# Results

## Baseline clinical data :

The age ranged between 35 to 59 years with a mean age of 48.2 ± 6.2 years. seven patients (14%) were hypertensives, nine patients (18%) had Diabetes Mellitus, three patients (6%) had dyslipidemia and four patients (8%) had +ve family history of premature CAD (**Table 1).**

**Table (1): Risk Factors of the studied patients.**

| Parameter | Total number = 50 patients |
|---|---|
| Age : Range (mean ± SD) in years. | 35-59 (48.2 ± 6.2) |
| Hypertensives ; n (%) | 7 (14%) |
| Diabetics ; n (%) | 9 (18%) |
| Dyslipidemic ; n (%) | 3 (6%) |
| Those with +ve family history of CAD ; n ( % ) | 4 (8%) |

## Clinical data before and 6 months after chemotherapy

The diastolic BP increased significantly from70 ± 18.2 mm Hg to 79.8 ± 11.0 mm Hg ($p < 0.05$). Dyspnoea and murmur of mitral regurgitation developed in 5 (10%) and 6 (12%) cases respectively after chemotherapy. The incidence of abnormal findings in the ECG as T wave inversion, and presence of arrhythmia developed in 7 cases (14%) . There was no significant change in the pulse and systolic blood pressure ($p > 0.05$) **(Table 2).**

**Table (2): Results of clinical examination and ECG before and after chemotherapy**

| | Before<br>n = 50 | After<br>n = 50 | P value |
|---|---|---|---|
| Pulse (mean ±sD) bpm | 75.8 ± 9.2 | 77.1± 12.0 | > 0.05 |
| SBP (mean ±sD)in mmHg | 121.2 ± 15.9 | 123 ± 15.7 | > 0.05 |
| DBP (mean±sD)in mmHg | 70 ± 18.2 | 79.8 ± 11.0 | < 0.05 |
| **Dyspnoea** | | | |
| No ; n ( %) | 50 (100%) | 45 (90%) | NA* |
| Yes ; n (%) | 0 | 5 (10%) | |
| **Cardiac Exam.** | | | |
| Normal ; n (%) | 50 (100%) | 44 (88%) | |
| Murmur** ; n (%) | 0 | 6 (12%) | NA |
| **ECG findings:** | | | |
| Normal ; n (%) | 50 (100%) | 43 (86%) | |
| Abnormal ECG*** ; n (%) | 0 (0) | 7 (14%) | NA |

* NA: Not applicable

** murmur: Mitral regurgitation

*** Abnormal ECG: Presence of conduction defect, arrhythmia ( PACs and PVCs) and ST segement or / and T wave changes .

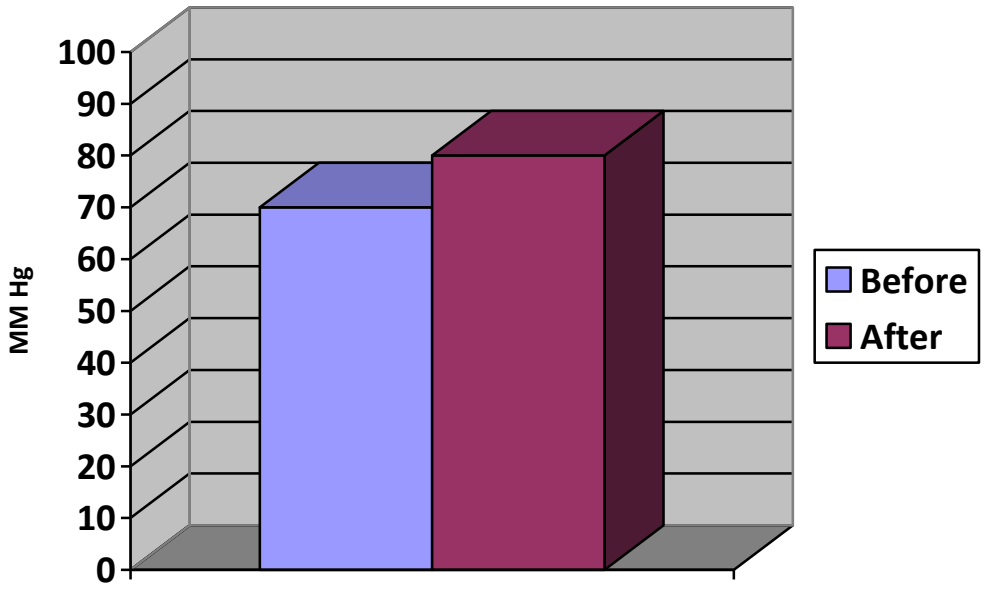


**Fig. (1): Diastolic BP before and After chemotherapy**

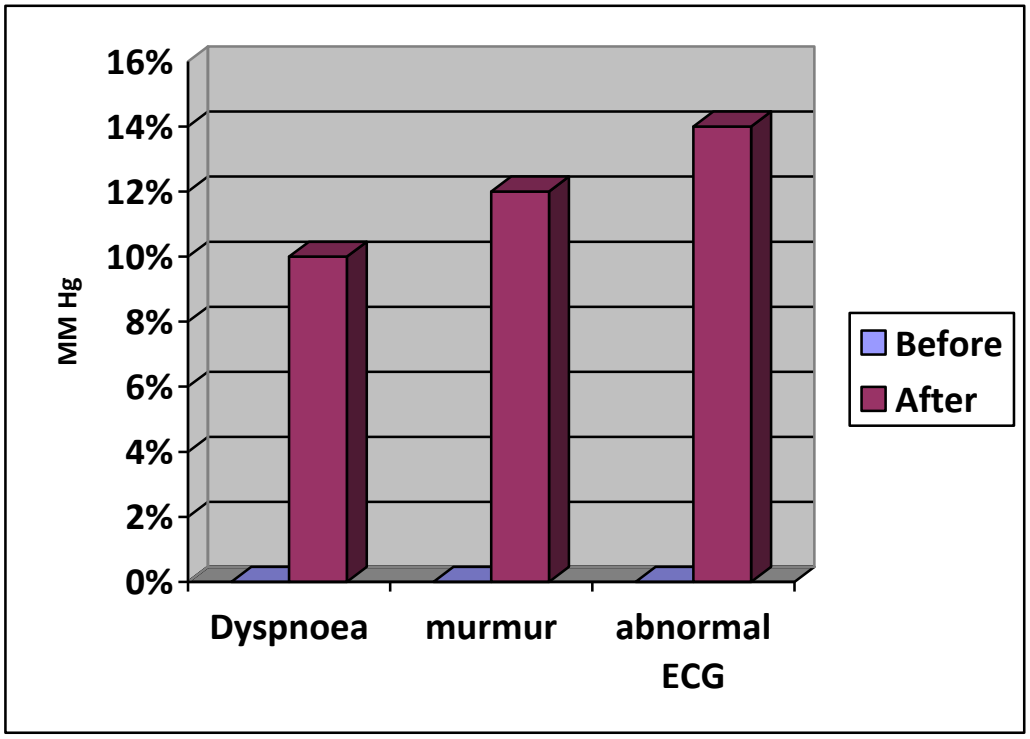


**Fig ( 2 ): Percentage of patients with abnormal results after chemotherapy**

## Echocardiographic Finding before and after chemotherapy :

**Table (3)** shows that there is no significant difference between the different echocardiographic parameters before and 6 months after chemotherapy except for the incidence of mitral regurgitation and the incidence of diastolic dysfunction which occurred in 6 (12%) and 5 (10%) patients respectively .

**Table (3): Results of echocardiographic study before and after chemotherapy**

| | Before N = 50 pt. | After N = 50 pt. | P value |
|---|---|---|---|
| EDD (Mean ± SD) (Cm) | 4.8 ± 0.6 | 4.9 ± 0.7 | > 0.05 |
| ESD (Mean ± SD) (Cm) | 2.9 ± 0.5 | 3.0 ± 0.6 | > 0.05 |
| PWT (Mean ± SD) (Cm) | 0. 8 ± 0.1 | 0.9 ± 0.1 | > 0.05 |
| SWT (Mean ± SD) (Cm) | 0.77 ± 0.1 | 0.82 ± 0.1 | > 0.05 |
| RVDD (Mean ± SD) (Cm) | 1.3 ± 0.4 | 1.34 ± 0.3 | > 0.05 |
| LAD (Mean ± SD) (Cm) | 3.3 ± 0.5 | 3.4 ± 0.4 | > 0.05 |
| Ao. (Mean ± SD) (Cm) | 3.1 ± 0.35 | 3.3 ± 0.4 | > 0.05 |
| EF% (Mean ± SD) (Cm) | 68% ± 7.8 | 65.1 ± 8.4 | > 0.05 |
| FS% (Mean ± SD) (Cm) | 37.8 ± 7.1 | 36.0 ± 6.8 | > 0.05 |
| Mitral Regurgitation (n (%)* | 0 | 6 (12%) | NA |
| Diastolic dysfunction (n (%)** | 0 | 5 (10%) | NA |

*Mitral Regurgitation ⟶MILD to Moderate

** Diastolic dysfunction ⟶Abnormal E/A ratio

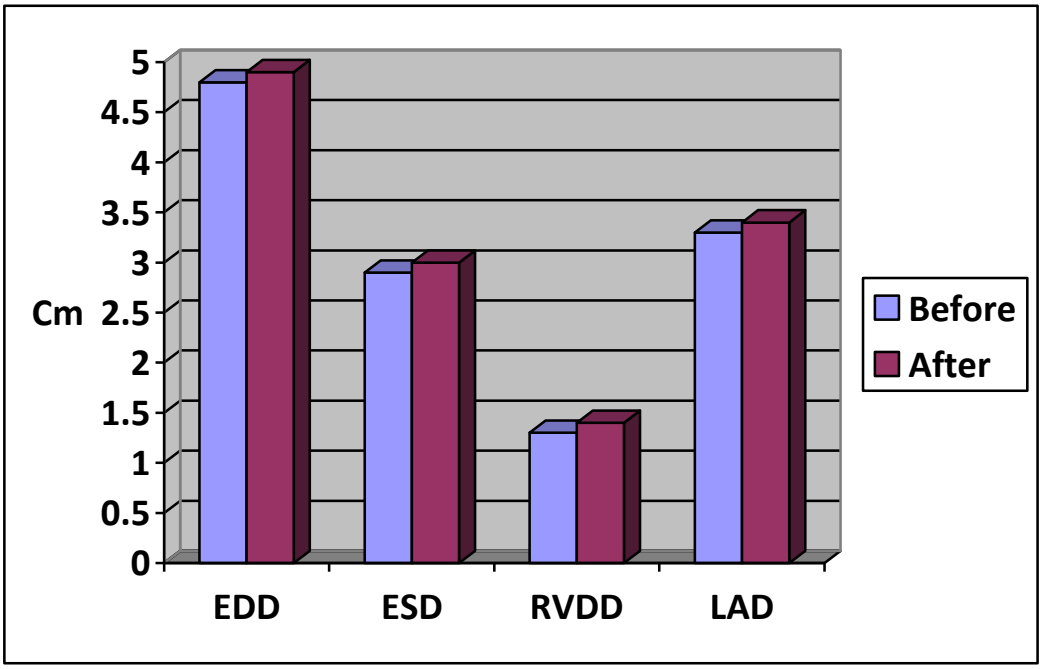


Fig (3): Cardiac chambers dimensions by echocardiography before and after chemotherapy

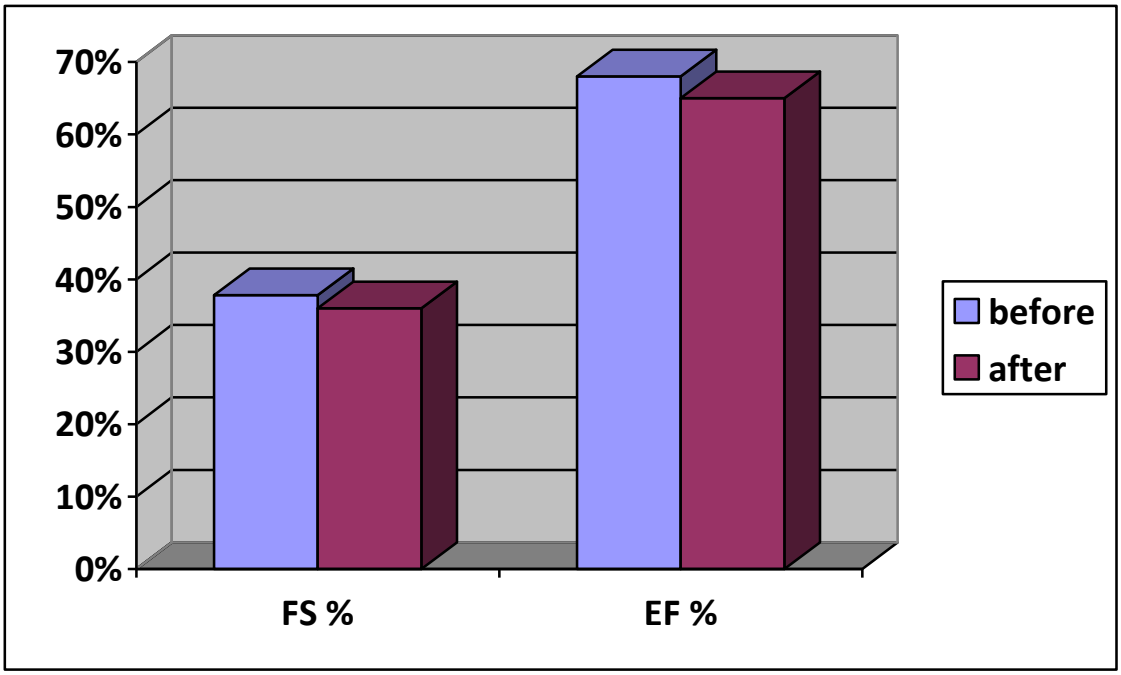


Fig (4): Indices of global systolic function before and after chemotherapy

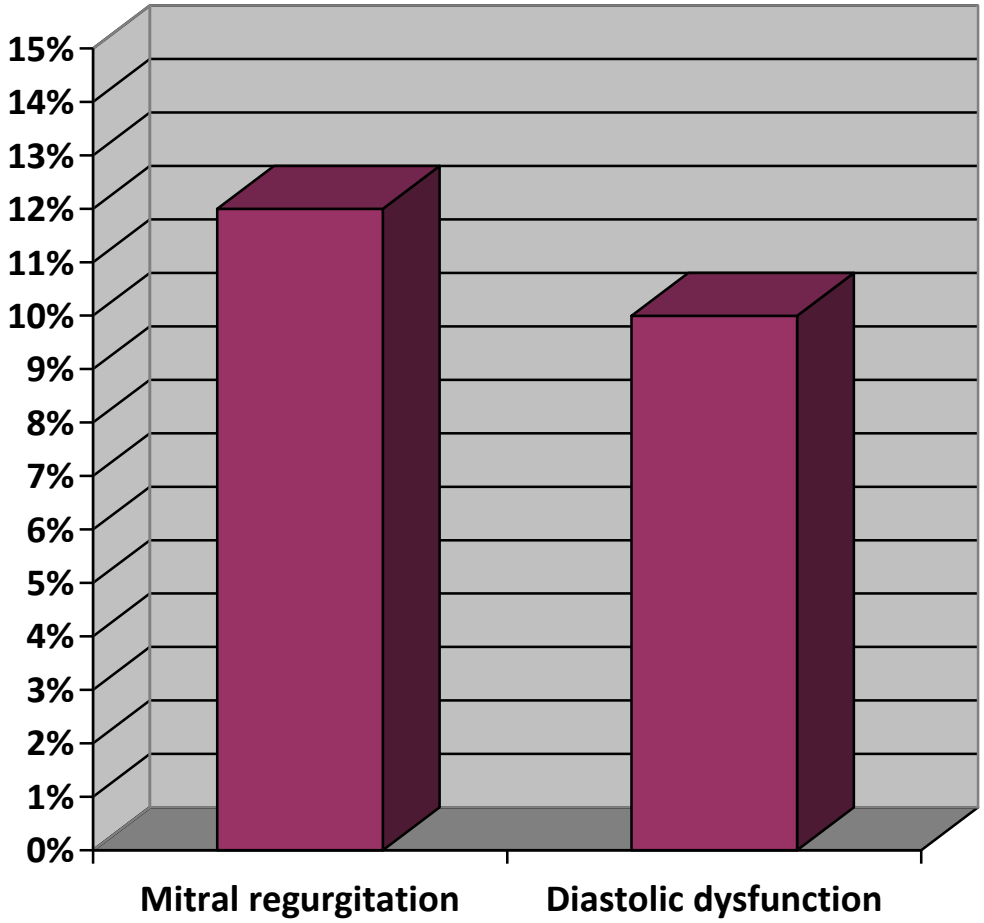


Fig (5): Incidence of mitral regurgitation and Diastolic dysfunction after chemotherapy

## Incidence of Cardiac Complications after chemotherapy :

Table (4) shows that dilated cardiomyopathy developed in 3 patients (6%), pulmonary hypertension occurred in 2 patients (4%), significant mitral regurgitation in 6 patients (12%), DVT in 2 patients (4%), and diastolic dysfunction in 5 patients (10%). The total number of patients who developed one or more cardiac complication was 11 (22 % ) i . e . about one fifth of cases .

## Their data are the following :

Patients who developed dilated cardiomyopathy were patients no. 19, 26 and 42. Their data were the following:

1). patient no **( 19 )** Aged 55 years old , hypertensive , Diabetic , + ve family history of ischemic heart diseases and breast cancer , complain of dyspnoea grade III , Apical systolic murmur , third heart sound .
The LV cavity dimensions increased from 4.7 cm to 6.3 cm at enddiastole and from 3.2 cm to 5.2 cm at endsystole .the FS and EF decreased from 32 % and 61 % to 17 % and 35 % respectively .

2). patient no **( 26 )** Aged 40 years old , diabetic , complain of dyspnoea grade III , Apical systolic murmur , third heart sound .
The LV cavity dimensions increased from 5.4 cm to 5.9 cm at enddiastole and from 2.9 cm to 4.4 cm at endsystole . the FS and EF decreased from 40 % and 66 % to 21 % and 42 % respectively .

3). patient no **(42)** Aged 58 years old , hypertensive , Diabetic , complain of dyspnoea grade II , Apical systolic murmur .
New ECG changes in the form of T wave inversion and atrial extrasystole.
The LV cavity dimensions increased from 5.4 cm to 5.8 cm at enddiastole and from 2.9 cm to 4.4 cm at endsystole . the FS and EF decreased from 46 % and 77 % to 23 % and 46 % respectively .

**Pulmonary HTN :**

. patient no **( 14 )** Aged 53 years old , not hypertensive , not Diabetic , no family history of heart disease .

( baseline PASP 25 raised to 40 mmHG )

. patient no **( 27 )** Aged 51 years old , not hypertensive , not Diabetic , no family history of heart disease .

( baseline PASP 22 raised to 35 mmHG )

Six patients developed denovo MR mild to moderate in patient no (9) , (23) , and (43) and moderate to severe in patient no (19) , (26 ) and (42 ) .

Two patients developed DVT with no evidence of pulmonary embolism .

Five patients developed diastolic dysfuncution as shown by reversed E/A in patient no ( 27 ), ( 31 ),( 34 ) and (43 ) – restrictive pattern in patient no ( 15 )

**Table (4): Complications of chemotherapy**

| Type of Complication | Complication Rate No ( % ) |
|---|---|
| Dilated Cardiomyopathy | 3 (6%) |
| Pulmonary hypertension | 2 (4%) |
| Mitral regurgitation | 6 (12%) |
| DVT | 2 (4%) |
| Diastolic Dysfunction | 5 (10%) |

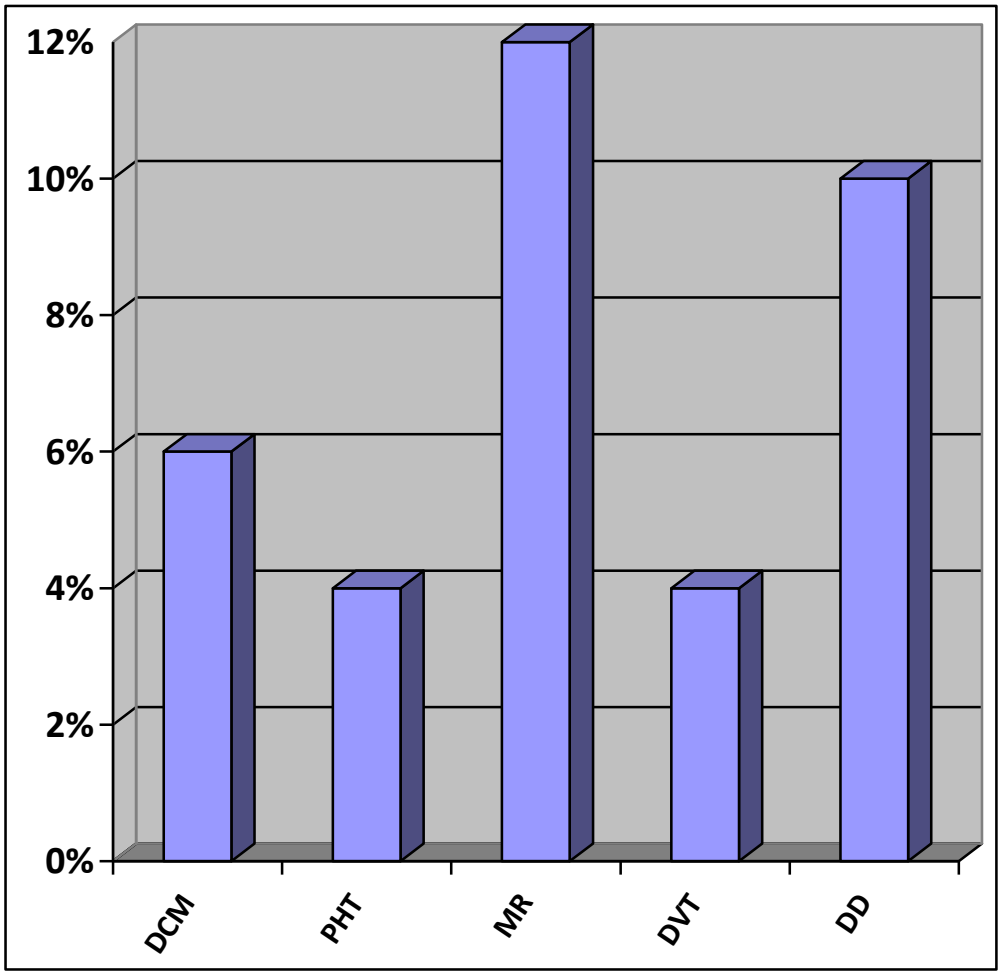


Fig. (6): Incidence of complications after chemotherapy

DCM = Dilated Cardiomyopathy

PHT = Pulmonary hypertension

MR = Mitral regurgitation

DVT = Deep vein thrombosis

DD = Diastolic Dysfunction

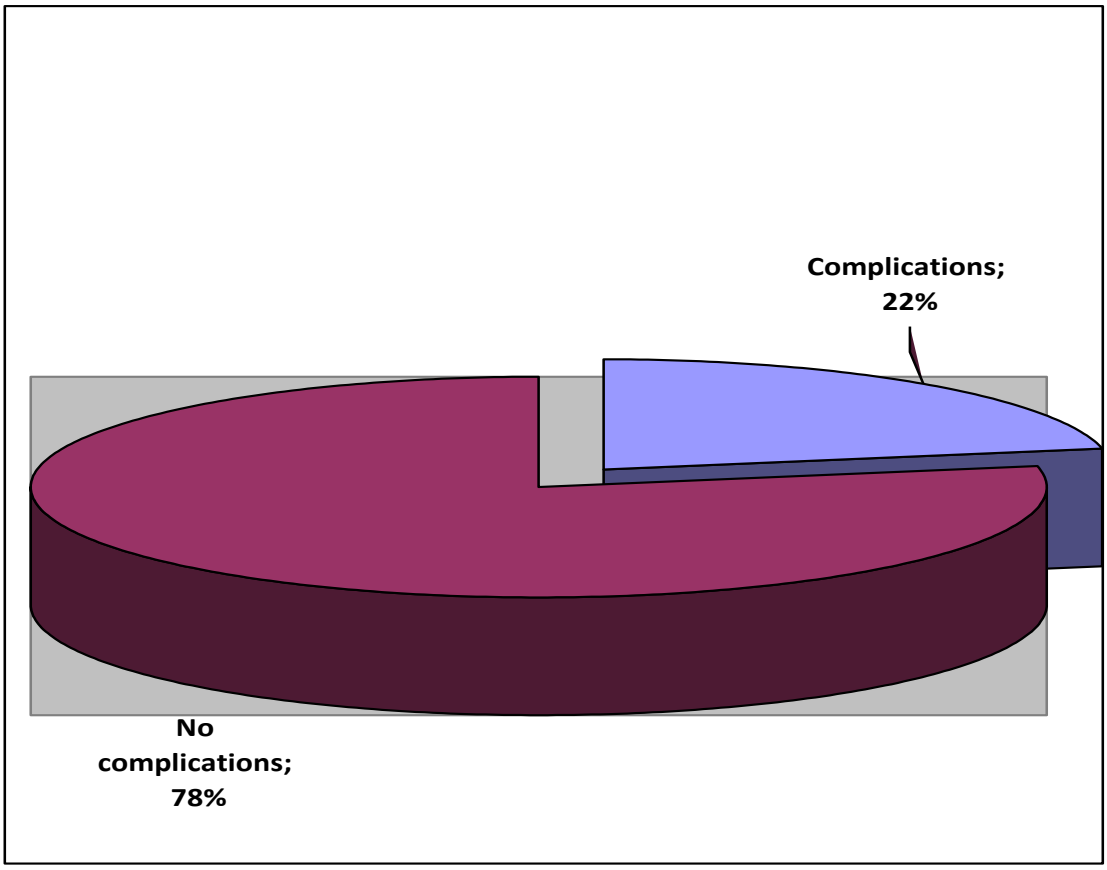


**Fig (7):** Incidence of complications after chemotherapy

The patients included in this study were classified into two subgroups according to the occurance of chemotherapy–induced cardiovascular complications :

- subgroup without complications , and
- subgroup with complications .

The baseline demographic, clinical and echocardiograpic data were compared between both groups.

As regard demographic data , the patients with complications when compared with those without complications , were older ( 51.2 ± 6.6 yrs vs 43.6 ± 4.9 yrs,$p < 0.05$ ), had higher incidence of hypertension (36.4 % vs . 7.7 % , $p < 0.001$ ) and had higher incidence of diabetes ( 36.4 % vs . 12.8 % , $p < 0.01$ ) **(Table 5).**

The mean cumulative dose of the drug used was significantly higher among patients with complications ($p < 0.001$) (Table 5)

**Table (5): Comparison between patients with and without cardiac complications as regard baseline demographic data**

| | Without complications N of pt. = 39 | With complications N of pt. = 11 | P value |
|---|---|---|---|
| Age (mean ± SD) (years) | 43.6 ± 4.9 | 51.2 ± 6.6 | < 0.05 |
| Hypertensives ; n (%) | 3 (7.7%) | 4 (36.4%) | <0.001 |
| Diabetics ; n (%) | 5 (12.8%) | 4 (36.4%) | < 0.01 |
| Cumulative dose (mean ± SD) ($mg/m^2$) | 450 ± 100 | 650 ± 150 | < 0.01 |

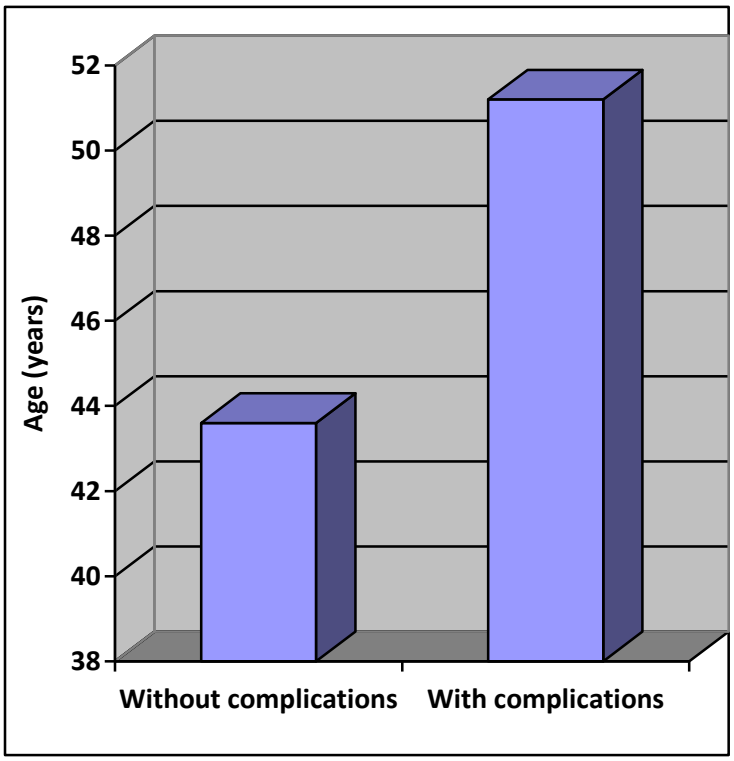


Fig. (8): Age of the patients with and without cardiac complications

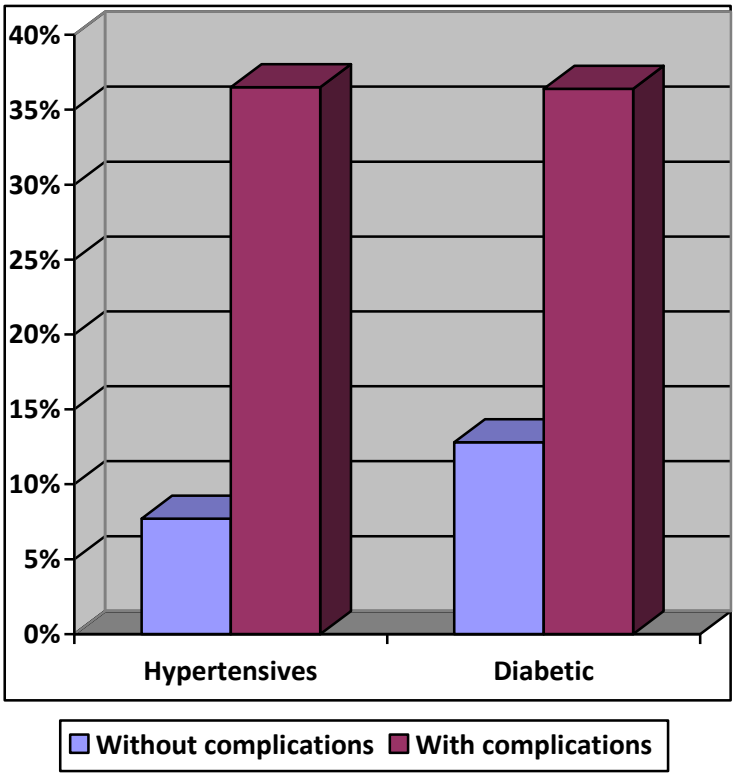


Fig. (9): The percentage of patients with hypertension and diabetes in both subgroups.

**Table(6)** shows the Comparison between patients with and without complications as regard the clinical parameters.The followings were significantly higher among patients with complications :

- Mean heart rate ( $p< 0.05$ )
- Diastolic B.P ($p<0.05$ )
- Incidence of dyspnoea ( $p < 0.05$ )
- Incidence cardiac murmur ($p < 0.05$ ) and,
- Incidence of abnormal ECG data ( $p < 0.05$ ).

**Table (6): comparison between patient with and without complications as regard clinical parameters**

| | Without complications N=39 | With complications N= 11 | P value |
|---|---|---|---|
| Pulse (Mean) | 73.5 ± 6.5 | 87.9 ± 10.6 | < 0.05 |
| SBP | 120.6 ± 14.3 | 124.7 ± 16.3 | > 0.05 |
| DBP | 76.5 ± 15.9 | 83.5 ± 15.0 | < 0.05 |
| **Dyspnoea Grade:** | | | |
| No Dyspnoea | 38 (97.4%) | 7 (63.6%) | < 0.05 |
| Dyspnoea | 1 (2.6%) | 4 (36.3%) | |
| **Cardiac Exam.** | | | |
| Normal | 36 (92.3%) | 8 (72.7%) | < 0.05 |
| Murmur | 3 (7.7%) | 3 (27.3%) | |
| **Abnormal ECG findings:** | 2 ( 5.1%) | 5 ( 45.5 % ) | <0.05 |

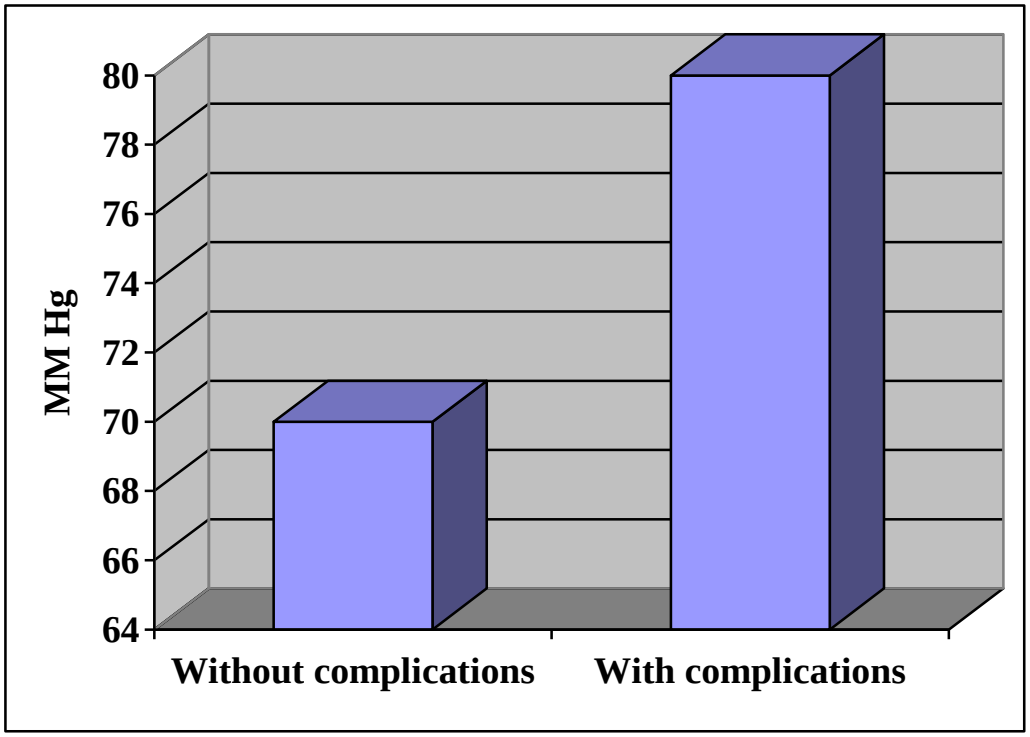


Fig. (10): Diastolic BP among patients with and without complications

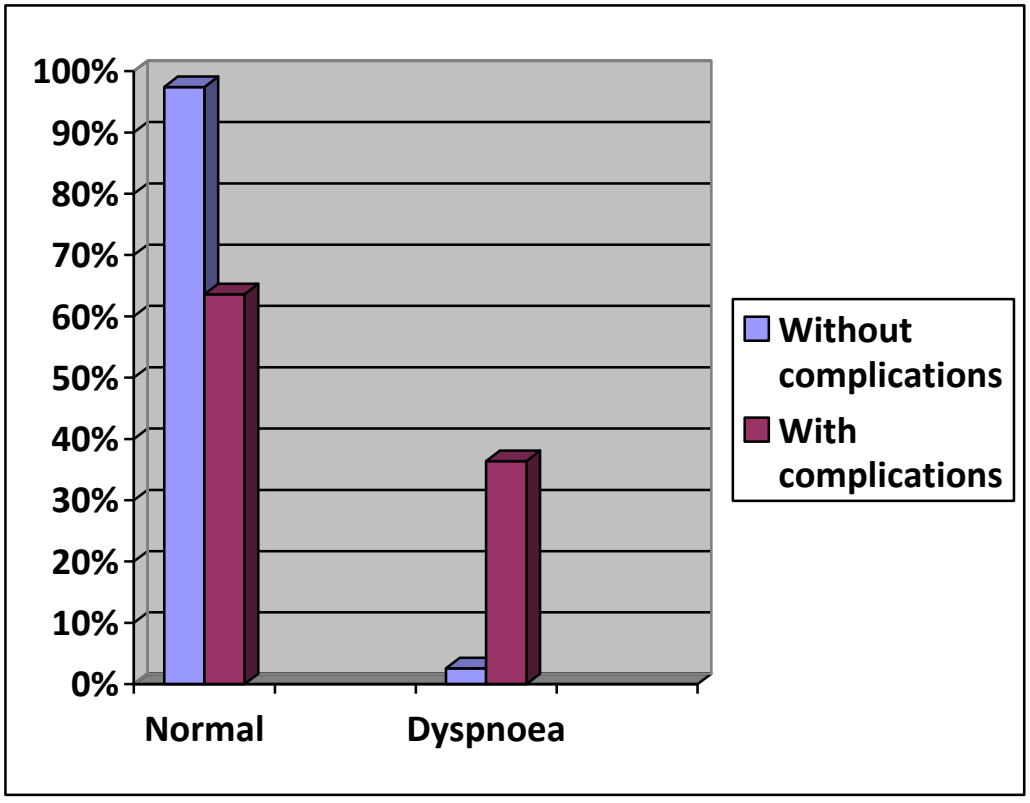


Fig. (11): Incidence of dyspnoea

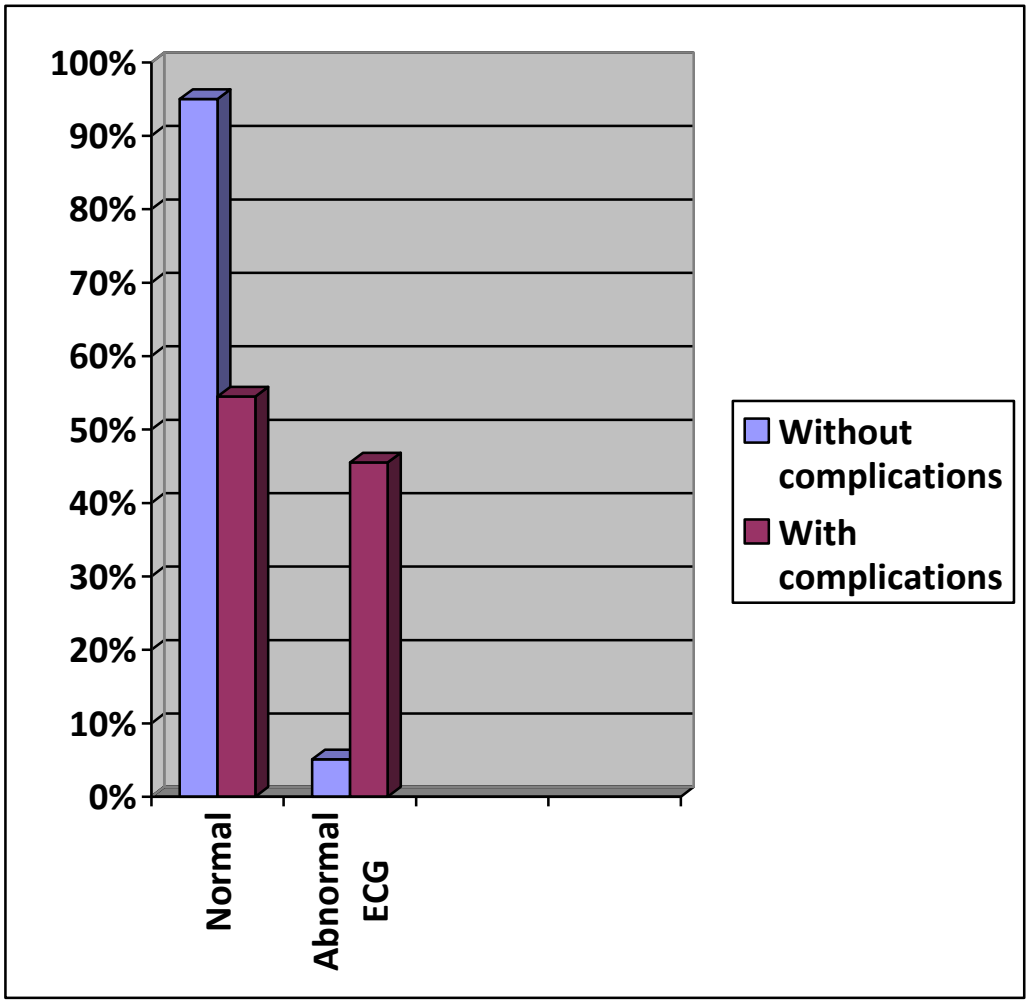


**Fig. (12)**: ECG findings among patients with and without complications

**Table (7 )** shows the comparison between patients with and without complications as regards echocardiographic data and revealed that the group of patients with complications had significantly higher mean LV dimensions at endsystole and at enddiastole and significantly lower means of FS and EF.The differences between both groups as regards the other parameters were insignificant.

**Table (7): comparison between patients with and without complications as regard echocardiogrphic data**

| | Without complications N of pt. = 39 | With complications N of pt. = 11 | P value |
|---|---|---|---|
| EDD (Mean ± SD) (Cm) | 4.7 ± 0.5 | 5.3 ± 0.8 | < 0.05 |
| ESD (Mean ± SD) (Cm) | 2.6 ± 0.4 | 3.7 ± 0.8 | < 0.05 |
| PWT (Mean ± SD) (Cm) | 0.8 ± 0.1 | 1.0 ± 0.1 | > 0.05 |
| SWT (Mean ± SD) (Cm) | 0.8 ± 0.1 | 0.89 ± 0.1 | > 0.05 |
| RVDD (Mean ± SD) (Cm) | 1.28 ± 0.3 | 1.5 ± 0.4 | > 0.05 |
| LAD (Mean ± SD) (Cm) | 3.2 ± 0.5 | 3.5 ± 0.4 | > 0.05 |
| Ao. (Mean ± SD) (Cm) | 3.1 ± 0.35 | 3.3 ± 0.4 | > 0.05 |
| EF% (Mean ± SD) (Cm) | 69% ± 6.7 | 56.5 ± 7.2 | < 0.05 |
| FS% (Mean ± SD) (Cm) | 38.5 ± 5.6 | 29.4 ± 6.3 | < 0.05 |

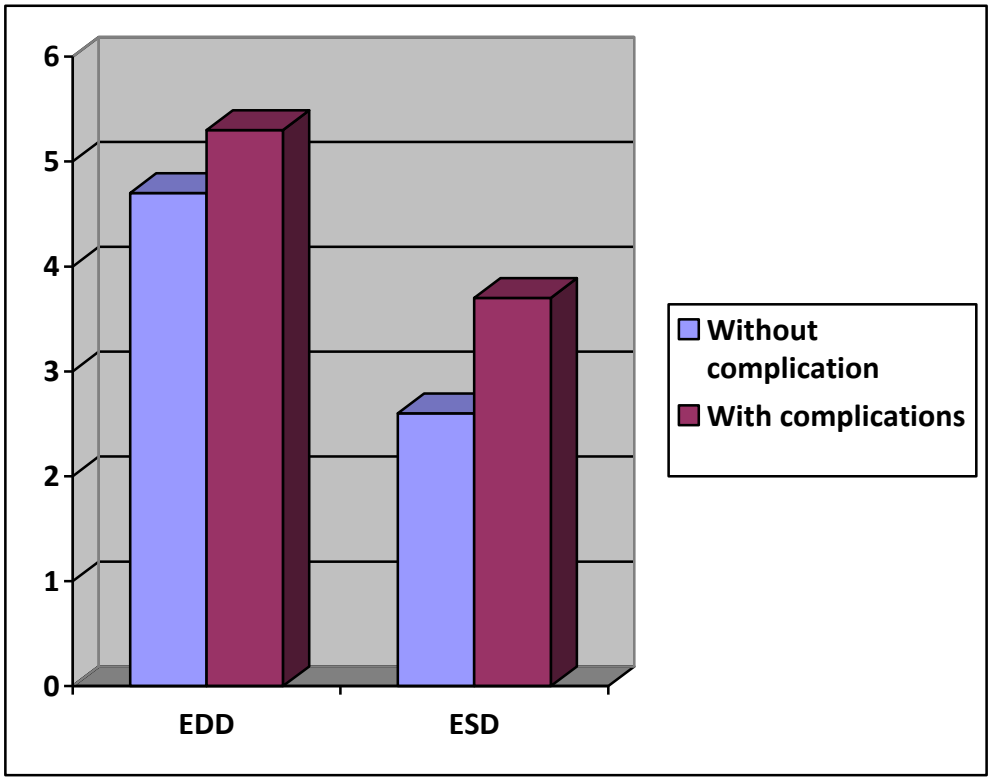


**Fig. (13):** EDD and ESD among patients with and without complications

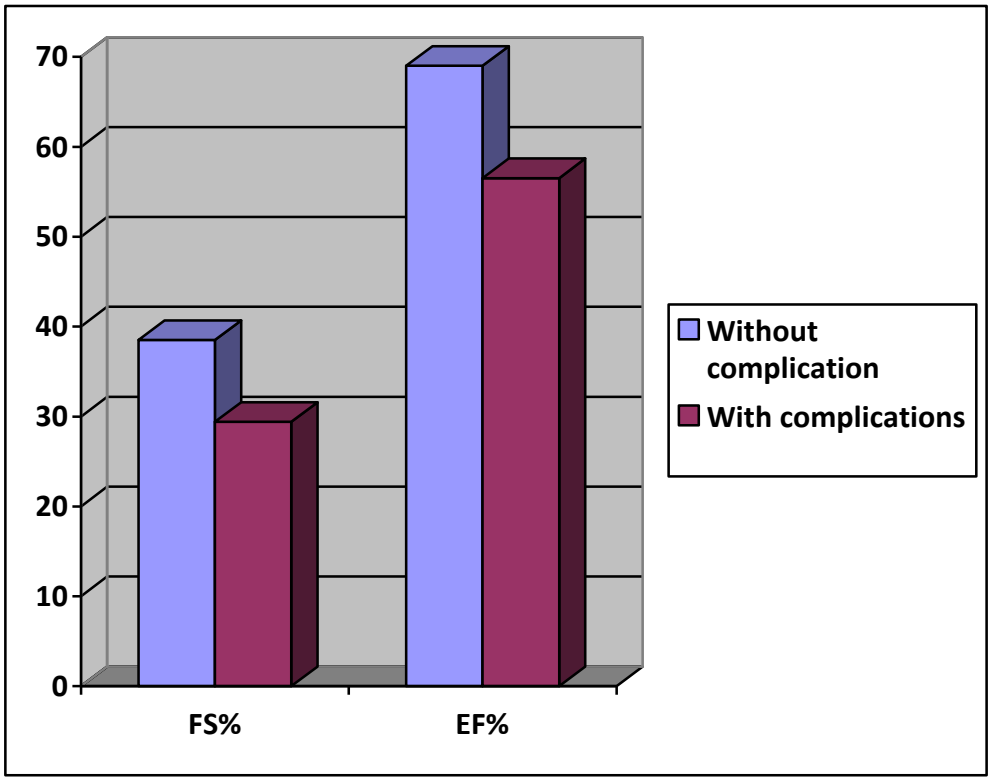


**Fig. (14):** FS% and EF% among patients with and without complications

Multivariate analysis of the different risk factors for the development of cardiovascular complications after chemotherapy showed that cumulative dose > 500 mg/$m^2$ were the most significant predictor (relative risk = 4.2 and 95% confidence interval between 2.0 -9.8), (P < 0.001), then hypertension and DM (relative risk = 2.8 and 95% confidence interval between 1.7 – 6.3) (p < 0.01). No other factors were found to have a significant prediction for the occurrence of cardiovascular complications after chemotherapy **(Table 8).**

**Table (8): multivariate analysis of the relative risk for significant predictors of the occurrence of complications after chemotherapy**

| Risk factor | Relative risk | 95% confidence interval | P value |
|---|---|---|---|
| Cumulative dose > 500 m/$m^2$ | 4.2 | 2.0 – 9.8 | < 0.001 |
| Hypertension | 2.8 | 1.7 – 6.3 | <0.01 |
| Diabetes | 2.8 | 1.7 – 6.3 | < 0.01 |