

To study the Prevalence of Microscopic Blood Pictures and anemia among Elderly in Rural Areas of a District in Haryana, India

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Abstract

Objective of study: To know the prevalence of microscopic blood pictures and their association with hemoglobin level, age and sex among rural elderly.

Methods: A rural community based cross-sectional study covering all elderly (≥ 60 years) in the population (15706) of three health sub-centers selected randomly out of total 21. The demographic information, peripheral blood smears and samples were taken by house-to-house visits. Pathologists examined smears and estimated hemoglobin using Cynmethemoglobin method.

Results: The prevalence of Normocytic-Normochromic, Normocytic-Hypochromic, Microcytic-Hypochromic, Dimorphic and Macrocytic-Normochromic blood pictures were 45.4%, 20.4%, 21.4%, 10.2% and 2.6% respectively. The proportion of elderly having Hemoglobin 10 gm% or more (i.e. normal or mildly anemic) among above types were 91.8%, 27.0%, 11.4%, 2.0%, 0% respectively and this association of Hb levels with various blood pictures was highly significantly. Females had less Hb level than males and showed more hypochromic picture. Hb level and Normocytic-Normochromic picture also declined with age. Thus, microscopic examination of blood film was significantly reliable in assessing the prevalence as well as broad causes of anemia.

Conclusion: Nine out of every ten rural elderly were anemic as per WHO definition with more than half having hypochromic pictures. Microscopic examination of blood smears was significantly reliable in diagnosing anemia as well as its broad causes in resource constrained situations.

INTRODUCTION

Anemia is the biggest enemy of elderly and its severity increases with age.^{1,2} It also increases the severity of other co-morbidities.³ Elderly people with anemia have twice the risk of experiencing physical declines that can end up robbing them of their independence⁴ and they also suffer increased mortality.^{5,6} Even Mild Anemia is a risk factor for loss of physical function. Immediate concerns in elderly with anemia are the complications that are linked to the onset of a form of vascular dementia or heart attacks. The survival rates in these morbidities are drastically decreased among anemic elderly than those without anemia.⁷

What's more, in India, that anemia problem is more common and severe in rural areas where about 80% of elderly reside.⁸

In Haryana, more than 65% of total population resides in rural areas.⁹ Most of the laborers or even well to do families from rural areas who migrate to urban areas, usually do not take their elderly parents with them and the elderly continue to live in their rural residences, where health services are also scanty and in rudimentary form. Thus, elderly become more vulnerable to mortality and morbidity. Therefore; the problem of elderly morbidities, anemia in particular in rural areas is very serious and worrying. Hence, there was a necessity to look for magnitude and causes of anemia among elderly for initiating effective interventions. Though, in present technological era, there are many advanced automated blood analyzers available world over; but, the practical utility of such instruments is almost negligible in our rural environment where even the very basic necessity of

electricity is often interrupted for weeks together. Clinically also, many a times, symptoms of anemia may be misleading as anemic patients gradually decrease their physical activity down to asymptomatic levels and they state, "They don't feel anything wrong".¹⁰ Further, even the hematocrit alone cannot be used for a firm diagnosis of anemia as it measures the percentage of blood cells volume with respect to total blood volume. So, a low hematocrit may indicate inappropriate fluid balance rather than true anemia. Confirmation of anemia is best done with the erythrocyte indices, which consider ratios among the three core measurements i.e. small red blood cells, reticulocyte or nucleated red cell count and mean corpuscular hemoglobin concentration (MCHC).¹¹ A visual (microscopic) examination of a blood smear is also equally helpful for the above indices and is sometimes a necessity in regions of the world where automated analysis for these is less accessible.¹²

Even the clinical examination for anemia at times may not be of much practical use due to high prevalence of chronic conjunctivitis, muddy sclera, poor oral and hand hygiene etc. Moreover, such clinical examinations on regular basis may not be feasible due to economic, manpower and other constraints. Under the existing circumstances, any national health program exclusively addressing elderly health problems is not feasible and visible in near future. Therefore, adding a new service element for elderly to an already well established regular health program could be a viable option. Like preparation of blood smear of elderly along with fortnightly slide preparations of all fever cases for malaria surveillance in rural areas was considered the most feasible, viable and effective option for assessing magnitude as well as diagnosing causes of anemia among elderly as the services for preparation of blood smears for malaria at fortnightly interval already existed in rural areas under active surveillance for malaria. Hemoglobin estimation using Cynmethemoglobin method was also done (as a gold standard) to assess the anemia problem and also the reliability of microscopic examination of blood smears for assessing anemia among elderly specially in resource constrained rural settings.

Routinely, in morphological approach, red blood cells are categorized microscopically in the following ways: Pale-colored (hypochromic); abnormally small (microcytic); abnormally large (macrocytic); normal colored and normal sized (normochromic-normocytic).¹³ It has been

emphatically documented in medical literature that red blood cell morphological approach will remain an important element of classification and diagnosis of anemia.¹⁴ Hence, keeping all such aspects in view, the present study was undertaken.

AIMS AND OBJECTIVES:

1. To know the prevalence of microscopic blood pictures and anemia among rural elderly.
2. To examine the association of microscopic blood pictures with hemoglobin levels, age and sex.

MATERIALS AND METHOD:

Study Area: The study was conducted in a Rural Community Development Block comprising of 24 villages having 96784 population served by 21 Health Sub-centers. Agriculture, animal rearing and services were the major occupations of people in the study area.

Study Population: Elderly aged 60 years and above in the study area.

Sample size: Taking a lower estimate of about 30% prevalence (p) of anemia among elderly with 10% of p as allowable error (L), the calculated sample size at 95% confidence level was 933 using the formula $= 4pq/L^2$ where $q = 1 - p$. To get the required sample size, taking around 7 % of elderly in the total population as per census-2001 data, 3 health sub-centers out of total 21 health sub-centers were selected randomly covering 15706 populations. All elderly persons aged 60 years and above in the sampled study population were enlisted by house-to-house visits and the list was also cross matched with family records available at health sub-centers. There were total 1103 elderly persons (547 males and 556 females) constituting 7.02% elderly in the total sampled population.

Study Design: Community based cross sectional.

Study Tool: Pre-tested, semi-structured schedule.

Data and samples collection: House-to-house visits were made to contact all the enlisted elderly persons for collection of required epidemiological data, blood samples and blood slides by the investigators after taking informed consent. All aseptic precautions were observed in collecting blood samples and preparing slides. Used needles and syringes were kept in 2% hypochlorite solution and were disposed off as per guidelines for biological waste disposal. Health workers of the area were involved in contacting and motivating the elderly for participation in the study. The

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blood samples were collected in screw-capped tubes having 5 milliliters Drabkins Reagent and slides were prepared on spot, dried for ten minutes and kept in slide boxes. An experienced trained laboratory technician accompanied the investigators for assistance in the above task. Samples and slides were transported same day to Department of Pathology; PGIMS Rohtak and Hb estimation was done using Cynmethaemoglobin method on the same day or occasionally next day morning. Staining of slides was also done on priority basis at the earliest possible, though examination took longer time as it was a time consuming task and was done by pathologists who were also involved in reporting for hospital patients.

Data analysis: The collected data and laboratory reports were compiled in Microsoft Office Excel 2007 and were tabulated, analyzed and interpreted using SPSS software (version 17.0). Statistical analysis included percentages and chi square test. For classification of anemia and its magnitude, WHO criteria were followed. The study plan was passed and ethically approved by Post Graduate Board of Studies in Medicine and Allied Sciences, Post Graduate Institute of Medical Sciences, Rohtak.

RESULTS:

General: A total of 1005 elderly (501 males and 504 females) could be contacted and 498 males and 503 females (total 1001), who gave informed consent for participation, were included in the study. Of the remaining 98 elderly out of total 1103 enlisted, 37 died during the study period before being contacted for data collection and the rest (61 elderly) could not be contacted even after three visits. 19 slides were discarded due to breakage, improper preparation or staining and finally the data of 982 cases (490 males and 492 females) were used for final analysis.

Magnitude of anemia problem among rural elderly (Table 1):

About 90% elderly were anemic as per WHO definition but only 4.9% were severely anemic. Thus, as per total prevalence, anemia problem was categorized as high magnitude problem (prevalence > 40%) and as per prevalence of severe anemia, it was moderate problem (1 to 9%) according to WHO criteria. Mean Hb level among women (9.40 ± 0.07 gm %) was approximately 1 gm less than that of men (10.36 ± 0.08 gm %), and this difference was highly significant. 39.8% and 45.7% elderly were mildly and moderately anemic respectively.

Table 1

Prevalence of microscopic blood pictures and their association with hemoglobin levels among elderly

| Blood Picture | Hemoglobin levels (gm %) & grades of anemia as per WHO criteria | | | | |
|----------------|---|--------------|--------------|--------------------|----------|
| | < 7/severe | 7 - 9.9/mod. | 10-11.9/mild | 12 or more/N Total | |
| NCy-NCh | 0 | 41(9.2) | 311(69.7) | 94(21.1) | 446(100) |
| NCy-HCh | 5(2.5) | 141(70.5) | 54(27) | 0 | 200(100) |
| MiCy-HCh | 9(4.3) | 177(84.3) | 24(11.4) | 0 | 210(100) |
| Dimorphic | 34(34.0) | 64(64.0) | 2(2.0) | 0 | 100(100) |
| Macrocytic-NCh | 0 | 26(100) | 0 | 0 | 26(100) |
| Total | 48(4.9) | 449(45.7) | 391(39.8) | 94(9.6) | 982(100) |

χ^2 value: 742.140, p value: 0.000 (highly significant), df=12. Mean Hb (gm%): 9.9 ± 1.65 SD;

(Range: 3.8–13.5). Mean Hb. males: 10.117 ± 1.81 SD; Mean Hb. females: 9.534 ± 1.52 SD.

Df =degree of freedom; mod = moderate; N=normal; NCy = Normocytic; MiCy=Microcytic;

NCh = Normochromic; HCh = Hypochromic. (Figures in parentheses are percentages).

Association of microscopic blood picture and hemoglobin level (Table 1): About half (45%) of elderly were having Normocytic-Normochromic blood picture, mostly with mild anemia or normal Hb level, but none of them was severely anemic (Hb < 7 gm %). Approximately one fifth of elderly were having Normocytic-Hypochromic blood picture and all were anemic and 70.5% of them were moderately anemic. 21.4% elderly were having Microcytic-Hypochromic blood picture; again all were anemic and 84.3% of them were moderately anemic and proportion of severely anemic also increased as compared to Normocytic-Hypochromic blood picture. 10.2% elderly were having Dimorphic picture and more than one third of them (34%) were severely anemic and 64% moderately anemic. Only 2.6% were having Macrocytic-Normochromic picture and all were moderately anemic. Thus, morphological examination of blood smear gave a fairly good estimate of anemia and the order of severity of anemia among different morphological blood pictures was as follow: Dimorphic > Microcytic-Hypochromic > Normocytic-Hypochromic > Normocytic-Normochromic. The associations between Hb levels and blood pictures was highly significant. Thus, merely by microscopic blood smear examination, which is possible in our existing circumstances without much extra efforts or resources, one can judge the grades of anemia. In general, the differential diagnosis of anemia can be substantially narrowed by sub-categorization into "microcytic," "normocytic," and "macrocytic" subtypes and each subtype then can be deciphered using a stepwise approach to arrive at

possible cause of anemia.¹⁵

Association of microscopic blood picture with age and sex (Table 2):

Microscopic blood picture showed highly significant association with age. The proportion of elderly with Normocytic-Normochromic blood picture increased with increasing age from age groups of 60-64 to 70-74 years with corresponding decline in the proportion of other types of pictures specially among Normocytic-Hypochromic as was evident in the table-2 itself. But, it needs to be interpreted in right perspective and not that Normocytic-Normochromic blood picture increased with age and other types decreased. As the proportion of elderly in each of the equal age groups of five years has declined progressively from 42% in 60-64 years to 8% in 74-79 year's age group with age due to old age mortality, and this process of mortality was selective primarily based on their health status or one can say the Hb. level to a great extent. Thus, persons with Normocytic-Normochromic blood picture survived more as compared to persons with other types of blood pictures. Hence, the proportion of elderly with Normocytic-Normochromic blood picture or with better Hb. level increased in comparison to other elderly. But, after 75 years, there was a decline in the percentage of Normocytic-Normochromic blood picture indicating a generalized decline in health status of aged.

Table 2

Association of microscopic blood pictures with age and sex.

| Variables | Microscopic blood picture | | | | |
|-----------|---------------------------|-----------|-----------|-----------|----------|
| Age: | NCy-NCh | NCy-HCh | MiCy-HCh | Di/Ma-NCh | Total |
| 60-64 | 188(44.5) | 89(21.1) | 91(21.6) | 54(12.8) | 422(100) |
| 65-69 | 120(50.0) | 45(18.3) | 51(21.7) | 24(10.0) | 240(100) |
| 70-74 | 82(61.2) | 20(14.9) | 22(16.4) | 10(7.5) | 134(100) |
| 75-79 | 20(23.8) | 22(26.2) | 26(31.0) | 16(19.0) | 84(100) |
| 80 & > | 36(35.3) | 24(23.5) | 20(19.6) | 22(21.6) | 102(100) |
| Sex: | | | | | |
| Male | 276(56.3) | 80(16.3) | 72(14.7) | 62(12.7) | 490(100) |
| Female | 170(34.6) | 120(24.4) | 138(28.0) | 64(13.0) | 492(100) |
| Total | 446(45.4) | 200(20.4) | 210(21.4) | 126(12.8) | 982(100) |

Age: $\chi^2 = 36.488$, p value = 0.001. Sex: $\chi^2 = 39.2$, p value = 0.000.

(Figures in parentheses are percentages). NCy=Normocytic; NCh=Normochromic; HCh=Hypochromic; MiCy=Microcytic; Di/Ma-NCh=Dimorphic & macrocytic-normochromic.

Sex wise association of blood picture showed that percentage of elderly males with Normocytic-Normochromic was significantly higher than their female counterparts and consequently, the proportions of other types of blood pictures associated with more anemia were higher in females than males. Similar other studies on prevalence also reported more prevalence of anemia among elderly females than elderly males in India.¹⁶

DISCUSSION:

Anemia among rural elderly was extraordinarily high up to 90% as per WHO definition. Gravity of the situation demands urgent intervention. The reported prevalence is certainly higher than other studies e.g. Niranjana GV et al.¹⁷ also reported prevalence of anemia amongst elderly (both males and females) in urban areas of Bangalore as 27.2% with Hb. less than 10 gm% as against 50.6% in the present study (Hb. <10 gm %). The comparative low prevalence in that study could be due to urban and rural difference and due to more proportion of males (56% males and 44% females) as the males are comparatively less anemic than females as was observed in the present study also. Other similar Indian studies also showed varying degree of anemia depending on difference in various variables but all showed comparatively less prevalence of anemia than the prevalence in present study. The typical situation of un-noticed neglect of elderly

in the study area could be the reason for such a high prevalence of anemia among them as most elderly staying in rural areas can be grouped in two categories. One category of elderly belonging to poor families who are living in rural areas. Although, such elderly are being cared by the family members, but poverty deprives them of adequate diet resulting in nutritional anemia. Other category comprises of elderly belonging to economically middle or higher class families who usually migrate to urban area, but in most cases elderly continue to stay in their rural abode alone facing neglect of care resulting in poor nutrition and anemia obviously. So, anemia problem was so severe.

Comparatively the very low prevalence of anemia among elderly in developed countries (around 10% in most of the studies)¹⁻⁶ obviously indicated that anemia being multi-dimensional problem mainly depends on socio-economic variables and level of development. Consequently, elderly as well as other segment of population in India probably will have to wait for long to attain that level of development and obviously the comparable Hb. level as in developed countries. Moreover, anemia is a cumulative problem and it goes on increasing with age from womb to tomb. Hence, it is so high among elderly.

The significant association of hemoglobin levels with morphology of RBCs in blood films raises hopes for some effective intervention to curb the menace of anemia in the practically neglected segment of our society, the elderly. The hopes hinge around well established malaria surveillance activities in rural areas where health workers prepare blood slides fortnightly from all fever cases. He can easily prepare the blood smears from elderly also and the slides can be examined by the pathologists at district hospitals or medical colleges as the case may be to diagnose anemia as well as differential diagnosis can be substantially narrowed by sub-categorization into "microcytic," "normocytic," and "macrocytic" subtypes and each subtype then can be deciphered using a stepwise approach involving history or tests to arrive at possible cause of anemia which can be of much help in the effective treatment of anemia. Starting a new program for elderly to control anemia may not be possible in the financially resource constrained countries like India, but, adding additional component of service in the already well established program is a viable feasible option. The above alternative is being explored to overcome the limitation of testing Hb. in field conditions in rural areas or moving elderly to health facilities for the same.

Discussion on comparison with other similar studies could not be possible as no such study of association of Hb. levels, age and sex with microscopic blood pictures among elderly was available in the literature. Hence, the study is unique in this aspect.

CONCLUSION AND RECOMMENDATIONS:

Most of the older persons in rural areas of Northern India were suffering from anemia of varying degrees. Microscopic examination of peripheral blood smears proved to be a reliable, viable and feasible method for diagnosing anemia and its broad causes in rural areas with constrained health care facilities and thereby making the treatment possible and effective through already existing malaria program. Though, it may be a small intervention, but has the potential to keep the elderly out of nursing homes and hospitals and to preserve their capacity of independence.

Strengths of study included: A community based study revealing the real magnitude of the problem in the population. A large sample size and uniqueness are other notable strengths of this study. Main weaknesses of the study included: Other more reliable tests for Hb. estimation and size of RBCs e.g. Serum ferritin radioimmunoassay, MCV & MCHC etc. could not be done due to resource constraints. Microscopic examination of slides is again not so easy and needs the services of experts, but still it can be outsourced.

Key points:

- Anemia prevalence was extra ordinarily high among older persons in rural areas of Haryana in Northern India.
- Nutritional anemia was most common as evidenced from predominantly hypo-chromic and micro-cytic pictures in blood smears among elderly who were not chronically ill which excluded that due to chronic illness.
- Microscopic examination of peripheral blood smears proved most feasible, viable and easy method to assess magnitude and diagnose the broad causes of anemia among rural elderly especially in areas with constrained health care facilities.
- Anemia prevention/control among elderly can be integrated with ongoing malaria surveillance activity in rural areas to keep them healthy and happy.

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