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A PHYSIOLOGICAL APPROACH TO EVALUATE CARDIAC AUTONOMIC NEUROPATHY AMONG LONG STANDING DIABETES IN THE PRE-OPERATIVE SETTINGS

Anaesthesiology

KEYWORDS: AUTONOMIC NEUROPATHY, DIABETES MELLITUS, MYOCARDIAL INFARCTION , ORTHOSTATIC HYPOTENSION.

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Introduction

Autonomic neuropathy as a feature of Diabetes Mellitus (DM), despite current knowledge of its gravity is commonly under-evaluated. Patients with longstanding Diabetes undergoing surgical interventions are at great risk of cardiovascular crises if they have cardiac autonomic neuropathy (CAN). Patients with CAN may present during any part of peri-operative period with life threatening catastrophes like myocardial infarction (MI), arrhythmias or sudden death. This study is undertaken to know the prevalence of CAN in chronic diabetics so that they are managed with caution peri-operatively for any untoward cardio-respiratory complications.

AIM

a) To identify CAN in chronic diabetics (both type 1 & 2) and its prevalence in patients attending pre-anesthetic clinic

b) To correlate proven pre-operative autonomic dysfunction to intra-operative critical incidents.

Materials and Method:

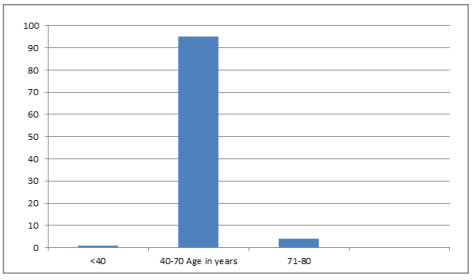
A Prospective observational study was conducted on 100 patients with type 2 diabetes of 5years or more duration scheduled for surgery and were assessed by the cardiac autonomic function tests (CARTs). CAN was assessed for parasympathetic function by analyzing resting tachycardia, heart rate variations during the standard tests (deep breathing, E:I ratio, lying to standing 30:15 ratio and Valsalva maneuver. Sympathetic functions were assessed by checking for orthostatic hypotension. The CAN score of each patient was analyzed. All the 100 patients were subjected to anesthesia (SAB/GA) depending on their surgical needs and were watched for any intra-operative critical events.

RESULTS

TABLE 1: AGE DISTRIBUTION

AGE IN YEARS	NO. OF PATIENTS	%
<40	1	1.0
40-70	95	95.0
71-80	4	4.0
TOTAL	100	100.0

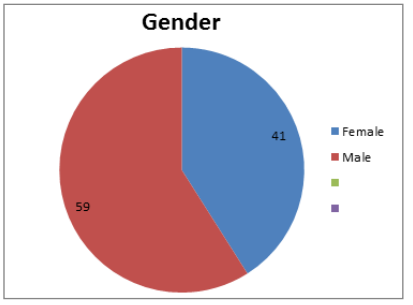
Mean – SD :56.94-8.61



Among the 100 diabetics, 95 patients were in the age group of 40 – 70 years

TABLE 2 : GENDER DISTRIBUTION

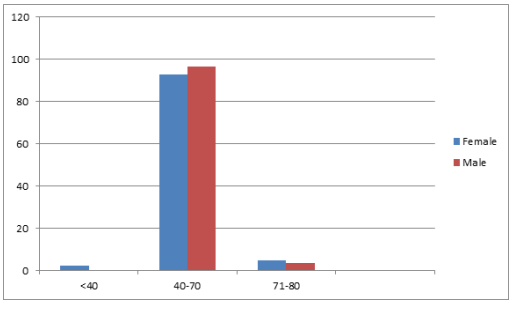
Gender	No. of patients	%
Female	41	41.0
Male	59	59.0
Total	100	100.0



59 out of 100 patients were males and 41 were females.

TABLE 3 : AGE AND GENDER DISTRIBUTION

Age in years	Gender		Total
	Female	Male	
<40	1(2.4%)	0(0%)	1(1%)
40-70	38(92.7%)	57(96.6%)	95(95%)
71-80	2(4.9%)	2(3.4%)	4(4%)
Total	41(100%)	59(100%)	100(100%)

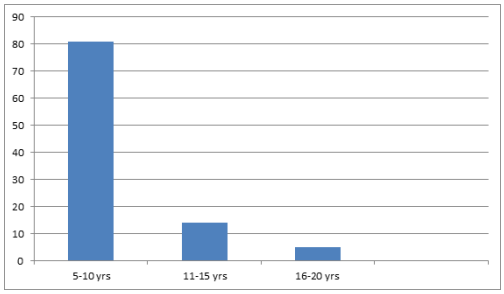


GRAPH 3 : AGE AND GENDER DISTRIBUTION

Most of the patients (95) fall in the age group between 40-70 years.

TABLE 4 : DURATION OF DM

Duration of DM (in	No. of patients	%
5-10 yrs	81	81.0
11-15 yrs	14	14
16-20 yrs	5	5.0
Total	100	100.0

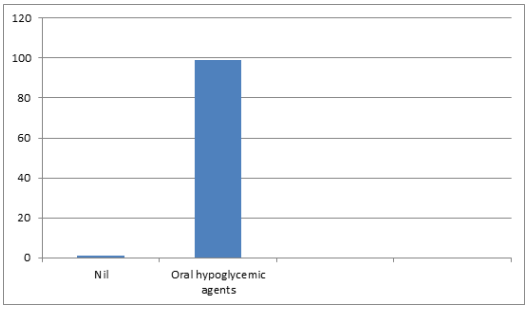


GRAPH 4 : DURATION OF DM

Most of the patients (81) had duration of diabetes between 5 to 10 years.

TABLE 4 : ANTI – DIABETIC TREATMENT

TREATMENT	NO. OF PATIENTS	%
Insulin	1	1.0
Oral hypoglycemic agents	99	99.0
TOTAL	100	100.0

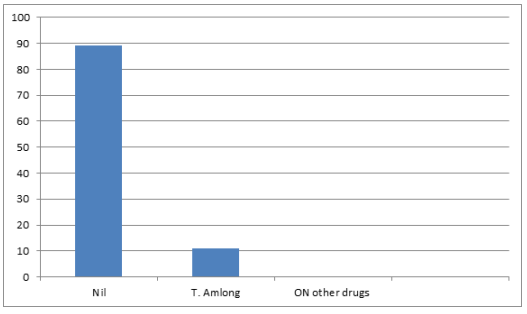


GRAPH 4 : ANTI – DIABETIC TREATMENT

Out of 100 patients, 99 of them were on oral hypoglycemic agents. Only 1 patient was on insulin.

TABLE 6: OTHER DRUGS

Other Drugs	No. of patients	%
Nil	89	89.0
Tab. Amlong	11	11.0
Total	100	100.0

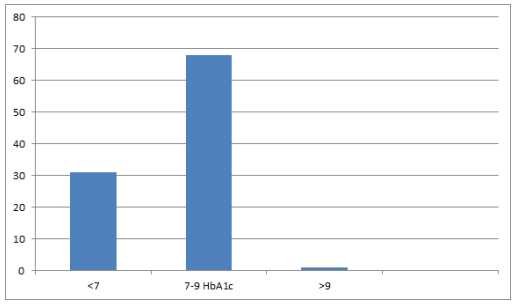


GRAPH 6: OTHER DRUGS

Among 100 diabetics studied, we had 11 patients who were hypertensive and were on antihypertensives.

TABLE 7: HbA1c Levels

HbA1c	No. of patients	%
<7	31	31.0
7-9	68	68.0
>9	1	1.0
Total	100	100.0

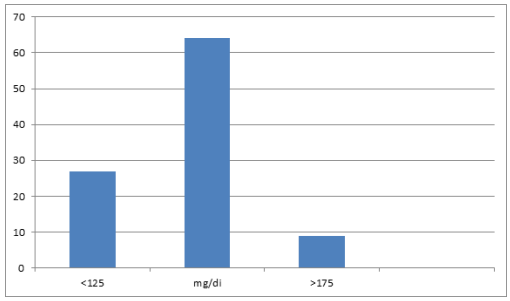


GRAPH 7: HbA1c Levels

Most Patients of our study group (68) had HbA1c levels between 7-9.

TABLE 8: PRE-OPERATIVE GRBS LEVELS

GRBS(mg/di)	No. of patients	%
<125	27	27.0
125-175	64	64.0
<200	9	9.0
Total	100	100.0

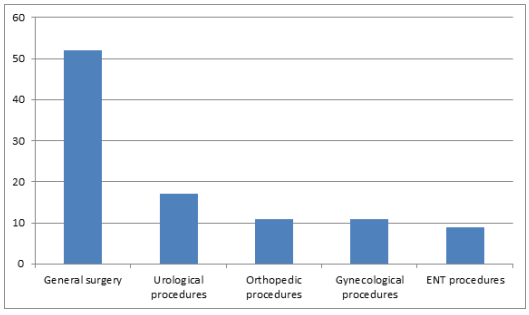


GRAPH 8: PRE-OPERATIVE GRBS LEVELS

All patients were under adequate control of blood sugar

TABLE 9:TYPE OF SURGERIES PERFORMED

Surgery	No. of patients	%
General surgery	52	52.0
Urological procedures	17	17.0
Orthopedic procedures	11	11.0
Gynecological procedures	11	11.0
ENT procedures	9	9.0
Total	100	100.0

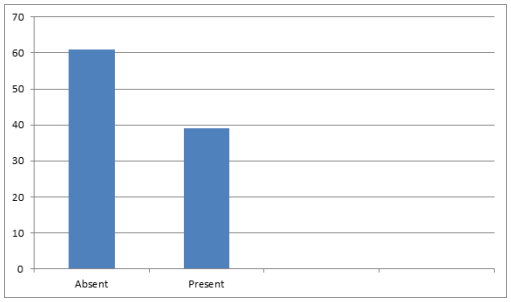


GRAPH 9:TYPE OF SURGERIES PERFORMED

TABLE 10: Prevalence of CAN

Prevalence of CAN	No. of patients	%
Absent	61	61.0
Present	39	39.0
Total	100	100.0

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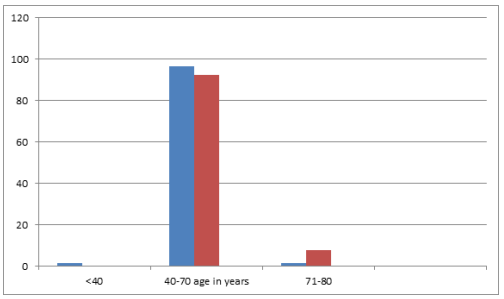
GRAPH 10: Prevalence of CAN

Out of 100 diabetics, CAN was positive in 39 patients, CAN was negative in 61 patients.
*3 of them were on anti hypertensive's.

TABLE 11: AGE DISTRIBUTION OF PATIENTS IN RELATION TO THE PREVALENCE OF CAN

Age in years	Prevalence of CAN		Total
	Absent	Present	
<40	1(1.6%)	0(0%)	1(1%)
40-70	59(96.7%)	36(92.3%)	95(95%)
71-80	1(1.6%)	3(7.7%)	4(4%)
Total	61(100%)	39(100%)	100(100%)

P=0.296, Not significant, Fisher Exact test.

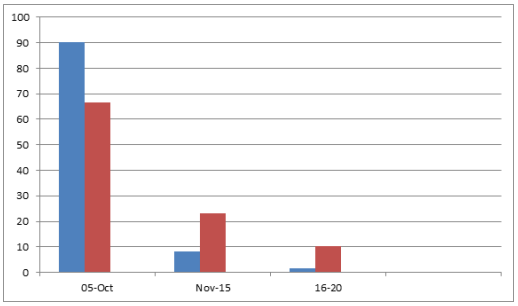


GRAPH 11: AGE DISTRIBUTION OF PATIENTS IN RELATION TO THE PREVALENCE OF CAN

36 out of 39 CAN positive patients were in the age group of 40-70 years.

TABLE 12: Duration of DM of patients in relation to the prevalence of CAN

Duration of DM (in years)	Prevalence of CAN		Total
	Absent	Present	
5-10	55(90.2%)	26(66.7%)	81(81%)
11-15	5(8.2%)	9(23.1%)	14(14%)
16-20	1(1.6%)	4(10.3%)	5(5%)
Total	61(100%)	39(100%)	100(100%)



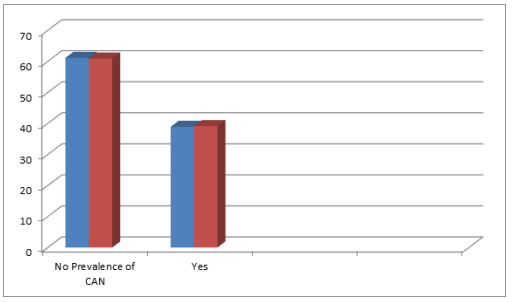
GRAPH 12: duration of dm of patients in relation to the prevalence of CAN

In our study, majority of our CAN patients (26) had 5-10 years duration of Diabetes, 9 CAN patients had duration of diabetes 11-15 years, 4 CAN patients had duration of diabetes 16-20 years.

TABLE 13: PREVALENCE OF CAN ACCORDING TO GENDER

Prevalence Of CAN	Gender		Total
	Male	Female	
No	36(61.1%)	25(60.9%)	61(61%)
Yes	23(38.9%)	16(39.1%)	39(39.0%)
Total	59(100%)	41(100%)	100(100%)

P=0.997, Not Significant, Chi-Square test

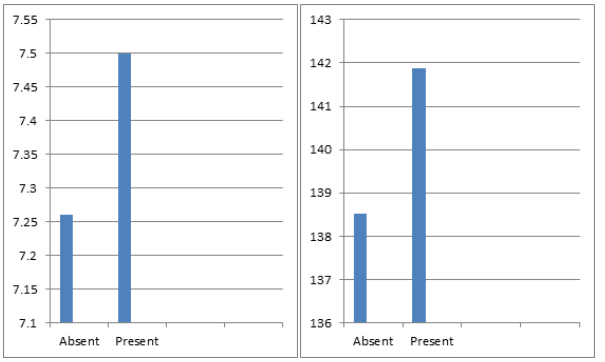


GRAPH 13: PREVALENCE OF CAN ACCORDING TO GENDER

In our study, we had male predominance (23 cases)

TABLE 14: COMPARISON OF HbA1c AND GRBS OF PATIENTS STUDIED IN RELATION TO THE PREVALENCE OF CAN

Variables	Prevalence of CAN		Mean	P value
	Absent	Present		
HbA1c%	7.26+1.79	7.61+0.86	7.39+0.83	0.039*
GRBS	138.52+2531	141.87+25.05	139.83+25.14	0.519

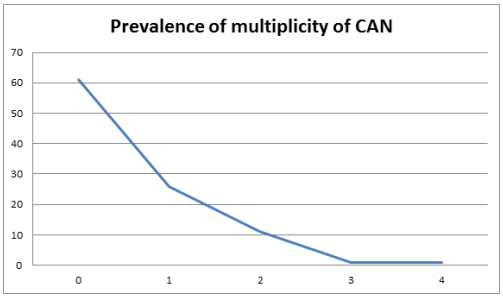


GRAPH 14: COMPARISON OF HbA1c AND GRBS OF PATIENTS STUDIED IN RELATION TO THE PREVALENCE OF CAN

There was not much difference between CAN positive and CAN negative patients regarding Pre-operative HbA1e and GRBS.

TABLE 15: PREVALENCE OF MULTIPLICITY OF CAN PARAMETERS

No. of CAN positive parameters	No. of patients	%
0	61	61.0
1	26	23+(3)*
2	11	11.0
3	1	1.0
4	1	1.0
Total	100	100.0



GRAPH 15: PREVALENCE OF MULTIPLICITY OF CAN PARAMETERS

Among the CAN positive patients, 23 patients had 1 parameter positive, 11 patients had 2 parameter positive and 1 patient had 3 parameters positive and 1 patient had 4 parameters positive.

TABLE 16: PRESENTATION OF CAN POSITIVE PARAMETERS (SINGLY AND IN COMBINATION)

CRITERIA	TOTAL	SINGLE TEST	COMBINATION TESTS	REMARKS
1. Resting HR	15	6	9	E:I ratio (1), orthostatic hypotension + DED (1), orthostatic hypotension + valsalva ratio+E:I ratio (1)
2. Orthostatic hypotension	27	18	9	DBD (1), 30:15(1), resting tachycardia(5), DBD + resting tachycardia (1), valsalva ratio + E:I ratio + restubg tacgtcardia (1)
3. 30:15 RATIO	5	1	4	DBD(2), Orthostatic hypotension(1), resting tachycardia (1)
4. VALSALVA RATIO	1	0	1	Resting tachycardia + Orthostaric hypotension + E:I ratio
5. DBD	6	1	5	Resting tachycardia (1), Orthostaric hypotension(1) 30:15 ratio(2) resting tachycardia + orthostatic hypotension
E:I ratio	1	0	1	Resting tachycardia + Orthostaric hypotension + Valsalva ratio

CAN parameters were positive singly or in combination.

6 patients with resting HR, 18 patients with Orthostatic hypotension, 1 patient with 30:15 RATIO and 1 patient with DBD presented singly, as sole parameter.9 patients each with resting HR and orthostatic hypotension, 4 patients with 30:15 ratio, 1 patient with valsalva ratio, 5 with DBD and 1 patient with E:I ratio presented with a combination of other parameters also.

TABLE 16 a : DISTRIBUTION OF MULTIPLE CAN POSITIVE FEATURES

TESTS	RHR	OH	30:15	VAL ratio	DBD	E:I ratio
SOLE FEATURE	6	18	1	-	1	-
COMBINED FEATURES : RHR	-	5	1	1	2	1
OH	5	-	1	1	2	1
30:15	1	1	-		1	
VAL	1	1	-	-	-	1
DBD	2	1	1	-	-	-
E:I	1	1		1	-	1

RHR – Resting Heart Rate OH-Orthostatic Hypotension VAL-Valsalva Ratio DED-Deep Breathing Difference E:I- Expiratory : Inspiratory RatioFor every CAN parameter, the exact distribution of co-existebce of other positive parameters is shown in table 16.a

TABLE 17: SENSITIVITY AND SPECIFICITY OF CAN TESTS:

Tests	Observation					Correlation to predict CAN					
	TP	FP	FN	TN	Total	sc	sp	PPV	NPV	Accuracy	P value
1. resting HR	15	0	24	61	100	38.4	100.0	100.0	71.8	76.0	<1.001**
2. Orthostatic Hypotension	27	0	12	61	100	69.2	100.0	100.0	83.6	88.0	<1.001**
3. 30:15 RATIO	5	0	34	61	100	12.8	100.0	100.0	64.2	66.0	0.008**
4. VALSALVA RATIO	1	0	38	61	100	2.6	100.0	100.0	61.6	62.0	0.390
5. DBD	6	0	33	61	100	15.4	100.0	100.0	64.9	67.0	0.003**
6. E:I ratio	1	0	38	61	100	2.6	100.0	100.0	61.6	62.0	0.390

TP-true positive FP-false positive FN- false negative PPV – Positive predictive value NPV-negative predictive value Sc- sensitivity SP-specificityOf all the CAN parameters, orthostatic hypotension in our series was highly specific and sensitive marker with statistical significance (p value 0.001); Resting tachycardia and all other parameters were less sensitive and specifc.

TABLE 18 : SEVERITY OF CAN

CAN SEVERITY	NO.
MILD OR POSSIBLE CAN (1 HR test abnormal)	8
MODERATE OR DEFINITE CAN (2 or more HR test abnormal/orthostatic hypotension.)	22
SEVERE OR ADVANCED CAN (HR test + presence of orthostatic)	9
TOTAL CAN POSITIVE	39
TOTAL NO OF DIABETICS STUDIED	100

Based on diagnostic criteria of CAN. We had 8 patients with mild CAN. 22 with moderate CAN and 9 with severe CAN.

TABLE 19 : ANESTHETIC TECHNIQUE

Remarks	No. of patients	%
Sub arachnoid block	74	74.0
General anesthesia	25	25.0
Peripheral nerve	1	1.0
Total	100	100.0

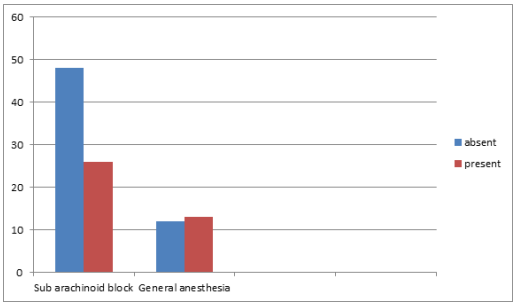
Out of 100 patients 74 patients received sub arachniod block, 25 patients received General anesthesia and 1 patient received peripheral nerve block.

TABLE 20 : ANESTHETIC TECHNIQUES ACCORDING TO PREVALENCE OF CAN

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REMARKS	PREVALENCE OF CAN		TOTAL
	ABSENT	PRESENT	
Sub arachnoid	48	26	74
General	12	13	25
Total	60	39	99*

P=0.147, Not Significant, Fisher Exact



*1 Patients underwent peripheral nerve block.

TABLE 21 : % FULL OF BP IN RELATION TO DIFFERENT TYPES OF ANESTHESIA

% fall in BP >20% in CAN positive patients	Sub arachnoid block	General anesthesia
No	6	4
Yes	20(76%)	9(72%)
Total	26	13

P<0.001**. Significant, Fisher Exact test.
Of 26 CAN (+) patients who underwent SAB. 20 (76%) showed >20% fall in BP Of 13 CAN (+) patients who underwent GA, 9(72%) showed >20% fall in BP.

TABLE 22 : % FALL OF BP IN RELATION TO DIFFERENT TYPES OF ANESTHESIA

% fall in BP >20% in CAN Negative	Sub arachnoid block	General anesthesia
No	36	7
Yes	12(24%)	5(40%)
Total	48	12

P<0.002**. Significant, Fisher Exact test.
Of 48 CAN (-) patients who underwent SAB. 12 (24%) showed >20% fall in BP Of 12 CAN (-) patients who underwent GA, 5(40%) showed >20% fall in BP.

DISCUSSION:

Cardiac autonomic neuropathy in long standing diabetics coming for surgery were evaluated pre-operatively and those with CAN were followed intra operatively to observe for any critical events.Risk markers for CAN are diabetes duration, age, glycemic control, microvascular complications (peripheral polyneuropathy, retinopathy and nephropathy), hypertension and dyslipidemia. Established risk factors for CAN are glycemic control in type 1 diabetes, and a combination of hypertension, dyslipidemia, obesity and glycemic control in type 2 diabetes. Screening for CAN should be performed at the diagnosis of type 2 diabetes and 5 years after the diagnosis of type 1 diabetes, particularly in those with a history of poor glycemic control or cardiovascular risk factors. 70 patients with a duration of DM between 6 to 10 years. 26 of them had features of CAN. Out of 14 patients with duration of DM of 11-15yrs, 9 featured CAN. Also, out of 5 patients with a duration 16-20 yrs of DM, 4 had CAN criteria.

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