Introduction

In India, the recent mortality pattern of the geriatric population (age group ≥ 60 years) suggests a rise in noncommunicable diseases than communicable diseases. There is a shift of the causes of mortality with noncommunicable diseases causing the maximum number of mortality among the geriatric population.

Generally, there is scarcity of information in disease prevalence, mortality rates, and patterns in developing countries especially in a heavily populated country like India and our multicultural and multietnic locality. This is contrary to what obtains in the Mortality pattern of elderly patients at a tertiary care hospital: A study from Sub-Himalayan region, Uttarakhand, India

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ABSTRACT

Background: Currently, in developing countries like India, there is a paradigm shift in the mortality patterns of elderly from communicable to noncommunicable diseases. Objective: This study is aimed at providing an insight on mortality patterns of elderly patients from March 2016 to March 2018 occurring in the Department of General Medicine, in AIIMS, Rishikesh, India. Materials and Methods: This study is a retrospective review of mortality patterns of elderly patients from March 2016 to March 2018 occurring in the Department of General Medicine, in AIIMS, Rishikesh, India. Information derived from the Medical Records Department of AIIMS Rishikesh include age, sex, clinical history, diagnosis, duration, and cause of death. Results: During this period, a total of 1101 elderly (≥60 years) admissions were done in the Department of General Medicine, AIIMS Rishikesh. A total of 66 patients had expired during their hospital stay. Among this, 35 and 31 cases were elderly male and female patients, respectively, and therefore the ratio of male to female was 1.1:1.0. The peak age group was 60–64 years accounting for 23 patients (34.8%). The age range of patients was 60–94 years, while the modal and mean ages were 65 and 69 years, respectively, with 8.1 standard deviation. The most commonly encountered cause of mortality was cerebrovascular accident constituting 19 (28.8%) cases. The second majority of mortality cases were hypertensive disorders constituting 13 (19.7%) cases, and the third majority were septicemia and pneumonia accounting for 12 (18.2%) and 12 (18.2%) cases, respectively. Others include diabetes mellitus [metabolic disorder; 10 (15.2%) cases], acute renal failure [10 (15.2%) cases], ischemic heart disease or coronary artery disease [6 (9.1%) cases], while malignancies, tuberculosis, hepatitis, chronic liver disease, and chronic obstructive pulmonary disease consisted of five cases (7.6%) each. Conclusion: Noncommunicable diseases particularly cerebrovascular diseases and hypertensive disorders were the most commonly encountered cause of elderly mortality in this region of North India, that is, the state of Uttarakhand. Notwithstanding a large percentage of mortality patterns also results from communicable diseases with septicemia and pneumonia as the third leading cause of mortality.

Keywords: Cerebrovascular accident, hypertensive disorders, mortality, septicemia

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developed countries where such data abound. However, the few reports available are hospital-based and may not adequately form a comprehensive national data of disease patterns as recommended by the World Health Organization (WHO), but definitely could serve in assessing the patterns of diseases and its mortality and morbidity when monitored over a long period. The significance of this study is remarkable in the objectives of the WHO in healthcare delivery and the achievement of the millennium development goals in India. Information derived from this surveillance patterns is significant to improvement of health services in India, and hence reducing patterns of morbidity and mortality among patients in developing countries.

Studies have shown that in the past, communicable diseases constituted a huge source of mortality and morbidity in India when compared with Western countries where noncommunicable disease predominates. However, currently there is a paradigm shift from communicable to noncommunicable diseases in India. Reports have shown that the disease patterns and mortality rates from cerebrovascular accidents, hypertensive diseases, diabetes, and renal diseases are on the rise in India to a huge extent especially in the elderly.

The objective of this study is mainly to provide a broad report on the diseases prevalence patterns and disease mortality in elderly within a 2-year period in a tertiary healthcare provider in Rishikesh, Uttarakhand, India. Again, this is to highlight the emerging noncommunicable diseases among the elderly in the Himalayan foothills.

Materials and Methods

Study setting and design

A written approval was taken from the ethics committee and research cell of AIIMS Rishikesh for extraction of data of patients admitted in the Department of General Medicine from March 2016 to March 2018. All these files were first scanned for the age data of the patients, and all the files of elderly (≥60 years) patients were taken for study purpose.

A total of 1101 elderly (≥60 years) patients were admitted in the Department of General Medicine, AIIMS Rishikesh from March 2016 to March 2018. All these files were opened in the Medical Records Department of AIIMS Rishikesh. Each of these files were scanned and scrutinized to see the progress details, and all those patients who had been issued a death certificate from the hospital were taken separately for our study.

Inclusion criteria

All elderly (≥60 years) patients who had expired in the Department of General Medicine from March 2016 to March 2018.

Exclusion criteria

- All patients <60 years
- Incomplete files where diagnosis was not written.

Demographic information derived from the request cards includes age, sex, clinical history, clinical diagnosis, and cause of death. The causes of death were broadly classified into noncommunicable and communicable patterns. Again, noncommunicable causes were further subclassified into cardiovascular, malignancy, renal, burns, hematological, nutritional, and metabolic including diabetes mellitus and others (pyrexia of unknown origin, hypersensitivity reaction, snake bites, tetanus, and parasitic infections).

Data management

Data were analyzed with SPSS version 19.

Results

A total of 1101 elderly (≥60 years) patients were admitted under the Internal Medicine Department of All India Institute of Medical Sciences, Rishikesh, during this 2-year period. Of these, 66 patients were certified death accounting for 5.99% as the mortality percentage. Of these, 35 cases were elderly male patients and 31 were elderly female patients. Hence, the ratio of male to female was 1.1:1.0. Among all, the disease mortality peak age group was 60–64 years accounting for 23 patients (34.8%). This is closely followed by 65–69 years constituting 15 (22.7%) cases. Only one case constituting 1.5% occurred above 90 years and was seen in a female. Other age of occurrence of disease mortality is shown in Table 1. The age range of patients was 60–94 years, while the modal and mean ages were 65 and 69 ± 8.1 years, respectively.

The pattern of diseases responsible for mortality in elderly age groups as seen in Table 2 is formatted in descending order of occurrence. Among these, the most commonly encountered includes cerebrovascular accident in both male and female elderly patients constituting a total of 19 (28.8%) cases. The second majority of mortality cases was hypertensive disorders occurring a distance second and accounting for 13 (19.7%) of all cases. The third majority was septicemia and pneumonia accounting

| Age (years) | Males (%) | Females (%) | Total (%) |
|------------|-----------|-------------|-----------|
| 60-64      | 10 (28.6) | 13 (41.9)   | 23 (34.8) |
| 65-69      | 10 (28.6) | 5 (16.1)    | 15 (22.7) |
| 70-74      | 7 (20.0)  | 5 (16.1)    | 12 (18.2) |
| 75-79      | 4 (11.4)  | 2 (6.5)     | 6 (9.1)   |
| 80-84      | 2 (5.7)   | 3 (9.7)     | 5 (7.6)   |
| 85-89      | 2 (5.7)   | 2 (6.5)     | 4 (6.1)   |
| 90-94      | 0 (0.0)   | 1 (3.2)     | 1 (1.5)   |
| 95-99      | 0 (0.0)   | 0 (0.0)     | 0 (0.0)   |
| 100 and above | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| Total      | 35 (53.0) | 31 (46.9)   | 66 (100)  |
the Indian studies done at various settings. The findings are at par with the findings of the study by Kauser et al.\(^\text{[5]}\) which was a study done in South India. But the difference was that this study by Kauser et al. was done for adult age groups and not only the geriatric group. It also shows that male mortality was more than the females among the elderly, thus supporting our research in the Uttarakhand environment.

This is also at par with the study done by Gupta et al.\(^\text{[3]}\) done in Central Uttar Pradesh which showed the increasing trend of mortality due to noncommunicable diseases in the elderly. Similar findings were seen by Holambe VM et al.\(^\text{[3]}\) which was done in Latur, Maharashtra, India, and Peres LC et al.\(^\text{[4]}\) where cardiovascular diseases were found to be the most common cause of mortality thus showing the upward trend of noncommunicable disease being the cause of mortality among elderly.

In this study, the mortality patterns of noncommunicable diseases in elderly were far more common than communicable diseases. This is similar to previous studies done internationally in developing countries like Nigeria by Ansa et al.\(^\text{[1]}\) and Nigerian Medical Journal study of Irrua where mortality from noncommunicable diseases was far more common than communicable diseases pattern.\(^\text{[3]}\) Again, this study is in tandem with reports of other researchers.\(^\text{[6-8]}\)

The prevalence of all noncommunicable diseases risk factors increased with age, and thus the increasing trends of geriatric mortality are from noncommunicable diseases. This is in accordance with a study published in the Journal of Medical and Dental Evolution in 2015 by Manisha Kujur,\(^\text{[8]}\) which was done in a teaching hospital, RIMS in the city of Ranchi, Jharkhand,

| Table 2: Mortality pattern of diseases among elderly patients in AIIMS, Rishikesh |
|-----------------|-----------------|-----------------|
| **Diagnosis**   | **Males**       | **Females**     | **Total (%)** |
| Cerebrovascular accident | 10              | 9               | 19 (28.8) |
| Hypertensive disorders | 9               | 4               | 13 (19.7) |
| Septicemia       | 7               | 5               | 12 (18.2) |
| Pneumonia        | 9               | 3               | 12 (18.2) |
| Diabetes mellitus| 8               | 2               | 10 (15.2) |
| Acute renal failure | 6              | 4               | 10 (15.2) |
| Ischemic heart disease (CAD) | 5     | 1               | 6 (9.1) |
| Malignancies     | 3               | 2               | 5 (7.6) |
| Tuberculosis     | 4               | 1               | 5 (7.6) |
| Hepatitis        | 5               | 0               | 5 (7.6) |
| Chronic liver disease | 5             | 0               | 5 (7.6) |
| Chronic obstructive pulmonary disease | 5 | 0 | 5 (7.6) |
| Severe anemia/hypovolemic shock | 3 | 1 | 4 (6.1) |
| Meningitis/encephalopathy | 3 | 1 | 4 (6.1) |
| Upper GI bleeding/PUD | 3 | 0 | 3 (4.5) |
| Seizure disorders | 2               | 1               | 3 (4.5) |
| Congestive heart failure with pleural effusion and pericardial effusion | 1 | 1 | 2 (3.0) |
| Chronic kidney disease | 1 | 1 | 2 (3.0) |
| MODS             | 1               | 1               | 2 (3.0) |
| Vasculitis       | 0               | 1               | 1 (1.5) |
| Parkinson’s disease | 0              | 1               | 1 (1.5) |

CAD: Coronary artery disease; GI: Gastrointestinal bleeding; PUD: Peptic ulcer disease; MODS: Multiorgan dysfunction syndrome.

for 12 (18.2%) cases each. Others in that order include diabetes mellitus [10 (15.2%) cases], acute renal failure [(15.2%) cases], and ischemic heart disease/coronary artery disease [6 (9.1%) cases]; malignancies, hepatitis, tuberculosis, chronic liver disease, and chronic obstructive pulmonary diseases constituted 5 (7.6%) cases each; meningitis/encephalopathy and severe anemia/hypovolemic shock 4 (6.1%) cases each, upper gastrointestinal bleeding/peptic ulcer disease, and seizure disorders constituted for 3 (4.5%) cases each; congestive heart failure with pleural and pericardial effusion accounted for 2 (3.0%) cases each; chronic kidney disease and multiorgan dysfunction syndrome accounted for 2 (3.0%) cases each; vasculitis and Parkinson’s disease constituted for 1 (1.5%) case each. Table 2 contains the entire list. The bar chart shows the pictorial representation in Table 2. The mortality rates of various diseases are plotted against the causes of mortality in the elderly in the 2-year period as depicted in bar charts in Figure 1.

**Discussion**

Despite the fact that this study of mortality patterns of elderly patients is a hospital-based study, its significance cannot be overemphasized as it shows the patterns of death in our geographic and ethnic location served by this hospital, that is, the north Indian region in the foothills of the Himalayas. However, since there are no comprehensive national data on death patterns in India, this may represent significantly part of the national health statistics if this is well extrapolated.

The cause of mortality is more due to noncommunicable diseases than communicable diseases. There is an upward trend of mortality due to noncommunicable diseases in India because of major changes in lifestyle and behavior. This is at par with...
This furthermore is supported in a teaching hospital in Barabanki, Uttar Pradesh, about 250 km from our teaching hospital. It supports the increasing trends of noncommunicable disease burden among all ages especially the elderly from a rural population. Again our teaching hospital sees both rural and urban types of patients.

Our study also shows similar trends with a cross-sectional study done by Agarwal et al.\(^\text{14}\) (April 2018), in a rural town in Barabanki, Uttar Pradesh, about 250 km from our teaching hospital. It supports the increasing trends of noncommunicable disease burden among all ages especially the elderly from a rural population. Again our teaching hospital sees both rural and urban types of patients.

Our study is also at par with another study by LA Adebusoye,\(^\text{11}\) MO Owolabi,\(^\text{2}\) SZ Kalula,\(^\text{13}\) and A Ogunniyi\(^\text{12}\) published in the Nigerian Journal of Health Sciences in 2015, which shows that the mortality pattern among the developing countries in Africa is mostly due to noncommunicable chronic diseases. LA Adebusoye et al.\(^\text{14}\) concluded that the most common factors associated with mortality among hospitalized elderly patients reported in studies were complications or acute exacerbation of chronic morbidities and noncommunicable diseases.

A study done by Shaya YL et al.\(^\text{15}\) in a teaching hospital in Kathmandu, Nepal, which is a neighboring country sharing some of its border with our state of Uttarakhand, also supports our study. They found hypertension to be one of the most important causative factors for elderly mortality.

However, this is different from the report of Adeolu et al.,\(^\text{11}\) where communicable disease particularly infectious disease was the most common cause of death. The difference in this variation may partly be due to sample size and age bracket of occurrence of infectious diseases occurring in younger age groups, particularly infants and childhood diseases. More so, a significant number of young adult and middle age die from high prevalence of HIV/AIDS which are rarely seen in elderly patients.

Our study confirms the emergence of noncommunicable diseases in our locale in Uttarakhand and the entire Northern India, in particular, and developing countries in general. The reason being partly due to the fact that age is a major risk factor to most of the noncommunicable diseases as this study was conducted in elderly patients. Again, lifestyle, western diet, and obesity have contributed to increased prevalence of noncommunicable diseases, especially cardiovascular diseases such as ischemic heart diseases or coronary artery disease. In this study, cerebrovascular accident was the most commonly encountered cause of death among admitted elderly patients.

This is further supported by other researchers where it was adjudged as the most common cause of morbidity and mortality in medical admissions.\(^\text{8,13}\) Furthermore, other noncommunicable diseases including hypertensive diseases, diabetes mellitus, ischemic heart disease, and acute renal failure accounted for a majority of mortality cases among the elderly in the environment of northern India. This once more is similar to previous global report where cardiovascular accidents accounted for most of the mortality patterns. Recent reports also corroborate this study revealing that it accounted for higher mortality rates in developing countries like India.\(^\text{8,14}\) This furthermore is supported by the statistics of the WHO suggesting that by 2020, 8 of every 10 cases of cardiovascular disease mortality would come from developing countries while there would be a decrease in the incidence of mortality rates in developed countries.\(^\text{17,18}\) This emerging trend of noncommunicable diseases of morbidity and mortality patterns in developing countries is worrisome because only very few well-equipped facilities to cater for such patients are available across the country with records of population explosion, especially because India is the second most populated country in the globe, just behind China.

Another very important fact to be noted is that hepatitis, chronic liver disease, and chronic obstructive pulmonary disease which constituted 7.6% of our cases have a male preponderance. No female mortality cases were seen in each of these diseases. These constituted the sixth largest cause of mortality among elderly in this time period. This fact comes parallel to other researches of the northern Indian region which have also shown that chronic obstructive pulmonary disease has a male preponderance because it is mainly dependent on cigarette smoking habits and air pollution which is very high at this present time in North India. Even tuberculosis assumes a male preponderance with four (80%) cases of five deaths occurring in males.

Cardiovascular disorders such as ischemic heart disease or coronary artery disease also occur mostly in males. This is mainly because of the stressful life of the modern days. Obesity, western diet, and lifestyle contribute a major role toward the development of ischemic heart disease especially in our environment.

Again various malignancies constituted the sixth majority mortality pattern of diseases in elderly patients; however, there is a slight preponderance of mortality patterns in elderly males. In elderly males, prostate cancer is among the most common cause of morbidity and mortality in India and worldwide.\(^\text{19}\) This high prevalence of malignancies in our locality is not surprising as age is a major risk factor to the occurrence of malignancies worldwide as most of our patients were 60 years old.

Figure 1: Mortality rates of diseases among elderly vs causes of mortality

| Disease | Causes of Mortality | Mortality Rates |
|---------|---------------------|-----------------|
| Cancer  | Heart Disease       | 20%             |
| HIV     | Liver Disease       | 15%             |
| Diabetes| Renal Failure       | 10%             |

India. These observations emphasize the importance of public health education and awareness about the increasing burden of noncommunicable diseases.
and above. Again, this center is the only tertiary institution in this hilly locality of Himalayas on the banks of the Ganges, servicing several towns and villages in the state of Uttarakhand and the nearby towns, villages, and cities of Uttar Pradesh west, India. In Uttarakhand, this hospital caters to patients from the districts of Haridwar, Tehri Garhwal, Pauri Garhwal, Udham Singh Nagar, Chamoli, Uttarkashi, Bageshwar, Champhawat, and Rudra Prayag. Therefore, it is serving as a referral center to most oncology, stroke, cardiovascular, metabolic, and renal cases from all secondary and primary health institutions in this locality. However, this is at variance with studies done by Okunola et al. where diabetes mellitus was the second most frequent morbidity and mortality patterns. The reason for this variation may partly be attributed to pattern of study as their study span across all age groups while our study was restricted to elderly patients.

Notwithstanding, it is important to note that a large percentage of elderly mortality cases comes from communicable especially infectious diseases. This is similar to several reports by different researchers. The reasons for this similarity may partly be attributed to poverty and overpopulation with overcrowding, poor hygiene, and sociocultural beliefs. On our list, sepsis/septicemia was the most common cause of mortality among the communicable diseases in elderly and it ranked third in the series and accounted for 18.2% of all-cause death in the elderly.

Another important cause of mortality is trauma, but it is not included in this study because we have a separate center for trauma, especially those of road traffic accidents which constitute a major percentage of mortality among patients of all age groups.

Thus, the limitation of this study is that it is a teaching hospital-based study, done for a short duration. Population-based studies over a long duration are needed to throw more light on mortality patterns in geriatric population of the region.

This article shows how there is a change in trend toward noncommunicable diseases among the elderly population in developing countries like India. This will be of help in the practice of family physicians as we will be required to focus more on the risk factors contributing to these conditions, especially those risk factors which can be modified by a modification in the daily lifestyle rather than communicable diseases which was earlier considered to be the greatest burden among elderly populations. This will lead us to follow a prevention-based strategy and family-based approach in clinical practice if we can identify the risk factors leading to the noncommunicable causes of mortality among the elderly population in our country. Family-based healthcare workers can be trained at the ground level for identifying risk factors. This will definitely help in the reduction in the percentage of hospital admissions and mortality among the elderly population.

Conclusion

Noncommunicable diseases particularly cerebrovascular diseases and hypertensive disorders are the leading causes of elderly mortality in our environment of Northern India. Diabetes mellitus and acute renal failure were also commonly encountered causes of death in the elderly. However, a large percentage of mortality patterns also results from communicable diseases with septicemia and pneumonia as the leading causes. Hence, there is the need to advocate a holistic care for the elderly to reduce the scourge of both noncommunicable and communicable diseases’ mortality in elderly.

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Conflicts of interest
There are no conflicts of interest.

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