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Indian Journal of
Forensic Medicine and Pathology

April-June 2021
Volume 14 Number 2

Contents

Original Article

Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 2, April - June 2021
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14221.10

Correlation Between Smoking and Lung Abnormalities

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How to cite this article:
Banwari L Meel/Correlation Between Smoking and Lung Abnormalities/Indian Journal of Forensic Medicine and Pathology/ 2021;14(2):83-89.

Abstract

Background: Both dust inhalation and smoking combined, led to more deleterious effect on the lungs. The health of gold miners is not only eroded by excessive exposure to dust in the mines, but also by the habit of smoking. Smokers have a significantly higher risk of getting lung cancer than non-smokers.

Objective: The objective of this study is to establish the relationship between smoking and lung abnormalities among ex-mineworkers in the Transkei region of South Africa.

Patients and Methods: During a two years period (May 1997 to May 1999) 2080 former mineworkers were examined at the Benefit Examination Clinic at Umtata General Hospital, a tertiary hospital attached to the Walter Sisulu University in Eastern Cape Province. Radiological examinations were carried out on (466) former mineworkers, in the age group ranging from 30 years to 70-plus years.

Results: Mineworkers who had smoked exhibited two to three times the number of gross lung abnormalities on radiological examination than those who had had no experience of smoking in their life. The readings taken indicated an odd ratio (OR) of 2.0 with a p value of <0.05, and Chi-square 8.3, indicative of statistically significant association between smoking and lung abnormality in the ex-mineworkers (i.e. ex-smokers, smokers, and non smokers).

Conclusion: There is a strong correlation between lung abnormalities and smoking among ex-mineworkers in this study.

Keywords: Smoking; Lung abnormality; Ex-mineworkers; Dust; Lung cancer.

Introduction

The global trend in tobacco related deaths is very high, according to a 1999 World Bank report. With current smoking patterns, 500 million people alive today will eventually be killed by tobacco use. More than half of these are now children and teenagers. By 2030 tobacco use is expected to be the single biggest cause of death worldwide.[3] Smoking-related deaths are projected to rise to 10 million a year by the 2020s, with 70% of these mortalities assumed to occur in poorer countries.[4] Lung diseases are ranked the third major killer in America, responsible for one in seven deaths. Today, more than 30 million Americans are living with chronic lung diseases such as asthma, emphysema and chronic bronchitis.[5] Lung cancer, one of the few malignancies of which the main cause is definitely known and that can be prevented, is on the increase especially in developing countries that have been targeted by tobacco companies.[6] The mining industry has also underestimated the crippling effects of tobacco smoking among its employees. The two commonly used legal drugs, alcohol and tobacco, are more frequently consumed among miners than all illegal drugs combined.[7]

No estimate of tobacco smoking in South Africa is available, but it seems to be a more serious and widespread problem than is readily acknowledged, especially among ex-mineworkers of Transkei. These mineworkers have also been exposed to silica

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dust, which, together with tobacco smoking that is a common practice among the black mineworkers, has a devastating effect on their health. The complex of dust inhalation with smoking in the causation of lung diseases is certainly health degenerating, as a large number of ex-mineworkers have experienced when they developed lung abnormalities.

Patients and Method

During a five years period from May 1997 to May 2002, about 3000 ex-mineworkers were examined at the Benefit Examination Clinic, a clinic located at Nelson Mandela Academic Hospital (NMAH) a tertiary hospital attached to the Walter Sisulu University in the Eastern Cape Province. The benefit examination of ex-mineworkers is done once a week. The ex-mineworkers present themselves on this day for a comprehensive checkup to enable them to claim compensation from their former employers. A record of their history of mining and ID documentation, a chest X-ray and a report of a physical examination are then documented and forwarded to the Medical Bureau of Occupational Diseases in Johannesburg to process the compensation claims.

This study was a descriptive one, carried out by random sampling of data collected from X-ray photographs taken from X-ray plates of the chests of 466 ex-mineworkers. These photographs were interpreted by an independent radiologist. The interpretations of the photographs by the radiologist were then compiled with smoking, non-smoking and ex-smoking histories in relation to lung abnormalities. The word "abnormalities" is defined in Longman's English dictionary as being different from what is expected, usual or average, especially in a bad or undesirable way. It has been used instead of disease throughout this study. Photographs of X-ray plates of ex-mineworkers were studied in an attempt to ascertain unusual states, different from normal ones, exhibiting gross morphological changes.

This examination sought to establish the presence of opacities in the lung fields, gross tracheal deviations, and structural abnormalities of the lungs and pleurae. In the majority of cases a mixed picture was observed and this was taken into account in the final diagnoses, with the help of an independent radiologist.

This method in fact leads to underestimation of lung pathologies, as many of the smaller opacities are not obviously visible on the X-ray photographs. Since it is a comparative study of lung abnormalities in three categories of mineworkers, i.e. non smokers, smokers and ex-smokers, gross errors in judgment are neutralized. All the data were collected and analyzed by Epi6 Info computer program. The result was displayed in figures and tables.

Results

Three-fifths (63%) of the ex-mineworkers presented signs of lung abnormality, as shown in Table VI. This was found mainly in 39% of the middle-aged (40-59 years) group. In contrast, no lung abnormality was detected in 174 (37%) of the ex-mineworkers sampled.

Table VI: Different age groups with lung abnormality detected in ex-mineworkers of the Transkei.

Age groups	Lung abnormality detected	No lung abnormality detected	Total
30 to 39	23 (5%)	33 (7%)	56 (12%)
40 to 49	84 (18%)	57 (12%)	141 (30%)
50 to 59	97 (21%)	40 (9%)	137 (30%)
60 to 69	68 (15%)	29 (6%)	97 (21%)
70 +	20 (4%)	15 (3%)	35 (7%)
Total	292 (63%)	174 (37%)	466 (100%)

Chi square 18.36 P value 0.001 (Statistically highly significant).

Non smokers showed lung abnormalities in about half (50%) of the photographs examined, as shown in Table III. The other half (50%) of non smokers did not present any detectable abnormality (Fig. 5).

Table III: Lung abnormality detected in non-smokers in age groups among ex-mineworkers of Transkei.

Age groups (years)	Gross lung abnormality detected	No lung abnormality Detected	Total
30 to 39	4 (4%)	11 (11%)	15 (15%)
40 to 49	11 (11%)	13 (14%)	24 (25%)
50 to 59	13 (14%)	10 (10%)	23 (24%)
60 to 69	13 (14%)	9 (9%)	22 (23%)
70+	7 (7%)	6 (6%)	13 (13%)
	48 (50%)	49 (50%)	97 (100%)

Chi square = 4.62, p value = 0.32 (Statistically not significant)

Three-fourths (75%) of the smokers group showed lung abnormality, as shown in Table IV. This was found predominantly (46%) in the middle-aged (40-59 years) group. In contrast, no lung abnormality was detected in one-fourth (25%) of ex-mineworkers who had been smoking.

Table IV: Lung abnormality detected in smokers in different age groups of ex-mineworkers in the Transkei.

Age Groups	Lung Abnormality Detected	No Abnormality Detected	Total
30 to 39	12 (8%)	7 (5%)	19 (13%)
40 to 49	33 (23%)	15 (10%)	48 (33%)
50 to 59	33 (23%)	8 (5%)	41(28%)
60 to 69	24 (17%)	5 (4%)	29 (21%)
70 +	5 (4%)	1 (1%)	6 (5%)
Total	107 (75%)	36 (25%)	143 (100%)

Chi square = 4.21, p value= 0.378 (Not significant).

Three-fifths (61%) of the ex-smokers among the ex-mineworkers showed lung abnormality, as shown in Table V. This was again found predominantly (41%) in the middle aged (40-59 years) group. In contrast, no lung abnormality was detected in two-fifths (39%) of ex-smokers.

Table V: Lung abnormality detected in ex-smokers in different age groups among ex-mineworkers in the Transkei.

Age Groups	Lung Abnormality Detected	No lung Abnormality Detected	Total
30 to 39	7 (3%)	15 (6%)	22 (9%)
40 to 49	40 (18%)	29 (13%)	69 (31%)
50 to 59	51 (23%)	22 (10%)	73 (33%)
60 to 69	31 (14%)	15 (7%)	46 (21%)
70+	8 (3%)	8 (3%)	16 (6%)
Total	137 (61%)	89 (39%)	226 (100%)

Chi square= 12.10, p value=0.016 (Statistically significant)

Discussion

This study is a first of its kind and aims to estimate the deleterious effects of smoking among ex-mineworkers of Transkei. The mortality and morbidity rate as a result of tobacco smoking among ex-mineworkers is difficult to estimate, but there are a number of indicators suggesting that the incidence of lung diseases is very high, and therefore mortality is probably high as well. This high incidence of lung diseases could be explained by the inhalation of pollutants, either mining dust or tobacco smoke or both.

Isolating the effects of these two types of pollutants on the lungs is not an easy task. However, it is clear from the radiological interpretations of X-rays that smokers presented more and also more complicated lung abnormalities than non-smokers, quantitatively as well as qualitatively. The proportion of dust and tobacco smoke inhalation could be creating a complex, which rapidly leads to pulmonary fibrosis, faster than when dust or smoke alone is inhaled. Tobacco smoke of course independently contributes to disability by causing chronic bronchitis and chronic airflow obstruction.[8]

More than three-fifths (63%) of the sampled ex-mineworkers showed lung abnormality, as shown in Table VI. This was found mainly (39%) in the middle aged (40-59 years) groups. In contrast, no lung abnormality was detected in 174 (37%) ex-miners. This high percentage of lung abnormalities could be associated with exposure to unlimited amounts of pollutants in the dusty environment, as well as smoking. The high prevalence of infectious diseases such as tuberculosis, with or without silicosis (71.2%), proved that abundant lung abnormality occurs among the ex-mineworkers.[1] The excessive mortality due to chronic respiratory diseases is not surprising. Both cigarette smoking and exposure to dust in mines are causal factors of chronic respiratory diseases.[9,10]

Fifty percent of the non smoking subjects showed lung abnormalities, though the other half presented no evidence of gross lung pathology, a ratio of 1:1; among smokers 75% showed abnormal pictures and the other 25% showed no abnormalities (ratio of 3:1); while in ex-smokers 61% indicated gross abnormalities of the lungs and 39% showed no abnormality (ratio of 3:2). This indicates that non smokers are much healthier than smokers and ex-smokers. It also indicates that ex-smokers are healthier than smokers. We can easily conclude that quitting smoking is advantageous. Again, the lung abnormalities detected in the study samples were observed predominantly in the 40-59 middle aged groups. Forty-six percent of smokers, 41% of ex-smokers, and 25% of non smokers showed abnormal lung pictures on the X-ray photographs' interpretations, as shown in Tables III-V.

In a normal individual, after the age of 25, lung function as measured by FEV1 normally declines steadily at a rate of 25-30 ml per year. In a smoker the rate approaches 60 ml per year and the FEV1 'nosedives'. This degree of deterioration could be steeper in ex-mineworkers, as they had also been exposed to dust inhalation in addition to smoking. On stopping smoking, although lost lung function is not recovered, the rate of decline slows to normal. Even when the smoker is disabled by chronic obstructive pulmonary disease (COPD), the rapid decline of FEV1 is slowed to normal by smoking cessation, and a worthwhile gain in quantity and quality of life is achieved. Therefore, it is never too late to stop smoking.[11]

COPD progresses very gradually and

breathlessness only becomes troublesome when about half of the lung has been destroyed. The disease is rarely reversible once it established. Smoking is now the main cause of COPD. It is very rare in non-smokers and at least 90% of deaths from this disease can be attributed to cigarette smoking.[12] By far the greatest risk factor for COPD is cigarette smoking. The mixture of smoking and dust exposure probably enhances the effects in the lung in the causation of COPD. In the experience of the author, COPD in women smokers is hardly ever as bad as among mineworkers. This is probably due to the fact that hardly any women are exposed to mining dust, since mining is not an occupation in which women are commonly found. Some further work needs to be done to establish the combined effects of smoking and dust in causing COPD. The mechanism of the relation between COPD and smoking is not at present completely understood. It is not simply the number of cigarettes smoked; some other factors, such as silica dust, also may cause COPD.[11]

In the case of COPD among young people, giving up smoking leads to the improvement of their lung function. However, in older people, such as many ex-mineworkers, such an improvement is not possible; although after cessation of smoking further deterioration will run parallel to that of non-smokers. Krishna et al., on the other hand, found that the FEV1 was significantly lower in smokers than in non-smokers and ex-smokers.[14] The risk of lung cancer, like all other cancers, increases steeply with advancing age. When smokers give up smoking, their risk of getting lung cancer starts decreasing so that after 10 to 15 years an ex-smoker's risk is only slightly greater than that of someone who has never smoked.[15] Other factors can cause lung cancer but they are much less important than smoking.[16] For smokers who are exposed to substances such as asbestos, their risk of developing lung cancer tends to multiply and become very large. The International Agency for Research on Cancer (IARC, 1987) has identified crystalline silica as a potential human carcinogen; most mineworkers are exposed to silica in their underground mining work. There is confusion though about the role of silica in causing lung cancer among mineworkers who are frequently exposed to silica and who also smoke. There is again a need for a case control study about the potentiality of silica inhalation and smoking in causing lung cancer.

The respiratory system is vital to life, and anything that prevents it from functioning can result in death. Often cancers of the respiratory system are not discovered until it is too late to cure them: less than 8% of lung cancer patients are alive five years after diagnosis.[17] In countries where smoking has been widespread for many years, the typical pattern of smoking induced deaths are from lung cancer and another quarter are from chronic obstructive lung diseases: bronchitis and emphysema. An ex-mineworker with lung cancer may have smoked cigarettes, had diagnostic X-rays and been occupationally exposed to silica dust in gold mines, so since occupational lung cancer does not have distinctive clinical features, an expert medical witness, using clinical judgment, cannot say that the disease is without question occupational in origin. The expert witness cannot say with certainty that the occupational exposure to silica dust was one of several causes of the cancer.[18] The lung abnormalities are progressive in non smokers, from 3% in the young age group (30-39 years) to 20% in the terminal age group (60+ years). This picture is different in smokers and ex-smokers, as the lung abnormalities rise sharply from 23% to 24% in middle age group i.e. 40 to 59 years.

The characteristic feature of all these groups is the progressive nature of their susceptibility to acquiring lung abnormalities, with fewer risk factors in the youngest and healthiest group and more in the older group. Lung abnormalities, it is found, are least in the youngest age group of 30-39. Susceptibility to diseases of the lungs is progressive, especially in the middle aged groups from 40-59 years of age, ranked progressively at 5%, 18% and 21%. Again, the phenomenon of lung cancer is prominent in smokers and ex-smokers among ex-mineworkers. There is a link between smoking along with dust inhalation in the causation and progression of lung disease, but the proportion is difficult to estimate. Examining the health of non-smoking mineworkers, which correlates with the lung abnormality of smokers and ex-smokers, has created doubts about the contribution of tobacco smoking alone to the condition of the health of mineworkers. In non-smokers, there is an end point at the level of about six percent (6%) in the terminal age groups. This is not so among the smokers.

Lung abnormalities are predominant in ex-smokers (30%), in smokers (23%), and men who had never smoked (10%). This contrasts with the absence of abnormalities in ex-smokers (19%), smokers (7%), and non smokers (10%). Almost half (a ratio of 1:1) of the non smokers have no lung abnormalities, more than half of the ex-smokers (2:3) are sick, and smokers are a majority (1:3) of those found to be sick as far as lung abnormality

is concerned. There is a marked relationship between smoking and lung abnormality, with a p value of <0.05, and Chi-square at 16.64. It is highly significant, indicating that smoking has a higher association with lung abnormalities (Table IX).

Table IX: History of smoking vs. lung abnormality detected in ex-mineworkers of the Transkei.

History of Smoking	Lung Abnormality Detected	Lung Abnormality not detected	Total
Ex-smokers	137 (29%)	89 (19%)	226 (48%)
Smokers	107 (23%)	36 (8%)	143 (31%)
Non smokers	48 (10%)	49 (11%)	97 (21%)
Total	292 (63%)	174 (37%)	466 (100%)

Chi square= 16.64 p value 0.0002 (Statistically highly significant).

There is a marked relationship between smoking and lung abnormality, with a p value of 0.0037, and Chi-square of 8.39, and Odd ratio of 2.00. It is highly significant, indicating that smokers are twice as vulnerable to lung abnormalities as non smokers (Table X).

Table X: Association between smoking and lung abnormality in ex-mineworkers of the Transkei.

History of smoking	Lung Abnormality	No lung Abnormality	Total
Smoking including ex-smokers	244 (52%)	125 (27%)	369 (79%)
Non-smoking (Never)	48 (10%)	49 (11%)	97 (21%)
Total	292 (63%)	174 (37%)	466 (100%)

Chi-square=8.39 p value 0.0037 OR=2.00 (Statistically highly significant).

Many of those concerned with awarding mineworker compensation in South Africa believe that the disability documented in silicotic subjects and other mineworkers exposed to silica results from cigarette smoking rather than from silicosis. Considering this, and the possibility of an etiological association between silicosis and smoking, it has become apparent that smoking may seriously confound studies of silicotic subjects either directly or indirectly.[19] Increased risk of developing lung cancer depends upon the age when a person starts smoking.

The younger a person is when he starts smoking, the greater the risk of developing lung cancer, especially among mine workers. Death rates increase approximately in proportion to the duration of smoking: doubling the duration of smoking from 10 to 20 years increases the incidence of lung cancer 16 times if daily cigarette consumption remains constant.[20]

The periodic examination of the condition of the lungs of miners in the South African mining industry was evaluated by determining the number and nature of abnormalities. It is suggested that the time between examinations can be extended, especially for younger workers, and that follow up of significant conditions can be undertaken more effectively if the examinations are conducted at the workplace.[21] Unfortunately, non smoking is hardly considered as either part of education strategy or promotion of health in mineworkers by their employers; it is my view that non smoking should be rewarded or an incentive attached to it.

In this study no socioeconomic factors were found to be influencing patterns of smoking and there was no association with social participation. These findings have important implications for the discussion on social capital and preventive measures.[22] Antidepressant drugs may work well to help the more severely addicted to quit. These drugs should be used in addition to nicotine substitutes, and must only be prescribed under medical control.[3] Counseling by doctors and nurses, behavioral interventions (individual counseling or group therapy), nicotine replacement treatment and several pharmacological interventions (such as antidepressants, bupropion and nortriptyline) increase smoking cessation rates.[23] In people trying to quit smoking, nicotine replacement treatments are effective in achieving smoking abstinence for between 6 and 12 months at a time.[24] Smoking is likely to relate to the predominant presence of tuberculosis.[24] It is likely, therefore, that there is an additive effect of smoking with tuberculosis in producing obstruction of the airways.[25]

The effects of tobacco use may be worsened by the incidence of infectious disease and environmental hazards in developing countries, which may cause increases in certain cancers. For example, tuberculosis is endemic in many less-developed countries and the risk of lung cancer is believed to be enhanced by the presence of tuberculosis. Occupational hazards such as mining dust; uranium or asbestos may act as synergistic carcinogens on workers.[26] The results show that the risk of pulmonary tuberculosis increases with the presence of radiologically diagnosed silicosis, with increasing cumulative exposure to silica dust, and with tobacco pack years. The presence of silicosis diagnosed radiologically increased the risk of pulmonary tuberculosis by about four times after adjustment for cumulative dust and smoking.[27]

A majority of mineworkers in the Transkei are infected with tuberculosis. This high vulnerability to pulmonary tuberculosis is due to either excessive exposure to silica dust, tobacco smoking or both.[1]

Conclusion

Tobacco smoking ex-mineworkers live with a much more deteriorated state of health than non-smokers. It seems that the role of dust and smoking is an additive in the causation of lung abnormalities. The mining owners have obligations to their employees, enshrined in the Occupational Safety and Health Act, 1993, regarding the health care of mineworkers. The provisions of this Act should be extended to ex-mineworkers as well. Most of the time, the measures taken by the mining health care advisers are either protective or curative in nature, but not preventive. Education regarding the bad effects of tobacco consumption and the rights of non-smokers should be incorporated in the practice at the workplace under this Act.

Acknowledgement

This article has published in a conference proceedings.

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Original Article

Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 2, April - June 2021
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14221.11

Bizygomatic Distance and Maxillary Sinus Dimensions as Predictors for Age Estimation: A Morphometric Analysis using Cone Beam Computed Tomography

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How to cite this article:

Aishwarya Ramesh, Karthikeya Patil, Mahima VG et al./Bizygomatic Distance and Maxillary Sinus Dimensions as Predictors for Age Estimation: A Morphometric Analysis using Cone Beam Computed Tomography/Indian J. Forensic Med Pathol. 2021;14(2): 91-96

Abstract

Aims: Aim of the study was to estimate, compare and differentiate the anatomical variations according to ageing in the bizygomatic distance and dimensions of maxillary sinuses on Cone Beam Computed Tomography (CBCT) images and to assess their authenticity in age estimation that might be used as an evidence in forensics.

Settings and Design: CBCT images of bilateral maxillary sinus were obtained from 30 subjects, categorized into 3 groups of age ranging between 20-40, 41-50, 51-60 years.

Methods and Material: Measurements such as bizygomatic distance and maxillary sinus dimensions namely length, height, width, area, perimeter and volume were evaluated.

Statistical Analysis Used: The data was subjected to descriptive statistical analysis followed by Chi-square test, One way ANOVA, regression ANOVA, Pearson's correlation and Post-Hoc test.

Results: The study showed a difference among mean values of different age groups but was statistically non significant. As age increased the left width, mean width of right and left maxillary sinus, left area, left perimeter, left volume and right and left mean volume of maxillary sinus decreased linearly and significantly with significant P values. The regression ANOVA revealed that volume is the true predictor of age of the subjects.

Conclusion: Age estimation with few linear measurements of maxillary sinus dimensions was possible among the study population. It was found that as the age increased few of the maxillary sinus dimensions decreased. Hence this study positively recommends the use of maxillary sinus dimensions for the purpose of age estimation in the field of forensics.

Keywords: Age estimation; Bizygomatic distance; Cone Beam Computed Tomography; Maxillary sinus.

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Introduction

Forensic anthropology is the application of the medical science in criminal law.[1] No two radiographs are alike,[2] paranasal sinuses show minute changes among the age groups radiographically. It is proved in few studies that when the different bones are severely mutilated among fatalities the maxillary sinus and zygomatic bone will remain intact.[3,4]

Cone Beam Computed Tomography (CBCT), is used as standard imaging modality for the

visualization of structures in multiple planes with thin sections.[5] This study was undertaken to establish if any anatomical variation exists in the bizygomatic distance and maxillary sinus dimensions according to ageing.[6]

Materials and Method

A prospective observational study performed on 30 apparently healthy subjects of age ranging between 20 - 60 years selected by the simple purposive sampling method and for those subjects who were advised CBCT imaging as a protocol for assessment of any maxillofacial conditions without evidence of any developmental defects or trauma to head and neck region with no evidence of midfacial fracture. The study samples were categorized into 3 different age groups. Group 1: 20-40 years. Group 2: 41-50 years. Group 3: 51-60 years.

Eligibility Criteria

Inclusion criteria

- Subjects without malocclusion and without previous history of orthodontic treatment.
- Radiographs free from the developmental anomalies, pathology and malunion of fractures affecting the bones of the maxillofacial region.
- Radiographs free from any artefacts.

Exclusion criteria

- Subjects without full complement of completely erupted maxillary teeth with or without the third molars.
- Ideal CBCT images with poor diagnostic quality, and images not clearly showing the maxillae including maxillary sinuses and the zygomatic arch.

Method

The clinical examination was carried out after procurement of the written informed consent from the selected subjects and the clinical findings were recorded in individual proforma specially designed for the study. Individuals satisfying the eligibility criteria were then subjected to CBCT examination at fixed operating parameters according to their built.

The requisite radiation protection measures were followed during the examination. Linear measurement of bizygomatic distance and measurements on axial and coronal sections for both right and left maxillary sinuses were performed using Planmeca Romexis 5.3 (3D Software). (Fig. 1) (Fig. 2) (Fig. 3) (Fig. 4)

The same observer repeated each of these measurements twice at an interval of 15 days each and the average was taken into consideration in order to overcome the intra examiner variability. Other parameters like area, perimeter and volume were calculated by using the following formula.

Area = Length x Width (cm^2)

Perimeter = 2 x Length + 2 x Width (cm)

Volume = Length x Width x Height x ½ (cm^3)

1. Bizygomatic Distance

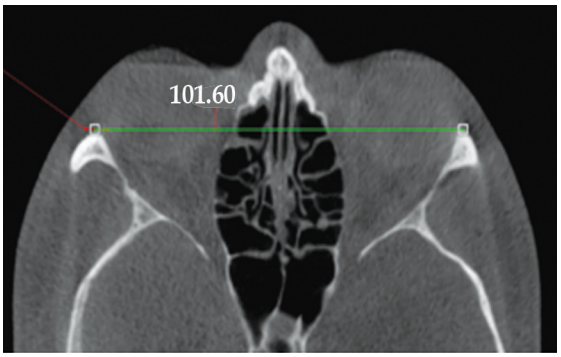


Fig. 1: Bizygomatic distance.

The bizygomatic width: Maximum distance between the most prominent points on both right side and left side zygomatic arches on axial images.

2. Maxillary sinus dimesnsions

(a) Length of the maxillary sinus

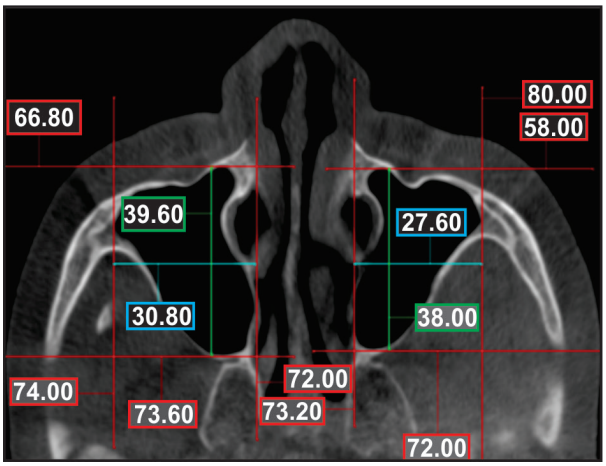


Fig. 2: Length of the maxillary sinus.

The length of the maxillary sinus: Longest anteroposterior distance from the point most anteriorly to the point most posteriorly on axial sections.

(b) Height of the maxillary sinus

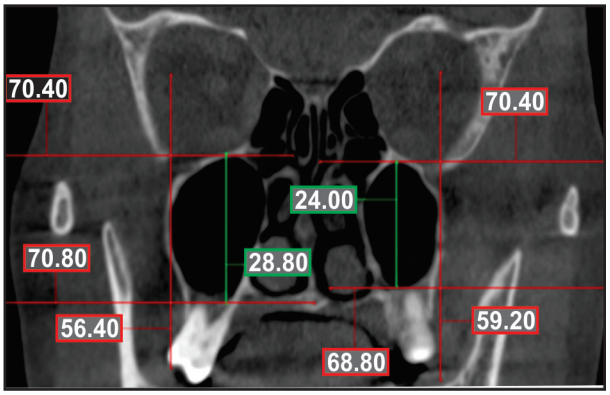


Fig. 3: Height of the maxillary sinus.

The height of the maxillary sinus: Longest distance from the point most inferiorly on the sinus floor to the point most superiorly on the sinus roof in the coronal sections.

(c) Width of the maxillary sinus

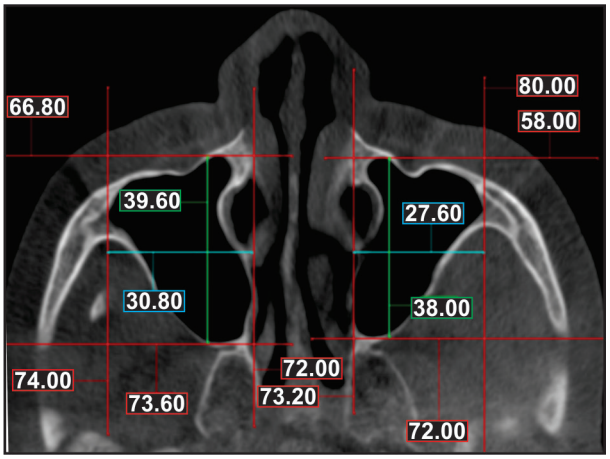


Fig. 4: Width of the maxillary sinus.

The width of the maxillary sinus: Longest distance perpendicularly from the medial wall of the

Table 1: Comparison of Age with bizygomatic distance and various parameters of right and left maxillary sinus.

Age	20-40 Years			41-50 Years			51-60 Years				
Parameter	n	Mean	Std deviation	n	Mean	Std deviation	n	Mean	Std deviation	F	P
Bizygomatic distance	10	94.9530	5.55256	10	94.6140	5.03540	10	92.1100	5.77827	0.808	0.456
MS right length	10	40.0600	4.10317	10	38.8820	3.57990	10	37.3600	3.07072	1.407	0.262
MS left length	10	40.0400	3.82483	10	38.6840	3.97182	10	36.9010	4.11261	1.571	0.226
Mean of right & left length	10	40.0500	3.88652	10	38.8610	3.55795	10	37.1300	3.42346	1.638	0.213
MS right height	10	36.4400	6.09393	10	34.6410	5.15764	10	31.5400	4.03986	2.302	0.119
MS left height	10	37.3600	6.40888	10	35.0420	6.51138	10	31.0600	5.52171	2.673	0.087
Mean of right & left height	10	36.9000	6.20054	10	34.8400	5.65591	10	31.3000	4.56095	2.638	0.090
MS right width	10	30.6000	3.79122	10	30.9250	3.84380	10	26.9620	4.79530	2.785	0.079
MS left width	10	31.5400	2.12927	10	30.0000	4.85890	10	26.9000	5.07127	3.111	0.061
Mean of right & left width	10	31.0700	2.66835	10	30.4620	4.16805	10	26.9310	4.85742	3.116	0.061
MS right area	10	1235.4200	254.54554	10	1212.4400	250.09712	10	1036.7340	274.76075	1.747	0.193
MS left area	10	1267.1400	187.88496	10	1147.8100	328.30694	10	1008.5160	288.42007	2.221	0.128
Mean of right & left area	10	1251.1400	210.00121	10	1179.7650	286.33432	10	1022.4890	277.99042	2.019	0.152
MS right perimeter	10	142.9200	15.11561	10	139.6140	14.17903	10	128.6040	15.16828	2.555	0.096
MS left perimeter	10	143.1600	10.80979	10	137.2880	16.77773	10	127.4400	17.94926	2.627	0.091
Mean of right & left perimeter	10	143.0000	12.18159	10	153.9640	56.73754	10	128.0000	16.11652	1.405	0.263
MS right volume	10	23806.4000	9035.15989	10	21453.2000	6914.38147	10	16452.4000	5635.92089	2.625	0.091
MS left volume	10	24531.5000	7948.44279	10	21212.1000	8763.71119	10	16202.0000	6895.74774	2.813	0.078
Mean of right & left volume	10	24168.8000	8264.98390	10	21332.4000	7718.24145	10	14275.2000	7050.09746	4.385	0.022

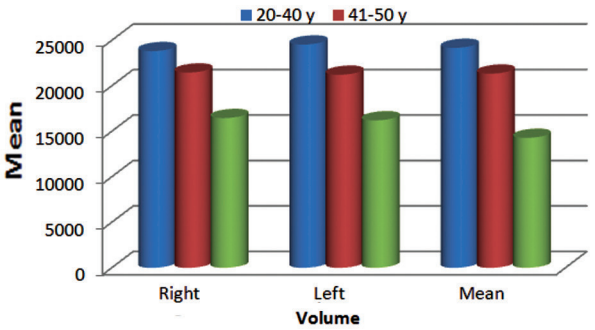
maxillary sinus to the outermost point on the lateral wall of the lateral process on axial sections. The obtained data were tabulated and then subjected to statistical analysis, comparision was made between both the right and the left maxillary sinuses of the same individual and between the age groups respectively using SPSS software version 22.0. The data obtained was then subjected to descriptive statistical analysis followed by Chi-square test, One-way ANOVA, Pearson's correlation and Post-Hoc test to arrive at the results.

Results

Of the 30 subjects, 15 (50%) were males and 15 (50%) were females. Each age group comprised of 05 (25%) males and 05 (25%) females with a mean age of 43.1333 for males and 41.8667 for females. The mean value of bizygomatic distance among group 1 (20-40 years) was 94.9530, group 2 (41-50 years) was 94.6140 and group 3 (51-60 years) was 92.1100. There were differences in the mean values between the groups but were statistically non-significant with P>0.05. The comparison was made within groups and between groups with ANOVA test for right and left maxillary sinus length, height, width, area, perimeter and volume along with their means.

Even though the differences were noted in the mean squares, it was statistically nonsignificant with P>0.05. Whereas, the mean volume of both right and left side sinus showed significant difference and was proven statistically significant with P<0.05, with means of 24168.8000cm3 in 20 to 40 years, 21332.4000 cm3 in 41 to 50 years and 14275.2000 cm3 in 51 to 60 years. Hence it was proved that as the age increases the volume of the sinus decreases. (Table 1)

Graph 1: Graph depicting mean values of maxillary sinus volume according to age distribution.

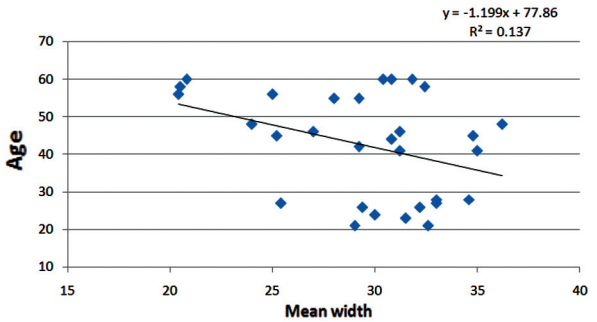


On application of Pearson's correlation, as the age increased the left width, left area, left perimeter, left volume and mean width and volume of right and left maxillary sinus decreased linearly and significantly with significant P<0.05. (Table 2)

Table 2: Pearson's correlation test for comparison between age and various parameters.

Variable 1	Variable 2	Pearson Correlation	N	Sig. (2-tailed)
Age	Bizygomatic distance	-0.145	28	0.445
Age	Right width	-0.286	28	0.126
Age	Left width	-0.422	28	0.020
Age	Mean width	-0.371	28	0.044
Age	Right length	-0.277	28	0.138
Age	Left length	-0.282	28	0.131
Age	Mean length	-0.289	28	0.121
Age	Right height	-0.325	28	0.080
Age	Left height	-0.346	28	0.061
Age	Mean height	-0.344	28	0.063
Age	Right area	-0.262	28	0.163
Age	Left area	-0.365	28	0.048
Age	Mean area	-0.323	28	0.082
Age	Right perimeter	-0.342	28	0.064
Age	Left perimeter	-0.377	28	0.040
Age	Mean perimeter	-0.180	28	0.342
Age	Right volume	-0.336	28	0.069
Age	Left volume	-0.371	28	0.043
Age	Mean volume	-0.439	28	0.015

Graph 2: Graph depicting Pearson's correlation between maxillary sinus mean width and age.



Graph 3: Graph depicting Pearson's correlation between maxillary sinus mean volume and age.

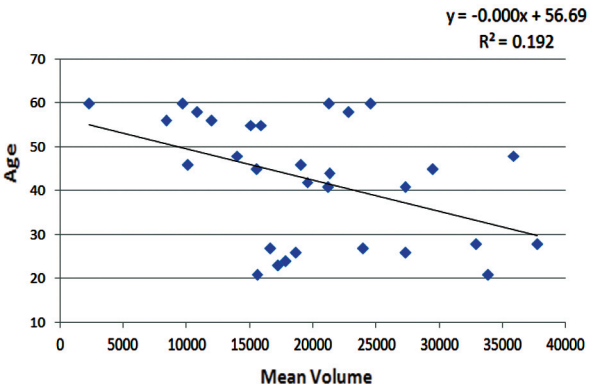


Table 3: Regression ANOVA.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.439a	.192	.164	12.68510

a. Predictors: (Constant), Mean volume.

ANOVA

Model	Sum of Squares	DF	Mean Square	F	Sig.
Regression	1073.973	1	1073.973	6.674	.015b
Residual	4505.527	28	160.912	–	–
Total	5579.500	29	–	–	–

a. Dependent Variable: Age

b. Predictors: (Constant), Mean volume

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	56.691	5.961	–	9.510	.000
Mean volume	-.001	.000	-.439	-2.583	.015

a. Dependent Variable: Age

16.4% of the right and left mean volume predicted the age of the selected sample out of 6 variables entered into the equation. Remaining variables like width, length, height, area and perimeter did not predict the age of the sample selected. The regression ANOVA revealed F value 6.674 with P value of 0.015 confirming that volume is the true predictor of age of the subjects with the beta value of -0.439 with the significance level of 0.015.

Discussion

In the field of forensic anthropology, the age estimation by morphological valuation is been considered to be the oldest procedures.[7] Identification of the human skeleton remains is one of the important challenging steps in forensics. Bizygomatic distance and maxillary sinus dimensions show high variability in its linear measurements in each individual according to sex and different age groups. In the present scenario, judicial demand for age estimation is being increased as there is increase in the criminal cases. Age estimation is considered to be one of the definitive procedures after the sex determination in the field of forensics as the estimation of age forms a major inchoative step in the identification of deceased person that helps in narrowing down the prediction of an unidentified cadaver in the direction of a precise possibility. In the field of forensics, the common procedures in post-mortem for identification include general external examination with complementary biological methods and radiographic methods.[8] Individual identity is based on their age, sex, ethnicity, and appearance that includes height, weight, hair colour, skin colour, cornea, facial profile etc.[9]

According to few literature reviews, it is stated that the accuracy rate of age estimation from the skeleton is 92%8,7 as it can anatomically withstand heavy injuries. Almost all craniofacial structures are being comparatively non-breakable as they are composed of hard tissues, because of which the possibility of getting intact maxillary sinus and zygomatic complex without deformity is very high. Henceforth the present study was outlined based on the above background in order to determine the reliability of the bizygomatic distance and dimensions of maxillary sinus as a tool for age estimation by using CBCT images of 30 subjects of age ranging between 20-60 years categorized into 3 different age groups.

Another study was conducted on 60 patients reporting to the Department of Radiology, Mamata General Hospital, Khammam. MRI of the brain and paranasal sinuses were obtained. Later the dimensions of maxillary sinus were measured by using Siemens software followed by statistical analysis. The estimation of age by utilizing the volume of maxillary sinus demonstrated no significant difference statistically from the actual age of the study subjects. The authors concluded that the dimensions and volume of the maxillary sinuses was found to be larger in males when compared to females, upon which they tend to be lesser with the increase in age.[10]

In a study which was carried out in Alexandria University with 82 CBCT scans of Egyptian patients aged between 20-65 years, designed to measure the height, width and length of maxillary sinus bilaterally on both the axial and coronal sections using On-Demand®software. No statistically significant differences were established in maxillary sinus measurements between different age groups. They concluded that the linear measurements of the maxillary sinus on the images of CBCT cannot be utilized for age estimation.[11]

In contradictory to this study our study showed positive results in regard to age estimation. There was a positive association noted between the age of the individual and few parameters of maxillary sinuses. As the age increased the left width,

left area, left perimeter, left volume and mean width and volume of right and left maxillary sinus decreased linearly and significantly with significant P values < 0.05. Hence, the differences in few of the study results obtained for age estimation with bizygomatic distance and dimensions of the maxillary sinus may be ascribed to the combination of numerous features like sample size, the difference in ethnic groups and racial groups, size of skeletal components, variations in stature of body, their physique and height, environmental and genetic factors, anatomical differences of the sinus and zygomatic complex, variations in the osteoclastic and osteoblastic activity and the pneumatization process of the sinus.[3,6]

In the current study, we primarily aimed at whether bizygomatic distance and maxillary sinus dimensions are good predictors for age estimation. Further studies can be undertaken with larger sample size for its accuracy rate. Research works in the field of forensics is being carried out since many years on both the living population and non-living things for various investigative purposes. Radiographic images are considered to be the best vital tool for age estimation in the field of forensic sciences. Out of many, the measurements of the bizygomatic distance and the maxillary sinus are of at most important as these can be considered as stable indicators even when the skull is severely destructed. The results obtained in the present study revealed that the Bizygomatic distance cannot be used as a tool for age estimation, but maxillary sinus dimensions show anatomic variations between different age groups of which few parameters were statistically significant. Therefore, it is concluded that the linear measurements on CBCT images with significant differences among different age groups can be used in forensic anthropology as a valuable tool for the estimation of age. Hence these measurements are supported for providing evidence in the field of forensics, to enhance the accuracy of estimation made by other means particularly when other skeletal structures are unobtainable. As this study was a time-bounded study only the best possible sample size was taken into consideration. Further studies with larger sample size have to be considered to authenticate the present findings.

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Original Article

Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 2, April - June 2021
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14221.12

Hair Dye Poisoning Patterns among Population in Nellore State Andhra Pradesh

Niranjan Kumar Gunjan[1], Kathi Aswani Kishore[2]

How to cite this article:
Niranjan Kumar Gunjan, Kathi Aswani Kishore/Hair Dye Poisoning Patterns among Population in Nellore State Andhra Pradesh/Indian J. Forensic Med Pathol. 2021;14(2):97-102

Abstract

Background: Hair Dyes are chemicals that are used to change hair colour. Hair colouring has become irresistible fascination to improve physiognomy especially people having grey hair. Hair dyeing is an ancient art and hair colourants are rapidly growing globally. But sometimes it is used to commit suicide. Hair dye poisoning occurs when someone swallows' dye or tint used to colour hair. Morbidity and mortality due to poisoning have been known to pose a significant burden on the health.

Aims and Objectives: To study the incidence and demographic features of hair dye poisoning in people who are admitted in Narayana Medical College Hospital, Nellore district State Andhra Pradesh South India.

Type of Study: This is a two years prospective study.

Place of study: Hair dye poisoning admitted in Narayana Medical College Hospital between the periods July 2012- June 2014.

Material and Methods: All patients admitted and managed for hair dye poisoning were retrieved and data collected. Age, sex, incidence, residence, education and marital status were all recorded on the prepared proforma.

Observation and Discussion: In our study, age wise distribution of 76 cases of paraphenylenediamine (PPD) hair dye poisoning revealed that maximum cases (56.6%) were in the age group 21–30 years with 27.96 ± 11.24 years mean and standard deviation respectively. Hair dye poisoning was common among females (76% of all cases). The incidence of hair dye poisoning was 154.84 patients of hair dye poisoning/1000 cases of all poisoning/year from July 2012 to June 2013 and 112.90 patients of hair dye poisoning/1000 cases of all poisoning/year during July 2013 – June 2014. Rural people (52.60%) consumed hair dye poison more than urban population. More common in under matriculation. Maximum persons (78.9% of all cases) were married.

Conclusion: Trend of hair dye consuming is increasing now a days among young, rural population. It is common among female, married persons and increasing burden on health care institution.

Keywords: Hair dye poisoning; Super vasmol poisoning; Paraphenylenediamine.

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Introduction

Dye is a natural or synthetic substance used to add a colour to or change the colour of something. Hair Dyes are chemicals that are used to change hair colour. Hair colouring has become irresistible fascination to improve physiognomy especially people having grey hair. Hair dyeing is an ancient art and hair colourants are rapidly growing globally. But sometimes it is used to commit suicide. Hair

dye poisoning occurs when someone swallows' dye or tint used to colour hair. Morbidity and mortality due to poisoning have been known to pose a significant burden on the health care institution for a long time. Globally suicide rates have increased by 60% in the last fifty years. Suicide now ranks among the three leading causes of death in the age group between 15 and 44 years.[1] Poisoning by hair dye ingestion is known in African countries. Its systemic toxicity was first documented by Nott H.W dating back to 1924, the victim was owner of a Beauty parlor.[2] Many reports have followed since then from African and the Middle East countries. Suliman SM et al studied 150 cases in between 1983 and 1993 at Khartoum teaching hospital in Sudan and published their study in 1995, noting the clinical and biochemical aspects.[3]

Ayoub Filali et al have undertaken a retrospective study of acute systemic poisoning of paraphenylenediamine (PPD), a principal component of hair dye, in Morocco between 1992-2002 and reported 374 cases, noting demographic aspects. It was found that hair dye poisoning was the second common cause of hospitalization in the I.C.U of the Casablanca University Hospital in 1999 and the first cause for admission in the Emergency Unit (Portes Medicales) of Rabat University Hospital in Moocco.[4] A A Elagmel et al have undertaken a retrospective study of hair dye poisoning complications and management in Khartoum, Sudan during June 2008 to December 2008.[5] In India, P. K. Jain et al. have conducted a prospective study of ingestion of hair dye poisoning in Northern India between July 2004 to March 2009 and clinical manifestations, management, prognosis and outcome were studied.[6] Many case reports are published since then in South India.

In recent years, incidence of hair dye poisoning is on the increase in Andhra Pradesh especially in Hyderabad, Secunderabad, Kadapa, Chittoor and Nellore district. Udaykiran Gella et al conducted a prospective study on prevalence of poisoning cases - focus on hair dye poisoning and he mentioned that 50 people die every year due to hair dye poisoning in Kadapa region.[7] No cases of hair dye poisoning was admitted to Narayana Medical College Hospital until 2004. After that there is increase in frequency in the past 10 years. Raghu Kondle et al8 have conducted a retrospective study of 50 cases admitted in NMCH, during years 2008 -2011.

Aims and Objective

As stated earlier, globally suicides rates have increased by 60% in the last fifty years. Suicide now ranks among the 3 leading causes of death in the young age group and nowadays hair dyes is used to commit suicide. It is emerging as a potential suicidal poison. Morbidity and mortality due to hair dye poisoning have been known to pose a significant burden on the health care institution for a long time. Poisoning is a medicolegal problem also which is alarming and a constant threat to the society. To encounter this problem in a given area, knowledge about hair dye poison is essentials for public and health professional. With this broad view in mind, this study was carried out involving the cases of hair dye poisoning admitted in Narayana Medical College Hospital between the periods July 2012 - June 2014, to achieve the following aims:

- To study the incidence of hair dye poisoning.
- To study demographic features of hair dye poisoning.

Materials and Methodology

Study design: This is a Prospective study which describes incidence and demographic features in hair dye poisoning patients.

Study Settings: Emergency department, HDU, ICU and Medical wards of Narayana medical college and hospital, chinthareddy Pallem, Nellore, a tertiary care teaching hospital.

Ethical approval: The study was approved by the Institutional Ethics Committee of Narayana Medical college Hospital, Nellore.

Subjects

a. Inclusion criteria: All patients who were brought to emergency department and those who were admitted into the HDU, ICU and medical wards of the hospital, with the alleged cause of hair dye ingestion were included in the study after the following exclusion criteria were ruled out.

b. Exclusion criteria: Patients with the following features were excluded from the study

- Those who consumed any other toxic substance or alcohol along with hair dye.
- Known diabetics, hypertensive, asthmatic's and epileptics.
- Those with any significant illness including renal, hepatic or cardiac disease.
- Those with any substance abuse like alcohol, tobacco or other drug abuse.
- Those who were on some form of medical or radiation therapy or surgical intervention within past 3 months of admission.

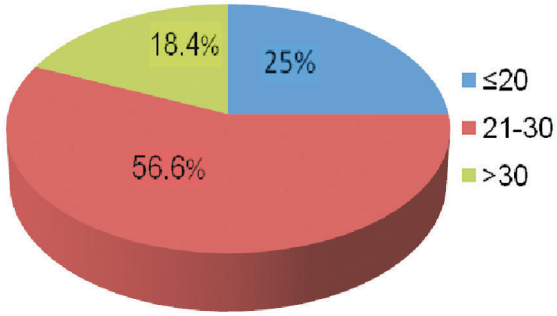
This study was carried out during the period July 2012 - June 2014. Patients of alleged hair dye ingestion were taken up for the study after the exclusion criteria were ruled out. Informed consent was obtained from every patient or patient's relatives. Age, sex, incidence, residence, educational status and marital status were recorded on the prepared proforma.

Observations and Results

In this prospective study a total 558 poisoning cases admitted in Narayana Medical College Hospital, Nellore during the July 2012 to June 2014. Out of 558 cases 76 Super vasmol poisoning cases were included in present study after exclusion criteria were ruled out. Details of patients like age, sex, incidence, residence, education status, marital status were noted. The above details are statistically analyzed and presented below as:

Table 1: Age wise distribution of patients.

Age Group (years)	Frequency	Percent (%)	Mean ± S.D	Range
≤ 20	19	25.0	27.96 ± 11.24	–
21 – 30	46	56.6	–	–
>30	11	18.4	–	55.00
Total	76	100.0	–	–



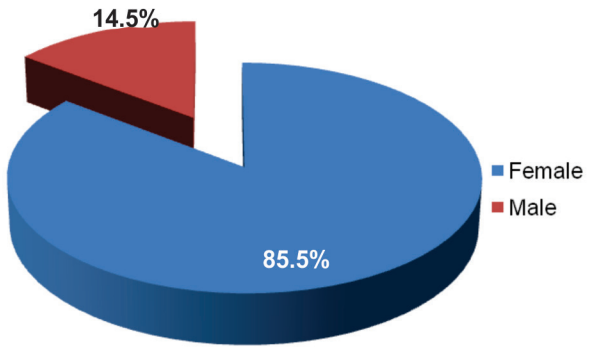
Graph **1:** Age wise distribution of patients.

In our study it was observed that maximum number of hair dye poisoning cases found in the age group 21-30 years (56.6%) followed by the age group ≤ 20 years as depicted in table no.1 and Graph no.1

Table 2: Sex wise distribution of patients.

Sex	Frequency	Percent
Female	65	85.5
Male	11	14.5
Total	76	100.0

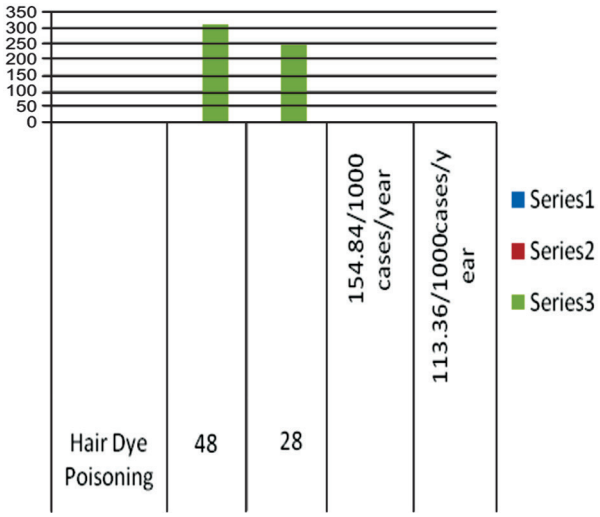
In our study we observed that females (85.5%) outnumbered males (14.5%) as depicted in table no. 2 and graph no. 2.



Graph 2: Sex wise distribution of patients.

Table 3: Incidence of Hair Dye Poisoning.

No. of Poisoning Cases	July 2012 – June 2013	July 2013 – June 2014	Incidence (July2012-June2013)	Incidence (July2013-June2014)
Hair Dye Poisoning	48	28	154.84/1000 cases/year	112.90/1000 cases/year
Total Poisoning	310	248		

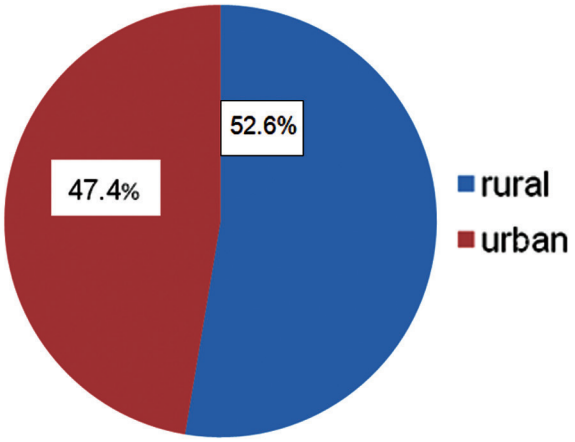


Graph 3: Incidence of Hair Dye Poisoning.

In our study the incidence of super vasmol hair dye poisoning was found 154.84 hair dye poisoning cases/1000 cases of all poisoning/year during July 2012 - June 2013 and 113.36 hair dye poisoning cases/1000 cases of all poison/year during July 2013 - June 2014 as depicted in table no. 3 and bar diagram no. 3

Table 4: Group distribution based on their residence.

Residence	Frequency	Percent
Rural	40	52.6
Urban	36	47.4
Total	76	100.0

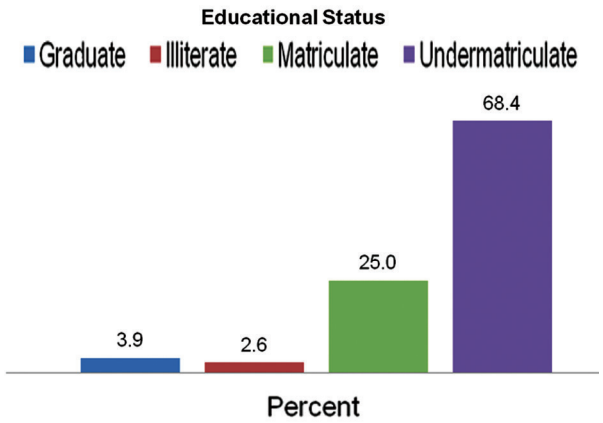


Graph 4: Based on their Residence.

It was observed that majority of patients (52.6%) who consumed hair dye poison, belonged to rural area as depicted in table no.4 and graph no.4

Table 5: Educational status wise distribution of patients.

Educational Status	Frequency	Percent
Graduate	3	3.9
Illiterate	2	2.6
Matriculation	19	25.0
Undermatriculation	52	68.4
Total	76	100.0

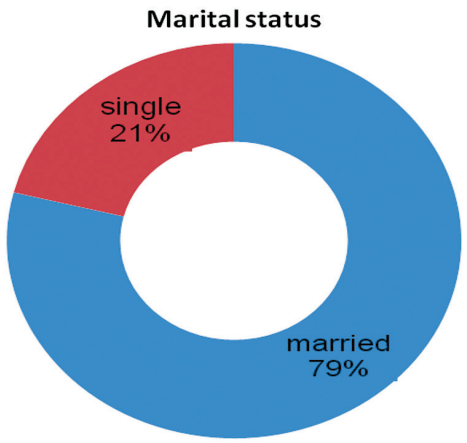


Graph. 5: Educational status.

It was observed that majority of patients (68.4%) were under matriculation standard followed by (25%) matriculation standard as depicted in table no. 5 and graph no. 5.

Table 6: Marital status wise distribution of patients.

Marital Status	Percent
Married	78.9
Single	21.1
Total	100.0



Graph 6: Based on marital status.

Maximum no. of victim (79%) of hair dye poisoning belonged to the married category as depicted in the table no. 6 and graph no. 6.

Discussion

In our study, age wise distribution of 76 cases of PPD hair dye poisoning revealed that maximum cases (56.6%) were in the age group 21–30 years with 27.96±11.24 years mean and standard deviation respectively. Manisha sahay et al[9] had found similar mean age with standard deviation 26.9±4.95 years among patients in their study. R. Ram et al[10] had found mean age with standard deviation 23.2±7.6 years among patients in their study. P. Suneetha et al[11] had also found similar mean age with standard deviation 25.1±9.1 years among patients in their study. Mary Nirmal S et al[12] had found mean age with standard deviation 24.7±6.51 years among patients in their study. Hatem Kallel et al[13] had found similar mean age with standard deviation 27.9 ± 16.8 years among patients in their study.

Bashir Anmed et al[14] had found similar mean age with standard deviation 25.87 ± 5.59 among patients in their study M. A. Akbar et al15 had found mean age with standard deviation 25.5±4.56 years among patients in their study. Study conducted by, Udaykiran Gella et al[7] revealed that hair dye poisoning was more common between the subjects of 12-25 years of age. Study conducted by D. Radhika et al[16]. Revealed that hair dye poisoning is more common between the subjects of 26 - 35 years of age. Study conducted by P. K. Jain et al6 revealed that hair dye poisoning is more common between the subjects of 15 - 25 years of age.

Hence, we can say majority of studies have similar finding regarding age group. Sex wise distribution in our study revealed that hair dye poisoning was more common among females (76%

of all cases). The same pattern was found in Manisha Sahay et al[9] with 80%, Udaykiran Gella et al[7] with 69.95%, D. Radhika et al[16] with 64.77%, P. K. Jain et al[6] with 71.96%, P. Suneetha et al[11] with 70.94%, Sachin S. Soni et al17 with 60%, Mary Nirmala S. et al[12] with 64.81%, Hatem Kallel et al[13] with 63.15%, Bashir Ahmed et al14 with 87.5%, M. A. Akbar et al[15] with 100%, S. M. Suliman et al[3] with 80% and A. A. Elagmel et al[5] with 80.5% female proportion in their study.

Hence, we can say majority of studies have similar finding regarding sex wise distribution of patients. It was observed in our study that the incidence of hair dye poisoning was 154.84 patients of hair dye poisoning/1000 cases of all poisoning/ year from July 2012 to June 2013 and 112.90 patients of hair dye poisoning/1000 cases of all poisoning/ year during July 2013 – June 2014.

We found 76 cases of hair dye poisoning among total number of 558 poisoning cases in Narayana Medical College Hospital, Nellore during a period from July 2012 to June 2014. Udaykiran Gella et a[17] have collected a total number of 680 poisoning cases at RIMS Hospital Kadapa (A.P.) during the period March 2011 to September 2011 and they found that 480 patients among them had consumed super vasmol hair dye poisoning. Hence, we can say hair dye poisonings are notably large in size in this region. Residence wise distribution of hair dye poisoning revealed that more rural people (52.60%) consumed hair dye poison than urban population. Study conducted by C. Sugunakar et al18 and Bashir Ahmed et al[14] also showed similar result.

Hence, we can say this might be due to hair dye is cheap and easily available in market. In our study education status wise distribution of hair dye poisoning revealed that maximum persons were Under Matriculation (68.4% of all cases). Udaykiran Gella et al[7] found that 60% of all case belonged to literate category and remaining 40% are illiterate category. Hence, we can say hair dye poisoning is common in people having low level of education. In our study, marital status wise distribution of patients showed that maximum persons (78.9% of all cases) were married. However, Bashir Ahmed et al[14] found that 56.3 % cases were married. A. A. Elagmel et al[5] study had revealed that only 26% case was married. More prevalent in married people might be because hair dye poisonings are more common in young age group between 20–35 years.

Summary and Conclusion

The incidence of Super vasmol 33 hair dye poisoning has been on a surge for the past 2 - 3 years as has been observed by the increase in number of cases being admitted into the hospitals. The incidence of super vasmol hair dye poisoning was found 154.84 hair dye poisoning cases/1000 cases of all poisoning/ year during July 2012 - June 2013 and 113.36 hair dye poisoning cases/1000 cases of all poison/year during July 2013 - June 2014. Maximum number (56.6%) of hair dye poisoning cases was found in the age group 21 - 30 years followed by the age group ≤ 20 years. Females (85.5%) outnumbered males (14.5%). Majority of patients (52.6%) who consumed hair dye poison, belonged to rural area. Majority of patients (68.4%) were under matriculation followed by (25%) matriculation. Maximum no. of victim (79%) was married.

Acknowledgement

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/editors/ publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

Source of funding: Nil

Conflict of Interest: Nil

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Original Article

Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 2, April - June 2021
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14221.13

Study of Histopathological Findings in Sudden Unexpected Natural Deaths in a Tertiary Care Hospital

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How to cite this article:
Shailaja Kupati, Gayathri T, Shashikala V et al./Study of Histopathological Findings in Sudden Unexpected Natural Deaths in a Tertiary Care Hospital/Indian J. Forensic Med Pathol. 2021;14(2):103-107

Abstract

Introduction: Sudden death (SD) is defined by World Health Organization (WHO) as 'death within 24 hours from onset of the symptoms'.[1] It is by definition natural and it excludes all deaths due to poison and trauma. The incidence of sudden cardiac death has been steadily increasing all over the world. When SD occurs in adults and elderly persons, coronary atherosclerosis is the usual cause. These diseases are frequently concealed and discovered with surprise only at post mortem using macroscopic and microscopic examination of heart.

Methods: Present study is a retrospective study, conducted in the department of Pathology, Vydehi Institute of Medical Sciences and Research Centre Bengaluru from July 2016 to June 2020. Patients of all age groups who died within 24 hours from the onset of symptoms were included.

Results: A total of 483 autopsy cases were received for histopathological examination, among which there were 134 cases with history of sudden death during the study period. Age distribution ranged from 6 days to 86 years. In our study we observed male preponderance. Maximum number of cases was observed in 31 to 40 years of age. Major causes for sudden deaths observed were coronary artery diseases in 98 cases (73%) followed by pulmonary causes in 12 cases (8.96%).

Conclusion: Present study highlighted the presence of increasing cases of sudden deaths among young males compared to developed countries. This will emphasize the need for research studies to find out the cause and early interventional measures to prevent the same.

Keywords: Sudden death; Autopsy; Histopathological findings.

Introduction

The World Health Organization (WHO) definition of sudden death according to the International classification of diseases, version 10 (ICD-10) is death, non violent and not otherwise explained, occurring less than 24 hours from the onset of symptoms[1], but this time is too long for many clinicians and pathologists; some of them only accept death within one hour from the onset of illness. From a view point of forensic medicine, sudden death (SD) is mainly defined as rapid,unexpected and natural death.[2] The incidence of sudden cardiac death has been steadily increasing all over the world particularly in urban population.[3] When SD occurs in adults and elderly persons, coronary atherosclerosis is the usual cause. These diseases are frequently concealed and discovered with surprise only at post mortem using thorough macroscopic and microscopic examination.

Materials and Methods

Present study is a retrospective study, which was conducted in the department of Pathology, Vydehi

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Institute of Medical Sciences and Research Centre, Bengaluru from July 2016 to June 2020. Ethical committee clearance was obtained before starting the study. Patients of all age groups who died within 24 hours from the onset of symptoms whose organs have been sent to department of pathology for histopathological examination were analyzed. The organs commonly received in case of sudden deaths are heart, lung, liver, kidney, spleen and brain. Deaths after 24 hrs of onset, deaths due to RTA, homicides, suicides, electrocution injuries, pregnancy related deaths were excluded from the study.

Statistical Analysis

Master chart of collected data was prepared in Excel sheet. Descriptive statistical analysis is presented in the form of tables, figures,graphs and diagrams wherever necessary using SPSS software.

Objectives of this study

- To evaluate the role of histopathological findings in providing conclusive cause of death.
- To study age and sex distribution of sudden death cases and to compare data with other studies.

Results

A total of 483 autopsy cases were received in the department pathology for histopathological examination, of which there were 134 cases with history of sudden deaths during the study period. Age distribution of sudden death cases ranged from 6 days old baby to 86 years (Fig. 1).

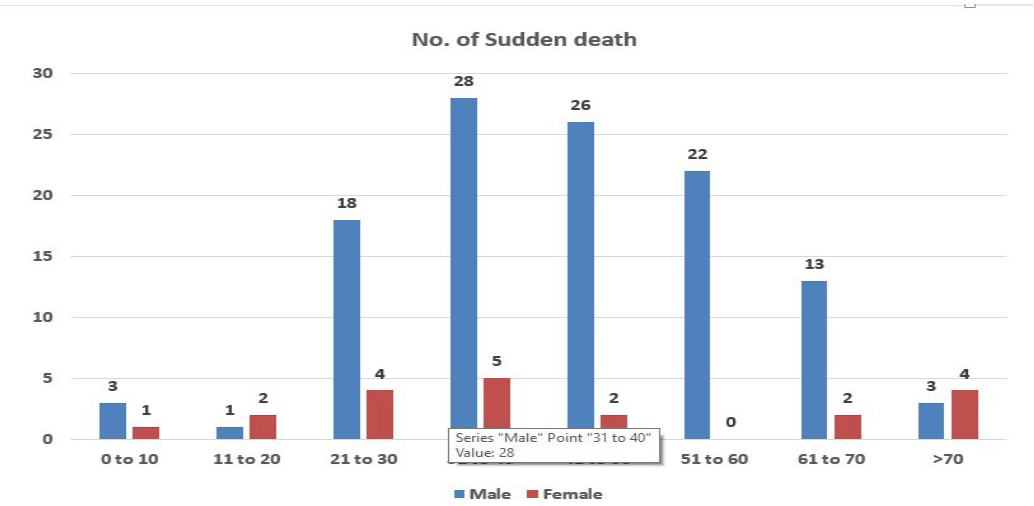

Fig. 1: Age distribution among sudden death cases (134 cases).

Male preponderance was observed with 114 (85%) of cases with the male: female ratio of 5.7:1 (Fig. 2). Maximum number of cases was observed in 31 to 40 years of age group.

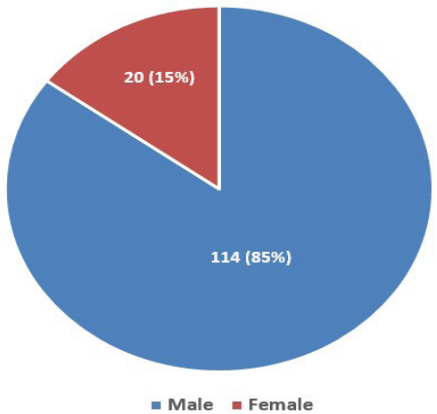

Fig. 2: Sex distribution of sudden death cases.

Table 1: Shows cardiac causes of sudden death.

Diagnosis	No of cases (Total- 103)	Percentage
Coronary artery disease	98	73.13%
Hypertrophic cardiomyopathy	2	1.49%
Aortic rupture	2	1.49%
Pericarditis	1	0.75%

Table 2: Shows Non cardiac causes of sudden death.

Diagnosis	No of cases (Total -31)	Percentage
Pulmonary embolism	12	8.96%
Cerebral stroke	6	4.48%
Aspiration	4	2.99%
Acute necrotizing pancreatitis	3	2.24%
SIDS	2	1.49%
Acute pyelonephritis with DIC	1	0.75%
No Conclusion	3	2.24%

The most frequent prodromal symptoms in our study were acute chest pain, circulatory collapse and dyspnoea and less common were fever, cough and epilepsy. We also observed that majority of our cases occurred in young adult males who were laborers and working in hot weather which may precipitate cardiovascular and respiratory diseases.

Distribution of causes of sudden deaths, cardiac and non-cardiac causes are mentioned in Table no. 1 and Table no. 2 respectively. The most common cause for sudden deaths were coronary artery diseases (Fig. 3) leading to myocardial infarction and its complications accounting for about 73.13% of total cases.

The most common non cardiac causes were due to pulmonary disease (Fig. 4) in 16 cases (51.6%), amongst which pulmonary embolism formed the majority in 12 cases (8.96%) followed by 4 (2.99%) cases of pulmonary aspiration. Other non cardiac causes for sudden deaths were cerebral stroke in 6 cases (4.48%), acute necrotizing pancreatitis in 3 (2.24%) cases and 1 case of DIC with acute pyelonephritis. Youngest case of our study was of 6day old female baby, in which we observed that lungs were showing bronchioles filled with homogenous eosinophilic material, with lipid droplets suggestive of milk. We also found 2 (1.49%) cases of SIDS (Sudden Infant Death Syndrome). In 3 cases even after detailed pathological examination cause of death could not be concluded.

Discussion

One of the challenges faced by pathologist is to determine the exact cause of death in a previously healthy appearing person.[2] Sequential examination of autopsy case which is suggested by Sheppard et al is to consider natural death first and then to consider non cardiac causes like cerebral stroke.[4] Majority of literature shows coronary artery diseases leading to myocardial infarction as the major cause for sudden deaths.[4-9] Our study shows 98 cases of coronary artery diseases including frank evidence of myocardial infarction which correlates with study conducted by Pandian et al[5] and Shanti et al.[6]

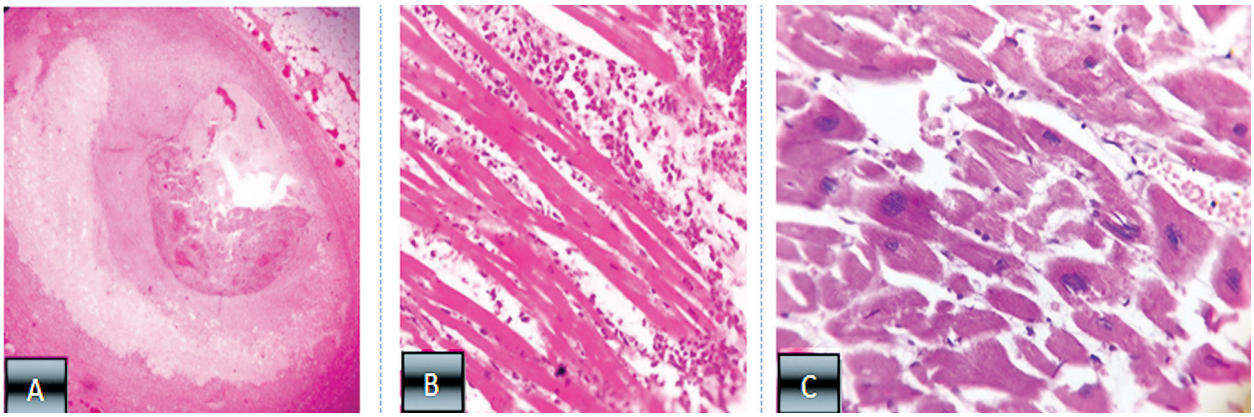

Fig. 3: Cardiovascular disease **A.** Complete blockage of coronary artery (H&E 10X), **B.** Early changes of myocardial infarction showing neutrophilic infiltration (H&E 10X), **C.** Hypertrophic cardiomyopathy showing muscle disarray and nucleomegaly (H&E 40X).

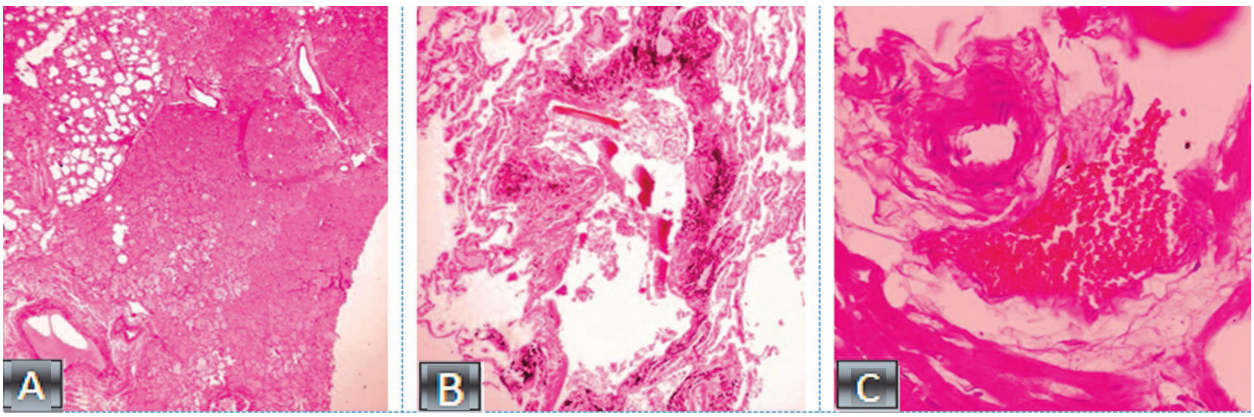

Fig. 4: Pulmonary causes for sudden death, **A.** Diffuse alveolar damage showing alveoli filled with fluid (H&E 10X), **B.** Pulmonary Aspiration showing food particles in bronchus (H&E 40X), **C.** Pulmonary embolism showing collapsed artery with adjacent congested vein (H&E 40X).

Majority of the studies have male preponderance of SD such as studies by Pandian J et al who had a male to female ratio of 6.5:1, and Hajra K Mehdi et al[13] with male to female ratio of 10:1.The present study also showed similar male to female ratio of 5.7:1. Sudden death incidence is more in males because of increased rate of cardiovascular diseases.

Coronary artery pathology in sudden death cases consists of single, double or triple vessel atherosclerotic disease and usually leads to thrombotic complete or near complete obstruction of coronary vessels which accounts for sharp interruption of regional blood flow.[5,6] In the young it is usually due to a single subobstructive plaque, located at the first segment of the anterior descending coronary artery, mostly fibro cellular, devoid of atheroma, fissuring or thrombosis. In the setting of acute thrombosis, superficial erosion seems to be a peculiar mechanism precipitating plaque instability, unlike in adults where it is mainly due to rupture of the thin fibrous cap of an atheromatous plaque.

Endothelial erosion may be the consequence of either plaque inflammation or intimal smooth muscle cell proliferation. The inflammatory nature of atherosclerotic plaque components prompted the postulation that either infection and/or autoimmune phenomena are involved in the onset and progression of the disease.[7]

We found 2 cases of hypertrophic cardio-myopathy. Grossly the weight of heart was increased to more than 500 gms, and microscopically it showed myocyte disarray, increase in myocyte nuclear size. Rhythm disturbances may lead to sudden death in these cases.[4]

Current definitions of SIDS are generally of exclusion, which means that the term "SIDS" can only be used for an infant death once other causes of sudden death have been excluded. These are diagnosed after taking consideration of scene of death. But still few microscopic findings like sections from the thymus and lungs show areas of interstitial hemorrhage corresponding to the macroscopically noted petechiae. The lungs are congested and edematous, sometimes with foci of incidental submucosal chronic inflammatory cells.[11]

The gross appearance of acute pancreatitis can vary greatly from mild hyperemia to frank hemorrhagic necrosis that extends to the adjacent tissue and beyond. It is necessary to distinguish postmortem autolysis and actual pancreatitis, the only way to definitively confirm the presence of pancreatitis is to examine the tissue microscopically and identify the acute inflammatory cell infiltrate.[12]

Conclusion

Present study highlighted the presence of increasing cases of sudden deaths among young males compared to developed countries.This will emphasize the need for research studies to find out the cause and early interventional measures to prevent the same. Histopathological findings in various organs will help to identify probable cause of sudden unexpected natural deaths.

Acknowledgement

We would like to thank Dr Shivarudrappa AS, former professor and HOD, Department of Pathology, VIMS and RC Bengaluru.

Conflict of Interest: None

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Original Article

Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 2, April - June 2021
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14221.14

Histopathological Array of Cardiac Lesions in a Tertiary Care Hospital: An Autopsy Study

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How to cite this article:
Prakash Sumitha Maniyan, Modepalli Nalini, Tirumala Anisha Sudarshan et al./Histopathological Array of Cardiac Lesions in a Tertiary Care Hospital: An Autopsy Study/Indian J. Forensic Med Pathol. 2021;14(2):109-115.

Abstract

Context: Cardiovascular diseases constitute the most common cause of sudden death. In medicolegal autopsies it is proposed that every possible organ must be sampled for histopathological examination as they provide the most accurate clues to a better understanding of human cardiovascular pathology.

Aims: The main aim of this study was to analyse the histopathological spectrum of cardiac diseases which play a major role as cause of death in autopsy specimens that were received in a tertiary care hospital.

Settings and Design: The study was conducted at a tertiary care hospital in Bangalore, the study period was from January 2015 to December 2019 during which a total of 276 autopsies were received. Out of these 173 cases included specimens of heart and were considered in this study.

Methods and Material: During the study period from January 2015 to December 2019, a total of 276 autopsies were received. Out of these 173 cases included specimens of heart and were considered in this study. Epidemiological data and post mortem findings were noted, gross findings documented and the heart opened through inflow outflow method. Microscopic findings on H and E stained sections were studied with special stains ordered wherever required. The histopathogical findings were analysed.

Results: Males outnumbered females with 85% of the total cases and maximum number of cases were observed between 3rd decade to 5th decade. On histopathology, 60.4% of the cases showed atherosclerotic changes involving the coronary arteries followed by myocardial infarction (9%), myocardial hypertrophy (7%), cardiomyopathy (4.2%) cases, myocarditis (3.4%), 0.5% case each of aortic stenosis and infective endocarditis. 15% of cases showed no significant abnormalities on gross and microscopic examination.

Conclusions: Atherosclerosis involving the coronaries is probably the commonest finding on histopathology of the heart in cases subjected to autopsies. Cardiomyopathy and Myocarditis presenting as sudden death is commom in the younger population.

Keywords: Coronaries; Heart; Post-mortem; Histopathology.

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Introduction

Incidence of cardiac deaths has been increasing all over the world particularly in urban population during last five decades. In India incidence of ischaemic heart disease has increased to about 10%.[1,2] Cardiovascular pathology is a major contributor for sudden death. In most of the patients the first and

only clinical expression of coronary atherosclerotic process is sudden death.[3]

The autopsy is for long been regarded as the 'gold standard' as the most important tool for retrospective quality assessment of clinical diagnoses as well as a key education tool.[4,5]

The role of the Forensic pathologist is to provide a detailed examination of the organs, especially heart, in order to identify a definitive cause of death.[3]

One of the challenges faced by the forensic expert is the inability to determine the cause of death in a person previously thought healthy.

The autopsies can be a valuable source for epidemiological information in addition to providing valuable information to deceased immediate family.[6,7]

The autopsy study provides a means of understanding the basic process which sets a stage for clinically significant atherosclerotic cardiovascular disease. There is no valid method of sampling of living population. It was therefore considered that death suspected due to cardiovascular pathology, probably provide the best sample of the living population for studying cardiovascular diseases.[8]

It was reported that concordance between clinical and pathological causes of death are moderate, and the autopsy still provides a very important procedure for evaluating causes of deaths. Over one fifth of clinically unexpected autopsy findings can be correctly diagnosed only by histological examination. Autopsy and particularly autopsy histology are still the most accurate method of determining the cause of death and auditing accuracy of clinical diagnosis, diagnostic tests and death certification.[6,8,9]

The main objective of the autopsy is establishment of final diagnosis and to determine cause and manner of death whenever possible. Moreover, these autopsies help to reveal important data for public prosecutors.[6,10]

Sudden cardiac death is commonly defined as an unexpected natural death due to cardiac cause within a short time period (usually within one hour) with or without onset of symptoms and without any prior conditions that would appear fatal. The majority of sudden cardiac deaths (SCDs) are attributable to atherosclerotic coronary artery disease and are manifest in the older population, whereas cardiomyopathies predominate in the young (<35 years). Reduced mortality from infectious diseases and the adoption of Western lifestyles has led to increased prevalence of ischemic heart disease in developing nations. More than 80% of cardiovascular deaths are associated with coronary atherosclerosis. Myocarditis is also a recognised cause of sudden unexpected death in both children and adults. Myocarditis is a recognised cause of cardiac failure in childhood and may present with non specific clinical features of progressive cardiac dysfunction or with those of dilated cardiomyopathy. Congenital heart diseases, which make up about 1% of human malformations, are among the most common malformations in fetuses. They contribute significantly to infant mortality rate due to poor prognosis.[5]

This study was conducted with the aim to study the various spectrum of cardiac diseases on histopathology in our institutional set up.

Materials and Methods

This observational study was undertaken in the histopathology section in the Department of Pathology at a Tertiary Care Hospital, Bangalore over a period of 5 years . The study period was from January 2015 to December 2019 and all the autopsy cases including medico-legal cases submitted for postmortem analysis were a part of the study.

A total of 276 autopsies were received during this period out of which 173 cases included specimens of heart. Epidemiological data and post mortem findings were collected from the post mortem papers.

Gross examination of the heart Weight and dimensions of whole heart were recorded. The external surface was looked for pericardial pathology and for evidence of recent or old infarct. The dissection of heart and coronary blood vessels was done by Virchow's method (following the direction of blood flow i.e the inflow outflow method) mentioned in current method of autopsy practice by Ludwig.[11]

The thickness of right ventricular wall, left ventricular wall and interventricular sptum were measured and noted. The valves were checked for their number, stenosis and calcification. Regions of either recent or old myocardial ischaemia were checked, and their location and sizes were recorded.

All the three coronary arteries; right coronary artery, left anterior descending artery and left circumflex coronary artery were examined using regular sections every 4-5mm.[12] The ascending aorta was checked for atherosclerotic changes and

dilatation/thickening. All gross findings as per proforma were recorded.

Microscopic Examination

Sections were taken from right and left ventricular walls, interventricular septum, apex and multiple sections from all the coronary arteries. In addition, sections were taken from suspected pathological lesions. All sections were fixed in 10% neutral formalin for 1 to 3 days in automated tissue processor. The fixed tissue sections then were embedded in paraffin.

Sections of 3 to 5 micrometer in thickness were cut and stained with haematoxylin and eosin and examined under light microscope by using 10x and 40x objectives and results were recorded. Special stains were performed whenever required i.e,Von kossa for calcification, Von gieson for elastin and Masson 's trichome for collagen.[6,12]

Results

A total of 173 hearts were studied. An obvious male dominance was observed with 85% (148) cases from male patients and 15% (25) cases from female patients. Our study included cases between newborns to 100 years old. Maximum number of cases were between 3rd decade to 5th decade.

Among these, on histopathology around 60.4% of the cases showed atherosclerotic changes involving the coronary arteries followed by myocardial infarction (9%) cases, myocardial hypertrophy (7%), cardiomyopathy (4.2%) cases, myocarditis (3.4%), 0.5% case each of aortic stenosis and infective endocarditis.

15% of cases showed no significant abnormalities on gross and microscopic examination. (Table 1)

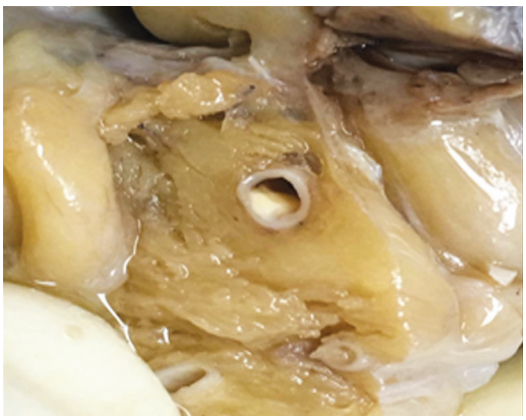

Fig. 1: Gross Photograph Showing Cut Section of Left Anterior Descending Artery (Lad) With Atherosclerotic Plaque.

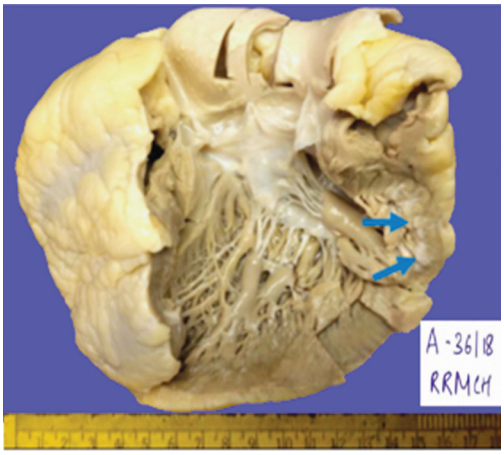

Fig. 2: Gross Photograph of Heart Showing Healed Myocardial Infarction (Blue Arrows Pointing at Grey White Areas).

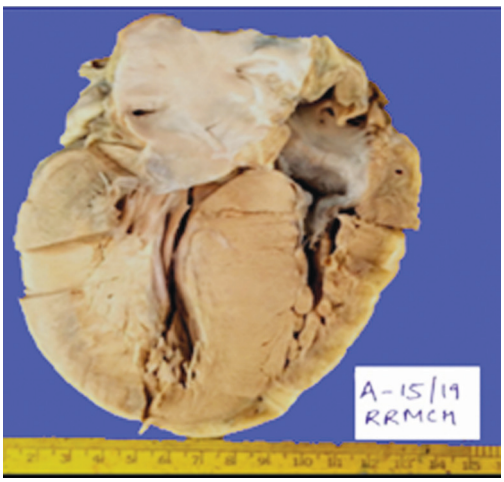

Fig. 3: Gross Photograph of Cut Section of Heart Showing Marked Left Ventricular and Interventricular Septal Hypertrophy.

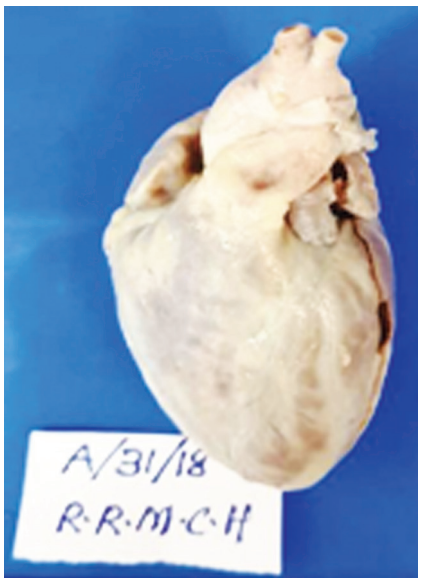

Fig. 4: Gross Photograph of A 7 Year Old Patient's Heart.

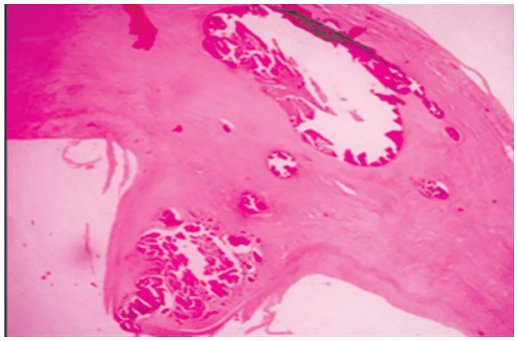

Fig. 5: Photomicrograph of Aortic Valve Showing Specks of Calcifications, H&E 10x.

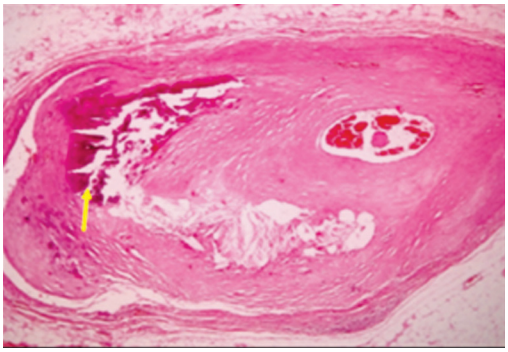

Fig. 6: Photomicrograph of Coronary Artery Showing Complicated Atherosclerotic Plaque (Grade –VI) Yellow Arrow Calcifications, H&E 10x.

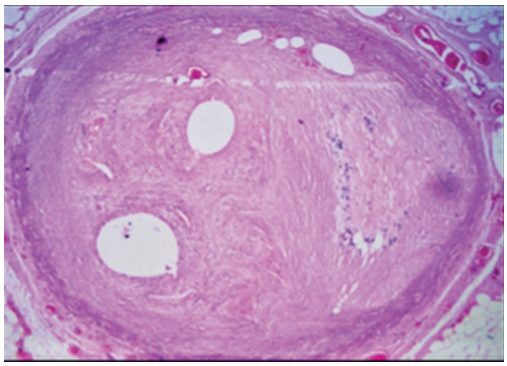

Fig. 7: Photomicrograph of Coronary Artery Showing Thrombus with Recanalisation of the Lumen, H&E 10x.

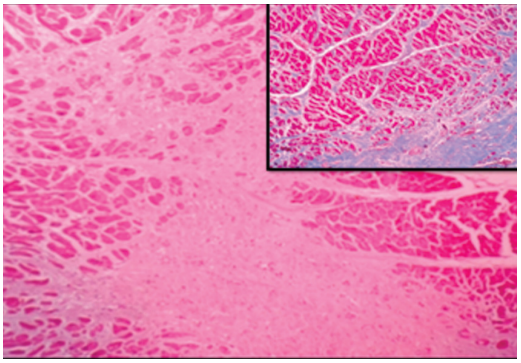

Fig. 8: Photomicrograph of Cardiac Muscle with Old/Healed Myocardial Infarction Replaced By Fibrous Scar, H&E, 10x. "Inset: Masson's Trichome Stain"

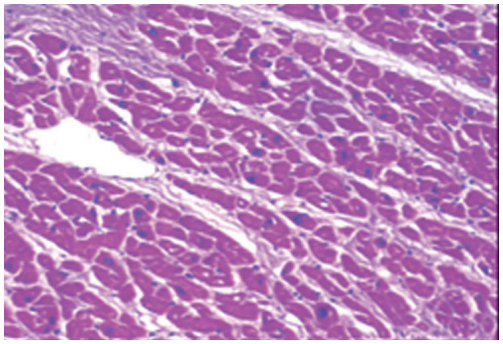

Fig. 9: Photomicrograph of Cardiac Muscle Tissue Exhibiting Marked Hypertrophy of Cardiomyocytes, H&E: 40x.

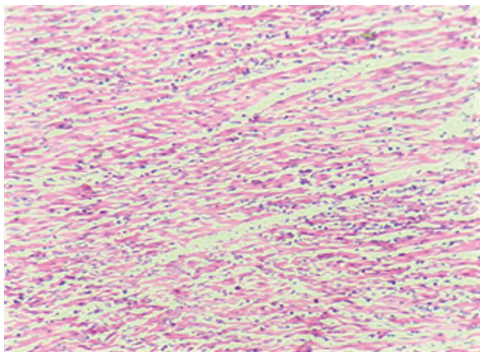

Fig. 10: Photomicrograph Showing Section of Left Ventricular Wall With Lymphocytic Myocarditis H&E, 10x.

Table 1:

Pathological Findings	Number of Cases	Percentage %
Atherosclerosis	105	60.6
Myocardial infarction	16	9.2
Myocardial hypertrophy	12	6.9
Cardiomyopathy	7	4
Myocarditis	6	3.4
Aortic Stenosis	1	0.5
Infective Endocarditis	1	0.5
No abnormality	25	14.9%
Total	173	100%

Table 2:

Coronary Artery Involved	Uncomplicated Plaque	Complicated Plaque	% Total
LAD	45%	29.5%	74.5%
LCX	9.5%	5%	14.5%
RCA	7%	3%	10%
Total	-	-	100%

In histopathological evaluation, most common finding was atherosclerosis 105 cases (60.9%) (Table 1). Triple vessel disease was observed in 66 cases (62.8%) of coronary atherosclerosis. Among 105 cases of atherosclerosis, 27 (25.7%) cases were

complicated with calcification within atheromatous plaque, 3 (2.8%) cases showed superimposed thrombus (Table 3).

Table 3: Changes in coronaries.

Findings	Number of Cases	%	Coronary Artery Involved
Atherosclerosis	75	71.5%	LAD-60% LCX-20% RCA-20%
Atherosclerosis with calcification	27	25.7%	LAD-40% LCX-30% RCA-30%
Atherosclerosis with thrombus	3	2.8%	LAD- 25% LCX-35% RCA-40%
Total	105	100%	

Aortic atherosclerosis was noted in 122 cases (70.5%) out of total 173 cases.

Myocardial Infarction was observed in 16 cases. Out of 16 cases, 10 (62.5%) cases showed recent or acute infarct and 6 (37.5%) cases revealed old infarct (Table 4)

Table 4:

	Number	Percentage
Acute/recent infarct	10	62.5%
Old healed infarct	6	37.5%
Total	16	100%

Myocardial hypertrophy was observed in 12 of 173 (7%) cases in total which involved the left ventricle and interventricular septum in 83.3 % cases, bilateral ventricles in 41.6% cases and only IVS in 33.3% cases.

4.2% (7/173) cases of cardiomyopathy comprising of HOCM(4) and DCM(3) and 3.4% (6/173) cases of myocarditis consisting of 5 cases of viral myocarditis and 1 cases of plasmodium falciparum myocarditis was observed. They were more common in younger population especially young adults & children. One case (0.5%)each of aortic stenosis and infective endocarditis were also observed in this present study.

26 out of 173 hearts accounting to almost 15% cases showed no abnormality in the heart on both gross and histopathologic examination.

Discussion

Cardiovascular diseases being the most common cause of deaths as mentioned in literature, the cardiac autopsies were performed with the aim to observe histomorphological spectrum that could guide and solve the mystery of death, especially sudden death.[3,6]

The major goal of the present study was to focus on cardiovascular findings in a study population at a tertiary care hospital whose corpuses were subjected to medico-legal examination.

This study seems to represent an underrepresentation of the cardiac conditions prevalent in the female population as clearly there is male dominance of the cases studied. This type of gender bias was also noted in the studies conducted by Wang et al.[13], Garg et al.[8], Ahmad et al.[14] and Sonawane et al.[15]

In present study, most of cardiovascular deaths occurred within age range of 21-50 years. This shows that age is a powerful risk factor for heart disease.

Sonawane et al., reported most cases between age group 41-50years (23.38%), also Marwah et al. observed most cases in the age group of 41-50 years and Garg et al. reported maximum cases in the age group of 51-60 years (26.24%). These variations in the age incidence may be due to sample size variation.[5]

In adults, sudden cardiac death (SCD) is a complication and often the first clinical manifestation of ischaemic heart disease. With decreasing age of the victim, the non atherosclerotic causes of sudden cardiac death like congenital coronary arterial abnormalities, premature coronary artery disease, cardiomyopathies, mitral valve prolapse and myocarditis become increasingly probable.[10]

Coronary atherosclerosis was most common histopathological finding in the present study accounting to 60.6% of cases. Similar findings were reported by Joshi C, 7 (65%), Karanfil R et al.[16] (75%) and Drory Y et al.[17] (58%). In more than 90% of cases, the cause of myocardial ischaemia is reduction in coronary blood flow due to atherosclerotic coronary arterial obstruction.1 Atherosclerosis with calcification was present in 25.7% cases in this study, whereas with thrombosis was present in 2.8% of cases. Joshi C, 7 reported calcification in 17% cases and thrombosis in 5 % cases. Ozdemir B et al.[18] reported coronary thrombosis in 4.8% cases. Patients with advanced coronary atherosclerotic calcification appear to be at increased risk for coronary events.

Thrombus formation is the most feared complication of atherosclerosis and may partially or completely occlude the lumen.[19] In the present study, major blockage was noted in Left anterior descending artery (LAD) (74.5%) left circumflex artery (LCA) (14.5%), and right coronary artery

(RCA) (10%). Rao DS, 2 reported 24 (11.8%) cases with major blockage in both main coronaries, in 87 (42.6%) cases in LADA and in 18 (51.5%) cases in RCA. The LAD is considered the most important of the three main coronary arteries and is almost always the largest. The Left anterior descending artery typically supplies over half of the heart muscle with blood, so twice as much as the other coronary arteries. For this reason, a major blockage occurs at the beginning of the artery.[3]

Plaque calcification is found more frequently in advanced lesions, it may also occur in small amounts in earlier lesions, which appear in 2nd and third decade of life. Histopathological investigations had shown that plaques with microscopic evidence of mineralization are larger. However, the relation of arterial calcification to the probability of plaque rupture is unknown.[8]

In this study histological evidence of myocardial infarction was present in 16 (9.2%) cases, similarly Wang HY, et al.[13], reported ischaemic heart disease in 7% cases whereas Bora Ozdemir et al.[18], reported myocardial infarction in 26% cases.[6] Ramazan et al.[20], reported myocardial infarction in 48% cases, which is higher than our study.

This difference may be due to time variability between onset of ischaemia and time of death. Because microscopic features depend upon the time period between onset of ischaemia and death.

Next common lesion in our study was myocardial hypertrophy which was present in 12 (6.9%) cases. In the literature, similar incidence that is 7% was reported by Cristino Basso et al, and Wang HY et al.[13] Ramazan Karanfil et al, and Chandrakala et al, reported a much higher incidence of cardiac hypertrophy in 66% and 52% cases respectively.[7,16,20]

Myocarditis was found in 6 (3.4%) out of total 173 cases. Variable percentage of myocarditis has been reported by different authors. Chandrakala Joshi 9%, Cristina Basso et al, 10%, Bora Ozdemir et al, 7%, Drory et al, 25% and Kramer et al, 29%. [5,7, 8,18]

Myocarditis is defined as an inflammatory disease of the myocardium established by histology, immunology and immunohistochemistry. Myocarditis can present in many different ways, including SD, particularly in the young population.[21]

All 6 cases of myocarditis were from young age group ranging from 4 yrs to <25 years presenting with sudden death. Grossly, the heart may appear normal, as seen in our case (Fig. 3) but at histological analysis, interstitial edema, focal or diffuse inflammatory infiltrates, predominantly lymphocytic with associated myocyte necrosis and replacement type fibrosis can be observed in the ventricular myocardium.

Conclusion

Cardiovascular diseases constitute the most common cause of sudden death. It is well known that lifestyle modification and drug therapy in selected individuals can reduce the risk of cardiac events, but current Framingham risk assessment is suboptimal.

So in medicolegal autopsies it is proposed that every possible organ must be sampled for histopathological examination and must be examined with a multidisciplinary approach (scene investigation, medical history, biochemical, microbiological, toxicological etc). Histopathology of various organs is very helpful to the forensic surgeons in arriving at a conclusion regarding the cause of death.

In present study most common cause of death is myocardial infarction due to atherosclerosis. Histopathological studies provide the most accurate clues to a better understanding of human cardiovascular diseases. With better insight into disease pathophysiology, novel interventions could be introduced to improve care and future outcomes for patients undergoing cardiovascular diseases.

Acknowledgement

Our sincere & heartfelt thanks & love for Dr K Shashikala for all the support and motivation.

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Case Report

Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 2, April - June 2021
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14221.15

Cutaneous Reactions Due to Accidental Exposure to Plant Growth Regulator: Occupational Pesticide Poisoning

Chandrashekhar B Bhuyyar[1], Anand mugadlimath[2], Tyagaraju MR[3], Vishal koulapur[4]

How to cite this article:
Chandrashekhar B Bhuyyar, Anand mugadlimath, Tyagaraju MR et al./Cutaneous Reactions Due to Accidental Exposure to Plant Growth Regulator: Occupational Pesticide Poisoning/Indian J. Forensic Med Pathol. 2021;14(2):117–119

Abstract

Accidental Pesticide poisoning is an important health issue in developing country like India. Adverse health effects by pesticides are common among farmers due inappropriate handling. Plant growth regulator hydrogen cyanamide (Dormex) is used mainly for the bud-cleaving and growth promotion of grapes in north karnataka. Accidental exposure to hydrogen cyanamide may result in wide range of health hazards like irritant contact dermatitis. Here we discuss such a case where the patient suffered severe health hazards due to accidental exposure to hydrogen cyanamide.

Keywords: Hydrogen Cyanamide; Accidental Exposure; Cutaneous Reactions.

Introduction

Accidental pesticide poisoning is an important health issue in developing country like India. The potent chemicals used in agriculture may harm persons by accidental exposure either during application to crops or due to careless storage. Reckless use of pesticides may have many deleterious effects on humans and environment. In spite of being immense education and sensitization about pesticides still accidental poisoning is prevalent in farmers. Skin rashes and skin itchiness were also found among agricultural workers to be significantly associated with pesticide spraying.[1] Agricultural workers are at higher risk of exposure as they are unaware, have no training or guidance of pesticide spraying, and do not use protective measures for the same.

Case Report

A male patient aged 26 years admitted to the emergency ward with cutaneous reactions, irritation and erythema all over the body. He gave history of exposure to Dormex in the grape field on the same day in the morning. The method of application by him was to put the cotton in solution of Dormex and to apply on the grape buds. He used only his bare hands without any personnel protection equipment for the application but the development of rashes was on entire body. Patient required hospitalization because of extensive skin (bullous lesions) involvement (fig. 1 & 2). The blood pressure was measured 100/60 mm of hg. The pulse rate was 52/min. The laboratory investigations revealed mild metabolic acidosis. The patient was with treated with fluids, corticosteroids and antihistamines effectively and discharged after 7 days. The final diagnosis of the patient was irritant contact dermatitis due to accidental exposure to hydrogen cyanamide.

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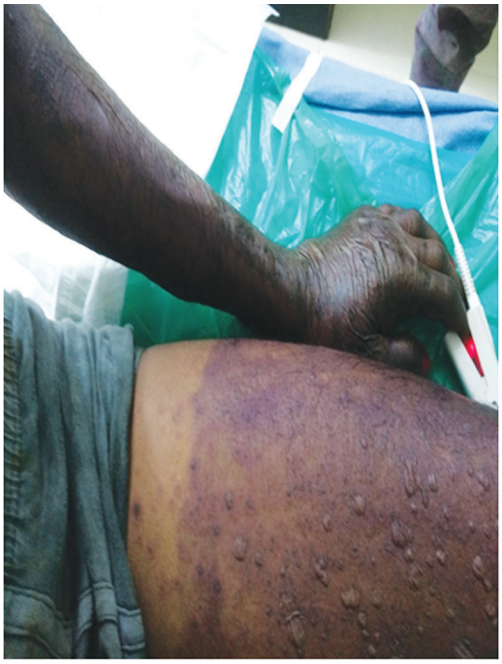

Fig. 1: Cutaneous reactions on thigh.

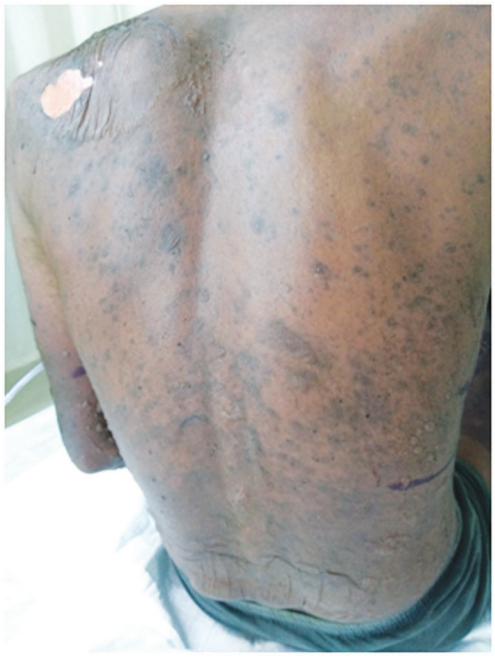

Fig. 2: Cutaneous reactions on back.

Discussion

Poisoning was responsible for an estimated 252000 deaths during the year 2008 world wide. In India about 28012 poisoning deaths were reported during the year 2010. Reports from india, Indonesia Sri lanka and Thailand indicate that common availability and use of toxic pesticidesis responsible for intentional and unintentional morbidity and mortality.[2]

Occupational poisoning as a result of dermal or inhalational exposure to chemicals is a common occurrence in the developing world and still occurs in the developed world.

The use of organic manure and other cultural methods of pest control were rapidly replaced by pesticides due to easy access, quick action, and high efficacy, and this becomes the high risk factor for adverse health hazards.[3]

The climatic conditions in the northen part of Karnataka are suitable for grapes. Flowering of seasonal plants can be enhanced with plant growth regulators like hydrogen cyanamide. Maximum yield can be obtained with the help of plant growth regulators.

Insufficient precautionary information on the label and due to illiteracy, people suffer hazardous effects after exposure to this chemical. During the season, illiterate, poor people are employed for applying hydrogen cyanamide to the grape buds. These daily wage workers do not use any kind of personal protection measures while applying the chemical.

Mild skin lesions have been noticed as a result of the improper handling of hydrogen cyanamide. Hydrogen cyanamide may also known to cause systemic effects such as vomiting, headache, hypotension, altered sensorium respiratory distress and palpitation.

Italy reported maximum of these cases, where the sale and use of this chemical was temporarily stopped in February 2002. Later it was re-introduced, in June 2003, with the enhancement of the precautionary measures.4 Despite the maximum precautions still they have reported many cases. 5 That's why the agricultural laborers should be educated regarding safe handling of this chemical.

Conclusions

Adverse effects of chemicals must be mentioned on the product label in the local language. Awareness programme must be arranged on regular basis to educate and sensitize the people about ill effects of these chemicals. Personal protective equipments should be provided to the workers while dealing with these chemicals.

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Case Report

Indian Journal of Forensic Medicine and Pathology
Volume 14 Number 2, April - June 2021
DOI: http://dx.doi.org/10.21088/ijfmp.0974.3383.14221.16

An Autopsy Study of Rheumatic Heart Disease: A Prevalent Iceberg Disease

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How to cite this article:
Muhammed Aseel Zahir Hussain, Archana B, Thanka J et al./An Autopsy Study of Rheumatic Heart Disease: A Prevalent Iceberg Disease/ Indian J. Forensic Med Pathol. 2021;14(2):121–124

Abstract

Cardiovascular diseases are a chief cause of sudden death. Rheumatic Heart Disease (RHD) exists as a hidden burden in developing countries. It occurs as a sequelae to Rheumatic Fever caused by Group A β Hemolytic Streptococcus. Despite the existence of antibiotics and prophylaxis by Penicillin it is still prevalent.

A 33 year old male was found unresponsive in his house and was later declared dead. He had a history of abdominal pain for the past 6 months for which he was on medication. There was no other relevant family and past history. He had no history of alcohol intake or smoking. Complete medico legal autopsy was done and confirmed to be RHD.

RHD is an "iceberg" disease which is still prevalent in developing countries. A cross reaction between foreign antigen and cardiac proteins leads to formation of autoantibodies causing autoimmune reaction. Mitral valve is commonly involved. RHD diagnosis can be established using Jones criteria during clinical examination.

RHD still exists despite use of advanced antibiotics and Penicillin prophylaxis and needs to be therefore considered as a diagnosis of sudden death of young adults.

Keywords: Caterpillar Cells; Sudden Death; Rheumatic Heart Disease.

Introduction

Cardiovascular diseases are the most significant and prevalent cause of sudden death in a person. Rheumatic Heart Disease (RHD) continues to be a burden in developing countries. It causes significant morbidity in young adults. It occurs as a complication of Rheumatic Fever caused by Group A β Hemolytic Streptococcus in genetically susceptible host. In the past, patients who were affected by RHD occupied a significant portion of the beds in hospitals of developed countries. In the recent past rheumatic fever has receded as being a health problem in the developed countries.

RHD is a preventable condition if intervention is given at the appropriate time. In the era of advanced antibiotics and Penicillin Prophylaxis it is still prevalent in a developing country like ours. We report an incidentally detected case of RHD in a male on autopsy.

Case Report

A 33 year old male was found unresponsive in his house and was later declared dead. He had a history of abdominal pain for the past 6 months for which he was on medication. There was no other relevant family and past history. He had no history of alcohol intake or smoking. Complete medico legal autopsy was done.

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Macroscopically: There was evidence of petechiae over left ventricle and congestion of liver, spleen and kidneys. Kidney shows thickening of walls of arterioles. Liver showed centrilobular necrosis and features of chronic venous congestion. Lungs were edematous with alveolar septal thickening and focal fibrosis.

Microscopically: Myocardium showed foci of fibrinoid necrosis, lymphocyte infiltration (Fig. 1) and plump macrophages with abundant cytoplasm, round to oval nuclei with central wavy chromatin (caterpillar cells). (Fig. 2) By IHC, the cells infiltrating the myocardium were positive for CD45, Vimentin and CD68 (Fig. 3) and negative for CK and SOX10, confirming them to be macrophages. Histological features were suggestive of Aschoff bodies (Fig. 4) consistent with the diagnosis of RHD.

Sections from liver showed congested sinusoids with focal centrilobular necrosis. Portal area showed lymphocytic infiltration. Hepatocyte zone 3 demonstrated presence of micro and macrovascular steatosis (10%).

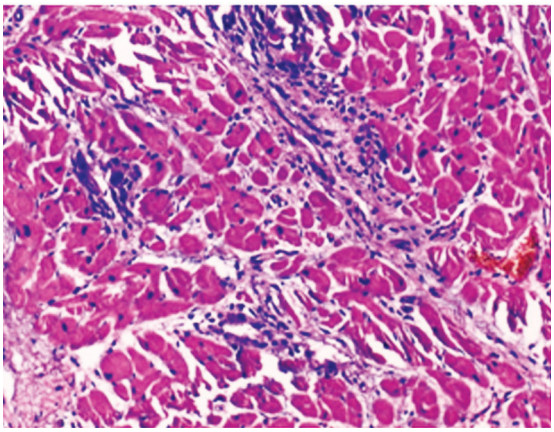

Fig. 1: Histopathological slide (100X) showing Features of Myocarditis.

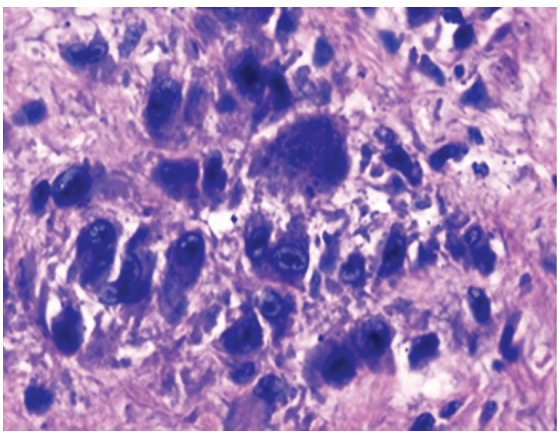

Fig. 2: Histopathological slide(400X) showing Caterpillar Cells in the Myocardium.

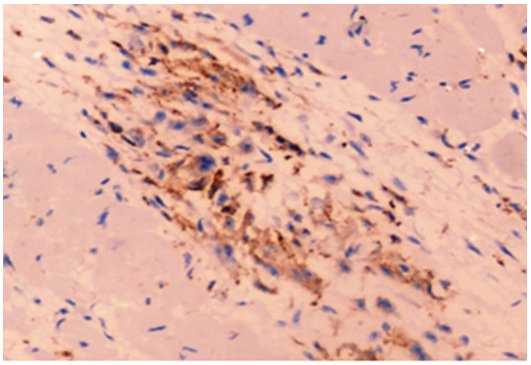

Fig. 3: Immmunohistochemistry; CD68 Positivity noted.

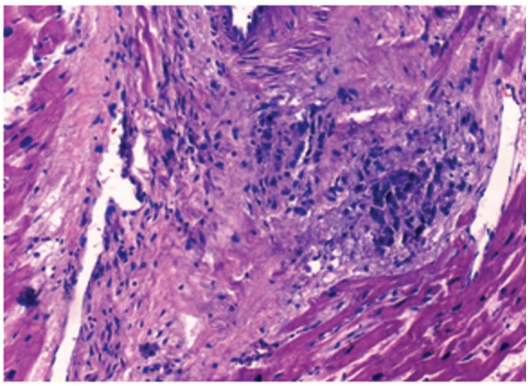

Fig. 4: Histopathological slide (100X) showing Aschoff Bodies.

Discussion

Cardiovascular causes form the most important cause of sudden death. RHD is an important disease causing cardiovascular mortality and morbidity in young adults. It occurs as a complication of Rheumatic Fever by Group A β Hemolytic Streptococcus in a genetically susceptible host due to an autoimmune reaction of the cardiac proteins with the streptococcal antigen.

Epidemiology RHD tends to be more common in females.[1] It also accounts for the greatest cardiovascular related loss of disability adjusted life years in children.[2] The number of disability adjusted life years due to rheumatic heart disease in 2015 was 10,513,200.[3]

RHD has affected 33.4 million people globally and causes 347,000 deaths annually.[4] Premature death contributed more to health loss of patients than years lived with disability.

The decrease in incidence in developed countries can be credited to better living conditions resulting in better hygiene, less overcrowding leading to decrease in transmission of infection. Patients suffering from rheumatic carditis are at a high risk of recurrence of RHD and they receive long term antibiotic prophylaxis. Patients with valvular

disease receive prophylaxis for a period of 10 years after the previous attack of acute rheumatic fever or until age of 40 years whichever is longer.

The key issues in the prevention of RHD is the inability to find an effective way for early identification of those with rheumatic heart disease to administer effective prophylaxis rather than going for surgery. The lack of primary preventive measures also adds to the burden of the disease. One of the major roadblocks in the study of RHD in developing countries is the overshadowing of the burden of rheumatic heart disease by other prevalent diseases like Immunodeficiency, Tuberculosis and Pneumonia.

One of the major drawbacks in combatting RHD can be attributed to the reliance on clinical examination for identifying patients of rheumatic heart disease rather than echocardiographic screening citing the lack of funds to do so in a resource poor set up. But a study conducted on school children by Marijon showed that echocardiographic screening identified nearly 10 times the number of cases detected by clinical examination which represent an exceptional number of cases that could go unnoticed and thus predispose them to the risk of recurring rheumatic fever.[5]

This suggests that Rheumatic Heart Disease is another "Iceberg Disease" that warrants attention because of its morbidity. The role of Group A β Hemolytic Streptococcus in RHD has been established due to increase in cases of Rheumatic fever following infection and also the increased Anti Streptococcal antibodies like Anti Streptolysin O in patients.

Foreign Antigen M Protein cross reacts with Cardiac Myosin leading to autoimmune reaction against heart valves. Autoantibodies are formed against carbohydrate of heart valve, binding to valve and leading to damage. This causes intracellular cardiac proteins to spill further instigating autoimmune reaction. The most commonly involved valve is Mitral Valve.[6] Vegetations may be present along the line of closure of valve leaflets.

One of the major presenting neural symptoms is Sydenham Chorea. Autoantibodies target dopaminergic receptors leading to altered dopamine levels and thus causing chorea. The diagnosis of RHD is established during clinical examination using Jones Criteria which includes migratory polyarthritis, carditis, erythema marginatum, Sydenham chorea and subcutaneous nodules. One of the minor criterion for diagnosis is the prolongation of PR interval on ECG.

Echocardiography is the gold standard for the diagnosis of carditis.[7] The most common lesion is mitral regurgitation (MR), while mitral stenosis (MS) is pathognomonic of RHD.[8]

Prophylaxis is administered in order to prevent infection by Group A β Hemolytic Streptococcus. Primordial prevention of RHD mainly involves preventing overcrowding. The strongest evidence for a causal association between a primordial (socioeconomic) determinant and RHD risk is for household or bedroom crowding.[9]

Primary prevention of Group A Streptococcus infection includes administration of Benzathine Penicillin and Penicillin V. In case of Penicillin allergy, cephalosporin, clindamycin or Azithromycin can be used.

Secondary prevention of Group A Streptococcus is done by administering Benzathine Penicillin G, Penicillin V and Erythromycin.

Duration of prophylaxis is 10 years since last episode of Rheumatic Fever or until 21 years of age, whichever is longer with prolongation till 35-40 years. Increased compliance to Penicillin is associated with decreased Acute Rheumatic Fever recurrence and decreased mortality.[10]

The most important prophylactic measure includes the improvement of sanitation, hygiene, nutrition and access to affordable health care.

Interventions like Catheter Intervention is used for stenotic lesions primarily. Patients having severe mitral stenosis benefit most from catheter based interventions.[4] Cardiac Surgery is the preferred intervention when patient is symptomatic.

Conclusion

RHD is a prevalent cardiovascular disease in developing countries due to the poor living conditions. It results from an autoimmune etiology. Clinically Jones criteria serves as a salient method of diagnosis whereas echocardiography has proven to be the gold standard to diagnose carditis. Presence of distinct histopathological features can clinch the diagnosis.

In this modern era of advanced antibiotic treatment, forensic pathologists should still consider RHD as a cause of sudden death in middle aged individuals.

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The second page should carry the full title of the manuscript and an abstract (of no more than 150 words for case reports, brief reports and 250 words for original articles). The abstract should be structured and state the Context (Background), Aims, Settings and Design, Methods and Materials, Statistical analysis used, Results and Conclusions. Below the abstract should provide 3 to 10 keywords.

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State the background of the study and purpose of the study and summarize the rationale for the study or observation.

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The methods section should include only information that was available at the time the plan or protocol for the study was written such as study approach, design, type of sample, sample size, sampling technique, setting of the study, description of data collection tools and methods; all information obtained during the conduct of the study belongs in the Results section.

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Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text; alternatively, it can be published only in the electronic version of the journal.

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Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

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Unpublished article

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