Results

In our study we looked at PHT in 80 consecutive patients with ESRD on regular hemodialysis via arterio-venous shunt (Group 1) in Benha university hospital and Kobry El-Kobba military hospital from February 2009 through February 2010 after exclusion of patients with possible secondary pulmonary hypertension. Forty random predialysis (CKD) patients were taken as a control (Group 2).

Demographic and clinical characteristics in group 1 and group 2: *(Table 1& figures 6-9).*

Comparing demographic and clinical characteristics between group 1 and group 2 there were no significant differences. (Table 1, fig.6-9)

Table 1: Demographic and clinical characteristics in group 1 and group 2

variables	Group 1	Group 2	P value
Patients No	80	40	
Age,yr (Mean±SD)	51.00±11.294	49.70±7.140	>0.05
Sex(male/female)	64(80%)/16(20%)	28(70%)/12(30%)	>0.05
DM	24(30%)	11(27.5%)	>0.05
HTN	50(62.5%)	24(60%)	>0.05
HR(BPM)	89.96±8.867	91.15±8.018	>0.05
Systolic BP(mmHg)	130.81±16.941	128.38±16.345	>0.05
Diastolic BP(mmHg)	79.12±12.319	81.50±9.884	>0.05

Fig.6: Age (yr) in group 1 and group 2

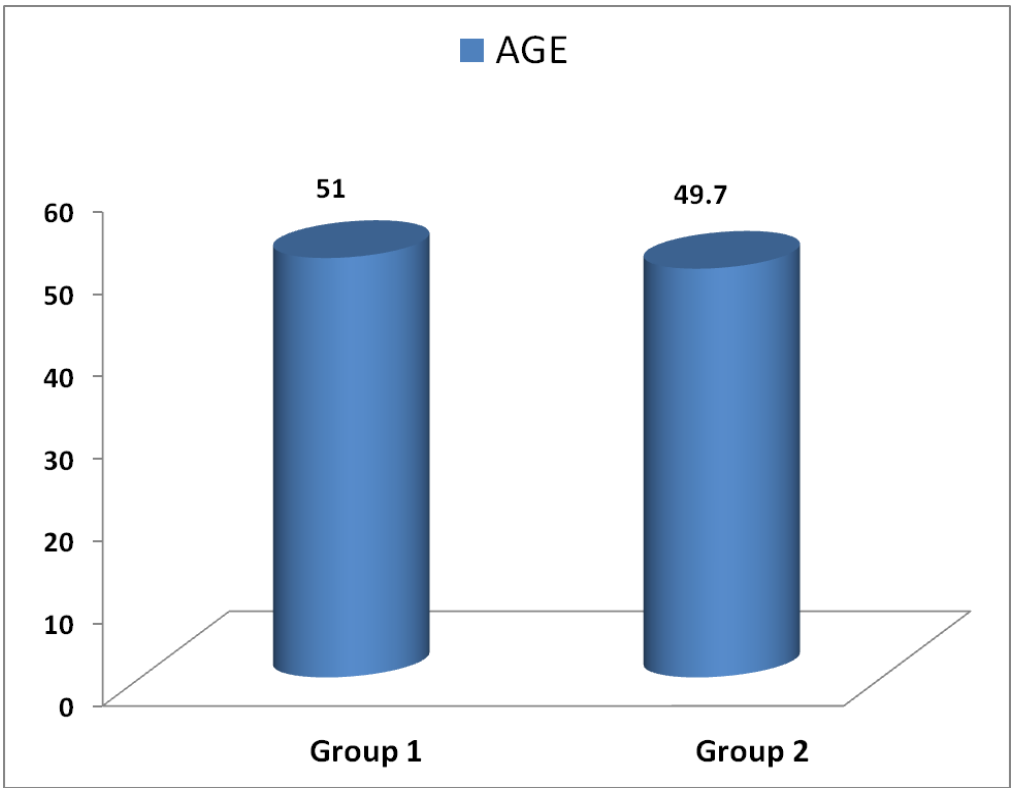


Fig.7: Sex (%) in group 1 and group 2.

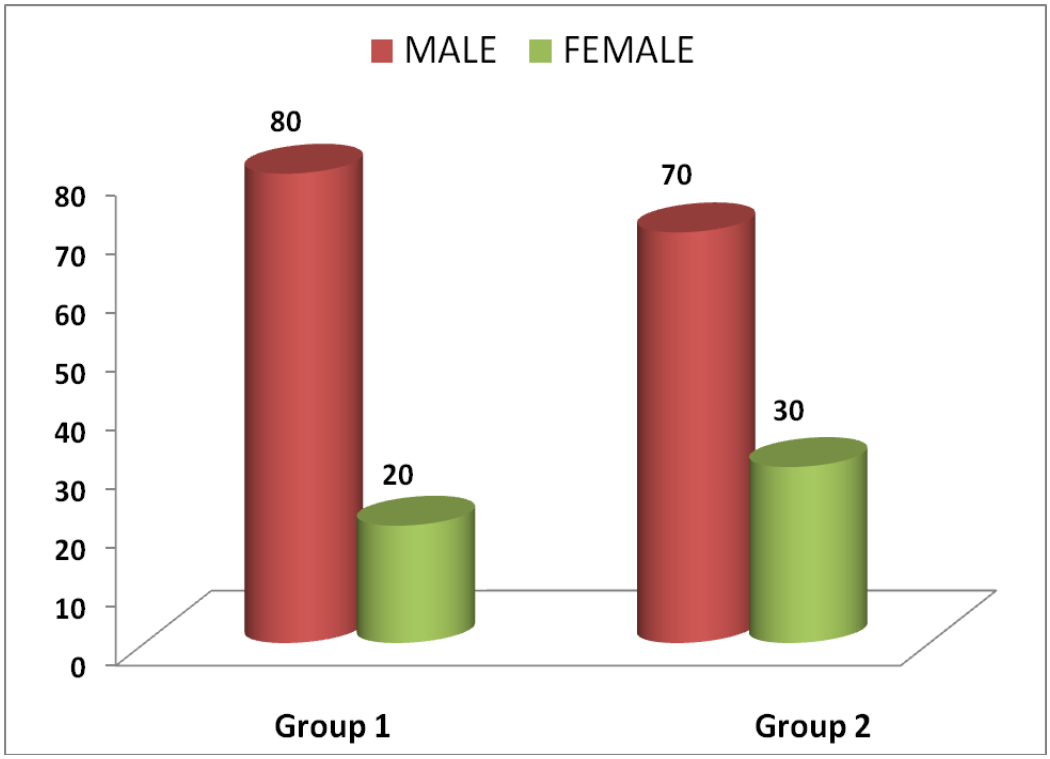


Fig.8: DM(%) and HTN(%) in group 1 and group 2.

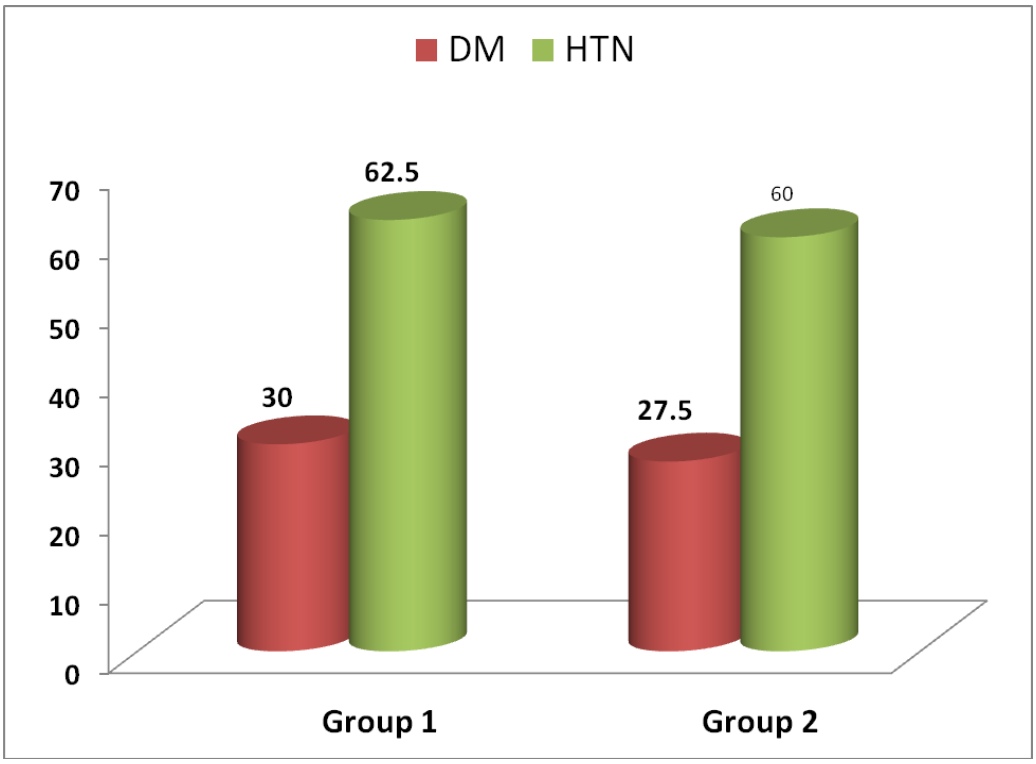
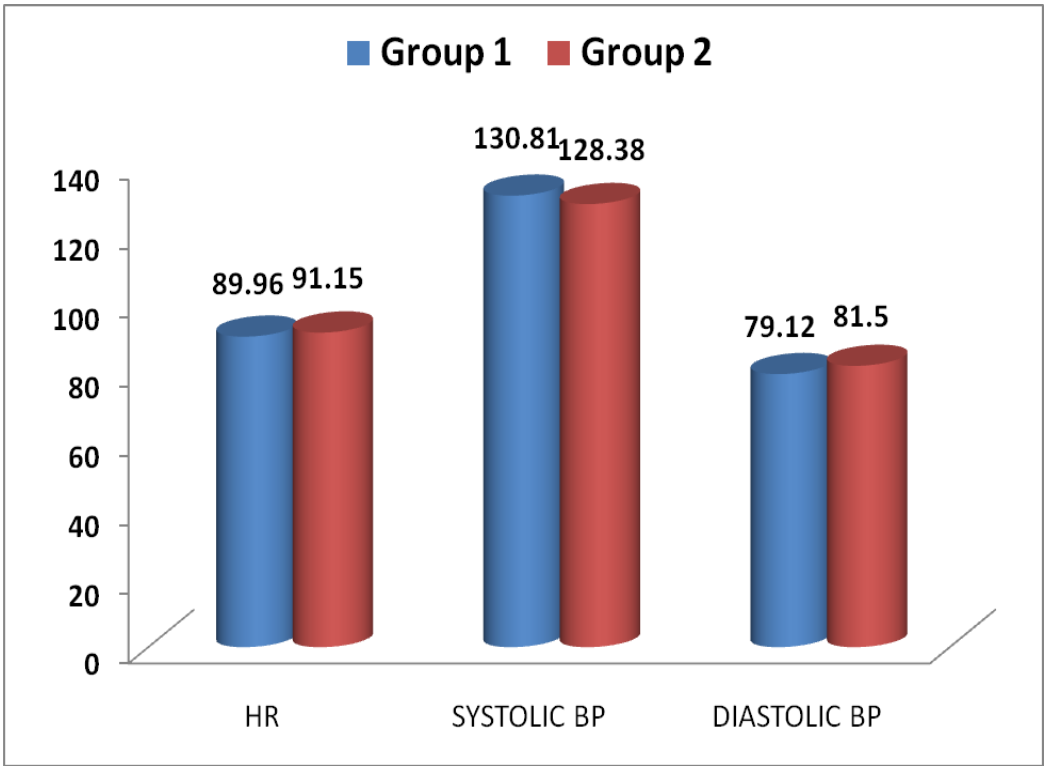


Fig.9: HR(BPM), systolic BP(mmHg) and diastolic BP(mmHg) in group 1 and group 2.



Laboratory & radiological investigations in group 1 and group 2: *(Table 2& figures 10, 11).*

Group 1 had a significantly higher S.Creatinine than group 2 where as no significant differences were found between the two groups with regard to Hb%, ECG and Chest X Ray (Table 2, fig.10, 11)

Table 2: Laboratory & radiological investigations in group 1 and group 2.

variables	Group 1	Group 2	P value
Hb% (gm/dl) (Mean±SD)	10.03±0.967	9.89±1.047	>0.05
S.Creatinine (mg/dl) (Mean±SD)	9.46±2.282	4.52±1.279	<0.05
ECG suggestive of PHT	12(15%)	4(10%)	>0.05
Chest X Ray suggestive of PHT	12(15%)	3(7.5%)	>0.05

Fig.10: Hb %(gm/dl) and S.Creatinine (mg/dl) in group 1 and group 2.

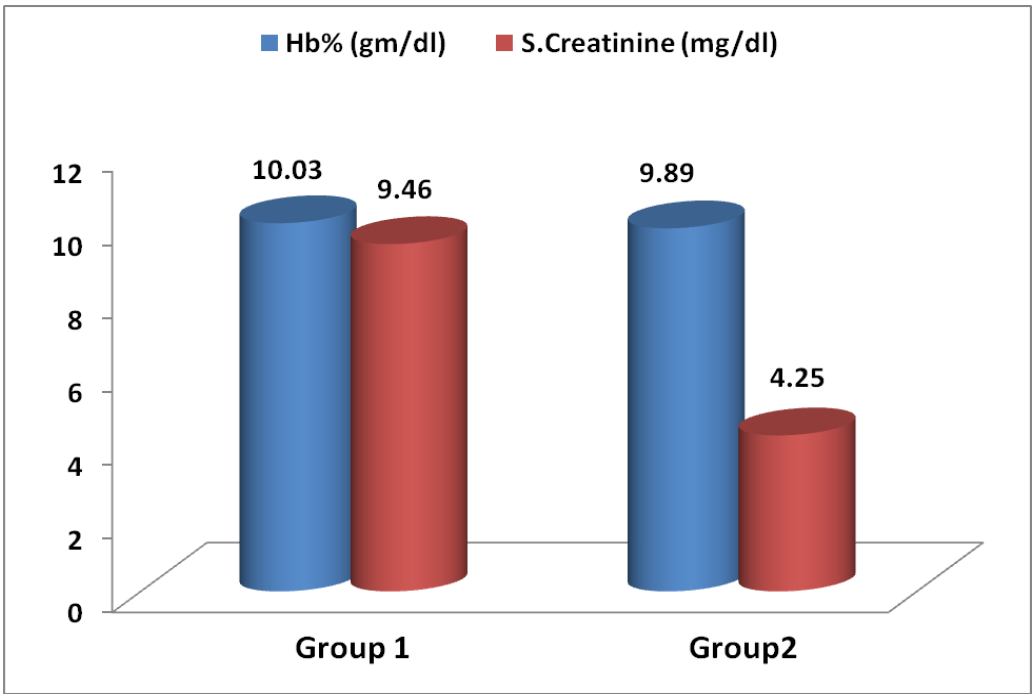
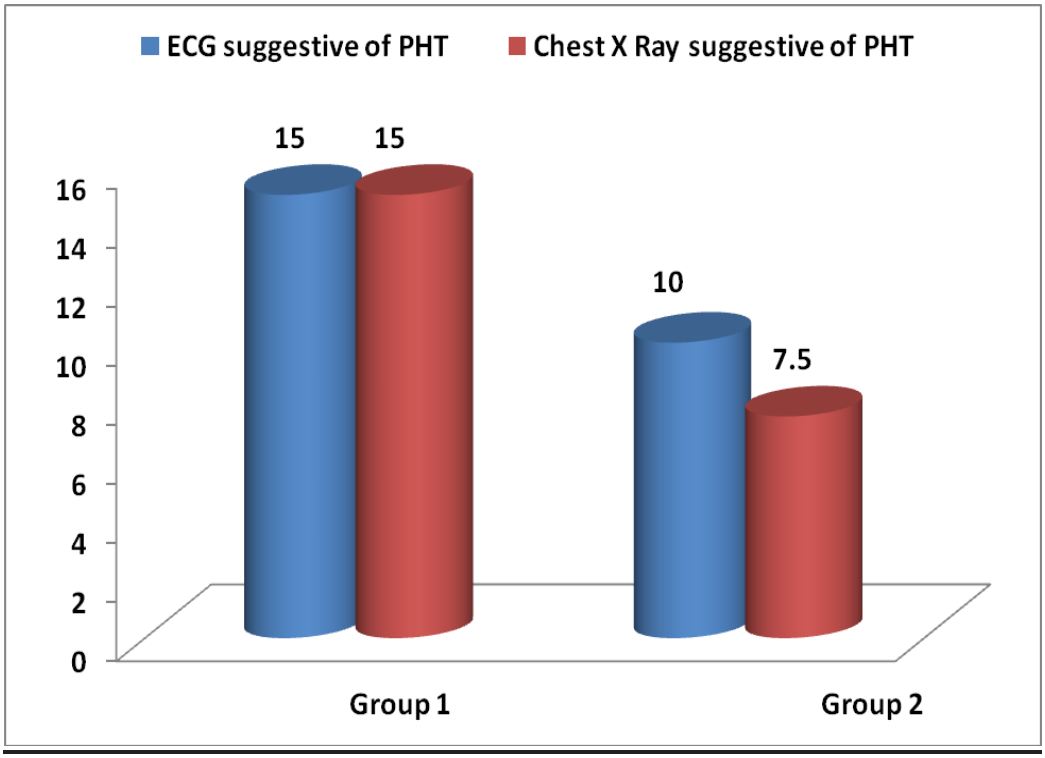


Fig.11: ECG suggestive of PHT (%) and Chest X Ray suggestive of PHT (%) in group 1 and group 2.



Echocardiographic data in group 1 and group 2: *(Table 3& figure 12-14).*

Group 1 had a significantly higher COP, sPAP and EF % than group 2 where as no significant differences were found between the two groups with regard to PHT, LVH and diastolic dysfunction (all patients had diastolic dysfunction grade 1). In group 1, 16(20 %) patients had PHT and 64 (80%) patients had no PHT with mean sPAP (33.1332±15.57697) mmHg whereas in group 2, 5(12.5 %) patients had PHT and 35 (87.5%) patients had no PHT with mean sPAP (26.0883±8.66754). (Table 3, fig.12-14)

Table 3: Echocardiographic data in group 1 and group 2.

variables	Group 1	Group 2	P value
COP(L/min) (Mean±SD)	8.405±1.5450	7.530±0.6207	<0.05
sPAP(mmHg) (Mean±SD)	33.1332±15.57697	26.0883±8.66754	<0.05
PHT(sPAP>35mmHg)	16(20 %)	5(12.5 %)	>0.05
-mild(35-49 mmHg)	7	4	
-moderate(50-69mmHg)	4	1	
-severe(≥70mmHg)	5	0	
EF% (Mean±SD)	63.46±5.65	59.48±7.338	<0.05
LVH	43(53.8%)	17(42.5%)	>0.05
Diastolic Dysfunction	39(48.7%)	16(40%)	>0.05

Fig.12: COP (L/min), sPAP (mmHg) and EF% in group 1 and group 2.

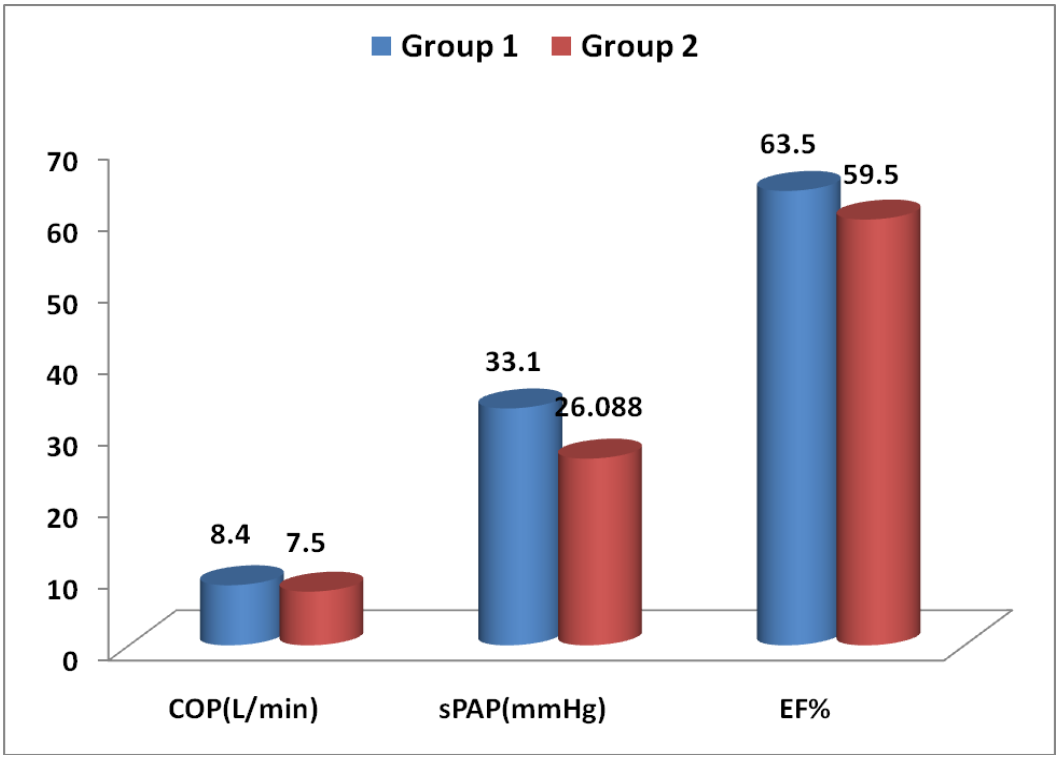


Fig.13: PHT and no PHT in group 1 and group2

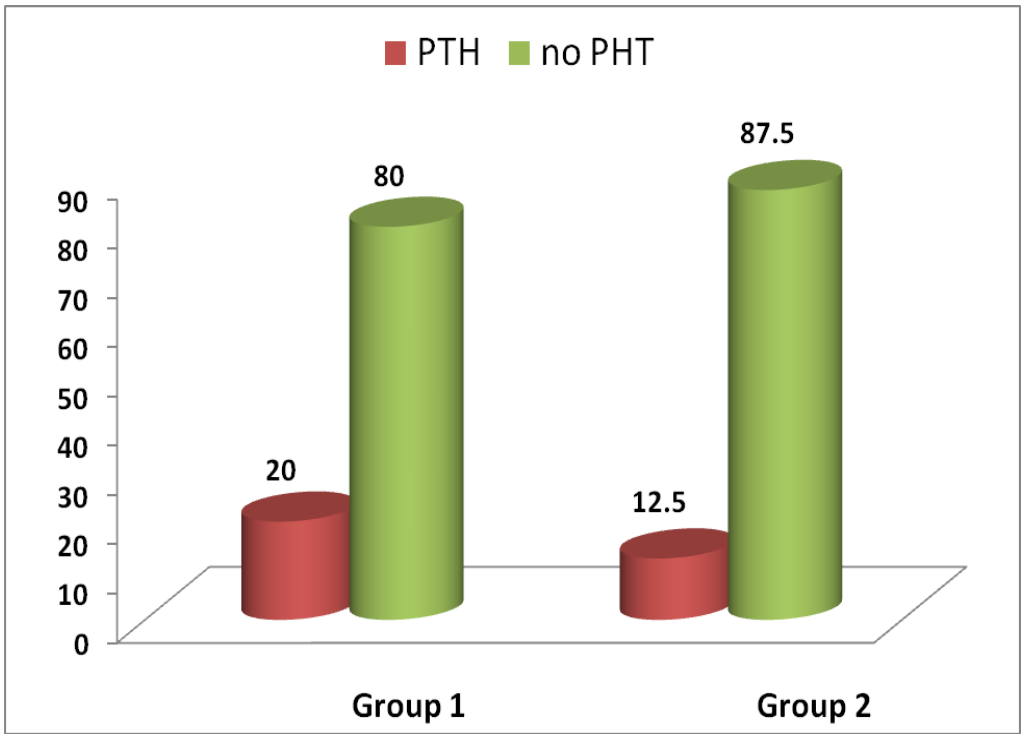
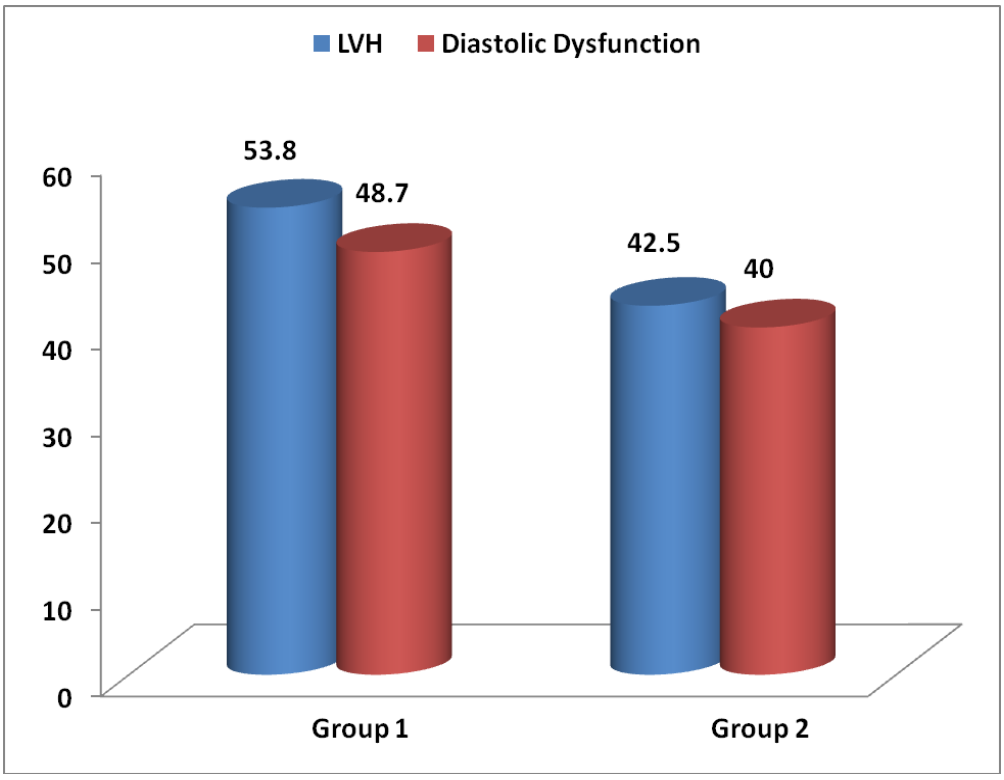


Fig.14: LVH (%) and diastolic dysfunction (%) in group 1 and group2.



Group 1 further subdivided into 2 groups:

Group A: included 16 patients with PHT (sPAP >35 mmHg)

Group B: included 64 patients without PHT (sPAP <35 mmHg)

Data of both groups were compared with each other.

Demographic and clinical characteristics in group A and group B: *(Table 4& figure 15-20).*

The mean dialysis duration (months) in the group A was (70.88) and (22.34) months in group B with highly significant difference (P-value<0.001) where as no significant differences were found between both groups with regard to age, sex, DM, HTN , shunt site,HR,systolic BP and diastolic BP. (Table 4, fig.15-20)

Table 4: Demographic and clinical characteristics in group A and group B

variables	Group A	Group B	P value
Patients No	16	64	
Age,yr (Mean±SD)	51.06±6.567	50.98±12.234	>0.05
Sex(male/female)	12(75%)/4(25%)	52(81.2%)/12(18.8%)	>0.05
DM	7 (43.8%)	17 (26.6%)	>0.05
HTN	11 (68.8%)	39 (60.9%)	>0.05
Dialysis Duration (months)	70.88±27.208	22.34±30.618	<0.001
Shunt Site(Brachial/Radial)	5(31.3%)/11(68.7%)	10(15.6%)/54(84.4%)	>0.05
HR(BPM)	91.06±10.083	89.69±8.602	>0.05
Systolic BP(mmHg)	135.00±18.974	129.77±16.389	>0.05
Diastolic BP(mmHg)	84.06±12.678	77.89±12.012	>0.05

Fig.15: Age (yr) in group A and group B.

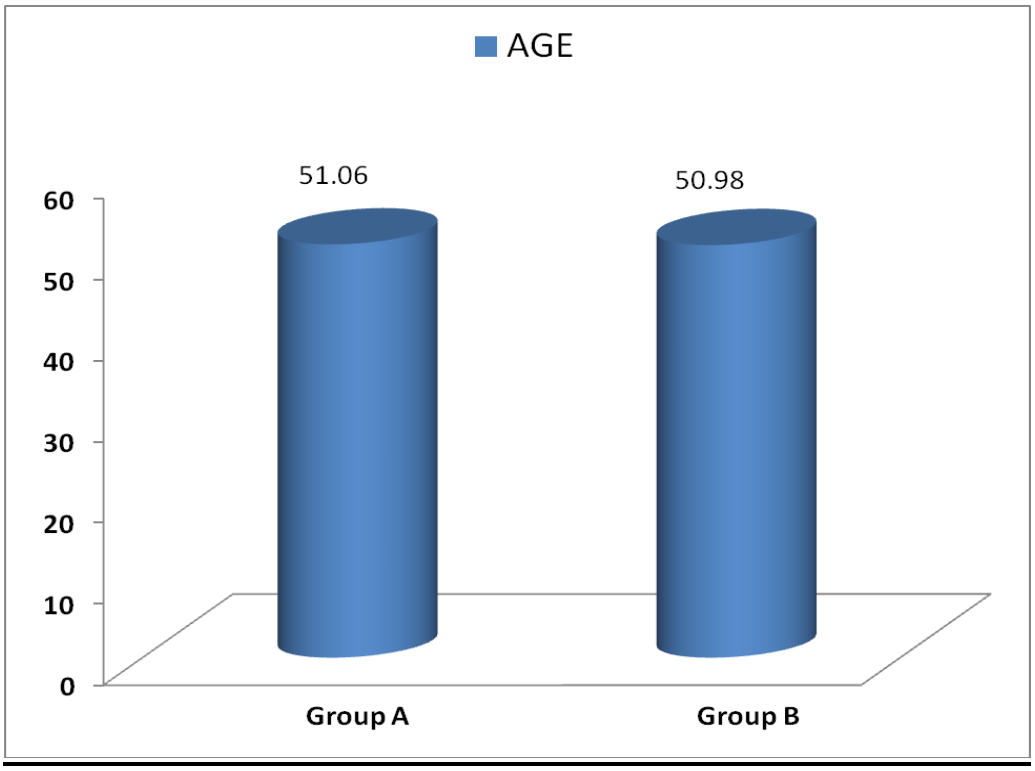


Fig.16: Sex (%)in group A and group B.

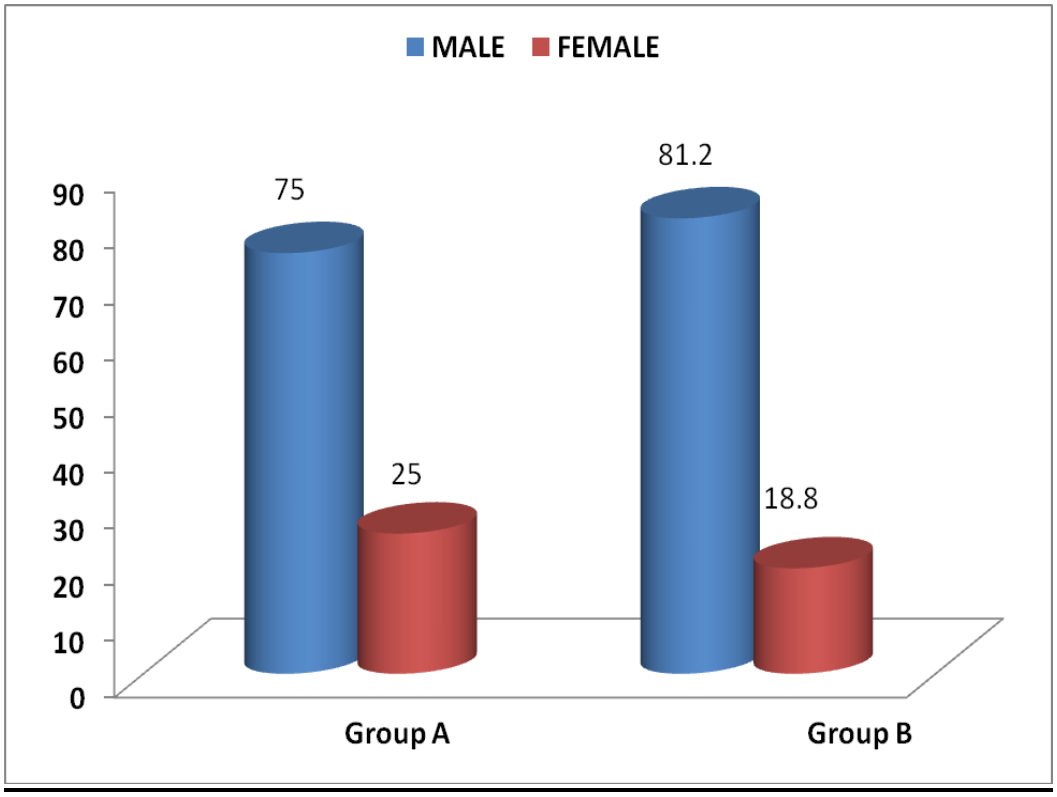


Fig.17: DM (%) and HTN (%) in group A and group B.

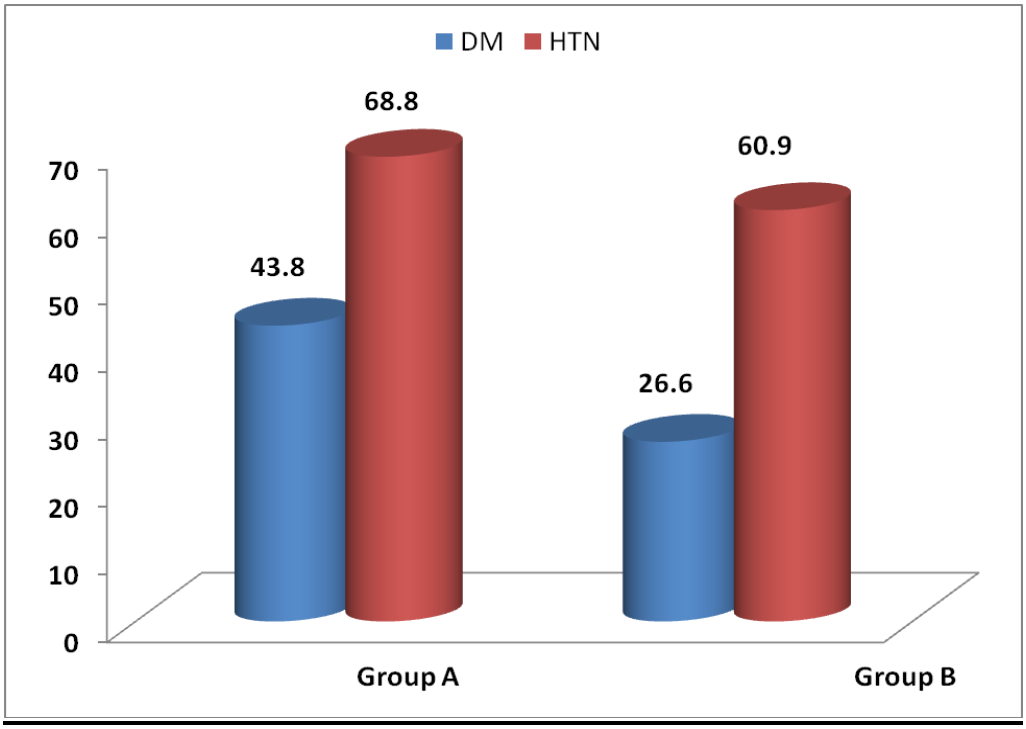


Fig.18: Dialysis duration(months) in group A and group B.

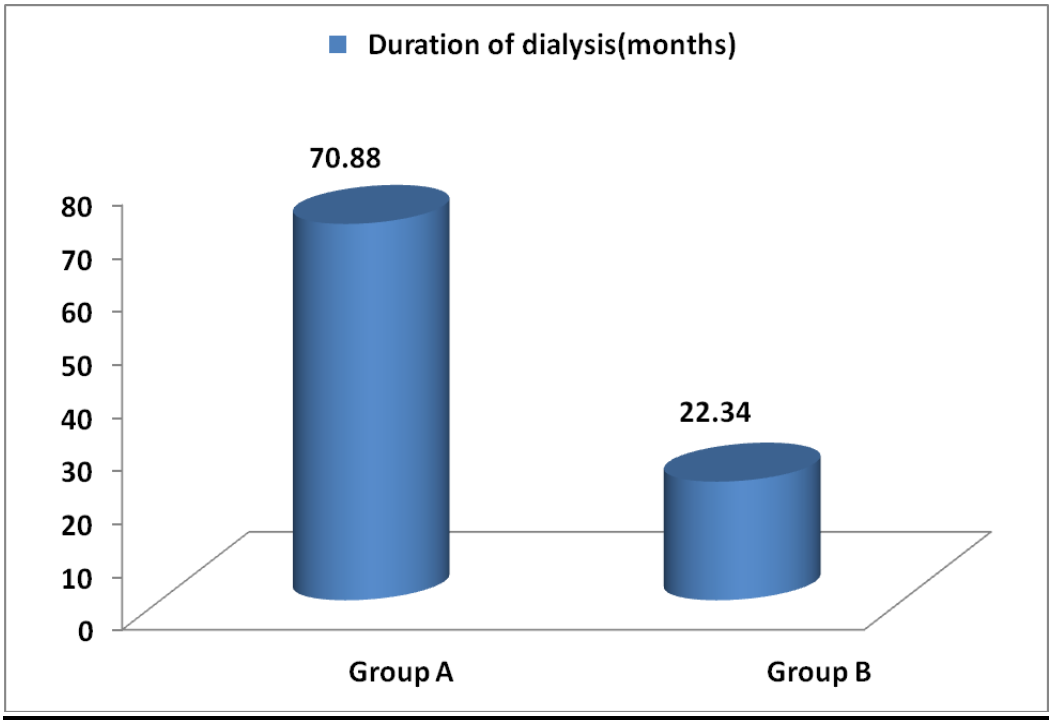


Fig.19: Shunt site (brachial/radial %) in group A and group B.

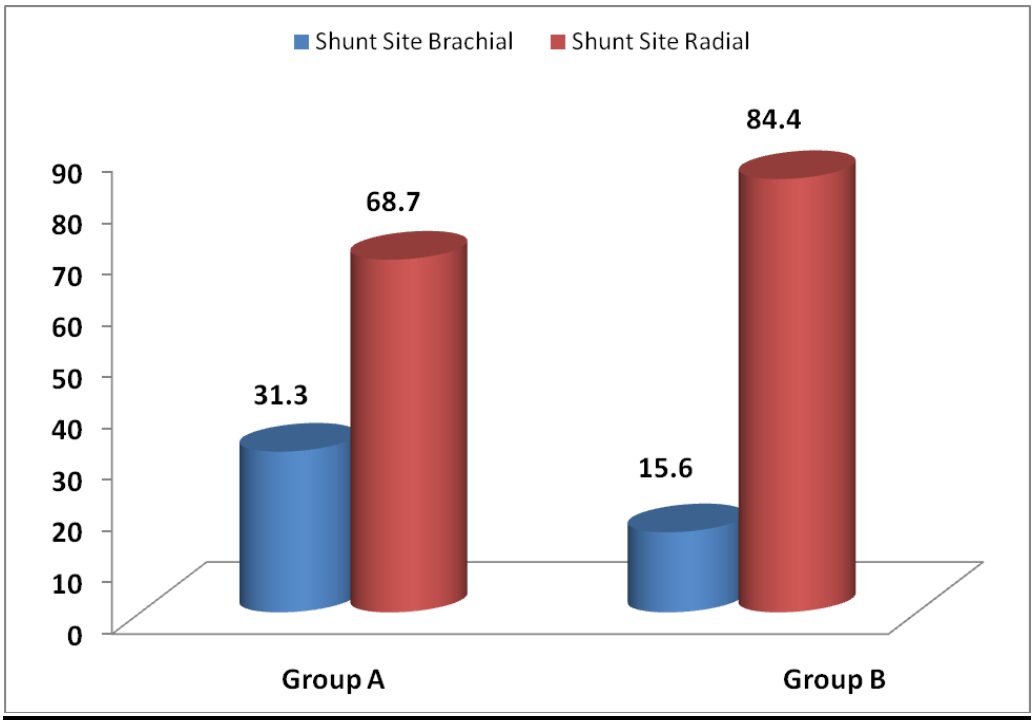
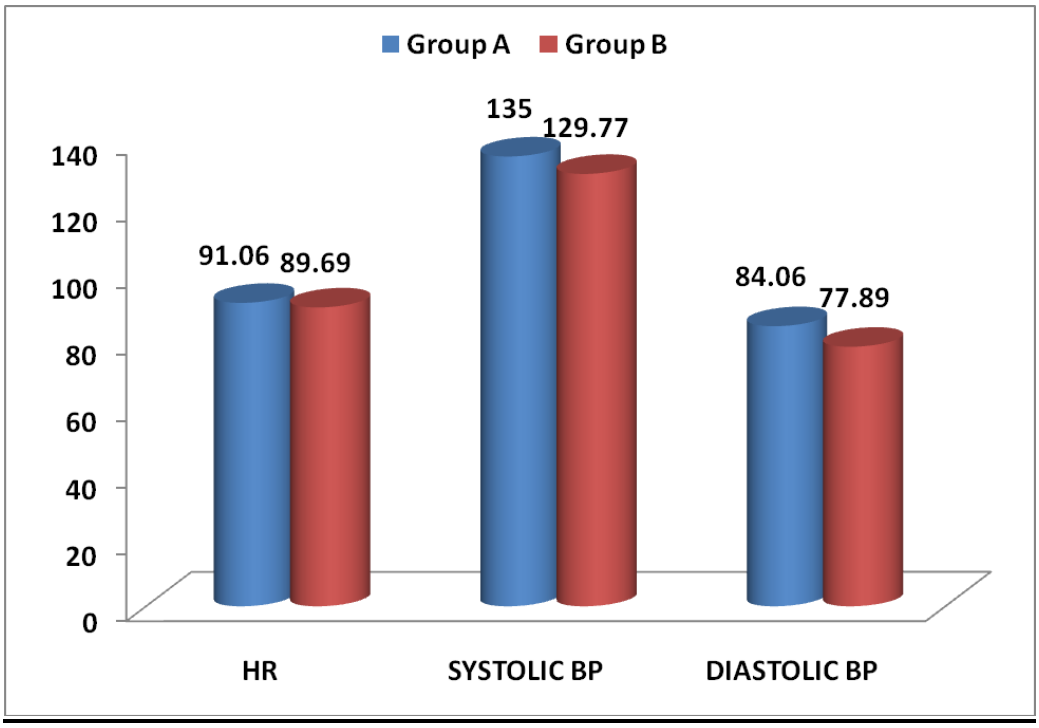


Fig.20: HR(BPM), systolic BP(mmHg) and diastolic BP(mmHg) in group A and group B



Laboratory & radiological investigations in group A and group B: *(Table 5& figures 21, 22).*

Group A had a significantly lower Hb% and a highly significant difference of ECG and Chest X Ray than group B where as no significant difference was found between both groups with regard to S.Creatinine (Table 5, fig.21, 22)

Table 5: Laboratory & radiological investigations in group A and group B

variables	Group A	Group B	P value
Hb% (gm/dl) (Mean±SD)	9.56±0.961	10.15±0.939	<0.05
S.Creatinine (mg/dl) (Mean±SD)	8.88±2.149	9.60±2.307	>0.05
ECG suggestive of PHT	10(62.5%)	2(3.1%)	<0.001
Chest X Ray suggestive of PHT	11(68.8%)	1(1.6%)	<0.001

Fig. 21: Hb %(gm/dl) and S.Creatinine (mg/dl) in group A and group B.

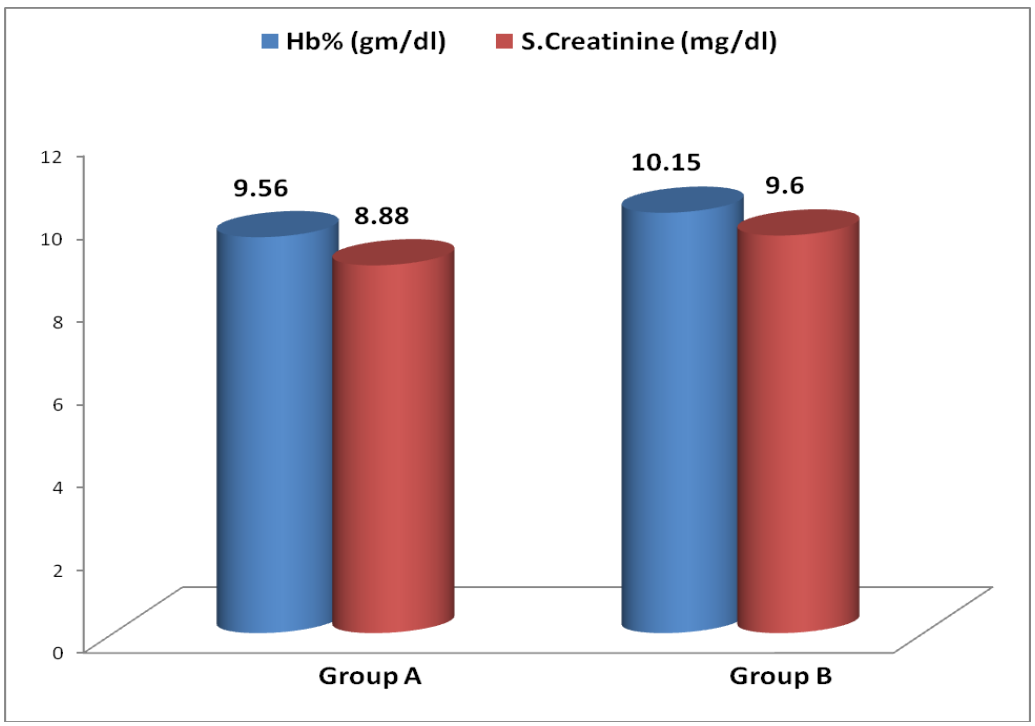
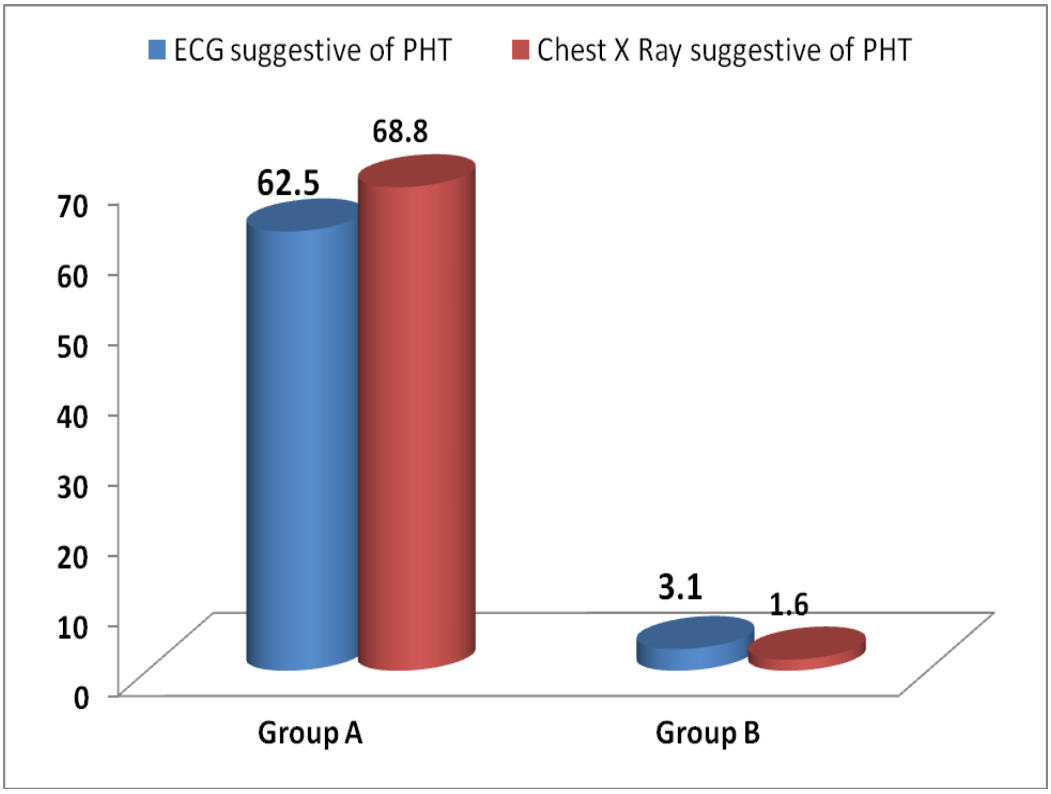


Fig.22: ECG suggestive of PHT (%) and Chest X Ray suggestive of PHT (%) in group A and group B.



Echocardiographic data in group A and group B: *(Table 6& figure 23, 24).*

The mean COP in group A was (9.256) L/min and (8.192) L/min in group B with significant difference (P-value<0.05) where as the mean sPAP in the group A was (59.1644) mmHg and (26.6255) mmHg in group B with highly significant difference (P-value<0.001) while no significant differences were found between both groups with regard to EF%, LVH and diastolic dysfunction. (Table 6, fig.23, 24)

Table 6:_Echocardiographic data in group A and group B

variables	Group A	Group B	P value
COP(L/min) (Mean±SD)	9.256±1.7538	8.192±1.4251	<0.05
sPAP(mmHg) (Mean±SD)	59.1644±17.28545	26.6255±4.24363	<0.001
EF% (Mean±SD)	61.69±6.215	63.91±5.462	>0.05
LVH	11(68.8%)	32(50.0%)	>0.05
Diastolic Dysfunction	9(56.2%)	30(46.9%)	>0.05

Fig.23: COP (L/min), sPAP (mmHg) and EF% in group A and group B.

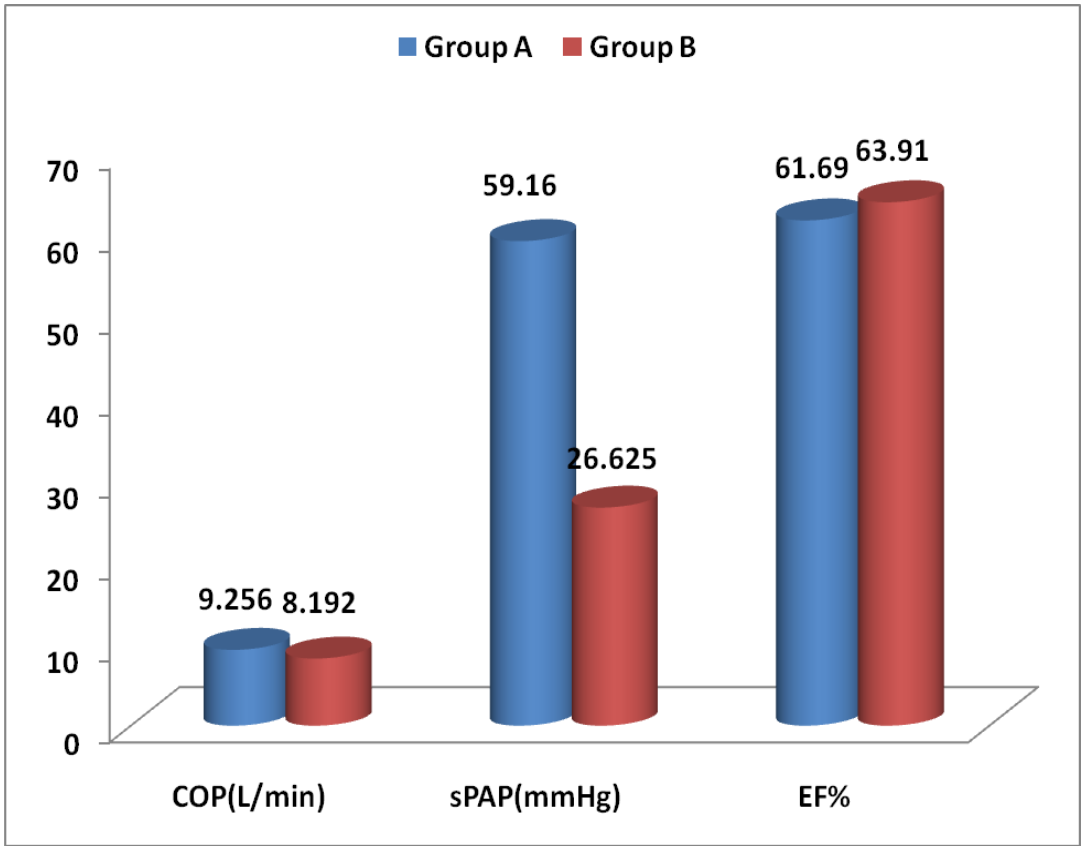
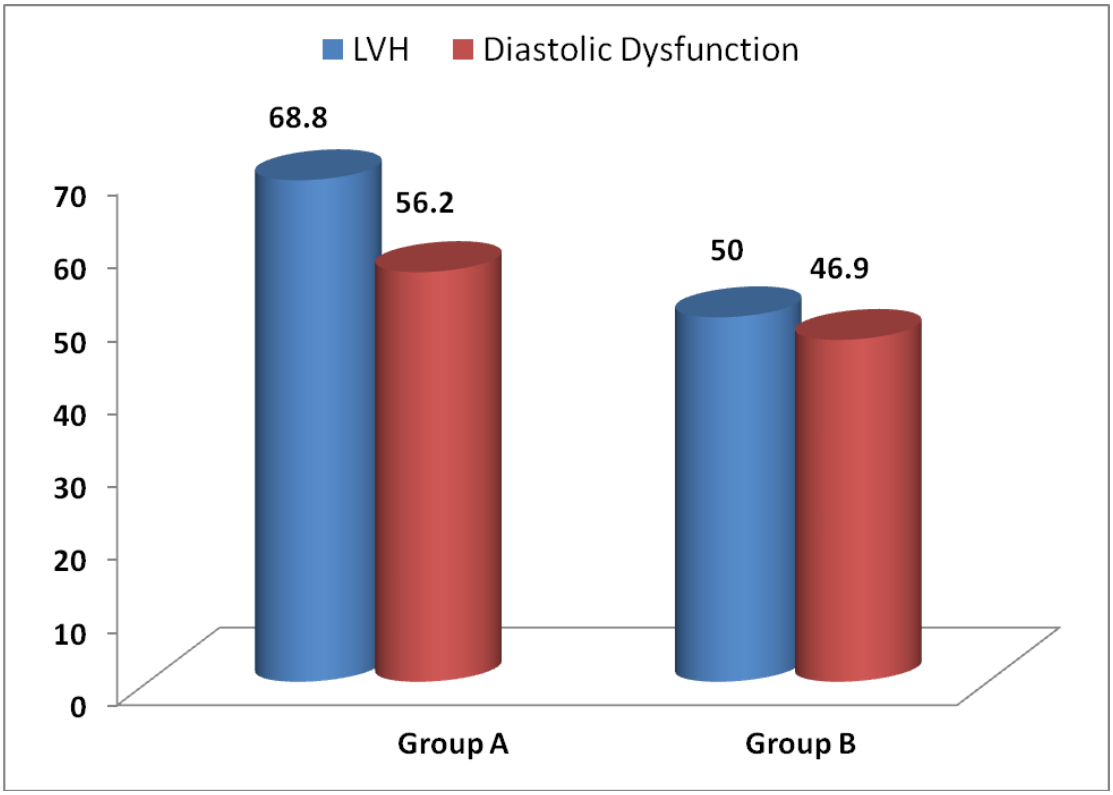


Fig.24: LVH (%) and diastolic dysfunction (%) in group A and group B.



Effect of temporary shunt compression on COP and sPAP in in group A: *(Table 7& figures 25, 26).*

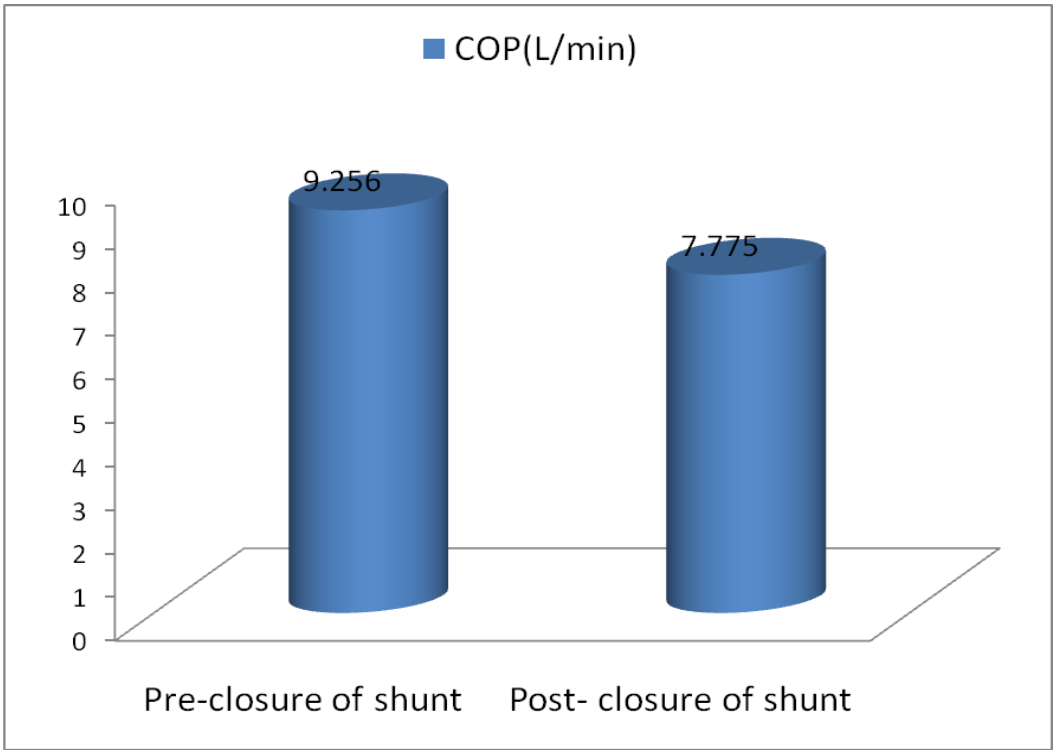
PAP and COP were measured in group A patients before and one-minute after arteriovenous shunt compression. During this maneuver, the mean cardiac output decreased from (9.256±1.7538) L/min to (7.775±1.7842) L/min with highly significant difference (P-value<0.001) and the mean systolic PAP decreased from (59.1644±17.28545) mmHg to (49.6300±14.91912) mmHg with highly significant difference (P-value<0.001). (Table 7, fig.25, 26)

Table 7: Effect of temporary shunt compression on COP and sPAP

variables	Pre-closure of shunt	Post- closure of shunt	P value
COP(L/min) (Mean±SD)	9.256±1.7538	7.775±1.7842	<0.001
sPAP(mmHg) (Mean±SD)	59.1644±17.28545	49.6300±14.91912	<0.001

Fig.25: Effect of temporary shunt compression on COP in group A

a)



b)

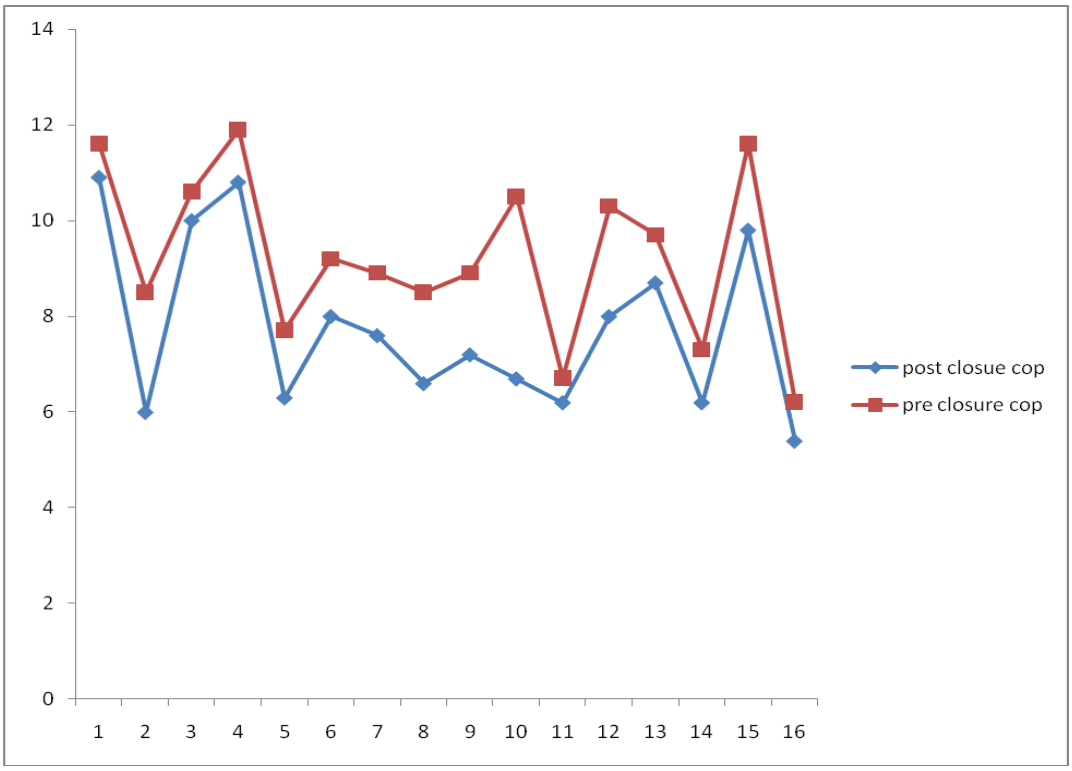
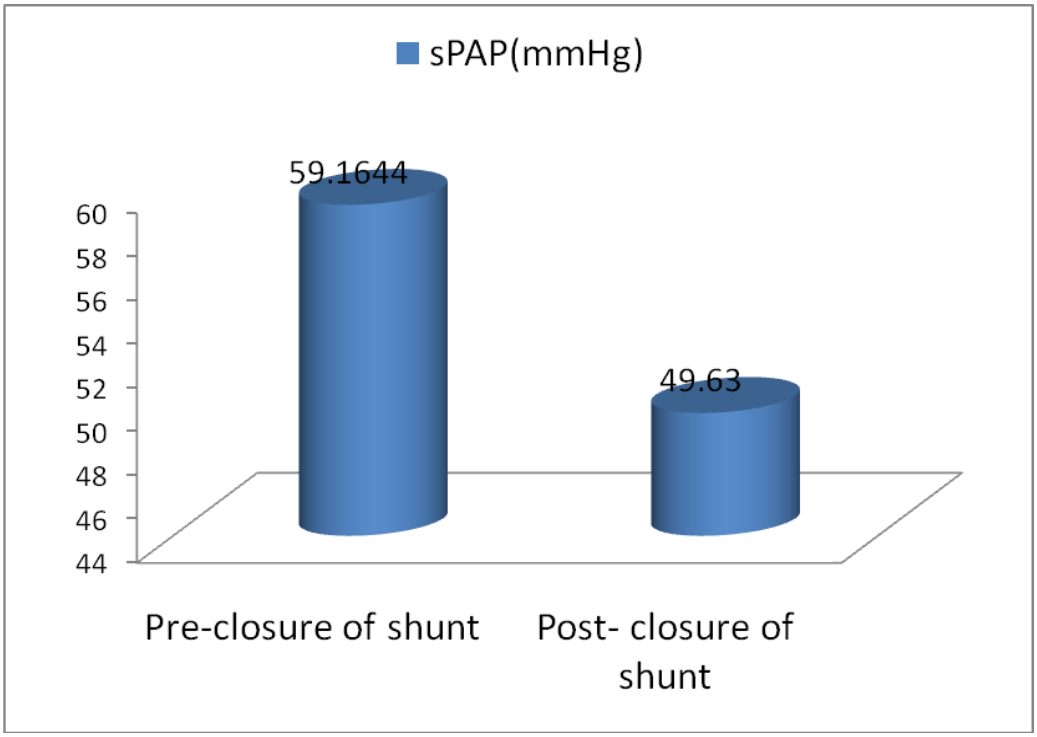
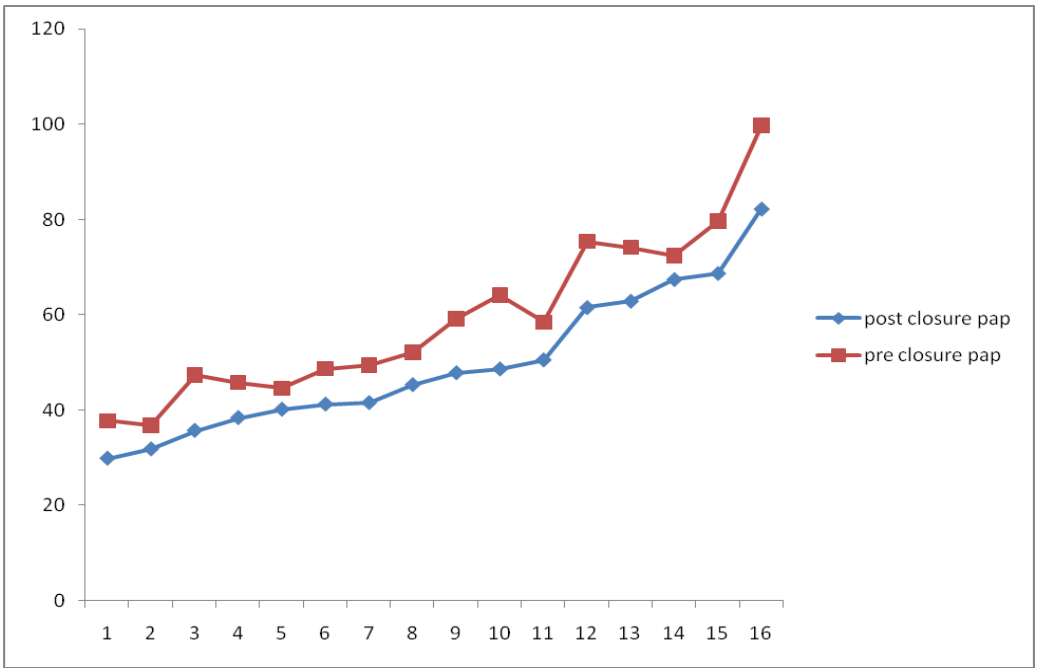


Fig.26: Effect of temporary shunt compression on sPAP in group A

a)

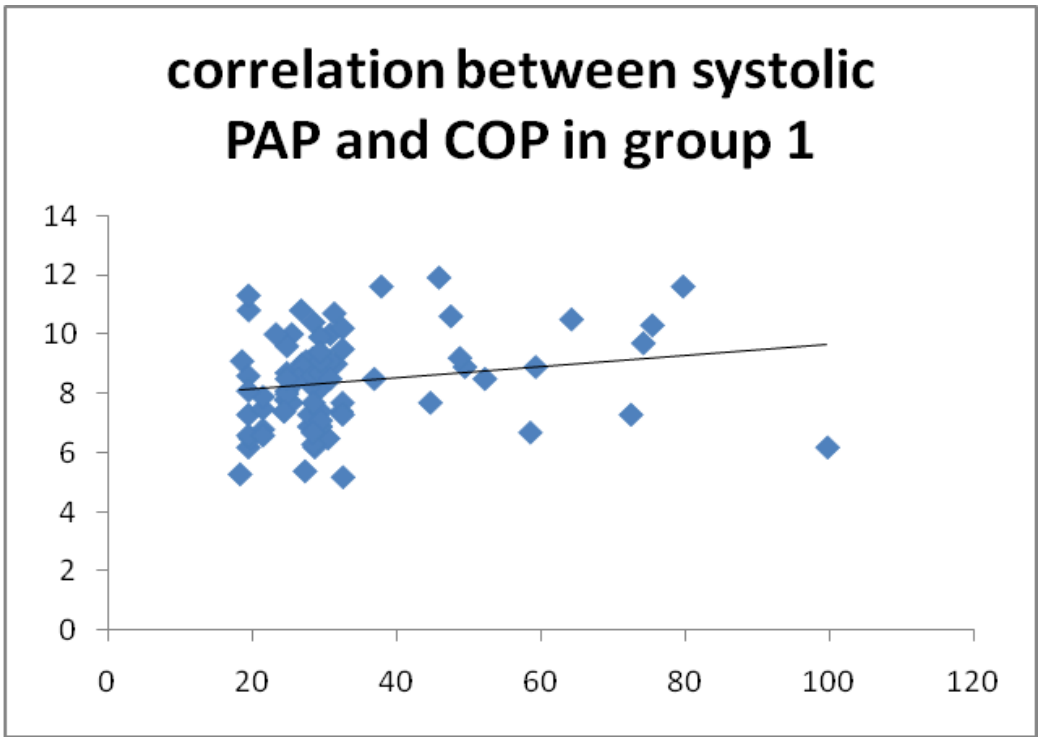


b)



The correlation between systolic PAP and COP in group 1 was investigated and positive relationship was found between them (r=0.257 and p=0.005).

Fig.27: correlation between systolic PAP and COP in group 1



Univariate analysis for PHT with different variables showed that dialysis duration (months), Hb% (gm/dl) and COP (L/min) were the significant variables (predictors)

Multivariate regression analysis for PHT with different variables showed that dialysis duration (months) is the only significant variable (independent factor contributing to PHT) (B = 0.527, P =0.037) (Table 8 ,fig.28)

Table 8: The multivariate regression analysis for PHT

variables	Beta	Sig.(P value)
Dialysis Duration (months)	0.527	0.037
COP(L/min)	0.674	0.218
Hb% (gm/dl)	0.440	0.120

Fig.28: Regression analysis of dialysis duration and PHT