

# Arterial Hypertension and Diabetes Mellitus in Adult Surgical Patients: Prevalence and Perioperative Impact

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## Abstract

**Background:** Arterial hypertension and diabetes mellitus are prevalent co-morbidities in surgical patients, and they might have an impact on perioperative care. Many times, the health-care team will conduct a preoperative test for diabetes that has gone unnoticed. However, it is rarely assessed how much these disorders affect perioperative anaesthetic care.

**Aim:** The aim of the study was to determine the prevalence of new, managed, and uncontrolled hypertension, diabetes mellitus, and their perioperative sequelae in adult surgical patients.

**Methods:** This prospective observational study was conducted in a tertiary care teaching hospital. Total 186 adults of both sexes, planned for elective non-cardiac surgery were included. Arterial hypertension (AHTN) and Diabetes Mellitus (DM) was defined as per JNC-7 and ADA definition. The prevalence of new, controlled, uncontrolled AHTN and DM and their perioperative anaesthetic were assessed.

**Results:** Total 186 patients' 98 (53%) cases posted were evaluated were with hypertension, 67(36%) cases with diabetes mellitus followed by 21 (11%) cases with both HTN and DM.

The prevalence of these co morbidities was found to be highest in 6th decade. The prevalence of DM was also higher in male than female, but the differences were statistically insignificant for AHTN, DM and for both. The prevalence of renal failure and coronary artery diseases, mean age in the patients with both the comorbidity were higher than either of hypertensive and diabetic group and both the differences were statistically significant.<sup>12</sup> (12.2%) hypertensive and 2 (3%) diabetic and patients were in the range of postponement of elective surgery.

**Conclusion:** Adults have a high prevalence of AHTN and DM, which increases dramatically with age. Both men and women are affected in the same way. The prevalence of uncontrolled AHTN and DM is concerning, demanding immediate action to treat these serious noncommunicable diseases.

**Keywords:** Arterial Hypertension; Diabetes Mellitus; Perioperative Impact.

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## Introduction

Currently, there are approximately 22 million people in the United States diagnosed with diabetes.<sup>1,2</sup> Unfortunately, it is estimated that more than 8 million additional persons have diabetes but are undiagnosed.<sup>1,4</sup> The National Health and Nutrition Survey (NHANES) indicates that nearly 13% of patients older than 20 years have diabetes; alarmingly, 40% of these cases are undiagnosed.<sup>1,2</sup>

There are many effects of diabetes on the human body that complicate the administration of anesthesia. It is imperative that ambulatory anesthesiologists understand the association between type 2 diabetes and these comorbid conditions and the complications that may present during sedation and general anesthesia. The stress of surgery, anesthesia and illness increases secretion of counter-regulatory hormones (cortisol, glucagon, growth hormone, catecholamines), which in turn causes decreased insulin secretion, increased insulin resistance, decreased peripheral utilization of glucose, increased lipolysis, and proteolysis.

As a consequence, gluconeogenesis and glycogenolysis increase, which subsequently results in worsening hyperglycemia termed as stress hyperglycemia. Uncontrolled hyperglycemia instigates osmotic diuresis (causing fluid and electrolyte imbalance), ketogenesis, and increased generation of pro-inflammatory cytokines with resultant mitochondrial injury, endothelial dysfunction, and immune deregulation.<sup>4,5</sup> Hence, achieving good glucose control during the perioperative period is associated with beneficial post-surgical outcomes.

The degree of hyperglycemia is also affected by the type of anaesthetic and operation used, with higher glucose levels reported with general anaesthesia or thoracic/abdominal surgeries versus epidural/local anaesthesia or peripheral/laparoscopic surgeries. The purpose of this study was to determine the prevalence of new, managed, and uncontrolled hypertension and diabetes mellitus in adult non-cardiac surgery patients, as well as their perioperative impact. The findings will aid us in better understanding, anticipating, and planning perioperative treatment for these patients.

## Materials and Methods

In a tertiary care teaching hospital, a hospital-based, cross-sectional, observational, sub-group study was done. The data was collected between December 2018 and May 2019. Participants must be 18 years of age or older, male or female, and attend a

preanaesthetic evaluation clinic (PAEC). If a patient presented to the PAEC with systolic blood pressure (SBP) >140 mmHg and/or diastolic blood pressure (DBP) >90 mmHg, according to Joint National Commission report 7 (JNC-7). If a patient reported to the PAEC with hyperglycemia, as defined by the American Diabetes Association (ADA), but no prior documentation or treatment history, the patient was identified as a new case of diabetes. If the HbA1c result is between 5.7 and 6.4 percent, the patient was previously unknown. The numbers of new, controlled, and uncontrolled cases were counted based on demographics, physical status, surgery category, clinical/medical history, and the number of new, controlled, and uncontrolled cases. Serum creatinine level was noted as abnormal (high) if the value was >1.2 mg% and the patient was designated to have renal injury/failure.

The information was provided in absolute numbers on a percentage scale. Male and female prevalence numbers were also estimated separately and compared to national and international data. There were additional considerations for perioperative anaesthesia and patient management. It was considered influential if the assessing anaesthesiologist requested a consultation/referral, retesting, or further investigation based on the blood sugar report and/or blood pressure level. Measures of central tendencies and dispersions were calculated and comparisons of the groups were done using Graph Pad Prism Software  $P < 0.05$  was considered statistically significant.

## Results

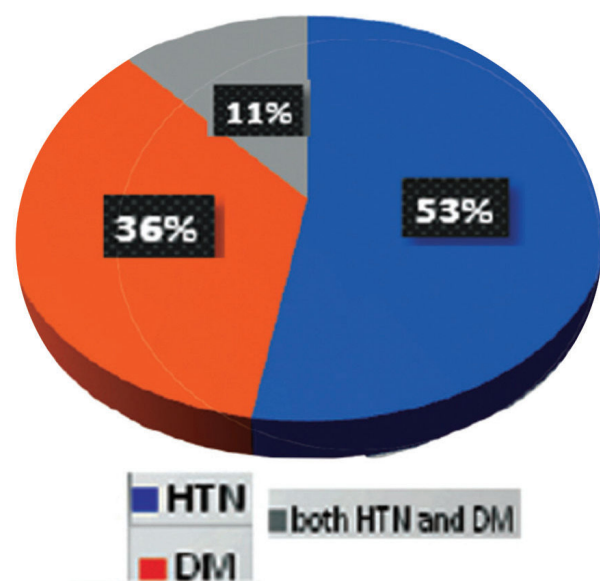


Fig. 1: Pie diagram showing distribution of hypertension and diabetes mellitus in cases.

Data from 621 adult patients were collected during the study period. 10 patients' data were excluded due to insufficient follow up till the day of surgery and incomplete data and 211 patients' of which 186 patients are with Hypertension, Diabetes mellitus or both.

98 (53%) cases posted were evaluated were with hypertension, 67(36%) cases with diabetes mellitus followed by 21 (11%) cases with both HTN and DM.

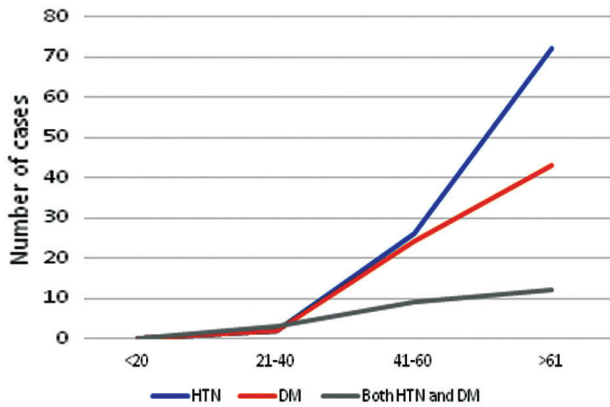


Fig. 2: Prevalence of age in all 3 groups.

With the increasing age, the prevalence of AHTN and/or DM increased. The prevalence of AHTN and/or DM in <20 year, 21 - 40 year, 41-60 years and above 61 year agegroups were 3.8 %, 32% and 68% respectively(p< 0.0001). The prevalence of these co morbidities was found to be highest in 6th decade of life.

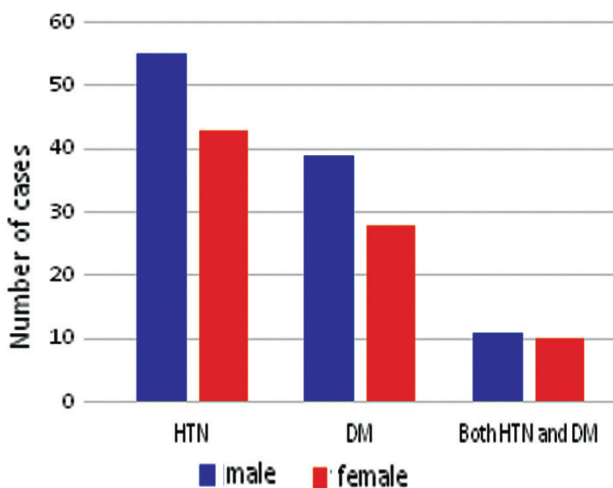


Fig. 3: Distribution of males and females in the study.

Half of both male and female patients were suffering from AHTN. The prevalence of DM was also higher in male than female, but the differences were statistically insignificant for AHTN, DM and for both

Table 1: Correlation of controls with hypertension.

Parameter	Controls (n-435)	HTN(n=98)	P-Values
Mean age in years	40 ± 9.1	54 ± 10.6	<0.0001
Mean weight in kgs	59 ± 12.1	61 ± 12.9	0.78
Obesity (n%)	10(2.3%)	3(3.1%)	0.14
Renal failure (n%)	1(0.2%)	7(7.1%)	<0.001
CAD(n%)	1(0.2%)	11(11.2)	<0.001

Mean age, renal failure and CAD are increase in Hypertensive diagnosed patients that in controls and the differences were statistically significant.

Table 2: Correlation of controls with DM.

Parameter	Controls (n-435)	DM(n=67)	P-Values
Mean age in years	40 ± 9.1	56 ± 11.3	0<0.001
Mean weight in kgs	59 ± 12.1	61 ± 13.5	0.21
Obesity (n%)	10(2.3%)	2(2.98%)	0.12
Renal failure (n%)	1(0.2%)	6(8.9%)	<0.001
CAD(n%)	1(0.2%)	8(11.9%)	<0.001

Mean age, renal failure and CAD are increase in Diabetes diagnosed patients that in controls and the differences were statistically significant.

Table 3: Correlation of controls with both.

Parameter	Controls (n-435)	HTN and DM(n=21)	P-Values
Mean age in years	40 ± 9.1	55 ± 12.3	<0.001
Mean weight in kgs	59 ± 12.1	62 ± 14.2	0.26
Obesity (n%)	10(2.3%)	4(19%)	<0.001
Renal failure (n%)	1(0.2%)	5(23.8%)	<0.001
CAD(n%)	1(0.2%)	6(28.5%)	<0.001

Mean age, obesity, renal failure and CAD are increase in Hypertensive and Diabetes diagnosed patients that in controls and the differences were statistically significant.

The prevalence of renal failure and coronary artery diseases, mean age in the patients with both the comorbidity were higher than either of hypertensive and diabetic group and both the differences were statistically significant.

12 (12.2%) hypertensive and 2 (3%) diabetic and patients were in the range of postponement of elective surgery.

## Discussion

In our study out of 621 adult patients were collected during the study period 186 patients are with Hypertension, Diabetes mellitus or both of which 98 (53%) cases posted were evaluated were

with hypertension, 67(36%) cases with diabetes mellitus followed by 21 (11%) cases with both HTN and DM.

In our study with the increasing age, the prevalence of AHTN and/or DM increased. The prevalence of AHTN and/or DM in groups were significant ( $p < 0.0001$ ). The prevalence of these co morbidities was found to be highest in 6th decade of life. Our study is similar to study done by Habib Md Rezaul Karim et al.<sup>6</sup> Among the steadily increasing population of surgical patients aged 65 yr and older, the fastest growing sector is individuals of 85 yr or older. As a result, greater numbers of patients are presenting for surgery with ageing-related, pre-existing conditions that place them at greater risk of an adverse outcome, such as cardiac or pulmonary disease or diabetes mellitus. It is, therefore, not surprising that the elderly have the highest mortality rate in the adult surgical population. Postoperative adverse effects on the cardiac, pulmonary, cerebral systems, and on cognitive function are the main concerns for elderly surgical patients who are at high risk. The function capacity of organs reduces with ageing, resulting in decreased reserve and ability to endure stress. Advanced age is, therefore, a significant risk factor for increased mortality. Co-existing disease further depresses organ function and/or reserve, exacerbating risk.<sup>7,8,9</sup>

In our study prevalence of DM was also higher in male than female, but the differences were statistically insignificant for AHTN, DM and for both. Data from USA also showed near similar prevalence (i.e. age-adjusted prevalence of hypertension among persons aged  $\geq 18$  years was 29.6%). Similar results were also noted with regard to DM.<sup>10</sup> Although the prevalence of DM in male patients was nearly similar; the prevalence of was higher for female patients in the Habib Md Rezaul Karim et al.<sup>6</sup> study (12.73% versus 8.6%) as compared to prevalence of hyperglycemia reported in NFHS-4.

In our study HTN, Dm and both HTN and DM groups have statistically significance between controls with renal failure and coronary artery diseases, mean age in the patients with both the comorbidity. Both the disease has significant impact in the perioperative management of surgical patients as uncontrolled condition can cause morbidity and even increased mortality.<sup>11,12</sup>

However both anaesthesiologists and surgical specialists are more related to the acute care of these patients. As far as the anaesthesia services (both in operation theatre and intensive care)

are concerned; anaesthesiologists are capable of controlling both the condition (i.e. high BP and hyperglycemia) relatively faster even if there are derangements.

Hypertension affects over 70 percent of patients with type 2 diabetes.<sup>17</sup> When hypertension and diabetes are combined, the risk of perioperative myocardial infarction, cerebrovascular accident, and microvascular illness, such as retinopathy and autonomic and sensory neuropathies, increases. Diabetic people have a 2-3 fold increased risk of congestive heart failure (CHF). Both anaesthesiologists and surgeons must be more pragmatic in their service utilisation to avoid unnecessary referrals, delays, and inconvenience to patients, particularly the elderly. Fourth, a large proportion of the DM cases were new, suggesting that a screening for DM could be beneficial.

## Conclusion

Adults have a high prevalence of AHTN and DM, which increases dramatically with age. Both men and women are affected in the same way. The prevalence of uncontrolled AHTN and DM is frightening, indicating the need to take immediate action to combat these critical non-communicable illnesses at the grass roots level.

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