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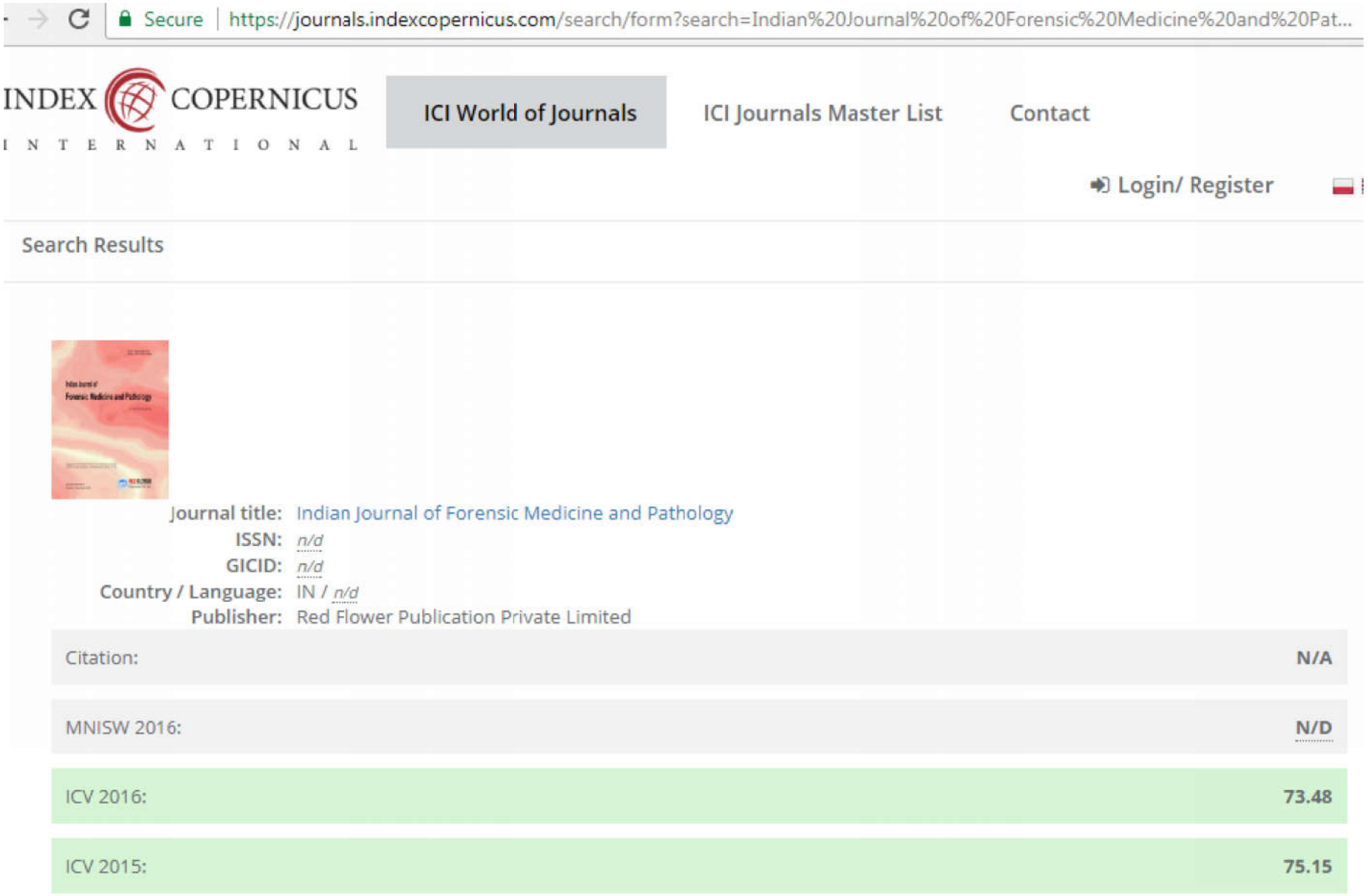
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Effectiveness and Significance of Fine Needle Aspiration Cytology in the Diagnosis of Thyroid Swelling: A Single Institute Experience in a Series of 710 Patients

Abilash Saidharannair Chandrakumari[1,5], Pammy Sinha[2], Shree Lakshmi Devi Singaravelu[3,5], Jai Kumar[4]

Abstract

Context: Thyroid swelling is a relatively common problem encountered in clinical practice throughout the world. Early detection of thyroid neoplasm is the fundamental basis of thyroid screening. A quest for ease, simple and accurate diagnostic tool that would differentiate between benign and malignant lesion has facilitated fine needle aspiration cytology (FNAC) as the first line tool in the initial thyroid evaluation. *Aims:* The study was aimed at classifying thyroid lesions according to the Bethesda System for Reporting Thyroid Cytopathology and to compare the diagnostic efficacy of fine needle aspiration cytology by correlating with gold standard histopathology. *Settings and Design:* This prospective cross-sectional study was conducted over a period of two years in a tertiary hospital, Kerala. *Methods and Material:* A total of 710 patients were included in the study. FNAC was performed and Staining was performed with Haematoxylin & Eosin (H&E), Papanicolaou and May-Grünwald Giemsa Stains. Diagnosis was made based on TBSRTC. Excision biopsies were fixed in 10% formalin. *Statistical Analysis used*: IBM Statistical Package for the Social Sciences Software version 21 was used to perform Pearson Chi-square test and Fischer Exact. *Results:* In this study 592 (83.4%) cases of non-neoplastic lesions, 111 (15.6%) cases of neoplastic lesions and seven cases were found unsatisfactory for diagnosis. FNAC showed high sensitivity and specificity in diagnosing neoplastic thyroid lesions and it showed high level of significance in diagnosing papillary thyroid carcinoma. *Conclusions*: FNAC is an excellent diagnostic tool in the management of thyroid lesions since it provides rapid diagnosis with high accuracy rate.

Keywords: Bethesda System; Neoplasm; Histopathology; Papillary Thyroid Carcinoma.

Introduction

Thyroid swelling is a relatively common problem encountered in clinical practice throughout the world. Though majority of these lesions are non-neoplastic still it might engender distress and affect wellness of an individual. The fundamental idea behind screening of thyroid lesion is the detection of neoplasm and differentiating between benign and malignant lesions. An accurate diagnostic tool helps in early detection of these lesions and allows planning of appropriate management with relevant patient counselling [1].

A visible growing lump in the neck is the most common presenting complaint, furthermore the enlarged gland can compress adjacent structures, can also produce multitude of symptoms related to hormonal imbalance and it also carries potential risk of malignancy. Thyroid lesions are more prevalent in females and their predilections remain throughout all age group [2]. Majority of these lesions are benign and only 5% are malignant which require definite surgical intervention [3].

Various diagnostic modalities including Ultrasonogram (USG), Radionucleotide scan, Fine Needle Aspiration Cytology (FNAC) and thyroid function tests are in vogue for the early diagnosis and detection of thyroid lesions. A quest for ease,

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simple and definitive diagnostic tool that would facilitate early diagnosis and treatment especially in malignant lesions has encouraged its great application in the initial evaluation of thyroid. The implementation of the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) has literally revolutionized thyroid FNAC. It became the first line diagnostic tool by introducing a standardized category based reporting and thereby reducing the toll of thyroid surgeries [4,5].

In current scenario, application of FNAC in the preoperative evaluation of thyroid lesion has been widely accepted as one of its most successful achievement. FNAC is considered cost effective, time saving and minimally invasive procedure which carries high rates of sensitivity and specificity. It is acknowledged and recognized as a vital diagnostic tool in the evaluation of thyroid lesions [6].

Acknowledging the significance of FNAC in pre-operative diagnosis of thyroid lesion, the current study was undertaken to classify thyroid swellings according to TBSRTC and to evaluate the diagnostic efficacy of FNAC by correlating with postoperative histopathology findings.

Materials and Methods

This prospective cross-sectional study was conducted in a tertiary hospital, Wayanad, Kerala for over a period of two years from August 2015 to July 2017. Patients presented with palpable thyroid swellings were referred to the department of pathology for performing FNAC. Institutional ethical committee approval was obtained and a total of 710 patients with palpable thyroid swelling were evaluated. Patients who underwent FNAC followed by histopathology were included in the study. Short clinical history was elicited from all patients; other findings including USG and biochemical parameters were recorded.

FNAC was performed in all cases and a preoperative cytological diagnosis was established followed by postoperative histopathological diagnosis. FNAC procedure was performed using a 23-24 gauge needle; the aspirate was smeared on multiple clean dried glass slides and was immediately fixed with alcohol. Staining was done with routine Haematoxylin & Eosin (H&E) and Papanicolaou (Pap) stains. Unfixed smears were air dried and stained with May-Grünwald Giemsa (MGG) *Stain*. Cytological evaluation and diagnosis was done based on TBSRTC.

Excision biopsies of thyroid were immediately introduced in 10% formalin, measurements and weights were noted. Paraffin blocks were prepared after routine histopathology processing techniques. From each block about 3-4 ìm sections were cut, mounted, dewaxed and stained with H&E. Slides were submitted for detailed microscopic examination and the findings were recorded.

Statistical Analysis

Statistical analysis was performed by using IBM Statistical Package for the Social Sciences (SPSS) Software version 21. Statistical methods including Pearson Chi-square test and Fischer Exact test were performed to assess the relationship between different variables. Significance of the statistical tests at P value less than 0.05 was based on 95% confidence interval.

Results

In this study out of 710 cases, 641 (90.3 %) cases were females and 69 (9.7%) cases were males setting up the male female ratio of 1:9.3. Age of the patients ranged from 14 to 81 years with a mean age of 43.94 (SD±12.78). About 45.6% of thyroid lesion were presented in the age group of 41 to 60years and 41.4% were found between age group of 21-40 years. Incidence was low in second (2.2%) and seventh (11.3%) decades of life. Cytological examination unveiled positive malignant rates of 14.5% among males and 8% among females (P=0.06). The mean age of malignancy was 44.2 (SD±7.86) for males and 46.25 (SD±10.99) for females.

Preoperative cytological diagnosis was compared with postoperative histopathological findings. The cytology results were categorized as per recent TBSRT into Benign (category II), Follicular neoplasm (FN)/suspicious of follicular neoplasm (SFN) (category IV), Suspicious of malignancy (SM) (Category V) and malignant category (category VI). In this study 592 (83.4%) cases of non-neoplastic lesions including 575 cases of colloid goitre, 14 cases of thyroiditis and three cases of thyroglossal cyst were classified under category II, 111(15.6%) cases of neoplastic lesions comprising of 50 cases of follicular adenomas and 61 cases of carcinomas were included under Categories IV, V, VI. Aspirates labelled as non - diagnostic/unsatisfactory (category I) and Atypia of undetermined significance or follicular lesions

of undetermined significance (Category III) were not included in the calculation.

Of the 575 cases of colloid goitre, 568 cases (98.78%) showed positive correlation with histopathology, two cases were thyroidits, three cases turned out to be follicular adenoma and two cases proved to be papillary carcinoma thyroid. The accuracy rate of FNAC in diagnosing colloid goitre was found to be 99% [Table 1].

Histopathological examination of all the 50 cases of FN/SFN showed follicular adenoma in 30 cases, follicular carcinoma in nine cases, follicular variant of papillary carcinoma in seven cases and adenomatoid goitre in four cases. Among the sixteen cases diagnosed as suspicious of malignancy (SM) by FNAC, histopathological examination confirmed papillary carcinoma in eight cases, follicular carcinoma in four cases, follicular adenoma in three cases and poorly differentiated carcinoma in one case. All the 45 cases diagnosed as malignant lesions by FNAC were found to be malignant on histopathology. The sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and accuracy of FNAC in diagnosing neoplastic lesions were shown in [Table 2]. Pearson chisquare test and fischer exact test showed high level of significance ($p < .001$) between the two methods in diagnosing neoplastic lesions.

Cytological diagnosis was unsatisfactory/non diagnostic in seven cases which were found to be colloid goitre (two cases), thyroiditis (two cases) Follicular adenoma (two Cases) and papillary carcinoma thyroid (one case) on histopathology.

Table 1: FNAC & Histopathology correlation of thyroid lesions

FNAC Diagnosis	HISTOPATHOLOGICAL DIAGNOSIS								
	Colloid Goitre	Thyroidi-tis	Thyroglossal Cyst	Follicular adenoma	Papillary Carcinoma	Follicular Carcinoma	Medullary Carcinoma	Anaplastic Carcinoma	Total
Benign	568	2	0	3	2	0	0	0	575
Colloid Goitre	7	7	0	0	0	0	0	0	14
Thyroiditis	0	0	3	0	0	0	0	0	3
Thyroglossal Cyst									
Non Diagnostic	2	2	0	2	1	0	0	0	7
FN/SFN	4	0	0	30	7	9	0	0	50
SM	0	0	0	3	8	4	0	1	16
Malignant	0	0	0	0	38	0	0	0	38
Papillary CA Medullary CA	0	0	0	0	0	0	3	0	3
Other CA	0	0	0	0	0	1		3	4
	581	11	3	38	56	14	3	4	710

*FN/SFN: Follicular neoplasm/suspicious of follicular neoplasm, *SM: Suspicious of malignancy, *CA: Carcinoma

Table 2: Statistical indices of FNAC in diagnosing Neoplastic thyroid lesions

Statistical indices of FNAC	Diagnosis of Neoplastic thyroid lesions
Sensitivity	95.50%
Specificity	99.32%
PPV	96.4%
NPV	99.15%
Accuracy	98.7%

*PPV: Positive Predictive Value, NPV: Negative Predictive value

Discussion

Thyroid enlargement presents as an evident lump in the neck. It often raises concern but does not always portend hazard. Rather than a dominant nodule, diffuse and symmetrical thyroid enlargement is more likely to be non-neoplastic. Thyroid nodules are seen in 7 -10% of adults and are more prevalent among females. Majority of these lesions are benign and only < 5% is malignant. Prompt and accurate diagnosis of these lesions will help the surgeon to decide the appropriate management [7,8,9].

FNAC remains the mainstay of investigation in the management of thyroid swelling. It carries good sensitivity and specificity with high diagnostic accuracy. The heading factor influencing the accuracy of FNAC is adequacy of sample, which mainly depends on sampling technique and aspirators skill. A sample is considered inadequate if the smears are obscured by haemorrhage or presence of very few follicle cells. In this study smears from 7 cases (<1%) were found inadequate/ non diagnostic which is highly compatible with the other international studies which showed that the rate of non-diagnostic test can go up to 10% [10,11,12,13].

In the present study 14 cases of thyroiditis were diagnosed by FNAC out of which seven cases turned out to be colloid goitre with secondary lymphoid aggregates on histopathology, this was considered as false positive thyroiditis by FNAC. Colloid goitre with significant lymphoid collections might mislead to the diagnosis of thyroiditis on cytology. Hence forth if significant numbers of lymphocytes were seen on smears, USG and biochemical correlations were suggested, if necessary repeated aspiration should be carried out to lower the incidence of false positive cases.

Diagnosis of follicular adenoma, follicular carcinoma and follicular variant of papillary carcinoma by aspiration cytology technique is always a challenge [14]. Though there is uncertainty in the diagnosis of follicular lesions the accuracy rate depends on the competency of pathologist. In our study 16 cases (32%) diagnosed as FN/SFN by FNAC were turned out to be malignant lesions on histopathology. The finding is accordant with the studies done by Baloch ZW et al and Faquin WC et al., which emphasized that about 30% of follicular neoplasm proved to be malignant on histopathology [15,16].

False positivity and false negativity is a major drawback of FNAC. In our study we found that there was no false positive malignancy on FNAC. The sensitivity, specificity, PPV, NPV and accuracy of FNAC in diagnosing malignancy was found to be 78.4%, 90.90%, 95.01%, 65.22%, and 82.24%. Studies done by Kini et al [17] and pinky pandey et al [18] have documented the sensitivity range from 52-98% and specificity range from 72-100%. Haberal AN et al had shown that rate of PPV and NPV can range 50-90% and 63-95% respectively [19]. The present study showed good congruence with the above studies.

False negative rate reveals the proportion of malignancy not diagnosed on FNAC. Many studies have recorded the false negative rate ranging from one to ten percentage [19,20]. The rate of false negativity in our study was found to be 4.5%. Three cases of follicular adenoma were diagnosed as adenomatoid goitre and two cases of papillary carcinoma thyroid were diagnosed as colloid goitre with cystic change on FNAC. Histopathological examination of both these papillary carcinoma thyroid showed cystic change. However in case of cystic nodule adequate sampling is mandatory, if needed USG guided aspiration of solid area to be carried out to lower the false negative rate. The sensitivity, specificity, PPV, NPV and accuracy of FNAC in diagnosing papillary carcinoma thyroid was found to be 82.61%, 100%, 100%, 65.2% and 86.89% respectively. In our study it was found that there was significant increased toll of malignancy among male cases, many other published studies also showed similar findings [21,22,23].

Conclusion

FNAC is an excellent diagnostic tool in the management of thyroid lesions since it provides rapid diagnosis with high accuracy rate. It showed high sensitivity and specificity in diagnosing malignant thyroid lesions. False positive diagnosis rate can be minimized by correlation with usg findings and by taking repeated representative samples.

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Conflict of Interest: No

Key Messages

The key factor which influences the diagnostic accuracy of FNAC is sample adequacy. Our study divulges high malignancy rates among males and significantly low false positive and negative rates.

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Original Article

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A Study of Unnatural Deaths of Medico Legal Importance in a Tertiary Care Centre

Murali Mohan[1], Shreedhara K.C.[2], Lohith Kumar R.[3], Abhishek Yadav[4]

Abstract

Background: Pattern of unnatural deaths is a reflection of the socio-economic status and mental health of the society. Objective of the study was to determine the pattern and cause of unnatural deaths and to find the association of causes with socio-demographic factors in a rural tertiary care hospital. *Material and Methods:* Retrospective record based study was conducted from the records of previous 2 years and 342 subjects were finally included. Institutional ethical clearance was obtained prior to the start of the study. Structured proforma was used to collect data related to cause and pattern of unnatural deaths. Data was analysed using SPSS 17 version software. p value <0.05 was considered as statistically significant. *Results:* Majority 52.04% were in the age group 41 to 60 years, 67.26% of them were females, 67.83% were from rural background and lower socioeconomic status (42.1%). Most common cause of unnatural death was head injury (35.08%), followed by poisoning (21.05%), burns in 13.45%, drowning in 9.94%, Hanging in 8.77% and other in 11.69% *Conclusion:* Head injury and poisoning were the most common cause for unnatural deaths and age, sex, locality and socioeconomic status determine the pattern of unnatural deaths.

Keywords: Unnatural Deaths; Retrospective Study; Socio Demographic Factors; Head Injury; Poisoning.

Introduction

Deaths may be accidental, suicidal and homicidal or remain undetermined [1]. The term "unnatural death" has been defined U/s 174 Cr. P.C, as that a person has committed suicide or he has been killed by another or he has been killed by an animal or by a machinery or an accident or the person has died under circumstances raising a reasonable suspicion that some other person has committed an offence.[2] Pattern of unnatural deaths is a reflection of the socio-economic status and mental health of the society [3]. In few cases, attending physician cannot determine a cause of death or death is suspicious. In such cases, after completion of autopsy, the outcome may often reveal some unnatural causes, the presence of which may trigger issue like association of disease with trauma, work, crime etc. and its relative contribution towards death [4]. This study was done with the objective to determine the pattern and cause of unnatural deaths and to find the association of causes with socio-demographic factors in a rural tertiary care hospital.

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Material and Methods

Retrospective record based study was carried out in a tertiary care centre, Department of Forensic medicine and Toxicology, Sri Devaraj Urs Medical College, Tamaka, Kolar. Study duration was from 2015 to 2017 for a period of 2 years. Sample size was estimated by using the proportion of most common cause for unnatural death as Head injury (33.46%) from the study Phani Kiran

Peethala et al. [5] using the formula N = Zα p (100-p)/ d2, p = 33.46, 100 – p = 66.54%, d = 5. Substituting the above values minimum sample size required was 342. Institutional ethical clearance was obtained prior to the start of the study. Data was analysed using SPSS 17 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test or Fischer's exact test (for 2x2 tables only) was used as test of significance for qualitative data. p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Results

A total of 342 unnatural deaths were included in the study. 52.04% were in the age group 41 to 60 years, 29.84% were age >60 years and 18.12% were in the age group <40 years. Majority 67.26% of them were females, 67.83% were from rural background. Majority were from the lower socioeconomic status (42.1%). Most common cause of unnatural death was head injury (35.08%), followed by poisoning (21.05%), burns in 13.45%, drowning in 9.94%, Hanging in 8.77% and other in 11.69% (Table 1).

In the present study it was observed that there was significant association between cause of unnatural death and all the socio demographic parameters i.e. age, sex, locality and socioeconomic status. Head injury was most commonly seen in the age group 41 to 60 years, males, urban population, lower socioeconomic status. Poisoning was commonly seen in the age group >60 years, females, rural population, lower socioeconomic status. Burns was commonly seen in the age group 41 to 60 years, females, rural population and in lower socioeconomic status. Drowning was commonly seen in the age group 41 to 60 years, females, rural population and in lower socioeconomic status. Hanging was commonly seen in the age group >60 years, females, rural population and lower socioeconomic status and other causes were commonly seen in the age group 41 to 60 years age group, females, rural population and lower class (Table 2).

Table 1: Profile of subjects with unnatural deaths in the study

		Count	%
Age	<40 years	62	18.12%
	41 to 60 years	178	52.04%
	>60 years	102	29.84%
Sex	Male	112	32.74%
	Female	230	67.26%
Locality	Rural	232	67.83%
	Urban	110	32.17%
Socioeconomic Status	Upper	22	6.43%
	Upper middle	35	10.23%
	Middle/lower middle	46	13.45%
	Lower/upper lower	95	27.77%
	Lower	144	42.10%
Cause of Unnatural death	Head Injury	120	35.08%
	Poisoning	72	21.05%
	Burns	46	13.45%
	Drowning	34	9.94%
	Hanging	30	8.77%
	Others	40	11.69%

Table 2: Association between Cause of unnatural death and various socio-demographic factors

		Head injury (n=120)	Poisoning (n=72)	Burns (46)	Drowning (34)	Hanging (30)	Others (40)	Total	P value
Age	<40 years	24	8	12	8	2	8	62	<0.001*
	41 to 60 years	74	26	21	22	12	23	178	
	>60 years	22	38	13	4	16	9	102	
Sex	Male	69	11	12	10	6	4	112	<0.001*
	Female	51	61	34	24	24	36	230	

		Head injury (n=120)	Poisoning (n=72)	Burns (46)	Drowning (34)	Hanging (30)	Others (40)	Total	P value
Locality	Rural	58	56	35	28	19	36	232	<0.001*
	Urban	62	16	11	6	11	4	110	
Socioeconomic Status	Upper	6	3	2	4	3	4	22	0.002*
	Upper middle	11	7	4	6	4	3	35	
	Middle/lower middle	13	10	7	6	7	3	46	
	Lower/upper lower	26	22	11	6	6	24	95	
	Lower	64	30	22	12	10	6	144	

Discussion

Unnatural deaths are an important indicator for mental health and socioeconomic status in the society. In the present study majority of deaths (52.04%) were in the age group 41 to 60 years. This age group constitutes the working age group, where in a death of a earning family member may lead to socio economic problems in the family. Majority 67.26% of them were females, 67.83% were from rural background and majority were from the lower socioeconomic status (42.1%). The above statistics suggests that females are subjected to unnatural deaths than males, this reflect the mental health and attitude of males towards females in the society. Rural population was subjected for unnatural deaths, this may due to illiteracy. Also they are prone for accidental unnatural causes of death. Socioeconomic status of the individual has shown to be having major influence on the cause of death.

Most common cause of unnatural death was head injury (35.08%), followed by poisoning (21.05%), burns in 13.45%, drowning in 9.94%, Hanging in 8.77% and other in 11.69%. Head injuries and polytrauma as a result of accidents are major contributors of mortality due to unnatural causes. In every year, deaths due to head injury, poisoning and burns are the major contributors of the statistical Medico-Legal deaths. In the study by Phani Kiran Peethala et al. [5], head injury was seen in 33.46% of cases, poisoning in 18.01%, burns in 14.56%, drowning in 2.65%, hanging in 6.2%, miscellaneous in 6.59% of cases. Naresh P. Zanjad et al. observed that most of the cases belonged to age group 31-40 years (28.50%) and 41-50 years (24.10%). Similar findings were found from the study of A. MeinaSingh et al (34.5%) [6], Kagne R.N. et al. (19%) [7], R. M. Whitington et al. [8], T. Sarkoija et al. [9].

From all above these studies, it is seen that the maximum number of unnatural deaths are seen in the middle age (31-50 years). This may be due to westernization of Indian society, increased road traffic accidents and alcohol consumption habit. The other studies were inconsistent in sex distribution, males (84.8%) were predominant in the study by Naresh P. Zanjad et al. [4]. Similar observations were made be T. Sarkoija et al. (82%) [9], Anthony Thomas et al. (73.9%) [10], Ivar Nordrum et al (79.67%) [11] & A. Meina Singh et al. (94.5%) [6]. The present study also observed that unnatural deaths were significantly associated with age, sex, locality and socioeconomic status [12]. This proves the role of socio demographic factors in unnatural deaths and follows a particular pattern.

Conclusion

From the study it can concluded that Head injury and poisoning were the most common cause for unnatural deaths and age, sex, locality and socioeconomic status determine the pattern of unnatural deaths.

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Original Article

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Assessment of Intention and Risk Factors for Suicide in Elderly: An Autopsy Study

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Abastract

Introduction: Over the past 30 years, Beck's Suicide Intent Scale (SIS) has been the prevailing psychometric scale for assessing suicide intent in suicide attempters. In recent studies showed a positive relationship between SIS scores. Since the proportion of older people in population is rising worldwide, indeed the increase in developing countries like India is even greater than the developed countries. *Material & Methods:* The present autopsy has been carried out in the Department of Forensic Medicine, Bangalore Medical College and Research Institute, Bangalore. All the cases aged 60 years and above brought to the department for medico-legal autopsy with alleged history of suicide were selected. Detailed information regarding the deceased particulars including suicidal scale I as in, presumptive stressful life events as in and the circumstances of death were collected from the relatives and police. *Results:* Previous suicidal attempt was present in 11% of the victims. Most had history of bad physical health prior to death in suicide victims. 68% had Family h/o suicide in elderly suicides. 21% of victims had CVS disorder, 12% diabetes. 80% of victims had low suicide intention. Total number of stressful life events experienced by study population was very high- 5.29±1.05 and 5.05±1.04 for males and females respectively. The mean stressful life event score for life time in study population was also high- 357.37±62.62 and 365.53±86.46 in males and females respectively. *Conclusions:* Total number of stressful life events experienced by study population was very high -5.29±1.05 and 5.05±1.04 for males and females respectively. The mean stressful life event score for life time in study population was also high- 357.37±62.62 and 365.53±86.46 in males and females respectively.

Keywords: Suicide Intent Scale (SIS); Elderly Suicide; Stressful Life Events.

Introduction

A great deal of research has been focused on the suicide in young, but surprisingly, limited research has been under taken in the area of suicide in elderly accomplished by under reporting. In India social studies were more likely to be associated with younger people than with older individuals. Although the number of young people who commit suicide is larger, suicide among elderly also forms a significant group. It is even more crucial to take seriously, any threats of suicide on the part of older individuals, because of their efforts to take their own lives so often to have a fatal outcome- older people tend to be more "successful" when they try to kill themselves.

Over the past 30 years, Beck's Suicide Intent Scale (SIS) has been the prevailing psychometric scale for assessing suicide intent in suicide attempters. In a recent review article, five out of 13 studies showed a positive relationship between SIS scores and suicide over a follow-up period ranging from 10 months to 20 years [1].

Since the proportion of older people in population is rising worldwide, indeed the increase in developing countries like India is even greater than the developed countries. It has been predicted "even if suicide rate remains stable over a period of time the larger size of the elder population will increase the number of elderly suicides, compared to today's figures".

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Material and Methods

The present autopsy study among elder people has been carried out in the Department of Forensic Medicine, Victoria Hospital, Bangalore Medical College and Research Institute, Bangalore during the period November 2005 to April 2007(18 months). All the cases aged 60 years and above brought to the department for medico-legal autopsy with alleged history of suicide and or detected as suicide by the circumstantial evidences and autopsy findings were selected. A sum total of 70 cases were studied for this prospective and descriptive study during above mentioned period.

Detailed information regarding the deceased particulars including suicidal scale I [1] as in, presumptive stressful life events [2] as in and the circumstances of death were collected from the relatives and police. In some cases this information was supplemented by either visit to the scene of crime, the photographs of scene of crime and also by suicide notes, if any.

The Suicide Intent Scale (SIS; Beck, Schuyler, & Herman, 1974) [2] is an interview-administered measure of the seriousness of the intent to commit suicide among patients who have actually attempted suicide. The Gurmeet Singh PSLE Scale [3] was used to estimate the effect of various psycho-social stressful events.

Results

Previous suicidal attempt was present in only 11% of the victims and 1 in every 8 victims had attempted suicide in the past Table 1. 65% had history of bad physical health prior to death in suicide victims Table 2.

Table 1: Previous suicidal attempts in elderly suicide victims

SI No.	Event	Total	%
1	Absent	62	89%
2	Present	8	11%
	Total	70	100%

Table 2: Physical health prior to death

Sl. No.	Condition	Male	Female	Total
1	Good	24 (34%)	2 (3%)	25 (35%)
2	Bad	27 (39%)	17 (24%)	45 (65%)
	Total	51(73%)	19 (27%)	70

Most cases (68%) had Family h/o suicide in elderly suicides Table 3. With respect to chronic illness and physical pain (some time unbearable)- 21% had CVS disorder, 12% diabetes & 10% each respiratory and Osteoarthritis Table 4. 80% of victims had low suicide intention Table 5. From the Table 6 we can see that, see that the total number of stressful life events experienced by study population was very high and as follows- for one year mean were 5.29±1.05 and 5.05±1.04 for males and females respectively. Similarly for the life time the average number of stressful life events experienced by study population was 7.65±1.34 and 7.74±1.35 in males and females respectively.

The mean stressful life event score for life time in study population was 357.37±62.62 and 365.53±86.46 in males and females respectively. Table 7.

Table 3: Family h/o suicide in elderly suicides

SI No.	Family history	Total	%
1	Absent	68	97%
2	Present	2	3%
	Total	70	100%

Table 4: Showing chronic illness and physical pain (some time unbearable) experienced by study population

SI No.	Disease	%	Total
1	Cardiovascular	21%	15
2	Diabetes	17%	12
3	Respiratory problem	14%	10
4	CNS Problem	7%	5
5	Osteoarthritis	14%	10
6	Pain abdomen	12%	9
7	Malignancy	7%	5
8	Urinary problem	5%	4
9	Liver disease	3%	2
	Total	100%	72

Table 5: Demonstrates gradating of suicide intention

Sl No	Suicide intention	No	%
1	Low	56	80%
2	Medium	13	19%
3	High	1	1%
	Total	70	100%

Table 6: Average number of stressful life events experienced by study population

	PSLE (Past 1 year) Mean±SD	PSLE (Life time) Mean±SD
Male	5.29±1.05	7.65±1.34
Female	5.05±1.04	7.74±1.35
Total	5.23±1.05	7.67±1.34

Table 7: Distribution of study population on the basis of SIS, PSLES for past one year and life time

Sex	Total Cases	SIS Mean±SD	PSLES (past one yr) Mean±SD	PSLES (life time) Mean±SD
Male	51	9.31±1.71	230.9±65.78	357.37±62.62
Female	19	8.63±1.80	226.95±55.19	365.53±86.46
Total	70	9.13±1.75	229±61.16	359±69.94

Discussion

Previous suicidal attempt was present in only 11% of the victims and 1 in every 8 victims had attempted suicide in the past. This is in contrast with the findings of Bennet [4], Hude Quan [5], Abraham VJ [6], O' Connel et al. [7] and Blow [8]. This could be due to the reason that when elderly attempt suicide, most of the time they were successful, because of strong suicidal intention.

More than half of the males and 2/3rd of females had ill health prior to death and similar findings were made by Howard Cattell [9], H R Cattell [10] and JN Vyas [11] indicating that exacerbation of chronic illness or ill health precipitates suicidal attempt. Family h/o suicide was present in only 3% of the suicide victims and same result was observed by Bennet [4] and is in contrast with Rubenowitz [12] which may be because of lack of knowledge about family h/o of suicide in the informants.

Cardiovascular problems (21%) were the most common chronic illness faced by study population. Others included diabetes mellitus (17%), respiratory problems (14%), osteoarthritis (14%), pain abdomen (12%), neurological problems (7%), cancers (7%), urinary problems (5%) and liver problems (3%). Similar findings were observed by Howard Cattell [8,9] and H R Cattell [10]. But high rate of cancer incidence among elderly who committed suicide was found by Haakon H Eilertsen [13]. This indicates cardiovascular and diabetes are not only causing financial and health burden on lower and middle class people, in addition they are contributing to increase in suicide rates among elderly.

Suicidal intention of study population was assessed by using suicide intent scale I and was found that 80% had low intention, 19% medium and one of the individual had high intention of suicide. This indicates that elderly suicide victims had strong intention to end their lives. A suicide note was found in only one of the case (1.4%) in contrast to Hude Quan [5] who noted in his study that 35.5% females and 28.6% males had left the suicidal note. This could be due to the fact that most of the individuals were fed up with their care takers and family conflicts, and not left even suicidal note and also not informed their suicidal ideation and this can also be attributed to a higher rate of illiterate victims in our study.

It was astonishing to see that the total number of stressful life events experienced by study population were very high and as follows- for one year mean were 5.29±1.05 and 5.05±1.04 for males and females respectively and the same events for normal adult population were 1.62±2.21 and 2.46±3.27 in males and females respectively (as found by Gurumeet Singh [3] and the Odds ratio are 7.68 and 8.64 in males and females respectively. This indicates that elderly suicide victims had experienced about 8 times more stressful events in past one year compared to the normal adult population. The actual difference between two means is more than twice the standard error of difference between the two means (for the past one year) [i.e. 3.67 and 2.59 in males and females compared to 0.499 and 0.8733 in males and females], indicating that a statistically significant number of elderly study population had experienced more stressful events for the past one year compared to normal adult population (mean stressful life event score for past one year was 230.9±65.78 in males and 226.95±55.19 in females).

Similarly for the life time the average number of stressful life events experienced by study population was 7.65±1.34 and 7.74±1.35 in males and females respectively but for normal adult population it was 10.18±5.24 and 11.26±5.28 in males and females respectively. The twice the standard error of difference between the two means (for the life time) was 1.0276 and 1.34 in males and females respectively compared to actual difference between two means 2.53 and 3.52 in males and females respectively, indicating that statistically significant number of elderly study population also had experienced more stressful events in their life time compared to normal adult population.

Conclusions

Total number of stressful life events experienced by study population was very high -5.29±1.05 and 5.05±1.04 for males and females respectively. The

mean stressful life event score for life time in study population was also high- 357.37±62.62 and 365.53±86.46 in males and females respectively.

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Profile of Homicidal Deaths: An Autopsy Based Study

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Abstract

Homicide is the most serious crime, as old as civilization and reported as early as in the Bible. The present prospective observational study was conducted at Forensic Medicine department of B J Govt. Medical College on 207 cases of alleged homicides brought for postmortem examination. The incidence of homicidal deaths was 1.76% with male preponderance and male to female victim ratio 3.9:1. Age group 21-30 years (36%) was the most commonly affected age group. Majority cases (55.55%) occurred during night and majority (36.71%) of the deaths occurred in summer season. Most common motive for killing was revenge (31.88%). Blunt injuries were commonest followed by sharp injuries, while hard and blunt weapon (53.14%) was the weapon of choice in majority. Head, neck and face region of body was most commonly affected in (49.4%) cases while brain (48.47%) was the most common internal organ/structures involved. Head injury (32.85%) was commonest cause of death followed by shock and haemorrhage due to injuries and asphyxial deaths.

Keywords: Homicide; Homicidal Deaths.

Introduction

The world's first murderer CAIN sought to evade an admission that he had just killed his own brother ABEL [1]. Since then man has been more fascinated by crime than by any other subject. Offences against human body are many, of which Homicide is the most heinous crime. The word Homicide has been derived from Latin word "Homo-a man [2] and cadre-to-kill or cut" [3].

Young offenders are becoming increasingly violent and this is a cause for concern, as they are tomorrow's generation [4]. India has earned dubious distinction of being the country where maximum number of murders takes place in the world, three times more than its neighbour Pakistan and double the figures in United States. Therefore homicide should be taken as public health issue, and emphasis has to be laid on reliable data and surveillance mechanisms, so that we can bring a practical and simple approach to homicide prevention. The incidence of murder (33,981) cases with national average rate of 2.7 has increased by 2.3% in 2014 as compared to previous year cases [5].

Until the forensic pathologist has demonstrated that death was produced directly or indirectly by some kind of violence or culpable negligence, there is no homicide to investigate. If he misdiagnoses a non –existent homicide, he may place an innocent person in jeopardy, conversely, if he fails to give adequate weight to the part played by violence and concludes that death resulted entirely from natural causes, a murderer goes free, and a crime goes unpunishe [6].

Homicide investigation can never be complete without a detailed post-mortem examination. Whatever barometer, adopted homicide is of vital importance to every citizen, entire community, the law enforcement authority and to the judiciary necessitating that the assailant be promptly identified, apprehended and punished. It is obvious that a thorough medical and scientific investigation

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is necessary in every suspicious homicidal death. Homicide is prevalent widely almost all over the world [4]. It deserves a thorough analysis in order to prevent violence [7].

The homicidal death pattern could be handy barometer of the social tensions in a community, and the comprehension thus acquired can be emphasized to reveal intensity of its footprint on the society as well as to find remedy by providing this convenient information to law-enforcement agencies. To analyze various epidemiological and demographical factors associated with homicidal deaths and to establish the incidence and patterns of various forms of homicidal deaths is the aim of the present study.

Materials and Methods

The present study was conducted at Department of Forensic Medicine and Toxicology of B J Govt. Medical College, Pune on 207 alleged homicidal cases brought for autopsy during the study period from September 2014 to September 2016 after getting approval from Institutional ethical committee. All cases of alleged homicides specified in the above mentioned period and confirmed by investigating officers before autopsies, or found to be homicide at autopsy were included in present study. Cases with incomplete data, Cases of deaths from explosions and cases other than alleged homicidal deaths were excluded from study.

Analysis of the necessary post mortem findings was done. The material and information regard to them as panchnama report, hospital treatment records were obtained from the police, apart from the post-mortem examination reports from the department.

The police personnel, relatives, friends and others persons who came along with the deceased were interviewed and further required information was collected from them as regards to factors like motive, literacy status etc.

In the mortuary prior to post-mortem examination, different external injuries were noted in detail, and were analyzed by taking in to account various parameters like gross appearance of injury, size, shape and nature of injury, number of injuries, location of injuries over different anatomical areas of the deceased etc. On internal examination, corresponding injuries to various internal organs were noted in detail. The post-mortem examination was conducted as per standard protocol and advanced cause of death certificate was prepared for same.

After obtaining the above information, a separate data sheet was used for each case and was filled to record above information. This data was analyzed, in order to get breakup of the information.

Results and Observations

During this two year study period, total 11702 cases were autopsied, out of which 207 (1.76%) cases were homicidal in nature. (Fig. 1) Majority of victims were from age group 21 to 30 yrs (3rd decade of life) i.e.74 (36%) cases, followed by age group of 31 to 40 yrs (4th decade of life) i.e.58 (28%). There were no cases of infanticides (Age <1 yr). Only 3(1%) deaths were noticed in the age group of above 70 years (Table 1). During the study period

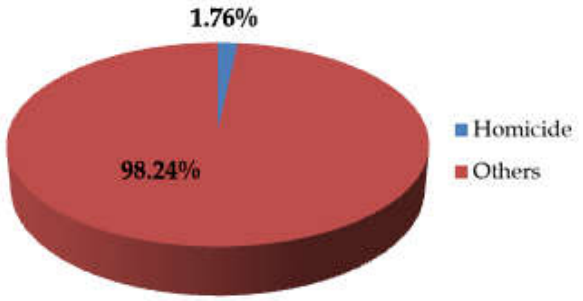

Fig. 1: Average distribution of Homicidal cases

Table 1: Distribution of cases according to age of the Victim

Age group(Years)	Number	Percent (n=207)
01-10	05	02
11-20	17	08
21-30	74	36
31-40	58	29
41-50	19	09
51-60	27	13
61-70	04	02
Above 70	03	01
Total	**207**	**100**

total 207 cases of homicides were autopsied, out of which, 165 (80%) were males and 42 (20%) were females (Table 2).

Majority of victims 141 (68.12%) were married while marital status of 16 (7.73%) victims was not known (Table 3). The time of assault over victim in majority cases 115 (55.55%) was night time, followed by morning hours (Tabl 4).

In the present study, 152 (73.43%) victims were literate and 39 (18.84%) victims were illiterate, while literacy status of 16 (7.73%) victims was not known (Table 5). It was also noticed that maximum homicidal cases occurred during summer season 76 (36.71%), followed by 74 (35.75%) cases during rainy season (Table 6). During the study we found that most common motive for homicide was revenge i.e.66 (31.88%) cases. Sudden grave provocation was next most frequent motive with 31(14.98%) cases followed by money and break down of relationship with 30 (14.49) victims each (Table 7).

Abrasion 112 (24.88%) was the most commonly inflicted injury on victim, followed by contusion in 103 (22.88%) cases (Table 8). Most commonly used

Table 2: Distribution of cases according to gender of Victim

Sex	Number	Percent (n=207)
Male	165	80
Female	42	20
Total	207	100

Table 3: Distribution of cases according to Marital status of the Victim

Marital Status	Male		Female		Total	
	No	Percent (n=165)	No	Percent (n=42)	No	Percent (n=207)
Married	105	63.64	36	85.71	141	68.12
Unmarried	45	27.27	05	11.90	50	24.15
Unknown	15	9.09	01	2.38	16	7.73
Total	165	100	42	100	207	100

Table 4: Distribution of cases according to time of assault

Time of assault	Number	Percent (n=207)
Morning	34	16.45
Afternoon	21	10.14
Evening	21	10.14
Night	115	55.55
Unknown	16	7.72
Total	207	100

Table 5: Distribution of Cases according to Literacy status of Victim

Literacy Status	Male		Female		Total	
	No	Percent (n=165)	No	Percent (n=42)	No	Percent (n=207)
Literate	127	76.97	25	59.52	152	73.43
Illiterate	23	13.94	16	38.10	39	18.84
Not known	15	9.09	01	02.38	16	07.73
Total	165	100	42	100	207	100

Table 6: Distribution of Cases according to Seasonal Variation

Season	Male		Female		Total	
	No	Percent (n=165)	No	Percent (n=42)	No	Percent (n=207)
Summer	61	36.97	15	35.71	76	36.71
Rainy	61	36.97	13	30.95	74	35.75
Winter	43	26.06	14	33.33	57	27.54
Total	165	100	42	100	207	100

weapon was hard & blunt object causing death of 110 (53.14%) victims, followed by sharp object 58(28%)(Table 9).

Head, neck & face was the most commonly involved anatomical region in 158 (49.40%) victims, followed by limbs in 65 (20.30%) victims (Table 10). While brain was the most commonly involved internal organ/structure affecting 143 (48.47%) victims, followed by neck structures affecting 45 (15.25%) victims (Table 11). In out of

Table 7: Distribution of Cases according to Motive of Homicide

Motive	Male		Female		Total	
	No	Percent (n=165)	No	Percent (n=42)	No	Percent (n=207)
Revenge	64	38.79	02	4.76	66	31.88
Sudden grave provocation	28	16.97	03	7.00	31	14.98
Money	25	15.15	05	12.71	30	14.49
Breakdown of relationship	06	3.64	24	57.00	30	14.49
Theft	15	9.09	04	9.52	19	9.18
Jealousy	12	7.27	00	0.00	12	5.80
Sexual assault	00	0.00	03	7.00	03	1.45
Not known	15	9.09	01	2.00	16	7.73
Total	165	100.00	42	100.00	207	100.00

Table 8: Distribution according to Injuries over body of Victim

Name of Injury	Male(n=165)	Female(n=42)	Total	
			No	Percent (n=207)
Abrasion	93	19	112	24.88
Contusion	84	19	103	22.88
Laceration	84	14	98	21.78
Incision	35	07	42	9.34
Chop	35	03	38	8.45
Stab	29	02	31	6.88
Firearms	13	01	14	3.12
Burns	03	09	12	2.67
Total	376	74	450	100

Table 9: Distribution of Cases according to kind of Weapon

Name of Weapon	Male(n=165)	Female(n=42)	Total	
			No	Percent (n=207)
Hard & Blunt	90	20	110	53.14
Sharp & Heavy	21	7	28	13.53
Sharp & Pointed	14	2	16	7.73
Sharp, heavy & Sharp, pointed	14	0	14	6.76
Fire	3	9	12	5.80
Firearm	5	2	07	3.40
Ligature & Blunt	5	1	06	2.90
Firearm & Sharp	6	0	06	2.90
Firearm & Blunt	2	0	02	0.96
Ligature	1	1	02	0.96
Ligature & Sharp	2	0	02	0.96
Blunt & Sharp	2	0	02	0.96
Total	165	42	207	100

Table 10: Distribution according to Involvement of Anatomical region of Victim

Anatomical region	Male(n=165)	Female(n=42)	Total	
			No	Percent (n=207)
Head, Neck & Face	123	35	158	49.40
Limbs	55	10	65	20.30
Chest	46	09	55	17.20
Abdomen	25	04	29	9.00
Genitals	02	05	07	2.20
Back	04	02	06	1.90
Total	255	65	320	100.00

Table 11: Distribution according to Involvement of internal organ/structure in Victim

Internal organ / Structure	Male(n=165)	Female(n=42)	Total No	Total Percent (n=207)
Brain	126	18	143	48.47
Neck Structures	32	14	45	15.25
Lungs	33	03	36	12.20
Stomach, bowels & mesentery	20	01	21	7.44
Liver	13	01	14	4.74
Heart	09	01	10	3.40
Nerves, bones & vertebra	08	01	09	3.50
Kidneys	04	01	05	1.70
Spleen	03	01	04	1.40
Vagina	00	02	02	0.75
Diaphragm	02	00	02	0.75
Anus	01	01	01	0.40
Total	251	44	295	100.00

Table 12: Distribution of cases according to Cause of Death

Cause of Death	Male(n=165)	Female(n=42)	Total No	Total Percent (n=207)
Head Injury	57	11	68	32.85
Shock & Haemorrhage due to injuries	57	09	66	31.88
Multiple Injuries	18	03	21	10.14
Complications of injury	15	02	17	8.24
Burns	03	10	13	6.28
Asphyxial deaths	03	05	08	3.86
Head Injury with strangulation	06	00	06	2.90
Cut throat injury with sexual assault	00	02	02	0.97
Blunt Trauma to Abdomen	01	00	01	0.48
Head injury with Throttling	01	00	01	0.48
Perforative peritonitis	01	00	01	0.48
Head Injury with Decapitation	01	00	01	0.48
Drowning with perianal injuries	00	01	01	0.48
Blunt Trauma to Chest & Abdomen	01	00	01	0.48
Total	165	42	207	100.00

total 207 victims autopsied, head injury 68 (32.85%) was the most common cause of death in majority of the victims, followed by shock and haemorrhage due to injuries in 66 (31.88%) victims (Table 12).

Discussion

In the present study, incidence of homicide was found much lower as compared to those observed by Shivakumar BC et al. [4] (4.76%) and Hugar BS et al. [8] (4.32%). The finding suggesting involvement of maximum number of victims from age group 21 to 30 yrs i.e. 36% cases is consistent with studies like Hilal A. et al. [7] (30.32%), Mada P. et al. [9] (42.33%), and Aggarwal NK et al. [10] (42.5%). The reason for more incidence of homicide in individuals of age group 21 to 30 years can be attributed to the facts that the persons belonging to this age group are most energetic and are the most struggling one's in life. They are constantly exposed to external environment leading to a state of insecurity and dissatisfaction arising from unresolved problems or unfulfilled needs. They have no restrictions on their movement and have high tendency to ignore the family commitments.

The present study shows male preponderance with 165 (80%) male victims and 42 (20%) female victims and male to female ratio of 3.9**:**1. This means male victims are 3.9 times more involved in homicidal incidences compared to female victims. This male preponderance is consistent with studies done by Hugar BS et al. [8] and Mada p. et al. [9].

The reason for more incidence of homicide in males than females can be attributed to the fact that our society follows breadwinner model, in which male earns

money to support other family members, and hence males are exposed greatly to anger, annoyance, and agony more than females. Also males tend to meet different people, thus leading to more one to one interaction, which may lead to annoyance and agony and may predispose to murder.

In the present study majority of victims were found to be married i.e. 141 (68.12%), and this finding is in agreement with studies done by researchers like Mada P. et al. [9], Patel DJ et al. [11] and Mohanty S. et al. [12]. However, study of Rawat V. et al. [13] mentioned that unmarried victims were more commonly affected.

In the present study out of 207 homicidal cases, the time of assault in majority cases 115 (55.55%) is during night time, followed by morning hours in 34 (16.45%) cases. Researchers like Shivakumar BC et al. [5], Mada P. et al. [9], Aggarwal NK et al. [10] and Mohanty S. et al. [12] also reported higher incidences of such events at night hours. However study of Hugar BS et al. [8] reported that maximum cases of homicides occurred during evening hours, while Bhupinder S. et al. 14] showed that maximum cases of homicides occurred during morning time.

Reason for majority of the homicidal deaths taking place during night time could be because of fact that there is little or no light at all during night hours and less surveillance, hence it is suitable for easy execution of the act.

In the present study out of 207 homicidal cases, maximum victims 152 (73.43%) were literate, and 39 (18.84%) victims were illiterate. This observation is consistent with the observations of Shivakumar BC et al. [4]. However study of Mada P. et al. [9] and Mohanty S. et al. [12] reported that illiterate victims were involved in more numbers compared to literate victims.

In the present study maximum homicidal cases were seen during summer season 76 (36.71%) followed by 74 (35.75%) cases during rainy season. This observation is in accordance with study of researchers like Rastogi AK et al. [15] and Mohanty S. et al. [12]. However this observation contradicts study of Patel D J. [11] who reported highest incidence in rainy season. The reason for spurting in summer season could be attributed to extremely hot and erratic climate. It is also season of weddings and fairs and festivals in this part of Maharashtra, forcing public to remain out of their houses and leading to more assembling and interactions. While in rainy and winter season people usually tend to remain inside their homes thus avoiding further consequences.

In the present study, commonest motive was found to be as revenge and sudden grave provocation was next most frequent motive. Revenge was also found to be main motive for homicide in studies reported by Hugar BS et al. [8] (26.5%) and Patel D J [11]. However Shivakumar BC et al. [4] reported enmity as main motive, Gupta A et al. [16] reported quarrel/violent rage as main motive, Shah JP et al. [17] reported money as main motive and Parmar D J [18] reported argument as main motive.

Revenge is reasonably a thoughtful and pre-planned crime while sudden grave provocation includes interaction on issues of personal, social or financial conflicts. This reflects that most of the acts start on inconsequential and non significant issues but due to self-image, hostility and prodding gets terminated in to heinous act like homicide.

In the present study, blunt weapon injuries were found to be most common injuries followed by sharp weapon injuries. Amongst the blunt weapon injuries abrasion 112 (24.88%) was the most common injury followed by contusion 103 (22.88%) and laceration in 98 (21.78%). Amongst the sharp weapon injuries chop injury 38 (8.45%) was the most common injury followed by incision 42 (9.34%) and stab 31 (6.88%). These were followed by firearm injury in 14 (3.12%) cases, followed by burns in 12 (2.67%) cases. The observation of blunt weapon injuries being the most commonly found injury is in agreement with study of other researchers like Buchade DD et al. [19] but is not in agreement with study of other researchers like Ghangale AL et al. [20] where sharp injuries were found to be more common. Hilal A. et al. [7] reported firearm injury as the commonest injury in their study, which was of minimal incidence in the present study.

In the present study most commonly used weapon was hard & blunt weapon causing death of 110 (53.14%) victims, followed by sharp weapons 58 (28%), followed by firearm in combination with blunt and sharp weapons in 15 (7.26%) victims.

This observation in the present study is in agreement with study of Mohanty MK et al. [21], and Mohanty S. et al. [22]. However researchers like Hugar BS et al. [8], Shivakumar BC et al. [4] and Mada P. et al. [9] reported that sharp weapons were weapon of choice in majority of cases.

The reason of higher incidence of blunt weapon injuries can be attributed to the fact of easy availability and accessibility of blunt weapons like iron rod, stone, brick, hammer, wooden stick and plank etc. When any person becomes aggressive

and is in heat of towering rage, he generally finds whatever is easily available and handy at that particular moment. Also most of the homicides are generally unpremeditated and blunt objects are easily found all over as compared to sharp and firearm weapons. Lastly blunt weapons are less costly and when discovered afterwards can be claimed to be domestic tools or agricultural instruments.

In the present study in majority of cases head, neck and face was the most commonly involved anatomical region affecting 158(49.40%) victims, followed by limbs affecting 65(20.30%) victims. This observation is consistent with the studies of researchers like Buchade DD et al. [19].

The reason for the involvement of head, neck and face targeted in majority of the cases can be attributed to the fact that it is easy to hide the originality of the victim by distorting the face, or by altering the shape of the head and face. Head contains one of the most key organs, the brain, while neck contains the wind pipe and major blood vessels. So any injury to head, neck and face will be fatal is a well known fact even to the lay man also.

In the present study brain is the most commonly involved internal organ/structure affecting 143 (48.47%) victims, followed by neck structures affecting 45 (15.25%) victims. This observation in the present study is similar to the study done by researchers like Mishra PK et al. [23]. Buchade DD et al. [19] reported involvement of neck structures as the most common one.

The reason for higher involvement of brain could be attributed to the fact that the brain is one of the most indispensible internal organs of the human body. Assailants focus to kill his victim at any cost and try to injure the most vital organ of the body.

In the present study, head injury 68 (32.85%) is the most common cause of death followed by shock and haemorrhage in 66 (31.88%) victims. This observation in the present study is similar to studies done by researchers like Mada P. et al. [9] and Mishra PK et al. [23]. On the other hand Buchade DD et al. [19] reported shock and haemorrhage as the commonest cause of death.

The reason for the dominance of head injury could be attributed to the fact that head is one of the most key regions of the human body and most endangered area of the body to accept injuries. It is target of choice in the great majority of assaults especially involving blunt injuries.

Conclusions

1. The incidence of homicidal deaths is 1.76%.
2. There is male preponderance with male to female victim ratio 3.9:1, and age group 21-30 years (36%) is the most common affected age group.
3. Majority cases (55.55%) occurred during night and majority (36.71%) of the deaths occurred in summer season.
4. Most common motive for killing is revenge in majority cases (31.88%).
5. Blunt injuries are commonest followed by sharp injuries in the present study while hard and blunt weapon (53.14%) is the weapon of choice in majority of the cases.
6. Head, neck and face region of body is most commonly affected in (49.4%) cases while brain (48.47%) is the most common internal organ/ structures involved.
7. Head injury (32.85%) is commonest cause of death followed by shock and haemorrhage due to injuries followed by asphyxial deaths.

Depending upon above observations we feel that there is a need to look into solutions for the problems of youth, as it is the most common age group involved in such crimes. Secondly strict night vigilance and strict implementation of laws against the ones possessing dangerous weapons can help to reduce such crimes. Secondly the difference between the findings of Indian authors can be attributed to different geographical areas, cultural diversity and local issues. Hence there is need of more such studies in different regions to get proper profile of homicidal deaths.

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Conflict of interest: Nil

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Burns in Married Women: An Autopsy Based Study

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Abstract

Background: Burns are a global public health problem, accounting for an estimated 265,000 deaths annually. Most of these happen in low- and middle-income countries and nearly half happen in the WHO South-East Asia region. Burn injuries involve both developing and developed nation. Goldman describes burns as "*the silent epidemic*". *Material & Methods:* A Prospective study was conducted from Jan 2013 to December 2013 in which 87 autopsy cases of burn deaths were taken out of 976 autopsies conducted in the mortuary of Raichur institute of medical sciences, Raichur. *Results:* The maximum incidences of burn deaths in married females were in 21-30 years age group (40.3%). Majority of the victims were educated below 10th (55.3%). The most common place of death was kitchen (71.3%) and the most common manner of death was accidental (51.8%). *Conclusion:* Burns represent an extreme stressful experience and are complex devastating conditions. Public awareness should be increased regarding the social problem and importance should be given to education which can be achieved by different medias of mass communication.

Keywords: Burns; Married Women; Manner of Death.

Introduction

Burns are a global public health problem, accounting for an estimated 265,000 deaths annually. Most of these happen in low- and middle-income countries and nearly half happen in the WHO South-East Asia Region [1]. Burn injuries involve both developing and developed nation. Goldman describes burns as "*the silent epidemic*" [2].

Burn is an injury which is caused by application of heat or chemical substance to the external or internal surface of the body, which causes destruction of tissues. Each year, a considerable proportion of deaths in India occur owing to burn injuries.Burns are among the leading causes of disability-adjusted life-years (DALYs) lost in low- and middle-income countries. In India, approximately there are 6 million burns cases annually of which around 0.7 million cases require hospitalization of which approximately 0.12 million die annually. Survival rate for burns patients in developing countries like India is around 50% for burns less than 40% while those in developed countries it is around 75-90% for 50% burns. Burn injuries cause significant morbidity and mortality and have considerable physical, psychological and economic effects on the patients, their families and society [3].

Burning of married females is very common in our country. These cases have increased probably due to marital disharmony, dowry harassment, humiliation, issues of property and land, depression aroused from physical torture and domestic violence. They are regarded as the commonest cause of unnatural deaths in India. Most of these cases are accidental or suicidal in nature [4].

A detailed knowledge of various factors associated with burns in married women in that particular geographical area is very much necessary. Keeping

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this in mind we conducted a prospective study at Raichur to focus on the various factors associated with burns in married women with a view to identify the areas of intervention. Thus burns in married women needs a careful and refined approach so as to study the factors related to it, the causes and if possible to find ways to prevent such tragedies.

Materials and Methods

A prospective study was conducted on 87 victims subjected to medico-legal autopsy at mortuary of department of Forensic medicine, Raichur institute of medical sciences, Raichur over a period of one year from January 2013 to December 2013. The study design comprised of thoroughly scrutinized information gathered from the police and the relatives of the deceased, hospital records and laboratory report of viscera and their contents. Unmarried female, children, unknown cases and decomposed burned cases were excluded.

Statistical Methodology

The results were analyzed using Statistical Software Package SPSS version 2.0. Statistical analysis was done for frequencies, percentages, proportions & ratios and results were interpreted.

Results and Dscussion

A total of 976 dead bodies were brought for post-mortem examination at Raichur institute of medical sciences, Raichur during a period of one year from January 2013 to December 2013. After post-mortem examination and correlating with the history received from the police and relatives of the deceased, it was confirmed that in 87 cases (8.9 %), the victims had died due to burns. These 87 cases were the part of our study.

Table 1 shows the age wise distribution of deaths due to burns. The largest group was found to be in 21-30 yrs(40.3%) followed by 11-20 yrs(24.1%) which was in consistent with the study done by Piyush T et al. [5], Ambade VN et al. [6], Sharma BR et al. [7], Agarwal S et al. [8]. The above findings can easily be explained by the fact that 21-30 years of age group is the common age for marriage, most active, entrusted with responsibilities of family, susceptible to frustration in life, inability to cope with the physical and psychological stress of marriage and harassment from parents in law.

Table 2 shows that the education wise distribution of death which shows the maximum predominance in the victims who were educated below 10 th (55.3%) which was in consistent with the study done by Piyush T et al. [5] who reported 51% of the victims were educated below 10^{th} standard, Dasgupta et al[9] and Kumar V et al. [10] . This high incidence of death among married females could be attributed to illiteracy or decreased education which makes them economically dependent on their spouse which can be a triggering factor for burns and also to having limited and unsafe knowledge about cooking measures.

Table 3 shows that the familial disharmony was present in 40.2% cases which was in consistent with the study done by Piyush T et al. [6] and Jha SS [11]. The family disharmony may involve domestic quarrels, marital disharmony, Infidelity etc.

Table 4 shows that the maximum victims sustained burns in kitchen (71.3%) which was in consistent with the study done by Piyush T et al. [8] and Kumar et al. [12]. This high incidence may be due to various socioeconomic factors in which females still use firewood and kerosene stoves for cooking.

Table 5 shows that majority of the victims (73.6%) sustained 80 to 100% of burns which was in consistent with the study done by Piyush T et al. [6] and Shaha KK et al. [13]. It indicates that the burn

Table 1: Age wise distribution of cases

Age group	Number	Percentage
0-10 yrs	0	0%
11-20yrs	21	24.1%
21-30yrs	35	40.3%
31-40 yrs	18	20.7%
41-50 yrs	05	5.7%
51-60yrs	03	3.5%
>60 yrs	05	5.7%
Total	87	100%

Table 2: Education wise distribution of cases

Education	Number	Percentage
Below 10th	48	55.3%
10^{th}-12th	36	41.3%
Degree	03	3.4%
Total	87	100

Table 3: Familial disharmony

Familial disharmony	Number	Percentage
Present	35	40.2%
Absent	52	59.8%
Total	87	100%

Table 4: Place of occurrence

Place of occurrence	Number	Percentage
Kitchen	62	71.3%
Bedroom	18	20.7%^
Bathroom	05	5.7%
Outside house	02	2.3%
Total	87	100%

exceeding 80% of TBSA are usually fatal and mortality is higher in such cases though better care and treatment are provided to the patient.

Table 6 shows that the common cause of death was shock (41.4%) followed by toxaemia (27.6%) which was consistent with the study done by Piyush T et al. [6] .

Table 7 shows that the accidental (51.8%) was the most common manner of death followed by suicidal (26.4%) which was consistent with the study done by Piyush T et al. [6] and Bullar DS [14]. The cooking activities involving fire associated with wearing of loose synthetic materials lead to accidental burns and it is also one of the commonest manner of suicidal in married females.

Table 5: Percentage of total body surface area (TBSA) of victims involved

TBSA	Number	Percentage
<10	00	0%
10-20	00	0%
20-30	01	1.2%
30-40	02	2.3%
40-50	02	2.3%
50-60	04	4.6%
60-70	09	10.3%
70-80	05	5.7%%
80-90	26	29.9%
90-100	38	43.7%
Total	87	100%

Table 6: Cause of death

Cause of death	Number	Percentage
Shock	36	41.4%
Toxaemia	24	27.6%
Septicaemia/ Sepsis	27	31%
Total	87	100%

Table 7: Manner of death

Manner of death	Number	Percentage
Suicidal	23	26.4%
Homicidal	19	21.8%
Accidental	45	51.8%
Total	87	100%

Conclusion

Burns represent an extreme stressful experience and are complex devastating conditions. Public awareness should be increased regarding the social problem and importance should be given to education which can be achieved by different medias of mass communication. Importance should also be given to safety precautions to be adopted to prevent domestic accidents. The cause of death profile is an important set of public health information and forms the cornerstone of the health information system. At provincial level it is needed for deciding on intervention strategies and an effective coordination should be sought between the government, nongovernment and law enforcing agencies.

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Dried Salivary Stain Detection using Ultraviolet- Light Spectrophotometer, Fluorescent and Raman Spectroscopy

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Abstract

Objectives: To detect the salivary stains, in particular, any improvement in the ability to target an area of DNA analysis. To evaluate the efficacy in detection of salivary stains between UV light, fluorescent and Raman spectroscopy. *Study Design:* Prospective randomised study. *Place & Duration of Study:* Department of Oral & Maxillofacial Pathology, Sri Rajiv Gandhi College of Dental Sciences & Hospital; Forensic science laboratory, Bangalore Test Centre & Indian institute of Science, Bangalore, Karnataka; between August 2013 to December 2014. *Patients & Methods:* Dried salivary stain samples from 20 volunteers were collected and exposed to ultraviolet-light spectrophotometer, Fluorescent spectroscopy and Raman spectroscopy. Water was used as a control sample and Tryptophan, to assess the presence of saliva from the collected samples. *Results:* A total number of 20 volunteers dried salivary stain samples were taken. The absorption spectra of the saliva samples revealed the excited wavelength of 240 to 248 nm coinciding with the excited wavelength of tryptophan in case of ultraviolet spectroscopy; the excited wavelength was 280 to 288 nm coinciding with the excited wavelength of tryptophan with less concentration of saliva in case of fluorescent spectroscopy; and in case of Raman spectroscopy, saliva was not detected instead the diluted content of KCL solution was only noted. *Conclusions:* Ultraviolet light spectrophotometer and fluorescent spectroscopy are a rapid and non-invasive technique for the detection of dried salivary stain, in which the sensitivity and accuracy is best with the fluorescent spectroscopy.

Keywords: Spectroscopy; Saliva; Forensic Science; Salivary Amylase; Light Source.

Introduction

Saliva, one of the biological fluids secreted contains several types of amylase isoenzymes that has been identified exhibiting genetic variations and hence can be used for individualization. Saliva being a oral fluid, is a diagnostic medium that can be easily collected and with minimal invasion [1]. It is usually found deposited in bite marks found in many homicides, assault and other criminal cases and is of medico-legal importance providing circumstantial evidence at the crime scene.[2] It is recovered for DNA extraction and typing to evaluate its usefulness for practical case investigation and discuss the contribution of saliva DNA typing in forensic dentistry [2,3]. Dried salivary stains are invisible, making its recognition and collection difficult. However, the presence of saliva can be confirmed by an amylase assay [2]. Tryptophan, the aromatic amino acid is one of the amino acids present in salivary amylase, a constituent of enzyme in saliva which can be used as a confirmatory subject for the presence of saliva [4]. It appears likely that the content of the aromatic amino acid tryptophan in amylase is largely responsible for emission [5]. Thus tryptophan can act as a prevalent probe in detecting dried salivary stains on human skin [1].

Forensic light source being one of the simplest presumptive test have been used in the detection of biological evidences due to their natural

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characteristic light absorption and fluorescent effect. When Forensic light source are emitted on saliva; fluorescence is observed due to the absorption of light by saliva, a biological evidence at particular wavelength re-emitting at a longer wavelength [6]. when saliva is subjected to ultra violet rays, it emits bluish white light which cannot be differentiated with other biological fluids, so the ultraviolet- light spectrophotometer is used that detects saliva when exposed to a certain wavelength of light [6]. Various other techniques were done in past to detect saliva like; starch iodine test, Phadebas reagent test, amylase azure, RSID-saliva test, but the results were not accurate [7]. The most emerging nondestructive confirmatory tests are fluorescent and Raman spectroscopy, in which the tests are still being experimented [8]. Raman scattering is a powerful qualitative and quantitative analytical method based on a process where incident monochromatic photons interact with a sample to produce scattered photons with an energy distribution characteristic of molecular structure. Raman spectroscopy is less sensitive in comparison with fluorescence but has higher selectivity and specificity to biochemical species [8]. The peak fluorescence intensity in saliva samples was found to vary among the volunteer population due to the different protein content of saliva.

This study was aimed to know the high sensitivity and selectivity of dried salivary stain detection which is a source of DNA in forensic science using ultraviolet- light spectrophotometer, Fluorescent and Raman spectroscopy.

Methodology

This study includes dried salivary stain samples taken from 20 volunteers between August 2013 to December 2014 conducted in the Dept of Oral & Maxillofacial Pathology, Sri Rajiv Gandhi College of Dental Sciences & Hospital; Forensic science laboratory; Bangalore Test Centre & Indian institute of Science; Bangalore, Karnataka. This study was approved by the Ethical committee of Sri Rajiv Gandhi College of Dental Sciences & Hospital, Bangalore, Karnataka.

The criteria for the sample selections were volunteers free of any oral diseases. The equipment used were plastic and quartz cuvettes, micropipettes, glass slides, Ultraviolet - Visible light Spectrophotometer, fluorescent spectroscopy, Raman spectroscopy. The volunteers were instructed to clean their forearm with soap and water. The area where saliva has to be deposited was marked which was on the ventral side of the forearm and water as a control sample to be deposited on the contra lateral arm. Both water and saliva were allowed to dry for 45 minutes to 1 hour. The fibre free Cotton was dipped in buffer solution of pH 7.4; the excess solution was squeezed out and samples were collected by rubbing over the marked area. Then the collected samples were transferred to the cuvettes.

They were subjected to ultraviolet emission, fluorescence emission and Raman emission spectrum by adding 0.1M KCL solution making up to 2 ml solution. In case of ultraviolet spectroscopy and fluorescent spectroscopy, emission spectrum was recorded from 200 to 400 nm. In case of Raman spectroscopy, a drop of saliva sample is dropped on the glass slide and emission spectrum was recorded from 500 to 1750 Raman shift/cm^{-1}.

The emission spectrum of tryptophan was recorded by dissolving 0.5mg/ml of tryptophan in 0.1M KCL solution. This solution was excited at a wavelength of 244 nm and 290 nm for UV-light and fluorescence spectroscopy respectively.

Results

The absorption spectra of the saliva samples varied in each type of spectroscopy. The absorption spectra of the saliva samples were recorded on excitation at a wavelength of 240 nm to 300 nm and the excitation peaks were recorded. The

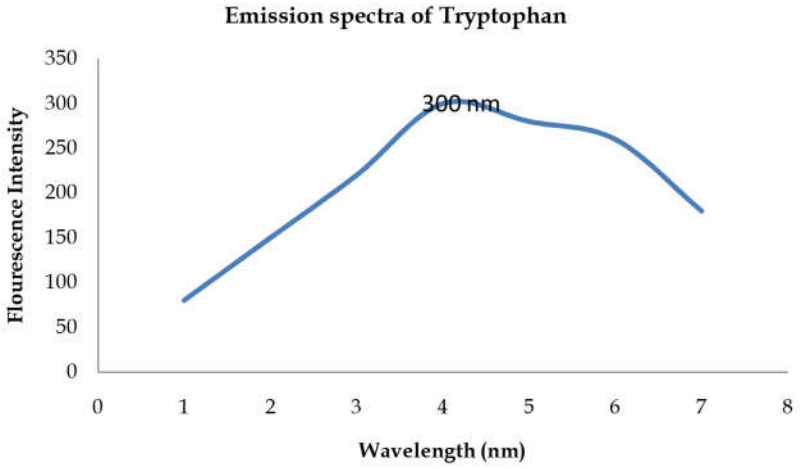

Fig. 1: Emission spectra of Tryptophan (control)

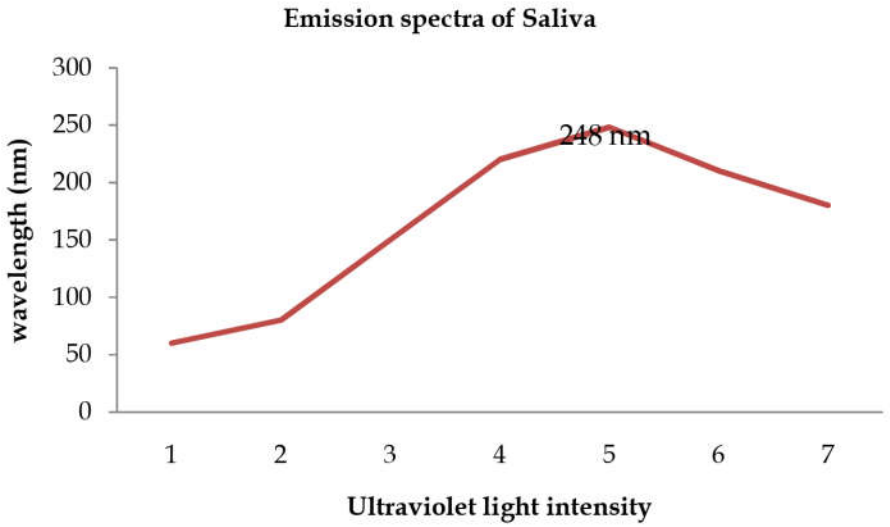

Fig. 2: Emission spectra of Saliva – Ultraviolet Light Spectrophotometer

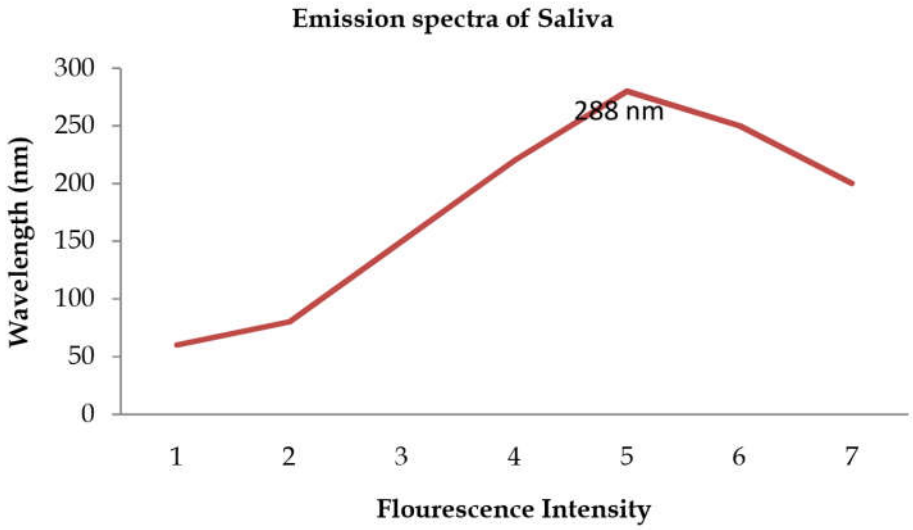

Fig. 3: Emission spectra of Saliva - Fluorescent spectroscopy

control, tryptophan's excited wavelength is 240 nm to 300 nm [Figure 1].

In case of Ultraviolet light spectroscopy, the excited wavelength was 240 nm to 248 nm [Figure 2] that coincided with the excited wavelength of tryptophan. But more the dilution rate of saliva, the rate of excitation peak increased. The excited wavelength was 280 to 288 nm [Figure 3] coinciding with the excited wavelength of tryptophan with less concentration of saliva in case of Fluorescent spectroscopy. In case of Raman spectroscopy, saliva was not detected instead the diluted content of KCL solution was only noted. The data were illustrated in Figure 1, Figure 2, and Figure 3.

Discussion

Both Ultraviolet light spectrophotometer and fluorescent spectroscopy methods were able to detect the diluted saliva samples; but as the dilution rate of saliva increased, the rate of excitation peak increased in Ultraviolet Spectrophotometer indicating its low specificity compared to

fluorescent spectroscopy. Fluorescent spectroscopy showed the peak excitation of 288 nm coinciding with the excited wavelength of tryptophan with less concentration of saliva. Thus Ultraviolet light spectrophotometer and fluorescent spectroscopy are a rapid and non-invasive technique for the detection of dried salivary stain, in which the sensitivity and accuracy is best with the fluorescent spectroscopy. In case of Raman spectroscopy, various studies have proved to identify the traces of saliva using confocal Raman microscope and also have the potential to detect the saliva in a mixed multiple body fluids. Raman spectroscopy is used to characterize the entire composition of the fluid instead of probing a specific chemical group or compound. But in the present study a particular chemical compound Tryptophan was used, thus was not able to detect the sample. Each body fluid has a complex biochemical composition which is heterogeneous in nature and no single characteristic spectrum can satisfactorily represent the experiment. Even though Raman spectroscopy has higher selectivity and specificity, it is less sensitive to detect through the methodology used in this study.

Conclusion

Results from our study showed that dried salivary stain can be detected through both Ultraviolet light spectrophotometer and Fluorescent spectroscopy. But the fluorescent spectroscopy showed more sensitivity and specificity than the Ultraviolet light spectrophotometer comparatively. In case of Raman spectroscopy method, it failed to detect the salivary constituent tryptophan. Even though Raman spectroscopy has higher selectivity and specificity, it is less sensitive to detect through the methodology used in this study. So different methods can be used to detect saliva and further studies have to be experimented with more sample size.

However our study was effective in detecting the saliva through a non-invasive method accurately with Fluorescent spectroscopy that acts as a diagnostic aid in detection of DNA in the field of forensic science.

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Original Article

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Profile of Fatal Head Injuries in and Around Jamnagar Region

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Abstract

Background: Head is the vital part of the body. So any injury to head may be fatal in the form of neurogenic shock, fracture or intracranial haemorrhage which is caused by mostly blunt object and some time it may be due to firearm injury. *Aims:* To study the epidemiological aspect of fatal head injuries. *Material and Method:* In this study 150 cases of fatal head injuries studied for their various aspect. *Results:* Most cases are of road traffic accident (RTA). Most of them are young male between 20-40 years of age. Though majority of them died within in 1hrs, on the spot or on the way. Most of them are in the form any form of skull fracture or intracranial haemorrhage. *Conclusion:* Most of the fatal head injuries are of fracture of the skull followed by any of intracranial haemorrhage which were due to any form of road traffic accident.

Keywords: Neurogenic Shock; Intracranial Haemorrhage; Cranium.

Introduction

Head injuries are common during any form of accidents and most of them are fatal even if they get immediate treatment. 20-25% traumatic accidents leads to head injuries and road traffic accidents are of 75% of it [1,2]. They are in the form of coup and contrecoup injury. It is due to mechanical force and acceleration and deceleration force [3]. Head is easily accessible by assaultant and its minor degree of trauma may be fatal so head is targeted during homicidal attack.

It is rising day by day due to urbanization, modernization, increase transport, fast life style, drinking habit and increase use of mobile and devises during driving. In some areas due to seasonal variation due to fog or rain may have higher rate of accidents. Death rate is increasing in developing countries due to head injury where pedestrians, motorcyclists and passengers are especially vulnerable. These deaths are not truly accidental death as accidents are due to men made factors which can t be prevented by taken care during the driving and transportation [4].

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Material and Method

The present prospective study was conducted in Department of Forensic Medicine, M. P. Shah Govt. Medical College from 01-01-2014 to 31-12-2014. During that period out of 1166 autopsies, 150 cases of fatal head injuries were selected for the present study.

Accompanying person of the victims of the head injuries and accompanying police were asked for the general information like age, sex, address, occupation, personal habits, socioeconomic status, time and date of head injury. The information about the incident of head injuries collected consisted whether road traffic accident, railway injury, firearm, assault, etc were asked, if vehicular accident the position of victim during road traffic accident whether driver, pedestrian or occupant. The nature of injury, type of skull fracture, intracranial haemorrhage, manner of injury and other body injury are noted. The data and post mortem finding were collected and filled in the performa and analyzed.

Observations & Results

Followings were the observation of this study. Majority of the victims of head injury were male (74.6%), with maximum number (32.6%) in 21-30 years of age group followed by 31-40 (20.6%) and 41-50 (15.3%) years [Table 1]. More than one third of the cases of head injury were died on the spot or within an hour of the accident. Only 10% cases survived for more than 2 day then died [Table 2]. Amongst the head injuries, road traffic accident was the most common cause (57.3%) followed by injuries by railway injury (12%), fall from height (8.6%) & fire arm. (2.6%); Amongst the RTA four wheeler (36.5%) followed by two wheeler (34.6%) were responsible for more than two-third of the fatalities. Majority (73.3) of the head injury cases were accidental followed by homicidal (11.3%) and suicidal (8%). The manner of death could not ascertain in 7.3% of the cases [Table 3]. Superficial injury like lacerated wounds (70%) was the commonest form followed by, abrasion and contusion (17.3%) , deep injury was in the form of scalp hematoma (90.6), fracture (92%), crush injury (14%) while incised wound in 8%, firearm wounds were seen in 2.6% in form of penetrating wound. Injuries were not seen on scalp in 4.6% cases. Amongst the fractures, linear fracture was the commonest (45.3%) followed by comminuted fracture (22.6%), depressed (11.3%) and diastatic fractures (8.6%). Fracture in form of penetrating on the skull areas also found in 2.6% . [Table 4] Skull vault fracture were seen in almost (92%) of the cases , mostly on the vault (51.3%) followed by both vault& base of skull in 23.3% cases. The base of skull alone was fractured in 17.3% and no fracture seen in 8% cases of head injury [Table 5]. Regarding fracture of part of the skull bone temporal bone was involved in (65.8%), parietal bone was involved in

Table 1: Distribution of cases according to Age and Sex

Sr. No.	Age (Yrs)	Cases		Sex			
			%	Male	%	Female	%
1	<10	6	4	5	3.3	1	0.7
2	11-20	14	9.3	12	8	5	1.3
3	21-30	49	32.6	35	23.3	14	9.3
4	31-40	31	20.6	22	14.6	9	6
5	41-50	23	15.3	19	12.6	4	2.6
6	51-60	16	10.6	11	7.3	5	3.3
7	>60	10	6.6	8	5.3	2	1.3
	Total	150	100%	112	74.6	38	25.4

Table 2: Distribution of cases according to Survival period

Sr. No.	Survival Period	Cases	%
1	Spot Death/<1hrs	57	38
2	1-6hrs	34	22.7
3	6-24hrs	23	15.3
4	24-48hrs	21	14
5	>2day	15	10
	Total	150	100%

Table 3: Distribution of cases according to Mode & Manner of injuries

Sr. No.	Mode of injuries	Cases	%	Manner of Injury			
				Accident	Homicide	Suicide	Uncertain
1	RTA	86	57.3	86	-	-	-
2	Railway injury	18	12	9	0	6	3
3	Assaults other than firearms	14	9.3	-	14	-	0
4	Fall from height	13	8.6	8	0	5	0
5	Firearms (Gunshot)	4	2.6	-	3	1	-
6	Industrial	9	6	7	0	0	2
7	Others	6	4	0	0	0	6
	Total	150	100%	110(73.3%)	17(11.3%)	12(8%)	11(7.3%)

(56.4%), frontal bone in (31.2%) and occipital bones only in (25.9%) cases of which parieto-temporal involvement was the commonest. (21.3%) [Table 6]. Intracranial haemorrhages were seen in 94% cases of fatal head injuries, of which majority (48.5%) of them were mixed, either any of extradural, subdural & subarachnoid haemorrhages. Individually subdural, alone was in (24%) and combination, with other haemorrhages were the commonest. (53.2%). [Table 7] Beside head injury other parts of body were involved in most (66%) of the cases. Chest involvement (26%), followed by abdomen (18%) and multiple (12.6%). Extremities were affected in (8.7%) cases [Table 8].

Table 4: Distribution of cases according to Type of injury

Sr. No.	Type of injury		Cases	%
1	Superficial injuries	Abrasion/ Contusion	26	17.3
		Laceration	105	70
		Incised	12	8
		No injury	7	4.6
2	Scalp hematoma		136	90.6
3	Fracture*	Linear	68	45.3
		Depressed	17	11.3
		Comminuted	34	22.6
		Diastatic	13	8.6
4	No fracture	-	12	8
5	Crush injury	-	21	14
6	Penetrating	-	4	2.6

*= Multiple response

Table 5: Distribution of cases according to Part of skull involved

Sr. No.	Part	Cases	%
1	Skull Vault	77	51.3
2	Skull Base	26	17.3
3	Skull Vault and Base	35	23.3
4	No Skull injury	12	8
	Total	150	100

Table 6: Distribution of cases according to Fracture bone involved

Sr. No.	Skull bones fracture	Cases	%
1.	Frontal alone	6	4
2.	Parietal alone	9	6
3.	Temporal alone	11	7.3
4.	Occipital alone	11	7.3
5.	Frontal & Parietal	13	8.6
6.	Frontal & Temporal	16	10.6
7.	Parietal & Temporal	32	21.3
8.	Temporal & Occipital	9	6
9.	Frontal, Parietal & Temporal	12	8
10.	Parietal, Temporal & Occipital	19	12.6
11	No Fracture	12	8
	Total	150	100

Table 7: Distribution of cases according to Intracranial haemorrhage

Sr. No.	Injury/ Haemorrhage	Cases	%
1	Extradural	16	10.6
2	Subdural	36	24
3	Subarachnoid	11	7.3
4	Intracerebral	5	3.3
5	ED & SD	13	8.6
6	ED & SA	29	19.3
7	SD & SA	31	20.6
8	No Haemorrhage	9	6
	Total	150	100

Table 8: Distribution of cases according to Body parts

Sr. No.	Part	Cases	%
1	Only Head	51	34
2	Head & Chest	39	26
3	Head & Abdomen	28	18.7
4	Head & Limb	13	8.7
5	Head & Multiple	19	12.6
	Total	150	100

Disccussion

Majority, cases (74.6 %), were males since they are more into outdoor activities like driving vehicles, working outdoors hence more prone to accidents whereas females succumbed mainly to either accidental falls at their residence or due to RTA, they being pillion riders without headgear. This is consistent with Bhatt SB et al., Shankar UB et al., Kumar RB et al., Kumar S et al., Hemlatha N et al. [5-9].

The vulnerable age group was the 21-30years (32.6%), followed by age group of 31-40years (20.6 %). The reason may be that they form the work group, and hence are prone to injuries due to RTA, falls, assaults, etc. This is probably males & people of young age group are more exposed to RTA & other type of injuries. This is consistent with most of the study [5-9].

In our study More than 50% of the cases of head injury were died within 6hours of the casualty of which 38% died either on the spot or within an hour of the accident similar results are seen in studies by Bhatt SB et al., Rastogi AK, Tandel RM et al. [5,10,11].

Amongst the head injuries, road traffic accident is the single largest cause (57.3%) followed by injuries by railway (12%), fall from height (8.6%) & firearm. (2.6%); which is cinsistant RB,Kumars et al., Hemlatha N et al., Tandel RM et al., Honnungar RS et al.[8,9,11,12]. Accidental injury (73.3%) was most common followed by homicide (11.3%) which is consistant with Bhatt SB et al., Rastogi AK, Tandel RM et al. [5,10,11].

Laceration was the most common type of scalp injury, more commonly seen over bony prominences in parietal and frontal regions. Similar results were drawn in studies by Bhatt SB et al., Rastogi AK, Tandel RM et al. [5,10,11] where scalp laceration was noticed in 70 cases (38.7%) followed by scalp abrasion & contusion in 39 cases (21.5%).

Among the skull fractures , linear fracture 68 cases (45.3%) was the commonest, followed by comminute fracture - 34 cases (11.3 %). Similar results were found in study by Bhatt SB et al., Rastogi AK, Tandel RM, Honnungar RS et al., Arvind K et al. [5,10,11,12,13] where about half (49.6 %) of skull vault fractures (91.3%) were linear fractures, followed by communicated and depressed fractures. In contrast, a study done by Shankar UB et al., Menon A et al. [6,14] concluded that comminuted fracture (35.4%) was the commonest, followed by linear fracture (30.4 %). While Bhatt SB et al. and Pathak A et al. [5,15] had observed that fracture of skull was found in 56.3% and in 42.6% of the cases respectively, and fissure type of fracture was the most common type, followed by depressed comminuted fracture (45%). Incised wounds and punctured wounds were exclusively seen in males, as they are involved more commonly than females in assaults.

On considering the site of skull vault fracture, temporal bone was involved in (65.8%) as it is the thinnest bone and more prone to fractures, followed by parietal and frontal bones, (56.4%) and 20 cases (31.2%), respectively. Least involved area in fracture was occipital bone in (25.9%). Consisting with most of the study [5,6,9].

On considering the site of skull base fracture, majority of cases involved middle cranial fossa, (18%), due to thinness and larger area of impact as compared to anterior and posterior cranial fossa. In studies by Yattoo et al. [16] parietal bones and bones of middle cranial fossa were commonly involved areas. In contrast, Honnungar RS and et al., Pathak A et al., [12,17] had noted frontal bone (56%) and posterior cranial fossa involvement in (46%) being the commonest sites respectively.

In our study, subdural and subarachnoid haemorrhage (20.6%) was found to be the commonest intracranial haemorrhage associated with head injuries. This was consistent with Shankar UB et al., Kumar RB, Kumar S [6,7,8] while in contrast with studies done by , Equabal Z et al.,Yattoo et al. [16,17] intracranial haemorrhage found was subarachnoid followed by subdural haemorrhage (31%).

Beside injuries to skull other parts of body were involved in most (66%) of the cases of head injury which is consisting with Shankar UB et al. and Kumar RB, Kumar S et al. [6,7,8] while Yattoo et al.[17] noticed 40% cases involving other body parts along with head injury.

Conclusion

Majority victim of the head injury were male, of adult and middle age group died due to road traffic accidents in form of vehicular accidents. These can be prevented by life style modification like use of helmets, seat belts, don't drink and drive follow the traffic rules, don't use mobile device during driving and air bags. Apart from this few cases were due to injuries from heavy blunt/sharp cutting weapon and fire arm. Such cases were usually homicidal in nature which are not preventable. Fracture of skull and intracranial haemorrhage were seen in most of the cases. Among the fracture temporo-parietal bone were involved most often and intracranial haemorrhage were in the mixed form however subdural haemorrhage was the commonest. Most of the victims were died on the spot or on the way to hospital.

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Original Article

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Clinicopathologic Study of Granulomatous Lesions in the Bone Marrow

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Abstract

Introduction: Granulomatous lesion in the bone marrowis not a common finding and can be attributed to a variety of conditions ranging from infections to malignancies to drugs. Though tuberculosis is the most common etiology, bone marrow granulomas can be associated with a number of infections and other non infective conditions. The incidence of bone marrow granulomas has been increasing over the years due to the increasing surge of HIV infection. *Aims:* This study basically aims to study the prevalence of bone marrow granulomas, to identify the various causes and to study the pattern of granulomas in different conditions. *Materials & Methods:* This is a retrospective analysis of 100 cases of bone marrow granulomas conducted in the Clinical Laboratory of Kasturba hospital for a period of four and a half years from January 2009 to May 2013.The clinical details were collected from medical records and bone marrow biopsy slides were retrieved and studied. *Results:* Out of the 100 cases, 66% cases were diagnosed as tuberculosis. 17% cases were due to other infections like Typhoid fever (5%), Brucellosis (4%), Scrub typhus (2%), Hansen's disease (1%), Cryptococcosis (2%) and HIV infection itself without any other opportunistic infections (3%). Malignancies accounted for 9% cases, Sarcoidosis (1%) and in 7% cases a definitive diagnosis was not reached. Among the 66 cases of tuberculosis, 40 (60%) cases were immunodeficient due to HIV infection. HIV positive cases predominantly showed single (52%), ill defined granulomas (73%), with caseation necrosis (52%), while HIV negative cases predominantly showed single (54%), small (50%), well defined or ill defined granulomas with plump epithelioid cells (58%) and Langhans giant cells (42%). *Conclusion:* There can be varied etiology for bone marrow granulomas with tuberculosis being the most common cause.The morphology and pattern of granulomas can aid in the diagnosis of the condition hence study of bone marrow for granulomas should be considered as an important diagnostic tool in such conditions.

Keywords: Bone Marrow; Granuloma; Tuberculosis; HIV; Drugs; Morphology.

Introduction

Granulomatous inflammation is a distinctive pattern of chronic inflammation that develops as a cellular attempt to contain an offending agent that is persistent or difficult to eradicate thus inducing a cell mediated immune response [1].

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Although granuloma is an infrequent finding in a bone marrow biopsy, recognition of the granulomatous lesion is important because of the limited number of possible conditions associated with it and the significance of the diagnoses associated with the lesion [1]. Most of the associated diseases present with nonspecific symptoms and the finding of a granuloma can be a very important clue to a specific diagnosis and should be thoroughly investigated.Thus the histologic finding of bone marrow granuloma, although nonspecific, narrows the differential diagnosis to a well-known spectrum of diseases.

Aims

In our study we analysedthe bone marrows with granulomatous lesions and correlated with the clinical aspects and other laboratory investigations

to evaluate the prevalence of granulomatous lesions in bone marrow, associated morphology and the common etiology in our region.

Materials & Methods

This is a retrospective analysis of 100 cases of bone marrow granulomas, conducted in the Clinical Laboratory, Department of Pathology, Kasturba Medical College, Manipal, for a period of four and a half years, from 1 January 2009 to 31 May 2013. The study was approved by the Manipal institutional ethics committee.The relevant clinical details and laboratory data of patients were collected from thecase files of the patients. Bone marrow biopsy slides were retrieved and reviewed. The distinguishing features of granulomas were recorded using the proforma. Statistical analysis of the data was done using SPSS16.

Results

A total of 5693 bone marrow biopsies were received out of which, 100 cases showed granulomas on microscopic examination. This yielded a rate of 1.75 cases of granulomas per 100 biopsies or 22.64 cases of bone marrow granulomas per year.There were 68 males and 32 females with a male to female ratio of 2.1:1.

The patients belonged to a broad age group, ranging from 5 - 88 years, with a median age of 45 years, 50% of cases being in the 40 - 60 yrsage group.

The most common presenting symptoms were fever (81%), weight loss (31%), cough and dyspnoea (23%), fatigue and weakness (17%), anorexia (16%). Other complaints like abdominal pain, nausea and vomiting, diarrhoea, headache, myalgia, chills and rigor were present in < 10% of cases. Symptoms were present for more than 6 weeks in 39% cases, between 2 to 6 weeks in 30% and for less than 2 weeks in 30% of patients.

The most common physical finding on admission was pallor in 53% cases followed by hepatomegaly in 48% cases, lymphadenopathy in 36% cases and splenomegaly in 35% cases. Cervical lymph nodes were most commonly involved (21%).

The most consistent lab finding was decreased hemoglobin which was seen in 83% cases, of which 55% had moderate anaemia (Hb< 11 - 8 gm/dL).46 cases were positive for HIV. 14 out of 66 cases (21%) of tuberculosis showed X-ray findings suggestive of TB.

Out of the 100 cases, 66% cases were diagnosed as tuberculosis. 17% cases were due to other infections like Typhoid fever (5%), Brucellosis (4%), Scrub typhus (2%), Hansen's disease (1%), Cryptococcosis (2%) and HIV infection itself without any other opportunistic infections (3%). Malignancies accounted for 9% cases, Sarcoidosis (1%) and in 7% cases a definitive diagnosis was not reached. Among the 66 cases of tuberculosis, 40 (60%) cases were immunodeficient due to HIV infection.

Table 1: Different etiologies for bone marrow granulomas

Diagnosis	Number of Cases (%) (n=100)
Disseminated tuberculosis in hiv positive cases	40
Disseminated tuberculosis in hiv negative cases	26
Other infections	17
Malignancy	9
Sarcoidosis	1
Unknown	7

When the morphology of granulomas in 66 cases of tuberculosis were analysed the following features were seen. 35 (53%) cases showed a single granuloma in the bone marrow biopsy. A well circumscribed granuloma was seen in 25 (38%)cases, while 41 cases (62%) showed ill defined granulomas. Small granulomas were seen in 29 (44%) cases, 17 (26%) showed medium sized granulomas while 20 (30%) cases showed large granulomas. Caseous necrosis was seen in 29 (44%) cases. Plump epithelioid cells were seen in 25 (38%) cases, multinucleated Langhans giant cells in19 (29%) cases and lymphocyte cuffing in 21 (32%) cases. None of the granulomas showed significant increase in eosinophils.

Table 2: Comparison of morphology of tuberculous granuloma in hiv positive and hiv negative cases

Histopathologic findings	No. of Cases of Tuberculosis (n=66) HIV (n=40)	Non HIV (n=26)
Number of granuloma		
Single	21	14
2 - 4	17	9
Multiple (>4)	2	3
Well defined	11	14
Ill defined	29	12
Size of granuloma		
Small	16	13
Medium	9	8
Large	15	5
Plump epithelioid cells	10	15
Langhans giant cells	8	11
Caseation necrosis	21	8
Lymphocyte cuffing	12	9

The number of granulomas in HIV positive and negative cases were not statistically significant (P value= 0.513). Both HIV positive and negative cases of tuberculosis showed predominantly small granulomas (40% & 50% respectively), however large granulomas were seen more frequently in HIV positive cases (38%) as compared to HIV negative cases (19%). 54% cases of HIV negative tuberculosis showed well defined granulomas, where as 73% cases of HIV positive tuberculosis cases showed ill defined granulomas. Thus HIV positive cases were more associated with ill defined granulomas and this was statistically significant (p value = 0.031).

Plump epithelioid cells and multinucleated Langhans giant cells were more common in HIV negative cases (58% & 42%) as compared to HIV positive cases (25% & 20%). Caseous necrosis was seen more commonly in HIV positive cases (52%) as compared to HIV negative cases (31%). Lymphocyte cuffing was seen in both cases (30% & 35%). But on statistical analysis of these parameters, there was no significant difference.

Hence it was seen that HIV positive cases predominantly showed single (52%), ill defined granulomas (73%), with caseation necrosis (52%), while HIV negative cases predominantly showed single (54%), small (50%), well defined or ill defined granulomas with plump epithelioid cells (58%) and Langhans giant cells (42%).

Four of our cases with disseminated tuberculosis, had a coexistent granuloma associated entity. Two cases showed positive Weil Felix test thus suggestive of scrub typhus infection, one was a case of collagen vascular disease and other showed toxoplasma IgG and IgM positivity.

Table 3: Different infectious etiologies of bone marrow granulomaS

Infections	Number of Cases (n=83)
Tuberculosis	66
Typhoid	5
Brucellosis	4
Hansen's disease	1
Scrub typhus	2
Cryptococcosis	2
HIV	3

Besides tuberculosis, other infectious etiologies associated with bone marrow granulomas in our study were typhoid fever (5%), brucellosis (4%), scrub typhus (2%), Hansen's disease (1%), cryptococcosis (2%) and HIV infection itself without any other opportunistic infection (3%).

In typhoid the granulomas were smallill defined with absence of caseous necrosis, multinucleated giant cells and lymphocyte cuffing.All brucellosis cases showed one to two, ill defined granulomas without caseous necrosis, multinucleated giant cells or lymphocyte cuffing. Three cases showed small granulomas while one case showed medium sized granulomas. Plump epithelioid cells were seen in two cases. One case of Hansen's disease on multi drug therapy showed multiple small ill defined granulomas with numerous foamy macrophage. There was no caseous necrosis, multinucleated giant cells or lymphocyte cuffing. Two cases of scrub typhus showed characteristic ring granulomas,with multiple small well-formed granulomas around fat spaces, with no caseous necrosis. Two cases of culture confirmed cryptococcosis showed bone marrow granulomas, both patients were HIV positive. One case showed single, medium sized, ill-defined granuloma, while the other case showed single, small, well-formed granuloma, in both there was no caseation necrosis, multinucleated giant cells or lymphocyte cuffing. Both cases showed cryptococcal spores in the granuloma, which were positive for mucicarmine stain.In two patients infected with HIV without any other demonstrated concurrent opportunistic infections, bone marrow granulomas were identified. Both cases had bicytopenia and bone marrow showed single medium to large, ill-defined granulomas without caseous necrosis.

Nine percent (9%) of cases of bone marrow granulomas were due to malignancies, 8% due to hematologic neoplasms like Non Hodgkin lymphoma (3%), Hodgkin lymphoma (2%), Myeloma (2%), Acute myeloid leukemia(1%) and 1% due to non-hematologic malignancy.

The three cases of NHL were one case each of Follicular lymphoma, T cell/Histiocyte rich B cell lymphoma andDiffuse large B cell lymphoma. A case of T cell/Histiocyte rich B cell lymphoma showed small, ill defined granulomas with infiltration by occasional large atypical mononuclear cells while the other twocases showed small well defined granulomas without any infiltration by malignant cells. Caseation necrosis and multinucleated giant cells were absent in all three cases.

Two cases of Hodgkin lymphoma- mixed cellularity showed large, ill-defined granulomas. One case showed infiltration by mononuclear Hodgkin cells within the granuloma, while the other case had no evidence of infiltration by lymphoma. There was no caseation necrosis,

multinucleated giant cells or lymphocyte cuffing in both the cases. Bone marrow biopsy of a case of AML showed a well formed, medium sized granuloma surrounded by sheets of blasts.

Bone marrow biopsy of a case of non-secretory myeloma with cardiac amyloidosis, showed thickened blood vessels showing pink eosinophilic material in the vessel wall, which was Congo red positive along with collection of histiocytes forming an ill-defined granuloma. Another case of multiple myeloma also showed two small well defined granulomas with plump epithelioid cells and foreign body giant cells. A small, well formed granuloma was seen in a case of carcinoma pancreas on chemotherapy with Erlotinib induced leukemoid reaction. Patient had metastasis to the lung and liver but bone marrow did not show any metastasis.

A case of sarcoidosis showed bone marrow granulomas; four, ill defined, large non caseating granulomas with Langhans and foreign body giant cells, with no lymphocyte cuffing.

In seven of our cases showing bone marrow granulomas, confirmatory laboratory evidence for diagnosis was lacking. Five cases were treated as tuberculosis considering granuloma in bone marrow biopsy and showed improvement. One case presented with fever and pancytopenia and improved with symptomatic management and a diagnosis of post viral fever pancytopenia was reached. Another case had fever, petechiae and severe thrombocytopenia and was diagnosed as immune thrombocytopenic purpura.

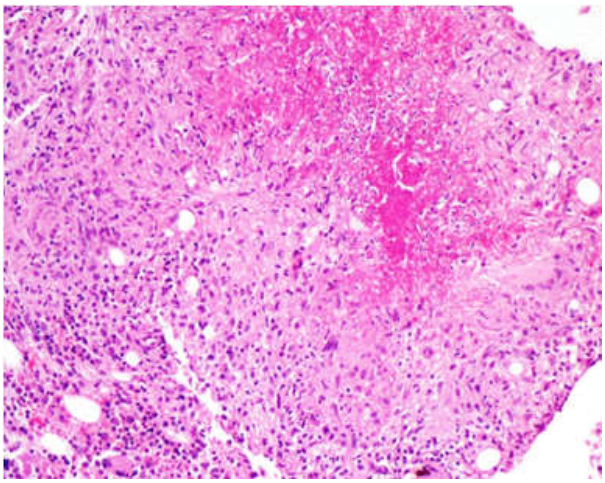

Fig. 2: Ill formed granuloma with extensive caseation necrosis in a HIV positive patient with tuberculosis. [Hematoxylin & Eosin; X 200]

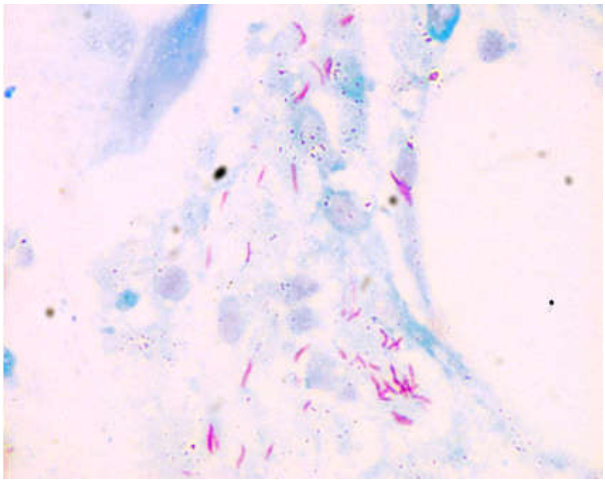

Fig. 3: AFB positive tuberculous bacilli. [ZN stain; X 400]

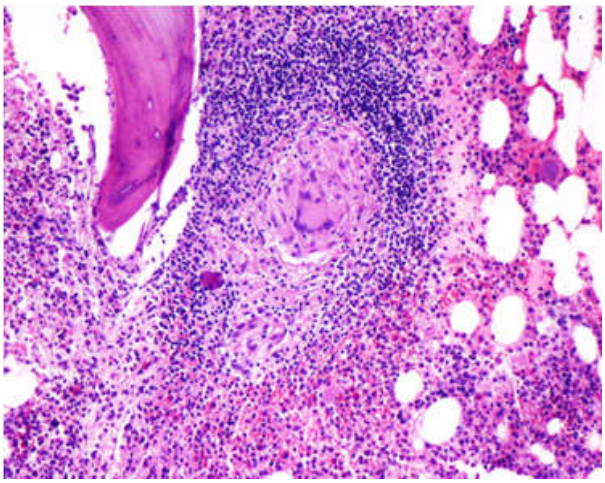

Fig. 1: Well formed granuloma with lymphocyte cuffing and Langhans giant cells in an immunocompetent patient with disseminated tuberculosis.
[Hematoxylin & Eosin; X100]

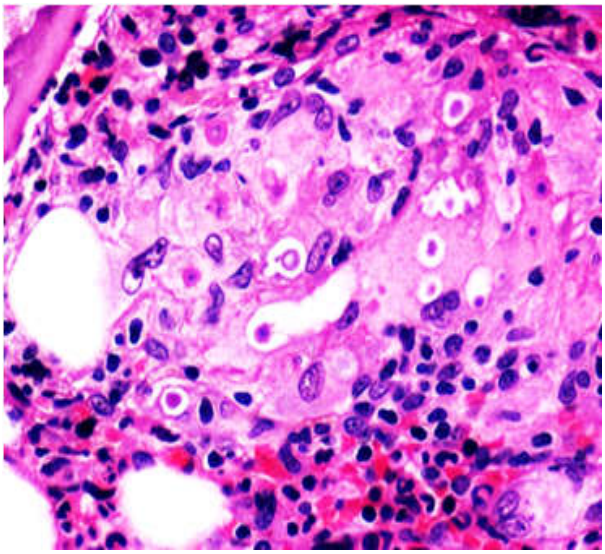

Fig. 4: Granuloma with spores of Cryptococcus in a HIV positive patient. [Hematoxylin & Eosin; X 400]

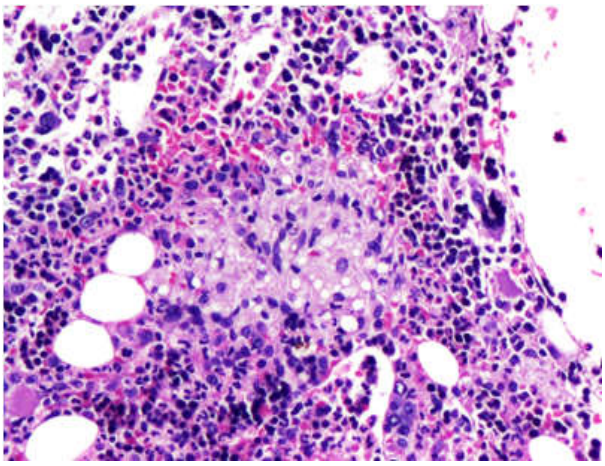

Fig. 5: Ill definedsmall granuloma with foamy macrophages in a case of leprosy.[Hematoxylin & Eosin; X 200]

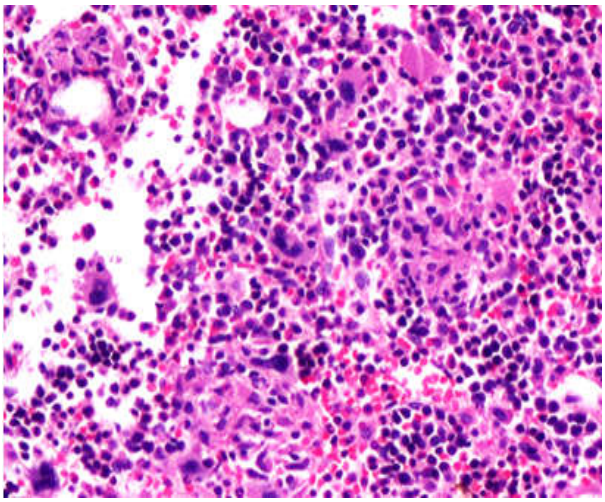

Fig. 6: Multiple small ill defined granulomas in a case of Typhoid [Hematoxylin & Eosin; X 200]

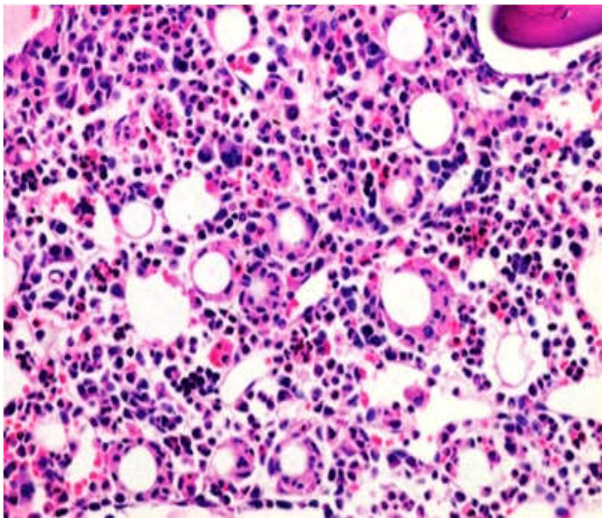

Fig. 7: Fibrin ring granuloma composed of central lipid vacuole, fibrinoid outer ring, epithelioid histiocytes and lymphocytes in Scrub Typhus. [Hematoxylin & Eosin; X 200]

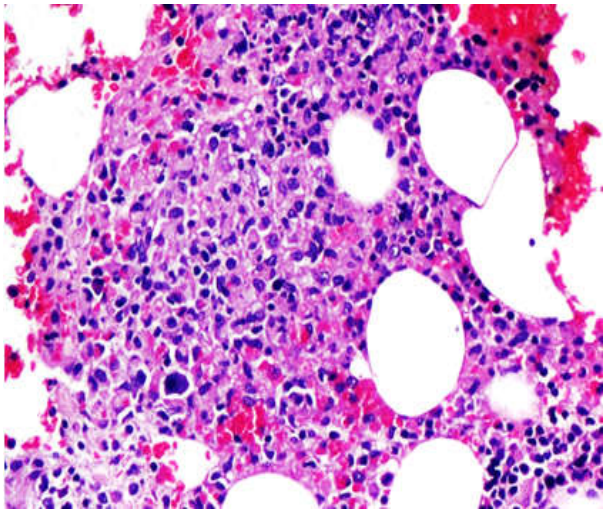

Fig. 8: Non Hodgkin Lymphoma. Granuloma with occasional large atypical mononuclear cell. [Hematoxylin & Eosin; X 200]

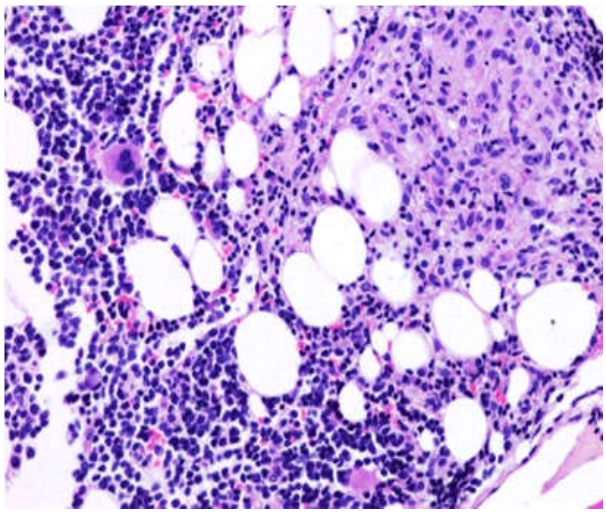

Fig. 9: AML with granuloma. [Hematoxylin & Eosin; X 200]

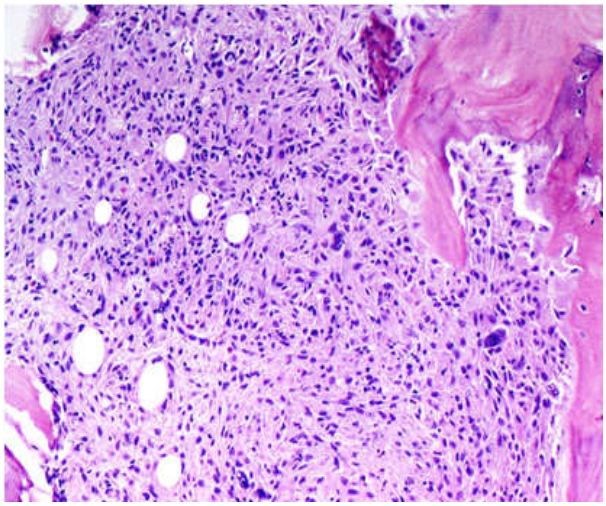

Fig. 10: Hodgkin lymphoma- Classical (Mixed cellularity). Mononuclear Hodgkin cells surrounded by epithelioid histiocytes and lymphocytes. [Hematoxylin & Eosin; X 200]

Discussion

The present study reported an incidence of 1.75 granulomas per 100 biopsies, which was higher than the incidence reported in western studies [2,3]. A study by Basu etal done in JIPMER, Pondicherry reported an incidence of 2.46 granulomas per 100 biopsies [4]. Thus it shows that the incidence of bone marrow granulomas is higher in Indian studies. Predominant age group affected in most of the studies is 30-60 yrs [2,3,5]. The present study showed male predominance, which was in concordance with the study by L. Brackers de Hugo etal and Bodem etal, except for the study by Vilalta-Castel etal which showed almost equal male to female ratio [2,3,5]. Fever,weight loss and fatigue are the common presenting symptoms [2,5]. Most of the patients in the present study presented with a chronic history with duration of symptoms existing for > 6weeks, as was seen in the study by Bodemetal. The common clinical findings were pallor; lymphadenopathy and organomegaly.

Among laboratory investigations, anemia was a consistent finding in the present study (83%) as well as in the study by L. Brackers de Hugo etal (71%) and Vilalta-Castel et al. (60%) [3,5]. Another important feature noted in our study was elevated ESR (61% cases). Other significant laboratory parameters in our study were thrombocytopenia (45%), leukopenia (34%) and pancytopenia (19%). These findings were in concordance with the study by L. Brackers de Hugo etal who reported thrombocytopenia, leukopenia and pancytopenia in 35%, 31% and 21% respectively. The present study reported 46% HIV positive cases, which is much higher when compared to study by L. Brackers de Hugo et al. (10.5%) [5].

Most studies have shown infections as the leading cause of bone marrow granulomas. But Indian studies have shown a higher proportion of bone marrow granulomas associated with infections when compared to the western studies. The increased incidence of infectious etiology in the present study can be attributed to the increased prevalence of tuberculosis in India. Next common cause in the present study was malignancy (9%) as well as in the studies by Bodem et al. (21%) and Vilalta-Castel et al. (22.5%), but the proportion of cases of granulomas associated with malignancy were less in our study as compared to the other studies [2,3].

L. Brackers de Hugo et al. reported sarcoidosis (21%) as the second leading etiology of bone marrow granulomas [5]. But the present study reported only a single case of bone marrow granuloma associated with sarcoidosis.

Though Tuberculosis is the most common infection associated with bone marrow granuloma in most studies, western studies have reported relatively lower number of cases as compared to Indian studies [3,4,5]. This shows the higher prevalence of tuberculosis in India.

Evaluation of morphology of granuloma in the cases of tuberculosis (66/100) showed that majority were ill defined with presence of caseation necrosis. Only 38% of cases showed well defined granulomas. Langhans giant cells and lymphocyte cuffing were seen in 30% cases. Peace etal reported 19 cases of bone marrow granulomas associated with

Table 4: Comparison of incidence of bone marrow granulomas

	Incidence in the Series	Annual Rate
Present study	1.75 per 100 biopsies	22.64 cases per year
Vilalta-Castel et al[6]	0.50 per 100 biopsies	3.80 cases per year
Bodem et al[4]	0.52 per 100 biopsies	4 cases per year
Basu et al[10]	2.46 per 100 biopsies	4.7 cases per year

Table 5: Comparison of diagnosis

Diagnosis	Number of Cases (%)				
	L. Brackers de Hugo et al[5] (n=48)	Bodem et al[2] (n=58)	Vilalta-Castel et al[3] (n=40)*	Basu et al[4] (n=14)	Present study (n=100)
Infection	16(33%)	22(38%)	20(50%)	10(71.4%)	83(83%)
Malignancy	9(19%)	12(21%)	9(22.5%)	1(7%)	9(9%)
Sarcoidosis	10(21%)	4(7%)	2(5%)	-	1(1%)
Autoimmune	-	5(9%)	1(2.5%)	-	-
Drugs	3(6%)	7(12%)	-	-	-
Unknown	10(21%)	8(13%)	7(17.5%)	3(21.4%)	7(7%)

tuberculosis and described well defined granulomas (84%) with caseation necrosis and Langhans giant cells (>60%) in majority of cases [6]. Thus, Peace et al. reported a higher proportion of cases with well defined granulomas and Langhans giant cells as compared to the present study. This may be because 61% of the tuberculosis cases in the present series were HIV positive and bone marrow granulomas in AIDS are usually described as small, subtle, loosely cohesive and difficult to detect [7].

When the morphology of tuberculous granulomas were compared between the HIV positive and negative patients, it was seen that HIV positive cases commonly showed ill defined granulomas (73%) with caseous necrosis (52%) whereas HIV negative cases showed predominantly well defined granulomas (54%) and other features like plump epithelioid cells, multinucleated giant cells and lymphocyte cuffing. HIV negative cases predominantly showed small sized granulomas whereas HIV positive cases had more or less equal number of small and large granulomas. In a study by Nichols etal on morphologic evaluation of tuberculous granuloma in HIV patients, large (59%) and tightly cohesive (52%) granulomas were described [8]. In a study of 49 patients with HIV by Castella et al., 8 (16%) cases showed granulomas, which were small andpoorly formed in most [9]. This shows that there is variation in the morphology of granulomas in HIV patients in different studies.

Typhoid accounted for 5% cases of bone marrow granulomas in the present study, which was similar to the study by Vilalta-Castel et al. (10%). In the present study all 4 cases showed small ill defined granulomas with absence ofcaseous necrosis, multinucleated giant cells and lymphocyte cuffing. In a study by B M Shin etal, bone marrow of 16 culture proven typhoid cases were analysed and 8 cases showed granulomas, 4 were well defined and 4 were ill defined without caseation necrosis or Langhans giant cells [10].

The present study reported 4% cases of brucellosis associated with bone marrow granulomas while Vilalta-Castel et al. reported 12.5% cases and Bodem et al reported 2% cases.The granulomas in brucellosis are usually small, ill defined without caseous necrosis, multinucleated giant cells or lymphocyte cuffing [6].

The present study reported 2% cases of cryptococcosis, which was in concordance with the study by Bodem et al. (2%). But L. Brackers de Hugo et al and Vilalta-Castel etal did not report any case of cryptococcosis in their study [2,3,5]. This may be because 46% cases in the present study were HIV patients as compared to 10.5% cases in the series by L.Brackers de Hugo et al. The present study described non caseating granulomas in both the cases; the cryptococcal spores were mucicarmine positive and bone marrow culture grew the organism. Bodem et al also reported noncaseating granulomas but special stains and bone marrow culture were negative for cryptococcus [2].

Scrub typhus accounted for 2% cases in the present study, but L. Brackers de Hugo etal, Vilalta-Castel etal and Bodem etal did not report any cases in their study. In the present study both cases of scrub typhus showed characteristic ring granulomas. Doughnut-ring granulomas described as a central empty space surrounded by eosinophilic fibrinoid material and rimmed by polymorphonuclear leucocytes and epithelioid cells, once thought to be charactertistic of Q fever, can also be seen in patients with leishmaniasis, toxoplasmosis, scrub typhus, viral infections like Ebstein Barr virus (EBV), Cytomegalovirus (CMV), Hepatitis A virus, in malignancies like Hodgkin lymphoma, peripheral T

Table 6: Comparison of infections associated with bone marrow granulomas

Infections	Number of Cases			
	L. Brackers de Hugo et al[5] (n=48)	Vilalta-Castel et al[3] (n=40)	Bodem et al[2] (n=58)	Present study (n=100)
Tuberculosis	10(21%)	8(20%)	4(7%)	66(66%)
Histoplasmosis	-	-	11(19%)	-
Typhoid	-	4(10%)	-	5(5%)
Brucellosis	-	5(12.5%)	1(2%)	4(4%)
Hansen's disease	-	-	-	1(1%)
Scrub typhus	-	-	-	2(2%)
Cryptococcosis	-	-	1(2%)	2(2%)
Hiv	1(2%)	-	-	3(3%)
Total no. of cases of infections	16*	20*	22*	83

*Not all the infectious causes are given in the table, so the columns do not add up to the total in the series

cell lymphoma, therapeutic agents like allopurinol hepatitis. In a review of 24 cases with bone marrow fibrin ring granuloma by Chung HJ et al., chronic or acute EBV infection accounted for majority of cases; 41.4% of patients (10/24). Remaining cases wereleukemia or lymphoma patients after chemotherapy (33.3%), hepatic failure and fever of unknown origin (20.8%) [11].

Hansen's disease accounted for 1% cases of bone marrow granulomas in the present study, butthere are not many reports of Hansens associated bone marrow granulomas in the literature. Bone marrow involvement in lepromatous leprosy is characterised histologically by granuloma formation, with accumulation of Virchow cells which are foamy histiocytes containing lepra bacilli. In lepromatous leprosy, the bacilli are found throughout the body diffusely involving the reticuloendothelial system in addition to the skin and nerves. Suster etal studied the bone marrow in three cases of biopsy proven lepromatous leprosy and demonstrated by Fite staining numerous bacilli lying free in the interstitium, in the absence of Virchow cells or focal collection of macrophages, and concluded that bone marrow may act as a reservoir for viable organisms in the absence of host response in lepromatous leprosy. It has been proposed that persistence of viable organisms in the bone marrow may be a factor in the high rate of relapse and/or recrudescence of leprosy following premature cessation of specific therapy [12,13]. 3% of cases in the present study had HIV infection without any other demonstrated concurrent opportunistic infection or lymphoproliferative process. L. Brackers de Hugo et al. also reported bone marrow granulomas in one HIV patient (2%) without any other granuloma associated causes [5]. Nichols etal examined 342 bone marrows from patients with HIV infection and granulomas were detected in 102 biopsies out of which 82 (80%) were associated with opportunistic infections. However 22 (20%) of 102 HIV patients had no subsequently or previously diagnosed opportunistic infection to potentially account for their bone marrow granulomas [8]. Thus, Human immunodeficiency virus in itself can cause bone marrow granulomas.

In the study by Bodem etal the most common infectious cause of bone marrow granuloma was histoplasmosis (19%), but in the present study no case of histoplasmosis was reported. Also Bodem etal reported infectious mononucleosis (2%), cytomegalovirus (2%), rocky mountain spotted fever (2%), tularemia (2%), Saccharomyces (2%) in his study, but none of these cases were reported in the present study [4]. Vilalta-Castel et al. reported Kala azar (5%), Viral hepatitis (2.5%) and L. Brackers de Hugo et al. reported M. genavense (4%), B. henselae (4%) and EBV (2%) infection associated with marrow granulomas in their series but none of these cases were reported in the present study [3,5].

The present study reported malignant etiology in 9% cases which was lower when compared to study by L. Brackers de Hugo et al. (19%) and Bodem et al. (21%) [2,5]. The commonest malignancy associated with bone marrow granuloma was lymphoma. Non Hodgkin lymphoma accounted for 3% cases in the present study but only one case showed abnormal cells. Bodem et al. reported 4 (7%) cases, which showed non caseating granulomas without malignant cells in the bone marrow [2]. Yu and Rywlin described 9 cases of bone marrow granulomas in patients with non Hodgkin lymphoma and malignant lymphoma cells were seen in 3 cases.

In the present study granulomas were seen in two cases of Hodgkin lymphoma and both showed large, ill defined granulomas. One case showed infiltration by mononuclear Hodgkin cells within the granuloma, while the other case had no evidence of infiltration by lymphoma. Peace et al. reported 15 (10%) cases of malignant lymphomas associated with bone marrow granulomas which included 2 cases of Hodgkin disease showing Reed Sternberg cells in the bone marrow lesion. Bodem et al. reported 4 (7%) cases of Hodgkinlymphoma with bone marrow granulomas and Reed Sternberg cells were absent in the marrow in all cases [2,6]. Hence, presence of granuloma does always indicate bone marrow infiltration in Hodgkin lymphoma. O'Carroll et al. analysed the bone marrow biopsies of 107 patients of Hodgkin disease, of which 6 (5%) showed granulomas, none had evidence of marrow infiltration by Hodgkin disease [14]. Bone marrow granuloma in patients with lymphoma is considered as a nonspecific immunologic response to cancer and is rarely due to the invasion of the bone marrow. The finding of a Reed-Sternberg cell within the granuloma is rare. Presence of granulomas has been associated with a good prognosis in patients with Hodgkin disease [15,16].

Present study reported 3 cases of other hematologic malignancies associated with bone marrow granulomas which included one case each of AML, Myeloma and non secretory Myeloma. Other studies have also shown association of bone marrow granulomas with other hematologic malignancies. L. Brackers de Hugo et al. reported 3 (6%) cases, one case each of hairy cell leukemia,

multiple myeloma and Waldenstroms disease. Bodem et al. reported 2 (3%) cases, one case of Mycosis fungoides and other of acute lymphoblastic leukemia [2,5].

In the present study 1 case of non hematologic malignancy ie, carcinoma pancreas was associated with bone marrow granuloma. Other studies have also reported non hematological malignancies associated with bone marrow granulomas. L. Brackers de Hugo et al. reported 3 (6%) cases of non hematologic malignancy associated with bone marrow granulomas which includes ovarian carcinoma, bladder cancer and hepatic sarcoma. Bodemetal reported two (3%) cases of non hematologic malignancies, one case each of large cell lung carcinoma and breast cancer [2].

Sarcoidosis has been reported as a common cause for bone marrow granulomas in the series by L. Brackers de Hugo et al. (21%), Bodem et al. (7%), Vilalta-Castel et al. (5%) and Peace et al. (6%) however, our study reported only one case [2,3,5,6]. This case showed four, ill defined, large non caseating granulomas with Langhans and foreign body giant cells, with no lymphocyte cuffing. Peace et al. described well formed lesions in two third cases, with Langhans giant cells in one third cases, without any caseous necrosis. Bodem et al. described well formed non caseating granulomas in all cases [2,6].

Yanardag H et al. analysed bone marrow samples of 50 patients with sarcoidosis and 10 patients revealed non caseating granulomas. Sarcoidosis patients with bone marrow involvement showed higher incidences of extrapulmonary involvement, leucopenia-lymphopenia and anaemia than those without bone marrow involvement, so they concluded that bone marrow involvement should be considered in sarcoidosis patients with anaemia, leucopenia-lymphopenia, and also extrapulmonary involvement [17].

In the present study in 93% cases an associated etiology for the granuloma was identified, while in 7% cases no definitive diagnosis was reached. Bodem etal found associated etiology in 87% cases, L. Brackers de Hugo et al. in 79% cases, Vilalta-Castel et al. in 82.5% cases [2,3,5].

In the present study out of the seven cases without confirmatory laboratory evidence for diagnosis, five cases were treated as tuberculosis considering granuloma in bone marrow biopsy and they improved with treatment. One case presented with fever and pancytopenia and improved with symptomatic management and a diagnosis of post viral fever pancytopenia was reached. Another case had fever, petechiae and severe thrombocytopenia and was diagnosed as immune thrombocytopenic purpura. Peace etal studied granulomatous bone marrow lesions in 150 patients and diagnosis of 20 patients was indeterminate. 3 of these cases were diagnosed as immune thrombocytopenic purpura [6]. Vilalta-Castel et al. also reported a case of bone marrow granuloma in a patient with sarcoidosis who also had idiopathic thrombocytopenic purpura [3]. Thus immune thrombocytopenic purpura can be considered as a rare cause of bone marrow granulomas.

L. Brackers de Hugo et al. reported 10 cases (21%) of bone marrow granulomas without any definitive diagnosis or who were diagnosed with a disease that was not associated with granuloma formation. On follow up one patient died from an unrelated disease. Out of the remaining 9 for four of them, their symptoms disappeared without treatment. So they concluded that bone marrow granulomas of undetermined origin has a good prognosis and is not associated with the development of underlying disease, such as tuberculosis or lymphoma [5].

Bodem etal reported 8 (13%) cases in whom definitive diagnosis for marrow granuloma was unknown. Five among them had presumptive evidence for tuberculosis and responded to anti tuberculous treatment. One was a case of silicosis and systemic granulomatous reaction has been described with silicosis, while the other two cases were unexplained [2].

Drugs were not found to be an etiologic factor of granulomatous bone marrow lesions in the present study, which was in concordance with the study by Peace et al. and Vilalta-Castel et al. [3,5]. L. Brackers de Hugo etal reported 3 (6%) cases of therapy induced granulomas associated with intravesical Bacillus Calmette Guerin installation for bladder cancer [8]. Bodem et al. described 7 (12%) cases associated with drugs including procainamide (1case), ibuprofen (2 cases), phenylbutazone (1 case) and indomethacin (1 case). The granulomas were non caseating and of variable sizes [2].

Conclusion

Although granuloma is not a very common finding in bone marrow, when present it is of utmost clinical significance and can aid in the diagnosis of the condition. Morphology of the granuloma also helps in differentiating different etiologies. The incidence is higher in India due to the higher prevalence of

tuberculosis which is further accentuated by the prevalence of HIV positive cases. Though in more than 90% of cases a definite etiology can be established, some cases may still remain a diagnostic dilemma and the treatment may purely depend upon clinical correlation.

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Original Article

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A Study on Sexual Offences at Chamarajanagar Institute of Medical Sciences, Chamarajanagar, Karnataka, India

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Abstract

Sexual violence is the most common form of violence and is becoming a global problem. The cases registered under sections 376, 366A, 363, 354, 377 IPC and POCSO act are brought for examination for the evidence of signs of sexual intercourse and age estimation. The present study aims to find out the profile of sexual offences at Chamarajanagar, Karnataka and to describe the characteristics of survivors and accused of sexual assault. A standardized proforma specially designed for this purpose was used and filled in each case after detailed interviews. Data entry was made in excel after cleaning and coding it was transferred into SPSS software and the data was analyzed. Total 58 cases brought to hospital included 30 (51.7%) survivors and 28 (48.3%) accused. Maximum number of survivors educated up to school. Unmarried accused were maximum cases. In majority of cases the incident had occurred between evening & mid night time. Majority of the sexual assault cases occurred in the accused house. Majority of the survivors were examined after 48 hours. In majority of cases accused were close friends of the victims. The manner of offence in majority of the rape cases were of consensual type.

Keywords: Sexual Violence; Sexual Assault; Rape; Expert Evidence.

Introduction

Sexual violence occurs throughout the world and has profound impacts on survivors' health by causing physical injuries, sexual and reproductive problems, as well as psychological disorders [1]. It continues to plague our Nation and destroy lives. There are various ways and forms in which sexual exploitation is practiced. The most perverted and degrading form is rape. Sexual abuse may include inappropriate exposure of a child to sexual acts or material, use of children as objects of sexual stimuli for adults and actual intercourse between children and adults. Such societal attitudes present a challenge to investigators when child sexual abuse is alleged. It is also difficult for children to tell anyone out of fear or ignorance [2]. The World Health Organization has defined child sexual abuse and exploitation as the involvement of a child in sexual activity that he or she does not fully comprehend, is unable to give informed consent to, or for which the child is not developmentally prepared and cannot give consent, or that violates the laws or social taboos of society [3].

Expert medical evidence is widely used in rape cases, but its contribution to the progress of legal cases is unclear. The examination of the survivors of alleged sexual offences is one of the most difficult task in Forensic Medicine. Considering the danger of allowing true offenders to go unpunished as well as injustice of wrong convictions, make the task of examining physician even more important. Hence, the role of medical evidence in sexual offence case cannot be undermined. The present study aims to find out the profile of sexual offences at

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Chamarajanagar, Karnataka and to describe the characteristics of victims and accused of sexual assault.

Materials and Methods

The study was conducted at Department of Forensic Medicine & Toxicology at Chamarajanagar Institute of Medical Sciences, Chamarajanagar, Karnataka, India. The present study was a cross sectional study carried out for a period of 1year. Using pre-tested structured schedule, all cases of sexual offence cases brought to Chamarajanagar Institute of Medical Sciences, Chamarajanagar, Karnataka for examination and those who fulfill the inclusion and exclusion criteria were selected on a purposive sampling basis. Informed written consent has been taken from the victim and accused for inclusion in the study. A standardized proforma specially designed for this purpose was used and filled in each case after detailed interviews with the investigating officials, victims/alleged accused and the relatives/friends of the victims/ alleged accused, the socio demographic data, marital status, menstrual history, history of sexual offence as disclosed by the victims and accused (place and details, number of offenders involved, relationship, etc. The examination findings and medico legal interpretation of the information, findings and injuries were recorded in the proforma. The ethical permission was obtained from Institutional Ethics Committee.

Results

During this period, we have examined total 58 cases, which include 30 (51.7%) victims and 28 (48.3%) accused. All victims were females. Maximum numbers of victims i.e. 25 (83.3%) were in the age group of 15 years to 20 years, followed by 5 (16.7%) cases were in the age group of 21 years to 30 years. Maximum number of accused i.e. 20 (71.42%) were in the age group of 21 years to 30 years, followed by 6 (21.4%) cases found in the age group of 31 years to 40 years and 2 (7.1%) found in the 11 years to 20 years. None of the accused was below 10 years.

Out of total 30 cases of victims, 16 (53.3%) cases belongs to Hindu, 12 (40%) cases belong to Christian religion and 2 (6.7%) cases were Muslims. Out of 28 accused, maximum i.e. 12 (42.8%) cases were Hindus, followed by 10 (35.7%) cases were Christian and 6 (21.5%) cases were Muslims.

Maximum number of victims i.e. 16 (53.4%) cases were educated up to school, 8 (26.6%) cases were graduated and 6 (20%) were uneducated. Maximum number of accused i.e. 13 (46.4%) cases were educated up to school, 4 (14.2%) cases were graduated and 11 (39.4%) were uneducated. unmarried victims were maximum i.e. 24 (80%) cases, whereas 6 victim (20%) was married. Unmarried accused were maximum i.e. 21 (75%) cases, whereas 7 (25%) cases were married.

Out of total 30 cases, in majority of cases i.e. 16 (53.3%) cases the incident had occurred between evening & mid night time, i.e. from 6.00PM to 12.00AM. It is followed by 8 (26.7%) cases, where incident occurred in the mid night & early morning period i.e. from 12.00AM to 6.00AM (Table 1).

Majority of the sexual assault i.e. 13 (43.3%) cases occurred in the accused house. It is followed by 7 (23.3%) cases occurred in the other indoor places like lodge, friend's house. In 6 (20%) cases, the place of incident was out door (Table 2).

From Table 3, it is evident that only 1 victims (3.3%) were examined within 24 hours of the incident.

Table 1: Distribution of Cases According to Time of Incident

Time	Number	Percentage
12.00am to 6.00am	8	26.7
6.oo am to 12.00pm	03	10
12.00 pm to 6.00pm	03	10
6.00pm to 12.00am	16	53.3
Total	30	100

Table 2: Distribution of Cases According to Place of Incident

Place	Number	Percentage
Victims' house	04	13.3
Accused house	13	43.3
Other indoor (lodge, friend's house)	7	23.3
Outdoor	06	20
Total	30	100

Table 3: Distribution of victims according to time interval between the incidence and examination

Time	Number	Percentage
Within 24 hours	01	3.3
24 to 48 hours	8	26.7
48 to 72 hours	13	43.3
72hours to 1st week	04	13.4
1st week to 2nd week	02	6.6
2nd week to 1st month	01	3.3
More than 1 month	01	3.3
Total	30	100

Majority of the victims 13 (43.3%) were examined after 48hours and 1 victims (3.3%) were examined after 1 month.

It is evident that, in 12 (40%) cases accused were close friends of the victims whereas in 9 (20%) cases accused were neighbours and in only 3 (5%) cases accused were strangers. It shows that majority of victims knew the accused (Table 4).

The manner of offence in majority of the rape cases i.e. 18 (60%) cases were of consensual type, which is followed by 7 cases (23.3%) of forcible rape, 2 cases (6.7%) statutory rape and in 3 (10%) case the offence occurred by threatening the victim. Among 30 victims, 6 cases (20%) presented with intact hymen. 14 cases (46.6%) presented with recent tears of hymen, 10 cases (33.3%) presented with old tears of hymen (Table 5).

Table 4: Distribution of sexual offence cases based on the relation between victim & accused

Relation	Number	Percentage
Closefriend	12	40.0
Relative	03	10.0
Neighbour	9	20.0
Stranger	03	10.0
College mate	03	10.0
Total	30	100

Table 5: Distribution of natural sexual offence (rape) cases based on the manner of offence

Manner	Number	Percentage
Statutory	02	6.7
Forcible	7	23.3
Threatened	03	10
Consensual	18	60
Total	30	100

Among accused Non genital external injuries were present in 2cases (7.15%). Local genital injuries were absent in all the cases. In 5 cases (17.85%), penis was circumcised. Presence of smegma was noted in only 1 case (3.5%).

Discussion

In our study, Maximum numbers of victims i.e. 25 (83.3%) were in the age group of 15 years to 20 years, followed by 5 (16.7%) cases were in the age group of 21 years to 30 years. The findings in the present study are consistent with other studies. [15,16,17,18,21,23] and it differ with the study done by Martin et al.[19], where 68.3% of the cases involved children under 15 years.

Maximum number of accused were in the age group of 21 years to 30 years, followed by 6 (21.4%) cases found in the age group of 31 years to 40 years and 2 (7.1%) found in the 11 years to 20 years. None of the accused was below 10 years. The age of accused ranged from 17 to 57 years. Majority of the accused (55.26%) were in the age group of 21-30 years. This finding is consistent with the findings of studies done by Bhowmik [24], veeresh [27]. Out of total 30 cases of victims, 16 (53.3%) cases belongs to Hindu, 12 (40%) cases belong to Christian religion and 2 (6.7%) cases were Muslims. Findings of present study are consistent with other studies [15,21,24]. This study differs with the study conducted in Bangladesh by Al-Azad MAS [26], where majority of the victims were Muslim. This is consistent with the population majority of both the countries.

Out of 28 accused, maximum i.e. 12 (42.8%) cases were Hindus, followed by 10 (35.7%) cases were Christian and 6(21.5%) cases were Muslims These findings are consistent with the findings of studies done by Bhowmik [24] and this is consistent with the population majority of India. Maximum number of victims i.e. 16 (53.4%) cases were educated up to school, 8 (26.6%) cases were graduated and 6 (20%) were uneducated. The findings in this study roughly consistent with the other study by Chandresh Tailor [16] who observed 99% cases educated, and it differs from the study done by Roy chaudhury UB [15] who observed majority of cases i.e. 45% of cases as illiterate. Maximum number of accused i.e. 13 (46.4%) cases were educated up to school, 4 (14.2%) cases were graduated and 11 (39.4%) were uneducated. The findings in the present study differ from the study done by Veeresh [27] in which 77.28% of accused were illiterates.

In the present study, unmarried victims were maximum i.e. 24 (80%) cases, whereas 6 victim (20%) was married. The findings in the study are consistent with other studies [15,17,21,24,25,26]. Unmarried accused were maximum i.e. 21 (75%) cases, whereas 7 (25%) cases were married. The findings in the study are consistent with other studies [24,27]. Out of total 30 cases, in majority of cases i.e. 16 (53.3%) cases the incident had occurred between evening & mid night time, i.e. from 6.00PM to 12.00AM. It is followed by 8 (26.7%) cases, where incident occurred in the mid night & early morning period i.e. from 12.00AM to 6.00AM. These findings correspond with the sleeping hours of the general population and these differ from the study done

in Ireland by Sean D McDermott et al. [20] who observed highest number of incidents between midnight and 6AM.

Majority of the sexual assault i.e. 13 (43.3%) cases occurred in the accused house. It is followed by 7 (23.3%) cases occurred in the other indoor places like lodge, friend's house. In 6 (20%) cases, the place of incident was out door. The findings of our study are consistent with the study done by Sean D McDermott et al. [20] in which 43% of cases occurred in the indoors but he has not categorized as victims'/ accused house.

The findings of our study differs with the study done by Sarkar [21] in which the common site of offence was victims' house in 41.1% of cases which is followed by accused house in 28.9% of cases. It also differs with another study done by Roy chowdhury et al. [15] who observed in 77.5% of cases the incidence occurred outside. And it also differs from the study done in Bangladesh by Al-Azad MAS et al. [26] in which they observed 36.95% of incidents occurred in victims' house.

In the present study, only 1 victims (3.3%) were examined within 24 hours of the incident. Majority of the victims 13 (43.3%) were examined after 48hours and 1 victims (3.3%) were examined after 1 month. The findings of the study are consistent with the otherstudies [18,21,23,25]. 12 (40%) cases accused were close friends of the victims whereas in 9 (20%) cases accused were neighbor and in only 3 (5%) cases accused were strangers. It shows that majority of victims knew the accused. The findings of the present study are consistent with the other studies [15,16,18,19,21].

In present study, the manner of offence in majority of the rape cases i.e. 18 (60%) cases were of consensual type, which is followed by 7 cases (23.3%) of forcible rape, 2 cases (6.7%) statutory rape and in 3 (10%) case the offence occurred by threatening the victim. The findings of our study are consistent with other studies [16,21] who observed similar findings.

Among 30 victims, 6 cases (20%) presented with intact hymen. 14 cases (46.6%) presented with recent tears of hymen, 10 cases (33.3%) presented with old tears of hymen.

The finding is consistent with the study done by Sarkar et al. [21] Among accused Non genital external injuries were present in 2cases (7.15%). Local genital injuries were absent in all the cases. In 5 cases (17.85%), penis was circumcised. Presence of smegma was noted in only 1 case (3.5%). The findings of our study are consistent with the study done by veeresh [27].

Conclusion

Sexual offences are mostly performed by the persons known to the victim and happen in familiar places. The actual physical assault/ force used is less common but in light of the recently amended legislations like Criminal Amendment Act, 2013 and POCSO Act many consensual sexual act also comes under the purview of sexual offence.

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Case Report

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Sheehan's Syndrome and Psychosis

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Abstract

Postpartum hypo-pituitarism is also termed as Sheehan's Syndrome. Heavy bleeding during or after delivery leading to further necrosis of the pituitary gland are all characteristic seen in Sheehan's Syndrome. It is commonly associated with hypo-volemic shock. The presentation of Sheehan's Syndrome most commonly include amenorrhoea, hypoglycaemia, hypothyroidism along with agalactorrhea, also psychiatric manifestations like commonly as psychosis are seen though they are not uncommon to be seen. In developed countries owing to advances in services of obstetric care the occurrence of Sheehan's Syndrome is seen relatively rare and is overall gradually decreasing worldwide. However, it can still be considered as common and relatively frequent seen in underdeveloped and developing countries. The diagnosis of Sheehan's Syndrome is commonly late as it evolves slowly, reporting of psychoses are quite rarely seen in cases of Sheehan's Syndrome. Herein in our study we discuss a case of 37 year old woman, diagnosis was psychotic disorder along with Sheehans Syndrome, diagnosed years later, with etiological aspects, follow-ups period and the details treatment with thyroxine, glucocorticoids which has shown a tremendous results with complete remission after attaining euthyroid and eucortisolemic state.

Keywords: Thyroxine; Psychosis; Sheehan's Syndrome; Post-Partum Hypo-Pituitarism.

Introduction

Sheehan's syndrome (SS) is a quite rare and uncommon but serious postpartum complication; it was described by Sheehan in the year 1937. Defining of Sheehan Syndrome by varying degrees of anterior pituitary deficiency which is due to postpartum ischemic necrosis of the pituitary gland seen usually after massive bleeding. Sheehan's syndrome rarely encountered, but still can be considered as one of the commonest causes of hypo-pituitarism commonly seen in developing country like India. Adrenal pituitary insufficiency accoutring from hypo-volemia which is secondary to excessive blood loss during or after delivery is Sheehan syndrome. Sheehan syndrome some time may also present in post-partum period or years and decades after the delivery [1].

In Sheehan's syndrome implications of abnormalities of hypophyseal arteries which include external compression, thrombosis and as well vascular spasm are done. Various factors had been proposed in Pathogenesis of Sheehan's syndrome viz, DIC, Small sized sella, autoimmunity and enlargement of pituitary gland [2]. Sheehan's Syndrome is being diagnosed which is based on various clinical features which are like associated hormone deficiency, history related with obstetric quite suggestive, findings of laboratory of decreased hormone levels and related with radiological features. Treatment of Sheehan's Syndrome usually needs lifelong replacement of hormones which are deficient.

From Indian subcontinent study of Sheehan's Syndrome made by Zargar A H et al. from Kashmir valley, the prevalence of Sheehan's Syndrome was estimated to be around 3% in the women who are above 20 years of age and it was almost two-thirds

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wherein the delivery of babies had occurred at home [3]. However, the same is a quite rare cause of hypo-pitutarism commonly in developed countries.

In another study, the findings reveal that among 1034 hypo-pituitary adults, sixth most frequent cause of growth hormone deficiency (GHD) was Sheehan's Syndrome, it was being considered responsible for around 3.1% of cases in the study [4]. In this study, we discuss a case in a 37 year old woman, that in which the diagnosis was a psychotic disorder and Sheehan's Syndrome, diagnosed years later, and the etiological aspect, including the follow-up period and treatment with thyroxine and glucocorticoids resulted in complete remission after attaining euthyroid and eucortisolemic state.

Case Report

Female Patient of 37 years age, Muslim by Religion, housewife, presented to the department of psychiatry along with her mother with the complaints of hearing voices, she lives in self with poor self care, she had no work and is not involved in any kind of activity, she had sleep disturbance and used abusive language for friends and family and all this since past two decades.

Patient's illness is continuous and progressing gradually. On further detail examination patients Mother revealed that she delivered her second child which was vaginal delivery but there had been excessive bleeding but it was hospital delivery. As informed by mother, the mattress was filled with blood and she was administered with haemostatic injections. D & C occurred 1 month after pregnancy. Immediately after the pregnancy within one month she stopped lactation and she had amenorrhea. Relatives and parents noticed drastic change in patient's behaviour which was apparently began after around two years post delivery of second child. The complaints include used to sleep 2-4 hrs at night and used to shout. She had complaints of hearing voices, contents were derogatory and threatening. She lived with fearfulness. Whole day she sat on one place, did not do any work and always used to mutter.

Patient had tendency to neglect her personal hygiene also she was negligent in her child's care. She started excessive use of tobacco chewing so that she has decreased mouth opening. In initial few years she lived with her husband but later she lived many times in parental home. She was looked after by her mother since last 4 years. Her husband and two children live separately. She does not take meals properly, so her general physical condition becomes worsen. Patient took regular multiple consultations from many psychiatrists for abnormal behaviour. Currently she is on antipsychotic medication but her symptoms persist. There was not any significant past psychiatry and neurological history. Patient husband drink alcohol in dependence form, so quarrel between patient and her husband very common, her grandfather also suffered from seizure disorder. Patient never had any kind of smoking nor had any drinks of alcohol nether abused any kind of illicit drugs, overall there was not any kind of past forensic record related to her.

General Physical Examination

Patient appeared anaemic and looked pale; on examination breast atrophy was appreciated as the important features of hypothyroidism. Her vital signs were seen abnormal and she was febrile. Her blood pressure was 75/55 mm of Hg, pulse rate 60/min. Skin has Icthysosis, no pubic and axillary hairs. She has difficulty in hearing and sub-mucous fibrosis present in oral cavity. Patient was clear and well oriented to time place and person. Bilateral up going plantars was revealed during Neurological examination of the patient. Gait appeared to be normal. Patient appearance was unkempt apathetic, revealed during mental status examination. She had a monotonous speech, brief reply and a very high reaction time was appreciated. Patients thought process had persecutory delusions, with auditory hallucinations, with intact memory. However she had unsatisfactory performance in attention and concentration task with verbal fluency test. Patient had no insight and understanding regarding why she had been to JNU Hospital in psychiatry department along with poor social judgement.

No abnormalities revealed on laboratory investigation which include Liver function, renal function as well as workup for inflammatory and infectious conditions. Patients profile for Hormones revealed very low levels of serum T3, T4, cortisol, FSH & LH and is being depicted in the Table 1. below normal range came for all electrolytes. Post menopausal shrunken ovaries were seen in Ultra sonography of abdomen and pelvis, whereas Magnetic resonance imaging of brain showed prominent supra-tentorial ventricular system with commensurate enlargement of sylvian fissure and cortical sulci suggestive of cerebral and cerebeller atrophy. Bilateral moderate to severe hearing loss was present on Audiometry.

Table 1: Laboratory Findings in the Patient presented

Investigation	Status	Result	Unit	Bio Ref Int	At Discharge
HB	L	8.3	Gm%	12 -15	8.4
TLC	L	2.9	Thousand/cu mm	4-11	8.4
N		46	%	40 -80	71
L		50	%	20 – 40	26
M		02	%	2 – 10	03
E		02	%	1 – 6	00
B		00	%	0 -2	00
TRBC	L	2.85	Millions/Cumm	4.5 – 5.5	2.95
PLATELETS	L	111	Thousand/ Cumm	150 - 500	155
MCV	L	79.3	FL	83 - 101	84.9
MCH		29.1	PG	27 – 32	29.4
MCHC	H	36.7	G/DL	30 - 35	34.6
PCV	L	22.6	%	38 - 45	22.9
IRON		61	UG/DL	50 - 170	
PBS - RBCs	Normocytic Normochromic Picture, Marked Anisopoikilocytosis Microcytes ++ Hypochromasia + Target Cell ++				
WBCs			Reduced On Smear		
PLATELETs			Reduced On Smear		
RBS		75	MG/DL	74 - 140	
SE UREA		21	MG/DL	15 - 45	
SE CREATININE		0.8	MG/DL	0.5 – 1.1	
SODIUM	LL	115	MMOL/L	135 - 145	127
POTASSIUM	L	3.2	MMOL/L	3.5 – 5.1	3.9
CHLORIDE	L	83	MMOL/L	98 - 110	93
CALCIUM	L	6.9	MG/DL	8.6 – 10.20	7.8
BILIRUBIN T		0.5	MG/DL	0.0 – 2.0	
DI		0.2	MG/DL	0.0 – 0.25	
INDI		0.3	MG/DL	0.2 - 10	
SGOT	H	113	U/L	5-46	
SGPT		47	U/L	0-49	
ALP	H	288	U/L	42-141	
TOTAL PROTEIN		6.5	G/DL	6.0 – 8.0	
ALBUMIN		3.8	G/DL	3.5 – 5.5	
GLOBULIN		2.7	G/DL	2.3 – 3.6	
A/G		1.4		1.0 – 2.0	
VIT D		56.1	NG/ML	30 - 100	
VIT B 12	H	>2000	PG/ML	239 - 931	
FREE T3	L	0.71	PG/ML	2.7 – 5.27	
FREE T4	L	0.07	NG/ML	0.78 – 2.19	
TSH		1.75	uIU/ML	0.465 – 4.68	
LH	L	0.87	mIU/ML	15.9 – 54.00	
FSH	L	3.42	mIU/ML	21.5 - 131	
CORTISOL	L	0.67	ug/dl	5 - 23	
ACTH	L	<5	Pg/ml	9 - 52	
PROLACTIN	L	<0.6	NG/ML	5.18 – 26.53	
DENGUE SEROLOGY			Non Reactive		
MP CARD			Negative		
CHEST X RAY (PA VIEW)			Normal		
USG (ABDOMEN – PELVIS)			Post Menopausal Ovary Contracted		
ECG -			T Wave Flattening In Lead 1,Avl, V4,V5,V6		

Finally the diagnosis of Sheehan's syndrome was finalised and patient was started with Aripiprazole 5 milligram for one week followed by 10 mg per day with tablet Clonazepam 0.5 mg 1HS or SOS, along with Injection Hydrocortisone 50 mg Intra venous QID for three days, followed by 25 mg/day orally, tablet Thyroxin 50 ug OD after five day 100 ug, Capsule Calcitriol 0.25 mg- 1 OD. With this overall treatment patient had a drastic improvement within few weeks for all of her physical and psychiatric symptoms. She was convinced for continuation of her treatment for her life time with counselling and the importance of continuous treatment and regular follow-up was made understood.

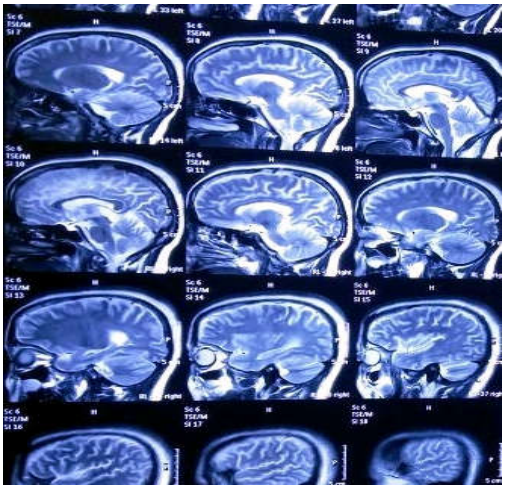

Fig. 1: MRI BRAIN reflecting marked atrophy of Anterior Pituitary with partially empty sella

Discussion

Physician's diagnosis of Sheehan's syndrome is purely based on the history given by the patient regarding postpartum haemorrhage which is usually followed by anterior pituitary failure which is complete along with MRI findings demonstrated as empty sella. Anterior pituitary which results in ischemic necrosis and hypo-pituitarism occur is commonly seen during pregnancy with enlargement of pituitary gland and postpartum haemorrhage [5].

Following the delivery the Sheehan's Syndrome can be presented soon or later even after few months or years later. In a study with sixty numbers of patients that revealed the average time between the earlier obstetric history and coming to diagnosis of Sheehan's syndrome shall be around thirteen years [6].

Failure to lactate, amenorrhoea, genital and Axillary hair loss, weakness, asthenia, wrinkles around eyes, lips which were very fine, along with prominent signs of aging with dry skin, hypo-pigmentations and altogether evidence suggestive of hypo-pituitarism were the usual features patient presented with. However. it is also to note that just mere presence of postpartum lactation or absence of amenorrhea is not the criterion to rule out the diagnosis of Sheehan's syndrome. It can also present as an emergency with severe hypo-natremia, hypoglycaemia, circulatory collapse, congestive cardiac failure or some time with psychosis [7].

In a study made by Ozkan and Colak, revived around twenty cases of Sheehan's Syndrome, around fifteen percent presented with hypoglycaemia and hypothyroidism, whereas hyponatremia seen in five percent of cases, six cases showed empty sella and in nine cases showed partial empty sella [1].

In Sheehan's syndrome very little attention was made towards psychoses, the reason for this neglect may be due to rarity of the disorder especially in western countries. First postpartum psychosis in a case of Sheehan's syndrome was being reported in the study of Kale K et al. [8]. In our case also the patient presented with psychosis along with Sheehan's syndrome. Our patient developed Sheehan's syndrome which proceeded by postpartum haemorrhage. Sudden drop of hormones level which leads to relative deficiency of such hormones during postpartum was appreciated and these may be responsible for some related psychiatric symptoms [9]. It is very clear from the study that either in initial stages or when the patient shows psychotic symptoms, antipsychotics may need to be administered to the patients as an adjunct [10]. Complete recovery resulted when the patient had treatment with Thyroxine and Gluco-corticoids soon after attaining euthyroid and eucortisolemic state.

Conclusion

Sheehan's syndrome patient presenting with psychosis is relatively uncommon. Treating physicians in case of postpartum- psychosis, with significant and prominent obstetric history must have a strong index of suspicion. With this case report presentation we emphasize the clear importance of meticulousness in history taking and patient's examination with postpartum psychosis.

Competing Interests

Authors have declared that no competing interests exist.

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Patient Consent: Obtained

Contributor-ship Statement

Dr. SKG made the diagnosis and was involved in the management of the patient. Dr. NAS wrote the manuscript and per- formed the literature search and corrected the manuscript. Both authors read and approved the final version of the manuscript.

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Case Report

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A Case of Parricide: An Analysis of Variables

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Abstract

The cases of crime against the elderly are on rise across India. Among the various manifestations of intra-familial violence, parricide-homicide is the most horrific. Though studies of parricide are reported in western countries, only few cases have been reported in the literature in India.The etiology is multifactorial in both the offenders and the elders, with psychiatric disorders being reported as most common cause. We present here a case of homicidal death of an elderly woman by her grandson as a result of long-standing conflict over money or property. Early behavior management of the aggressive offender with an efforts to strengthen and respect for family relationships would hinder the incidence of such cases.

Keywords: Parricide; Homicide; Elder; Head Injury.

Introduction

Parricide-homicide is a rare and the most heinous act among the domestic violence. In the eyes of many, the killing of an elderly is an incomprehensible event. The parricide is defined as murder of the father or the mother or any other legitimate ascendant [1]. Violence against parents has been reported earlier [1-5]. The causative factors of such acts range from psychological and sociological to economic. Studies on parricide show that quarrels are usual preconditions for the killing in very different contexts [2,5]. It is often seen as a dysfunctional harmony of the most family. In most countries, to deal with such quarrelsome and disobedient children, parents from all social backgrounds use the legal instruments available. Frequent complaining about their improper behavior, disrespect, drinking, swearing, debauchery and moral decay led to possible escalation to physical assault [6]. Factors associated with elder abuse and assault include low income, advanced age, functional impairment, and lack of social support particularly in elderly widows [7]. The case presented here portrays such a case of elderly homicide as a result of long-standing interfamilial conflict over money or property.

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Case Report

A seventy-year-old woman with alleged history of assault by her grandson by stone, was admitted in our hospital where she died after four days. The reason was homicide being an argument over money/ property. A medico-legal case was registered and post-mortem examination was conducted. At autopsy, the following antemortem injuries were noted. Sutured wound of size 3 cm x 0.1 cm present with 2 intact black sutures over left parietal region of scalp (Fig. 1). On removing the sutures, lacerated wound of size 3 cm x 1 cm x soft tissue deep present over left parietal region 2 cm in front of left parietal eminence. On reflection of scalp, sub-scalp contusion and pericranial hemorrhage present over both temporo-parietal region. Both temporalis muscles contused. On the vault of the skull, fissure fracture of length 6 cm present involving left parietal and

Fig. 1: Sutured lacerated wound over left parietal region of scalp

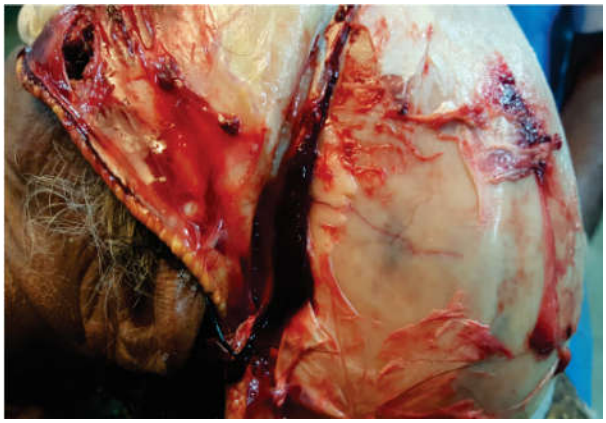

Fig. 2: Fissure fracture over left parietal and squamous temporal bone

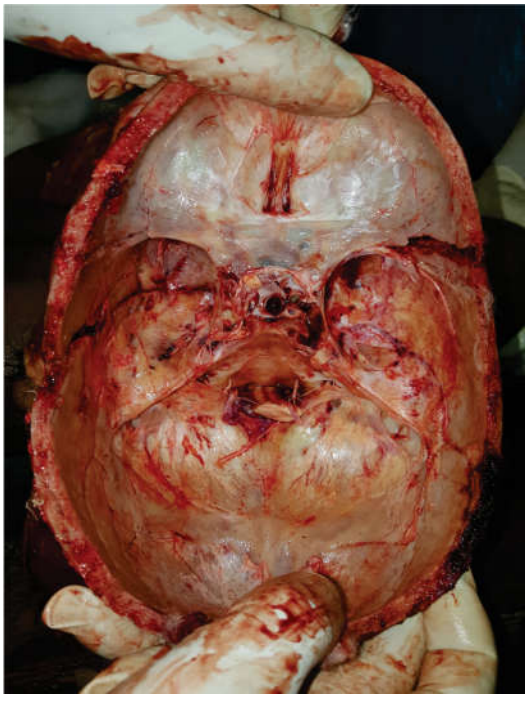

Fig. 3: Hinge fracture

squamous temporal bone (Fig. 2). On the base of the skull, in continuation with above mentioned fracture hinge fracture of length 20 cm extends along left squamous temporal bone passing through sella turcica of sphenoid bone and extending along the anterior border of middle cranial fossa on left side between lesser and greater wing of sphenoid bone (Fig. 3). On examination of the brain, diffuse subdural hemorrhage and subarachnoid hemorrhage present over cerebral hemisphere and cerebellum. Contusion of size 4 cm x 3 cm present over the lateral surface and tip of both temporal lobes. Bilateral lateral ventricle bleed present. The cause of death was opined as head injury.

Discussion

In India, according to the National Crime Records Bureau's report (2015), out of total of 20,532 cases of Indian Penal Code crimes against senior citizens registered during 2015, 5.1% were murder (1,053 cases) [8]. In the study conducted by Bourget D et al. between 1990 and 2005, 56 perpetrators (4 daughters and 52 sons) were involved in killing of 64 parents (27 mothers and 37 fathers) [2]. Walsh et al. reported 2,599 parricide cases during 1976–2003 which included killing of parents and stepparents. Female victims were 336 and male were 2,263. 21.8% were aged above 51 years [3]. Singhal and Dutta observed in their study that patricide was common than matricide and further noticed that fathers of perpetrator are significantly more punitive, and that the mothers being overprotective and more tolerant [4]. Phillip reported Bourget et al study reported that the main motives for the killings of mothers (matricide) and fathers (patricide) were depression or psychoses of perpetrators (65.5%) followed by long-standing intra-familial conflicts [2]. Psychiatric factors as major contribution of parricide was also described by other studies [9-11]. In a study by Heide and Petee, 2.9% parricide offences occurred due to argument over money or property. In western countries, fire arm and knife are reported as the most common weapon for infliction, followed by blunt object [3,5]. There were no studies that the author could find pertaining to parricidal deaths describing the patterns of injuries particularly with respect to head injuries. The study conducted by Sundaragiri et al. reported head injuries were common of homicidal deaths followed by strangulation and others [12]. Others studies also reported similar observations [13,14]. The Study of homicidal skull fractures by Sundaragiri et al. reported that out of 211 cases, 46%

cases had skull fractures with 85.6 % caused by blunt force trauma [12]. In their study, 5 cases (5.15 %) of homicidal deaths of elders were reported. Homicidal studies of Malik et al. [14] and Punia [15] also revealed such high incidence i.e. 71.3% and 75% respectively. Blunt force trauma of head in homicidal cases was also reported by other authors[13,14].

Conclusion

Most cases of parricide-homicide tragedy cannot be predicted and occur without prior knowledge or warning. However, in the cases where warning signs could be noticed in perpetrator, such as a recent behavioral disorganization with assaultive tendency, especially within the family, targeted approach to help perpetrators, how to deal properly with such strong emotion and to converse in more effective manner would be a promising area to start with. The efforts to strengthen family bonds and respect for family relationships should be made at every levels in the communities.

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Disclosure of Potential Conflicts of Interest

No potential conflict of interest relevant to this paper was reported.

Ethical clearance

None required

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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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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.

Discussion

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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Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O, Kidd EAM,

editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

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