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Assessment of insulin sensitivity in obese, nondiabetic subjects undergoing infra - umbilical abdominal surgeries

Engineering

KEYWORDS: INSULIN SENSITIVITY, OBESE, NONDIABETIC SUBJECTS ABDOMINAL SURGERIES.

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ABSTRACT

Aim: To assess the pre-operative insulin sensitivity status in adult female with BMI more than 30kg/mt^2, posted for infra-umbilical abdominal surgeries under anaesthesia. CBG level before arrival in the OT prior to any intervention.

Patients & Methods: This prospective, observational study was done on 100 non-diabetic obese patients having BMI more than 30 kg/m^2, posted for elective infraumbilical abdominal surgeries under anaesthesia. Fasting insulin and fasting blood glucose estimation done before arrival in the OT prior to any intervention.

Insulin sensitivity status were calculated by homeostatic model assessment(HOMA) score.

Insulin resistance was considered when HOMA score>2.1

Results: 42 % of subjects were impaired found with impaired fasting glucose level, 67% of patients were detected as insulin resistance.

Conclusion: A significant section of obese population has abnormal insulin glucose homeostasis manifested as impaired fasting glucose, insulin resistance, which needs to be taken care off for better anaesthetic technique to prevent deterioration of insulin sensitivity status of obese patients.

INTRODUCTION:

Introduction: Insulin resistance is a state in which normoglycemia is maintained with an elevated insulin concentration. After major surgical stress, there is increase in the circulatory levels of catabolic hormones and glucose which weakens its peripheral uses leading to insulin resistance, increase morbidity, prolonged ICU stay and increase mortality [1-6..]

Obese individuals may have abnormal insulin glucose homeostasis and insulin resistance 7.. There is lack of reported studies evaluating the incidence of pre-operative blood glucose level and insulin sensitivity status of obese non diabetic female patients undergoing planned abdominal surgeries under general anaesthesia. In preoperative check up insulin sensitivity status can be determined for a particular BMI that might help in determining the choice of technique of anaesthesia to prevent development of peri-operative insulin resistance.

Aim of study is to know pre-operative insulin sensitivity status in adult female with BMI more than 30kg/m2, posted for infra-umbilical abdominal surgeries under anaesthesia with an objective to know the pre - operative blood glucose levels, and to know the percentage of obese nondiabetic female having insulin resistance state in terms of HOMA score prior to abdominal surgeries.

PATIENTS AND METHODS:

Methods : After the approval of the IEC and informed consent from the patients, this research work was carried out at IPGME&R Kolkata between January 2014-December 2015. To obtain normally distributed data, a total of 100 obese female non-diabetic, ASA physical status I, II, age group between 25 and 45 with BMI more than 30 kg/mt2 posted for abdominal surgery were included for this prospective observational study. Haemodynamically unstable patients, pregnancy, patients with difficult airway, duration of surgery more than 1 hr or less than 45 minutes, receiving iv fluids, and receiving any drugs or fluid which may increase blood glucose level were excluded for study.

After detailed history taking, demographic profile including age ,weight, height, ASA, and haemodynamic status including pulse, blood pressure,SPO2%,ETCO2,respiratory rate, temperature, BIS were recorded. Routine pre-operative investigations and specific laboratory investigations were done to assess fitness for hysterectomy operation.

Blood was drawn for measurement of glucose and insulin level, in calm atmosphere before reaching into the operating room This was the end point of study. Visual analogue scale (VAS) – for pain assessment.was monitored.

Parameters studied:

a) CBG level before arrival in the OT prior to any intervention .

b) Insulin level before arrival in the OT prior to any intervention.

Insulin sensitivity status was calculated by homeostatic model assessment (HOMA) score.

HOMA score was calculated through the following mathematical formulae

HOMAIR =FI X FG /22.5.

Where F_I= fasting serum insulin (µIU/L)

F_G= fasting plasma glucose (mmol / L). And 22.5 is a constant.

Insulin resistance was considered when HOMA score>2.1

Non-insulin resistance was considered when HOMA score<2.1

Glucose concentration was determined in fresh capillary blood by reflectance photometry using an Accu-Check®Activeblood glucose monitor (Roche Diagnostics, Mannheim,Germany; Unit of measure: mg/dL, measuring range:10– 600 mg/dL or 0.56–33.6 mmol/L).

This was a state DST approved project and no extra financial help was required from any other source.This is a part of total research work.

The HOMA score at preoperative period was considered as the primary outcome measure for the study.

It was calculated that minimum of 33 subjects will be required per group in order to detect a difference of 0.7 in 48 hours post-operative HOMA score with 80% power and 5% probability of Type-1 error.

This calculation assumes a standard deviation of 1 for 48 hours post-operative HOMA score on the basis of an earlier study 8 .

A total of 100 patients will be included for this research work. 50 in each group (n=50) All statistical analysis was done in Statistica version 6 [Tulsa, Oklahoma: Stat Soft Inc., 2001]. Age, Height, Weight, BMI and Fasting Blood Glucose were normally distributed by Kolmogorov goodness of fit test. These were expressed as mean±SD. Other numerical variables like duration of surgery, fasting insulin levels, HOMAIR were skewed. Skewed data was expressed as median and interquartile range, comparison between groups like ASA1 and ASA2,Impaired Fasting Glucose and Non Impaired Fasting Glucose, Insulin Resistant and Non Insulin Resistant in terms of numerical variables were done by Student's unpaired t-test(normally distributed) and by Mann Whitney U test(skewed data).Comparison of categorical variables were done by Fisher's exact test 2 tailed. Demographic data was expressed as mean ± SD (age, weight, height) or proportion (sex and ASA physical status). CBG and insulin levels of the patients was analyzed by two-tailed unpaired students un t-test, Mann Whitney U test and Fishers exact test. $p<0.05$ was considered as statistically significant.

RESULTS

Table1. showed, there were 45 and 55 patients of height 1.50-1.60 &1.60-1.70 metres respectively. Number of patients having weights of 70-80, 80-90 and 90-100 kilograms were 33,57 &10 respectively. Body Mass Index(BMI) distribution in the study population show that, there are 68,19 and 3 patients of BMI 30-32.5, 32.5-35, 35-37.5 respectively. There are 54, 23and 23 patients having 45-50, 50-55 and 55-60 minutes of duration of surgery.

Table1.

Sl no.	Parameters	values	No of patients
1	Height(meters)	1.50-1.60	45.
		1.61-1.70	55.
2	Weight(kg)	70-80, 80-90 90-100	33, 57 10
3	Body mass index(kg/m2)	30-32.5	68
		32.5-35	19
		35-37.5	3
4	Duration of surgery(min)	45-50	54
		50-55	23
		55-60	23
5	ASA Physical status	1	53
		II	47

Table 2: Showing the distribution of fasting blood glucose in mmol/lt.

Fasting blood glucose (mmol/l).	No. of patients
3.5-4.0	2
4.0-4.5	4
4.5-5.0	8
5.0-5.5	13
5.5-6.0	23
6.0-6.5	29
6.5-<7	12

Table 2 showing that there were 2,4,8,13,23,29 and 12 patients having fasting blood glucose in the groups 3.5-4.0,4.0-4.5,4.5-5.0,5.0-5.5,5.5-6.0,6.0-6.5and 6.5-<7.0 respectively in mmol/L. There were 42 patients with impaired fasting glucose in our study as compared to 58 patients who had normal fasting glucose.

Table 3. Showing the distribution of fasting insulin level microgram IU/ml.

Fasting Insulin level microgram IU/ml	No. of patients
0-10	40
10-20	47
20-30	11
30-40	2

Table 3. showing that 40,47,11and 2 patients belong to groups having fasting insulin levels in the range 0-10,10-20,20-30 and 30-40 microgram IU/ml respectively.

Table 4. Showing the distribution of HOMAIR in the study population.

HOMAIR	No. of patients
<2.1	33
2.1-4.2	39
4.2-6.3	12
6.3-8.4	13
>8.4	3

Table 4.showing that 33,39,12,13 and 3 patients have HOMAIR in the range <2.1,2.1-4.2,4.2-6.3,6.3-8.4 and >8.4 respectively.

Hence out of the 100 patients enrolled ,67 (67%) were insulin resistant and 33(33%) were insulin non resistant by HOMAIR test.

Table 5.

BMI	Groups	Mean	SD	P value
	IR	32.56	1.496	0.000
	Non IR	31.11	0.949	

Table 5: Comparison between Insulin Resistant and Non Insulin Resistant groups in terms of BMI. There is a significant statistical relationship($p<0.05$) Insulin resistant and Non Insulin resistant groups in terms of BMI in our study

DISCUSSION:

Development of awareness to quantify insulin sensitivity/resistance in diabetic patients has paramount importance for the fear of metabolic syndrome in obese patients, but detection of insulin sensitivity status in nondiabetic obese should have been an important objective when dealing for a major surgery under anaesthesia.

The correlation of insulin sensitivity status of different body weight, individual varies with changes related to catabolic response to surgery Prevention of surgical complications as a result of hyperglycemia is possible with meticulous perioperative glucose management to prevent the development or worsening of insulin resistant state.

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Optimal or the best approach to peri-operative glycemic control ,their relative need for insulin, and control over any factors that may be likely to increase insulin requirements are the essential goal for anaesthetic management. The most common type of insulin resistance is associated with overweight and obesity in a condition known as the metabolic syndrome. Insulin resistance often progresses to full Type 2 diabetes mellitus (T2DM) or latent autoimmune diabetes of adults.[10.11.]

Obese diabetic patients are characterized by an extra-hepatic insulin resistance. Whereas, obese non – diabetic patients also have decreased hepatic insulin sensitivity, though the topic still remains controversial.The independent cause of hyperglycemia and insulin sensitivity is pointed out more frequently in diabetic patients, rather ignored in non diabetic patients.

Insulin resistance (IR) is one of the main culprits in the association between obesity, particularly visceral, and metabolic as well as non-metabolic diseases. It was found that 67 percent of the study population was insulin resistant by HOMAIR Insulin sensitivity can be estimated by "Homeostatic Model Assessment" score (HOMA), which is considered having similar efficacy with hyperinsulinaemic - euglycaemic clamp test. 100 patients were enrolled , out of them 67 patients 67%) were insulin resistant and 33(33%) were insulin non resistant by HOMAIR test. 42 percent of the subjects were impaired fasting glucose as per W.H.O definition. It was also found that significant statistical relationship existed in terms of BMI, insulin resistance and fasting insulin levels in impaired fasting group as compared to non impaired fasting glucose group. Insulin resistant subjects showed a higher BMI incidence, fasting insulin levels and impaired fasting glucose as compared to non insulin resistant subjects.

Conclusion: Insulin resistance in obese subjects posted for general anaesthesia normally undergo preoperative check-up before operation insulin sensitivity status must not be ignored form preoperative checkup. Insulin resistance is also associated with high BMI, high fasting insulin levels and a significant portion of the obese female population has impaired fasting glucose, which is detrimental in obese non diabetic population in peri-operative settings. General anaesthesia evokes a significant stress response which aggravates the aforementioned metabolic impairment. Therefore insulin sensitivity status must be detected in preoperative settings in every obese woman to prevent post operative morbidity and mortality, as well as help to decide the type of anaesthesia to prevent general anaesthesia related stress while planning abdominal operations.

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