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Comparative study of physiological changes of nil per oral vs glucose water vs free water in patients undergoing laparoscopic cholecystectomy: A randomized prospective study

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ABSTRACT

Background: The aim of this study was to compare the effect of ingestion of clear water and glucose water over 10 hours NPO in elective laparoscopic cholecystectomy surgery.

Materials and Methods: An observational study was conducted in Sir Sunderlal hospital, Banaras Hindu University. The study included ASA I-II patients undergoing laparoscopic cholecystectomy surgery. Patients undergoing general anaesthesia were included in the study. Among three groups, the control fasted in accordance to nil per os for 10 hours, second and third group received 200 mL of clear water and 200 mL of glucose water, respectively 2 hours before the surgery. Arterial Blood Gas analysis and blood glucose level was done in the immediate post-operative period. Arterial pH, serum electrolytes, serum lactate and blood glucose levels were compared for the above 3 groups. Results were given as mean \pm SD. Data collected were analysed using Student's t-test. Differences were considered statistically significant if P values were <0.05 .

Results: A total of 45 patients were included and 15 patients each were randomly assigned to one of the 3 groups. Patients who had 200 mL of clear water before surgery had lesser variation in serum K⁺ [$p=0.045$] and serum lactate level [$p=0.001$] than NPO. Patients fed with 200 mL of glucose water before surgery had lesser variation in serum K⁺ level [$p=0.02$], serum lactate level [$p<0.001$], in Random Blood Sugar level [$p<0.001$] and no episode of hypoglycaemia observed as compared to NPO. Patients given 200 mL of glucose water exhibited lesser variation in serum lactate level [$p=0.004$], in RBS level [$p<0.001$] and no hypoglycaemic episode recorded contrary to those supplied with 200 mL of clear water. More fluctuations in extreme values of pH and serum electrolytes values observed in group A. Episodes of hypoglycaemia found more frequent in NPO and patients that received only clear water. No significant side-effects were observed in any group.

Conclusion: We conclude that it is safe to give clear drinks 2 hours prior to surgery. Prolonged withholding of oral fluid may cause imbalance in pH, serum electrolytes and hypoglycaemia. The finding confirms the recent ASA guidelines which no longer recommends an indiscriminate 'NPO after midnight' policy.

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1. Introduction

Standard preparation for any surgery requires fasting of the patient. Nil per os is necessary to prevent aspiration of gastric contents into the lungs.¹ Mendelson first reported

that patients ingesting food just before surgery were prone for regurgitation of gastric contents.² High ASA score, emergency surgeries, difficulty in airway management, increase in gastric volume, acidity and intra-abdominal pressure, and gastro-intestinal reflux disease are some of the major risk factors for pulmonary aspiration.³ ASA guidelines recommend avoiding solid food 6-8 hours prior

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to surgery however, clear fluids can be taken up to 2 hours before surgery.⁴

Prolonged fasting results in dehydration leading to enhanced fluid requirement subsequently raises the potential for replacing surgical blood loss as well,⁵ which alters the pharmacokinetics of the drugs; leading to further complications.⁶ Surgical stress in association with prolonged fasting worsens the catabolic state leading to insulin resistance. Insulin resistance in turn causes hyperglycaemia and exacerbates post-operative catabolism, stimulating various endocrine and inflammatory mediators.⁷

Decrease in fasting period found associated with lower risk of dehydration and hypoglycaemia.⁸ Ingestion of carbohydrate containing drinks pre-operatively up to 2 hours before surgery has been reported as an efficient way to minimize insulin resistance and protein loss without affecting gastric emptying and pH.⁹ Pre-operative carbohydrate drinks have been reported to reduce insulin resistance significantly in laparoscopic surgeries.¹⁰ Oral intake of carbohydrate drinks also improves post-operative nausea, vomiting after laparoscopic surgery¹¹ and pre-operative thirst, hunger and anxiety than overnight fasting.¹²

2. Materials and Methods

A one-year observational study (January-December 2019) was performed on patients undergoing laparoscopic cholecystectomy in the Department of Anaesthesiology, Sir Sunderlal Hospital, Banaras Hindu University. Forty five patients having age > 18 years (both sexes) were included.

Patients undergoing non-elective surgery, pregnancy, CBD stone or stricture, gastrointestinal obstruction, associated hernia, anticipated difficult airway, routinely taking medications affecting gastrointestinal motility or secretions were excluded from the study.

Patients were sub-divided into following 3 groups:

Group A- treated with NPO after midnight.

Group B- given 200 mL free water orally 2 hours before surgery.

Group C- given 200 mL of glucose water [12.5 g/100mL] orally 2 hours before surgery.

Clear fluids are defined as transparent liquids which doesn't leave behind any solid particulate matter after boiling.

Standard premedication of tablets 0.5mg midazolam to alleviate anxiety, 150 mg ranitidine and 10 mg metoclopramide was given pre-emptively to reduce incidences of nausea and vomiting in all 3 groups.

General anaesthesia was given for surgery. Routine monitoring of Heart Rate, Non-invasive Blood Pressure, Pulse Oximetry and EtCO₂ was done. After pre-oxygenation of 3 minutes patients were induced with 2-3 mg/kg body weight of propofol and 2-3 mcg/kg body weight

of fentanyl citrate. 0.1 mg/kg body weight of vecuronium was given for skeletal muscle relaxation. Igel was placed. 0.1-0.2 mg/kg body weight of propofol infusion was used for maintenance. Injection Ondansetron 8 mg was given for reduction of post-operative nausea and vomiting. Infusion was stopped just after completion of surgery. Patients were reversed and extubated after eye opening.

Arterial Blood Gas analysis and blood glucose level was done in the immediate post-operative period. Arterial pH, serum electrolytes, serum lactate and blood glucose levels were compared for the 3 groups. Any evidence of side effects were recorded in the immediate post-operative period.

Results were given as mean \pm SD. Data collected were analysed using Student's t-test. Differences were considered statistically significant if P values were <0.05.

3. Results

Table 1: Patient demographics

	Group A	Group B	Group C
Age	41.2 \pm 6.67	44.8 \pm 6.29	42.93 \pm 7.13
Males	7	7	6
Females	8	8	9
Weight	55 \pm 4.69	58 \pm 5.36	56 \pm 6.69

There was no significant difference between the groups with regard to weight, age and sex. Patients in Group A had an average fasting time of 10 hours. The ingestion - surgery interval for Group B and C was on an average 2 hours.

Patients who had 200 ml of clear water in Group B had lesser variation in serum K⁺ level [3.78 \pm 0.54; p=0.045] and serum lactate level [1.81 \pm 0.80; p=0.001] than that of Group A [4.19 \pm 0.52; 2.82 \pm 0.75], which was statistically significant (Table 2).

Patients who had 200 ml of glucose water in Group C had lesser variation in serum K⁺ level [3.82 \pm 0.24; p=0.02], serum lactate level [1.12 \pm 0.26; p<0.001], RBS level [145.73 \pm 8.75; p<0.001] and no episode of hypoglycaemia noticed as compared to Group A [4.19 \pm 0.52; 2.82 \pm 0.75; 108.55 \pm 21.90], which was statistically significant (Table 3).

Patients in Group C had lesser variation in serum lactate level [1.12 \pm 0.26; p=0.004], RBS level [145.73 \pm 8.75; p<0.001] and no episode of hypoglycaemia recorded as compared to Group B [1.81 \pm 0.80; 109.20 \pm 12.67], which was statistically significant (Table 4). The other parameters were found to be in the same range for both the groups (Table 4).

Episodes of hypoglycaemia were more frequent in Groups A and B. More fluctuations in extreme values of pH and serum electrolytes values observed in group A. No significant differences recorded among the three groups regarding side effects such as post-operative nausea and vomiting. No incidence of pulmonary aspiration was noted

Table 2: Comparison of arterial pH, serum electrolytes and blood glucose level in groups A and B

	Group A	Group B	P value
Arterial pH	7.34±0.08	7.36±0.04	0.34
Extremes	7.57-7.22	7.42-7.29	
Serum Na+	136.95±9.62	137.99±4.60	0.71
Extremes	152.4-121.2	146-130.2	
Serum K+	4.19±0.52	3.78±0.54	0.045
Extremes	5.08-3.37	4.8-3.09	
Serum Cl-	101.44±8.29	102.69±3.70	0.60
Extremes	114.7-88.9	109.9-97.4	
RBS	108.55±21.90	109.20±12.67	0.92
Extremes	170-76.3	127-82	
LACTATE	2.82±0.75	1.81±0.80	0.001
Extremes	3.52-1.23	3.67±0.69	

Table 3: Comparison of arterial pH, serum electrolytes and blood glucose level in groups A and C

	Group A	Group C	P value
Arterial pH	7.34±0.08	7.39±0.02	0.3
Extremes	7.57-7.22	7.43-7.36	
Serum Na+	136.95±9.62	139.83±2.95	0.28
Extremes	152.4-121.2	145.1-135.9	
Serum K+	4.19±0.52	3.82±0.24	0.02
Extremes	5.08-3.37	4.26-3.33	
Serum Cl-	101.44±8.29	104.87±3.38	0.15
Extremes	114.7-88.9	109.6-100.1	
RBS	108.55±21.90	145.73±8.75	<0.001
Extremes	170-76.3	160-132	
LACTATE	2.82±0.75	1.12±0.26	<0.001
Extremes	3.52-1.23	1.60-0.63	

Table 4: Comparison of arterial pH, serum electrolytes and blood glucose level in groups B and C

	Group B	Group C	P value
Arterial pH	7.36±0.04	7.39±0.02	0.45
Extremes	7.42-7.29	7.43-7.36	
Serum Na+	137.99±4.60	139.83±2.95	0.2
Extremes	146-130.2	145.1-135.9	
Serum K+	3.78±0.54	3.82±0.24	0.78
Extremes	4.8-3.09	4.26-3.33	
Serum Cl-	102.69±3.70	104.87±3.38	0.1
Extremes	109.9-97.4	109.6-100.1	
RBS	109.20±12.67	145.73±8.75	<0.001
Extremes	127-82	160-132	
LACTATE	1.81±0.80	1.12±0.26	0.004
Extremes	3.67-0.69	1.60-0.63	

Table 5: Comparison of side effects in post-operative period in groups A, B and C

Side Effects		Group A	Group B	Group C	P value
Nausea	1. No	13	14	14	0.906
	2. Yes	2	1	1	
Vomiting	1. No	14	14	15	0.470
	2. Yes	1	1	0	
Pulmonary aspiration	1. No	15	15	15	N/A
	2. Yes	0	0	0	

in any group. (Table 5)

4. Discussion

Preoperative thirst is a major cause of discomfort among patients which is followed by hunger and anxiety.¹³ Intake of clear water 2 hours prior to surgery quenches the thirst of the patients but has no effect on hunger. The traditional practice of overnight fasting patients before surgery causes depletion of hepatic glycogen, increase in gluconeogenesis and development of insulin resistance,¹⁴ which is further augmented by the stress induced by surgery.¹⁵ None of the previous studies have reported any adverse events following ingestion of carbohydrate drinks such as glucose water during or after surgery.

The aim of this study was to determine whether ingestion of clear water or glucose water is better in comparison to overnight fasting. Patients who received either 200 mL of clear water or 200 mL of glucose water had lesser variation in serum lactate levels and serum potassium levels than patients kept NPO for 10 hours. pH and serum electrolytes had more fluctuating values in patients kept NPO for 10 hours. Episodes of hypoglycaemia were more frequent in patients kept NPO and also in patients receiving 200 mL of clear water. Least variation in ABG parameters as well as a stable RBS was noted in patients who received 200 mL of glucose water. Studies have also shown that giving carbohydrate drinks preoperatively results in increased patient comfort, decreased anxiety and thirst.^{11,12}

5. Conclusion

We conclude that it is safe to give clear drinks 2 hours prior to surgery. Prolonged withholding of oral fluid may cause imbalance in pH, serum electrolytes and hypoglycaemia. The finding confirms the recent ASA guidelines which no longer recommends an indiscriminate 'NPO after midnight' policy.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare that there is no conflict of interest.

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