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RESEARCH ARTICLE

EARLY NEUROLOGICAL COMPLICATIONS AFTER CORONARY BYPASS SURGERY.

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Abstract

Background: Coronary Artery Bypass Graft surgery (CABG) is one of the most common surgery procedures performed annually in worldwide. The objective of this study is to determine the prevalence and risk factors of the early neurologic complications emerged after CABG surgery. **Materials and Methods:** In a prospective study we have investigated 134 patients undergoing CABG between July 2016 and June 2017 in cardiac surgery ward, Bugshan hospital, Jeddah, KSA. Risk factors that evaluated in our analysis consist of hypertension (HTN), diabetes, body mass index (BMI), dyslipidemia and severity of carotid artery stenosis. Our dependent variables were change in conscious level, CVA and seizure. **Results:** In our analysis, of total 134 patients, 14 (10.4%) were female. Mean age of patients was 57±20 years. Of total patients, 72 (53.7%) were found to have HTN, 82 (61.2%) had diabetes, 110 (82.1%) had dyslipidemia, 6 (4.5%) significant ($\geq 50\%$) carotid stenosis and 112 (83.6%) had abnormal [$\geq 25 \text{ kg/m}^2$] BMI, (40.3% were overweight (BMI ≥ 25 and $< 30 \text{ kg/m}^2$), 35.8% obese (BMI ≥ 30 and $< 35 \text{ kg/m}^2$) and 7.5% severely obese (BMI $\geq 35 \text{ kg/m}^2$)]. The incidence rate of change in sensorium after CABG was 6 (4 was diagnosed as HIE and 2 with NCSE) and for CVA were 6 (4.5%). Dyslipidemia, BMI and HTN were the important risk factors.

Conclusion: According to this analysis, Dyslipidemia, BMI and HTN were the most important risk factors of neurological complications after CABG.

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Introduction:-

Coronary Artery Bypass Graft (CABG) surgery is one of the most prevalent surgeries performed annually throughout the world. More than 500000 CABG surgeries are performed in the U.S. annually¹. Neurological complications are a major cause of morbidity and mortality during the immediate postoperative period following cardiac surgery². Those individuals undergoing these surgeries are mostly of the elderly people suffering from coronary artery disease and are undergone the surgery either as an emergency surgery or an elective surgery. This surgery comes with some complications as is the case for other surgeries which the neurologic and cognitive complications constitute an important portion of these complications. The neurologic complications like the stroke and impaired sensorium are regarded as the most prevalent and important complications occurred after CABG which can also affect the patient's quality of life at next years and increase the patient's hospital stay^{3,4}. Based on the

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performed studies, the incidence rate of stroke after CABG surgery is in the range 0.8-5.2%⁵. Moreover, the incidence time of stroke after CABG surgery varies considerably. Those patients who are affected with stroke after surgery have poor prognoses compared to those without this complication. However, etiology of stroke after CABG varies and some factors such as hypertension, diabetes, old age, dyslipidemia and stroke background are regarded as the stroke's risk factors after CABG⁶. In a previously performed study, the death risk of patients affected with stroke was three times higher than those without stroke⁷. Aside from stroke, differing degrees of decrease in the level of consciousness (which we will refer to as encephalopathy), a more or less evident deterioration in neuropsychological function and convulsive seizures may be observed during the immediate postoperative period following cardiac surgery⁸. The cause of many of the neurological complications of open heart surgery has not been determined, but mounting evidence has pointed to ischemic events secondary to micro-emboli. A trans-cranial Doppler ultrasound investigation provided evidence for micro-emboli in the middle cerebral artery during cardiopulmonary bypass⁹.

Methods:-

The study cohort comprised 134 patients who underwent elective CABG surgery during the 12-month period from July 2016 to June 2017 in cardiac surgery ward, Bugshan hospital, Jeddah, KSA. There were 14 women (10.4%) and 120 men (89.6%). Aged 37-77 (mean 57±20) years. Detailed history and clinical neurologic assessment of all patients was undertaken in the 2 days prior to surgery to identify preoperative neurologic abnormalities and to define previous episodes of neurologic illness and possible risk factors for neurologic complications of surgery (Age, DM, HTN, weight and height), BMI was calculated, lipid profile and color Doppler-ultrasound for carotid arteries (existence of atherosclerosis disease in carotid arteries, artery stenosis reported as percent diameter stenosis of the carotid artery) were done for all patients (≥50% stenosis considered significant). Postoperatively the patients were seen and neurologically assessed on a daily basis until discharge from the hospital. Our dependent variables were change in conscious level, Cerebro-vascular accident (CVA) and seizure. Patients with prior CVA and those died during or shortly after procedure were excluded from this study. The postoperative CVA and seizure were evaluated by using the examination of patients and evaluation of brain CT scan and EEG tests results. Brain CT and EEG were done for patients they developed neurological abnormalities. The data recording was in an anonymous manner and the participation in the study was voluntary and optional. Moreover, the above-mentioned plan was matched with the format approved by the Ethics Committee of Bugshan hospital. The statistical analysis was done using the Chi-squared test with the p-Value less than 0.05 considered significant. This analysis was performed using the SPSS-16 software.

Results:-

In this study, 134 patients undergoing CABG between July 2016 and June 2017 in Bugshan hospital, Jeddah, KSA were investigated. Of total 134 patients, 14 (10.4%) and 120 (89.6%) were female and male respectively. Mean age of the patients was 57±20 years. Of total 134 studied patients, 6 (4.5%) and 6 (4.5%) people were affected with change in conscious level (4 patient was diagnosed as hypoxic ischemic encephalopathy and 2 patient were diagnosed as non-convulsive status epilepticus) and CVA respectively. In the performed examination, of total 134 patients, 72 (53.74%) were found to have HTN, 82 (61.2%) had diabetes, 110 (82.1%) had dyslipidemia, 6 (4.5%) significant (≥50%) carotid stenosis and 112 (83.6%) had abnormal ((≥25 kg/m²) BMI, (40.3% were overweight (BMI ≥25 and <30 kg/m²), 35.8% obese (BMI ≥30 and < 35 kg/m²) and 7.5% severely obese (BMI ≥35 kg/m²). Regarding the six patients with depressed consciousness (4 patients with HIE and 2 patients with NCSE) 4 patients were with DM, 2 patients were with HTN, all patients were dyslipidemic, 4 patients were obese and 2 were overweight, 2 patients were with significant carotid stenosis (≥50%) and were aged 57,58 and 72 year old, of total population of women and men, 4 woman (28.6% of women) and 2 men (1.7% of men) had been affected after the CABG surgery (table 1). Regarding CVA (all were ischemic) 4 patients were with DM, 2 patients were with HTN, 4 patients were dyslipidemic, 2 patients were obese and 4 were overweight, 2 patients were with significant carotid stenosis (56%) and were aged 55, 74 and 76 year old, of total population of women and men, 6 men (5% of men) had been affected with CVA after the CABG surgery, no woman was affected with CVA (table 2). Regarding investigation results were done for affected 12 patients (6 with change in conscious level and 6 with CVA), CT brain showed ischemic cerebrovascular strokes, in different vascular territories, no hemorrhagic strokes were seen, (figures 1-6). Regarding the 6 patients with depressed consciousness, CT brain was unremarkable in all patients and EEG was showed picture of non-convulsive status epilepticus in 2 patients and diffuse encephalopathy in the other four.

Table (1):- Correlation between risk factors and change in consciousness

Risk factor	No. of patients	Complications (no)	P. value
HTN	72 (53.7%)	2 (2.7%)	0.0177*
DM	82 (61.2%)	4 (4.9%)	0.0006*
dyslipidemia	110 (82.1%)	6 (5.5%)	0.0001*
Abnormal BMI	112 (83.6%)	6 (5.4%)	0.0001*
Signif. carotid stenosis	6 (4.5%)	2 (33.3%)	0.2048

Table (1) showed significant correlation between HTN, DM, Dyslipidemia and BMI and postoperative complications as regard change in conscious level and insignificant correlation between carotid stenosis and these complications.

Table 2:- Correlation between risk factors and CVA

Risk factor	No. of patients	Complications (no)	P. value
HTN	72 (53.7%)	2 (2.7%)	0.0177*
DM	82 (61.2%)	4 (4.9%)	0.0006*
dyslipidemia	110 (82.1%)	4 (3.6%)	0.0003*
Abnormal BMI	112 (83.6%)	6 (5.4%)	0.0001*
Signif. carotid stenosis	6 (4.5%)	2 (33.3%)	0.2048

Table (2) showed significant correlation between HTN, DM, Dyslipidemia and BMI and postoperative complications as regard cerebrovascular stroke and insignificant correlation between carotid stenosis and these complications.

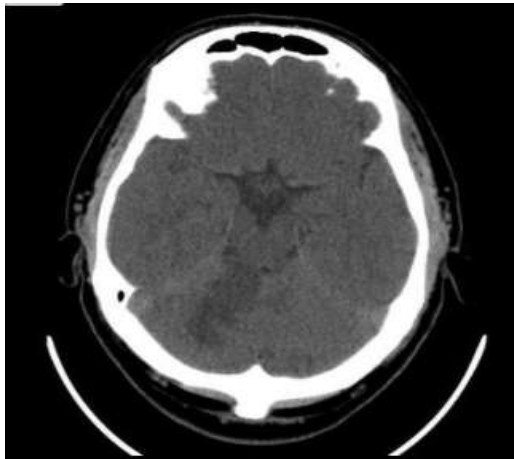


Fig. (1) A 67 year old male patient known with HTN, dyslipidemia, DM and obese, with postoperative right hemi-ataxia and truncal ataxia, CT showed right cerebellar infarction.

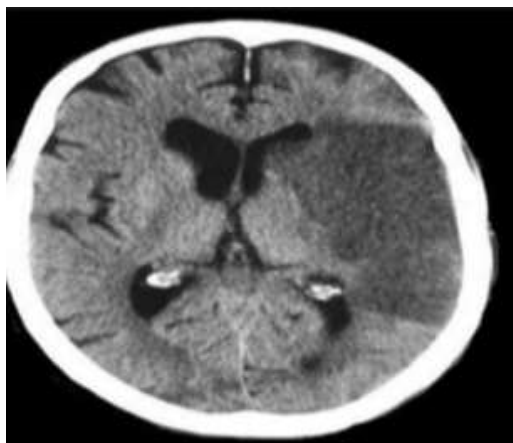


Fig. (2) A 71 year old male patient known with DM, Dyslipidemia, over weight and significant (52%) left internal carotid artery stenosis, with postoperative right sided hemiplegia and right gaze palsy, CT brain showed left middle cerebral artery territory infarction.

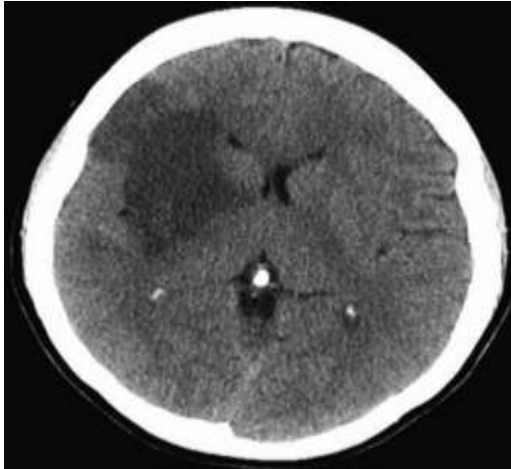


Fig. (3) A 56 year old male patient known with DM, dyslipidemia, obese and significant (50%) right internal carotid artery stenosis, with postoperative left hemiplegia more in upper limb, CT brain showed right middle cerebral artery (upper branch) territory infarction.

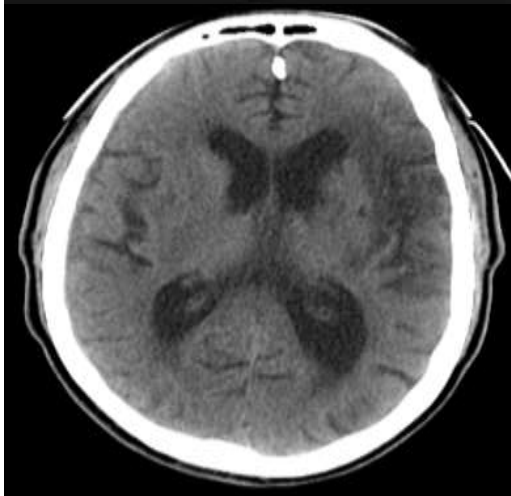


Fig. (4) A 63 year old male patient known with HTN, dyslipidemia and obesity, with postoperative right sided hemiplegia and right gaze palsy, CT brain showed left middle cerebral artery territory infarction.



Fig. (5) A 72 year old male patient known with DM and obesity, with postoperative subtle left sided hemiparesis and visual impairment, CT brain showed right posterior cerebral territory infarction.



Fig. (6) A 57 year old male patient known with overweight, with postoperative right sided hemiplegia more in lower limb, CT brain showed left middle cerebral (lower branch) territory infarction.

Discussion:-

The CABG surgery is one of the most prevalent surgeries throughout the world that many patients are undergone this surgery annually. The neurologic complication after the CABG surgery is one of the most prevalent and most costly postoperative complications. In this study, 54% had HTN, 61% had diabetes, 82% had dyslipidemia, 4.5% had significant ($\geq 50\%$) carotid stenosis and 84% had abnormal BMI. The incidence rates of postoperative HIE, seizure disorder (NCSE) and CVA were 3%, 1.5% and 4.5% respectively. No mortality due to neurological complications was observed in this study. Of total studied patients, the following percentages of patients were affected with postoperative neurological complications: 9.7% of diabetic patients, 5.5% of patients with HTN, 9% of patients with dyslipidemia, 10.7% of patients with abnormal BMI and 66.6% of patients with significant carotid stenosis. Statistically significant correlation was observed between HTN, DM, dyslipidemia and BMI and the incidence rate of disturbed LOC (P- value: 0.0177, 0.0006, 0.0001 and 0.0001 respectively) but the correlation was insignificant (P- value: 0.2048) for carotid stenosis as a risk factor. Regarding the HTN as a risk factor for postoperative neurologic complications, the results of the present study, there was a significant relationship and that agreed with¹⁰⁻¹³ they found that a significant and clear relationship between the history of HTN and the prevalence of postoperative neurologic complications, our results disagreed with^{14, 15} they reported no or poor relationship between hypertension and prevalence of postoperative neurologic complications. Regarding DM as other risk factor in our study, we found a significant correlation between DM and postoperative neurologic complications, this result was agreed with¹⁶⁻²² they found a significant correlation between DM and postoperative neurologic complications and disagreed with¹⁰⁻¹³ they found no significant correlation between DM and postoperative neurologic complications. Another risk factor which is dyslipidemia, in this study, there is a significant correlation between it and postoperative neurologic complications; this is agreed with²³⁻²⁹ they found a strong and significant correlation between dyslipidemia and postoperative neurological complications. In this study, another risk factor is BMI; we find a significant correlation between BMI and postoperative neurologic complications and this result was agreed with³⁰⁻³² they found that BMI was a significant risk factor for prevalence of neurologic complications after CABG surgery, while this result disagreed with³³ who found that BMI has no impact on postoperative neurological complications. Another risk factor which is studied in this study is the severity of carotid artery stenosis that its diagnosis and measurement was performed preoperatively using the color Doppler ultrasound, we find no significant correlation between carotid stenosis and postoperative neurologic complications and our result was agreed with^{34, 35} they reported no significant correlation between carotid stenosis and postoperative neurologic complications. This result can be indicative of this fact that this type of carotid artery stenosis cannot itself alone be a risk factor for the neurologic complications after the CABG surgery and it may be hazardous only when accompanied by other risk factors.³⁶⁻³⁹ disagreed with our result as they reported significant correlation between carotid stenosis and postoperative neurologic complications.

Conclusion:-

Proper control of HTN, DM, Dyslipidemia and obesity and proper selection of patients for CABG surgery, well improved the general outcome after surgery and decrease post-operative neurological complications.

Abbreviations:-

CABG: coronary artery bypass graft, DM: diabetes mellitus, HTN: hypertension, BMI: body mass index, NCSE: non convulsive status epilepticus, HIE: hypoxic ischemic encephalopathy, CVA: cerebro-vascular accident, LOC: loss of consciousness, CT: computed tomography, EEG: electro-encephalography.

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