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The effect of oral glucose administration before surgery based on Enhanced Recovery After Surgery (ERAS) protocol on preventing insulin resistance and patient's quality of life

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ABSTRACT

Introduction: Preoperative oral glucose administration is part of the ERAS protocol, which is still not implemented worldwide. This study aims to determine the effect of preoperative oral glucose administration based on the ERAS protocol on the patient's quality of life and insulin resistance.
Method: This study is a quantitative quasi-experimental study (post-test with control group) involving patients undergoing surgery using general anesthesia at dr. Zainoel Abidin Banda Aceh from January 2021 to April 2021. The intervention was carried out on patients who were about to undergo surgery divided into two groups: the group receiving and the group not receiving 50 grams of oral glucose 2 hours before surgery according to the ERAS protocol. The data obtained were processed using Chi Square statistical test, Mann- Whitney, and unpaired T-test to assess patients' quality of life and insulin resistance.
Result: A total of 48 patients (24 treatment group and 24 control group patients) were involved in the study. There were significant mean differences in all quality of life indicators between the group receiving and the group not receiving oral glucose with a significance value of $p<0.05$. There is a relationship between oral glucose administration and prevention of insulin resistance with a significance value of $p<0.05$.
Conclusion: There is a relationship between preoperative oral glucose administration on quality of life and postoperative insulin resistance according to the ERAS protocol.

Keywords: insulin resistance, oral glucose, quality of life
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INTRODUCTION

Quality of life is an individual's perception of his life in terms of the cultural contexts, behaviors, and value systems in which they live and relate to standards of living, expectations, pleasures, and an individual's assessment of their position in life. Quality of life-related to health is multidimensional, including psychosocial, physical, and emotional status and patient autonomy. It applies to a variety of medical conditions. According to WHO, four aspects that affect the quality of life is physical health, psychological well-being, social relationships, and relationship with the environment.[1,2]

Currently, the discussion about the quality of life has been widely studied and used as an important consideration to evaluate the success of service health, including perioperative services such as protocols *Enhanced Recovery After Surgery* (ERAS). ERAS is a stage of perioperative protocol that aims to: improve the patient's ability to cope with major surgery and improve consequent postoperative recovery.[3,4] The ERAS approach focuses on reducing tissue stress and restoring function so that patients recover more quickly after surgery, reduce the risk of complications, and reduce hospitalization days so that the service burden reduced health.[5,6] Along with the development of knowledge and technology, the ERAS protocol continues to develop and has been widely used in more than 25 countries, including Sweden, the Netherlands, UK, Switzerland, Canada, Australia, USA, France, Spain and Americas Latin.[7] In Indonesia, several teaching center hospitals have started implementing ERAS protocols, such as the National Central General Hospital Dr. Cipto Mangunkusumo Jakarta, Regional General Hospital Dr. Sardjito Surabaya, and Dr. Hospital. Hasan Sadikin Bandung.[8–10]

Research on quality of life in patients undergoing the ERAS. Protocol perioperative procedures have been performed in several hospitals. In his study, Jakobson et al. and Mari et al. concluded that there was an improvement in the quality of life in patients who had undergone the ERAS protocol. This improvement in the quality of life is also

accompanied by a decrease in days of hospitalization and increased patient satisfaction with the ERAS protocol.[11,12] One component of the ERAS protocol is the administration of oral glucose 2 hours prior to a surgical operation. The ERAS concept states that preoperative oral glucose administration can reduce thirst, hunger, malaise, fatigue, and perioperative anxiety and prevent insulin resistance.[13] Insulin resistance is a metabolic change center during surgical stress, which is directly proportional to the magnitude of the operation. This situation causes hyperglycemia in non-diabetic patients, so stimulation occurs in various endocrine and inflammatory systems.[14]

Administration of glucose before surgery has been shown to make metabolism anabolic more dominant than catabolic metabolism, thereby reducing the possibility of insulin resistance occurs.[15] A meta-analysis study conducted by Awad et al. (2013) concluded that administration of 50 grams of oral glucose 2 to 4 hours before anesthesia in patients undergoing open abdominal surgery (colorectal, liver, esophagogastric and pancreatic surgery), laparoscopic or open cholecystectomy, thyroid, inguinal hernia, cardiac surgery and orthopedic surgery could reduce postoperative insulin resistance and reduced length of stay.[16] Given the importance for surgeons to understand the quality of life of patients undergoing surgery and prevention of insulin resistance postoperatively. This study aims to determine the effect of preoperative oral glucose administration based on the ERAS protocol on the patient's quality of life and insulin resistance.

METHOD

This research is quantitative quasi-experimental research (*post-test with a control group*). The patient is given the treatment and measures the treatment's effect but does not use random samples to infer changes caused by treatment. The intervention carried out is that patients who undergo surgery are divided into receiving and not receiving 50 grams of oral glucose 2 hours before surgery. The study was conducted at the Regional General Hospital (RSUD) dr. Zainoel Abidin Banda Aceh from January 2021 to April 2021. The population of this study is all patients who underwent surgery using general anesthesia in RSUD dr. Zainoel Abidin Banda Aceh from January 2021 to April 2021. The research sample is patients who met the inclusion criteria. Inclusion criteria in this study include: (1) Aged between 20-55 years, (2) Patients were undergoing major surgery by a surgeon, (3) Patients with physical status ASA 1 and 2, (4) Patients were willing to participate in the study. While the exclusion criteria in this study, namely: (1) Patients with type 1 and type 2 diabetes mellitus, (2) Surgery emergency, (3) Patients undergoing laparotomy surgery with comorbidities.

The number of samples was calculated using the Slovin formula. A total sample that 48 people are needed. Sampling in this study using technique *quota sampling*, where researchers took patients who underwent laparotomy who met the inclusion criteria during the study period until they met the minimum number of samples required. The data obtained were recorded in the research form, processed, presented, and analyzed. The analysis carried out is bivariate analysis. The test used is *Chi-Square*, unpaired T test and Mann-Whitney test with significance acceptable $p<0.05$. This research has received ethical approval from the Research Ethics Committee Health Faculty of Medicine Syiah Kuala University / Regional General Hospital (Hospital) dr. Zainoel Abidin Banda Aceh with the number: 015/EA/FK-RSUDZA/2021.

RESULTS

This study assessed the effect of preoperative oral glucose administration based on protocol *Enhanced Recovery After Surgery* (ERAS) on the patient's quality of life and the prevention of insulin resistance. Data collection was carried out from January 2021 to April 2021 in the inpatient room of dr. Zainoel Abidin Banda Aceh.

There were a total of 48 patients who were divided into two groups: a control group without oral glucose and the group with oral glucose administration, with characteristics as in **Table 1**. The table above presents data on the characteristics of research subjects with a median age of 50.50 years in the control group and 44.50 years in the treatment group, and distribution of more males than females in both groups. Grade median value triglycerides, blood glucose levels, and levels of the TyG index in the treatment group were over lower than the control group. Statistically, there is a difference in mean significance on triglyceride levels and TyG index levels between the treatment and control groups with a significance value of p<0.001. However, statistically, there is no significant mean difference in fasting blood glucose levels between the treatment and control groups with a significance value of p=0.171.

Table 2 shows the effect of preoperative oral glucose administration on the prevention of insulin resistance. Insulin resistance was categorized as a

Table 1. Characteristics of Research Subjects

Characteristics	No Oral Glucose		Oral Glucose		p-value
	Frequency (n)	%	Frequency (n)	%	
Age (year) Median (min-max)	44.5 (23-54)		50.5 (21-54)		0.569[a]
Gender					
Man	11	40.7	16	59.3	0.244[b]
Woman	13	61.9	8	38.1	
Triglycerides (mg/dL) Mean (SD)	123.42 (13.33)		92.50 (7.68)		0.000*[c]
Fasting blood glucose (mg/dL), median (min-max)	96.00 (91-99)		92.50 (78-109)		0.171[a]
TyG Index Median (min-max)	5.97 (4.51-7.12)		4.35 (3.37-4.85)		0.000*a

*p-value<0.05; [a]Mann-Whitney test; [b]Chi Square test; [c]Unpaired T test

TyG index value that was less than equal to 4.49. There are 25 patients with insulin resistance, with details of 1 patient who received oral glucose and 24 patients who did not. Statistically, there is a relationship between oral glucose administration and the prevention of insulin resistance with a significance of p<0.001.

Table 3 shows the effect of preoperative oral glucose administration on a patient's quality of life. Assess the patient's quality of life using eight indicators: physical function, physical limitations, body pain, general health, vitality, social functioning, limitations, emotional, and mental health. The majority of patients with prior oral glucose administration operation have a good quality of life; most patients with no glucose administration orally before surgery have a poor quality of life. Statistically, there is a relationship between preoperative oral glucose administration and good quality of life in patients with a significance value of p<0.001.

DISCUSSION

This research was conducted in RSUD dr. Zainoel Abidin Banda Aceh from January 2021 to April 2021 with a total sample of 48 patients divided into groups treatment receiving oral glucose (according to the ERAS protocol) and the control group without intervention. Quality of life was assessed using Short Form 36 and measurement of the TyG index as a marker of insulin resistance. Quality of life is an individual's perception of his life in terms of the cultural contexts, behaviors, and value systems in which they live and relate to standards of living, expectations, pleasures, and an individual's assessment of their position in life. Assessment of the patient's quality of life using a Short Form 36 questionnaire with eight indicators: physical function, physical limitations, body pain, general health, vitality, social functioning, emotional limitations, and mental health. Each indicator has a different number of questions: 10 physical function questions, 4 physical limitations questions, 2 body pain questions, 6 general health questions, 4 vitality questions, 2 social function questions, 3 emotional limitations questions, and 5 mental health questions.

Physical function indicators consist of activity restrictions that require energy ranging from light to strenuous activities. Function indicator Physical fitness is closely related to indicators of physical limitations consisting of questions: about problems related to work or daily activities. This study found that statistically, there is a difference in the mean score of physical function and significant physical limitations scores between groups receiving oral glucose and those who did not receive oral glucose with a significance value of p<0.001. Can be concluded that the administration of oral glucose before surgery can improve the physical function of the quality of patient's life significantly. This result is different from the research conducted by Henriksen et al. (2003) of 48 patients who underwent surgery in which there was no significant difference in the return speed of the unaided running function on patients receiving carbohydrate fluids compared to patients who fasted before operation.[17]

Body pain indicators consist of questions about the perception of pain in the body and how much pain or discomfort interferes with daily activities and includes to a person's discomfort. This study found a statistically significant difference in the mean body pain score between the group that received oral glucose and those who did not receive oral glucose with values significance p<0.001. It can be concluded that oral glucose administration before surgery significantly reduce pain in patients. These results are in accordance with the research conducted by Claw et al. (2016), which states that the administration of fluids carbohydrates before thyroidectomy increases patient comfort and reduces preoperative discomfort, including hunger, thirst, dry

Table 2. Effect of Oral Glucose Administration on Insulin Resistance

	Insulin Resistance n (%)	Non-insulin resistance N (%)	p-value
Oral Glucose	1 (4.2)	23 (95.8)	0.000*
Non-oral Glucose	24 (100)	0 (0)	

*Chi-square test p-value <0.001

Table 3. Effect of Oral Glucose Administration on Quality of Life

Quality of Life	Mean (SD) or Median (Minimum-Maksimum)		p-value
Parameter	Without Oral Glucose	With Oral Glucose	
Physical function	41.46 (7.59)	78.96 (13.672)	a 0,000
Physical limitations	25 (0-75)	75 (50-100)	b 0,000
Body Pain	38.75 (20-55)	80 (60-100)	b 0,000
General Health	41.35 (8.64)	80.21 (9.3)	a 0,000
Vitality	45.83 (9.96)	83.54 (10.16)	a 0,000
Social Function	50 (37.50-75)	87.50 (62.50-100)	b 0,000
Emotional Limitations	66.67 (33.33-66.67)	100 (66.67-100)	b 0,000
Mental Health	48 (32-68)	88 (68-96)	b 0,000

[a]Independent T-Test;[b] Mann-Whitney Test

mouth, fatigue, and headaches reduce postoperative complications such as vomiting and pain.[18]

Health indicators generally consist of questions about a person's perception to his health. Health indicators in general are also related to vitality indicators. The vitality indicator consists of questions about taste enthusiasm and energy in influencing daily activities carried out. On In this study it was found that statistically there was a difference in the mean score general health and vitality scores were significant between the groups receiving oral glucose and those who did not receive oral glucose with a significance value of p<0.001. Could In conclusion, giving oral glucose before surgery can improve health in general and the patient's vitality significantly. These results are in accordance with Obrink's research et al. (2019) which states that giving 200 ml of nutritional fluid before surgery is effective improve the quality of healing in female patients undergoing cholecystectomy laparoscopic.[19]

Social function indicators consist of physical health conditions or emotional problems that affect social activities. In this study, it was found that there is a statistically significant difference in the mean social function scores between the group that received oral glucose and those who did not receive oral glucose with values significance p<0.001. It was concluded that administering oral glucose before surgery can significantly improve the social functioning of the patient's quality of life. This result is suitable with research by Dahlin et al. (2009) which states that the provision of drinks rich in carbohydrates before surgery significantly affects various quality variables patient's life such as reducing anxiety, reducing tension, and improving social activity.[20]

Indicators of emotional limitations consist of questions about limitations of work or daily activities as a result of emotional problems. Indicator Emotional limitations are closely related to mental health indicators consisting of questions about how a person feels about stress, hopelessness and sadness, and a feeling of calm and peace. In this study, it was found that statistically, there is a significant difference in the mean scores of emotional limitations and mental health between the group that received oral glucose and those who did not receive oral glucose with values significance p<0.001. It can be concluded that oral glucose administration before surgery can significantly improve the patient's mental health. This result is suitable with research from Ali Gok M et al. (2020), which states that the administration of fluids rich in carbohydrates 2 hours before surgery will make the patient comfortable by reducing hunger or thirst. Research results from Noba et al (2019) also stated that preoperative administration of carbohydrate fluids could reduce resistance to insulin and improve postoperative comfort, especially in patients undergoing laparoscopic cholecystectomy. However, Doo A et al. (2017) reported different things, which states that there is no significant effect on welfare and patient satisfaction after being given carbohydrates before surgery in patients undergoing thyroidectomy surgery.[21–23]

Overall, oral glucose administration before surgery has a significant positive relationship on all quality of life indicators. It supports the ERAS protocol, which includes oral glucose administration. Based on previous research, The ERAS protocol has been shown to affect the patient's quality of life. Research conducted by Mari et al. (2014) proved that on the 14th postoperative day, patients who underwent the ERAS protocol had the ability to return to a state of activity faster than patients without the ERAS protocol.[12]

Administration of oral glucose 2 hours before surgery also aims to control metabolic response that occurs as a result of the stress response of surgery so that the patient will be not fully fasted during the operation. This situation is referred to as "*carbohydrate-loading*" will make insulin secreted and increase sensitivity" insulin so that the metabolic response can be controlled.[24] Insulin resistance is a Central change metabolism during surgical stress that is directly proportional to the magnitude of the operation. This situation causes hyperglycemia in non-diabetic patients, stimulating various endocrine and inflammatory systems.[14] This study assesses the prevention incidence of insulin resistance in patients undergoing surgery with oral glucose intervention before surgery. Insulin resistance was determined using the Triglyceride-Glucose Index (TyG index) with the formula In [triglycerides (mg/dL) x blood plasma glucose (mg/dL)] / 2. The measurement results are categorized as insulin resistance if the value is more than 4.49 and is categorized as not insulin resistance if the value is less than/equal to 4.49 according to the study by Salazat et al. in 2017.[25,26]

In this study, a statistical relationship was found between the administration of glucose orally with the prevention of insulin resistance with a significance of p<0.001. This result is suitable with research conducted by Kobayashi et al. (2010) of 26 patients who had undergone liver resection. There was increased insulin sensitivity in patients who had received fluid mixtures of carbohydrates and amino acids. Research by Kaska et al. (2010) of 221 patients who underwent colorectal resection surgery also concluded a decrease in insulin sensitivity in the group without carbohydrate fluids. Faria et al. (2009) reported in their study of 21 patients who underwent laparoscopic cholecystectomy surgery a marked increase in insulin sensitivity significant in patients receiving oral carbohydrate fluids before surgery. However, different results were obtained in the study conducted by Svanfeldt et al. (2007). There was no significant difference in insulin sensitivity between patients receiving oral glucose and those not receiving oral glucose.[27–30]

CONCLUSION

This study concludes a relationship between oral glucose administration and before surgery according to the ERAS protocol on quality of life and prevention of postoperative insulin resistance. Further research is needed on the effect of oral glucose administration before surgery on quality of life and prevention of resistance insulin with different levels of oral glucose administration, with the time of administration different oral glucose levels, and in certain, more specific types of surgery.

DISCLOSURE

Conflict of interest

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Author contribution

All authors have contributed to all process in this research, including preparation, data gathering and analysis, drafting and approval for publication of this manuscript.

Ethic approval

This research has received ethical approval from the Research Ethics Committee Health Faculty of Medicine Syiah Kuala University / Regional General Hospital (Hospital) dr. Zainoel Abidin Banda Aceh with the number: 015/EA/FK-RSUDZA/2021.

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