCOPY UNDER TOTAL INTRAVENOUS ANAESTHESIA

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CONTENTS

CHAPTER I

Introduction

INTRODUCTION

Laparoscopy means inspection of the structures found inside the peritoneal cavity. It was first used in dogs by Kelling in 1902. The procedure was first employed to observe the female genital organs by Nordentoeft in 1912 but only became popular following advances in lighting and optical systems.[1]

Laparoscopy is now a common procedure particularly in Gynaecology.[2] It is usually used for diagnostic or therapeutic indications.[3] It is often assumed to be a minor event due to many factors including : the small skin incision, the short duration of the procedure and its use on a day-case basis.[2]

The procedure is usually performed with the production of pneumoperitoneum with certain gases such as carbon dioxide, air, nitrous oxide or oxygen ; in order to get better visualization of pelvic viscera. The gas is insufflated by midline percutaneous puncture through a Verres needle into the peritoneal cavity. The initial flow rate is one litre per minute later reduced to about 200 - 400 ml/min. in order to maintain an intra-abdominal pressure of 15 - 20 mm Hg. The laparoscope is then passed into the peritoneal cavity via a small skin incision below the umbilicus.[1,4]

The successful management of a laparoscopic procedure is based upon three factors. First : a comprehensive appreciation of the effect of the procedure on the physiological responses of the patient. Secondly : an awareness of the potential complications and thirdly : a prudent meticulous approach to all elements of anaesthetic management. Laparoscopy introduces three major alterations in the anaesthetized patient. These are the Trendelenburg-lithotomy position, the artificial pneumoperitoneum and the introduction of exogenous carbon dioxide which is more commonly used in the production of pneumoperitoneum than other gases.[3]

The 10 - 20 degrees Trendelenburg position increases the venous pressure of the head and neck.[3,5] It also increases the venous return from lower limbs thus increasing the pulmonary blood flow which restricts the volumetric expansion of the lungs.[3,5] It reduces ventilation by 14 - 24 %.[6,7] This may be due to many factors including : the pressure of the abdominal viscera upon the diaphragm, the decrease in lung compliance, the increase in the work of breathing and the change in the ventilation-perfusion ratio (V/Q).[8] The lithotomy position also increases the venous return from lower limbs with its effect on the pulmonary blood flow and lung compliance,[9] and it reduces ventilation by 3 - 10 %.[7,10] Other hazards of Trendelenburg-lithotomy positions during laparoscopy are brachial plexus palsy,[3] regurgitation of

gastric contents[3,11] and inadvertent endobronchial intubation.[3]

Artificial pneumoperitoneum at pressures up to 20 cm H_2O, increases the femoral vein and the central venous pressures. It elevates the diaphragm which presses upon the base of the lungs thus reducing the tidal volume, the residual and the expiratory reserve volumes.[3] The minute volume is increased in relation to the increase in intra-abdominal pressure following CO_2 insufflation due to an increase in the respiratory rate.[9]

Carbon dioxide is used more frequently than nitrous oxide to produce artificial pneumoperitoneum as it is non-explosive, non-combustible and it is more soluble in blood ; so carbon dioxide gas embolism is uncommon.[1,3] Due to the rapid absorption of the gas from the peritoneal cavity, shoulder tip pain is uncommon postoperatively.[1,3] Rapid absorption of large amounts of carbon dioxide from the peritoneal cavity elevates the arterial carbon dioxide tension. Rapid increase in P_aCO_2 in the conscious and to a lesser extent in the anaesthetized patient increases cardiac output, stroke volume, right atrial filling pressure, systolic blood pressure and heart rate. It decreases peripheral vascular resistance and dilates skin blood vessels. Increased P_aCO_2 reduces C.S.F. pH thus stimulating the respiratory centre, producing hyperventilation and increasing the minute volume. It also

decreases the alveolar oxygen tension and shifts the oxygen dissociation curve to the right thus decreasing oxygen saturation and P_aO_2 .[12]

Techniques of Anaesthesia:

Laparoscopy can be performed under local anaesthesia, spinal subarachnoid analgesia, extradural analgesia or general anaesthesia. The later is usually preferred by the surgeon and the patient. It is a matter of dispute between different anaesthetists, whether controlled ventilation or spontaneous respiration with or without endotracheal intubation is preferable.

The circulatory effects of peritoneal insufflation with nitrous oxide up to 20 cm H_2O during controlled ventilation showed that there is a significant decrease in cardiac output due to a decrease in venous return as a result of the increase in intra-abdominal pressure.(14) This increase in intra-abdominal pressure compresses the arterial blood vessels as well and increases the peripheral vascular resistance leading to an increase in mean arterial blood pressure and heart rate.(14)

Central venous pressure is also increased due to the increase in intra-abdominal pressure, intrathoracic pressure, air way resistance and sympathetic tone.(14) This increase in central venous pressure is less in parous than in nulliparous due to their lax abdominal wall so that intra-abdominal pressure rises less rapidly.(15)

These values for peripheral resistance, mean arterial blood pressure and central venous pressure are much higher when

carbon dioxide is used as the insufflating gas, and cardiac output is increased due to the inotropic and pressor effects of carbon dioxide. Also due to sympathetic overactivity and catecholamine release mediated through operative stress and hypercarbia.[14,16]

Arterial carbon dioxide tension is not significantly changed after Trendelenburg-lithotomy positions but significant increase is noted following carbon dioxide insufflation with mild respiratory acidosis.[15] When nitrous oxide is used, no rise or slight insignificant increase in P_aCO_2 is noted with no change in pH.[17] All values returned to the preoperative level slowly after abdominal deflation.

Controlled ventilation with cuffed endotracheal intubation facilitates the maintenance of the patient's airway and prevents the possibility of hypoxia and aspiration but it was noted that the incidence of postoperative respiratory complications as apnoea, sore-throat, laryngitis, bronchitis and hoarsness of voice is much higher during endotracheal anaesthesia than during spontaneous respiration.[18,19]

The circulatory effects of peritoneal insufflation with nitrous oxide[20] or carbon dioxide[21] during spontaneous respiration show that when carbon dioxide is used, cardiac output is not affected while mean arterial blood pressure, heart rate and central venous pressure are significantly increased.

Arterial carbon dioxide tension is increased while arterial blood pH is significantly reduced.[21] With nitrous oxide insufflation cardiac output is decreased, arterial blood pressure, heart rate and central venous pressure are significantly increased. Arterial carbon dioxide tension and pH show no change.[20]

Increased resistance to spontaneous respiration after artificial pneumoperitoneum is not in doubt due to the pressure on the diaphragm but this is counteracted by the respiratory drive of hypercarbia due to endogenous and exogenous carbon dioxide.[1,22] Respiratory complications after spontaneous respiration with a face mask are minimal while cardiovascular complications in the form of dysrhythmias are more than with controlled ventilation.[19] These dysrhythmias can not be attributed to hypercarbia alone as it usually occurs in the early insufflation phase and maximal records of arterial carbon dioxide tension are usually noted in the post-insufflation period.[19]

Though laparoscopy under local anaesthesia provides a conscious cooperative patient thus increasing the safety of the procedure and lowering its cost [24,25] yet many patients complained of discomfort, distension and shoulder tip pain following CO_2 insufflation, others complained of pain following tubal fulgration and resection. These could be minimized

by decreasing the degree of head-down tilt, by using smaller volumes of nitrous oxide instead of the irritant carbon dioxide, and by bathing the uterus and the tubes with local anaesthetic solution.[24-29]

Spinal subarachnoid analgesia is satisfactory for laparoscopy too, but it does not gain an access as it provides an uncomfortable position to a conscious patient with some abdominal distension and shoulder tip pain following CO_2 insufflation.

The Respiratory centre (R.C.) is not depressed during spinal subarachnoid analgesia and it can coupe with endogenous as well as exogenous CO_2 by hyperventilation. This improves P_aO_2 while breathing room air and keeps P_aCO_2 and pH at normal preoperative levels.[30]

Hazards and Complications of Laparoscopy:

- Cardiac arrest is the most dangerous complication. It is most probably the result of gas embolism due to over distension of peritoneal cavity with excessive amount of carbon dioxide.

- Possibility of severe bradycardia from reflex increase in cardio-vagal tone consequent with peritoneal manipulation.

- Cardiac dysrrhythmia and cardiovascular collapse may occur in early insufflation phase with carbon dioxide.

- Explosion hazards may occur when diathermy, electronic camera or laser are used with nitrous oxide as the insufflating gas.

- Tachycardia and hypotension may result when the intra-abdominal pressure reaches over 40 cm H_2O for short time with rapid recovery after deflation. It is unique to the supine hypotensive syndrome of late pregnancy.

- Injury to the abdominal and pelvic viscera by the trocar, the hooks used for sterilization or thermal injury.

- Injury to the aorta and great vessels with severe haemorrhage and collapse or injury to the lumbo-sacral roots.

- Regurgitation of gastric contents and aspiration due to the Trendelendburg-lithotomy position, pneumperitoneum and pressure of the surgeon on the abdomen.

- Complications due to unexperienced surgeon as failed

laparoscopy, pelvic abscess, bleeding from skin and subcutaneous tissue, bowel perforation, surgical emphysema .. etc.

- The postoperative respiratory complications as apnoea, sore throat, laryngitis, bronchitis, hoarsness of voice and cough.

- Theatre pollution by the expired gases and vapours.

Total Intravenous Anaesthesia:

Recent consent over the possible effects of atmospheric pollution by anaesthetic vapour and gases on theatre personnel has led to an increased interest in techniques which rely on maintaining anaesthesia with drugs given intravenously and which produce the same advantages of inhalational anaesthesia viz. hypnosis, analgesia, supression of unwanted reflexes and muscular relaxation.(31)

The first drug which was given intravenously to produce anaesthesia was pernocton (sodium 2-butylbromallyl barbiturate) in 1927. Hedanol (methyl propylcarbinol-urethane) had gained some popularity in Russia in the first decade of this century. Alcohol, ether, chloroform, paraldehyde and similar drugs had all been injected I.V. to produce anaesthesia. However, it was the marriage of the short acting barbiturate and the intravenous route that produced the first realy satisfactory intravenous anaesthetic to be neither very long acting nor damaging to the veins themselves. This led to a revolution in the attitude of the paitent to anaesthesia but paradoxically it brought added responsibilities for anaesthetists as it put into their hands a potentially lethal technique.(32)

When hexobarbitone and thiopentone were introduced into anaesthetic practice it was anticipated that they would be used for total intravenous anaesthesia. The use of these

drugs in inappropriate dosage produced profound cardiovascular and respiratory depression. In addition, they are slowly metabolised by the liver so that the return of consciousness depends on redistribution into lean body mass. On recovery the patient may have a hangover and changes in E.E.G. may continue for one or two days.[33]

The ideal intravenous anaesthetic agent has to fulfil the following criteria :

1. Soluble in water so that the property of the solvent can be ignored.
2. Stable in solution and on exposure to light over long periods of time.
3. No adsorption onto plastic or glasses so that accurate doses can be given.
4. No venous damage or tissue damage if happened to be injected extravenously or intra-arterially.
5. Should have rapid onset of action with short duration.
6. Should be inactivated by metabolism with no comulative effect.
7. No histamine release.
8. No cardiovascular or respiratory depression.
9. Should have good analgesic properties.[31,34] Unfortunately, uptill the moment no such a drug is ever present. In search for better intravenous anaesthetic for total intravenous anaesthesia various non barbiturate drugs have been

tried. Propanidid and althesin are both rapidly metabolised but they have the disadvantage of not being soluble in water and they have sometimes produced severe sensitivity reactions with cardiovascular depression and collapse.[31,34]

Neuroleptanalgesia is the term used for the effects of a combination of a neuroleptic agent such as dropridol and an analgesic such as fentanyl.[31]

Ketamine Hydrochloride:

Ketamine would appear to be one of the most suitable drugs for the technique of total intravenous anaesthesia because the light sedative effect and the profound analgesia make it suitable for different clinical situations especially when combined with flunitrazepam (Rohypnol^{R}) to counteract its disadvantages viz. slow onset of action and the adverse reactions during recovery.(34)

The ketamine molecule (2-(O-chlorophenyl)-2-methyl-amino-cyclohexanon) has a molecular weight of 238, is water soluble and contains a chiral centre producing two resolvable optical isomers.(35)

Ketamine produces a "dissociative" anaesthetic state which has been discribed as a functional and electrophysiological dissociation between the thalamo-neocortical and limbic systems.(35)

The unique clinical anaesthetic state produced by ketamine has been characterised as a state of catalepsy in which the eyes remain open with a slow nystagmic gaze while corneal and light reflexes remain intact. Varying degrees of hypertonus and occasional purposful movements unrelated to painful stimuli are noted in the presence of adequate surgical anaesthesia.(34,36)

Analgesia following ketamine anaesthesia outlasts the period of surgical anaesthesia and this analgesic effect occurs even at subanaesthetic doses.(37)

Most anaesthetic agents produce some degree of hypotension. Ketamine usually has the opposite effect with a transient rise in cardiac index but without significant alteration of the stroke index. This is due to sympathetic nervous system overactivity(38) but in absence of autonomic control, ketamine has a direct myocardial depressant properties.(39) The effect of ketamine on the cardiac rhythm is controversial. Ketamine either sensitizes the myocardium to catecholamines or has a transient dose-related antiarrhythmic properties.(40) Ketamine has no effect on systemic vascular resistance.(41) While it increases the coronary blood flow, it increases the oxygen consumption of the myocardium.(41,42) Ketamine also elevates the pulmonary artery pressure and right ventricular stroke work, secondary to increased pulmonary vascular resistance.(43)

Respiratory effects are minimal with ketamine unless a high plasma level is achieved by rapid intravenous injection, when transient respiratory depression and significant reduction in P_aO_2 can occur.(44) In contrast ketamine infusion, causes no significant changes in P_aO_2 and P_aCO_2.(45,46) Ketamine dilates bronchial smooth muscles and antagonises the spasmogenic effect of histamine.(47) Salivary and

tracheobronchial mucous gland secretions are increased by ketamine. Despite alleged retension of the protective pharyngeal and laryngeal reflexes,[48] tracheal soiling and aspiration has been reported.[49] Ketamine increases lung compliance and reduces the airway resistance in patient with asthma.[50]

Flunitrazepam or diazepam reduces the adverse reactions during recovery from ketamine anaesthesia.[34,51]

Flunitrazepam (Rohypnol^{R}):

Flunitrazepam selectively reinforces the synaptic inhibitory mechanism in the brain and spinal cord.(53) It depresses the limbic system and the amygdala- the relay area for expression of emotion - so that its anxiolytic and tranquillizing effect is characterized by rapid onset of sleep, prolongation of sleep time and suppression of noctornal awakening and is superior to that of barbiturates and other members of benzodiazepins.(54) Flunitrazepam has a specific amnesic effect especially when given intravenously. It is more that of diazepam.(55) This is useful to forget the unpleasent events of the peri-operative period.(54) Opiate and hyoscine premedication increase the amnesic action of flunitrazepam and though the later has no analgesic properties it potentiates the action of other analgesic drugs.(54) Flunitrazepam has no appreciable effects on the cardiovascular system. Minimal reduction in mean arterial blood pressure, heart rate, cardiac and stroke index. Total peripheral resistance, the central venous pressure and pulmonary artery pressure are reduced. Some kinds of arrhythmia disappear after flunitrazepam injection.(55)

Flunitrazepam when given in clinical doses causes a slight degree of respiratory depression due to hypotonia of muscles including those of respiration rather than to depression of respiratory center.(56)

Aim of the Work

AIM OF THE WORK

The aim of this work was to study some respiratory functions, blood gases and acid-base status during pelvic laparoscopy under total intravenous anaesthesia.

Material

MATERIAL

Twenty female patients undergoing gynaecological laparoscopy were studied.

These were consecutive patients on the routine lists in the Shatby University Maternity Hospital who fulfil the following criteria :

- Their age ranged from 20 - 40 years,
- Within normal weight according to the formula :
  Ideal weight for female in Kg = Hight in cm - 105 ± 5.
- They had no cardiopulmonary or metabolic diseases as judged by clinical examination and routine laboratory investigations.
- Obese patients were excluded from the start.
- Duration of the procedure was expected to be short (projects of laparoscopy training are excluded from the study).

CHAPTER IV

Methods

METHODS

All patients submitted for the study were asked about their predominant hand and the other hand was examined for the anastmosis between the radial and ulnar arteries. If Allan's test is positive, the study was carried on.

All patients were premedicated with one mg atropine sulphate and 100 mg pethidine given intramuscularly half an hour before induction.
Local anaesthetic solution of lignocaine 1 % was injected around the radial artery at the wrist before its cannulation using an arterial catheter G 20 by non-invasive technique.

A 16 G venous catheter was placed in the subclavian vein via the antecubital vein and was connected to a C.V.P. saline manometer.

The cuff of the "VITA-STAT BLOOD PRESSURE MONITOR" was applied around the contralateral arm.

The E.C.G. electrodes were fitted to the anterior chest wall and connected to a cardiometer.

Anaesthetic Technique:

Preoxygenation was applied for 3 - 5 minutes before induction and was maintained throughout the laparoscopic procedure using a flow of oxygen range 6 - 8 L/min.

Anaesthesia was induced with flunitrazepam 1 mg and ketamine hydrochloride 1 - 1.5 mg/Kg body weight given very slowly intravenously over 3 - 5 minutes through a venous catheter.

Maintenance of anaesthesia was by a mixture of ketamine hydrochloride 500 mg and 4 mg flunitrazepam in 500 ml dextrose 5 % solution. This mixture produced a solution of 1 mg ketamine/1 ml dextrose which was given at a rate of 0.5 - 0.75 mg/min. using a pediatric infusion set.

The following parameters were counted, measured and monitored throughout the procedure :

- Respiratory rate was counted.
- Tidal volume and minute ventilation were measured using Wright's respirometer.
- Heart rate and mean arterial blood pressure were measured using the "VITA-STAT BLOOD PRESSURE MONITOR".
- E.C.G. was monitored using a cardiometer.
- C.V.P. was measured using a C.V.P. saline manometer.

- Arterial blood samples were withdrown from the arterial catheter using heparinized syringes which were kept in ice until blood gas analysis was carried on within one hour using automatic blood gas analyzer BL2.

Time of Sampling:

1. Before induction.
2. Three minutes after induction.
3. Three minutes after Trendelenburg-lithotomy position and CO_2 insufflation.
4. Three minutes after deflation of the gas and the return to the flat position.

Statistical Analysis:

The data obtained from this study was tabulated and statistically analysed according to the following formulae:

1. Mean Value = $\frac{\text{Sum of observations}}{\text{Number of observations}}$

$$m = \frac{\Sigma x}{n}$$

2. Standard deviation (S.D.) = $\sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}}$

3. Tests of significance (t - value)

$$t = \frac{\text{mena difference}}{\text{standard error of the mean difference}}$$

where mean difference = the mean of the differences and the standard error of the mean difference (S.E.M.) =

$$\frac{\text{stadard deviation of differences (S.D.)}}{\sqrt{n}}$$

t - values were compared with tabulated probability values (P - values) at the 5 % level of significance.

Results

RESULTS

Twenty female patients were studied, their age ranged from 22 - 36 years with a mean age of 29.35 years S.D. ± 4.511, their weight ranged from 53 - 72 Kg with a mean weight of 62.5 Kg S.D. ± 5.892 and their height ranged from 148 - 172 cm with a mean height of 161.4 cm S.D. ± 7.059 (Table I).

Changes in Heart Rate:(Table II, Figure 1)

Preoperative values of heart rate ranged from 76 - 86/min with a mean value of 81.3/min S.D. ±3.13. After induction, it ranged from 83 - 96/min with a mean value of 90.7/min S.D. ±3.799. The increase was significant ($P < 0.05$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 105 - 127/min with a mean value of 113.85/min S.D. ±5.284. The increase was significant ($P < 0.05$). At the end of the procedure, the pulse ranged from 81 - 90/min with a mean value of 85.15/min S.D. ± 2.961. The increase was significant ($P < 0.05$).

Changes in Mean Arterial Blood Pressure:(Table III, Figure 2)

Before induction, the mean arterial blood pressure ranged from 77 - 103 mm Hg with a mean value of 94 mm Hg S.D. ± 7.49. After induction, it ranged from 88 - 110 mm Hg with

Table (I) : AGE IN YEARS, WEIGHT IN KILOGRAMS AND HEIGHT IN CM

	Age	Weight	Height
1	22	57	155
2	31	54	153
3	27	60	157
4	30	63	162
5	36	65	165
6	35	70	165
7	23	64	170
8	35	63	160
9	27	53	148
10	23	65	172
11	25	70	169
12	26	68	163
13	34	70	164
14	32	72	168
15	26	65	163
16	35	55	168
17	27	57	150
18	28	64	163
19	33	56	150
20	32	59	163
Range	22 - 36	53 - 72	148 - 172
Mean	29.35	62.5	161.4
S.D. ±	4.511	5.862	7.059

Table (II) : CHANGES IN HEART RATE/MINUTE

	I	II	III	IV
1	80	92	112	85
2	83	91	110	89
3	78	83	113	81
4	80	88	110	86
5	82	89	115	85
6	76	87	127	80
7	80	91	113	85
8	86	98	118	90
9	82	93	112	84
10	80	90	120	84
11	76	86	109	80
12	86	94	116	89
13	83	93	111	83
14	78	88	110	87
15	84	94	119	85
16	82	92	113	85
17	85	96	123	87
18	86	94	110	90
19	80	90	111	85
20	79	85	105	83
Range	76 - 86	83 - 96	105 - 127	81 - 90
Mean	81.3	90.7	113.85	85.15
S.D. ±	3.130	3.799	5.284	2.961
t		21.78*	25.259*	8.812*

t is considered to be significant at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & carbon dioxide insufflation and IV = Three minutes after the end of the procedure.

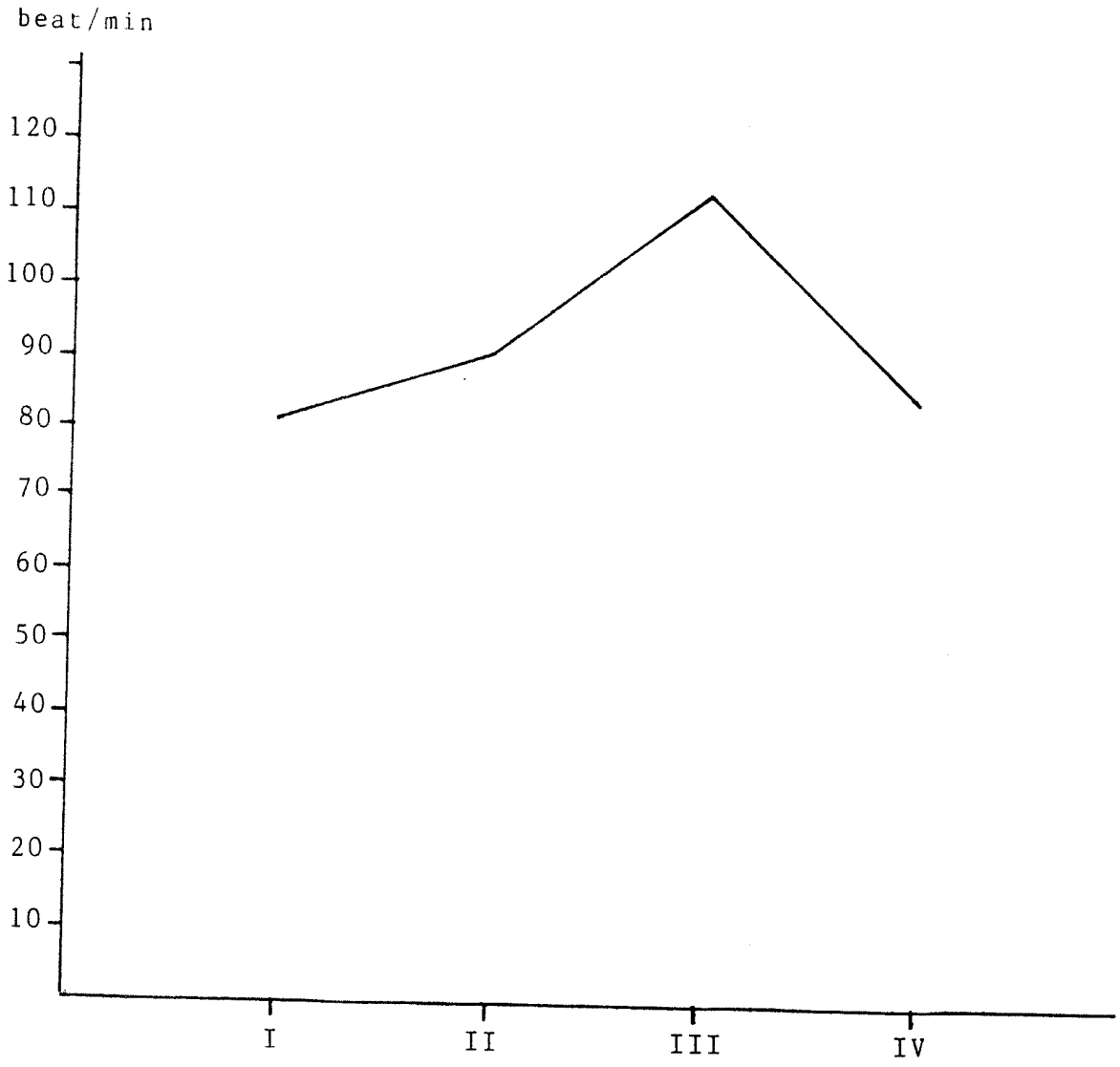

Figure (1) : Changes in Heart Rate (beat/minute)

Table (III) : CHANGES IN MEAN ARTERIAL BLOOD PRESSURE IN mm Hg

	I	II	III	IV
1	93	102	113	95
2	91	97	111	94
3	97	101	117	97
4	102	110	123	107
5	94	100	112	98
6	87	95	107	90
7	97	106	116	99
8	85	97	105	88
9	77	88	99	83
10	90	94	107	95
11	103	109	117	102
12	98	89	110	100
13	83	90	100	93
14	103	108	113	97
15	103	103	115	104
16	89	98	106	93
17	100	110	116	105
18	90	98	115	93
19	103	104	115	96
20	95	102	105	93
Range	77 - 103	88 - 110	99 - 123	83 - 104
Mean	94	100.05	110.6	96.1
S.D. ±	7.49	6.755	6.146	5.821
t		5.806*	19.521*	3.424*

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = Three minutes after the end of the procedure.

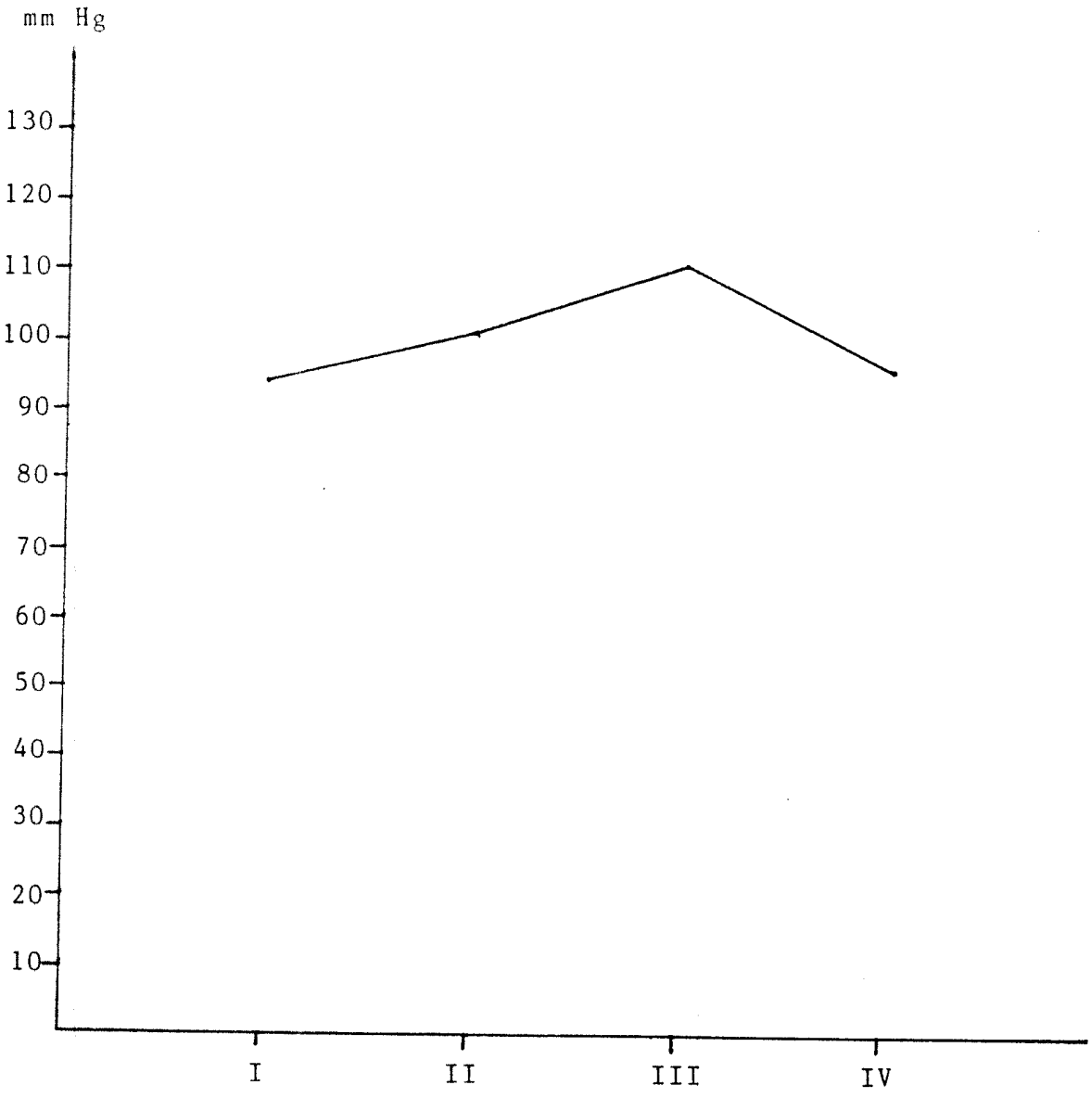

Figure (2) : Changes in mean arterial blood pressure.
(mm Hg)

a mean value of 100.05 mm Hg S.D. ± 6.755. The increase was significant ($P < 0.05$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 99 - 123 mm Hg with a mean value of 110.6 mm Hg S.D. ± 6.146. The increase was significant ($P < 0.05$). At the end of the procedure and patients flat, the mean arterial blood pressure ranged from 83 - 104 mm Hg with a mean value of 96.1 mm Hg S.D. ± 5.821. The increase was significant ($P < 0.05$).

Changes in Central Venous Pressure: (Table IV, Figure 3)

Preoperative reading of C.V.P. ranged from 1.4 - 6.3 cm H_2O with a mean value of 3.29 cm H_2O S.D. ± 1.529. After induction, it ranged from 2.2 - 6.7 cm H_2O with a mean value of 3.8 cm H_2O S.D. ± 1.447. The increase was significant ($P < 0.05$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 6 - 13 cm H_2O with a mean value of 8.66 cm H_2O S.D. ± 1.875. The increase was significant ($P < 0.05$). At the end of the procedure, it ranged from 1.6 - 6.4 with a mean value of 3.39 cm H_2O S.D. ± 1.487. The increase was significant ($P < 0.05$).

Changes in Respiratory Rate: (Table V, Figure 4)

Preoperative respiratory rate ranged from 15 - 20 min with a mean value of 17.6 minutes S.D. ± 1.569. After induction, it ranged from 12 - 18/min with a mean value of

Table (IV) : CHANGES IN CENTRAL VENOUS PRESSURE IN cm H_2O

	I	II	III	IV
1	2.2	2.4	6.5	2.4
2	4.6	4.9	8.3	4.9
3	3.5	3.9	6.9	3.5
4	1.4	2.2	6.0	1.6
5	6.1	6.5	13.0	6.3
6	6.3	6.7	12.0	6.4
7	5.5	6.0	8.5	5.2
8	1.6	3.0	7.2	1.8
9	1.9	2.5	8.0	2.1
10	3.0	2.7	8.2	3.3
11	5.0	5.3	10.0	5.1
12	2.1	3.0	9.3	2.2
13	3.4	3.5	8.5	3.0
14	2.0	2.5	7.4	2.2
15	1.6	2.2	6.9	1.7
16	2.3	3.0	7.8	2.5
17	3.2	3.8	9.0	3.2
18	4.1	5.0	12.0	4.0
19	3.5	3.9	8.7	3.7
20	2.5	3.0	9.0	2.7
Range	1.4 - 6.3	2.2 - 6.7	6.0 - 13.0	1.6 - 6.4
Mean	3.29	3.8	8.66	3.39
S.D. ±	1.529	1.447	1.875	1.487
t		6.558*	19.587*	2.431*

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

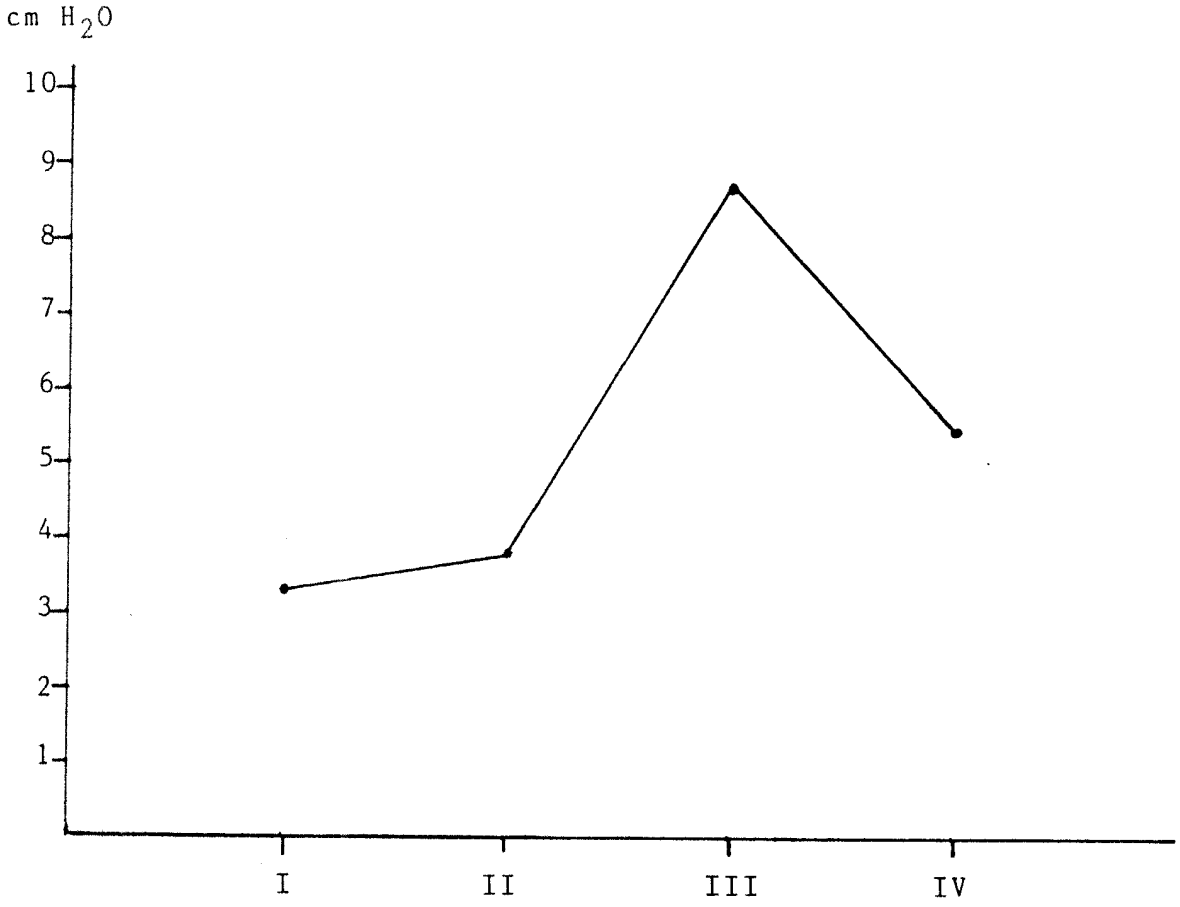

Figure (3) : Changes in central venous pressure in cm H_2O

Table (V) : CHANGES IN RESPIRATORY RATE/MINUTE.

	I	II	III	IV
1	18	16	26	22
2	18	15	25	23
3	17	14	26	21
4	16	16	25	22
5	20	16	26	20
6	20	18	30	23
7	16	15	28	23
8	17	16	22	19
9	16	14	28	18
10	19	17	25	21
11	17	16	26	19
12	16	15	22	18
13	18	16	24	20
14	20	17	23	20
15	17	16	26	19
16	20	17	24	20
17	18	16	23	23
18	15	12	24	19
19	16	15	24	20
20	18	17	28	22
Range	15 - 20	12 - 18	22 - 30	18 - 23
Mean	17.6	15.7	25.25	20.6
S.D. ±	1.569	1.342	2.124	1.698
t		8.322*	13.696*	6.891*

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

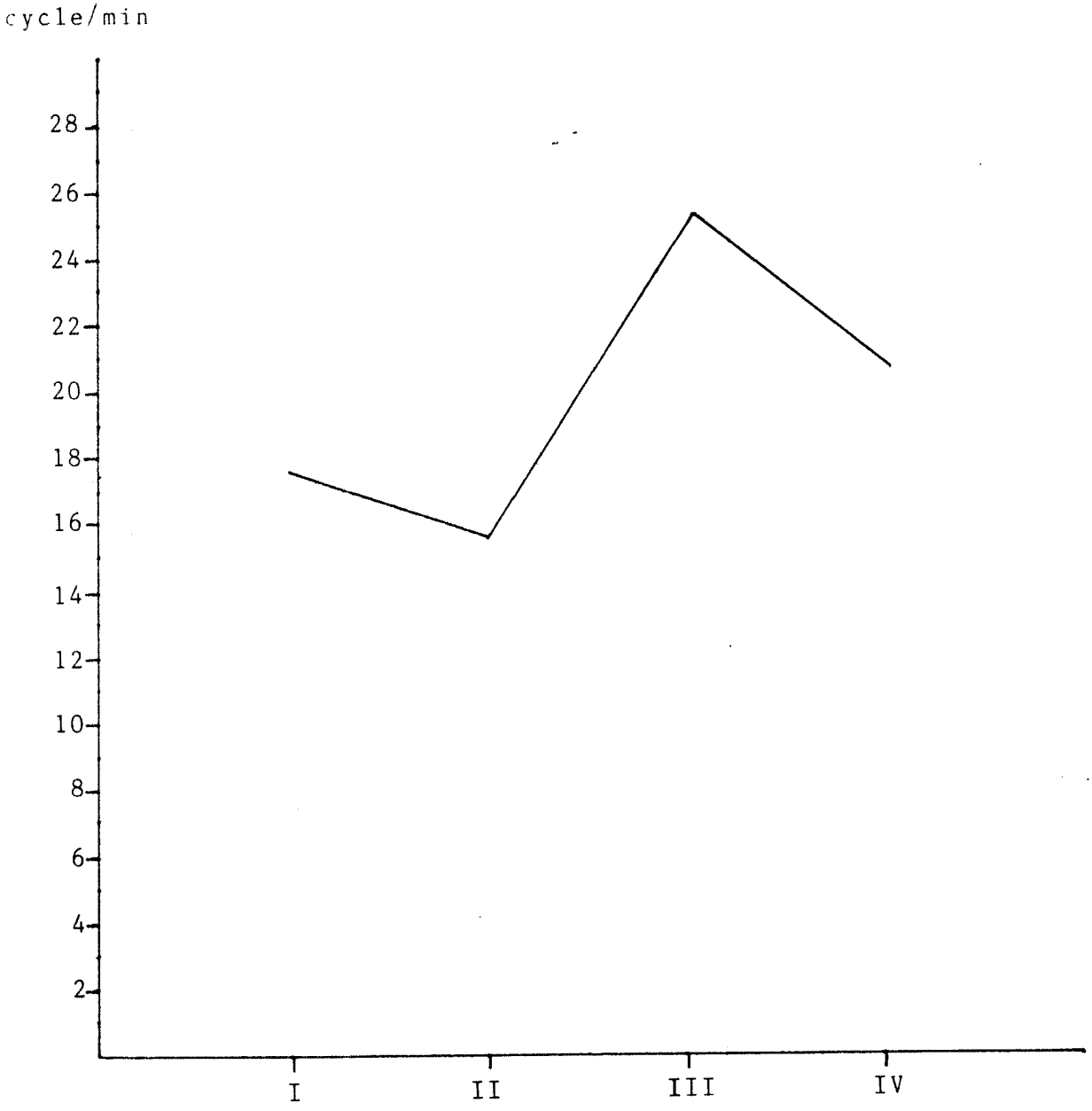

Figure (4) : Changes in respiratory rate (cycle/minute).

15.7/min S.D. 1.342. The decrease was significant ($P < 0.05$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 22 - 30/min with a mean value of 25.25/min S.D. ± 2.124. The increase was significant ($P < 0.05$). At the end of the procedure, it ranged from 18 - 23/min with a mean value of 20.6/min S.D. ± 1.698. The increase was significant ($P < 0.05$).

Changes in Minute Ventilation: (Table VI, Figure 5)

Before induction the minute ventilation ranged from 5.6 - 10.4 L/minute with a mean value of 6.81 L/minute S.D. ± 1.1. After induction, it ranged from 4.2 - 7.7 L/minute with a mean value of 5.545 L/minute S.D. ± 0.904. The decrease was significant ($P < 0.05$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 7 - 10.3 L/minute with a mean value of 8.295 L/minute S.D. ± 0.920. The increase was significant ($P < 0.05$). At the end of the procedure, it ranged from 5.8 - 8.3 L/minute with a mean value of 7.175 L/minute S.D. ± 0.762. The increase was insignificant ($t = 1.374$).

Changes in Tidal Volume: (Table VII, Figure 6)

Before induction, tidal volume ranged from 350 - 520 ml with a mean value of 386.5 ml S.D. ± 41.330 ml. After induction, it ranged from 300 - 450 ml with a mean value of

Table (VI) : CHANGES IN MEAN MINUTE VENTILATION (L/min)

	I	II	III	IV
1	6.1	4.8	8.3	7.3
2	6.1	4.5	8.0	7.8
3	6.1	4.5	8.8	7.4
4	6.4	5.8	9.8	8.1
5	7.8	5.0	7.5	6.2
6	8.4	6.1	8.4	8.1
7	6.1	5.3	8.4	6.7
8	6.5	5.6	7.0	5.9
9	5.6	4.2	9.0	5.8
10	7.4	6.8	10.3	7.8
11	7.1	5.8	9.1	7.2
12	6.7	5.7	7.5	7.8
13	7.2	5.8	7.2	6.4
14	10.4	7.7	9.2	7.8
15	6.6	6.0	8.8	6.7
16	7.0	6.3	7.9	7.2
17	6.1	6.4	8.1	8.3
18	6.0	4.2	7.2	6.5
19	5.8	4.8	7.0	6.5
20	6.8	5.6	8.4	7.0
Range	5.6 - 10.4	4.2 - 7.7	7.0 - 10.3	5.8 - 8.3
Mean	6.810	5.545	8.296	7.175
S.D. ±	1.100	0.904	0.920	0.762
t		7.563*	5.288*	1.374

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

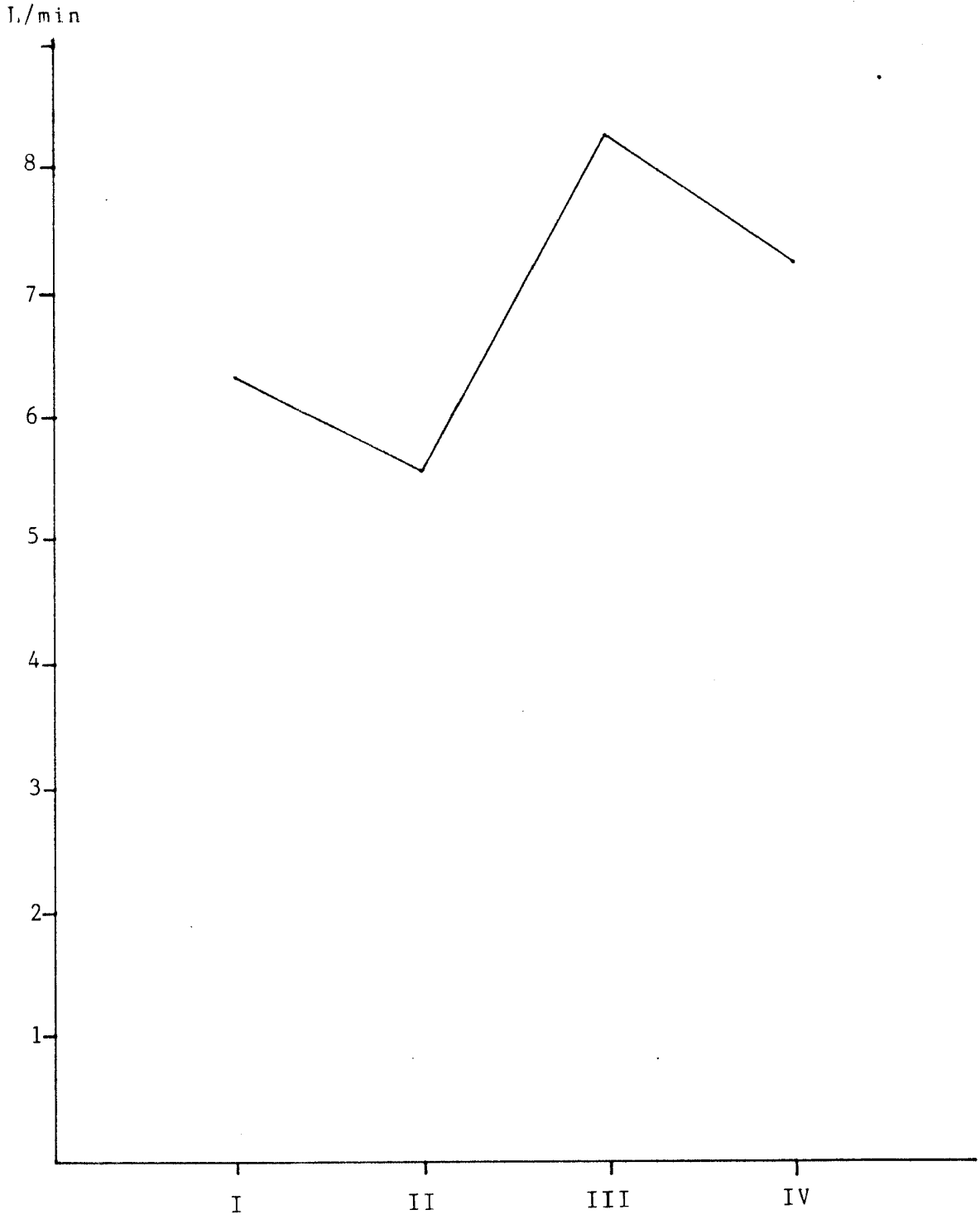

Figure (5) : Changes in minute ventilation (L/min)

Table (VII) : CHANGES IN TIDAL VOLUME (ml)

	I	II	III	IV
1	340	300	320	330
2	340	300	320	340
3	360	320	340	350
4	400	360	390	370
5	390	310	290	310
6	420	340	280	350
7	380	350	300	330
8	380	350	320	310
9	350	300	320	320
10	390	400	410	370
11	420	360	350	380
12	420	380	340	430
13	400	360	300	320
14	520	450	400	390
15	390	380	340	350
16	350	370	330	360
17	340	400	350	360
18	400	350	300	340
19	360	320	290	330
20	380	330	300	320
Range	340 - 520	300 - 450	280 - 410	310 - 430
Mean	386.5	351.5	329.5	348.0
S.D. ±	41.33	38.972	36.775	30.018
t		4.653*	5.759*	4.597*

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

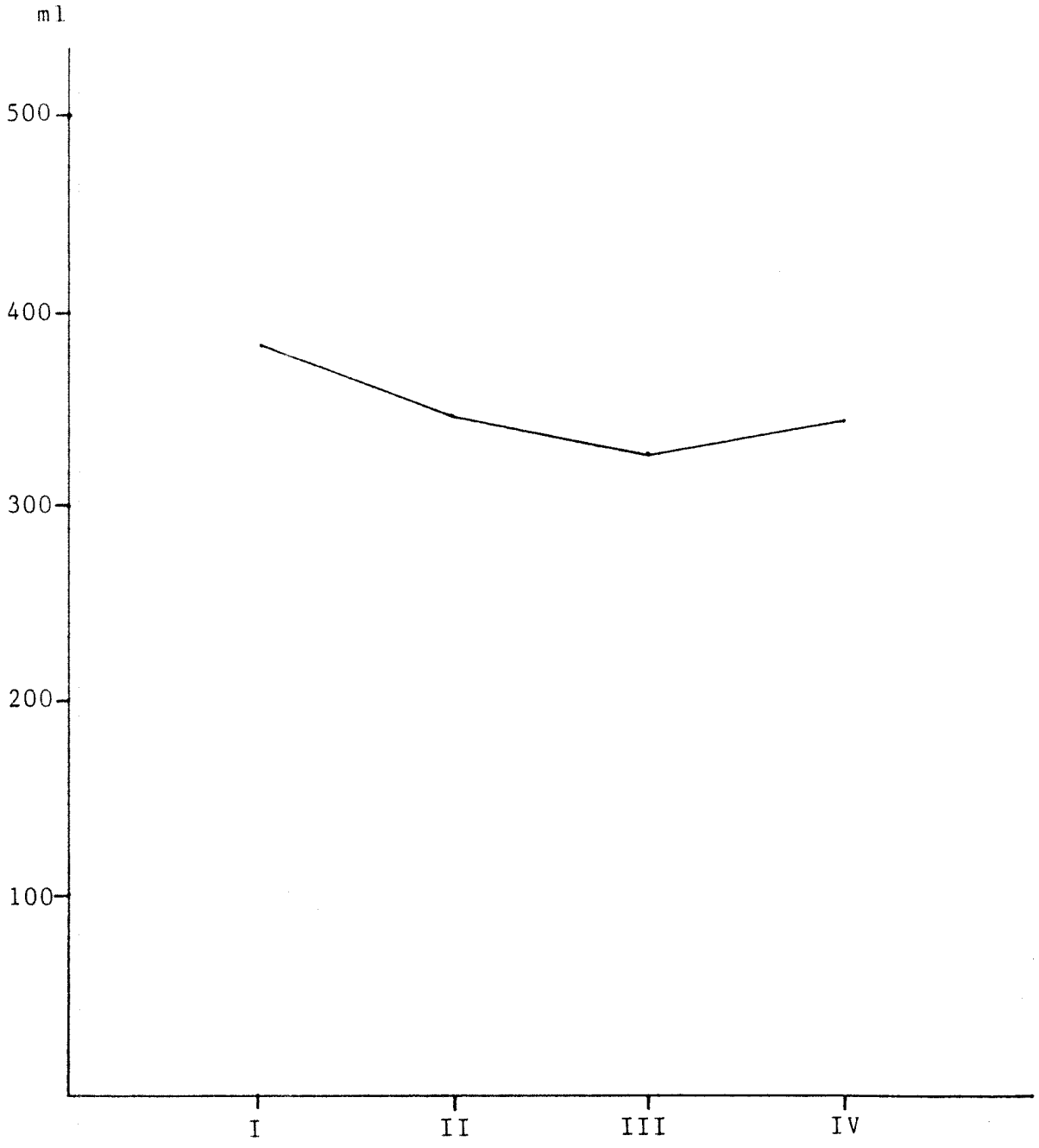

Figure (6) : Changes in tidal volume V_T (ml)

351.5 ml S.D. ± 38.972. The decrease was significant ($p < 0.05$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 290 - 410 ml with a mean value of 329.5 ml S.D. ± 36.775. The decrease was significant ($P < 0.05$). At the end of the procedure, it ranged from 310 - 430 ml with a mean value of 348 ml S.D. ± 37.455. The decrease was significant ($P < 0.05$).

Changes in Arterial Oxygen Tension: (Table VIII, Figure 7)

Preoperative P_aO_2 ranged from 252.6 - 542.3 mm Hg with a mean value of 463.165 mm Hg S.D. ± 85.253 mm Hg. After induction, it ranged from 242 - 543.7 mm Hg with a mean value of 473.755 mm Hg S.D. ± 89.147. The increase was insignificant ($t = 0.955$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 232.4 - 585.6 mm Hg with a mean value of 440.025 mm Hg S.D. ± 66.771 mm Hg. The decrease was insignificant ($t = 1.55$). At the end of the procedure, it ranged from 212.2 - 502.3 mm Hg with a mean value of 400.73 mm Hg S.D. ± 56.965 mm Hg. The decrease was significant ($P < 0.05$).

Changes in Carbon Dioxide Tension: (Table IX, Figure 8)

Before induction P_aCO_2 ranged from 37.2 - 46.7 mm Hg, with a mean value of 41.97 mm Hg S.D. ± 2.450. After induction, it ranged from 38.4 - 49.8 mm Hg with a mean value

Table (VIII) : CHANGES IN ARTERIAL OXYGEN TENSION (mm Hg)

	I	II	III	IV
1	476.6	347.2	333.9	359.9
2	500.1	540.1	462.6	339.5
3	518.1	543.4	585.6	480.7
4	537.1	537.2	566.5	476.2
5	436.9	478.2	323.7	290.9
6	252.6	242.0	232.4	229.9
7	291.1	318.7	393.5	212.2
8	476.6	413.3	347.2	359.9
9	539.2	521.7	486.6	493.9
10	501.3	543.2	470.1	440.2
11	436.9	478.2	323.7	383.6
12	563.5	500.1	491.3	502.3
13	476.3	421.7	392.4	401.8
14	500.3	543.1	463.7	336.2
15	436.9	477.3	470.0	443.2
16	501.0	542.6	513.2	468.4
17	537.1	544.3	502.5	491.3
18	299.1	397.9	313.8	359.7
19	500.3	541.2	501.3	469.6
20	542.3	543.7	566.5	475.2
Range	252.6 - 542.3	242.0 - 543.7	232.4-585.6	212.2-502.3
Mean	463.165	473.755	407.025	400.73
S.D. ±	85.253	89.147	98.436	88.119
t		0.955	1.776	4.902*

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

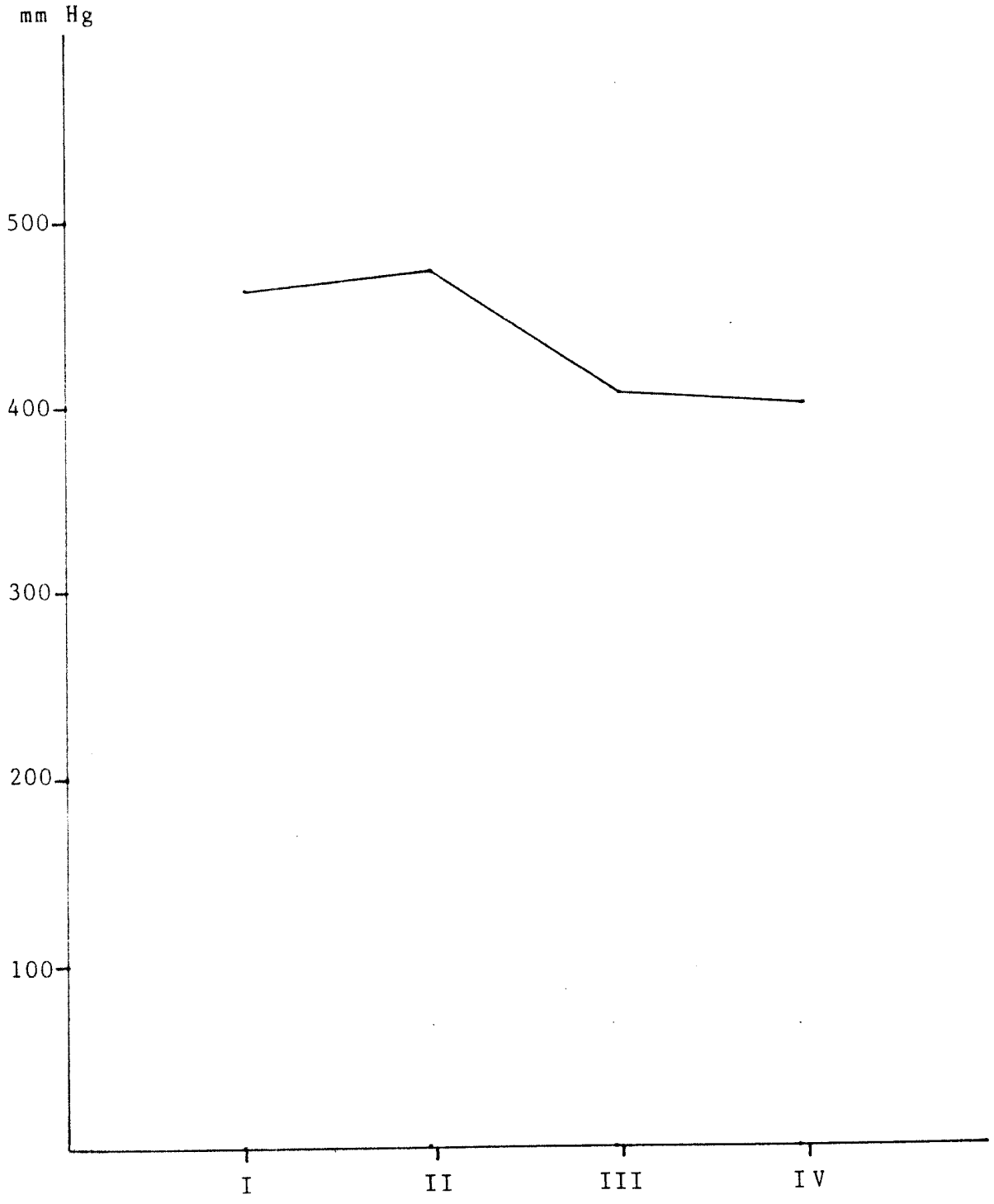

Figure (7) : Changes in arterial oxygen tension P_aO_2 (mm Hg)

Table (IX) : CHANGES IN ARTERIAL CARBON DIOXIDE TENSION (mm Hg)

	I	II	III	IV
1	44.6	46.0	47.3	49.2
2	42.1	44.5	44.0	40.3
3	41.6	38.4	39.2	38.5
4	39.7	39.6	38.2	38.0
5	42.7	49.8	53.5	48.8
6	46.7	49.1	51.7	51.7
7	37.2	43.3	47.6	49.6
8	44.6	46.0	47.3	49.2
9	39.7	39.5	39.3	38.7
10	42.1	44.6	43.9	40.5
11	42.7	49.8	53.5	48.8
12	43.1	43.6	44.3	44.0
13	44.6	46.0	47.3	49.2
14	42.5	43.3	45.5	43.6
15	42.5	48.8	51.0	42.9
16	43.2	43.8	44.7	44.3
17	39.9	40.5	42.5	39.9
18	37.2	43.3	47.7	49.5
19	43.0	46.7	45.0	44.3
20	39.7	40.7	43.9	42.0
Range	37.2 - 46.7	38.4 - 49.8	39.2 - 53.5	38 - 51.7
Mean	41.97	44.365	45.87	44.650
S.D. ±	2.450	3.474	4.371	4.486
t		3.806*	4.232*	2.772*

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

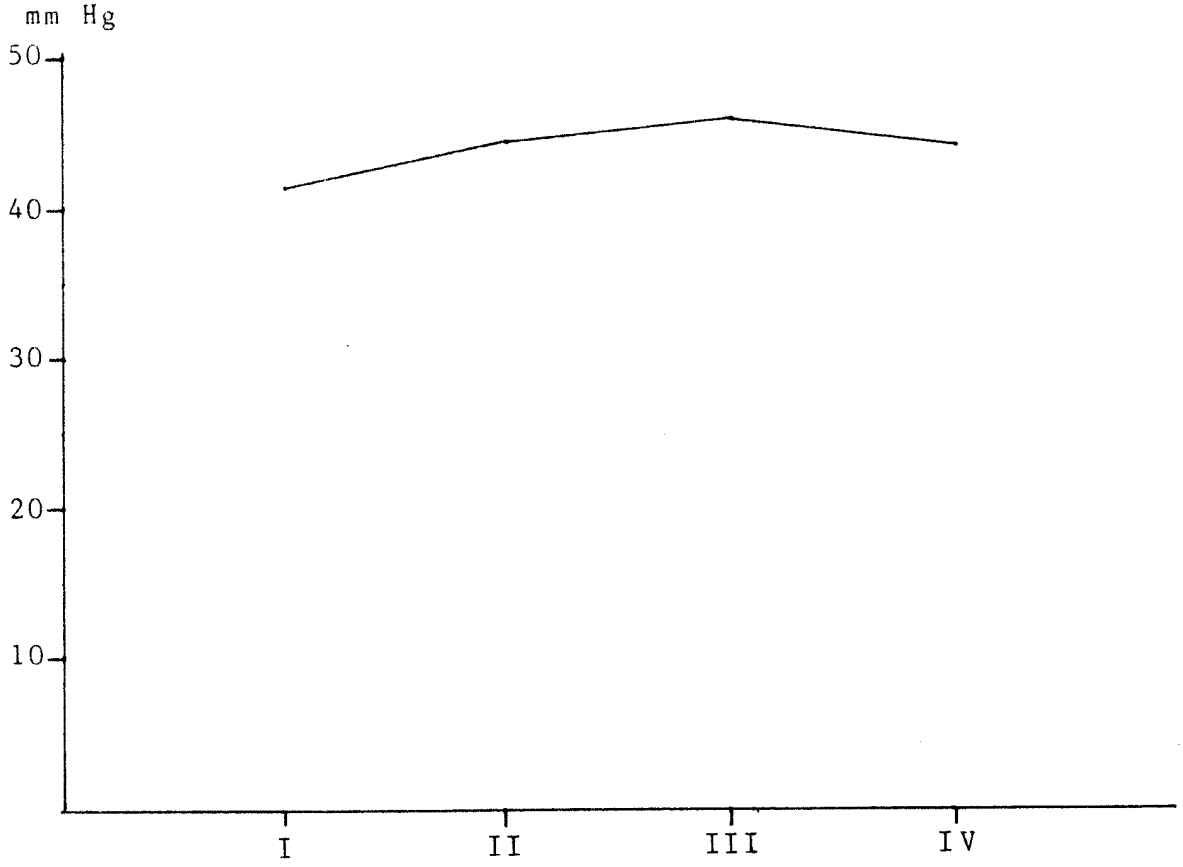

Figure (8) : Changes in arterial carbon dioxide tension P_aCO_2 (mm Hg)

of 44.365 mm Hg S.D. ± 3.474 mm Hg. The increase was significant ($P < 0.05$). After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 39.2 - 53.5 mm Hg with a mean value of 45.87 mm Hg S.D. ± 4.371 mm Hg. The increase was significant ($P < 0.05$). At the end of the procedure, it ranged from 38 - 51.7 mm Hg with a mean value of 44.650 mm Hg S.D. ± 4.486. The increase was significant ($P < 0.05$).

Changes in Arterial Blood pH: (Table X, Figure 9)

Preoperative arterial blood pH ranged from 7.296 - 7.354, with a mean value of 7.329 S.D. ± 0.018. After induction, it ranged from 7.296 - 7.363 with a mean value of 7.320 S.D. ± 0.022. The decrease was significant ($p < 0.05$). After Trendelenburg-lithotmy position and carbon dioxide insufflation, it ranged from 7.264 - 7.360 with a mean value of 7.3055 S.D. ± 0.03. the decrease was significant ($P < 0.05$). At the end of the procedure, it ranged from 7.228 - 7.357 with a mean value of 7.301 S.D. ± 0.042. The decrease was significant ($P < 0.05$).

Changes in Bicarbonate Content: (Table XI, Figure 10)

Before induction, it ranged from 20.5 - 23.4 m mol/L with a mean value of 21.995 S.D. ± 0.082. After induction it ranged from 19.1 - 23.1 m mol/L with a mean value of 21.705 S.D. ± 1.272. the decrease was insignificant ($t = 1.607$).

Table (X) : CHANGES IN ARTERIAL BLOOD pH

	I	II	III	IV
1	7.319	7.301	7.275	7.253
2	7.331	7.315	7.309	7.344
3	7.348	7.363	7.335	7.357
4	7.354	7.350	7.360	7.357
5	7.296	7.296	7.264	7.278
6	7.337	7.297	7.294	7.235
7	7.327	7.323	7.290	7.291
8	7.319	7.301	7.275	7.253
9	7.354	7.352	7.339	7.327
10	7.328	7.317	7.315	7.313
11	7.298	7.295	7.266	7.228
12	7.328	7.317	7.315	7.313
13	7.319	7.301	7.275	7.313
14	7.331	7.315	7.308	7.314
15	7.309	7.299	7.273	7.234
16	7.328	7.319	7.315	7.313
17	7.354	7.352	7.339	7.327
18	7.327	7.323	7.290	7.291
19	7.327	7.317	7.315	7.313
20	7.354	7.350	7.360	7.357
Range	7.296-7.354	7.296-7.363	7.264-7.360	7.228-7.357
Mean	7.329	7.320	7.306	7.301
S.D. ±	0.017	0.022	0.030	0.042
t		3.843 *	6.721*	3.972*

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

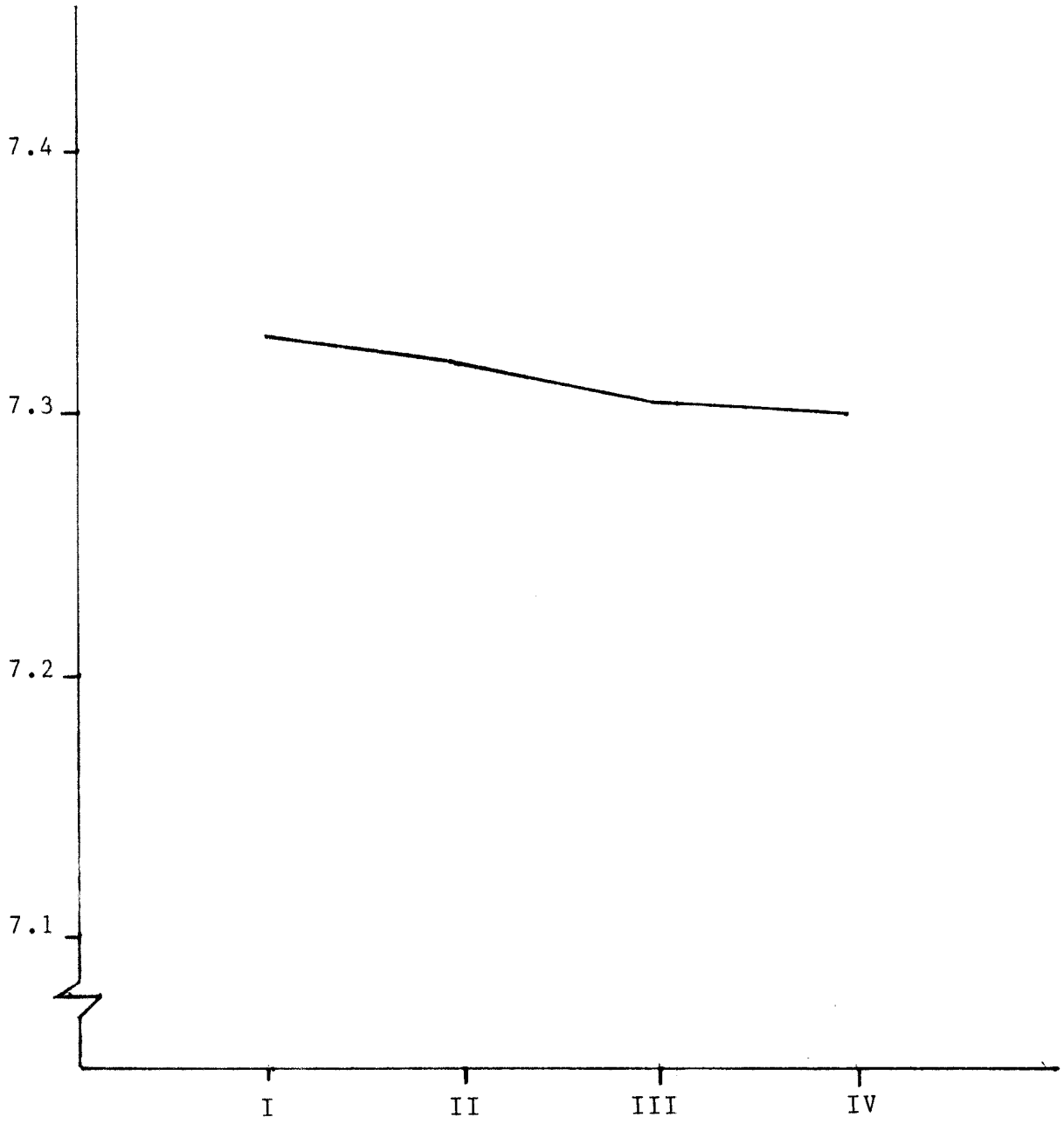

Figure (9) : Changes in arterial blood pH.

Table (XI) : CHANGES IN BICARBONATE CONTENT (m mol/L)

	I	II	III	IV
1	21.8	22.5	23.0	23.3
2	21.7	22.1	21.5	21.8
3	22.4	21.4	21.4	21.1
4	21.6	21.4	21.1	20.9
5	23.4	23.1	23.5	21.9
6	20.5	19.0	19.2	20.0
7	21.1	19.1	19.3	20.1
8	21.8	22.5	23.0	23.3
9	21.5	21.4	21.2	21.0
10	22.1	22.0	22.2	21.9
11	23.4	23.1	23.5	22.9
12	21.6	22.0	21.6	21.7
13	23.4	23.0	23.5	21.9
14	22.0	22.1	22.2	21.8
15	23.4	23.0	23.5	21.8
16	22.1	22.1	22.2	22.0
17	21.6	21.5	21.2	21.0
18	21.3	19.1	19.3	20.1
19	21.6	22.0	21.6	21.7
20	21.6	21.6	21.2	21.1
Range	20.5-23.4	19.1-23.1	19.2-23.5	20.0-23.3
Mean	21.995	21.705	21.76	21.565
S.D. ±	0.82	1.266	1.377	0.940
t		1.607	1.295	2.060

t is considered to be significant if > 2.09 at P 0.05 .

I = Before induction, II = Three minutes after induction, III = Three minutes after Trendelenburg-lithotomy position & CO_2 insufflation and IV = At the end of the procedure.

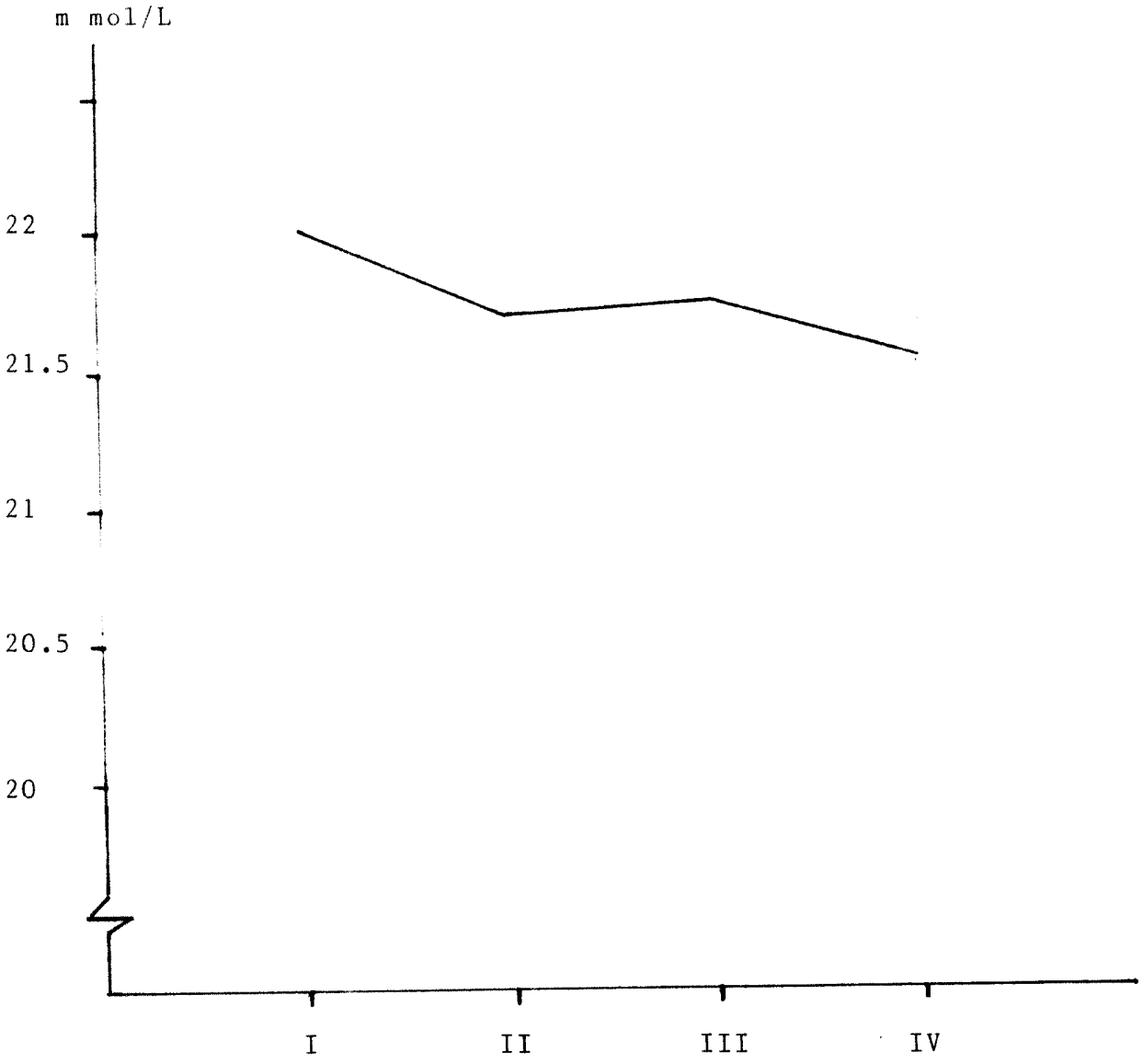

Figure (10) : Changes in Bicarbonate content (m mol/L).

After Trendelenburg-lithotomy position and carbon dioxide insufflation, it ranged from 19.2 - 23.5 m mol/L with a mean value of 21.760 m mol/L S.D. ± 1.377. The decrease was insignificant (t = 1.296). At the end of the procedure, it ranged from 20.2 - 23.3 m mol/L with a mean value of 21.565 m mol/L S.D. ± 0.940. The decrease was insignificant (t = 2.06).

Duration and Dosage:

The total duration of the procedure ranged from 12 - 29 minutes with a mean duration of 20.45 minutes S.D. ± 5.063 min (Table XII).

The total dose of ketamine ranged from 92.5 - 132 mg with a mean of 113.15 mg S.D. ± 10.824 mg. This produced a dose of 5.3 mg/Kg/h. (Table XII).

The total dose of flunitrazepam used ranged from 1.096 - 1.232 mg with a mean dose of 1.164 mg S.D. ± 0.041. This equalled to a dose of 0.055 mg/Kg/h. (Table XII).

Side Effects during the Procedure: (Table XIII)

One patient regurgitated during the procedure, three showed involuntary movements, three had sinus tachycardia (pulse > 140/min) and two showed mild degree of sweating.

Table (XII) : DURATION OF THE PROCEDURE IN MINUTES, TOTAL DOSE OF KETAMINE HYDROCHLORIDE AND FLUNITRAZEPAM (mg)

	Duration of procedure (min)	Total dose of ketamine (mg)	Total dose of flunitrazepam (mg)
1	20	105.5	1.160
2	25	92.5	1.200
3	20	110.0	1.160
4	24	118.5	1.192
5	15	112.5	1.120
6	15	120.0	1.120
7	29	125.0	1.232
8	23	117.5	1.184
9	17	96.5	1.136
10	24	121.5	1.192
11	27	132.0	1.216
12	23	125.0	1.184
13	13	118.0	1.104
14	12	120.0	1.096
15	26	123.5	1.208
16	20	102.5	1.160
17	26	104.5	1.208
18	19	115.0	1.152
19	15	99.0	1.120
20	16	104.0	1.128
Range	12 - 29	92.5 - 132.0	1.096 - 1.232
Mean	20.45	113.15	1.164
S.D. ±	5.063	10.824	0.041

Table (XIII) : SIDE EFFECTS DURING THE PROCEDURE

	No.
Regurgitation and vomiting	1
Cough	1
Hiccough	-
Cyanosis	-
Involuntary movements	3
Hypotension and Collapse	-
Arrhythmia	3
Laryngeal spasm	-
Inadequate Anaesthesia	-
Swelling	2
Others	-

Recovery Time: (Table XIV)

Reflexes returned after 12 - 24 minutes with a mean duration of 16.25 minutes, S.D. ± 3.851.

Response to verbal commands began 22 - 40 minutes, with a mean value of 27.6 minutes S.D. ± 4.695.

Postoperative need for analgesics was 35 - 55 minutes after the end of the procedure with a mean duration of 40.5 minutes S.D. ± 5.042.

Post-operative Period: (Table XI)

1. Recovery was smooth in 17 cases.
2. Stormy in three patients who developed hallucination and excessive movements.
3. Five patients had headache.
4. Two vomited.
5. Two complained of blurring of vision.
6. Two showed hangover.
7. Three cases had radial artery haematoma.

Table (XIV) : RECOVERY TIME IN MINUTES

	Return of Reflexes	Response to verbal commands	Postoperative analgesia
1	12	23	35
2	15	25	40
3	13	25	43
4	17	29	42
5	20	30	45
6	24	35	40
7	23	40	55
8	12	25	35
9	13	24	40
10	15	29	35
11	18	28	40
12	20	30	40
13	22	32	50
14	15	25	35
15	17	30	40
16	13	25	40
17	12	20	35
18	17	30	40
19	15	25	40
20	12	22	40
Range	12 - 24	22 - 40	35 - 55
Mean	16.25	27.60	40.5
S.D. ±	3.851	4.695	5.042

Table (XV): RECOVERY AND POSTOPERATIVE PERIOD

	No.
Smooth	17
Stormy	3
Headache	5
Vomiting	2
Blurred vision	2
Hangover	2
Venous tenderness	-
Radial artery haematoma	3

Discussion

DISCUSSION

Laparoscopy may be regarded surgically as a relatively minor procedure, but actually it may pose major problems for the anaesthelogist.[2] It produces major alterations in the physiological responses of the anaesthetized patients. These are the Trendelenburg-lithotomy position and the introduction of exogenous gas to produce artificial pneumoperitoneum.[3] There is a considerable dispute as the ideal anaesthetic technique for laparoscopy using carbon dioxide as the insufflating gas.[13] The ideal one has to provide adequate circumstances for the surgeon and to keep the patient away from any side effects during the procedure. In addition, it has to provide rapid recovery, adequate post-operative analgesia and no post-operative complications.[57] These are especially needed when the procedure is used on a day-case basis thus, reducing its cost and minimizing the stay in the hospital.[57,58] Can these requirements be achieved by total intravenous anaesthesia ? The aim of the present work was to evaluate the efficacy of this technique on some respiratory functions, blood gases and acid-base status.

Vital Signs:

In the present study the vital signs (heart rate, mean arterial blood pressure and central venous pressure) showed a significant increase following induction of anaesthesia by

flunitrazepam and ketamine hydrochloride. Flunitrazepam had no dtectable effects on the cardio-vascular system.[55] So, ketamine could explain the rapid increase in these parameters due to its inotropic[59] and sympathomimetic effects.[60] Johnstone (1976)[61] attributed this rapid increase to the facilitation of calcium ion transport across the cell membrane of cardiac muscles and purkinje' fibres.

The haemodynamic parameters showed a significant increase following the ten degrees Trendelenburg-lithotomy position and carbon dioxide insufflation. This increase could be attributed to the inotropic[59] and the sympathomimetic[60] effects of ketamine on heart muscles, resistant as well as capacitant blood vessles.[62] The ten degrees head-down tilt and the lithotomy position increased the venous return from the capacitant vessles in the lower limbs and decreased that from head, neck and upper limbs.[3,5,9] The increase in intra-abdominal pressure up to 20 mm Hg had increased the venous return from the splanchnic area and squeezed the blood out of the abdominal cavity,[1] thus increasing the venous return to the right side of the heart. The effect of increased intra-abdominal pressure on venous return from lower limbs might be antagonised by the slight head-down tilt and by elevating the legs in a lithotomy position. All these factors had increased the venous return to the right atrium, increasing the right atrial filling pressure and the central venous pressure.

Through Bainbridge phenomenon, heart rate and concomitantly the mean arterial blood pressure were also increased. In addition, ketamine,[53] operative stress[2] and the absorbed carbon dioxide from the peritoneal cavity[12] stimulated the release of catecholamines into the circulation with their chrontropic, inotropic and pressor effects. Smith[64] and his associates (1975) showed a concomitant increase in these parameters with increased intra-abdominal pressure up to 40 or 50 cm H_2O. Above these levels sudden drop in these parameters was noted and discribed as a state comparable to the supine hypotensive syndrome of late pregnancy. In agreement Kelmanet al (1972),[16] Marshal et al (1972),[21] Metow et al (1973),[14] Lenz et al (1976),[19] Youssef et al (1982),[15] and Beilin et al (1986).[65]

At the end of the procedure all parameters began to decline slowly towards the pre-operative level. This slow decline after eliminating the effects of head-down tilt, the lithotomy position and the increased intra-abdominal pressure could be explained by the continuous inotropic, chronotropic and pressor effects of ketamine,[61] hypercarbia[12] and catecholamines .[2]

Electrocardiographic monitoring all-through the procedure showed no abnormal changes except for three cases of sinus tachycardia (Heart rate > 140/min.). This could be explained

by the sympathomimetic effects of ketamine,[60] carbon dioxide[12] and catecholamines[2] released secondary to ketamine[63] and hypercarbia.[12] In the present work, ketamine and flunitrazepam were used. Both had a slight anti-arrhythmic properties.[40,55] In addition, the possibility of hypoxia or excessive hypercarbia was absent.

In agreement, Beilin et al, (1986)[65] and Anis et al, (1987)[66] showed decreased incidence of cardiac arrhythmias following neuroleptanalgesia for laparoscopy using carbon dioxide as the insufflating gas.

Respiratory functions:

The wide range of the pre-operative values of respiratory rate, tidal volume and minute ventilation might be attributed to the effect of consciousness.[67] As conscious patients could not tolerate well the tight oxygen mask and the sensation that their respiration was measured, counted and monitored. So periods of breath holding, rapid shallow respiration and hyperventilation interdigitated in the same patient at the same time.

Once consciousness was lost following induction of anaesthesia, there was a sort of respiratory depression as indicated by the significant decrease in tidal volume, respiratory rate and minute volume. The respiratory depressant

effect of intravenous ketamine anaesthesia was minimal and lasted for few minutes especially when high plasma level was not achieved rapidly or when given as an infusion.(44-46) Flunitrazepam had a mild respiratory depression which was due to a weak muscle relaxant effect rather than to a direct respiratory centre depression.(56) The synergistic effect of both drugs added to and potentiating the respiratory depressant effect of pethidine given as a premedicant might explain this significant respiratory depression.(67)

In the present work all the patients had some degree of muscular hypertonus following ketamine injection(34) which was slightly balanced by the very weak muscle relaxant effect of flunitrazepam.(56) The net result of this alteration in these central and peripheral respiratory control systems was that a significant increase in arterial carbon dioxide tension was noted. This might be due to alveolar hypoventilation thus retaining the endogenous carbon dioxide. On clinical ground however, non of the patients were considered to be in need of artificial ventilation as arterial carbon dioxide tension was far from critical values.(12)

Following the ten degrees Trendelenburg-lithotomy position and carbon dioxide insufflation, a significant decrease in tidal volume was noted. This was attributed to the pressure of the abdominal viscera firstly upon the diaphragm thus,

impairing its movement and secondly upon the lower lung lobes thus, reducing their volumes.[13] However, the weight of the abdominal viscera acting on ten degrees from the horizontal (the position attained in the present study) would not offer serious impediment to the movement of the respiratory muscles in thin fit adults and with tidal volumes below one litre. A decreased lung compliance secondary to the increased pulmonary blood flow as a result of increased venous return from the lower limbs and the abdominal cavity added some explanation.[68] The 20 mm Hg increased intra-abdominal pressure was a third explanation which hindered diaphragmatic movements and decreased the lower lung volumes.[3]

This significantly reduced tidal volume was accompanied by a significant increase in respiratory rate and minute ventilation. These could be attributed to the significant increase in arterial carbon dioxide tension and the significant decrease in pH as a result of retaining the endogenous carbon dioxide and absorbing the exogenous one from the peritoneal cavity. These changes in arterial carbon dioxide tension and pH stimulated the chemoreceptors in the brain and the aortic arch.[67]

In agreement, Baratz et al (1969)[70] and Lewis et el, (1972)[69] showed significant changes in arterial carbon dioxide tension and pH followed by significant increase in

respiratory rate and minute ventilation with spontaneous respiration during laparoscopy.

The non-explosive, non-combustible rapidly absorbable carbon dioxide gas was used in the present work as it was unlikely to lead to serious embolic phenomena per-operatively or shoulder tip pain post-operatively especially when smaller volumes were used. The high difference in partial pressure between the gas in the peritoneal cavity and the blood perfusing the peritoneum would be expected to lead to very high level of P_aCO_2. This was not the case. The 20 mm Hg increased intra-abdominal pressure pressing upon the diaphragm and the lower lung lobes might as well compress the capillary beds in the blood perfusing the peritoneum. Thus, reducing the rate of carbon dioxide absorption and consequently the volume. In agreement, Lewis et al, (1972)[69] showed that, the higher levels of arterial carbon dioxide tension were late in the post-insufflation phase or during recovery, and not during the early insufflation phase.

In the erect posture, the apical zones of the lungs were poorly perfused and well ventilated. This ventilation-perfusion ratio was improved after attaining the supine position or a 10 degrees head-down tilt.[71]

The pressures upon the lower lung lobes decreased their volumes. This was accompanied by a concomitant decrease in

their perfusion,[71] thus improving their V/Q. These improvements in V/Q of lower lobes as well as upper lobes might explain why critical values of P_aCO_2 or pH were not noticed. These changes in P_aCO_2 and pH were not considered to be dangerous as halothane was not used.

At the end of the procedure, the tidal volume, the respiratory rate and the minute ventilation began to return slowly towards the pre-operative levels. The still rise in arterial carbon dioxide tension after eliminating the effects of positioning and the increased intra-abdominal pressure might be attributed to the continuous absorption of the residual carbon dioxide from the peritoneal cavity[69] and to the continuous effect of pethidine[72] ketamine[61] and flunitrazepam.[54]

Acidosis was purely respiratory in origin due to the increased arterial carbon dioxide tension as a result of gas absorption from the peritoneal cavity. In agreement, Kruer et al, (1984)[73] showed this decrease in pH after CO_2 insuflation and noticed no significant change in pH or P_aCO_2 following N_2O insufflation in a spontaneously breathing patients under halothane anaesthesia. The short duration of the procedure had no place for compansatory metabolic alkalosis to take place. So that hyperventilation was the only rapid mechanism by which all patients began to maintain an optimum pH and P_aCO_2. Acidosis itself increased the slope of

carbon dioxide response curve thus antagonising some effects of pethidine premedication and anaesthesia.[74]

Hypoxia was unlikely during the whole period of the procedure as the patients were breathing pure oxygen 6-8 Litre/minute which kept the arterial oxygen tension very well above hypoxic levels.[69] Also, the absence of a significant decrease in arterial oxygen tension following the 10 degrees Trendelenburg-lithotomy position and carbon dioxide insufflation might explain the compansatory increase in respiratory rate and minute ventilation. Carbon dioxide is twenty times more diffusable than oxygen[69] so that hypoventilation could not be the major factor which lead to arterial carbon dioxide tension increase following positioning and gas insufflation.

The absorbed carbon dioxide must be the major factor. In agreement, Kruer et al, (1984)[73] showed no change in arterial carbon dioxide tension or pH following positioning and nitrous oxide insufflation in spontaneously breathing patient under halothane anaesthesia.

Duration of the procedure:

Laparoscopy carried on by well experienced hands usually takes few minutes either for diagnostic evaluation or for therapeutic sterilization.[75] In the present study, the

mean duration of the procedure was 20.45 minutes ± 5.063. This duration was expected to be near such values so that muscle relaxants was not given. So post-intubation respiratory complications such as sore-throat, hoarsness of voice, trachitis and bronchitis were also avoided.

Muscle tone:

The abdominal muscle tone present allover the procedure because of the non-use of muscle relaxants made the introduction of the Verres needle and the laparoscope easy. The surgical procedure required a firm abdominal musculature so that marked indentation with these instruments towards the major abdominal vessels did not occur.[57,76] After insertion of the laparoscope, the abdominal musculature was still firm and it was not necessary to insufflate large volumes of carbon dioxide to distend this non-compliant abdominal cavity wall. The total volume of carbon dioxide required all through the procedure was small (2 - 3½ L). This reduced volume of exogenous carbon dioxide did not raise the arterial carbon dioxide tension beyond any pathological range.[12] In agreement, Simth et al, (1975)[64] showed that larger volumes of carbon dioxide were used to insufflate parous ladies than nulliparous. This was attributed to the difference in the laxity of their abdominal wall.

Side effects:

1. Regurgitation:

Regurgitation was a minor side effect that happened in the persent study. Only one patient out of twenty showed this sequelae inspite of many factors which were thought to favour its occurrence. These are the head-down tilt, the increased intra-abdominal pressure and the external pressure exerted by the surgeon.(74) This low incidence could be attributed to the well preparation of patients, the increased muscle tone of the diaphragm after ketamine injection, the increase in the lower oesophageal sphincter tone secondary to the Trendelenburg-lithotomy position,(76) and flunitrazepam injection.(77)

2. Aspiration:

Aspiration was unlikely to occur. This could be explained by the intact pharyngeal and laryngeal reflexes following ketamine anaesthesia.(48) The head-down tilt prevented the regurgitated materials from entering the upper airways. The use of a transparant mask, the routine oropharyngeal toilet before reversing the head-down tilt at the end of the procedure made the possibility of aspiration unlikely.

3. Involuntary movements:

Involuntary movements irrilivent to painful stimuli was noted in three patients. This was a normal observation during ketamine anaesthesia with no apparent cause. Sympathetic nervous system over-activity was the cause[34,36] which was incompletely minimized by the hypnotic and tranquillizing effect of flunitrazepam.[54]

4. Sweating:

Sweating was noted in three patients. This could be atributed to the sympathetic over-activity secondary to ketamine, hypercarbia, and operative stress.

5. Cough:

One patient coughed during the procedure. She was the case who regurgitated. This should favour the use of ketamine which kept pharyngeal as well as laryngeal reflexes intact.[48]

Recovery:

1. Return of reflexes began 16 - 25 minutes ± 3.851 after cessation of anaesthesia
2. Respond to verbal commands began 27.6 minutes ± 4.695 after the end of the procedure. Flunitrazepam which stimulated a natural sleep and prolonged the normal sleep

time could explain these long duration of recovery after ketamine anaesthesia.[54] The potentiating effect of pethidine could add another explanation.

3. Post-operative analgesia was needed after 40.5 minutes ± 5.042 from the end of the procedure. The profound analgesia produced by ketamine and the potentiating effects of flunitrazepam[54] as well as the narcotic analgesic properties of pethidine could explain this long duration of analgesia. Complete absorption of the highly soluble carbon dioxide from the peritoneal cavity reduced its irritating effect.[23] The small skin incision used for laparoscopy decreased the threshold of pain in the post-operative period.[28]

Recovery as a whole was smooth in 17 cases and stormy in another three who were presented with hallucinations and excessive movements in beds. The sedative, hypnotic and anxiolytic effects of benzodiazepins in general and flunitrazepam in particular was not in doubt[54] so that the adverse reaction following ketamine was unlikely in the majority of cases.[34,51]

Summary

SUMMARY

The increasing demands of short timed laparoscopy on a day-case basis have lead to create a new anaesthetic technique which can provide rapid recovery, adequate analgesia and no peri-operative complications, especially when using carbon dioxide as an insufflating gas.

Twenty female patients whose mean age was 29.35 years ± 4.511 and with mean weight and height of 62.5 kg ± 5.862 and 161.4 cm ± 7.059 respectively were studied. All were clinically free and premedicated with 1 mg atropine sulphate and 100 mg pethidine given intra-muscularly half an hour before induction. All patients were asked about their dominant hand whose upper arm was connected to the VITA STAT BLOOD PRESSURE MONITOR. Allan's test was applied to the contralateral arm and then its radial artery was cannulated. The superior vena cava was also cannulated for central venous pressure monitoring. All patients were connected to a cardioscope allthrough the procedure.

Pre-oxygenation was applied for five minutes before the control values of heart rate, mean arterial blood pressure, central venous pressure, respiratory rate and minute ventilation were measured and before the first arterial blood sample was withdrawn using a heparinized syringe which was kept in ice for blood gas analysis within one hour.

Conclusion

Anaesthesia was induced with flunitrazepam 1 mg and ketamine hydrochloride 1 - 1.5 mg/kg. It is maintained with glucose 5 % solution containing 1 mg ketamine HCl and 0.008 mg flunitrazepam/ml at a rate of 0.5 - 1 ml/min. increased on demands. There was a significant increase in vital signs (heart rate, mean arterial blood pressure and central venous pressure). This was attributed to the inotropic and sympathomimetic effects of ketamine, hypercarbia and catecholamines released secondary to operative stress, ketamine and hypercarbia. There was a significant decrease in respiratory functions (tidal volume, respiratory rate and minute ventilation). This was attributed to the depressant effect of pethidine, ketamine and flunitrazepam. These significantly increased the arterial carbon dioxide tension.

Three minutes after the ten degrees Trendelenburg-lithotomy position and carbon dioxide insufflation, there was a significant increase in vital signs (heart rate, mean arterial blood pressure and central venous pressure). This was attributed to the rapid increase in venous return to the right heart from lower limbs and the abdominal cavity in addition to the inotropic and sympathomimetic effects of ketamine, hypercarbia and catecholamines. Significant decrease in tidal volume which was slightly compansated by the significant increase in respiratory rate and minute ventilation had resulted in a significant respiratory acidosis and a significant increase in P_aCO_2. This was attributed

mainly to the rapid absorption of large volumes of exogenous carbon dioxide from the peritoneal cavity and partly to hypoventilation.

At the end of the procedure, all parameters began to decline slowly towards the pre-operative levels. This slow decline after eliminating the effects of increased intra-abdominal pressure and positioning was attributed to the continuous absorption of the residual carbon dioxide from the peritoneal cavity and to the residual effects of pethidine, ketamine and catecholamines.

The use of pure oxygen 6 - 8 Litre/minute allthrough the short period of the procedure had eliminated the chance of hypoxia or a compansatory metabolic alkalosis.

Although one case regurgitated and coughed during the procedure due to the increased intra-abdominal pressure, yet the Trendelenburg position, the intact reflexes, the use of a transparent mask and the routine oropharyngeal toilet before reversing the position had decreased the incidnece of aspiration.

Muscle tone was maintained during the whole period of the procedure (20.45 minutes ± 5.063) and met well the surgical as well as the anaesthetic requirements. So less volumes

of carbon dioxide were used and less peri-operative side effects were noted such as sinus tachycardia (3 cases), involuntary movements (3 cases) and mild sweating (2 cases). All were attributed to the inotropic and the sympathetic overactivity during this technique of anaesthesia.

Recovery as a whole was smooth in 17 cases and stormy in three who were presented with hallucinations and excessive movements. This was attributed to the ketamine's recovery adverse reactions (113.15 mg ± 10.82) unbalanced by pethidine and the small dose of flunitrazepam (1.164 mg ± 0.041). Two patients vomited which was considered to be normal after intra-peritoneal operations.

Return of reflexes secondary to painful stimuli started 16.25 minutes ± 3.851 after the end of anaesthesia. The response to verbal commands began 27.6 minutes ± 4.694. The need for post operative analgesia started at 35.55 minutes ± 5.042. These were attributed to the profound analgesic effect of pethidine and ketamine and due to the potentiating effect of flunitrazepam.

CONCLUSION

1. Preservation of abdominal muscle tone reduced the insufflating gas volume used to reach a desired pressure compared with a compliant wall.

2. Total intravenous anaesthesia resulted in good haemodynamic parameters allthrough the procedure.

3. The use of smaller volumes of carbon dioxide insufflating gas resulted in no gross changes in blood gases and acid-base status.

4. The use of total intravenous anaesthesia minimized the operative and post-operative side effects.

5. Recovery after the procedure was smooth and required minimal post-operative analgesia.

6. Total intravenous anaesthesia was satisfactory for short timed-laparoscopy in thin fit adult females.

7. Total intravenous anaesthesia could be applied for laparoscopy carried on a day-case basis.

RECOMMENDATIONS

1. Total intravenous anaesthesia necessitates the use of minimal carbon dioxide gas volume and consequently less delirious effects on haemodynamics, respiratory functions, blood gases and acid-base status.

2. The use of other gases other than carbon dioxide can minimize more these consequences.

3. Total intravenous anaesthesia can be used safely in circumstances where no much sophisticated equipments are present.

4. Total intravenous anaesthesia lessens the incidence of post-operative respiratory complications as sore throat and hoarsness of voice.

5. Total intravenous anaesthesia is cheap, satisfactory and reliable.

CHAPTER IX

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(دراسة بعض تاثيرات منظار الحوض تحت التخدير الكلى عن طريق الوريد)

A STUDY OF SOME EFFECTS OF PELVIC LAPAROSCOPY UNDER TOTAL INTRAVENOUS ANAESTHESIA

Protocol of thesis submitted to the Faculty of Medicine, University of Alexandria, in partial fulfilments of the requirements of the degree of

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ماجستير التخدير

by

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INTRODUCTION

Laparoscopy is now a very common procedure, particulary in gynaecology. It is often assumed to be a minor event. This may be due to many factors including : the small skin incision, the short duration of the procedure and its use on a day-case basis.(1)

Indication for pelvic laparoscopy includes : diagnostic, therapeutic and research indications.(2)

The successful anaesthetic management of a laparoscopic procedure is based upon three factors. Firstly a comprehensive appreciation of the effect of the procedure on the physiological responses of the patient. Secondly an awareness of the potential complications and thirdly a prudent meticulous approach to all elements of anaesthetic management.(3)

Laparoscopy introduces three major alterations in the anaesthetized patient. These are Trendlenberg-lithotomy position, the artificial pneumo-peritoneum and the introduction of exogenous carbon dioxide.

Trendlenberg position 5-10 degrees produces an increase in the venous pressure of the head and neck and an increase in the venous return from the lower limbs. This leads to an increase in the pulmonary blood flow. Trendlenberg position also produces a decrease in ventilation from 14-24 %(4) due to the pressure of the abdominal viscera on the diaphragm. But if the patient is able to increase the inspiratory effort, the patient may be able to maintain adequte ventilation and arterial oxygen tension.(5)

The lithotomy position decreases the tidal volume by 3 % [6] but it increases the venous return and hence the pulmonary blood flow which restricts the volumetric expansion of the lungs. Other hazards of the Trendlenberg-lithotomy position are brachial plexus palsy and regurgitation of gastric contents. [7]

Artificial pneumoperitoneum up to 20 cm H_2O leads to an increase in the femoral vein pressure and the central venous pressure. It also causes an elevation of the diaphragm with a decrease in expiratory reserve volume, residual and tidal volumes. Other hazards of pneumoperitoneum are pneumothorax, pneumomediastinum, parietal or subcutaneous emphysema, pulmonary embolism, intestinal perforation and traumatic adheasions or lysis. [3,8]

Exogenous carbon dioxide is used more frequently than nitrous oxide as it is non explosive, non combustible and it is more soluble in blood so carbon dioxide embolism is uncommon. Arterial carbon dioxide tension shows a significant increase after inflation but not to a serious level especially if ventilation is adequate. [3,8,9]

Laparoscopy can be performed under local analgesia or general anaesthesia with controlled ventilation through endotracheal intubation or with spontaneous respiration with a face mask. One of the recent techniques of anaesthesia is the total intravenous anaesthesia which gains an assess to all fields of surgery as it removes the hazards and complications of inhalational anaesthesia. [10,11]

Aim of The Work

Study some respiratory functions and blood gases in pelvic laparoscopy under total intravenous anaesthesia.

Some respiratory functions viz. the tidal volume and the minute ventilation will be studied.

Blood gases and acid base status viz. arterial oxygen tension, arterial carbon dioxide tension, pH , bicarbonate and base excess will also be studied.

MATERIAL

Twenty patients undergoing gynaecological laparoscopy will be studied. These are consecutive patients on the routine lists in the Shatby University Maternity Hospital who fulfil the following criteria:their age ranges 20-40 years,within normal weight and having no cardiopulmonary or metabolic diseases as judged by clinical examination and routine laboratory investigations.

METHODS

All patients are premedicated with one mg atropine sulphate and 100 mg pethidine given intramuscularly half an hour before induction.

Preoxygenation is applied for 3-5 minutes before induction and is continued throughout the procedure with a face mask using a flow of oxygen ranged 6-8 L / minute.

Anaesthesia is induced with flunitrazepam 1 mg and ketamine hydrochloride 1-1.5 mg / kg body weight given slowly intravenously through a venous catheter. Maintenance of anaesthesia is by a mixture of ketamine hydrochloride 500 mg and 4 mg flunitrazepam in 500 ml dextrose 5% solution. This mixture produces a solution of 1 mg ketamine /1 ml dextrose which is given at a rate of 0.5-0.75 mg /minute using **pediatric infusion set.**

The following parameters are measured and monitored throughout the procedure:

1 - The respiratory rate, **tidal volume and minute ventilation.**

2 - The heart rate.

3 - The mean arterial blood pressure.

4 - The arterial blood **gases.**

2&3 are measured using VITA-STAT BLOOD PRESSURE MONITOR.

5 - The E.C.G. is monitored using a cardiorator.

6 - The C.V.P. is measured using 16 G. venous catheter placed in the subclavian vein via the antecubital vein.

Samples:-

Arterial blood samples are withdrqwn from the non used hand by non-invasive technique using an arterial catheter G. 20,placed in the radial artery. Heparinized syringes are used for collecting the samples.

Time Of Sampling And Measuring:-

1. Before induction.
2. After induction.
3. After Trendlenberg-lithotomy position and CO_2 inflation.
4. After deflation of the gas and the return to the flat position.

Statistical Studies:-

$$\sqrt{\frac{\sum X^2 - \left(\frac{\sum x}{n}\right)^2}{n - I}}$$

Student "t" test =

$$\sqrt{\frac{\text{Difference of means } (m_1 - m_2)}{\left(\frac{S.D}{m}\,2\right)^2 - \left(\frac{S.D}{m}\,I\right)^2}}$$

RESULTS

The results obtained from this work will be tabulated, interpreted and analysed statistically to find out the degree of significance.

DISCUSSION

The data obtained will be discussed with those of other worker in the same field of research.

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Arabic Summary

ملّخص باللغة العربية

ملخص اللغة العربية

دراسة بعض تأثيرات منظار الحوض تحت التخدير الكلى عن طريق الوريد

أدت الزيادة المطردة لاستخدام منظار الحوض فى جراحات النساء والتوليد القائمة على أساس "جراحات اليوم الواحد" الى البحث عن طرق جديدة للتخدير تستطيع أن توفر وقتا أسرع للأفاقة وحجما مناسبا من تسكين آلام بعد الجراحة وتجنب المريض الأعراض الجانبيه قبل وأثناء وبعد الجراحة . وتزداد أهميه هذه الطرق خصوصا اذا أستخدم غاز ثانى اكسيد الكربون لنفخ التجوف البطنى.

وقد تمت دراسة عشرين مريضه متوسط أعمارهن ٢٠ر٣٥ عاما ± ٤ر٥١١ وكان متوسط أوزانهن وأطوالهن على الترتيب ٥ر٦٢ كيلو جراما ± ٥ر٨٦٢ و١٦١ر٤ سم ± ٧ر٠٦٩ . وكن جميعهن خاليات من أى أمراض بالجهاز الدورى والقلب أو بالجهاز التنفسى أو بجهاز الغدد الصماء .

وقد أعطى لهن جميعا مائة ميلليجرام من عقار هيدروكلوريد البيثيدين وواحد ميلليجرام من عقار سلفات الأتروبين حقنا بالعضل قبل بدء الجراحة بنصف ساعة وبعد تطبيق اختبار "الن" على معصم اليد غير المستعملة تم تركيب قسطرة شريانية لجميع المريضات ، كما تم تركيب قسطرة بالوريد الأجوف العلوى لقياس الضغط الوريدى المركزى ، وتم ايصال الذراع الأخرى للمريضات بجهاز مراقب نبضات القلب ومتوسط ضغط الدم الشريانى الأوتوماتيكى كما تم توصيل جميع المريضات بجهاز مراقب القلب الكهربائى .

وبعد اعطاء جميع المريضات غاز الأكسجين النقى للتنفس عن طريق قناع الوجه بمعدل سريان ٦ – ٨ لترا بالدقيقة تم قراءة القياسات الحيوية للمريضات وهى عدد نبضات القلب بالدقيقة ومتوسط ضغط الدم الشريانى والضغط الوريدى المركزى . كما تم قياس وظائف التنفس وهى معدل التنفس فى الدقيقة وحجم التنفس الواحد وحجم التنفس فى الدقيقة وذلك باستخدام مقياس "رايتر" كما تم سحب أول عينة من الدم الشريانى بواسطة محقن معالج بعقار الهيبارين وتم غلقه جيدا وحفظه تحت الثلج لقياس غازات الدم ودرجة حموضته أو قلويته

فى خلال ساعة واحدة من وقت سحب العينة ، وقد أعتبرت هذه القراءات والنتائج كقراءات ثابتة لملاحظة أى تغيير يطرأ عليها فيما بعد .

وقد أعطيت الجرعة الابتدائية للتخدير بواسطة عقار هيدروكلوريد الكيتامين١٫٥ ميلليجرام لكل كيلو جراما من وزن المريضة بالأضافة الى واحد ميلليجراما من عقار الفلونيترازيبام عن طريق الحقن الوريدى البطئ وتمت مواصلة التخدير حتى أنتهاء الجراحة بواسطة محلول جلوكوز ٥ ٪ يحتوى كل ١ ميلليترا منه على ١ ميلليجراما من عقار هيدروكلوريد الكيتامين و٠٫٠٨ ميلليجراما من عقار الفلونيترازيبام . وقد أعطى هذا المحلول بمعدل سريان ٠٫٥ - ٠٫٧٥ ميللترا بالدقيقة .

وقد لوحظ بعد ثلاث دقائق من بدء التخدير انه تحدث زيادة معنوية فى القياسات الحيوية للمرض . وقد أعزيت هذه الزيادة الى تأثير عقار هيدروكلوريد الكيتامين المنشط لعضلة القلب وتأثيره السيمبثاوى على كل من القلب والأوعية الدموية . وتسهيله لدخول ايونات الكالسيوم الى داخل عضلات وأعصاب القلب كما أعزيت هذه الزيادة الى التأثير السيمبثاوى لغاز ثانى أكسيد الكربون وأمينات الكاتيكول الناتجه عن استخدام عقار هيدروكلوريد الكيتامين وكذا نتيجة لضغط الجراحة العصبى .

كما لوحظ انخفاض معنوى فى وظائف التنفس مثل معدل التنفس فى الدقيقة وحجم التنفس فى الدقيقة وحجم التنفس الواحد . وقد أعزى هذا الأنخفاض المعنوى الى تأثير عقاقير هيدروكلوريد البيثيدين وهيدروكلوريد الكيتامين وعقار الفلونيترازيبام المهبط للتنفس مما أدى الى زيادة معنوية فى ضغط غاز ثانى اكسيد الكربون بالدم الشريانى .

وبعد ثلاث دقائق من وضع المريضات عشر درجات فى وضع الـ"ترندلنبرج"ووضع الـ"ليثوتومى" وبعد نفخ تجويف البطن بغاز ثانى أكسيد الكربون لوحظت زيادة معنوية فى القياسات الحيوية للمريضات . وقد أعزيت هذه الزيادة السريعة فى الدم الوريدى العائد الى القلب من الأطراف السفلية ومن تجويف البطن بالأضافة الى التأثيرات السابقة لعقار الكيتامين وغاز ثانى أكسيد الكربون وأمينات الكايتكول .

هذا وقد لوحظ أيضا انخفاض معنوى فى حجم التنفس الواحد قابلته زيادة معنوية فى معدل التنفس فى الدقيقة وحجم التنفس فى الدقيقة مما أدى الى زيادة معنوية فى ضغط غاز ثانى أكسيد الكربون بالدم الشريانى وانخفاض معنوى فى درجة حموضه الدم الشريانى ، وقد أعزيت هذه التغيرات بالدرجة الأولى الى امتصاص غاز ثانى اكسيد الكربون بكميات كبيرة من التجويف البريتونى وبالدرجة الثانية الى قصور وظائف التنفس .

وبعد ثلاث دقائق من نهاية الجراحة لوحظ أن جميع قراءات المريضات قد بدأت تعود ببطء نحو قراءات ماقبل الجراحة وقد أعزى هذا التراجع البطىء على الرغم من أنتهاء تأثير وضع المريض وأنتهاء تأثير زيادة الضغط داخل التجويف البطنى الى أستمرار امتصاص غاز ثانى أكسيد الكربون المتبقى والتأثير الممتد لعقاقير هيدروكلوريد البيثيدين وهيدروكلوريد الكيتامين وعقار الفلونيترازيبام .

وقد كان لأستخدام غاز الأكسجين بمعدل سريان ٦ - ٨ لترا بالدقيقة أثرا فى منع حدوث هبوط مستوى الأكسجين بالدم الشريانى . كما أدى قصر مدة الجراحة الى عدم حدوث تعادل قلوى تمثيلى .

وعلى الرغم من أرتداد محتويات المعده الى تجويف الفم فى حالة واحدة نتجت عن زيادة الضغط داخل تجويف البطن مع وجود الرأس فى مستوى أقل انخفاضا عن المعدة الا أن هذا الوضع ذاته قد منع وصول هذه المحتويات الى داخل تجويف الممرات الهوائية للمريضة . كما كان لبقاء ردود فعل الحنجرة والبلعوم بعد التخدير واستخدام قناع شفاف بالأضافة الى تنظيف التجويف الفمى البلعومى قبل أستعدال وضع المريضة فى نهاية الجراحة أثرا فى تقليل فرصه حدوثه .

وقد كان لاستمرار قوة أنقباض عضلات الجسم طوال فترة الجراحة التى أمتدت الى ٢٠٫٤٥ دقيقة ± ٥٫٠٦٣ أكبر الأثر على كفاءه الجراحة والتخدير على السواء . وذلك لاستخدام حجوم أقل من غاز ثانى أكسيد الكربون وبالتالى لقلة الآثار الجانبية أثناء وبعد الجراحة التى أعزيت جميعها لنشاط الجهاز العصبى السيمبثاوى أثناء هذه الطريقة من التخدير .

وكانت مرحلة الافاقه هادئة لسبعه عشر مريضة وأظهرت ثلاثة من المريضات بعض الهلوسة وكثرة الحركة فى الفراش وقد أعزيت هذه الظاهره لتأثير عقار هيدروكلوريد الكيتامين المنشط للجهاز العصبى السيمبثاوى وعدم القدرة المهدئة لعقارى هيدروكلوريد البيثيدين والفلونيترازيبام على معادله هذا التأثير .

ويتضح من هذه الدراسة :-

١- أن الأبقاء على قوة عضلات جدار البطن قد قلل من حجوم غاز ثانى أكسيد الكربون المستعمله بالمقارنه بحالات أخرى ذات عضلات مرتخيه .

٢- وأن التخدير الكلى عن طريق الوريد قد أدى الى وظائف أحسن للجهاز الدورى والقلب طوال فترة الجراحة والتخدير .

٣- أن أستخدام حجوم أقل من غاز ثانى أكسيد الكربون قد أدى الى تغييراتأقل فى ضغط غاز ثانى اكسيد الكربون بالدم الشريانى أو فى درجة حموضته و قلويته .

٤- أن أستخدام التخدير الكلى عن طريق الوريد قد قلل من الآثار الجانبيه أثناء وبعد العملية الجراحية .

٥- الافاقة كانت هادئة وأستلزمت كميات أقل من عقاقير تسكين آلام مابعدالجراحة

٦- أن التخدير الكلى عن طريق الوريد طريقة مرضية لتخدير سيدات بالغاتأصحاء

٧- التخدير الكلى عن طريق الوريد يمكن تطبيقه فىحالات منظار الحوض القائمة على أساس "جراحات اليوم الواحد" .

وعلى ذلك فانه ينصح :

١- أستخدام حجوم أقل من غاز ثانى أكسيد الكربون لنفخ التجويف البطنى وذلك عند أستخدام طريقة التخدير عن طريقة الوريد وذلك لتقليل التغيرات على الجهاز الدورى والجهاز التنفسى وعلى غازات الدم وحموضته وقلويته .

٢- أستخدام غازات أخرى غير ثانى اكسيد الكربون فقد تؤدى الى تأثيرات أقل فى هذه القراءات .

٣- استخدام طريقة التخدير الكلى عن طريق الوريد فى الظروف التى لاتتوفر فيها مثل هذه الأجهزة المتقدمة والمعقدة .

٤- وأستخدام طريقة التخدير الكلى عن طريق الوريد لأنهاتؤدى الى تقليل نسبة الآثار الجانبية خصوصا بالنسبة للجهاز التنفسى مثل ألتهاب الحلق وبحه الصوت .

٥- التخدير الكلى عن طريق الوريد طريقة رخيصة ويمكن الأعتماد عليها جيدا .

المشرفون

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تحت التخدير الكلى عن طريق الوريد

رسالة

مقدمة الى كلية الطب

جامعة الاسكندرية

ايفاء جزئيا لشرط الحصول على درجة

ماجستير التخدير

من

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١٩٨٧