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Diabetes Mellitus and Hypertension in Chronic Kidney Disease

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ABSTRACT:

Diabetes Mellitus and Hypertension have world wide prevalence and are proven to be risk factors for cardiovascular and renal diseases. An ICMR study in 2011 reported 64.4 and 77.2 million people had diabetes and hypertension respectively. According to WHO report in 2010 global status of prevalence of hypertension has increased from 16% to 32.6% in 2008. Diabetes mellitus and Hypertension together increase the risk of Chronic Kidney Disease (CKD). Prevention, early detection and intervention play a major role in the prevention and progression of CKD. This study aims to report prevalence of diabetes and hypertension in CKD patients.

MATERIALS AND METHOD:

A retrospective analysis of patients who visited the Department of Special care Dentistry from June 2019 to March 2020. 268 case sheets of patients with special needs were screened and finally 14 patients with CKD were selected. The medical records of these 14 patients were reviewed and data extracted and analysed. Patients with CKD and coexisting conditions with diabetes and hypertension were studied and chi square analysis was done.

RESULTS:

The study consisted of 14 patients out of which 10 were male (71.4%) and 4 were female patients (28.5%).Predominant age group in the study population was 60-70 years (35.7%) followed by 50-60 years (21.3%). 8 patients (57.14%) with CKD had both Type 2 - Diabetes mellitus and Hypertension. 3 patients (21.43%) with CKD had only Type -2 Diabetes mellitus and 3 patients (21.4%) with CKD had only Hypertension.Descriptive analysis of comparison between age with diabetes mellitus and hypertension in the study population was statistically not significant ($p > 0.05$).

CONCLUSION:

Our study reports presence of diabetes and hypertension ,either in combination or in isolation in patients with CKD. Both diabetes and hypertension are major risk factors for chronic kidney diseases. Early detection and treatment for diabetes and hypertension can prevent development of CKD or its progression to end stage renal failure.

KEYWORDS:Chronic kidney disease,Diabetes mellitus, Hypertension

INTRODUCTION:

Hypertension and diabetes mellitus are the most prevalent diseases worldwide and is a major risk factor for the decline in the kidney function in patients. CKD patients also inevitably develop hypertension during the course of the disease. Incidence [(Patil *et al.*, 2018)] of CKD has varied across cities in Asia but tends to be higher in urban areas [(Muthukrishnan and Kumar, 2017)]. CKD in patients with diabetes is clinically defined as the presence of persistent albuminuria and/or persistent low estimated glomerular filtration rate regardless of the etiology [(Levin *et al.*, 2013)]. The pathogenesis of HT in CKD is said to be multifocal and can be associated with diabetic neuropathy, glomerulonephritis, nephropathy [(Covic, Kanbay and Lerma, 2017)]. CKD patients with diabetes have decreased insulin clearance

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[(Pecoits-Filho and Abensur, 2016)]. With an increasing incidence of systemic disease [(Dharman and Muthukrishnan, 2016)] like diabetes mellitus and hypertension in most parts of the world the the incidence of CKD is also increasing[(Venugopal and Maheswari, 2016)].Studies have shown that diabetes patients tend to have poor oral hygiene [(Subashri and Uma Maheshwari, 2016)] and oral health problems such as poor periodontal health leading to tooth mobility and loss [(Warnakulasuriya and Muthukrishnan, 2018)], decreased salivary flow [(Maheswari *et al.*, 2018)], increased incidence of dental caries [(Rohini and Kumar, 2017)], delayed wound healing [(Chaitanya and Muthukrishnan, 2018)] and also a predisposition for neuropathic pain [(Subha and Arvind, 2019)].Patients are still not aware of the complications arising due to comorbidities like diabetes and hypertension in CKD and its impact on the quality of life [(Chaitanya and Muthukrishnan, 2017)] and the renal dysfunction present in diabetic and hypertensive patients [(Dash *et al.*, 2018)]. In developed countries like the United States, diabetes is responsible for over 40% of new cases of kidney disease and is the forerunner for incidence of kidney failure. CKD with existing comorbidities has reported to have a very lower survival rate. Proper physical examination [(Steele *et al.*, 2015)], knowledge on the medical and familial history [(Muthukrishnan, Kumar and Ramalingam, 2016)] and early diagnosis [(Misra *et al.*, 2015)] about the diabetes-hypertension-CKD relationship is essential for understanding and successful management of patients with chronic kidney disease [(Choudhury and Panigrahi, 2015)].

Aim of the study was to evaluate the prevalence of Diabetes Mellitus and Hypertension in patients with chronic kidney disease.

Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Ariga *et al.*, 2018; Basha, Ganapathy and Venugopalan, 2018; Hannah *et al.*, 2018; Hussainy *et al.*, 2018; Jeevanandan and Govindaraju, 2018; Kannan and Venugopalan, 2018; Kumar and Antony, 2018; Manohar and Sharma, 2018; Menon *et al.*, 2018; Nandakumar and Nasim, 2018; Nandhini, Babu and Mohanraj, 2018; Ravinthar and Jayalakshmi, 2018; Seppan *et al.*, 2018; Teja, Ramesh and Priya, 2018; Duraisamy *et al.*, 2019; Gheena and Ezhilarasan, 2019; Hema Shree *et al.*, 2019; Rajakeerthi and Ms, 2019; Rajendran *et al.*, 2019; Sekar *et al.*, 2019; Sharma *et al.*, 2019; Siddique *et al.*, 2019; Janani, Palanivelu and Sandhya, 2020; Johnson *et al.*, 2020; Jose, Ajitha and Subbaiyan, 2020).

MATERIALS AND METHODS:

A retrospective study was done in the Department of Special Care Dentistry from June 2019 to March 2020. Case sheets of 268 patients with special needs were screened. The study was approved by the scientific review board (SRB) and institutional ethical committee (Approval number SDC/SIHEC/2020/DIASDATA /0619-0320). Data was retrieved from the hospital database by 2 researchers. After analysing all records 14 patients with diagnosed kidney disease under treatment were included and their medical history records were retrieved. Cross verification was done by assessing previous medical records. Sampling bias was reduced as the patients were already diagnosed of these conditions and were under treatment and

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complementary lab investigatory reports were assessed.Patients with no proper history and sufficient records on their systemic conditions were excluded from the study.

The retrieved data was then formulated into excel sheets and then imported to SPSS (IBM 20). The qualitative variables were blood sugar levels, blood pressure level, renal function tests of either GFR, creatinine or blood urea nitrogen.

Frequency distribution tests were done to check for the prevalence of diabetes and hypertension in chronic kidney disease patients using SPSS IBM20.

RESULTS:

In this retrospective study of 14 patients who were previously diagnosed and under treatment for CKD were included. Out of the 14 patients 10 patients were male (71.2%)and 4 patients were female (28.5%) and [Graph 1].

Majority of patients were in age group of 60-70 years (35.7%), 50-60 years (21.43%), 70-80 years (14.29%) , 30-40 years and 40-50 years (14.2%) [Graph 2]

3 patients with CKD had diabetes (21.43%), 3 patients with CKD had Hypertension (21.43%) and 8 patients with CKD had both DM and Hypertension (57.14%) [Graph 3].

Descriptive analysis of comparison between age and diabetes mellitus in the study population which was statistically not significant ($p > 0.05$)[Graph 4].

Descriptive analysis of comparison between age and hypertension in the study population which was statistically not significant ($p > 0.05$)[Graph 5].

DISCUSSION:

Diabetes and hypertension acts as risk factors and precursors for complications like CKD [(Dash *et al.*, 2018)] which is a huge burden on the patient socioeconomically and co-existence synergistically increases risk of microvascular diseases. There is a genetic predisposition for hypertensive patients to develop CKD which results in excessive salt and water retention and finally produces irreversible damage to the renal medulla leading to end stage renal failure. Our study reveals that there were more of male (71.2%) predominance than the female (28.5%) which was in concordance to the study done by Suresh Chandra et al [(Dash *et al.*, 2018)].The incidence of age groups in the study subjects that were affected by diabetes and hypertension fall above 65 years of age in studies done by Pecoits- Filho et al [(Pecoits-Filho and Abensur, 2016)] and Beata Franczyk et al [(Franczyk *et al.*, 2017)] which is in concordance with our study.

CKD can be staged into five stages given by the National Kidney Foundation - clinical practice guidelines as Stage I : Kidney damage with normal or increased GFR (GFR 60-90 ml/min); Stage II : Kidney Damage with mildly decreased GFR (60-90ml/min); Stage III: Moderately decreased GFR (30-59ml/min); Stage IV: Severely decreased GFR (15-29ml/min); Stage V : Kidney Failure (GFR <15ml/min). A study done by Buffet Leticia et al [(Buffet and Ricchetti, 2012)] or by Franczyk et al [(Franczyk *et al.*, 2017)] have grouped

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CKD into V stages which was a drawback in our study as all our patients did not have their GFR estimated and is not done in majority of renal disease centres.

There are very limited studies done on the prevalence of hypertension and diabetes mellitus in CKD which was the main focus of attention in our study.The study done by Suresh Chandra et al [(Dash *et al.*, 2018)] had analysed correlation of diabetes, hypertension and CKD and reported prevalence of 78.7% whereas our study showed it to be 57.14% . Similarly the presence of either Hypertension or diabetes in our study had an equal percentage of 21.43 % whereas Suresh Chandra et al [(Dash *et al.*, 2018)] study reported hypertension to be 75.4% and Diabetic status to be 78.57%. This could possibly be due to a limited sample size of our study.

In comparison of age with diabetes (45.5%) and hypertension (66.6%) for correlation, there was a higher prevalence in the 6th-7th decade of life which was in concordance to the studies done by Pecoits- Filho et al [(Pecoits-Filho and Abensur, 2016)] and Beata Franczyk et al [(Franczyk *et al.*, 2017)].Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

Future scope should involve multicentric study with specialised renal centres to assess diabetes and hypertension comorbidities in patients with chronic kidney disease. Furthermore all diabetic and hypertensive patients also need to be screened for kidney disorders as patients may be asymptomatic but renal tests would reveal signs of CKD. Thus early diagnosis in these cases can prevent progression of CKD to end stage renal failure.

CONCLUSION:

Present study will add to the existing evidence on association between kidney disease, hypertension and diabetes patients. Diabetes mellitus and Hypertension predisposes the development of CKD.Controlling underlying diabetes and hypertension can help in kidney functions returning to normal state.

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AUTHORS CONTRIBUTION:

Abhinaya LM has made substantial contributions towards study design, acquiring an analysis of data,drafting the final paper and revising it critically.
M.Arvind has made substantial contributions towards study design, acquiring an analysis of data,drafting the final paper and revising it critically.
Deepika Rajendran has made substantial contributions in proofreading and final drafting.

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CONFLICT OF INTEREST:
NIL

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LEGENDS FOR GRAPHS:

GRAPH 1: Graph depicting the gender distribution in the study population

GRAPH 2: Graph depicting the different age groups among the study population

GRAPH 3: Graph depicting the prevalence of Diabetes and Hypertension in the study population

GRAPH 4: Descriptive analysis of comparison between age and diabetes mellitus in the study population

GRAPH 5: Descriptive analysis of comparison between age and hypertension in the study population

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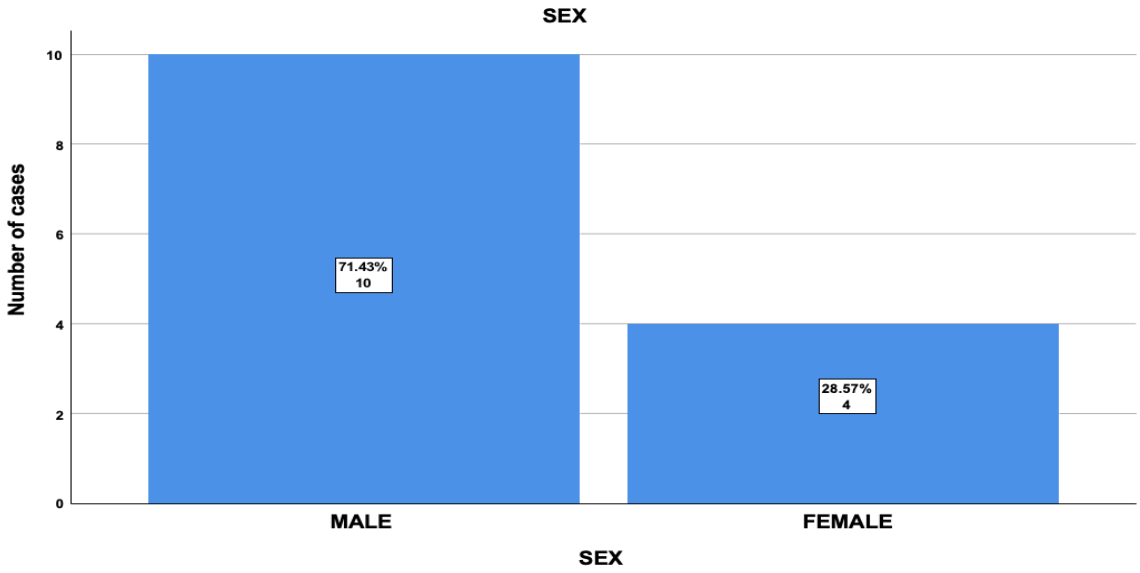
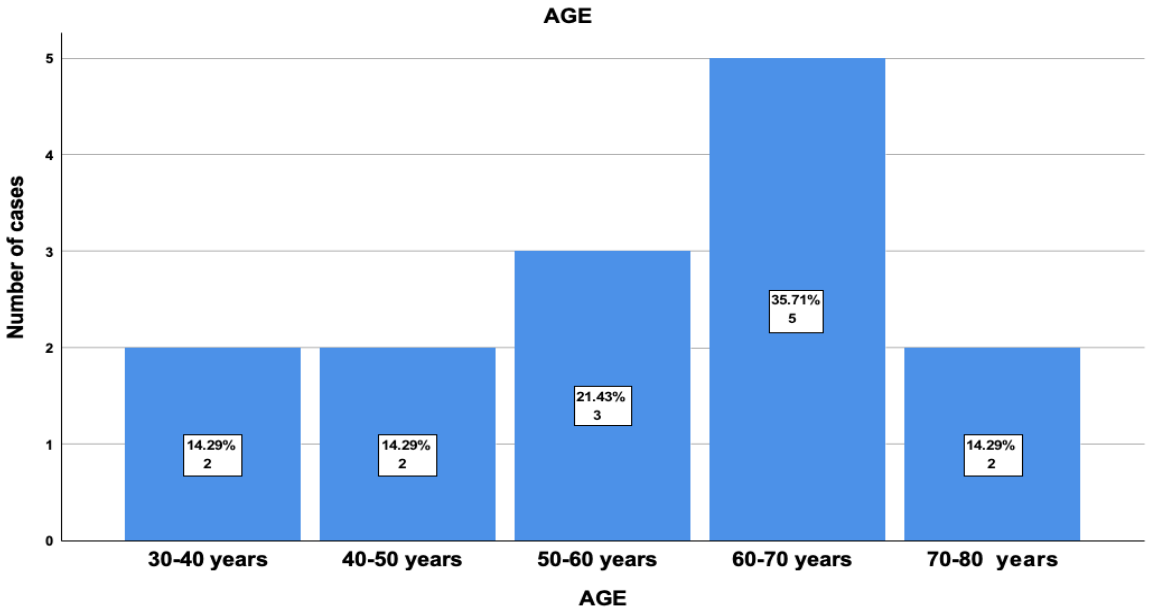


GRAPH 1: This graph depicts the frequency distribution of gender in the study population. X-axis depicts the gender of patients and Y-axis depicts the frequency in number of patients in the study population. Graph 1 shows that there are 10 male participants and 4 female participants in the study.



GRAPH 2: This graph shows frequency of patients in different age groups with chronic kidney disease. X-axis depicts the age groups distributed among the study population and Y-axis depicts the frequency in numbers of patients.There were 5 patients in the age group of 60-70 years, 3 patients in 50-60 years, 2 patients in 70-80 years, 2 patients each in 30-40 years and 40-50 year age groups.

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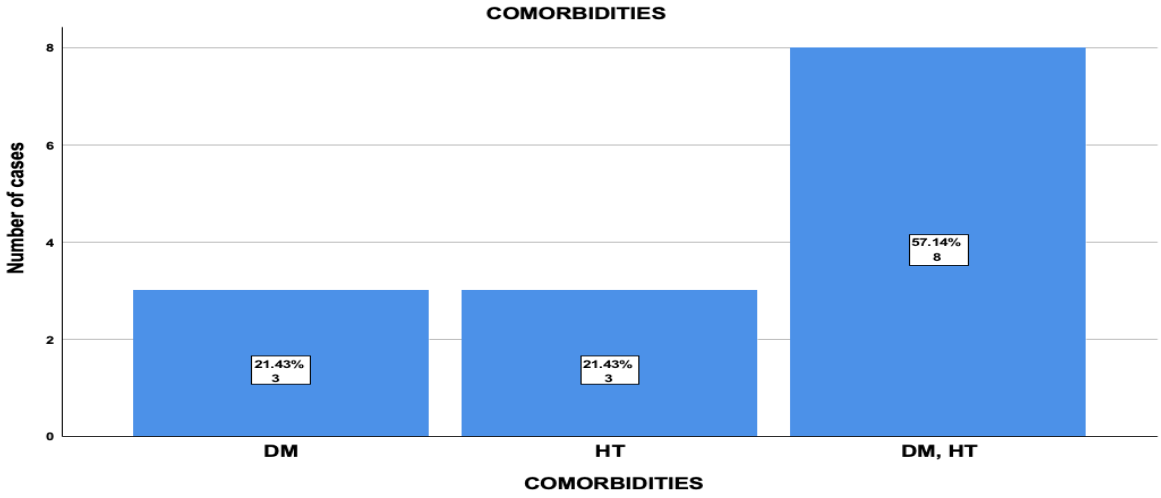
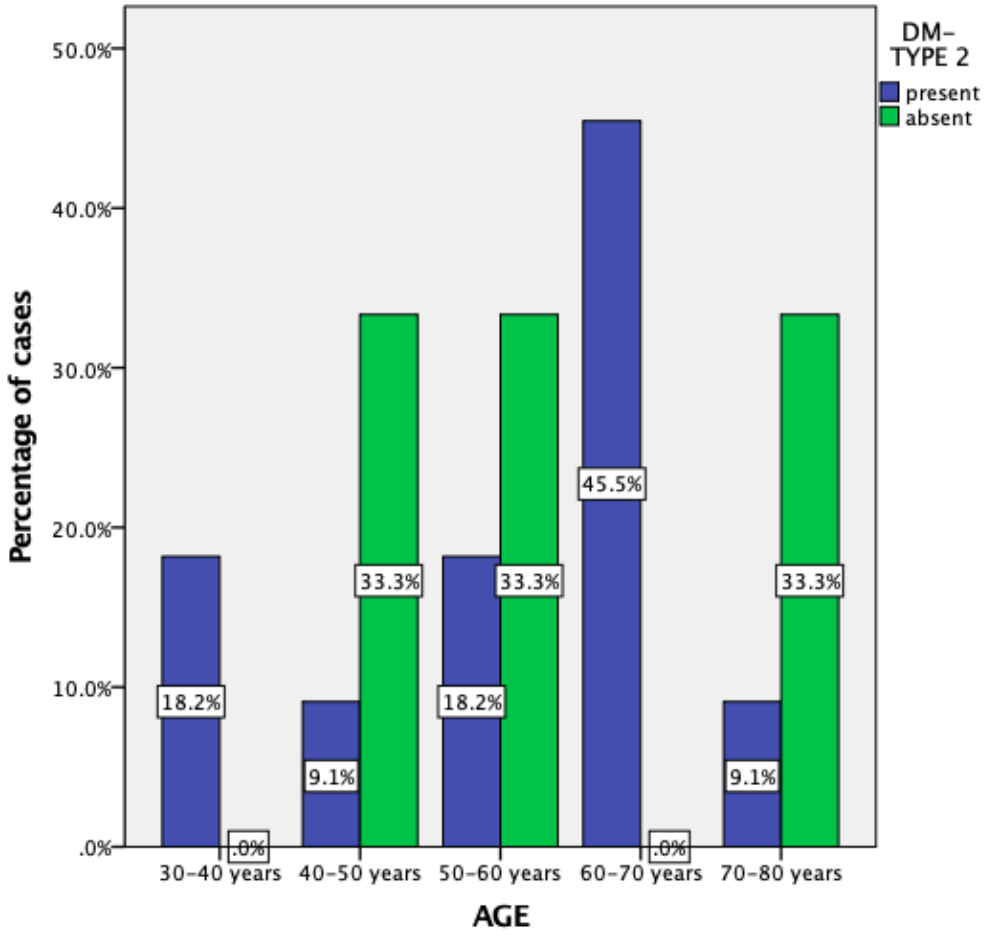


GRAPH 3: This graph depicts the presence of comorbidities along with chronic kidney disease in the study population. X-axis depicts the presence of systemic diseases - Diabetes Mellitus (DM), Hypertension (HT) and combination of diabetes and hypertension whereas Y-axis depicts the frequency in number of patients in the study population.8 patients had both DM and HT with CKD and 3 patients had DM and 3 patients had HT alone with CKD. Majority of CKD patients have both diabetes and hypertension as comorbidities.



GRAPH 4: Bar graph depicting the association between age and occurrence of diabetes mellitus in the study population. X-axis shows the age distribution and Y-axis shows the

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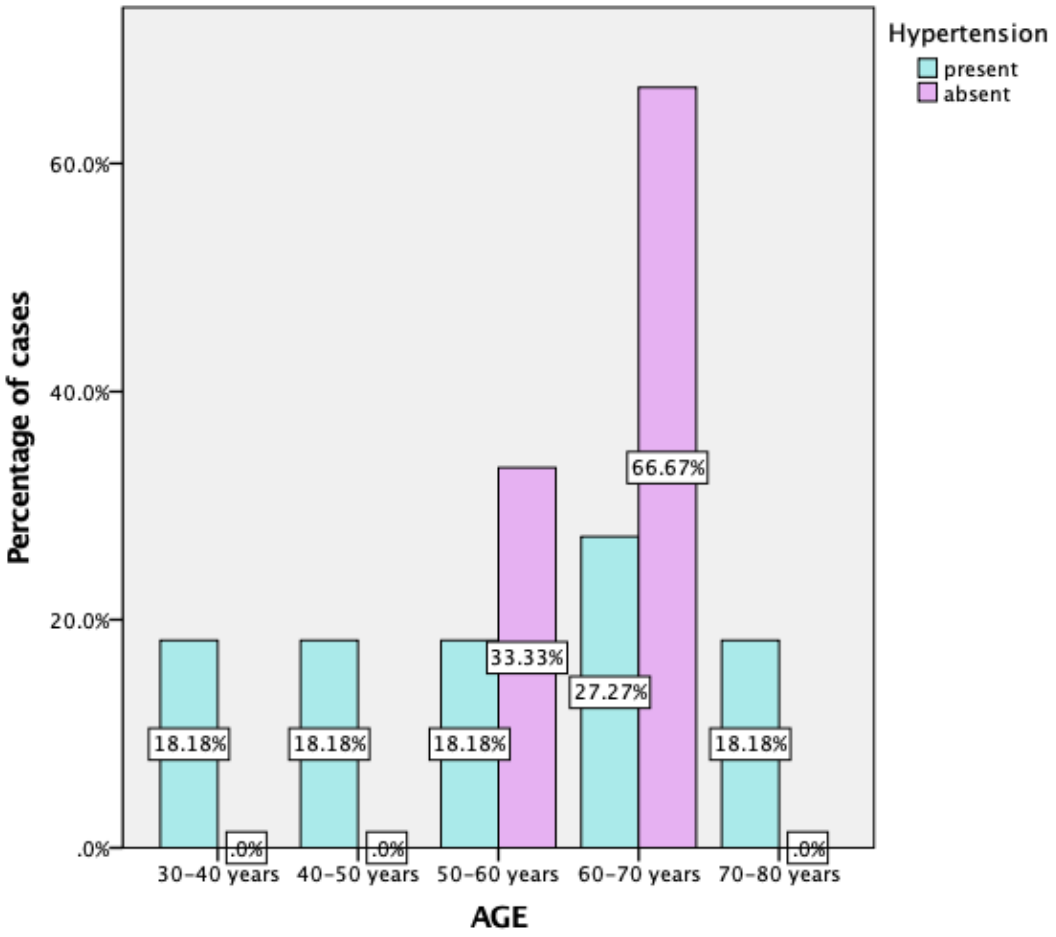
percentage of patients.The chi-square analysis [chi square-4.101; df-4; p=.393 (p>0.05)] was statistically not significant. There is a higher occurrence of diabetes mellitus in the age group 60-70 years when compared to 50-60 years of age.



GRAPH 5: Bar graph depicting the association between age and occurrence of hypertension in the study population. X-axis shows the age distribution and Y-axis shows the percentage of patients. The chi-square analysis [chi square- 2.913; df-4; p -0.572 (p>0.05)] statistically not significant. There is a higher occurrence of hypertension in the age group 60-70 years when compared to the other age groups.